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“Internal substitution policies and external power projection: How the pursuit of energy autonomy affects international cooperation and conflict: An examination of the United States and the European Union.”

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1. Introduction

In a world where newly emerging political and economic powers are competing for energy resources that appear to be holding steady at best and dwindling at worst, access to energy producing resources is no doubt becoming increasingly relevant. However, the supposition that such competition necessarily leads to war, or any other form of conflict for that matter, is questionable. Does international competition for access to energy resources increase the likelihood of war? Or is it more likely to lead to cooperation? The fact is that states which are highly dependent on external suppliers of oil and natural gas are not constantly engaged in war. Energy is no doubt vital for their economic well-being, but economics alone cannot explain state behavior. What can is the ability to project power, since that is what matters in international politics. This raises two important research questions: (1) how do energy policies affect a state's power projection capability? and (2) what is the relationship between domestic investments in substitute fuels and technologies and international cooperation and conflict?

Unless a country is entirely self-sufficient in terms of fuel resources, it will be forced to acquire them abroad, lower its economic standard, decrease its power projection capacity, or transform its entire economy to another energy source through substitution. States are most likely to choose external acquisition because reducing economic standards or power projection capacities are politically undesirable options. Switching to alternative fuels is politically risky because it runs against a very strong set of established rights and vested interests; and it requires long-term investments based on speculative future developments that, outside of autocracy, far exceed the electoral cycles of political decision makers.

The competitive pursuit of external resources is bound to determine power relations between states. Thus the determinant factor in the relationship between domestic energy policy and international cooperation and conflict is not the entirety of domestic energy policy, but rather the importance that states place on energy in terms of their relative power position toward other states. That importance is ultimately determined by the degree to which states are energy autonomous, which is defined by their ability to switch fuels.

Two intervening variables explain the relationship between energy and state behavior on the international stage. The first is the resource-price, which can take an ideal form of high or low. The second is the importance of supply availability to power projection (SAPP), which can be either actual or perceived. The most visible elements of domestic energy policies such as regulatory frameworks, environmental and efficiency standards, and taxes have no real discernable effect on external state behavior because all they do is raise the bar (by extending

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time periods) a little bit on when restricted flow circumstances will force states to act violently. Cooperation among weak states can be expected, but even the weak will fight when cornered. Thus the only aspect that ever changes on the internal front that is serious enough to warrant a change in behavior on the external front is the successful or failed implementation of a substitution policy because success translates into an immediate and definitive decline in SAPP and thus reduced conflict; and failure threatens the ability of the state to survive in competition with other states.

Depending on combined circumstances of price and SAPP, states will adopt one of three strategies: (1) a market commodities approach aimed at expanding free markets, (2) a cooperation approach aimed at coordinating policies to mitigate price and supply shocks, or (3) any set of a gamut of conflict approaches from threats to outright military attacks. Since states can be expected to take the least costly approach to acquiring necessary energy resources we can assume that under the circumstances of low prices and free flowing resources, states will focus their external policies on free commodity markets. When prices are high and resource flow is restricted or under threat of restriction, states are more likely to seek cooperation through a variety of foreign policy instruments. Under the same circumstances, a state will resort to military means only when the salience of SAPP is high. Likewise, these circumstances and outcomes affect domestic investments and policies toward substitution technologies, creating a feedback loop. What then is the relationship between domestic investments in substitute fuels and technologies and international cooperation and conflict? The more a state needs to cooperate or even resort to conflict so too should we find increased spending in substitutes and efficiency.

These propositions can be tested by looking at the behavior of the US and the EU under different price and supply availability circumstances. Given that the EU and US share a similarly high salience on supply availability for their economic well-being, we can assume that both will take market-commodity approaches under low-price-free-flow circumstances. However, under high-price-restricted-flow circumstances, the US, which places higher salience on SAPP, should be more likely than the EU or its Member States to resort to military means and even armed conflict to secure either access or flow. Conversely, since the EU places a relatively low salience on SAPP it should be expected to seek cooperation even when prices are high and flow is restricted. Finally, we should be able to observe increased investments into substitutes by both the EU and US when prices are high and flow is restricted and dramatically reduced investments under conditions of low prices and free flow.

1.1. The problem: energy as a cause of war

Do states ever go to war over energy resources? Some suggest that energy is not only relevant, but actually a determinant causal factor of international conflict; and that even the possession of large supplies may be a significant enough factor to deter attacks from more powerful states. Michael Klare claims that “the possession of potent military arsenals can be upstaged by the ownership of mammoth reserves of oil, natural gas, and other sources of primary energy” (Klare, 2008:9) and that “resource wars will become, in the years ahead, the most distinctive feature of the global security environment” (Klare, 2001:213).¹ Klare accurately identifies the essence of the energy war question. States do need energy for power projection, the use of which ultimately determines their relative power vis-à-vis other states and thus the global distribution or balance of power. No modern country can seriously consider the domestic survival of their state free from the need for energy supplies since energy is required for virtually every activity of state power; and availability of energy is a specific determinant of a state’s military capacity. Without energy, a state is quite literally powerless vis-à-vis other states as well as within its borders between the government and the governed. It is therefore logical to assume that some linkage exists between state requirements for energy and its international behavior. Nevertheless, it is unclear whether the evidence confirms such an assumption.²

It is a well established fact that states have fought resource wars throughout history. According Clifford Singer, mineral resources have been “a focal point of conflicts from before the Conquistadors sacked the Americas through the present day” (Singer, 2008:xv). However, the hypothesis that states go to war over finite energy resources is a different claim. Singer argues, for example that oil will “inevitably” decrease in importance because “it is just another industrially useful commodity [...] not worth shedding blood over who controls it” (2008:9). Whether he is correct in his assessment of the value of energy resources as strategic or not, the notion that one day current energy resources vital for power projection will be substituted by another resource and thus rendered redundant or irrelevant is an important aspect of linking internal energy policies to interstate war. A state fully independent for its energy resources, and thus free to fuel

¹ For a critical rebuttal of Klare’s thesis based on the difficulty of finding direct supporting cases, see Victor (2007).

² There is ample evidence in the literature to suggest a linkage between natural resources and civil wars. See Collier and Hoeffler (1998), Humphreys (2005), Le Billon (2001). Even in the case of civil conflict, the causal mechanisms between natural resources and the onset of civil wars are not well understood Ross (2004a), Ross (2004b) and the evidence is far from robust.

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its military adventures at will, would hardly face the need to engage in wars over energy resources.

Linking internal energy policy with external state behavior rests on three assumptions. The first assumption is that energy is essential to a state's ability to project power, in particular military power, which ultimately determines its ability to survive and thrive in relation to other states in the international system. The second assumption is that the importance that states place on their ability to project power explains the importance they place on the availability of energy supplies to that end. States with small militaries and little interest in projecting hard power are less likely to take actions that may lead to armed conflicts over energy resources than states with large militaries and are thus, more likely to seek cooperation. The third assumption is that every state seeks the goal of becoming energy autonomous. However, the effort and internal investments they make to become energy independent depends on the level of perceived threat to their ability to project power. Therefore, external threats posed to a state's relative power position vis-à-vis its needs for energy ultimately shape its internal energy policy.

With these three assumptions in mind, we can say that states that place a high value on their ability to project power (strong states) will resort sooner and more often to military means to secure their access to energy resources than those less interested or less capable (weak states) of doing so. Energy can lead to war, but it must not do so. Equally important, when supply availability is restricted, both the strong and weak types will exhibit the same behavior in terms of the pursuit of substitutes; and thus, external conditions determine internal policy.

While it is reasonable to assume that some correlation exists between international competition to acquire natural resources in general and international war (for example, multiple Arab-Israeli conflicts over control of the Sea of Galilee and the Litani River; Iraq and Iran over oil fields on either side of Shatt-al-Arab; and the conflicts fought over the Americas and Africa by the European colonial powers) each so-called "resource war" is better explained as a competition for relative power gains whereby the resource being sought plays a secondary role. The real prize in such conflicts is not the resource itself, but rather the increased power won by acquiring control of the resource in question. Merely "having" a resource is not equal to being able to exploit it; the cases of Iran or Venezuela come to mind. Nor is it equal to having the will to use it, as for instance is the case of Norway or Canada.

The dual arguments that "energy resources" can be treated as just another resource similar to gold or silver (thus, they are not strategic goods) and that interstate competition over them causes states to go to war are both problematic. These two arguments rest on the assumption

that if causality can be found between natural resources and war then the same must be true of energy resources. However, in order for that causality to be strong, the predicted outcomes of the resource war theory must always have been the case, and examples to the contrary would decrease, if not negate, the explanatory value of such a hypothesis or at least ask for an amendment to the theory. While there is substantial evidence that interstate wars have occurred over mineral resources throughout history, the conclusion that wars over mineral conquest such as gold, silver, or tin equate to wars over energy resources is not so clear.³ Minerals no doubt have economic value useable to purchase military capabilities, but that is not the same thing as the energy needed to fuel those capabilities. Spain's search for gold in the America's provides a good example.

At the time of the Spanish conquest of the Americas gold was the primary currency of world trade. Spain's acquisition of Latin American gold paid for its military adventures and expanded the wealth of its crown. However, the capacity to move its naval fleet was determined by large quantities of wind energy, not large amounts of gold, and no amount of gold could ever have purchased the wind necessary for conquest irrespective of the quantity and quality of its ships. Had the mineral resource of gold indeed been equivalent in power projection value to the energy resource of wind, Spain later may have won the Battle of Trafalgar, which it lost in large part due to changes in the direction and force of the wind (Adkins, 2005). The Spanish example demonstrates a basic problem in equating energy resources with other non-energy commodities. While both are used at various stages of manufacturing and trade, energy is a feature of every form of activity and is integrated into every economically relevant product and service. Energy resources are different than other mineral resources. Whether finite or renewable, once a specific energy resource takes its place as the primary fuel of power projection, it becomes a strategic good. The same cannot be said of all other mineral commodities, which offer varying degrees of usability for specific and limited processes and, in the case of gold and silver, were at various times in history sought after as currency itself.

The causality case between international competition to gain access to natural resources and interstate war is stronger when one considers the pursuit of territorial expansion to gain control over those resources. However, it requires a leap of logic to claim the same for energy resources

³ Examples of the evidence of mineral resources causing conflict see Dinar (2011), Gathii (2010), Gedicks (1993), Le Billon (2005), Le Billon and International Institute for Strategic Studies. (2005), Renner, Prugh and Worldwatch Institute. (2002).

just because they are resources. Renewable energy resources for example are available everywhere all the time; and thus its ubiquity precludes the necessity for war; that is unless one state develops technology that can block the sun, alter wind flows or reroute water flows across another. Furthermore, finite fossil energy resources only have been the subject of concern since the dawn of the industrial age. None of the resources fought over as part of the territorial expansion of colonial conquest were about energy resources and therefore it is unreasonable to claim that there is a historical connection between energy resources and interstate war.

A simple cost-benefit analysis of energy resource wars further weakens the argument that states are likely to initiate wars over energy supplies. The energy dependent nature of mechanized warfare and modern air and sea power means that for energy resources to be a cause for wars there has to be at least the threat of a crippling crunch in supply that necessitates military action before the shortfall occurs. Here we are specifically talking about the causes of war and not the actions taken once war has already begun for some other reason.⁴ The cost associated with initiating wars in territories where energy resources are located and currently flowing could as well discourage the onset of hostilities based on its affect on the cost of the fuel necessary to win that war.⁵ For example, the United States apparently gained no increase in supplies from its conquest of Iraq, instead experiencing only increased costs in blood and treasure. If the goal was to acquire cheap access to large supplies of oil, similar to Rommel's goal in North Africa, the mission clearly failed.

For all of these aforementioned reasons it is difficult to prove the case that states wage wars over energy. However, it must not be impossible. The presence of military deployments along key energy trading corridors, the concentration of military forces in energy rich supplier zones and the ongoing territorial disputes and coastal sovereignty claims over energy rich off-shore areas all point, at least anecdotally, to some link between energy and hostile international conflict. So does

⁴ It seems clear that campaigns in ongoing wars have focused on the control of fuel resources for the maintenance of those wars, as was the case behind Rommel's campaign in North Africa in World War II Rommel and Liddell Hart (1988).

⁵ Since the US invasion of Iraq in 2003, the cost of global petroleum has tripled, increasing the cost of US military operations. According to Andrews (2009) and Andrews and Schwartz (2008), between 2000 and 2008, US military outlays for fuel increased by nearly 500% and the cost per gallon of jet-fuel used in Iraq increased from \$0.70 to \$2.00. For details of the specific fuel costs per soldier in Iraq and Afghanistan, see: Crowley, Corrie, Diamond, Funk, Hansen, Stenhoff, Swift and Logistics Management Inst Mclean (2007) available at: <http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA467003&Location=U2&doc=GetTRDoc.pdf>. While it is impossible to conclude that prices would not have spiked had the invasion not occurred, it nevertheless illustrates the added cost-benefit problem of waging wars in areas critical to the steady flow of energy supplies.

international competition for access to energy resources really increase the likelihood of war? Yes and no. Under certain specific conditions it may lead to war. However, in most cases it will not. The reason for this lies in the fact that internal energy policies are not merely as important as two intervening variables exogenous to domestic policy, namely fuel prices and supply availability for power projection. While the former will impact the economies of all consumer states in fairly equal manner, the latter more than any other factor will determine policy outcomes; that is, as long as the state in question is not fully autonomous in its energy needs.

1.2. Three possible external outcomes.

States are likely to act in one of three ideal ways when faced with different conditions of price and supply availability. They can do nothing; they can cooperate; or they can enter into conflict.

When prices are cheap, resources are easily accessed, and no perceived or actual threat exists to long-term supplies, no state is likely to take any action that will either raise the cost of that resource or hamper its flow. This does not mean that highly dependent states will not adopt efficiency standards, or establish taxes in order to reduce consumption in a bid to reduce external dependence. However, it does mean that the efforts to do so will be significantly less than under conditions of high prices and restricted flow.

Moreover, internal energy policies are for the most part externally irrelevant. Indeed, one might argue that internal energy policies are somewhat of a chimera because they often consist of a wide variety of disconnected steps taken in spurts and built up in response to embedded domestic interests and short-term internal or external needs. For example, recent trends to introduce carbon taxes designed to reduce consumption and pay for the negative externalities of energy use may raise the price of a fuel in an internal market and thus spur reduced consumption, but one would be hard pressed to argue that it has any real impact on short or medium term international market prices, which are tied to a balance between global production and consumption levels. Even if lower consumption were the result of internal policies, external suppliers would likely cut production to increase prices offsetting any economic gain.

Such steps can be directly juxtaposed to investments in alternative fuels and strategic stocks designed either to replace dependence with autonomy altogether or to prepare an economy to survive short-term supply shocks. It is precisely these latter approaches which are less likely to occur when there is no pressing need.

Conversely, when prices are high and the flow of resources become restricted the external behavior of states change. Instead of focusing on an internal moderation and an external do

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nothing policy, states faced with high prices or a short or medium term supply crunch begin to act internationally in one of two ways. Either they will seek cooperation with other states or they will enter into conflict with other states.

International cooperation in the energy sphere manifests itself in different ways. The most visible examples include the international negotiation of common rules and standards such as those pertaining to transparency, market rules, and laws about the transit of energy supplies. However, more often than not it takes the form of specialized bilateral arrangements, particularly deals about supply quantities, prices, and routes. The most obvious manifestation of this is the case of pipeline politics, where special arrangements, contracts, and treaties are negotiated over many years. In a more extreme case, producers or consumers may band together to form unions to pool their resources either to control prices or to mitigate the risks of supply shocks.

In either case, states choose to cooperate externally for one of two reasons. Either they have no ability to enter into conflict and come out ahead in securing their interests or they do not prioritize power projection as being important enough to justify the use of harder power instruments. This is not to say that states with low priorities of power projection will never enter into conflict or that those that do will automatically enter into conflict, but rather that states with such capacities are more likely to do so sooner.

The energy leads to war theory suggests that the most likely outcome to high prices and restricted flows is international conflict. However, states are only likely to enter into conflict under high price-restricted flow conditions when they place a high priority on power projection, i.e. they define their security in terms of their relative power vis-à-vis other states. This distinction is important because it means that states must not necessarily go to war over the struggle for energy resources, even if they are uncomfortably or even entirely dependent upon them. The key explanatory variable in the energy war formula is not internal politics, but rather the global competition for relative power. This helps explain both the occurrences of conflict surrounding energy as well as the avoidance of them. The mere presence of a major power player in an energy rich region can just as well incite a conflict as have a deterrent effect on the actions of lesser powers that would otherwise act militarily to enrich their own power.

1.3. Energy autonomy and the feedback loop of its internal and external dimensions.

Energy is only relevant in international politics as long as states are at least somewhat dependent on external suppliers. The widespread and extant lack of energy independence among states

poses serious challenges for the autonomy principle in international relations. Autonomy places states on equal legal footing, regardless of their size or capacity; they alone are responsible for their own physical survival. However, the imbalanced global distribution of energy resources arguably places consumer states at the mercy of suppliers and thus autonomy is little more than an ideal notion rather than a material fact. This became evident in Europe in the 1970s when it faced dramatic shortages of oil due to two separate Arab oil embargoes and is arguably a driving factor in current EU policies to reduce its foreign levels of dependence on Russian gas.

So long as states lack energy autonomy, they can never be fully secure either economically or militarily. A complete lack of available energy resources would cripple a country's transport sector, endangering its ability to survive and eliminating its power projection capacity.⁶ While it is unreasonable to expect to find such an extreme case, or even a policy of one state aimed at another to create such a condition short of war, mere deficiencies in fuel supplies will translate into higher costs and present inflationary pressures on all produced and consumed products, including food. Energy autonomy is thus inexorably linked to national security, a point elaborated by US Senator Evan Bayh in his claim that "economic and financial matters are inextricably related to national security matters" and "[t]he same could be said for our energy dependency" (Bayh and United States, 2009). Unlike the notion of autonomy itself, the linkage between energy autonomy and national security is positively correlated and robust. Countries with high energy consumption have larger economies and power projection capabilities.

The condition of higher prices and restricted resource flows clearly affects the internal dimension of energy policy. It does so by spurring government response in the form of internal policy initiatives such as increased efficiency standards, regulations, and investments. The first two are largely symbolic in terms of their impact on the external dimension. They may reduce consumption somewhat, but not enough to offset increased demand resulting from economic growth. The third, however, can have a huge impact on external behavior, at least theoretically.

Faced with the pressing need to reduce foreign dependence on a specific fuel, the only internal action that states can take short of shrinking their economy or downgrading their power projection capacities, is to identify an alternative fuel, acquire it if it is available or develop it if it is

⁶ I am excluding animal and human labor as a source of energy, although both were the primary sources of energy production and conversion throughout much of history. For an appropriate handling, see Fouquet and Pearson (1998), United States. Department of Energy (2007), and for a comparative historical discussion of the evolution of the economic uses of energy over the centuries see, Schubert (2008).

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not, and provide an infrastructure to allow for its distribution. The most important area where this can occur is in transportation, since mobility is the key both to economic well being and the ability to project power. Heating and electricity, the two other areas most applicable to energy use are producible through a variety of fuels, and are thus more easily subject to substitution. Transport is a special sector when it comes to the question of autonomy and essential to understanding the affect of external outcomes on internal energy policy. When states are faced either with actual restrictive conditions, or perceive that such restrictions are on the horizon, they will be more likely to invest in substitution programs. Conversely, when such threats neither exist nor are perceived, states will not only be less likely to spend on substitution, they will be more likely to reduce spending on existing programs.

Similarly, if a state succeeds in developing energy substitutes, it will dramatically reduce the pull affect of international conditions on its external policy options. Brazil is a case in point. Not long ago, Brazil was a net importer of petroleum, a dependence that reduced its importance as a regional power. But in the 1990s, the country implemented a nation-wide flex-fuel program and developed biofuels from sugar cane that freed the country from its imbalanced foreign dependence, and has spurred not only economic growth but growing relevance as a regional power. Seen in the light of the global balance of power, Brazil is neither a major player nor does it place a high priority on power projection. However, the lessons learned from Brazil are clear. Substitution in the transport sector can alter the trajectory of state power regionally and in the case of the right players, also globally. It also illustrates the interactive nature of the internal and external dimensions of energy policy.

From a starting point of relative autonomy, states are either more able or less able to project power abroad. When conditions of higher prices and restricted flow come about, states initiate or expedite existing substitution programs, particularly in the area of transport. The longer those conditions hold the more likely it is that states will succeed in finding and implementing substitutes, hence, increasing their autonomy and thus, altering the initial parameters for the next spike in prices or reduction in supplies. Although most internal energy policies are irrelevant to external state behavior, over time internal energy policies toward substitution fluctuate between being the independent and dependent variable in the internal-external energy equation. When conditions are favorable, internal policy is the independent variable. When conditions are not, internal substitution policy becomes the dependent variable.

Finally, we cannot know the actual external policy outcome of total energy autonomy, because for the moment it does not exist. History, however, provides some possible insights. Previous to the

industrial revolution, every nation was perfectly energy independent. Those powers that possessed the greatest mobility either on land or sea dominated their neighbors and large swaths of earth's territory, from the Romans with their networks of roads and single mast ore driven ships to Great Britain's mighty navy. Arguably, each great historical power placed a high priority on power projection. It is thus not at all unlikely that perfect energy autonomy in the modern age could unleash similar forces of conquest, so long as the state in question places an equally high priority on its ability to project its power.

1.4. Nine hypotheses in three groups.

Based on the assumptions that energy is vital to power projection, that states must not prioritize power projection, and that initial conditions of autonomy and investments into substitutes modify state behavior under different price and resource flow conditions, we can propose several hypotheses for this study to examine. By looking at the behavior of the US and the EU under different price and supply availability conditions we should be able observe a set of common and distinctive behaviors and link them to levels of their energy autonomy and the importance they place on supply availability for power projection.

Because both the EU and US share a similarly high salience on supply availability for their economic well-being, the first hypothesis is:

- H1: Both the US and the EU will adopt market-commodity approaches under low-price-free-flow circumstances.

When prices are low and access is easy, neither the US nor the EU will take significant internal or external actions to alter the current circumstance. We may call this the *cheap and easy hypothesis*.

The next four hypotheses extend from the assumption that there are differences in the perception of importance of power projection between the US and EU, where the former places a higher priority than the latter. Together we may call these four the *expensive and difficult hypotheses*.

- H2: Under high-price-restricted-flow circumstances, both the EU and US will employ a cooperation strategy.
- H3: Under high-price-restricted-flow circumstances, the US, which places higher salience on SAPP, is more likely than the EU or its Member States to resort to military means and even armed conflict to secure either access or flow.

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- H4: Under high-price-restricted-flow circumstances, the EU, which places lower salience on SAPP, is less likely than the US to resort to military means and even armed conflict to secure either access or flow.

Because the EU places a relatively low salience on SAPP, we can posit that

- H5: The EU will never seek conflict even when prices are high and flow is restricted.

Based on the assumptions made about states' drive to enhance their energy autonomy, we also should be able to pose two *feedback hypotheses*:

- H6: Both the US and the EU will increase investments into substitutes when prices are high and flow is restricted

and

- H7: Both the US and the EU will dramatically reduce investments under conditions of low prices and free flow.

And finally, for logical completeness we can posit two counter or null hypotheses that would disprove the relevance of the intervening variables and any determinant relationship between those variables and internal policies toward substitution.

- H8: Both the US and the EU never enter into conflict in energy rich areas when energy prices are high or disruptions are imminent.

- H9: Both the US and the EU do not change their investments strategies toward substitutes when conditions of prices and flow change.

1.5. Methodology and sources.

The approach to investigating the main hypotheses of this study is divided into two large parts. The first involves establishing a formal framework for analysis to answer the main research question, how do energy policies affect a state's power projection? as well as the related questions, does international competition for energy resources increase the likelihood of war? and what is the relationship between domestic investments in substitute fuels and technologies and international cooperation and conflict?

The framework for analysis will establish a model for comparing the relationship between internal energy policies and external policy outcomes resulting from different conditions. It will provide the basis for a series of assumptions about state behavior in the energy domain. Once presented,

the model will then be tested by describing the evolution of internal energy policies and analyzing the salience of SAPP for two international actors, the US and EU. Here we will not only describe the current policy but identify key milestones where policy changed in some important fashion, prioritizing steps taken to increase or reduce the actor's investments in substitutes or explicit changes in its perception of the importance of supply availability to power projection. To do this a mix of quantitative and qualitative methods will be used. Estimates of the importance of supply availability for power projection will be made by summing a states military investment in terms of hardware and personnel, and where possible the fuel costs of operating its military missions at home and abroad. Since conflict is not the only possible outcome, a similar method will be used to measure efforts in international negotiation and even cooperation by examining investments in diplomatic activities, aid, and personnel. Qualitatively, we will analyze executive documents, official strategy papers, and press releases to identify explicit changes in policy positions and attitudes toward energy and energy relevant regions and states.

To measure external effects on domestic policy behavior, we can sum the total investments in internal substitution programs in correlation with relevant time periods of low or high prices and free or restricted flow and the occurrences of specific external policy outcomes. Similarly, we will look for those elements of domestic legislation which either directly or indirectly endeavor to achieve that end. Because of the complexity and enormity of modern legislation in the EU and US, we will limit our focus to only those areas of legislation identified in the framework for analysis as having bearing on substitution technologies and not every policy related in some fashion to energy.

We will then investigate four similar cases where conditions of energy prices and flow equally affected both international actors. Although it is clear that the US and the EU play on different international fields and their dependence varies between different geographically distributed suppliers, there are four cases pertaining to petroleum where the relevant factor of price and supply availability are common, thus providing a equal platform to assess the relevance of SAPP salience.

The four cases are in reference to time periods and include (1) the two consecutive oil crises of the 1970s resulting from the OPEC oil embargo and the Iranian Revolution respectively (high price -restricted flow); (2) the declining price, free flow years of the mid 1980s; (3) the low price - free flow years of the 1990s; and (4) the rising price - restricted flow period from 2003 to 2009. In each case we will examine US and EU responses in terms of whether each adopted a commodity market (inaction) or cooperation approach, or chose to enter into some form of conflict in order

to secure their energy interests. We will also test the feedback loop hypothesis by measuring their internal investments in substitutes over the relevant time periods.

The problem of determining whether actions were of a cooperative or conflicting nature or a combination of the two will be resolved by examining official statements and measuring military and diplomatic investments and deployments directed at the problem and the region in question. We will specifically search for correlations between the quantity and geographic distribution of each actor's foreign dependence on a specific fuel, determine whether it is relevant to their power projection capability and how they prioritize that ability, and then assess their military and diplomatic engagement in those areas under the context of different price and flow conditions. What sometimes may appear only to be a cooperation strategy, may in material fact be a conflicting one.

1.6. Shortcomings and caveats

The assumption that most domestic energy legislation simply does not matter in terms of external state choices over inaction, cooperation, and conflict may be incorrect. It may also be that there are variables other than price and the importance placed on supply availability for power projection that shape both internal and external state behavior or even that no relation exists whatsoever. External state behavior may be almost entirely determined by relative power positions in global balance of power as posited by structural IR theories or it may be that the globalized economy so intimately binds states together, that economics explains everything. Energy may be no different than agriculture; it is just another area of policy. By excluding so many known factors relevant to foreign policy such as attitudes toward international institutions and the specific culture of relations between states, this study does indeed have many shortcomings.

Further, by examining only the EU and US, we have excluded a myriad of other actors that are certainly relevant to the actions of either. Both actors are large consumers of oil, gas, and coal, but so are India, China and Russia, all three of which are relevant regional and global players. Structural IR theory would argue that definitively determining the role of energy in external relations requires at least some consideration of these players and their roles in balancing the actions of others. This study cannot aptly counter such a critique.

Also because the selected cases are common in terms of the fuel in question, the price, and flow factors, it cannot say anything about cases where the conditions would be different, the geography of dependence specific to either actor, or where another fuel is in question. It may be

that the EU would act very differently if its natural gas were directly and deliberately cut off by its main supplier Russia. It may be that the US would act differently if Mexico or Canada stopped delivering gas in the deepest winter months than it would if OPEC collectively reduced production of petroleum for several years. It would have been equally possible to look at the global competition for coal and uranium or to have taken up the question of electricity as a reasonable substitution approach. However, none of these appears to be particularly applicable to the transport sector, which was identified as essential to power projection. It is possible, however, that fuels for electricity may be equally if not even more important than transport for the maintenance of economic well being or even power projection and thus have even more explanatory power than oil.

For each of these reasons, and there are certainly more left unconsidered, this study does not purport to explain all forms of international behavior in relation to energy. Nor does it fully explain the depth and complexity of the internal dimension of energy policy and the effects that non-transport-related substitution policies might have. What it hopefully provides is an additional perspective for understanding some aspects of the relationship between the internal and external dimensions of energy policy and furthers the debate about linkages between energy and international cooperation and conflict.

1.7. Roadmap forward

This dissertation proceeds in three parts. The first part will present a framework for analysis. It is divided into five subchapters. The first chapter explains why energy policy is unique among internal policies in terms of its affect on external behavior. The second chapter examines the actors, institutions, processes, and instruments that should be commonly found in internal energy policy formation. The third chapter introduces and explains the role of the intervening variables of price and supply availability for power projection. The fourth chapter describes these may lead to three different types of external policy outcomes. The fifth chapter discusses how those intervening variables and related outcomes affect internal investments into substitutes creating an interactive feedback loop of internal-external energy policies. Consolidating the thoughts of the previous four chapters, it establish a model for examining the flow of energy from internal to external policy and back and introduces a few general assumptions about energy and external state behavior. The two most important are that the priority a state places on power projection affects whether it enters into conflict or cooperation when prices and the threat of disruptions are high. Conversely, under the condition where access to fuel is easy and prices are cheap, we can expect that states will do little to nothing.

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The second part of the dissertation tests the model presented in part one by examining the evolution of energy policy in the US and the EU and the respective salience of supply availability to power projection for each. It is divided into four broad sections, one that introduces the politicization of energy, one historical review for each actor as well as an assessment of the SAPP salience for each, and one dedicated to introducing the specific hypotheses based on the assumptions of the model and the analysis of each actor. The third part of the thesis tests these hypotheses by taking up four common international cases involving oil and comparing the responses of the US and EU. The dissertation concludes with a summary of the work's findings and provides some suggestions of how the ideas posited here may be of value to the larger field of international relations.

2. Framework for analysis

2.1. The uniqueness of energy policy

Energy policies differ significantly from other public policies in several important ways. Despite explicit declarations and titles, energy policies often tend to be vague and diffuse, and relevant decisions focus internally, just like most other policy areas. However, they also have serious external implications because they directly affect national security by altering external power projection capabilities. Meanwhile, the decision making process around energy is uniquely affected by a complex cocktail of factors that limit available options. These include time, technology, endowments, alternatives, and externalities. And during different periods of stability and crisis, the quantity and quality of actors involved in the decision making process undergoes extreme shifts to a degree unparalleled in any other internal policy domain.

At first thought energy policies may seem simple enough: a diverse set of specific laws and rules designed to manage supply and demand of resources and the externalities of their use to the benefit of the public good. The reality is, however, that despite explicitly stated goals and titles, energy policies both are broader in scope and much vaguer in practice. Energy is necessary for every social, economic, and political activity. But then again so is currency. The fact is that energy applies in some manner to the entire range of public policy decisions. So what differentiates energy policy from any other deep impact public policy? Which types of government programs can be considered part of that policy? The answers to both questions set energy policies apart from all other types of public action.

The main challenge is determining which programs and actions apply and which do not. For example, consider a policy to build an extensive road network. Is that part of an energy policy? Certainly the roads will be used for transport and the employed labor and materials will come with energy costs. One could as well classify such a policy as a works or transportation program as opposed to an energy policy because its primary goal is to increase employment or the efficiency of transport and thus energy choices only indirectly. What about environmental rules and regulations? It is now commonplace to combine energy and environmental policies as if they were one in the same. They are not. No doubt, energy is relevant to the environment. However, policies aimed at controlling greenhouse gas emission of non energy producing industries (even though the pollution they produce results from the use of energy) can hardly be deemed an explicit energy policy.

In contrast to these indirect types of energy related programs, there are explicit energy laws regulating the production, distribution, and consumption of resources as well as legislated incentives, taxes, and oversight bodies. From an internal economic perspective, these various energy-specific policies alter the costs of almost every area of commercial production (Jorgenson, 1984; Kneese and Sweeney, 1985; Slesser, 1978) and thus market price of every good and service (Herendeen, 1973; Pimentel and Pimentel, 1996) including food and agriculture.⁷ Some of these fall under pieces of legislation or executive fiat with the word energy in the title. Others do not. Explicit or implicit, most energy related policy decisions target changes to extant consumer or producer behavior. They have limited impact and their initial primary direction of focus is inward. However, a wide range of these decisions, from efficiency and environmental standards to the allocation of drilling rights, do directly impact the lives of citizens and can transform the power of government.⁸ This transformative power is one way in which energy policies distinctively differ from most other internal public policies.

Energy related decisions produce national security and foreign policy consequences in that they directly affect power projection capabilities. Some of these have an immediate but short-term effect such as policies over the size and management of strategic reserves that determine not only the time that an economy can withstand a supply crunch, but also the time that a country can continue fueling military operations. The effects of many choices are felt over the medium to long-term such as those about licensing of transnational pipelines, tanker-ready ports and other import facilities. One group of policies is of a definitively long-term nature: the investment of material and human resources into the development and implementation of substitutes.

While one could argue that every public policy serves the national interest in some manner, policies in the energy domain stand out because, to a degree unlike any other policy area, they can change the calculus of government options across the entire spectrum of internal and external policy. Most importantly they can alter physical security strategies through their impact on the industrial base and its ability to support external power projection capabilities. Energy policies, therefore, constitute a fundamental component of national security.

⁷ For an survey of recent ongoing research in energy economics, see: Caldwell and Taylor (2008) For some country specific studies, see: Bosselman, Rossi and Weaver (2000), British Institute of Energy Economics. Conference (1995 : University of Warwick), MacKerron, Pearson and British Institute of Energy Economics. (1996), Wei (2010).

⁸ One could argue that energy policies do not much differ from other trade policies because they tend aim at protecting domestic economic interests while promoting external opportunities. Seen as such, their bearing on external policy would be limited to a subset of a broader approach to trade.

At the core of the industrial base of any nation is the ability to produce physical tools of power. That base determines its military capacity through the construction and maintenance of defensive military armaments and technologies and allows for the projection of force abroad. It is energy reliant and for the foreseeable future specifically reliant on depleting petroleum resources.

Because military tools produced by that base require enormous amounts of fuel to function, more powerful states, defined by the size and quality of their militaries, will necessarily have greater demands energy resources. For example, the military constitutes the “single largest consumer of petroleum” in the US (Aldridge and Etter, 2001:10). Under the management of its own specialized Defense Logistics Agency (DLA), the US military purchases on average between 165,000 to 200,000 barrels per day of military grade jet fuel alone and manages fuel supply agreements in some 40 different countries around the world (Andrews, 2009). The market price of petroleum thus directly affects the cost of power projection. Assuming that its price will continue to increase over time (Gray, 1914; Hotelling, 1931), governments that place a premium on military power or at the minimum on self defense will invest into substitutes to reduce both the risks of disruption and costs of waging war.

Although the EU prioritizes its internal market over military power projection, it has increased its internal biofuel production in recent decades, a measure that will enhance its security perspectives vis-à-vis its primary oil suppliers. In 2007, EU public R&D into transport biofuels surpassed €340 million (Wiesenthal, et al., 2009). The EU’s internal focus highlights another unique aspect of the energy policy domain. Decisions about energy mixes and distribution infrastructures can either enhance or inhibit the smooth navigation of commercial and military assets across the entire space of sovereign control.

This is particularly important in the areas of power transmission and communication links. Both the US, through its “National interest electric transmission corridors” (Wellinghoff, 2009:11) and the EU, through its “Trans-European Energy Networks” (most recently 1364/2006/EC) are good examples of how electricity infrastructure policies aim to mitigate the vulnerabilities from external supply shocks, enhancing their autonomy to act and freeing up resources for other policy programs, in both the internal and external dimensions. Internally established energy policies thus affect government autonomy in ways that fundamentally change the calculus of external decision making.

Energy policies also stand out as distinct in comparison to other policy domains because technology, resource endowments, alternatives, and externalities form a unique cocktail of

factors that shape decision making processes and limit outcomes, each of which is negatively affected by time.

In the lifespan of an energy policy, time is its predator. The temporal horizons required for sound economic decision-making as well as preparing for or responding to the ebb and flow of energy politics far exceed those of most politicians. It is fool's errand to put arbitrary deadlines on scientific discovery and technological innovation. In fact, unless sustained for decades, passing appropriate legislation is meaningless in the energy sector. For example, expanding domestic production of oil or gas will have no immediate or even medium-term affect on domestic supply or prices. It can take up to fifteen or even twenty years to explore, develop, and deliver new oil and gas supplies to the market. Likewise, developing new technologies to tap unconventional resources, such as shale-based gas deposits, come with huge financial and environmental costs. Even if successful, one still cannot control the production behavior of external parties, which can offset domestic supply gains. And renewable based substitution policies targeting environmental externalities are even more challenging. Reductions in CO₂ exhausts and emissions require huge investments in new industrial production techniques, scrubbers, sequestration, and processes to convert captured GHGs into other usable resources, all of which could take a generation to implement. When the urgent need for a solution inevitably dissipates (as a result of heightened international production, new discoveries, or reduced domestic demand) support for such programs logically will wane. Therefore, decisions about energy today are laden with the political and financial uncertainties of tomorrow.

One might argue that time is of equal significance in other policy areas. Public health emergencies, responses to natural disasters, and financial crises all come to mind. However, in each of these cases, short term mobilization of resources can resolve the problem immediately. New rules and regulations can immediately change behavior and thus have instant affects on long-term outcomes. This is not the case in the energy domain where short-term decisions can only have short-term effects, but little to no strategic impact. Nowhere is this more evident than in the development of new technologies.

In the energy domain, technology changes the parameters of policy in ways that are difficult to predict. For example, over the course of only a few decades in the early twentieth century, the development of the gasoline driven combustion engine and advances in chemical sciences turned petroleum from a highly inefficient fuel for illuminating street lamps into a strategic commodity that fueled the rise of the US to great power status. New technologies to use oil as a fuel changed

the way wars were fought. Oil became the alternative to coal, just as today renewables are perceived as a future alternative to oil.

The switch to oil had dramatically different outcomes for the external policies of different actors primarily due to differences in their domestic resource endowments. Where the US was saturated with petroleum, known deposits of oil were scarce in Europe. While in the US, large supplies, low prices and free flow initially led to a do nothing policy, the need for the new resource caused by rapid developments in technology led European powers to actively seek policies of territorial acquisition. Acquiring oil abroad became a priority of the external policies of the UK, France and Italy, and ultimately caused Germany to invest heavily in synthetic alternatives. As a result, oil evolved into the ultimate prize in the international competition for power. And that is only the external dimension.

Internally, energy became the driving force for government intervention in markets after centuries of avoiding government ownership of private business. Again, resource endowments played a role producing fundamentally different government-industry relationships. In the US, it provoked an adversarial environment with the government taking on the oil industry as a threat to open competition and national sovereignty leading to the establishment of anti-trust laws and regulations that are the hall-mark of contemporary regulatory societies. In Europe, however, it had the opposite effect, stimulating government cooperation with private industry.⁹

Technological innovation and resource endowments thus modify the choices available to decision-makers. Technologies are fluid. Resource endowments are not. Governments can decrease development costs, but they cannot impose discovery through policy. Indeed, the two most profound technological advancements of the industrial age, electricity and the internal combustion engine were developed with little to no government support.

It is precisely this point which constrains contemporary attempts to switch primary fuel use from oil to renewable alternatives (Deutch and Schlesinger, 2007). They simply are not yet commercially viable substitutes to produce necessary products such as plastics, asphalt, or lubrication fluids, each of which is essential to a modern industrialized economy.

Renewable energies also are problematic because they are intermittent and thus less predictable than fossil fuels (Heal, 2009); they are economically inefficient. The UK House of Lords found that

⁹ This may also in part be explained by different distributions of capital wealth and land ownership, which were much more widely distributed in the US than in Europe.

without substantial government financing, wind energy will remain uncompetitive and any policy to increase its use would fail. In its report it wrote that “a significantly greater capacity of wind than of conventional or nuclear plant is needed for any given output of electricity” (United Kingdom, 2008:6). But renewable energy resources are attractive precisely because of the static nature of resource endowments.¹⁰

Where exhaustible resources are limited and unevenly distributed geographically, renewable energy resources are ubiquitous and infinite. Therefore, technological innovations that allow renewable energy sources to replace finite ones, and oil in particular, fundamentally strengthens the decision making autonomy of every government. While such a development may not end government intervention in the energy markets, it most certainly would downgrade the importance of the competition over energy resources on the world stage and address one of the most politically sensitive topics associated with energy use, namely its massive set of negative externalities.

From mining and production down through distribution and consumption, energy causes explicit negative impacts on the environment and public health. It is reasonable to argue that no other area of internal political decision making has such a sizeable affect.¹¹ On a local level, the long chain of energy use affects air and noise pollution. On the regional and global levels, it affects global warming, increases water levels and shifts river flows. Some suggest that it may even affect seasonal weather patterns. Such problems are beyond the scope of any single interest group. They are truly threats to the public good and thus require government intervention; and the problem is not limited to fossil fuels.

The human health risks associated with nuclear power are well documented, but renewable energy forms are not environmental angels either (Owen, 2006a). Those that choose to use arable land to replace gasoline with biofuel crops risk consuming limited fresh water supplies and creating new forms of pollution through drainage. Large scale solar and wind farms consume vast

¹⁰ For a discussion of emerging thoughts on the economics of renewable energies see de Vries, van Vuuren and Hoogwijk (2007), European Commission (1998), Jackson, Loughton (1990), Resch, Held, Faber, Panzer, Toro and Haas (2008), United States. Congress (2007). Verbruggen and Lauber (2009) and Sovacool (2009) examine the technical feasibility of renewable technologies. Cataluña, da Silva, de Menezes and Ivanov (2008), Gowen (1989), Gupta and Demirbas (2010), Reijnders (2010) each examine the role of biofuels in current and future markets and Gerboni and Salvador (2009) focus on hydrogen as future alternative in the transport sector.

¹¹ Holdren (2006) argues that countering the negative environmental impacts of energy use is one of the main purposes of energy policy because it aims to mitigate tensions between the need for increased domestic fuel production and its impact on fragile eco-systems.

swaths of territory endangering fragile ecosystems. Although technology may help mitigate some of these externalities and the ubiquitous nature of renewables may make the choices between the best of bad options easier, every energy related decision creates negative externalities in a proportion that far outweighs any other field of public policymaking.

This complex cocktail of factors (technology, endowment, alternatives, externalities, and time) often leads to contradictory policy outcomes that negate their targeted impacts. For example, heightened efficiency standards and higher fuel taxes do not necessarily lead consumers to find substitutes or even to drive less (Portney, et al., 2003). Raising taxes on gasoline in order to ‘push’ substitution may expedite the switch to alternative fuels if one is readily available at a competitive price. However, it may delay such an outcome by triggering changes in complimentary goods such as more fuel efficient cars that offset the price increase and diminish the immediate need for substitution. Conversely, heightened vehicle fuel efficiency standards may offset higher fuel prices caused by higher taxes and spread the utility cost per kilometer of driving, neither of which leads to the desired effect of substitution or a reduction in driving.

Finally, this special mix of factors is paralleled by a diverse set of vested interests groups that compete for beneficial outcomes. The energy domain is not unique in this manner and at first glance its politics do appear similar to other internal policy domains in terms of the influence wielded by powerful commercial interests. National champions, whether state owned or private, no doubt are important. However, the ubiquitous economic use of energy and its relevance to national security, particularly to external power projection, leads to extreme shifts in the quantity and quality of actors and interests involved in the decision making process during different times of stability and crisis.

When energy resources flow free of disruption, debates surrounding energy tend to be boisterous, even disorderly, and engage a complex network of vested and emerging commercial, environmental, civil and government interest groups. The engagement of so many actors is indicative of the substantial social and economic consequences of energy related decisions.

But from the moment that external resource flow begins to slow (for example through supply crunches and disruptions) or the control of domestic supplies is explicitly deemed essential as a foreign policy tool (such as in the cases of OPEC and Russia), debates become increasingly focused. In the event of war they are outright muted. Along the way even hotly held political principles such as support for free markets are exchanged for executive intervention and control - just like President Nixon did in 1971 when he stated, “I am now a Keynesian” (Silk, 1971).

The twentieth century witnessed several examples of such occurrences. The need to acquire oil to fuel the Royal Navy spurred the UK government in 1914 to take a 51% stake in the Anglo-Persian Oil Company, breaking a long tradition of staying out of private industry.¹² During World War II the US established a Petroleum Administration for War to take control of oil supplies and deliveries (Yergin, 1991) working together with the same oil companies that it spent decades trying to breakup. In response to the 1973 Arab oil embargo, both Europe and the US established strategic petroleum reserves, introduced fuel efficiency standards, conservation measures, and imposed price controls. Many such actions occurred through executive fiat. Those that did occur through legislation met little or no significant resistance.

Also, as energy issues climb latter of urgency, which they inevitably will, the quantity of actors involved in the decision making process shrinks considerably and policies become securitized. Fewer actors are engaged in the process of forming foreign policies than those in the domestic public policy process. When military or security matters are involved, as they quickly become in an energy crunch, the stress of urgency shrinks the quantity even further. Traditionally relevant, powerful vested interested groups see their influence diminish and are ultimately forced to submit to executive political will. In no other policy domain are non-governmental players as easily shut out of the decision making process as in that of energy, not even in the financial sector where a few key non-governmental players have a profound effect on the economic well-being of millions. In this manner energy is unlike any other economic policy.

Despite its globalized nature, energy stubbornly remains the one area of economics still dominated by interstate politics (Westphal, 2004).¹³ When shortages or disruptions occur, governments are forced to act and do so rapidly. Politicians simply do not have the luxury of time to wait for a new equilibrium of prices, demand, and substitutes to settle and to build a consensus among a diverse set of competing domestic interests. Unless governments are fortunate enough to control vast domestic reserves and the means to immediately access them, they will have to intervene abroad to secure necessary fuels. The same simply cannot be said of purely economic or social problems.

¹² One of the antecedents to today's BP Plc.

¹³ Nevertheless, economic studies have greatly enhanced our understanding energy politics, from early works by Gray (1914) on the assumptions of rent and exhaustibility and Hotelling (1931) on the pricing of depletable resources, to the optimal depletion strategies of Dasgupta and Heal (1974), Kamien and Schwartz (1978), the affects of energy on growth and innovation by Stiglitz (1974) and Dasgupta, Gilbert and Stiglitz (1982) respectively, on the structure of markets by Alhajji and Huettner (2000), Hillman and Van Long (1983), Sweeney (1977), and trading behavior Boscheck (2007), Brown and Errera (1987), Dahl (2004).

Our framework thus consists of four components. First is the internal dimension of energy policy which examines how energy policies are made by looking at the actors, institutions, processes and instruments involved. The second looks at the variables that shape external policy outcomes, namely price and supply availability and the importance given to power projection. The third aspect focuses on the outcome of external policies, which are assumed to range from inaction to cooperation to conflict and determined in large part by the importance placed on relative power. The fourth aspect links back to the internal dimension by enhancing or diminishing the immediate need to invest in substitutes, which in turn changes the significance of the variables of price and supply availability.

2.2. The Internal dimension (how energy policies are made)

The internal dimension of energy policy is messy and engages a diverse set of actors, institutions, processes, and instruments. Many of these are spatially and temporally specific to the political-economic structures and conditions of the polity in question and the structural relationship between central (federal or supranational) and state governments. Also, the highly technical content of the subject matter tends to limit public understanding of the problems and available solutions and thus both enhances the role of technical experts and increases to the margin for political error. The following assumptions apply to liberal democracies that loosely regulate markets and are made up of distributed multilevel institutions.

When it comes to formulating and maintaining long term policies, representative democracies are at a distinct disadvantage in comparison to autocratic regimes. Where political leaders in the latter largely are free from the stresses of public opinion, the former's short electoral cycles render most energy policies vulnerable to the vagaries of political expediency. Domestic consumers require affordable fuels for transportation and electricity and heat for their homes and businesses. Politicians that fail to deliver such stability literally risk their job security. In terms of its relation to voter's pocket books, energy is a component of domestic politics.

Moreover, changes in energy consumption patterns and associated infrastructures span large temporal horizons, and require sustained long-term financial and political support if they are to be substantially effective. Building a working consensus in a liberal democracy takes time and all the more when government in that system is distributed (as opposed to a highly centralized unitary state where policies can be changed more rapidly). Time and power distribution thus transforms energy policymaking in liberal democracies into a cumbersome and cyclical process

that tends to be responsive in nature. Support will rise and wane according to immediate contemporary conditions: when energy supplies are inexpensive or even tolerable, its importance logically declines. As a result, those energy policies that have the greatest external impact - those that target a substantial shift in the production and use of domestically produced alternative fuels - almost never survive long enough to take shape.

This is explained in part by the fact that energy policies in liberal democracies largely are considered as matters of 'low' politics because most related decisions fall under the rubric of internal economic policy in some manner. Their primary targets are market structures and consumer behavior, not relative power projection. Regulations, standards, and taxation are the primary instruments of government, not military conquest. Because markets tend to dominate the institutional landscape around energy, the policy process tends to be more inclusive rather than exclusive, engaging a large and diverse set of actors. All of this is understandable in light of the prevailing perception held throughout the 1980s and 1990s that energy supplies were globally abundant and easily accessible.¹⁴ Also understandable is how this diverse set of factors contracts when governments are faced with crises.

Importantly, the internal dimension is not static. As conditions warrant, its importance migrates from the purely internal to the external, driven by the exogenous factors of price, the availability supplies and substitutes, and the importance power projection. Since the only internal controllable policy which can change the calculus of energy in power projection is the existence of substitutes, our focus is limited to those related components.

2.2.1. Actors

The actors that participate and shape the formulation and implementation of energy policies in general and substitution policies specifically can be categorized in two broad groups. They are either independent governmental or non-governmental agents. Prontera (2009) suggests that the most relevant non-governmental actors will be found in the transport and industry sectors. The former seems reasonable enough, but the latter is far too broad. Only those that directly conduct or finance research and development of alternative technologies matter and thus warrant our attention.

¹⁴ This also explains the surprising dearth of post-1980 scholarly investigations into the actual political processes behind the making of domestic energy policy.

There are certain types of actors that are involved in the formation of general energy policies in all states. However, they are not necessarily substitution specific. This is either because privileges embedded in institutional design limit their access or because they lack the necessary resources required to conduct applicable research and development.¹⁵ Nevertheless, we can expect that peak economic associations (Olson, 1982; Shively, 2008), powerful private market players, a few select legislators (assuming no dictatorship), high-ranking executive branch officials, senior military officials, and the scientists that work for them will each play some role in the process. These actors can be contrasted to mid-level bureaucrats, environmentalists, key media players, and non-physical scientists, who also may be involved in the debate, but their role in the formation and implementation of actual substitution policies will be more peripheral than direct.

This is not to say that quasi-governmental entities such as public utilities and cooperative private-public agencies are entirely irrelevant. However, their role in substitution is either limited or subordinate to the interests of their public and private shareholders. The behavior and interests of public utilities (transport, electricity, water, and heating) is an outgrowth of public policy and not an input. One might even consider them to be instruments of policy as opposed to actors. What they certainly are not is independent. Likewise, quasi-governmental agencies that focus on oversight and governance¹⁶ or government sponsored research and development centers (RDC)¹⁷ consist of a mix of various private, public and academic actors, each of which falls under one of the two broader actor groups. Such institutions often have a place at parliamentary hearings and are valuable for their technical expertise, but since they either are in part owned or managed by government institutions, they too could be considered tools rather than self-serving agents.

There are two main groups of independent governmental actors. The first are key political executives and the officials representing their agencies (ministries, cabinets, and directorates). The other consists of key senior legislators operating in the legislative and oversight bodies they control. Although there are many lower and intermediate level executives and legislators involved in determining much of the detail of domestic energy policy, two important factors separate the

¹⁵ The approach of identifying specific actors within the context of their institutions draws upon the actor-centered institutionalism of Scharpf (1997).

¹⁶ California's Independent System Operator and the European Network of Transmission System Operators for Electricity (ENTSO-E) are appropriate examples.

¹⁷ For example, the US Department of Energy sponsors 18 such entities (see the 'Federally Funded R&D Centers Master Government List' at <http://www.nsf.gov/statistics/ffrdclist/activity.cfm>) and the government of France funds four separate agencies that focus on energy research and development (see 'Major French Research Institutes' at <http://www.ademe.fr/pcrd/telechargements/partenaires/poren.pdf>).

senior group. They play a noticeably enhanced role in the assignment of financial support and granting of regulatory exceptions explicitly required for a policy of substitution; i.e. they control important instruments of power. And in concert they define the overall importance of power projection for the government and thus determine the significance of the military as an institutional actor in the energy policy process. This latter point is particularly relevant in the context of the US and EU where civilian oversight of the military is distributed between legislative committees in the former and independently budgeted and controlled by Member States in the latter.

Key political executives include the heads of government and ministries of energy and (where relevant) the environment, national security, and defense. These actors are present at both the Member State and the federal or supranational levels. Such individuals are distinctive, not because they set policy directions, but rather because they are entrusted with some power of executive fiat. They may control a discretionary budget and/or possess the authority to issue orders and directives.

Similarly, a few key senior legislators can promote or block bills at various stages of the legislative process, from before they are even opened for debate up to controlling the lines of inquiry in committee meetings. Such individuals also usually have some degree of control over budgetary assignments within their respective institutions by virtue of their positions as chairpersons or by pressuring other legislators over their support for particular programs through internal party mechanics, institutional procedure, or political largesse. However, in deciding to support or oppose substitution programs, key public officials and civil servants are bound to come under pressure from important non-governmental actors.

The fact is non-governmental actors play a significant role in the research, development, and implementation of technology as well monitoring the externalities of their exploitation. Their cooperation and compliance are essential for any policy to be implemented. This is particularly true in the area of substitution where the contemporary state of science and technology and related trends in commercial investments are more likely to determine legislative and executive action than to be determined by it.

Seen broadly, the non-governmental category includes virtually every commercial and civil interest group. However, for the purposes of comparison, one need only identify the largest and best financed. Among these would be the key commercial players and national champions in the production and distribution of energy, the main manufacturers in the transport sector, and the peak economic groups representing capital and labor. Each of these players has vested interests

in the status quo. Equally important are peak environmentalist groups, whose large membership bases and annual budgets, allow them promote goals that often tend to be diametrically opposed to the status quo aims of their commercial counterparts.

Each of these powerful vested interests groups is adept at promoting public support or opposition to programs and the politicians that back them. And money is important. Using their large resources and vested interests, these groups invest significant human and financial capital into lobbying in favor of, or in opposition to, any program that enhances or diminishes their prospects or goals, sometimes leading to bitter fights while at others creating strange bedfellows. Substitution policies based on replacing gasoline with biofuels or electricity provides a good example.

The petroleum industry (producers, refinery and filling station owners, and their employees) and automobile manufacturers, stand to suffer significant financial loss if the share of petroleum in gasoline is reduced or eliminated altogether. In pursuit of legitimate concerns about pollution and land and water use in the production of fuel crops, powerful environmentalist lobbies that serve as traditional critics of both industries take on the role of temporary allies. Meanwhile, chemical and agricultural concerns, normally aligned with the main players in the energy industry, wholeheartedly support such programs as they look forward to windfall profits gained from the increased use of their land and technologies.

Throw in the alternative of electric vehicles into the mix and the debate increases in controversy and acrimony. A shift away from liquid transport fuels puts petroleum producers in the position to lose their customer base altogether and forces the automotive industry to undergo a dramatic retooling of its factories. Given that the latter will not voluntarily shift production to electric cars in the absence of a government program to finance either the costs of refurbishing factories or the necessary recharging infrastructure to justify sales, political mandates are likely to spark lobbying wars for public financing and regulatory exception. All the while, both the oil and automotive sectors are equally likely to hedge their bets by competing for available research funding.

Indeed, no major player in the energy or transport sector will passively ignore a substitution program. And given their importance to employment and general economic well being, one would be remiss to disregard their influence on powerful members of their respective governments, their institutions, or the processes involved in decision making.

2.2.2. Institutions

The most important institutions engaged in energy substitution policies are the three main branches of government, fuel commodity markets, and the military. In the specific cases of the US and EU, government institutions operate both at the federal/supranational and member state levels, while in the EU, the military is germane only for Member States. Each is relevant in specific ways. Government institutions play the role of initiator, setting priorities, targets, and rules. The unique security providing function of the military makes it one of the largest and most stable consumers and thus it often acts as a trend setter. And markets serve as the venues where success or failure can be observed and measured through the supply and demand for alternative fuels.

Initiating substitution goals and setting targets are primarily the responsibility of the high government authorities. This means that both in the US and the EU, federal and supranational institutions are likely to play a central role in setting agendas and targets. However, success depends on the active participation and with cooperation of Member States because they largely are responsible for implementation and enforcement. Sub-federal or community level governments often take the lead in pushing the direction and velocity of change, which in turn can advance or hinder centrally established goals.

Two examples demonstrate how Member States play an important role in linking energy substitution targets with actions to achieve them. They also show why it is absolutely necessary to include them when examining the internal dimension of energy substitution policies. In the US, California frequently plays the role of trend setter outpacing the federal government both with targets and the laws to achieve them. The state recently added a \$5,000 tax credit on top of an existing \$7,500 federal tax credit for buyers of a low-emission private vehicles and \$20,000 to buyers for equivalent commercial vehicles (Smith, 2010). It did so in accordance with its own independently issued 2006 gubernatorial executive order to raise the minimum biofuel share to 75% by 2050, a target far in excess of national goals.¹⁸ Likewise, the EU' largest economy, Germany has regularly exceeded the EU's minimum share of biofuels in the transport sector (originally 2% in 2005 and 5.75% by 2010 and since watered down to include any type of green

¹⁸ See California Governor's Executive Order S-06-06, April 25, 2006 at <http://gov.ca.gov/executive-order/183/>.

energy).¹⁹ In respect to incentives, however, Germany reversed its position on pushing biofuels into the market in 2006 by introducing a tax that significantly contracted the share of biofuels in its fuel market (Vogelpohl, 2010). Previously, Germany had led the EU with respect to market share largely because of the tax exemption it awarded biofuel production.

Irrespective of where ideas originate, every substitution policy requires targets and the means to achieve them and this requires the involvement of all three branches of government at both the federal/supranational and member state levels. Targets are set and later enforced in the executive branches of government. However, the means are established via legislation and executive fiat; and the legitimacy of the use of those means (in some cases the legal right to mandate targets in the first place) falls under the authority of the judiciary.

The EU executive can set targets for biofuels, legislate fuel blend percentages in the consumer market, and through courts can even force a powerful member like Germany to accept the use of soybean oil as a source (which it has refused), but it cannot control how much Berlin will invest in supporting infrastructure or as of yet mandate the actual energy mix of resources used in the production of electricity in the country. Likewise in the US, the executive branch has wide authority to establish standards, but tends to have that authority watered down by legislation and even reversed through appeals in court. Such was the case in December 2008, when US courts struck down prevailing pollution control standards associated with electric power plants.²⁰

In the specific policy domain of substitution, the most important institutions are those that establish regulatory laws, conduct land management, and provide public financing for research. They consist of legislatures, the offices of the heads of government, and those departments that are legally responsible for specific activities. The land management domain, for example, is important for energy resource mining, crop production, and transport via pipelines and ports. Responsibility in the US for leases and drilling rights in coastal waters falls under the jurisdiction of the Department of Interior's Bureau of Ocean Energy Management, Regulation, and Enforcement

¹⁹ EU biofuel targets were originally laid out in a 2003 biofuels directive (2003/30 EC) and later in the Commission's "Strategy for Biofuels" (COM (2006) 34) and amended in a 2009 directive on the promotion of the use of energy from renewable sources (2009/28/EC).

²⁰ See: *State of North Carolina, v. Environmental Protection Agency*, Case No. 05-1244, United States Court of Appeals, D.C. Circuit (<http://www.epa.gov/airmarkets/progsregs/cair/docs/CAIRRemandOrder.pdf>).

(formerly the Mineral Management Service).²¹ That department also oversees the extraction of mineral resources in the country's federally-managed lands. Because the EU has no uniquely defined public lands, management of its own energy resources, whether coastal or on shore is the sole responsibility of its Member States. This complicates the coordination of policies, particularly with respect to increasing domestic fossil fuel production.

Further complicating matters for the executive branch is the fact that its legislative counterpart possesses the power of purse and thus determines the availability of public finances for their endeavors. Specific to policies of substitution, it allocates financial resources for research and development of alternative fuels and technologies, an area where both the EU and US are very active.²² According to national records submitted to the International Energy Agency, EU Member States France, Germany Italy, and the United Kingdom spent close to €79 billion (in 2009 prices) in energy related research and development between 1974 and 2009. Over the same period, the US invested as much as €115 billion. However, only a small fraction (2%) of that funding was directed towards substitute-related activities such as biofuels, hydrogen, and energy storage. As in the case of actors, the role of money and the price of resources are central to institutional involvement in the internal energy policy domain.

In order to realize the potential of energy commodity substitution, new technologies and the infrastructure to support them are required.²³ The requisite time and investment costs to develop and implement them are significant obstacles to market entry and the most important issue is that of competitive pricing.

Energy prices are set in commodity markets (that is before government issued taxes and subsidies take effect).²⁴ Those markets are largely dependent on external gluts and shortages, and highly

²¹ The name was changed on June 18, 2010 in response to the Deepwater Horizon incident through internal Order No. 3302 issued by Ken Salazar, Secretary of the Interior. A scanned photocopy of the order is available at: <http://www.doi.gov/deepwaterhorizon/loader.cfm?csModule=security/getfile&PageID=35872>.

²² Under its Seventh Framework Program, the Brussels has allocated around €2.3 billion for non-nuclear energy related research and development between 2007 and 2013. This is in addition to individual state investments which among the EU-15 in 2005 amounted to €1.9 billion. For a breakdown of these investments, see <<http://www.eea.europa.eu/data-and-maps/figures/total-energy-research-and-development-1>>.

²³ In the case of automobiles, hybrids, flex-fuel, ethanol, hydrogen, and lithium-ion battery powered vehicles are currently entering the market, although the infrastructure to support them is strikingly limited.

²⁴ In some cases, as in natural gas, pipelines inexorably link external suppliers to internal markets according to long-term contracts and fixed prices, creating recurrent tensions and limiting the political options to find alternative fuels and suppliers.

integrated internationally such as in the case of primary fossil fuels like oil, coal, and natural gas. Price shifts in one country are rapidly manifested everywhere. Pricing in newer or smaller markets, such as growing trades in liquefied natural gas (LNG) and biofuels, tend to be more dependent on their geographic position.²⁵ The average landfall price of LNG (per MMBTU) in July 2010 was \$4.55 on the eastern seaboard of the US, \$6.95 in Spain, and \$7.30 in Japan (FERC, 2010).

Market location affects prices and shapes state priorities vis-à-vis its federal or supranational counterpart. Those variances tend to divide Member States more often than unite them. Pipeline infrastructures provide a good example. In Europe, where market integration and fuel transportation infrastructures are still under development, physically detached and competing markets lead to wide variations in price and supplier composition per each Member State, causing stiff debate over the merits of Union-financed supplier-connected pipeline strategies. Similarly, despite a higher degree of interconnection (30 large interstate pipelines transport about 81 percent of consumed gas through 24 hubs), the US is still divided into five regional distribution networks and states continuously compete over federal funded investments into port facilities and new pipeline routes.

Market size and trade volume is a major determinant of whether or not a substitution policy is actually having any affect. The presence of spot and future contract markets and the volume of trade inform us about the economic relevance of substitute fuels. The fact that the quantity of LNG contracts sold on the market are so much smaller than standard gas or crude oil markets reveals a structural favoritism in the marketplace, one that similarly hampers the entry of new substitute fuels such as ethanol, hydrogen, and biodiesel and thus suggests the need for government intervention in the form of regulations and incentives to increase their competitive value. As is often the case, however, government intervention in the marketplace tends to bias one product over another leading to unintended consequences. For example, trade in ethanol has

²⁵ Prices for LNG in Europe vary according to national or regional schemes, connected to an index of prices of oil and other energy related futures. In the UK prices are set by the country's National Balancing Point (NBP). In US, LNG prices are driven by the indexed price of piped natural gas depending on its geographic origin or distribution point (Henry Hub for Gulf of Mexico gas and New York 'Citygate' for gas transferred from interstate or intrastate pipelines to a local natural gas utility).

been stymied in Europe because it is classified as an agricultural good and therefore taxed at higher rate than biodiesel, which is considered to be an industrial good (Klepper, 2008).²⁶

Markets take the lead role in transforming government substitution goals into reality. As ExxonMobil CEO Rex Tillerson once commented “You [the government] set the taxes. We work on it” (United States. Senate Committee on the Judiciary, 2006). In response to the EU’s establishment of a trading scheme for greenhouse gas emission allowances (Directives 2003/87/EC and 2004/101/EC) and similar program called the Regional Greenhouse Gas Initiative in the US, the New York Mercantile Exchange (NYMEX) established a highly lucrative Green Exchange in early 2010 to cover both US and EU contracts and added four European biofuel commodities to its trading portfolio.^{27/28/29} Ethanol is now regularly traded on the Chicago Mercantile Exchange (CME) and NYMEX.³⁰ Global biofuel production now exceeds 74 billion liters per annum, far more than the 18 billion produced in 2000.³¹ And as of 2009, EU countries were consuming some 12 million toe of biofuel annually (Eurobserv’ER, 2010).³²

By creating the basis for effective supply and demand, markets provide essential private financing in areas of research and development. Increasing volumes of trade in the NASDAQ’s Clean Edge U.S. Liquid Series, Bloomberg’s World Energy Alternate Source and the Frankfurt Dax’s DAXGlobal Alternative Energy Index are all examples of how markets pair public policy targets with private investment and risk management. And because markets are central to the success of substitution policies, overcoming barriers to access are often the primary focus of government intervention (Beck and Martinot, 2004; Martinot, 2004).

²⁶ Ethanol’s agricultural classification allows countries to impose higher tariff rates to protect domestic producers. In 2008, EU tariffs were 0.192 €/liter for undenatured and 0.102 €/liter for denatured ethanol.

²⁷ The EU scheme covers over 11,000 installations across the EU and almost half of the Union’s annual CO₂ emissions.

²⁸ On July, 23 2010, the U.S. Commodity Future Trading Commission (CFTC) approved the Green Exchange as a designated contract market (DCM) allowing the trade of emissions allowances and credits in CO₂, NOX, and SO₂. European biofuel swaps include two biodiesel and two ethanol contracts, all FOB Rotterdam.

²⁹ The US RGGI is the first such mandatory market-based effort in the country and involves ten Northeastern and Mid-Atlantic. See <http://www.rggi.org/>.

³⁰ Since ethanol’s future is intimately linked to that of the corn and sugar crops, both markets are also indicative of the importance of biofuels play in the marketplace.

³¹ According Eurobserv’ER (2010) “The incorporation rate has dropped in turn from 7.3% in 2007, to 5.9% in 2008, down to 5.5% in 2009. The reason for this drop in consumption (by 7.8% between 2008 and 2009) is that the German Bundestag decided to reduce the incorporation quotas in June 2009.”

³² Germany actually experienced a decline in the share of biofuel in its fuel market after removing a tax exception status.

For all of these aforementioned reasons, markets and three branches of government are important institutions in the formation of energy policy. Markets serve as the venue where one can observe the success or failure of a substitution policy because it is there where we can measure the availability of supply and demand for alternative fuels. Government institutions serve as the initiators because they set the priorities, targets, the rules of the game. Yet there is still one other institution that plays a vital role both as consumer and shaper of policy, namely the military.

In comparison to the complexity of other government institutions and markets, the military's impact on substitution is simple and very direct. Entrusted with the responsibility to protect the state and to project power abroad where deemed necessary, the military has the immediate material need for substitute technologies and fuels, possesses the political prestige to win funding for research and development, and maintains the institutional stability to plan and act over long temporal horizons.

The military requires fuels for the mobility of its forces. A disruption in times of war is lethal, but even supply squeezes in peacetime can pose serious problems. Without large volumes of aviation fuel, airspaces are indefensible and the normal transportation of troops could be reduced to a trickle. The US military, for example, consumes more energy "than any other private or public organization, as well as more than 100 nations" on a daily basis (Warner and Singer, 2009).

When countries prioritize military power projection, their immediate energy needs and the perceived vulnerability of international supplies create a nexus of motivations to develop and deploy domestically produced substitutes. This explains the US Air Force's plan to deploy blends of domestically produced synthetic fuels for 50 percent of its aviation fuel by 2016 (Kristine E. Blackwell, 2007).³³ If achieved, the program's impact will reach far beyond the confines of the US military, affecting other nation's national defense strategies and changing the market landscape for the global supply of aviation fuel.

Even when countries do not prioritize force projection, military concern over the cost and availability of fuel supplies is still high on the security agenda. In 2007, the UK and France had combined military fuels costs of \$1.6 billion; and in 2008, France was forced to cancel three separate naval operations because of "soaring fuel prices" (Pfeifer, 2009). Those costs drove the

³³ The US navy is in the final stages of certifying a 50/50 biofuel mix from Honeywell made from camelina oil and petroleum-derived military jet fuel.

UK to invest in new gas and diesel powered electric propulsion systems for its next generation of aircraft carriers as well as finance a massive waste-to-energy plant to power the ships when they are at port. Despite the general tendency of the EU to avoid international military conflicts, many EU countries are actively engaged in foreign naval operations from the Arabian Gulf to the Mediterranean. In the latter, Greece, Italy, Spain, Denmark, and Germany are all active participants in operations to maintain transit security for key trade routes for fossil fuels and resources. Eight EU countries have troops, ships, or planes deployed around the Gulf of Aden for similar ends. And although not well advertised, NATO maintains two secure military-use pipeline systems that connect Denmark and Germany with Belgium, France, Luxembourg and the Netherlands.

Most importantly, military institutions carry special weight as consumers. This is not merely due to the volumes of fuel they consume. It also is because they are sources of national pride, the final guarantors of national autonomy and sovereignty in times of crisis, and exemplify the institutional stability of government.

Because of their reach into local communities and its constant need for hardware and fuel, military institutions tend to be deeply embedded into domestic politics and industry. The US, the UK, and France each maintain a large standing force of volunteers. They annually invest between 2.3% and 4.3% of their GDP on defense related activities and maintain expensive and active nuclear deterrents. In fact, all three countries have thriving armaments industries that together with Germany annually employ more than 2.6 million citizens in the direct production of arms; and US and EU companies make up all of the top ten and all but two of the top thirty arms manufacturers in the world (SIPRI, 2010).

Therefore, when the military claims that it needs specific resources to secure the national defense, keep pace with allies, or maintain a comparative advantage over rivals, both the markets and the political establishment listen either out of national security concerns or electoral and economic expediency. And because few would ever doubt that the military will still be there decades into the future, it has the creditability to plan for and manage long-term projects, a quality that no other institution or individual actor can provide. This unique status positions the military to lead the charge toward substitutes. If and when the military decides that substitutes are necessary, it will use its prestige to gain public financing for research and development and establish the market links necessary to meet its demands. The military thus plays a special role in the processes that underlie the formulation and success of related policies.

2.2.3. Processes

Why is it that so many substitution policies target reified *fata morganas* such as energy independence or environmental purity and result in only slight shifts in consumer and market behavior? The answer lies in the interaction of processes present in government, market, and scientific decision making. Substitution policies are initiated when political executives set policy goals to achieve targeted shares of a fuel or technology in the market. They are put into practice via legislation and executive action; and they are achieved through the actions of market players and scientific investigation. In the time it takes to cross the gap between idea and practical reality, goals and their importance are bound to change. It simply takes too long for new fuels and technologies to become commercially competitive. Because they need continuous long-term political and financial support, most attempts are doomed from the start.

As a rule, substitution policies always target specific fuels or technologies and do so in identifiable packages of laws, regulations and incentives that reduce market barriers and increase access to capital financing for energy research, development, and demonstration (ERD). Therefore, the procedures behind energy substitution policies are dependent upon the technological and market status of the alternative in question. If the fuels or technologies are fully developed but too expensive to be competitive, focus will be placed on reducing market barriers. If they do not exist or are not yet sufficiently developed, focus will be placed on ERD.

Although the precise modalities of how substitution policies are formed will vary between political systems and markets, we can assume that substitution relevant policymaking involves similar procedures as found in other policy domains (initiation, formulation, implementation, reevaluation, and review).³⁴ They are self-interested endeavors that involve setting goals first and then going out to find the most efficient means to achieve them.³⁵ Those goals are what distinguish substitution programs from the broader and more loosely defined notion of an overall energy policy.

Most conservation or efficiency policies address the symptoms of a problem, but the development of alternative fuels attacks the cause head on. The results of the former can be observed in the medium-term; the results of the latter only over the long-term. And where the

³⁴ For a critical handling of the policymaking process see Fischer (2003).

³⁵ Simon (1983) calls this the 'rational' model. For an opposing view that explains the policy process as less goal oriented and more pragmatic see the 'incremental' process model of Lindblom (1979).

former is often either vague (increase use of alternatives) and indeterminate (becoming more efficient), substitution policies are very specific and their outputs are reasonably easy to measure through financial cost and market activity. The large scale substitution of petroleum with biofuels or batteries in the transport sector will have direct quantifiable effects on the consumption of petroleum irrespective of economic growth. Conversely, higher fuel efficiency standards can be offset with increased driving.

The legislative procedure behind the budgeting of ERD largely depends on the form and organization of government. Differences present in presidential, semi-presidential, and parliamentary governments do affect the procedural process as does the degree to which fiscal decision making is centralized. In the EU, most public ERD funding occurs through Member States where as in the US, most public funding stems from the federal government.³⁶ In the latter, the President has the ability to request funds and targets, but the charge to finance such programs falls squarely in the hands of Congress where decisions are debated and responses planned in powerful committees such as Ways and Means, which determine the type of measure (market interventions or grant funding) and Appropriations, which decide the amounts to be allocated. Likewise, all matters related to the military's budget and activities or energy are decided in the Armed Services and Energy committees respectively.

In the EU, the Commission is responsible for initiating proposals. According to the co-decision procedure, legislative powers are shared by the European Parliament and the Council, both of which have specialized committees responsible for recommendations and decisions over substitution specific matters such as research, the environment, trans-European networks, and their associated budgets. For example, the EP's Industry, Research and Energy Committee is responsible for consultations and co-decision procedures on the Union's industrial policy, the application of new technologies, research policy, and Community measures relating to energy policy in general. However, the Council in its various configurations constitutes the EU's real "decision-making centre" (Wessels, 1991) because that is where Member State governments are represented.³⁷

³⁶ At the supranational level the EU has been funding energy related scientific research since 1957 when the first Joint Research Centers were established through the EURATOM treaty, but it took until the European Single Act of 1987 for science to become a Community responsibility.

³⁷ Seen from an intergovernmentalist perspective such as Moravcsik (1998), committee members are strategically calculating actors acting primarily in the interests their home countries and not the Community as a whole.

Since energy policies largely are the responsibility of the Member States, most substitution related decisions in the EU are decided at the Ministerial level in the Transport, Telecommunications and Energy Council (TTE).³⁸ The TTE meets around four times a year to decide on proposals up for consideration. Before matters are considered by the TTE, proposals are run through influential working parties. There are currently five energy specific TTE working parties that prepare materials for the Council on Land Transport, Shipping, Aviation, Intermodal Questions and Networks, and Energy, including one High-level Working Party on Energy (Council, 2010). Most are of a semi-permanent nature. Others are temporary, such as the Ad Hoc Working Group on Sustainability Criteria for Biofuels. Made up of national experts, these groups prepare technical dossiers before passing them up to the Permanent Representative Committees (COREPER I or II) and finally onto the Ministerial level, which exclusively has the authority to make legally binding decisions. Other relevant working parties such as the Budget Committee, which approves financial allocations together with the EP, and the Working Party on Tax Question, which decides over energy related taxation, are equally relevant.

Despite differences in the EU and US legislative procedures, the strong role of committees constitute some important commonalities in way in which policies are developed. Both are subject to intensive lobbying by advocacy groups and actors directly engaged in related issue networks (Helco, 1978), particularly in when it comes to decisions over choices of fuels and technologies (Hallacher, 2005). In the US particularly this has been known to take on the form of 'iron triangles' where executive agencies, powerful commercial actors, and Congressional committees form a sort of mini-government that coordinates preferential regulation, such as in the cases of military contracting and off-shore drilling rights and rules (Adams, 1982; Vernon, et al., 1991). These networks or triangles play an important role in the process of developing policy by providing technical expertise not otherwise available to political decision makers.

The scientific, market, and defense related knowledge provided by those outside of the legislative process are essential for sound decision making. Technical experts provide assessments of what is possible. Powerful market actors, provide valuable insight into the commercial viability of those possibilities. And the military sets the bar on the importance of substitution for national security. Each play an important role in a complex 'Technical Enterprise' (Fusfeld, 1986) that links

³⁸ The TTE has been in existence since 2002. Previously all energy-related decisions were made by the Energy Council, COREPER and its associated working parties.

government, industry and academia and shapes the relationship between public policy and the behavior of ERD organizations that contribute to technological advance (Crow, 1988).

When policies are drawn up to meet targets, they invariably rely on these inputs. However, the often contradictory nature of their positions, the wide time and financial gaps that separate possibility from feasibility complicate the process substantially and lead to acrimonious encounters between politicians and energy executives. Such was the case in a public 2006 US Senate hearing on rising energy prices when Senator Schumer faced off against Rex Tillerson, the Chairman and CEO of ExxonMobil Corporation:

“Sen. Schumer: ... you have said, Mr. Tillerson, that you have no need, really, to pursue alternative fuels. OK? It seems to me your investment in alternative fuels, non-fossil fuel sources, is close to zero. Do you think that serves the public--first, is it? And second, do you think that serves the public interest as prices go up, up, up, up, up, up?

Mr. Tillerson: Our investments in alternative fuel sources [are] in the area of technology. We do not see any of the currently available alternative--

Sen. Schumer [interrupting]: Technology on fossil fuels?

Mr. Tillerson: Technology on alternatives, whether it be biofuels, breakthrough research on cellulosic conversion techniques, breakthrough research on other ways to commercialize coal, breakthrough research on, you know, on other sources of energy.

Sen. Schumer: My time is limited, so what--how much did you invest in coal, the cellu--what is it?, cellu-what?

Mr. Tillerson: Well, we are supporting—

Sen. Schumer [interrupting]: How much did you invest in coal research?

Mr. Tillerson: We are supporting breakthrough research at Stanford University.

Sen. Schumer: How much did you invest?

Mr. Tillerson: We committed \$100 million to them over a period of time for work that they have under way.

Sen. Schumer: One hundred million over how many years?

Mr. Tillerson: Ten years.

Sen. Schumer: That is \$10 million a year. OK? How much did you invest in the biofuels?

Mr. Tillerson: Well, that is part of that research—

Sen. Schumer [interrupting]: That is part of the \$10 million, OK. And how much did you invest in the cellulosic--I hope I am pronouncing it right.

Mr. Tillerson: Well, Senator, I think your question is—

Sen. Schumer [interrupting]: How much?

Mr. Tillerson [continuing]: are we investing heavily in alternatives, and we are not.

Sen. Schumer: You are not.

Mr. Tillerson: We are investing in technology and we are investing heavily in conventional oil and natural gas, which is the business we are in. We are not in those other businesses.

Sen. Schumer: Right. OK. I just think the public ought to know how little. Ten million dollars a year in alternative-type fuels, when the price of fossil fuels is through the roof, to me doesn't seem to be serving the public. Now, you have a different view in terms of your shareholders, I understand that. But we have a public view." (United States. Senate Committee on the Judiciary, 2006)

The above dialogue is not atypical for the sometimes hostile public interaction between policymakers and market professionals, military staff, and leading members of the scientific community. However, it belies the fact that they are all intimately engaged in a mutually beneficial process where rules are made and funds are provided in pursuit of the public good. Despite the rants of politicians, the defensive justifications provided by industry, and the utopian or doomsday scenarios put out by competing advocacy coalitions, the process behind the making of energy policies in general and substitution policies specifically requires the cooperation, if not the consent, of all involved.

2.2.4. Instruments

Politicians can choose from an array of instruments in the broad domain of energy policy.³⁹ Most are of the market intervention kind, such as taxes, incentives, efficiency standards, environmental controls, purchase obligations, and price fixing by utilities and quasi-governmental institutions (Prontera, 2009).⁴⁰ More often than not, however, the use of such tools leads to a slow evolutionary enhancement of competition and a minor tweaking of consumer behavior. Following their successful implementation, the primary fuels previously used in the economy remain dominant; only the efficiency of their use has changed. This is because the effectiveness of most energy policy instruments are hindered by the fact that existing technologies are not particularly

³⁹ For a detailed description of public policy instruments see Elrnore (1987) and for how the choices between policy goals and instruments interact in a multi-level nested way, see Howlett (2009).

⁴⁰ Several authors have studied the instruments available for specific subcomponents of energy policy. Tews, Busch and Jörgens (2003) and Sterner (2003) examine those for environmental and natural resource management respectively and Gerlagh and Van der Zwaan (2006) examine the use of financial instruments to lower CO₂ emissions.

elastic in terms of the fuels that power them or the time it takes to achieve technological progress.⁴¹

The substitution component of an internal energy policy is very specific and thus the instruments available are fewer, their targets are more precise, and their impact is more direct. They seek to introduce large amounts of alternative fuels into energy markets. Because those markets “are not now and never have been fully competitive and open” (Sawin, 2004:7), substantial and sustained intervention is required to achieve even the most modest goals. Very few instruments are likely to achieve such practical impact. Since logic deems that alternative fuels are uncompetitive because the cost of their production and use is greater than that of existing options, where substitution instruments are used, they will take specific legal or financial form and be designed to change the balance of products and prices in the market in favor of alternatives. They will incentivize and rebate the purchase of specific fuels and technologies, directly fund ERD and enhanced infrastructures, and in their most extreme theoretical form, prohibit the use of existing fuels and technologies.

There are two classes of policy instruments for promoting fuel substitution. They are either financial or legal. They can occur as mandatory or voluntary, which in turn affects the time period in which we can expect to see a measurable impact. Legal mandates (regulations) are the most powerful policy instruments because they force compliance in relatively short period of time. Inducements or incentives can be helpful, but their voluntary nature limits their practical impact. Financial measures can result in immediate market changes if they apply to existing products and technologies, but only over the long-run if spent on developing new options.

Financial instruments include taxes, inducements, penalties, and investments and can be either direct or supportive. Direct financial instruments target the competitiveness of substitutes in the market and include fuel specific tax hikes and reductions as well as subsidies and grants that immediately affect market prices. Supportive financial actions attempt to address the lack of substitute fuels in the market by paying for research, development, and deployment of new fuels, technologies, and infrastructures and by easing access to credit through, for example, low interest loan programs. While most direct financial instruments bias the market in some obvious manner, some are more subtle such as active payback systems (rebates) to consumers and industries that are willing to comply with certain voluntary targets, such as the installation of grid-connected

⁴¹ Kuper and van Soest (2003) argue that this is largely the result of path precedence and that most energy policy models produce biased estimates because they in fail to account for the role of history.

photovoltaic equipment or the installation of new windows in a home. Likewise, while most financial instruments are voluntary (one need not accept a loan or a rebate), taxation is always mandatory.

Conversely, legal instruments are more obligatory than voluntary. They include regulations, the powers invested into oversight bodies, and changes in the distribution of authority. These in turn force consumers or producers to change the technologies they use, ease or complicate the granting permits and licenses, and enhance or restrict competition. One type of legal instrument is the Directive. Both the EU and the US have legal instruments called Directives, but they are similar only in name. In the EU, they are formal pieces of targeted legislation that order Member States to align legislation, although the method of implementation is left to the Member State, and together with regulations and decisions, are one of the most important instruments of supranational legislative authority in Europe. In the US, Directives take one of two forms. They either are requirements placed on executive agencies (often in relation to oversight activities) by Congress or executive orders of the President to his or her agencies.⁴² As where EU legislative Directives are always binding in some manner on some Member States, only those that are explicitly referenced in bills in the US carry an obligation (Dep. of Commerce, 2008).⁴³ Meanwhile, all directives ordered by the President are immediately binding upon all agencies and through executive orders.

Irrespective of their different naming conventions, legal instruments do provide powerful tools in promoting substitution. They can be applied toward specific services, such as feed-in policies for electricity or transportation fuel mix requirements for ethanol and other biofuels, or more generally and indirectly by establishing conversion efficiency and environmental standards unachievable by existing technologies, thus initiating a market-wide switch toward a substitute.

Deregulation and changes in the distribution of authority (decentralization, liberalization, and nationalization) push the responsibility of developing competitive substitutes away from existing

⁴² Use of the term Directive in the US executive largely pertains to national security orders. Known as Presidential Decision Directives (PDDs), they are only one type of executive order. Others include Determinations, Memorandums, Proclamations, and Notices, each of which has varying degrees of affect on agency behavior. An archive of recent US executive orders is available online through The Federal Register at <http://www.archives.gov/federal-register/executive-orders/>. For detailed explanation of US President's power and use of executive orders see Relyea (2008).

⁴³ Most Congressional directives come in the form of nonbinding House and Senate reports that accompany appropriation bills. As a rule, such language is not legally binding, but because budget authority is annual in the US, non-compliance can lead to more restrictive language in the following year's appropriation act.

institutions under the assumption that current management or governance structures are the primary obstacle to market emergence or integration. In pursuit of enhancing competition, at one time or another both the US and the EU passed legislation breaking up powerful monopolies in their respective electricity sectors giving consumers the power to select their electricity suppliers.⁴⁴ Another approach to competition is to tax both consumers and producers into behavioral change. This is precisely what the Netherlands did in 2001, when in order to expedite increases in alternative sources of energy, the government levied a large tax on fossil fuel based electricity driving many consumers to switch to providers that generated their power from renewable supplies.

The instrumentalization of government intervention is a factor of the time period over which it is suppose to be effective. As a rule, both financial and legal inducements have short term affects unless the programs are permanent, and while investments will increase capacities over time, their affects can only be observed over longer temporal horizons. Likewise, most mandatory legal instruments such as regulations that set fuel efficiency standards are implemented slowly over long time periods to allow producers to bring upgraded vehicles to market and allow consumers the time to purchase them. They are often coupled with voluntarily accessible financial instruments such as tax breaks for purchasing new fuel efficient vehicles or low-interest loans to produce them. And both may apply either to the entire population or a specific focus group.

Certain types of regulatory mechanisms such as deadlines and purchase requirements can impose product changes over time and force producers and consumers to spend parts of their disposable income. Requirements to switch to energy saving light bulbs, to procure new and more fuel efficient vehicles, or use more heat efficient building materials are all examples of such actions. Compliance in such cases may be voluntary for some period before mandates kick in and financial penalties in the form of fines or higher taxes are applied.

Finally, governments can actively invest into infrastructure to support emergent technologies or provide an incentive for commercial investment and economic growth. The US interstate highway system, which took thirty six years of continuous investment to build (1956 to 1992) and was paid for by federal taxes on gasoline has led to a significant rate of return on aggregate economic growth and productivity (Mamuneas and Nadiri, 1996).⁴⁵ Today, both the EU and US are investing

⁴⁴ Those choices are often limited by the continued dominance of local market providers.

⁴⁵ The final leg of all routes originally planned in the US Federal-Aid Highway Act of 1956, a stretch through Glenwood Canyon in Colorado was completed in 1992. See Stufflebeam-Row, LaDow and Moler (2004).

in biofuel infrastructures. As of early 2010, the US had almost 2,100 E-85 stations.⁴⁶ Germany had just over 330 and Sweden had over 1,200. In fact, since the city of Stockholm decided to purchase flex-fuel vehicles (FFVs) in the 1990s, Sweden has seen the number of FFVs expand from around 700 to more than 100,000 (Kroh, 2008).

In order for ERD investments to have a noticeable impact, however, they need to be substantial and sustained. Since 1986, the EU has spent over €550 million in some 200 research projects on hydrogen energy technologies. In 2008, it agreed to a cooperative six year public-private effort to spend another €940 million to support the development of hydrogen-powered cars (Stearns, 2008). The US has spent close to \$2 billion since launching its national hydrogen initiative in 2003. However, by 2010 these investments only led to a few small demonstration projects across the US and EU.⁴⁷ And projected estimates as to how much it will cost to convert the transport market to hydrogen fuel, for example, range between €10 billion, which according to industry advocacy groups would supply 70% of the vehicles currently on the road, to \$500 billion to serve only 40% of light-duty vehicles according to experts from the US Argonne National Laboratory (Mintz, et al., 2002). The fact is that direct financial investment into substitution technologies and fuels amount to the modern equivalent of a Manhattan Project.

Used in combination, legal and financial legislative and executive instruments can create or open up markets to players and products otherwise excluded. The most recent occurrences have involved new markets for government sanctioned green certificates or Guarantees of Origin that allow utilities and customers to trade renewable energy production and/or consumption credits independently of actual electricity sales or use.⁴⁸ Likewise, in the electricity sector, feed-in policies have been effective by requiring public utilities to purchase renewable energies at fixed prices

⁴⁶ See “Alternative Fueling Station Total Counts by State and Fuel Type” at the Alternative Fuels and Advanced Vehicles Data Center, US Department of Energy: http://www.afdc.energy.gov/afdc/fuels/stations_counts.html. Statistics are update regularly.

⁴⁷ There were 70 hydrogen refueling stations in Europe and 92 in North America as of early 2010. For EU hydrogen developments, see the EU’s Commission web page for research on fuel cells and hydrogen at http://ec.europa.eu/research/energy/eu/research/fch/support/index_en.htm. For hydrogen projects in the US see the previous note.

⁴⁸ Europe embarked upon a “test phase” of such a system between 2001 and 2002, but ultimately chose a system whereby Member States could sell or trade excess credits to each other based on statistical values. See: <http://www.euractiv.com/en/energy/eu-renewable-energy-policy/article-117536>.

from small producers. Several EU Member States (Denmark, France, Italy, Portugal, and Spain) recently have implemented such programs and Germany's dates back to 1991.⁴⁹

Together with a package of voluntary incentives, mandatory regulations, and time dependent phase-in and phase-outs of certain technologies, substitution policies thus take generally blunt policy instruments and convert them into fine scalpels. Sustained over a longer period of time, such packages amount to an industrial policy, examples of which can be found in both the EU and the US where the promotion of 'green industries' are seen not only as mechanism toward enhanced autonomy or environmental stewardship, but also as structurally redistributive employment and economic recovery programs.

2.2.5. *Internal vs. external dimension*

The four components of internal energy policy (actors, institutions, processes, and instruments) interact in ways that largely are restricted to domestic politics. Either because of jurisdiction or self-interested motive, the actors and institutions involved in the process of energy policy making debate over the form and use of instruments almost entirely in an internal context.

The main issues of debate in internal energy policies pertain to access and pricing of public goods (how much should we tax gasoline to pay for road repair, what should be the maximum price for electricity in our cities, should we build more nuclear reactors) and the mitigation of negative externalities (should we have a carbon tax, should we set pollution limits, where do we store radioactive waste). Likewise, legislated efficiency standards, executive ordered environmental standards, and local taxation are each bound to affect supply, demand, and prices in domestic markets in some way and thus cross the interests of virtually every domestic actor and institution. For this reason, energy policies are not only broad in scope; they tend to be vague in practice.

The process of configuring energy policies is further complicated by the fact that elected, appointed, or approved officials in the US and the EU (and the various Member States in each) compete for access and control over a limited set of resources and programs. Power is divided among them and it is often disputed. In order for any energy policy to take hold, it requires not

⁴⁹ When it was initially installed the policy required utilities to purchase electricity from renewable producers at 90% of the retail market price. The law changed in 2000 to allow for differences in technology. For a description of how feed-in policies came about in the US following the 1978 Public Utilities Regulatory Policy Act (PURPA), see Martinot, Wiser and Hamrin (2005).

only the consent of politicians, but also the compliance of a wide range of commercial players, advocacy groups, and the military. Often they will have contradictory goals. That makes the internal process very messy and subjects it to alteration under political and economic winds of change common in representative political systems.

Still, because energy markets are globalized, internal policy choices will always have some degree of short-term external affect. More often than not, those affects are offset by long-term market factors exogenous to internal decision making. Short-term decreases in the demand for oil in the US or EU will drive down international market prices for some time, but only as long as all other buyers remain steady in their demand and suppliers do not reduce their production; a rather unlikely scenario given the very same globalization reasoning.

Internal substitution policies on the other hand differ from general energy policies in two important ways. When successfully implemented, substitution affects the international market by permanently reducing dependency on or altogether delinking an economy from the specific globalized market, and thus enhancing political and military autonomy in international politics. This is not simply a matter of comparative or absolute advantage in economic terms, but rather a source of relative power gain in political terms. At this point the ideal switch to domestically produced alternative fuels is entirely theoretical as no country has yet achieved implementing a successful program in the transport sector, which ultimately determines the ability to project military power. However, the mere perception that substitutes can so significantly increase external power projection options and capacities enhances the role of those actors who are directly engaged in national security and foreign policy, in particular the executive agencies of the government and the military. Thus, substitution policies are driven by fewer actors whose stake in the process tends to be of a higher order than mere market or consumer players.

The second reason is that support for substitution policies are directly caused by external conditions. The very notion of developing a substitute for an existing fuel occurs either because of the vaguely perceived danger of foreign dependence on a specific fuel or the specific specter of some foreign government using its control of supplies to harm one's national and economic security. No matter how vocal issue-specific advocacy groups might be, the motive to finance a substitution program over decades does not depend on the popularity of environmental, social or even macroeconomic concerns. Substitution policies are not created and implemented to save the world, but rather instead and only in response to disruptions or the threat thereof.

Thus substitution policies can be either dependent or independent variables in the relationship between internal energy policies and international outcomes. Their status depends on the

progress of internal substitution programs, the relative importance placed of the ability to project power abroad, and the price and availability of existing external supplies. Assuming that power projection is important, when substitutes are lacking and disruptions occur, internal energy policies will initiate substitution measures and governments will actively pursue external policies to secure external resources. Thus, in most cases substitution policies are dependent variables. However, once a substitute is in place and competitive with externally supplied fuels in the market, higher prices or disruptions are at least going to mitigate the need for immediate external action, which significantly lessens the likelihood of international conflict in the short-term. Hence, substitution policies become an independent variable that shape international outcomes by weakening the pull affect of external conditions.

This dual internal-external quality of substitution policies is unlike any area of energy policy, including the use of large strategic reserves. Efficiency standards, environmental laws, and even carbon taxes have no immediate effect on the external behavior of states because they do not in any way alter the ability to project power. While such programs may make a country less dependent on a specific fuel or supplier, it will not eliminate nor even reduce the dependency to a degree that it can change the strategic necessity to secure foreign energy resources.

Similarly, strategic petroleum reserves (SPR) are emergency response tools only. They are helpful in mitigating the immediate effects of supply disruptions. However, any event significant enough to require a drawdown is equally likely to force governments to act externally (either through diplomatic, financial and/or military means). Indeed, a country that is so desperate that it must tap its reserves literally faces a strategic energy dilemma. Notwithstanding temporary exchanges to commercial suppliers following accidents, the US has in fact drawn on its strategic reserves only three times, and as of August 2010, its 725 million barrel SPR could at best offset only 75 days of net imports.⁵⁰ Whether that is enough to warrant increases or decreases in SPR purchasing activity or is a justifiable basis to spend billions on alternative fuels is a question asked by many actors and institutions engaged in the energy policy process and one that largely depends on their perspective towards external power projection.

⁵⁰ US strategic reserve draw-downs occurred twice between 1990 and 1991 during the Gulf war and again in 2005 following Hurricane Katrina. During the Gulf War, it had virtually no affect on prices and despite efforts in response to Katrina, the actions could not stop prices from rising significantly. In total, 62 million barrels of oil have been sold out and another 68 million have been 'exchanged' or loaned since 1985. Weekly updated Statistics by the Department of Energy can be found at: http://www.eia.gov/dnav/pet/pet_sum_top.asp.

Finally, the links between internal substitution policies and external outcomes are measureable over time. Although the data is not conveniently stored in any single location, it is possible to tally the investments of governments into alternative fuels and technologies and compare substitute fuel and vehicle shares in the market over time. Likewise, we can measure fuel autonomy by tallying fuel costs published by governments, or where that information is not forthcoming, count the fuel consuming vehicles, vessels and warplanes in an arsenal and estimate their annual fuel consumption needs and then subtract from that available information on domestic production and stocks. This quantifiable information compliments a deep reservoir of primary sourced documents containing declarations, orders, and debate transcripts from legislatures and executive agencies of government.

All of this rests on the assumption that changes in internal substitution policy occur in representative political systems only when external forces and conditions are perceived to threaten the national interest, in particular the domestic economic welfare or the ability to project power abroad, and when they are to some degree dependent on external suppliers. This will not be the case for all governments and political systems. In autocratic or non-market driven economies that are dependent on foreign supplies, substitution policies might flourish because they are deemed essential to regime survival and not power projection or even the general welfare of its population per se. And in countries where the export of energy resources is the primary base of national income, there will be no need for a substitution policy in the first place.

2.3. Intervening variables

Energy's relevance in international politics rests on the dual assumptions that states deem autonomy to be important and that most are to some degree interdependent on one another in the supply chain of energy resources. Thus the only scenario where energy could become irrelevant is one where the largest consumers become autonomous through the development of alternatives producible by all other players.

Accordingly, consumer states should be expected put aside substantial financial resources to develop those alternatives in a sustained manner. Such is the purpose of internal fuel substitution policies. Likewise, until they have achieved this autonomous condition, they should prioritize acquisition of external energy resources with all the means they have at their disposal, including the threat and use of military force. However, this is not always the case. There is in fact an ebb and flow in the financing of internal substitution programs and the use of external tools of state power to secure energy resources; Why this contradictory vacillation?

Two intervening variables explain the relationship between internal support for energy substitution programs and external state behavior. These are the price of a particular energy resource and the importance placed on supply availability of that resource for the purpose of power projection (SAPP) by the state or group of states in question. Prices can be measured in high or low terms and are usually linked to the actual availability of supplies, which in turn can be understood as free flowing or restricted.⁵¹ The importance of power projection to a state is independent from the actual international flow conditions of a particular fuel supply. In combination with perceptions about how current or future flows affect that capability, however, it can become a reason for action if not even a *casus belli*.

Price, supply availability, and the importance placed on the latter for power projection are most relevant for those fuels upon which mobility is dependent.⁵² At present, fuels for transport are derived overwhelmingly from petroleum products. Therefore, in order to measure the effects of energy prices and perceptions of supply availability on internal energy policies and international outcomes, we must focus our study on oil. This does not mean that international competition for natural gas, coal, and Uranium is irrelevant, but rather that the ease by which they can be

⁵¹ Prices could be high and the resource will flow freely in major producer countries where the resource is the primary export and source of income. For example, such was the case in US in first half of the twentieth century and is currently so for the Russian Federation.

⁵² All energy commodities are useable for generating electricity and many for heat.

interchanged for the same utility decreases their explanatory power. Thus the focus is not on oil for oil's sake, but rather for its utility value in transport, domestic economic well being, and external power projection. Natural gas may one day be the primary fuel for mobility, as coal once was. If or when that time occurs, we will be able to apply a similar method as we do here for oil.⁵³

2.3.1. Prices matter

Oil prices matter because there is a negative correlation between oil prices and macroeconomic activity (Sauter and Awerbuch, 2003).⁵⁴ It is particularly relevant in the area of transport where price swings immediately change the costs of virtually every good and service and thus determine to some extent disposable income and the cost of public policy programs. Hence, oil prices have a direct internal impact on policy choices and their costs.

Like any other commodity, the price of oil changes with variations in scarcity or market control. The former applies to the balance of supply and demand; the latter to changes in the degree of monopoly.

In its earliest decades, the world oil market was controlled by a single private monopoly (Standard Oil Trust). Up until 1910, the United States supplied as much as seventy percent of the world's demand and during World War II it provided six of the seven billion barrels of petroleum consumed by the allies (Mintz, 2010). Oil companies from the UK, France and Italy soon transformed that market into an oligopoly, but up until World War II, the global price of oil continued to be defined as the 'US price plus freight' (Adelman, 1995:4).⁵⁵ For a period stretching over ninety years (1880 and 1970) scarcity was low. Supply far outstripped demand. Prices were cheap (never reaching \$30 in 2000 prices). Government intervention was rare. Taxes were low or non-existent. And the market was controlled by a few major international suppliers.

The oil market has changed drastically since 1970. Early in the decade most foreign held assets of European and American oil companies were nationalized by local governments. Those

⁵³ For a discussion of the relationship between gas prices (in the markets of Europe, North America, and Japan) and the international oil price, see Siliverstovs, L'Hégaret, Neumann and von Hirschhausen (2005).

⁵⁴ Hamilton (1983) first introduced the notion that a negative relationship between oil prices and macroeconomic activity exists; his most recent analysis is reflected in Hamilton (2008).

⁵⁵ It is probable that they never would have been able to compete if it were not for the breakup of Standard Oil Trust as a result of the introduction of US antitrust laws.

governments, bound together in a cartel, set a floor on prices and tried to take control of the market. As a result, despite the addition of new discoveries, scarcity levels changed as markets became tighter.⁵⁶ Control of the flow of supply into the market is now firmly in the hands of nationally owned corporations well outside the influence of Europe and the United States.

Meanwhile, global demand has almost doubled since 1970 when the EU and US accounted for 28% and 34% of oil consumption respectively.⁵⁷ Today, the EU accounts for only 17% and the US for only 22% respectively. The list of major competitors has grown. China and India, each an emerging economic power in their own right, combined for 14% of global demand in 2009. That is phenomenal given that in 1970 they consumed just over 2% of global production. And along the way the average annual price (in 2009 dollars) has risen from just around \$10 in 1970 to over \$60 in 2009.⁵⁸

As the world's most actively traded commodity, oil prices are set in international markets, and the vast majority of trades are in futures contracts. Three separate international benchmarks are used for pricing international crude sales, depending on market location and fuel origin. These are West-Texas Intermediate (WTI), Brent Blend, and Dubai. A fourth, the OPEC Reference Basket of Crudes (ORB), is used by the Organization of Petroleum Exporting Countries (OPEC).⁵⁹

Benchmarks are important because they provide stability and add transparency to markets, but also because using one allows us to normalize data when evaluating the effect of international prices on states' external behavior and internal investments into substitutes. The most heavily traded contract by volume is currently WTI futures, but such contracts only date back to the early

⁵⁶ Scarcity in this sense refers to daily production and consumption. Investments into exploration have actually driven up the long-term prospect for supply availability. According to BP (2010), the Global Reserves-to-production ratio (R/P) ratio has risen from a 1980 value of 36.8 years to 45.7 years in 2009. Global R/P is calculated by taking the reserves remaining at the end of any year and dividing by the production in that year. The ratio refers the length of time in years that those remaining reserves would last if production were to continue at the same annual rate and no new sources were added.

⁵⁷ According to data published by BP (2010), World consumption in 1970 was 45.7 million barrels a day and 84 million in 2009. BP's EU figures exclude Estonia, Latvia and Lithuania prior to 1985 and Slovenia prior to 1991.

⁵⁸ All numbers used in this paragraph come from BP's *Statistical Review of World Energy June 2010*.

⁵⁹ As of August 2010, the OPEC Reference Basket of Crudes (ORB), consisted of Saharan Blend (Algeria), Girassol (Angola), Oriente (Ecuador), Iran Heavy (Islamic Republic of Iran), Basra Light (Iraq), Kuwait Export (Kuwait), Es Sider (Libya), Bonny Light (Nigeria), Qatar Marine (Qatar), Arab Light (Saudi Arabia), Murban (UAE) and Merey (Venezuela).

1980s.⁶⁰ Records for WTI spot trades date back to the 1940s. Until the futures market in crude oil opened for trading in 1983, all trades were spot.⁶¹ BP (2010) publishes inflation adjusted averaged annual historic prices since 1861 where it uses Arabian Light posted at Ras Tanura for values between 1945-1983 and Brent-Dated for values from 1984 forward.⁶² For purposes of consistency, we will use the BP historic data for annual average pricing and NYMEX future contract prices for purposes of forward speculation.

Similar to the breakup of Standard Oil, the emergence of international majors and the rise of OPEC, the 1983 introduction of crude oil futures on the NYMEX transformed the international oil market. It permanently undermined OPEC's price setting power by taking away the organization's ability to determine who had "rights to a single barrel of oil" (Yergin, 1991:725) in what amounted to the final phase of an evolutionary shift in market control from monopoly to an open market.

Futures contracts are now the primary price setting mechanism in the international oil market. Because oil is a consumption asset it has a significant cost of carry (storage costs plus financing less income earned). Under normal conditions, therefore, the futures price will be higher than the actual future spot price. But conditions are not always normal and predicting future spot prices on consumption assets as opposed to investment assets is problematic. In fact, Hull (2009:73) concludes that, "In the case of consumption assets, it is not possible to obtain the futures price as a function of the [current] spot price and other observable variables" (2009:76). Nonetheless, that does mean that there is no observable relationship.

Silvapulle and Moosa (1999) argue that future prices have a sort of pull or 'lead-lag' affect on actual spot prices and Bekiros and Diks (2008) claim that this is because futures prices respond to new information quicker than spot prices. This may be true since a futures contract has lower transaction costs than spot trades because the former does not immediately fill inventories and is

⁶⁰ Data based on the author's evaluation of published volume data on the NYMEX and ICE markets. According to EIG (1994) there are more than 161 different blends of oil sold on various international markets, the prices of which are reflected in the price of the main traded commodities WTI and Brent. WTI and Brent both sell at premium to the OPEC Basket because they are of a higher quality (lower sulfur content). In December 2009, Saudi Arabia switched from WTI to Argus Sour Crude Index (ASCI) as the benchmark for its oil exports. ASCI is a volume-weighted average of daily spot sales of the three U.S. Gulf Coast medium sour crudes.

⁶¹ Future trading in other oil products such as heating oil and gasoline were introduced in 1979 and 1981 respectively. For an detailed description of the historical evolution of oil trading see Yergin (1991).

⁶² Brent-Dated is the name given to North Sea Brent blend cargo assigned a date to be loaded onto a tanker. These so-called wet barrels differ from paper barrels that lack a loading date and are traded for speculative or hedging purposes.

flexible through the practice of short selling (the sale of a borrowed asset with the expectation that the asset will fall in value). Because such contracts can be executed immediately by parties with no intention of actually taking control of the oil, it also is an inviting venue for speculators and hedgers, who balance each other's opposite goals.

Hull provides a clear explanation of this balance, rooted in economic theory.

“John Maynard Keynes and John Hicks, in the 1930s, argued that if hedgers tend to hold short positions and speculators tend to hold long positions, the future price will be below the expected future spot price. This is because speculators require compensation for the risks they are bearing. They will trade only if there is an expectation that the futures price will rise over time. Hedgers, on the other hand, because they are reducing their risks, are prepared to enter into contracts where the expected payoff is slightly negative. If hedgers tend to hold long positions while speculators hold short positions, Keynes and Hicks argue that the futures price must be above the expected future spot price. The reason is similar. To compensate speculators for the risks they are bearing, there must be an expectation that the futures prices will decline over time.” (Hull, 2009:76)

Finally, the importance of futures extends beyond their price setting influence or their historic liberation of market control. They provide insight into the psychology of the market and the effect of known and unknown information on the outlook of investors toward a myriad of economic and political factors. As their name implies, futures incorporate imperfect information about potential developments. Hence, perceptions about the prospective implications of current events to some degree drive the price of oil. It is not merely a matter of supply and demand.

Spot trades are still the most important marker for immediate decision making because their pricing is concrete evidence of the contemporary state of the supply/demand balance (scarcity) in the market. This is reflected in the fact that much of the volume of futures contracts look only toward the immediate future, a month or two in advance, and fall off sharply the more distant one projects into the future. However, the trade in crude oil futures opens a lens through which one can observe expectation and concern about the future state of that scarcity.

Fears about the possible onset of hostilities and bad weather are just as valuable inputs as declarations about future production intentions by a major producer or poor economic data from

the EU, not to mention the actual outbreak of war.⁶³ Some events cannot be predicted; it is impossible to forecast sudden natural disasters, major terrorist attacks on critical infrastructure, or the destructive force of seasonal Hurricanes, although, in the latter case, some cyclic drop off in supply is often assumed. Certain seasonal trends are commonplace.

Likewise political conditions that are expected to lead to severe supply disruptions are often figured into the price long before the event actually occurs. Thus international market prices are valuable indicators of concern about the current state of the world's affairs. This in turn complicates internal and external policymaking.

Externally it affects policymakers by raising the transaction costs of any possible future military action or economic sanction. On one hand it positively influences states to choose inaction or appeasement in order to keep prices steady or low in defense of their domestic economies. On the other, it negatively influences the choice to resort to armed intervention by raising the fuel costs of any such operation.

Internally it directly affects substitution programs because from the moment that the market becomes aware of a government's major investment into alternatives, it will figure that into the future price of oil. Unless a project and its costs are conducted under maximum secrecy à la the Manhattan Project or Sputnik, traders will factor in expectations about future technologies and their effect on both supply and demand. Ceteris paribus, the closer that policy gets to achieving success, the quicker oil's futures and expected future spot prices will decline, reducing or even eliminating the economic impetus to continue supporting the program.

2.3.1.1. When prices are low

When oil prices are low, governments in large energy consuming nations should be less likely to invest substantial resources in developing alternatives. This is because it is difficult to justify allocating huge sums of public money to fix a problem that either does not exist or is beyond decision making horizon of elected officials. Also, from a political economy perspective, low prices are indicative of markets that are working either efficiently or at least to the benefit of the public at large. Thus it is equally unlikely that governments would take concerted action to intervene in

⁶³ Since unbeknown wars rarely occur in places vital to oil production or transit, we can exclude the notion that existing armed conflict is not included in current pricing.

those markets, based on the assumption that intervention is bound to unleash unknown forces that may drive up prices.

In addition to its negative effect on support for internal substitution programs and domestic market intervention, conditions of cheap oil should also reduce the impetus for interstate cooperation in the same areas. Following the maxim “if it's not broke, don't fix it”, states are not likely to act in concert with others if there is not a clear and present need to do so. In fact, because cheap oil lowers the material costs of power projection, it increases the perception of liberty to act as an autonomous agent on the world stage, allowing states to pursue other foreign policy goals that might otherwise be considered too risky or costly.

Finally, the effect of low prices on economic activity (as measured in GDP growth) is not as severe as that of high prices (Sauter and Awerbuch, 2003). In their study of seven OECD countries, Mork, et al. (1994) found that while the positive economic effects of oil-price decreases vary between some and none in industrialized states, increases have a consistently negative effect.

2.3.1.2. When prices are high

When oil prices are high, governments in consuming nations should be more likely to invest substantial resources in developing alternatives. This is because the strain of high prices on the domestic economy justifies allocating huge sums of public money to fix a clear and present problem.⁶⁴

There is strong quantitative evidence linking sudden spikes in oil prices and government monetary policy responses to negative macroeconomic output. Hooker (1996) and Hamilton (2003) found that following a 10% spike in oil prices, GDP growth declined by between 0.6% and 1.4%. In their study of 14 European countries Cuñado and Pérez de Gracia (2003) found that the negative effects of upward swings (5% and 10%) peak at around six months after the shock and that recovery can take up to three years.⁶⁵

⁶⁴ This is obviously not the case for large producing or net exporting states that depend on oil revenues for the lion's share of their national budget such as Russia, Saudi Arabia, and Venezuela, each of which would welcome high prices as a boost to their economic fortunes.

⁶⁵ For a recent assessment of studies examining the relationship between oil shocks and macroeconomic activity see Jones, Leiby and Paik (2004).

Also, because high prices usually occur in tandem with restricted flow of a resource internationally or because global markets are tight, i.e. the margin of spare capacity has been reduced, the problem is often identified as originating externally. Thus it is equally likely that governments will take concerted action to intervene in internal markets, based on the assumption that through such intervention they can reduce the domestic costs of the fuel by temporarily reducing or eliminating taxes, providing subsidies, or even setting or capping prices.

Just as low prices have a negative effect on support for internal substitution programs and domestic market intervention, conditions of expensive oil should enhance the impetus for interstate cooperation in these areas under the rubric of 'energy security'. We can expect that states will be more likely to act in concert with others precisely because there is an immediate need to do so. And finally, since expensive oil amplifies the material costs of power projection, and thus constrains the liberty to act as autonomous agents on the world stage, we can expect that states will see cooperation as a more cost effective way to seek individual foreign policy goals than when prices are low.

In sum, if price was the only determinant factor in explaining internal substitution policies and external behavior, we should expect to see the following:

Low Prices → Less Investment into substitutes

→ Reduced impetus for international cooperation

High Prices → Substantial investment into substitutes

→ Increased market intervention

→ Increased international cooperation and/or conflict

Price is not, however, the only factor. When prices are low, resources tend to flow freely. But when disruptions and market tightness restrict flows, prices logically rise. When that happens the salience of energy supply availability for the purposes of power projection becomes a determining factor.

2.3.2. *The salience of supply availability for power projection (SAPP)*

‘Supply availability’ and ‘supply availability for power projection’ (SAPP) are not the same thing. The former refers to the actual or perceived flow of resources internationally. It is largely a matter of the balance between supply and demand or production and consumption, and is an important factor in economic planning and trade relations. The latter refers to the importance placed on the availability of supplies by states for purposes of maintaining military advantage over others and their ability to use armed force as an instrument of foreign policy. It is an essential component of the equation behind state behavior. It is not merely a matter of ‘securitization’ in the constructivist sense.⁶⁶ It is a real material fact that determines the ability to wage war.

By power projection, we specifically refer to the capability to change the behavior of other states through some sort of coercion in order to secure state interests on the world stage. Since supply availability is vulnerable to disruptions of pipelines and maritime bottle necks, those with the capability and the political determination to secure the steady flow of resources are likely to use whatever means are at their disposal including diplomatic and economic agreements and the use of armed force. The need to access a fuel resource as a means to project force can be labeled supply availability for power projection (SAPP). It is a variable which alters the path of external policy outcomes.

The status of SAPP will vary significantly between states. This is because power projection is not equally important for all players; nor must it always imply the use of force. In absence of the ability to employ hard power assets, however, third parties are less likely to succumb to pressure. Thus, those states that prioritize power projection are likely to invest more resources into military capabilities, which in large part are determined by the availability of fuels necessary for mobility. This makes the prioritization of power projection an essential component of state approaches to the steady supply of energy resources and may explain which states are more or less likely to resort to conflict when faced with disruptions.

Furthermore, SAPP can be understood both as an actual or perceived condition. Sudden and actual supply reductions have immediate, if only short-term effects. Following the onset of the Suez Crisis in late 1956, for example, the UK and Germany were forced to introduce severe

⁶⁶ Securitization in this sense means the legitimization or enabling of the use of force in the name of security. For a detailed discussion of the concept of securitization see Buzan, Wæver and Wilde (1998).

rationing programs, limiting individual access to gasoline and fuel-oil deliveries up to 20%.⁶⁷ Similarly, during the winters of 2006 and 2009 Europe experienced significant declines in natural gas deliveries as a result of disagreements about transit fees between Russia and Ukraine.

Most of the time fears about supply availability are projections based on the perception that supplies are or will become restricted in the near or medium term. In the market, this is revealed through futures contracts. In politics, it is visible in the political dialogue and the budgets invested into both the deployment of forces to protect fuel shipments and investments into substitute fuels. In this regard one might conclude that energy has simply not yet been 'securitized' to the extent necessary to cause affected governments to change their SAPP priority. And when they do, they would then be more likely to resort to military measures to secure their interests. But this suggests that energy by itself is not an issue of national security, unless it is deemed as such, and this simply is not the case. The availability of energy supplies is and always has been an internal economic and political security issue. Its specific place in the projection of power has been a hallmark of the geopolitical balance of power only since the early twentieth century.

Nevertheless, it seems logical that that most discussions about supply availability are limited to market based approaches. Restricted flows and high prices usually occur simultaneously or with a slightly delayed effect, the result of tightness in the market and limited spare capacity of producers to ramp up production in times of immediate need. When faced with these flow restrictions, markets will quickly find a settlement price to reflect the new state of scarcity.

Government reactions to swings in supply availability depend on more than just the price of a fuel because those swings change the material costs of internal economic and external policy activities. Governments that place a high salience on SAPP cannot ignore the negative impact of high prices and restricted flow on their military capabilities.

Energy's specific value to the military is located in its centrality to projecting force in a world where comparative military advantage largely determines the balance of power; and the mobility of forces largely determines the ability to do so. Transport fuels are essential for transferring forces and arms to theatres of war and regions of heightened concern. Without their steady supply, air forces would be grounded, mechanized equipment immobilized, and troop deployments would

⁶⁷ A detailed description of the measures taken by European governments was reported by Time Magazine in the early weeks of December 1956.

See: <<http://www.time.com/time/magazine/article/0,9171,808686,00.html>>.

take far too long to be relevant. In any supply constrained situation, governments will lose the ability to project force, rendering them vulnerable to attack and reducing their relative power position vis-à-vis others.⁶⁸ This in turn can drive states to act unilaterally with very uncertain outcomes; and hence, makes the perception of SAPP a political game changer in world affairs.

Finally, prioritizing supply availability for internal economic stability is distinctively different than prioritizing supply availability for the purposes of power projection. While it seems logical that every government prioritizes supply availability to some extent and thus pursues some degree of cooperation to secure their interests, only those that place a premium on relative power in the world would be willing to exert to force. This is because their relative military power itself is dependent upon mobility to be effective. Hence countries with higher military budgets should be more likely to prioritize securing the flow of energy resources than those with lower budgets. The null hypothesis here is that a country with no military or security budget would never be able to engage in force projection, let alone prioritize it.

2.3.2.1. When SAPP prioritization is low

States that place a low priority on SAPP should have relatively small military budgets, be less likely than those with higher SAPP priority to respond with force to disruptions and threats to supply, and invest substantially less in substitute fuels. The assumption here is that the desire and ability to project power are connected and visible through military activity. This does not mean that governments which minimize power projection in the traditional hard power sense do not pursue other means of influence, such as international rules and regulations, or in the EU context specifically, rule export. It does suggest, however, that they will not spend the resources necessary to be able to do so unilaterally if and when the need arises.

Those with a low SAPP should almost never resort to international force. Instead they will choose either to do nothing (i.e. leave the securing of supply availability to the market or others) or seek cooperation through negotiations, depending upon the prevailing price. The variable in this case is not the importance of energy, but rather the importance of relative power and the maneuverings of a state to maintain or alter its position vis-à-vis others. Hence, when the priority to project

⁶⁸ This is not to say that the economic fallout of a severe disruption is irrelevant as it surely is painful for most consumers. However, its effect on the military poses a greater long-term risk to national security by robbing states of arguably most important, if not last resort, tool of external policy.

power is low, the options of external action will be limited to diplomatic and commercial negotiations.

Finally, in terms of internal investments into substitute fuels, it is not immediately clear whether low SAPP contestants would be more or less likely to sustain their efforts when supplies flow freely. What is clear is that their militaries will play a lesser role in the process than in high SAPP priority countries. They also should be more likely to pool their resources in cooperative research programs in an attempt to reduce their foreign dependence on a specific fuel irrespective of its general availability and flow. In all likelihood, their efforts will be very visible and public because the matter does not fall under the rubric of national security and because the economy-centric orientation of such states would make open markets the preferred platform for seeking alternatives. Despite their public nature, however, the financial resources invested should be significantly less in countries with low rather than high SAPP priorities.

2.3.2.2. When SAPP prioritization is high

States that prioritize SAPP should have robust military budgets, be more likely than those with a lower SAPP priority to respond to supply threats with some application of force, and in combination with conditions of high prices, also be more likely to invest larger sums of money into the research, development, and deployment of substitute fuels. The assumption here is that a high salience of power projection will be reflected in significantly higher military budgets as a percentage of GDP. This does not mean that governments which maximize power projection in the traditional hard power sense will not pursue diplomatic means or eschew cooperation in general, but rather that they will spend substantially more resources to allow unilateral action if and when the need arises.

Those with a high SAPP should not only be more ready to resort to force, they should actually apply that force more frequently and over greater distances, even when the resource or location in question does not play a significant role in fueling their military capabilities, such as when they deploy forces to protect oil conduits that supply allies or are designed merely to deter aggressive actions of other states. This is because high SAPP countries perceive themselves as engaged in a global competition for relative power and see the projection of force as the primary means by which they can either maintain the status quo or promote a revisionist strategy. Because such states prioritize their relative position with respect to other states in the international system, unilateral external military action is always more likely than reliance on universal cooperation or

market mechanisms.⁶⁹ Although cooperation and negotiation may be preferable and less costly in blood and treasure, doing nothing may be tantamount to forfeiting a leadership role.

For similar reasons, high SAPP contestants should always invest substantially more resources into substitute fuels than their low SAPP counterparts when perceived or actual conditions of supply constraints exist. This is logical because they have much more to lose if supplies are in fact disrupted. Where disruptions will certainly create economic hardship for both low and high SAPP countries, the latter may also lose its ability to project power and hence reduce or lose its ordering position in world affairs. As a result, militaries in high SAPP countries can be expected to play a visibly more important role in substitution programs than in low SAPP countries. And given that political support for alternative energy research will fluctuate with prices over time, the military in such countries should be the most stable supporter of research into alternative transportation fuels. That is, even when prices decline and political support wanes in the economy at large, the military should continue to support such programs.

Finally, high SAPP salience should translate into an activist foreign policy that prioritizes both substitution and securitization of energy issues. This may lead to international cooperation in the form of substitution research and joint military exercises. But it can equally lead to unilateral actions and the refusal to cooperate if such cooperation requires any reduction in material military or industrial capabilities.⁷⁰

2.3.2.3. The combination of prices and SAPP

Prices and SAPP interact to determine external outcomes. Since prices and SAPP can be either high or low and supply flows can be either free or restricted, they can be combined into a total of eight ideal configurations. However, because flows always refer to international movements and prices are measured on international markets (the two are intimately linked), we can exclude two combinations each of restricted flows and low prices and free flows and high prices respectively.

If we were to focus at a different level of analysis, say domestic market prices, then self sufficient countries such as Saudi Arabia and its Emirate neighbors, which can keep domestic prices low

⁶⁹ This conclusion is based on the findings of Realist thinkers such as Morgenthau (1948) and Waltz (1979) who provide detailed discussions about state strategies and the role of armed force in the balance of power.

⁷⁰ It is precisely in the context of perceived need to maintain or expand industrial capacity that most international agreements over climate change have run into difficulties.

through subsidies or proximity to well heads, could be seen as operating under conditions of restricted international flows and either high or low domestic prices. Both place a low priority on SAPP. Thus they could constitute the combinations LP-RF-Low-SAPP and HP-FF-Low-SAPP respectively. Likewise, countries such as Russia, Iran, and Venezuela, each of which is self sufficient in oil supplies and places a relatively higher priority on SAPP would constitute reasonable examples of LP-RF-High-SAPP and HP-FF-High-SAPP conditions.

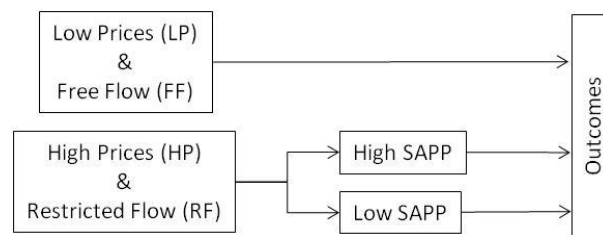
That leaves four remaining configurations that would be applicable to states that are not self sufficient in terms of oil. Since we can assume that prices and flows will negatively correlate, we can say that there should be two variable sets (HP-RF and LP-FF) that can combine with high or low SAPP and that any of these four combinations should lead to different outcomes. But we can whittle our list even further when we consider the logic of these four combinations.

SAPP is only really relevant when prices are high and actual or perceived flows are restricted. Irrespective of its salience, the combined condition of low prices and free flows predicates a reduced incentive for states to take any international action, be it of a cooperative or conflictual nature. There simply is no good reason to spend human, material, or financial resources to secure resources that are cheap and freely flowing.

Such conditions must not decrease the probability that high SAPP states will execute military operations in pursuit of relative power gains in general. It may even increase their activities because the fuel costs of doing so are cheaper. But the explanatory power of SAPP in predicting their actions, i.e. the causal factors involved, cannot reasonably be linked to the price or flow status of the resource any more than the general pursuit of power itself.

Therefore, the specific combination of LP-FF with high or low SAPP is not particularly helpful in understanding the role of energy in external behavior. Instead, we can take the LP-FF condition as a common block and assume that as far as energy supplies are concerned, states of either ilk will pursue passive and non-interventionist strategies. Under such conditions both will do little to nothing. Meanwhile, under conditions of high prices and restricted flow, different outcomes will depend on SAPP prioritization. When SAPP is low, cooperation should always be the result and when it is high conflict should become more likely. The three relevant combinations of price, flow and SAPP are represented below in Figure 1.

Figure 1: Price, flow, and SAPP



2.4. Outcomes

Three possible outcomes or external strategies emerge from the combination of domestic substitution programs, prices, supply flows, and the salience of supply availability for power projection. These are the Market-Commodity Approach, Cooperation, or Conflict. Depending on prevailing conditions governments are likely to change their strategies accordingly.

2.4.1. Market-Commodity Approach

The Market-Commodity Approach (MCA) is a minimalist, Laissez Faire, strategy whereby governments eschew any action that might alter or disrupt the free functioning of international energy markets. They can be identified by a low securitization and general lack of cooperation on energy issues. Inherent in such a strategy is the assumption that markets are the best mechanism to allow for the continuous and secure supply of energy resources. It also assumes that substitutes will be developed by opportunity seekers in the market who are willing to gamble that particular commodities may price themselves out of the market opening new avenues of income for products that are currently uncompetitive.

Still, some cooperation may occur. But like any action, it will come with a price tag. Thus under MCA strategies governments may agree to coordinate strategies, such as build up domestic strategic reserves or even finance some research into substitutes. However, the actions largely will be focused internally. Reserves will be built up and drawn down not for the purposes of sharing internationally, but rather for domestic emergencies alone. And financing for substitution programs will be significantly lower than under high price conditions.

2.4.2. Cooperation

Cooperation is largely, but not exclusively, a strategy of peaceful interstate coordination. It is most likely to occur when prices are high. Under high price and restricted flow conditions there is a clear impetus to take action. Diplomatic agreements, rule export, and coordinated interventions in the market will be its most common manifestations. The most visible example is the International Energy Agency and the EU's Energy Charter. However, depending on the severity of price and flow pressures, it can also lead to coordination of joint military maneuvers and security operations to secure vital energy transit choke points and pathways.

Unlike the Laissez Faire policy of Market-Commodity Approach (MCA) where governments eschew action that might disrupt the free functioning of the market, cooperation can take the internal form of coordination between the government and private sector, such as specialized subsidies, tax breaks and other hidden tariffs. Because such actions can be understood as protectionist, they usually lead to interstate negotiations in order to harmonize or balance the independent actions of other states.

Cooperation is likely to focus in some way on mitigating the negative effects of prices, reducing the risks of disruption and in the extreme coordinating responses to disruptions such as the transferring of strategic reserves in times of emergency. Inherent in a cooperative strategy is the assumption that energy markets are imperfect in that they fail to allow for the continuous and secure supply of energy resources at affordable prices and that substitutes will not be developed by opportunity seekers in the market. Therefore, market intervention is assumed to be required and in order to spread the risk of that intervention, cooperation is chosen over doing nothing or choosing conflict.

High-level government to government contacts and agreements (both bilateral and multilateral) reveal attempts to either increase cooperation or, in response to miscues or events, to mitigate heightened tensions. Diplomatic activities can be measured in the size of embassies (staff and budget), the number of high-level state visits and receptions, the negotiation of treaties, and engagements in energy related international institutions.

In terms of substitution policies both high and low SAPP countries are more likely to invest into the research, development, and deployment of substitute fuels under the same conditions that cause cooperation. However, in countries where SAPP is prioritized, the investments should be substantially larger.

2.4.3. Conflict

Conflict includes a broad category of disputes that can range from simple disagreements to outright war. We can assume that differences in energy related needs, uses, and choices necessarily lead to differences in interests and desired outcomes between states, thus creating conflicts where otherwise they would be absent. Inherent in the occurrence of conflicts is the assumption that markets have either failed or are about to fail to deliver stable supplies at affordable prices. Also assumed is that peaceful resolution through negotiation and cooperation will be or has become ineffective.

Conflicts are most likely to occur under conditions of high prices and restricted flows. Disruptions are the most obvious trigger, but heightened concern about possible future disruptions are equally likely to motivate high SAPP countries to prepare for hostilities by moving forces into or near vital theatres of operations in order to deter perceived threats to the steady flow of supplies. At present, there are armed international fleets guarding the Persian Gulf, the Mediterranean, Strait of Malacca, and the Gulf of Aden precisely for this purpose.

While the quality of the relationship between states (ally, rival, or enemy) surely shapes the nature of conflicts when they arise, alliances can fail, enemies can become friends and rivalries can turn into unions or all out wars. It seems logical to assume that when the ability to project force is threatened and hence autonomy restricted to the point that it is perceived to be an existential threat, states will respond in a military manner. Examples of this may include sudden responses to *inter alia* the immediate cessation of fuel deliveries by a highly important supplier or the closure of routes to deliver them.

In terms of substitution policies, conflict outcomes should have the greatest impact. Countries that prioritize SAPP may be more likely to fight to secure the flow of an existing fuel, but for similar reasons, they also are likely to invest substantially more in substitution programs than those that minimize SAPP. Indeed, in the former the military itself can be expected to play a lead role in financing and providing a strategic market for substitutes because doing so as rapidly as possible minimizes the risks of future disruption to its ability to project force.

2.5. General assumptions

Based on the model presented so far we can make several assumptions about autonomy and substitution, intervening variables and outcomes, intervening variables and internal policy, and the relationship between all three. Since the latter provides an overall picture of our model, we will begin there.

2.5.1. *Overriding assumption linking internal policy, outcomes and intervening variables*

2.5.1.1. *Assumption 1: A feedback loop exists between internal substitution policies, intervening variables and external outcomes.*

Every external outcome has a feedback effect on internal substitution policies, which in turn revises the importance of supply availability for power projection over time (Figure 2 below). This is because the combination of prices, supply flow and outcomes enhance or decrease the need and impetus to legislate and invest in substitution programs.

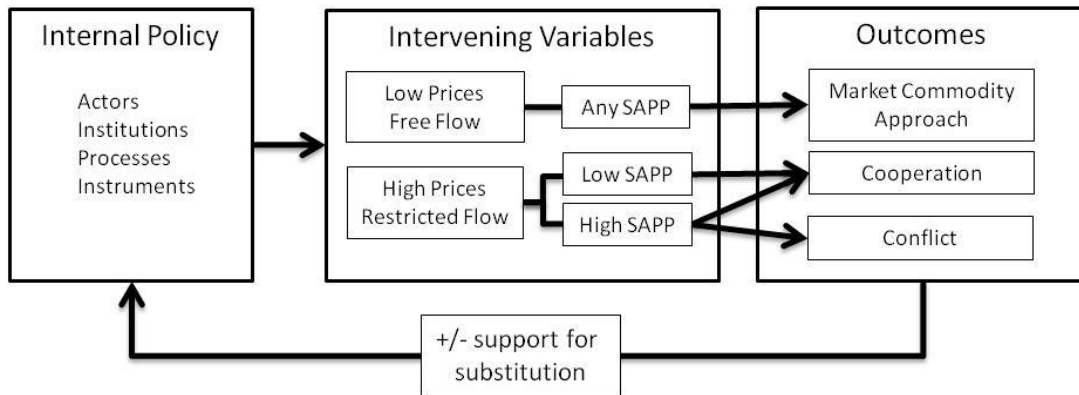
When prices are low and a resource flows freely the momentum of substitution programs lose speed as their legitimacy is reduced. There simply is no economic need to tax existing fuels or to subsidize alternatives. Nor is it politically astute to do so in a political environment where voters often make electoral decisions based on personal economic imperatives. Thus it is logical to assume that there is an inverse relationship between government intervention in supporting the emergence of substitutes and the time that prices of existing fuels remain low.

Conversely, as prices rise, the political inertia against government intervention decreases. The longer prices remain high and flows are restricted, the more likely it is that both the public and private sectors will invest into alternatives. The degree to which they succeed in developing and deploying domestically produced substitutes in turn reduces the need to secure fuel supplies abroad.

The graphic below implies an ideal type representation where cooperation includes both interstate coordination and internal government-private sector collaboration. It does not exclude the tendency among states to maintain sovereign control of their energy mix. Indeed, independent states will always strive to maximize their autonomy, and that is in fact the ultimate goal of substitution policies. Rather, the implication here is that high prices/restricted flows should always lead to either cooperation or conflict and never to the MCA approach, which is the closest equivalent to a Laissez Faire policy. While it is theoretically possible that governments

could eschew cooperative opportunities to reduce their overall energy costs, it seems contrary to logic to assume that they would do so willingly in the face of higher costs.

Figure 2: Feedback loop of internal-external energy policy



One important caveat bears mentioning. The timeframes involved in the feedback loop between internal substitution policies and external outcomes are long. Whether measured in years or decades, the time it takes to develop and deploy substitute fuels and transform or exchange existing technologies to use them will extend far beyond the relatively short-term crises that originally caused the policy change. Where the intervening variables should have immediate impact on outcomes, the effects of both on internal policy can be observed only over broad temporal horizons.

2.5.2. Assumptions about autonomy and substitution

2.5.2.1. Assumption 2: Energy autonomy is the underlying purpose of substitution policies

The primary purpose of internal substitution policies is to increase the level of energy autonomy vis-à-vis international markets and suppliers, which in turn is directly connected to the prioritization of securing supplies for power projection purposes. Most states are dependent in some way on foreign energy supplies and thus vulnerable to disruptions.⁷¹ Either they import fuels or, if fully self sufficient depend on trade with others that place a premium on the access to such resources. Mitigating and ideally eliminating that vulnerability is not only popular politically, it directly enhances national security. Indeed, without the strategic goal of increasing autonomy

⁷¹ Levels of foreign dependency and in the case of oil specifically, a state's vulnerability to disruption, have been the subject of numerous quantitative studies, among which Gupta (2008) produces a useful oil vulnerability index (OVI).

based on an ideal target of achieving complete energy independence, there would be no strategic rationale to invest substantial resources into developing and deploying costly alternatives.

There are other reasons to invest in substitutes, but they seem insufficient. Climate change and economic progress are two good examples. Substitutes may mitigate climate change. However, the actual extent of environmental externalities caused by the production of alternative fuels (*et al* ethanol, biofuels, and even hydrogen) and electricity are unknown and untested. If developing these substitutes requires the increased involvement of external producers or reduces self sufficiency in agriculture, political support is likely to drop off quickly precisely because it increases rather than reduces external dependence. Similarly, policies aimed at structurally changing the economy by introducing 'green industries' certainly will result in higher investments into alternatives. But without sustained high prices of existing fuels, the market is unlikely to cooperate voluntarily without substantial and sustained government intervention. This is a serious problem because governments are particularly fickle with public resources.

2.5.2.2. Assumption 3: Long durations of cheap prices reduce concerns about supply availability and sap support for substitution programs

Long periods of cheap prices are likely to sap support and reduce the stress to develop substitutes because even slight declines in price (like that between the early and mid 1980s) are likely to be misinterpreted as synonymous with positive changes in supply. However, price declines are more often than not the result of a decrease in demand, not an increase in production or even the perceived long term availability of supplies.⁷² Nevertheless, it is safe to assume that long durations of cheap prices translate into reduced concerns about supply availability.

If left entirely to the market, the development and deployment of alternative fuels will take a very long time. The investments required are far beyond the capacities of any single company and the rollout of such technologies can only be planned over decades. It is simply impossible to upgrade or exchange the majority of existing privately owned combustion engines to use exclusively or even partial mixes of biofuels in a matter of few years. Thus when prices do not remain high for very long, it is reasonable to assume that that companies will be unlikely to invest resources into

⁷² If the latter were the case, ongoing oil and gas exploration in the Arctic, Africa, and Canada should have already resulted in significant declines. They did not because of the dual reasons that the costs of accessing these resources are significantly higher than easier fields and global demand is continuously rising.

Framework for analysis

uncompetitive alternatives unless governments require them to do so or provide opportunities to make alternatives more competitive by investing in alternative infrastructures and providing subsidies.

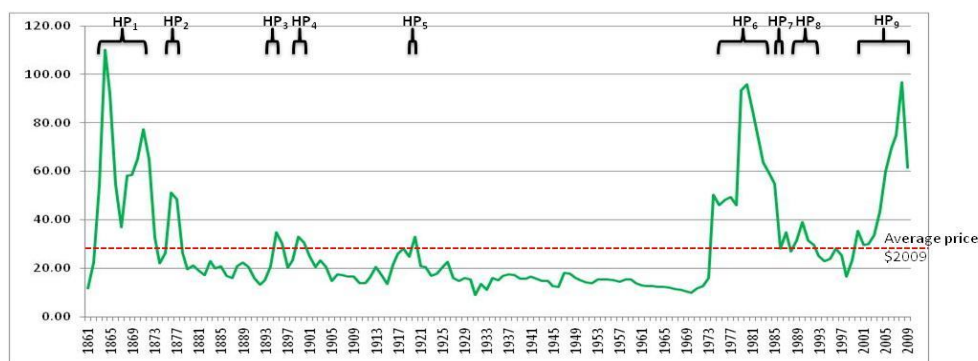
Oil prices since 1861 reveal that they have tended to be either high or low, with very little middle ground. Using inflation adjusted figures of \$2009 the average price of oil between 1861 and 2009 was \$28.64, within which the price was below the average more than twice as often as vice versa and only exceeded the average for longer than two years on four occasions. Periods of cheap oil tend to last twice as long (10 years) as expensive oil (5 years) and most high price periods lasted for only two years or less, way too few to justify a serious investment into alternatives (See Table 1 and Figure 3 below). The two most recent spikes were from 1989 to 1992 and 2000 to 2009. Hence, assuming that oil supplies are not about to disappear, time does not work in favor of long term investments into alternative fuels.

Table 1: High/low periods of oil prices (P) since 1861

P < Average		Duration	P _(Average)	P > Average		Duration	P _(Average)
1861	1862	2	17.06	1863	1873	11	64.10
1874	1875	2	24.18	1876	1877	2	49.96
1878	1894	17	19.37	1895	1896	2	32.62
1897	1898	2	21.83	1899	1900	2	31.85
1901	1919	19	19.35	1920	1920	1	32.86
1921	1973	53	14.91	1974	1985	12	63.79
1986	1986	1	28.25	1987	1987	1	34.82
1988	1988	1	27.06	1989	1992	4	32.88
1993	1999	7	23.67	2000	2009	10	53.47
Total Years		104				45	
Average duration		11.6				5	

Source: (BP, 2010)

Figure 3: High oil prices and durations 1861-2009



Source: (BP, 2010)

2.5.2.3. Assumption 4: Achieving total energy autonomy is an ideal possibility

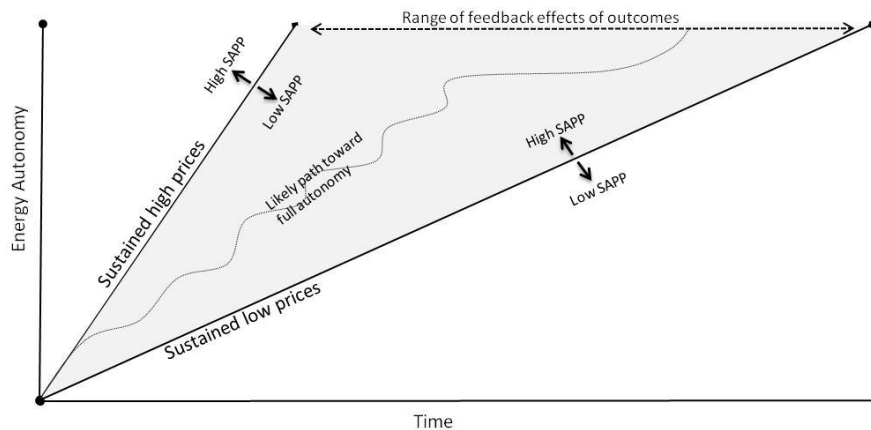
Although unlikely in the short term, the achievement of complete energy autonomy is by no measure impossible in the long run. Before the advent of petroleum most countries were entirely energy independent. It seems logical to assume that at one point in the future they will be again. In fact, the longer the period where a resource remains expensive and is perceived to be vulnerable to disruption, the higher the priority will be to act both externally to secure their steady flow and internally to develop and deploy alternatives.

The post 1974 concentration of extended periods of expensive oil indicate that supply availability is in fact becoming more restricted and more expensive with time (see page 70). In its first hundred years, a barrel of oil cost \$24.13 on average. In the last fifty it averaged \$36.60 and in the last twenty it average almost \$40. This means that the maintenance of military dominance in the world is becoming more expensive and thus increasing the need to adopt measures that reduce those costs if political autonomy is to be secured.

In an ideal situation, prices remain high for a time period such that domestically produced substitutes can enter the market, become competitive and satisfy all domestic demand for the primary fuel. This would result in total energy autonomy and reduce the value of SAPP to a point approaching null, thus removing any link between international energy prices and external conflict.

Each time that a conflicts occurs the process will be accelerated in sudden and short term spurts, but when countries revert to Market Commodity Approach the process will be decelerated, if not reversed. Since conflicts do not occur perpetually and throughout most of its history the price of oil has been well below its overall average (see page 70) the evolution toward energy autonomy can be expected to be slow, arduous and uneven where long periods of relatively affordable and stable prices reduce the momentum toward substitutes (see Figure 4 below).

Figure 4: Diagrammatic representation of the path toward energy autonomy



2.5.3. Assumptions about intervening variables and outcomes

2.5.3.1. Assumption 5: The importance of SAPP should be visibly evident

The importance of SAPP is directly related to the mobility of military assets, economic goods and services, and the control over key routes that allow states to pursue those ends. Because existing energy resources are unevenly distributed, regionally concentrated, and increasingly being developed offshore, certain geopolitical indicators should reveal the extent to which state prioritize supply availability for power projection.⁷³

The SAPP prioritization of states should be visibly evident through domestic military and diplomatic budgets, through their physical engagements on the world stage, and official declarations about energy security, a political euphemism for maintaining the free flow of primary resources. Where available the annual fuel budgets will be particularly telling. Less specific, but nonetheless informative is the number of geographically distinct deployments (both military and diplomatic) in areas that are either transit or source points of transport fuels. To a lesser extent, but still relevant, is aid in the form of grants and loans and the supply of war materials and training to important resource-supplying countries.

⁷³ Classical geopolitical thought stemming from Mahan (1890) and Mackinder (1904) hold that there is a permanent struggle between land and sea powers. Egypt through its control of key rivers, Athens versus Sparta, Rome versus Carthage, and the Spanish and British quests for world empires exemplify the importance of maritime power as where Germany and Russia are classic examples of land-based heartland centered powers. Pape (2004) explains the added importance of air power.

We can assume that cooperation and conflict outcomes will occur in areas where there are transnational pipelines, maritime choke points, and resource concentrations both on land and at sea.⁷⁴ Since there are only a few key passages through which much of sea-borne global trade flows, we can expect to find there higher concentrations of military deployments by states that prioritize SAPP. We should be able to observe similar deployments on or near land where primary fuels are produced.

2.5.3.2. Assumption 6: low prices and free flows, always lead to market commodity approaches irrespective of SAPP

Large net energy importing states are likely to adopt a Market Commodity Approach during periods of low prices and free flows because there is reduced impetus to take any sort of action. As long as there is no perception of an impending supply crunch or disruption, there is simply no reason to seek conflict or even any heightened degree of cooperation. Doing so might change the outlook on the market, raise prices and thus result in higher transaction costs for every sort of government action, be it internal or external.

We further may assume that the absence of stress to secure the flow of supplies is a prerequisite to such as a strategy. As a consequence, under such conditions, MCA strategies will be adopted by governments irrespective of their prioritization of supply availability for power projection. While some states (those that place a premium on power projection in general) may still pursue aggressive actions on the international stage because they are interested in increasing their relative power positions, they would be doing so for reasons that have little to do with the specific availability of energy supplies.

⁷⁴ Pipelines are concentration in the land based zones of Central Asia, Central and Eastern Europe, the Mediterranean Basin states, the East Asia landmass, and North America. At sea, there are five natural trade choke points (Strait of Hormuz, the Strait of Malacca, the Bab el-Mandab, the Bosphorus/Turkish Straits, and the Strait of Gibraltar and two constructed ones (the Suez and Panama Canals).

2.5.3.3. Assumption 7: Disruptions (actual and perceived) lead to conflict only under high SAPP salience

In terms of energy supply availability, we can assume that actual disruptions or the perception that disruptions are imminent or forthcoming will lead to conflicts only when they affect at least one net energy importing state that places a premium on power projection. No state with a low SAPP priority can reasonably be expected to initiate hostilities, choosing instead either to adopt a strategy of cooperation or leave the business of conflict to an ally. Logically, countries that place a high priority on SAPP will have larger militaries and fuel budgets and thus feel the cost of any disruption in its ability to maintain or increase its relative power. Thus, conflicts will only be initiated by countries that have both the capacity and the resolve to do so.

In fact, not only are such states inclined to use force more frequently and earlier than low SAPP countries, they also are more likely to eschew cooperation and pursue unilateral actions. The need to satisfy supply availability for power projection has caused several countries that prioritize SAPP to initiate or prepare for conflicts in the past century. Most actions have been of a deterrent nature, but at least one explicitly targeted the free flow of oil to the military in pursuit of relative power positioning. In 1956, the UK and France, both of which considered fuel supplies for their navies as a vital to their ability to project power and reflective of their great power status tried and failed to seize control of the Suez Canal.⁷⁵

2.5.3.4. Assumption 8: Disruptions lead to cooperation when SAPP salience is low

Contrary to the case when SAPP salience is high, countries that place a low priority on SAPP are likely to cooperate as a result of disruptions or under conditions when concerns about disruptions are heightened. Such countries should place a lower priority on power projection. Thus they will have smaller military budgets.⁷⁶ This does not mean that countries which place a premium on

⁷⁵ According to Immerman (2006), the action also provided an impetus for Soviet Union to crush the uprising in Hungary for fear of losing it along with Egypt and changed the attitudes of France and the UK toward the US, driving a wedge in Atlantic Alliance. As where the severe economic hardships incurred by the UK in the crisis led the future UK Prime Minister Harold Macmillan to declare, "We have to stop because the economy is going to collapse" which, according to Owen (2006b) resulted in a British decision to never again to "fall out of step" with the US, France took the opposite track and prioritized cooperation with Europe. A year after the conflict subsided, France joined Belgium, Germany, Italy, Luxembourg and the Netherlands in forming the European Economic Community (EEC) while the UK sat on the sidelines.

⁷⁶ An important caveat: military spending does not necessarily equal military strength.

SAPP will eschew cooperation at all times, but rather that they are more likely to pursue conflict when fuel supplies are at risk and are less likely to exhibit patience in letting cooperation run its course. Even in the extreme event that low SAPP countries are forced into conflict in some manner, such as joining a naval fleet to secure vital transit pathways, they will always choose to pool their resources, rather than act unilaterally. And given the complexity and risks associated with cooperative military efforts, they thus can be expected to almost never resort to force.

It is safe to assume also that because low SAPP countries have reduced military expenditures, their militaries play a lesser role in the formulation of external policies and are less present as a tool of foreign policy. Therefore, the impact of fuel disruptions, while equally felt by the military will be more severely recognized within the economy at large, which inevitably will lead to market intervention. And because fuel markets transcend borders and unilateral military action in such countries is rarely considered an option, let alone feasible, the impetus to coordinate market interventions between consumers will be strong. Logically, disruptions will more severely affect those economies with a higher and more concentrated external dependence than those with a diverse set of suppliers, but this too will lead to cooperation among low SAPP countries as they work to spread their diversification across a wider group of consumers. To a certain extent this is the notion underlying strategic reserves. But it is also the underlying notion to developing what the EU calls its 'internal energy market'.

It is important to mention that the notion that a country actually can have a low salience of power projection is a relatively recent development. Until the end of World War II, it was widely assumed that every country places a premium on their relative power positions, and when they did not, it was only because they were held in check by other powers. The advent of the EU and other cooperative international institutions reveal the growing explanatory power of different cultural understandings of power itself. In comparing the EU and the US for example, Kagan (2002) refers to a growing gap in perceptions about the merits of diplomacy and force, an argument that highlights the role of power perception and projection in international outcomes and suggests that power projection remains highly salient in the US and significantly reduced in the EU.

2.5.4. Assumptions about intervening variables and internal policy

2.5.4.1. Assumption 9: Lower salience of SAPP equals less investment in substitute technologies

Countries with a lower salience of supply availability for power projection can be expected to invest less in developing and deploying substitute fuels than those with a higher salience. The reasons for this are similar to those that explain why low SAPP countries are more likely to cooperate under actual or threatened disruptions. The two most important are that they have fewer costs for military adventures and will tend to cooperate in research activities, thus spreading the costs of development. This should hold true even when prices are high and flows are restricted, and even when disruptions occur or are perceived to be forthcoming.

Because militaries play a lesser role when power projection is downgraded, one can safely assume that they will have smaller fuel budgets, which will be reflected in fewer available financial resources and market opportunities for the corporate and scientific institutions that they contract. It is safe to assume that in highly salient SAPP states, the military is the largest, coherently organized, consumer-driven financier of substitution fuel research. While the energy departments of national governments and related directorates in international or supranational institutions also fund research, they are not end consumers and are not likely to be able order volumes to satisfy the risk of investing in the research in the first place, which in low salience SAPP countries largely depends on commercial market demand even if it may be driven to a limited extent through government intervention.

Also, because public support for such programs will ebb and flow with the price of the fuel that is supposed to be substituted, those involved in the research face the risk of either losing their funding or never finding a market when prices change. Meanwhile, when the military pays to develop and deploy a new fuel, there is a much higher certainty that it will end up purchasing large orders. This higher certainty in terms of future sales all but guarantees a higher level of interest and rate of return by those in the private sector charged with developing the substitute in the first place.

Therefore, overall public outlays into substitution fuels will be lower in countries where the salience of SAPP is low rather than high even under conditions of where prices are high and flows are restricted or disrupted.

3. Testing the Model

Before proceeding to test the model, one important caveat bears mentioning. Comparing the US and the EU poses serious challenges. They are, after all, very different institutions. The former is for the most part a united entity, a single international actor with a strong central government. Despite all its efforts at cooperation, the latter is not. The most important decision makers in the EU are the Member States. In the US, the most important actors tend to be in the federal executive; although even this is not always the case and largely depends on the issue at hand and the conditions at play. In terms of the tools of foreign policy, the two are also very different. Since 1941, the US actively has fielded a large and united military force and used it for not only national defense, but also the extension of its political will. While some EU Member States have done the same to lesser degrees, the EU does not, and some might argue cannot, field such a force.

On the energy front specifically, the two are even harder to compare. For as much as half of the modern history of oil, the US was the world's leading producer, consumer, and exporter. It was entirely self-sufficient. The history behind that development created animosities and alliances in the US that are central to the country's political dynamic. The EU and its Member States never had the luxury of surplus oil. When a few individual Member States did achieve petroleum self-sufficiency through discoveries at home, they could not maintain it for long. The rest needed to go out and get it and usually relied on government support. The same is to a large extent true of natural gas.

Further, the US emerged as a world power only in the twentieth century as where the UK, France, Germany, Spain, Portugal, the Netherlands, and not too long past, Austria, were all major world powers across the previous centuries. Easy access to energy was the core ingredient of the US' rise. Conversely, energy was a factor in Europe's disintegration into both World Wars. Finally, the evolution of energy policy in the EU and US has not been documented to the same degree. Many of the conversations, internal debates, and even certain supply data have been published in full only recently by the EU. Before that many of its states, either out of national security reasons or lack of need published very little. The opposite is the case in the US. The US Freedom of Information Act (1966) has brought to light such diverse records as telephone conversations, cabinet meetings, and embassy communiqués. Further, Congress has exercised its power over the years to require the Federal Government to publish historical, current, and projection data. It is thus a great deal easier to document with certainty what US policymakers were thinking, when they thought it, and how they planned to achieve it. Indeed, the EU and US are two vastly different units that in many ways defy reasonable comparison.

Despite their dissimilarity, the two are, nevertheless, comparable in several aspects. When combined as a whole, the EU is equal if not larger in physical and economic dimension than the US. Both units (or in the case of the EU its subunits) have nuclear weapons. Both can field large military forces, assuming there is a need and will to execute action. Both are major importers and consumers of petroleum and have been for much of the post-World War II era. At the core of both economies is transportation and mobility. In the problem area of diverse and competing energy mixes of Member States, they are similar in that those mixes apply to the whole and not its parts, which tend to act independently according to their available resources. In the electricity mix, for example, France relies on nuclear power and Germany relies increasingly on natural gas; and Member States use various mixes of coal despite supranational efforts to reduce it as a group. Likewise, in the US, big states like Illinois, California, and Texas get more electricity from oil than from natural gas or coal while the important electoral swing state of Ohio relies on coal for more than 85% of its electricity. Where there are highly influential state-owned companies, so-called national champions, in EU Member States, there also are powerful corporate interests, albeit privately owned, and state or regional regulatory bodies in many US Member States. There also are similarities in the internal balance of power between large and small Member States. There is little doubt that Texas, California, and New York are in many respects just as influential in determining US policy at the domestic legislative level, as France, Germany, or the UK is in determining the internal workings of the EU. Finally, while the EU executive certainly is weaker than its US counterpart, treaty obligations do oblige Member States to cooperate in areas of trade, and increasingly in matters of foreign policy. In fact, one might argue that having many Foreign Ministers simultaneously pursuing common interests abroad can be more effective in achieving targeted goals than being limited to one.

For the reasons identified above, the validity of the comparisons below will always be subject to the fair criticism that the US and the EU are incomparable at the unit level. One cannot in good faith discount such a critique. However, by assuming that there are in fact common grounds for comparing energy policies, the exercise may broaden our understanding of the feedback loop between the internal energy policy and the external behavior of large players in the international system of states. It is the suggestion of this thesis that such a comparison and analysis can be achieved by looking at energy.

3.1. The politicization of energy

The very existence of internal and external energy policies are, in fact, recent phenomena. In order to compare them it is useful to understand some of the common roots and key points of divergence as they emerged. Across the preindustrial age, energy was a communal good, neither excludable nor particularly subject to rivalry. The widespread availability of wind, water, and wood made the issue of supply availability too insignificant to be considered essential for power projection. Europe's great powers (and subsequently the US) relied almost exclusively on animal and muscle power for economic production and mobility, and timber for heat.⁷⁷ By modern standards, trade and power projection were extremely expensive⁷⁸ and energy was not a political issue.

Between Holland's mastering of wind and biomass power in the seventeenth century⁷⁹ and the advent of the gasoline-powered combustion engine in the early twentieth century a series of scientific advancements in the use of energy resources lowered the costs and increased the speed of transport. It also transformed economies and political powers and increased the role of SAPP as a determinant factor in international affairs. Already by 1900, energy had evolved from a universally accessible asset to a highly competitive marketable good, in part because of political choices made by governments to pursue better and faster means of transport. Coal and iron had become the core components of economic and military power. And just a few decades later, oil would take its place in solidifying the role of energy as a strategic good.

Energy emerged as a relevant internal political factor in the industrial age, particularly through the inventions of the coal-driven steam engine and the electric generator. Gross (1971) sums these developments up succinctly:

“The substitution of mineral fuel for wood and charcoal and of steam for water power was not only the most general component of industrialization, in the wider

⁷⁷ For an historical account of preindustrial energy use see Smil (1994) and Reynolds (1983). Detailed studies on the preindustrial uses of energy in England have been produced by Fouquet and Pearson (1998) and Peter Bowden's "Statistical Appendix" in Finberg and Thirsk (1967).

⁷⁸ Eckel (1920) estimated that the cost of moving a “ton of anything” anywhere in 1750 was around \$0.50 cents per mile (or circa €2.3 per kilometer at today's value). Today prices vary depending on the means and commodity of transport. However in 1998, for example, shipping “anything” by water cost on average \$.007 per mile, by road \$.25, and by air \$.59. For details of cost estimates and models see Ballou (1999).

⁷⁹ Holland's advancements in the use of wind power on land and sea allowed it to specialize its economy and dedicate its population to productive labor, while hiring mercenaries to fight its wars. For a detailed history of the Dutch Golden Age see de Vries (1974).

sense of the term. It also was a prerequisite for the growth potential of firms and industries in many instances, among them such strategic sectors as iron and steel or overland transportation.” (Gross, 1971:898)

In rapid succession over the course of a single century, these inventions led to the developments of railroads, steamships, widespread illumination and mechanical power, mass transit, telegraphy, telephony, and the radio. And they also transformed the external behavior of states through their effects on military science, where the advent of these new technologies initiated a revolution in naval tactics and strategy. Steam became a substitute for wind to power ships and did so first and foremost by increasing their speed.

By enhancing the speed of military vessels, the introduction of the steam powered warship increased power projection capabilities and set off a mid century arms race between Europe’s great powers (Brodie, 1969). The process began with France’s introduction of the first ocean-faring ironclad in 1859. The UK quickly followed suit with the first all-iron high-speed steam warship a year later (Sondhaus, 2001:73). Shortly thereafter, European powers Austria, Italy, Russia, and Spain began developing their own coal driven fleets. And over the next twenty years, this new intra-European competition driven by the pursuit of political and military power resulted in rapid advancements in engine design, increased efficiency of coal use (Beeler, 2001), and heightened competition for control of the high seas, a domain that had been dominated by the UK for much of the previous century. Indeed, the Royal Navy considered the advancement of other European navies to be so threatening to its supremacy that it adopted the so-called ‘two-power standard’ whereby it committed to build and maintain a coal and then later an oil-driven fleet larger than the combined forces of the next two largest navies (Parkes, 1990).⁸⁰

The embedding of coal into the calculus of naval supremacy changed the strategy of naval combat itself. During the age of sail, naval strategies largely amounted to blockades of ports. But because steamships only could carry a finite amount of fuel, enemy fleets had to be attacked in harbor as soon as possible before fuel supplies were depleted, a problem first experienced by the French navy when it attempted to blockade Wilhelmshaven in 1870 at the onset of the Franco-Prussian War.⁸¹ Cheap and universally available wind was not only obsolete by the turn of the twentieth

⁸⁰ The policy was encapsulated in its 1889 ‘Naval Defence Act’.

⁸¹ For a detailed depiction of this and other steam warship battles, see Sondhaus (2001).

century, it had been replaced almost entirely by coal, the control and the technology of which had become central to naval power projection.

The introduction of electricity had equally profound political and military implications leading to communication technologies that dramatically shortened the time it took to make decisions and accelerated technological development in virtually every industrial process. By 1896 electric generators were being fitted onto ships, not just for illumination, but for mechanical control of gun turrets (Hammond and Pound, 1941:253) and shortly thereafter for wireless telegraphy allowing vessels to coordinate maneuvers. By the onset of World War I, such features were commonplace on naval vessels in virtually every major fleet. Meanwhile, commercial generators began powering residential and industrial services in London, Paris, New York, and Berlin.⁸² Electric lighting was quickly adapted to the mining, textile, steel, and printing industries. In Paris, it powered the elevators of the newly built Eiffel Tower in the 1889 *Exposition Universelle*. A year later it was used for the city's trams and by 1900 electricity was powering its public subway system (Soppelsa, 2009). Only a few years later everything from stoves to sewing machines to cranes was powered by electricity. Just like coal, it had become a marketable and competitive commodity and its use was becoming so ubiquitous that it was emerging as a public good.

The rapid growth in demand for electric power led to the construction of multi-megawatt steam-driven generators, sparking further technological revolutions in turbine technologies, which led to even greater advances in the transportation and military sectors⁸³ and accelerated the evolution of mass production and developments in the iron industry, particularly steel production. Because of the latter's greater strength, buildings and armaments could now be constructed with much less material, altering the art and business of weapons production, and permanently binding economic and political power with the production of coal and steel.

Massive increases in energy consumption followed. Between 1840 and 1913, for example, UK, consumption of coal in the shipbuilding and railroad industries increased 3,500 percent to 32 million tons (Fouquet and Pearson, 1998). And it pitted producers against one another for control of Europe's booming markets. By 1900, the UK and Germany were Europe's largest producers of

⁸² Edison's plants were opened in 1882; Humphrey Davy (1808) and Michael Faraday (1831) had previously invented the electric light bulb.

⁸³ For details of early turbine development, see McDonald (1962) and an example of how energy transformed the big city (the case of Chicago) see Platt (1991).

coal and France was one of their most competitive markets (Fremdling, 1995).⁸⁴ Where a century earlier, the world's great powers were energy independent, by 1918, France and much of the continent were increasingly becoming dependent on Germany and the UK for their primary fuels; and together with the US, the three were the only remaining energy independent industrialized economies.

Where the European switch to coal was explicitly connected to the power projection capabilities of its great powers, the American drive for coal in the latter half of the twentieth century was less tied to military power projection than to basic internal development. Economically far behind its European counterparts and emerging from a destructive civil war (1861–1865), the country's westward expansion heavily relied on the development of railroads to create new trade and transport routes. Tracks were laid systematically in accordance with coal deposits, which in turn set the foundation for a highly efficient coal production and distribution infrastructure. According to the US Department of Energy, between 1880 and 1918, the country quadrupled its thirst for energy and by the end of World War I, coal fueled some seventy-five percent of its energy needs, all of which was produced domestically.

The biggest breakthrough for the politicization of energy was, however, the discovery and use of oil as a transport fuel. Although the existence of petroleum had been known for millennia, it was not until advances in chemistry in the mid-nineteenth century made it possible to distill kerosene from the product that it began to serve the purpose of industrial and communal lighting.⁸⁵ Enormous finds in the US, allowed the country to quickly corner the global market in illumination oils replacing coal-derived gas and whale oil. In short order the US became the world's largest exporter of the product, a status it would maintain well into the twentieth century.

The use of oil would soon dominate the transport sector and take its place as the primary fuel for the world's most powerful navies. As chemical distillation processes advanced, oil began to be used to drive vehicles powered by internal combustion engines. On land, these new engines and their backers pushed electric cars out of the recreational market.⁸⁶ Within a matter of only a few years, oil had become the dominant transport motor fuel. From a technological perspective,

⁸⁴ The US was the largest worldwide. Fremdling provides a detailed analysis of the Anglo-German rivalry to control Europe's coal markets between 1850 and 1913. For a handling of coal use in the Austria and Hungary between 1831 and 1913, see Gross (1971).

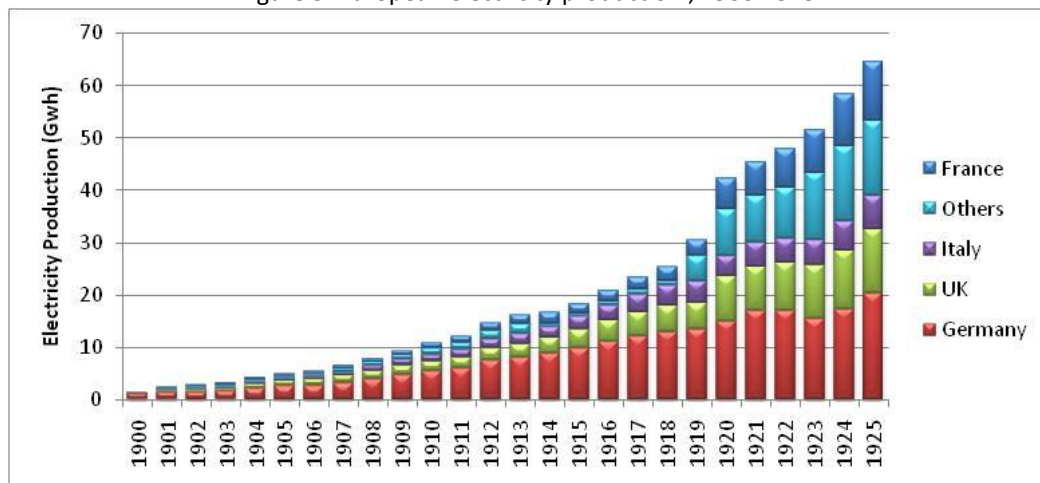
⁸⁵ A detailed account of the history of petroleum and the personalities involved in its discovery and commercialization is laid out in detail by Yergin (1991).

⁸⁶ They had been outselling all other types in the US until 1900.

Europe led the way in producing automobiles and aircraft engines until Ford introduced the Model-T in 1908. Within twenty years, millions of oil powered cars were driving on US and European roads and these new engines were being fit into mechanized war vehicles, from tanks to airplanes.⁸⁷

The parallel entry of motorized vehicles and electricity took different paths in Europe and the US that would be reflective of future approaches. Although motor vehicle technologies were evolving at an exponential rate with faster and more powerful engines coming out of small European production houses, their presence in the US quickly dwarfed that of Europe. By 1929, three quarters of the world's cars were located in the US, one car for every five Americans. By comparison, there was only one for every 30 persons in France and the UK, one for every 102 in Germany, and one for every 6,130 in the Soviet Union (Yergin, 1991:208-9). Nye (1999) suggests that the reason for the large difference between the US and Europe in adopting the automobile lies in the fact that Europe had long since developed densely populated urban centers allowing for greater use of intra- and inter-city railways to service its urban population. The same argument explains Europe's much more rapid advance over the US in installing and using electricity. Denser populations make electricity distribution easier to provide universally and politically much more difficult to deny on a commercial basis. Thus, where electricity services remained under private control in the US, they quickly became a public service in Europe.

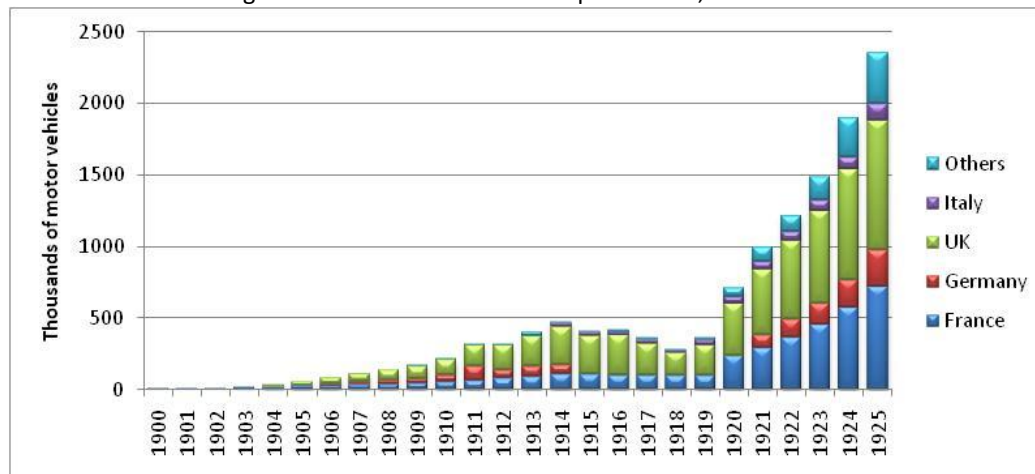
Figure 5: European electricity production , 1900-1925



Source: (Mitchell, 2003:562-3)

⁸⁷ For a detailed telling of the early history of the automobile, the automotive industry and the development of motorized transport for civilian and military uses, see Eckermann (2001).

Figure 6: Motor vehicles on European roads, 1900-1925



Source: (Mitchell, 2003:735-8)

Table 2: Imports of petroleum in selected years and countries in thousands of metric tonnes

	France	Germany	UK	Italy
1905	117	959	1172	67
1913	117	1034	1907	150
1923	352	492	5158	349
1930	3857	3271	9076	739
1938	8293	4986	11849	1682

Source: (Mitchell, 2003:487-97)

The next major politicization of energy was set into motion against the backdrop of Europe's increased competition for naval supremacy. Just as rumors began to emerge that Germany was developing oil-powered ocean liners, Kaiser Wilhelm dispatched a gunboat to Agadir amidst the second Moroccan Crisis in 1911.⁸⁸ Fearful of losing the advantage of speed over Wilhelm's fleet, the UK responded by converting its fleet from steam to motor engines and its fuel from coal to oil.⁸⁹ As Admiral John Fisher advised Winston Churchill, "The first of all necessities is SPEED, so as to be able to fight-*When* you like, *Where* you like, and *How* you like" (Yergin, 1991:155).⁹⁰

The policy was at odds, however, with the UK's domestic resource endowment. The problem was that it had no domestic sources of oil. At the time, the US was producing two-thirds of the world's

⁸⁸ The First Moroccan Crisis occurred between 1905 and 1906 as Germany disputed France's claim on Morocco insisting on access and pushed for Moroccan independence. For a detailed account of the dispute see Morel (1920).

⁸⁹ See Yergin:11 and 154-158.

⁹⁰ Highlights are from Yergin's original text.

oil. Thus, once the decision was made to switch fuels, acquiring oil became the government's highest priority and over the course of following decades, it led to a national security policy to acquire and control oil and the routes to deliver it. Departing from centuries of non intervention in the markets, the UK government initiated an approach to directly invest in a privately owned commercial venture to explore and control oil far beyond its borders and by 1914 had acquired a 51% stake in the Anglo-Persian Oil Company. As in the developments of iron armor and coal, its European competitors quickly followed suit.

What previously was a competition for naval supremacy had now become a global struggle to control the supply of fuel. The UK and the Netherlands were best positioned for this new race to globalize what Rockefeller had coined the "Great Game" given their expansive territorial holdings.⁹¹ And they would be successful, ultimately forming two of the world's largest integrated oil companies (Royal Dutch-Shell and Anglo-Persian) which in only a few years (by 1920) would control approximately half of the world's proven reserves.

Across the Atlantic, the abundance of oil led to the opposite effect, spurring an adversarial relationship between government and the oil industry, with the former seeing the latter as a threat to fair play, open competition, and national sovereignty. In the late nineteenth century, the US was emerging as a global industrial power and oil was literally bubbling out of the ground. But most of the country's production was controlled by a single company, the Standard Oil Trust, which had anything but a cooperative relationship with the government. It is noteworthy that the same year (1911) that the UK decided to consolidate control of foreign oil, the US Supreme Court decided to break-up Standard Oil's control of domestic resources, a move that marked the beginning of anti-trust laws that are a vibrant part of modern regulatory economies.

The rapidity of oil's ascendance as a substitute for coal is a remarkable feature of the politicization of energy resources. Oil industry executives had already expanded outward to secure new reserves in foreign countries.⁹² The increasing need for foreign oil amplified the strategic value of key maritime transit routes to ship fuel from Asia and the Middle East to Europe. By 1892, the world's first oil tanker (the Murex) had transited the Suez Canal. Meanwhile, the Italo-Turkish War (1911-12) and the two Balkan Wars (1912-1913) highlighted the impending breakup of the

⁹¹ The term "Great Game" comes Rockefeller's reference to domestic US competition to make profits and transform the country from an agrarian to an industrialized power; see Yergin (1991) page 37.

⁹² Their actions led to major discoveries in Sumatra (1885), Mexico (1901), Iran (1908), Venezuela (1914) and Iraq (1927).

Ottoman Empire. Italy won Libya and Rhodes as new colonies and the former would become a vital source of European oil, while the remainder of Ottoman holdings would soon become the target of European oil barons. These new events further increased the geopolitical importance of Europe's colonies and the territories of the Ottoman Empire and raised the profile of the Caspian littoral states as a source of oil for Germany and Russia.⁹³ In the Wars that would follow, coal and then oil would become bound with iron, steel, and conflict as wartime strategies increasingly focused on supply lines and security of fuel and war materials.

By the onset of World War I, oil already had solidified its position in the national economic and political systems on both sides of the Atlantic. Europe's navies were switching from coal to oil rapidly; the US took a little longer to start, but the transformation was well underway by 1925. Before the interwar period came to close, the international competition for oil had become a matter of the highest political order. Consumption had risen so much that even the US was beginning to import small amounts to make up for domestic demand.

Concerns that reduced oil supplies could endanger national security and power projection capabilities already were on the rise in the early twentieth century. They became palpable during World War I. French Prime Minister George Clemenceau highlighted these concerns in a November 1917 telegram to US President, Woodrow Wilson, where he wrote:

“At the decisive moment of this war, when ... major military operations get under way on the Western Front, our armies must at no time lack the fuel required for our military trucks, for our aviation, for our mobile field artillery (...) France must possess the gasoline that will be as necessary as blood in tomorrow's battles”
(Bérenger, 1920:59-60)

Oil was growing in importance, particularly with respect to military mobility, but it was still only one aspect of the issue. The struggle for control of iron and coal resources in the Rhineland was equally important as a definitive component of World War I's Western Front. In the opening days of hostilities, Germany occupied the steel-industry-rich areas of Belgium and Luxembourg, and took just enough French territory to control three quarters (30 out of 41 million tons) of the latter's 1913 coal production (Jensen, 1968). In the subsequent months (July-September 1914), annual German-Austrian coal production rose from 355 to 420 million tons and allied production declined from 405 to 375 million tons (Eckel, 1920:78-0). By Autumn, member of France's

⁹³ Similar to the role of Mexico and Venezuela for the US.

government were calling for the “the destruction of German industrial power through ... the annexation of the Rhineland’s coal regions” in particular the Saar (Henze, 2005).⁹⁴

By the end of World War I, it had become abundantly evident that energy resources were a “critical element in the balance between war and peace” (Singer, 2008:75) and oil was emerging as the key component. As Sassi (2004) observed, “The First World War demonstrated powerfully and unequivocally that oil was an essential strategic product for armed forces, both land- and sea-based.” The combined control of oil, coal, and steel was now almost synonymous with national security. Recognizing this, France used the Treaty of Versailles to secure almost all of southwestern Germany's metallurgic industry, annexed Alsace and Lorraine, and German-owned property was sold to French buyers with the proceeds returned to France as reparations. For France, Germany, the UK and the US, supply availability for power projection had become a top priority and driver of external behavior.

The shift was not only sudden; it was also volatile, particularly in reference to petroleum. Immediately following the war, concerns that oil was running out sent oil prices higher (from \$1.98 in 1918 to \$3.07 in 1920 in nominal values) and sparked a nationalist driven global struggle to control the remainder of world’s known oil reserves (even initiating claims that oil could be extracted from shale deposits and artichokes).⁹⁵ Because most easy oil was located within the boundaries of their vast colonial holdings, France, Holland, and the UK were particularly well poised to win this new competition and they took advantage of it by initially excluding each other and the US from exploiting their respective territories.

As part of the Versailles peace settlement, both France and the UK won interests in the Turkish Petroleum Company (TPC).⁹⁶ In 1920, the UK and France agreed in San Remo to divide the vast oil reserves of Mesopotamia between them (building on their secret 1916 Sykes-Picot Agreement to divide up Arabia). The US, which saw its influential companies being excluded, responded by passing the Mineral Leasing Act, the country’s first update since 1872, restricting foreign rights to drill for American oil unless equal access was provided to American companies. Meanwhile,

⁹⁴ Russia was unable to transport its own coal and steel products reliably to the front and stopped altogether in 1917 after the Bolshevik Revolution. Meanwhile, the US, which at the onset of the war was producing 570 million tons of coal and 31 million tons of steel annually, came to the aid of the allies and tipped the energy balance in their favor.

⁹⁵ Yergin (1991) describes the situation in some detail (pp.194-196).

⁹⁶ Sassi (2004) provides a detailed description of the emergence of the French oil industry in the interwar period.

France, which had recovered TPC shares previously held by the Deutsche Bank, formed its first national oil champion, the Compagnie Française des Pétroles (CFP) in 1924.

It soon became clear, however, that transatlantic cooperation in exploration was necessary, particularly with respect to the financial and technical means required for successful exploitation. That recognition led to a flurry of diplomatic and commercial negotiations resulting in European and American cooperation in exploiting the reserves of the Middle East. In 1928, European and American companies would cooperate to form the Iraq Petroleum Company⁹⁷ and over the course of the next ten years, international oil prices remained volatile, but never exceeded two dollars. The immediate inter-war energy crisis had been avoided, but a new and far more ominous one was about to begin.

World War II witnessed a repeat of the struggle for the Rhineland's vital resources. After Germany swept across France in 1940, it re-annexed Alsace and Lorraine and used its resources for its expanding military dominion. It also witnessed the first explicit evidence of restricted SAPP (while costs of the fuel were relatively low) causing the development of internal substitution programs.

In 1938, Germany consumed a relatively moderate 44 million barrels of oil annually, of which only 3.8 million barrels were produced domestically.⁹⁸ More than half of its needs came from overseas imports (28 million barrels) while an additional 3.8 million barrels came from European sources (mostly from Romania) and the remaining 9 million were produced synthetically from coal (United States Strategic Bombing Survey, 1945).⁹⁹ When the war began, Germany had a total of 15 million barrels of oil in stock. Although it would add 5 million barrels by seizing fields in Norway, Holland, Belgium, and France and import another 5 million from the Soviet Union between 1940 and the Summer of 1941, it was estimated that because its monthly military requirements were around 7.25 million barrels, its "stocks would be exhausted by August 1941" (Becker, 1981).¹⁰⁰

⁹⁷ Ownership was distributed as follows: British Petroleum (23.75%), Royal Dutch-Shell (23.75%), Compagnie Française des Pétroles (23.75%), the Near East Development Company, a consortium of five US oil companies, (23.75%), and Partex Gulbenkian, the original founder of the Turkish Petroleum Company, (5%).

⁹⁸ By comparison, in the same year the UK consumed 76 million, Russia 183 million, and the US approximately one billion barrels. See United States Strategic Bombing Survey (1945).

⁹⁹ Although total imports were even higher in 1939 (33 million barrels), before the onset of the allied blockade.

¹⁰⁰ Becker (1981) cites his numbers from W. Tomberg. "Wehrwirtschaftliche Erkenntnisse von 5 Kriegsjahren," (November 1944), pp. 58, 61, which he researched at the German Federal Archives in

The termination of overseas oil imports at the start of the war so significantly endangered Germany's ability to conduct warfare that terminating its treaty and invading the Soviet Union to "gain possession of the Russian oil fields in the Caucasus mountains, together with ... Donets coal" became an attractive if not necessary option (Becker, 1981). While Germany would later try and fail to seize fields and refineries in Grozny and Baku, Romanian fields continued to supply Germany well into the war until allied air raids destroyed much of their refining capacity.¹⁰¹ Germany also began developing its own fields and following annexation of Austria ultimately boosted its internal output to 12 million barrels by 1944 (Birkenfeld, 1964:217). However, it was Germany's development of synthetic fuels that made the difference and reflected Hitler's desire to make Germany energy independent (Petzina, 1968:36).

Using hydrogenation, Germany tried to master the art of turning coal into high-octane gasoline, useable in all its military vehicles and particularly its air force. At the start of the war, Germany had seven plants in operation producing almost 5 million barrels of petroleum fuels and planned to build enough capacity to produce at first 36 million barrels by October 1938 and 68 million by 1943 (Birkenfeld, 1964).¹⁰² Germany was never able to achieve the high end of its goals and did not build a single new synthetic aviation fuel plant after September 1939, but between 1938 and 1943, it did match the 36 million mark, and the substitute fuel constituted about half of its needs by 1943 (United States Strategic Bombing Survey, 1945:74). Interestingly, the war also caused a reverse or retro-substitution in 1942 when Germany was forced to introduce a plan to switch vehicles from liquid to solid fuels amounting to some 8 million barrels of savings by 1943. Although these developments came too late to save the German war effort, the importance placed by Germany on its substitution program highlights the changes that had occurred in the previous decades. Energy resources, and liquid fuels for transport in particular, had become essential to power projection. And Germany's pursuit of alternative fuels demonstrated that internal substitution both affected and were affected by external events.

German Field Marshal Erhard Milch summed up this condition in 1943 by declaring that Germany's hydrogenation plants "are our most vulnerable spots; with them stands and falls our entire ability to wage war. Not only will planes no longer fly, but tanks and submarines also will

Koblenz; and Speer's remarks in Imperial War Museum in London, FDC 1, Interrogation of Albert Speer, 5th Session, May 30, 1945. I will draw on these numbers and sources in the following paragraphs.

¹⁰¹ Becker (1981) cites the "20th Meeting of Zentrale Planung", October 29, 1942, pp. 15, 7.

¹⁰² See specifically pages 82, 113-14, 120-25, and 179-231.

stop running if the hydrogenation plants should actually be attacked (Becker, 1981).¹⁰³ His vision was prophetic. In May of the next year, the allies attacked those plants, putting a final end to Germany's substitution program and its ability to wage war.

By the war's end, the politicization of energy was almost fully complete. States that had once eschewed intervention in markets in general now saw such intervention in the energy sector as natural as taxation. Even the US, previously adverse to public-private cooperation, was convinced of the necessity for coordination and in 1946, President Truman requested his Secretary of Interior to establish a quasi-public body "to assure coordination in peace-time of the Federal Government's many interests in petroleum, petroleum products and associated hydrocarbons" (Truman, 1946). Perhaps even more importantly, supply availability for power projection was explicitly evident in the policies of all the major powers. Battle lines had been drawn over the locations of key coal deposits and oil fields; refineries had become targets of acquisition and attack; and Germany's initial attempts to develop an internal fuel substitution program in pursuit energy supplies to project power had proven limitedly successful.

Furthermore, World War II's enormous destruction highlighted the need to find a solution to the ongoing conflict between Germany and France (three wars between 1870 and 1945). The post-war Marshall Plan (1948) was part of that process. Integration of Europe's war-making and war-fueling capabilities was another.

Europe's initial steps toward integration were not easy. Following the war, some French officials initially wanted to repeat the mistakes of Versailles and re-acquire the Saar and Ruhr areas, or at least "Frenchify" them (Dinan, 2004).¹⁰⁴ Their aims were overcome, however, by the efforts of France's Jean Monet and Robert Schuman, to place "the whole of Franco-German coal and steel production under a common High Authority, with the framework of an organization open to the participation of the other countries of Europe" (Dinan, 2005:11; Fontaine, 1990:44). If Europe was to find peace, it was to do so by instrumentalizing energy as a common basis of interdependence and security. The establishment of the new European Coal and Steel Community (ECSC) in 1951 marked the beginning of a structural transformation of historical conflict over the trade in natural resources. As Henze (2005) notes, "While the primary cause of conflict between France and

¹⁰³ Becker cites the 37th Meeting of the Zentrale Planung, April 22, 1943, p. 42.

¹⁰⁴ It also wanted to retain many of its colonial holdings, as did the UK, a desire that would lead to their disastrous cooperation in trying to seize the Suez Canal in 1957.

Germany was geopolitical, the solution lay in resolving the issue of natural resource competition. The ECSC was thus a first step into a new world.”

Europe and the US now faced a world where the control of energy resources in general and oil specifically were paramount to national security. New actors including large private and national energy companies (national champions) had entered the fold of internal policymaking and the military had emerged as one of the most important players in determining the necessity to find substitutes. New legislation in the US and Europe created powerful committees and oversight bodies enhancing the power of both the executive and legislative branches at multiple levels of government providing new instruments for market intervention. Just as these changes took form, the markets for primary fuels boomed in volume, setting the stage for an increasing level competition over national and international control and coordination.

In the course of little more than one century, energy had undergone a paradigm shift that altered the global landscape of economic and military power. It had evolved from a freely accessible, non-tradable commodity in a world of energy independent countries to a strategic resource and thus became the wellspring both of cooperation and conflict. With Europe divided, in ruins, and emerging as a new cooperative pact, the US had become the world's leading industrial and military power. The Soviet Union controlled the energy resources of the Caucasus, the Urals, the Caspian Sea and its Littoral states. French and UK companies controlled most of the oil fields in the Middle East and North Africa. And coal and steel, the core components of industrial power and war making, became the focal points of a new and more peaceful Europe.

3.2. The EU's Energy Policy

3.2.1. Evolution of Internal policy

The foundation of the present day EU finds its roots in the post-World War II notion that peace could be built through energy cooperation and security. Two of the three founding treaties explicitly deal with energy issues. The 1951 Paris Treaty between France, Germany, Italy, and three Benelux countries (Belgium, Luxembourg, and the Netherlands) established the European Coal and Steel Community (ECSC) and the 1957 Euratom Treaty among the same six established intra-European coordination over uranium supplies. Both were *leges speciales*, sectoral treaties that aimed at introducing coordination with regard to specific commodities, but in practice “did not intend to establish a coherent and common energy policy” (Pollak and Schubert, 2010:5).

From its inception, the EU's predecessors constituted a liberal economic project, based on a market commodity approach of non-intervention. The ECSC established a common free market for coal and steel, the necessary elements of war, devoid of subsidies and import and export duties. Intriguingly, European leaders excluded oil from their original energy agenda. Although clearly important, Europe had little of it on the continent. Focus was placed instead on atomic energy because of "high expectations about the role" it would play in the future and French advances in the technology (de Jong, 2008:96).¹⁰⁵ The omission of oil would come back to haunt Europe's political elite as early as 1956 when its supplies would be reduced for weeks during the Suez Crises. At that time, discussions about wider economic and nuclear cooperation were so close to fruition that the new ECSC Member States decided to put oil (and the broader agenda of energy cooperation) off for later discussion. The EU was thus founded on the control of two energy resources, coal and uranium.

3.2.1.1. Phase 1: The early years 1951-1970

In the incipient years of the EU, energy was a core component of discussion, but hardly one of complete cooperation. The UK, a coal powerhouse and holder of major oil assets in the Middle East and Asia was not a founding member of either the 1951 ECSC or the 1957 European Economic Community (EEC). Coordination, where it existed was limited to the six continental powers. Even though nuclear power offered future promise and free flowing supplies of cheap foreign oil provided the basis for building the foundation of a common energy market, coal remained the primary energy source for heating and electricity generation on the continent. Agreements over oil and natural gas were hindered by both political and technical considerations.

Energy policies have always been affected by scientific, technological, and price issues, and at the time (in the early 1950s) there was little evidence of any cost effective alternative to oil as a transport fuel, nor for that matter any reason to be concerned about supply availability. Oil was abundant and Europe controlled most of the world's known reserves. But cooperation on the energy front also confronted European leaders with dilemmas about the high degree of

¹⁰⁵ As a result, the parties later agreed to a separate treaty on atomic power in 1957 (Euratom) to coordinate the supply of fissile material. The development was closely related to the US "Atoms for Peace Program".

interdependence between energy resources and a diverse set of policy sectors such as competition, external relations, transport, industry, and environment externalities.

Also, the fact that energy was (and still is) regarded as a strategic good (Prontera 2009) by the EU's founders, led its Member States "to favor national energy champions instead of opting for integrated, transnational approaches" (Pollak and Schubert, 2010:5), which in turn complicated relations over primary fuel policies and led to diverging and sometimes even contradictory political objectives. Indeed, in this early phase, Member States were more interested to secure the energy supplies that their national industries required for post war reconstruction than they were in sharing those resources. As a result, they tended to promote national energy companies, which to a large degree were controlled by the respective states. Thus at the earliest stages of Europe's nascent energy policy, state executives and national champions played a vital role in setting tone and direction. And because commodity prices were low (despite an obvious increase in post-war demand) the need to extend cooperation beyond the rules of free trade seemed unnecessary if not even against their respective national interests.

Moreover, with necessary materials of war regulated, adjacent attempts were made to establish a common defense community, particularly in opposition to US calls for the rearmament of West Germany and its inclusion in the newly established North Atlantic Treaty Organization (NATO). Those attempts subsequently failed, however, in 1954, when Gaullists in the French Parliament blocked ratification (preventing a vote) on the basis that such an agreement would endanger France's national sovereignty and independence; a prelude for a problem that would later become one of the primary weaknesses in the EU's ability to act with unanimity on the international stage.¹⁰⁶

Not long afterwards, ECSC foreign ministers met in Messina in 1955 *inter alia* to appoint a successor to Jean Monnet as the High Authority's next president and discuss expanded economic cooperation in the form of a fully-fledged customs union.¹⁰⁷ The end result was an agreement to move forward on greater economic integration through a gradual reduction of trades and tariffs and a sector-based approach for integrating transportation and energy.

¹⁰⁶ In referring to the EU, we imply all its predecessors including the ECSC and EEC. Euratom remains an independent legal entity.

¹⁰⁷ The representatives included Johan W. Beyen of the Netherlands, Gaetano Martino of Italy, Joseph Bech of Luxembourg, Antoine Pinay of France, Walter Hallstein from Germany, and Paul-H. Spaak of Belgium.

A new committee was formed to prepare a step-by-step plan chaired by Belgium's foreign minister Paul-Henri Spaak. The work of Spaak's committee led to the 1957 Treaty of Rome and the formation of both Euratom and the EEC. Again, oil was absent from the resulting agreement. As Willenborg, Tönjes and Perlot (2004) aptly note, the EEC treaty did contain references to non-coal and uranium energy resources, but it did so without special stipulation and created a fragmentary legal structure that became a serious barrier to achieving an integrated European energy policy.

Energy cooperation or at least the pursuit thereof began to take off with the establishment of the Community's first energy related executive committee, but it also ran into its first major obstacle, namely the competing national interests of its Member States. One of the first actions of the EEC's new executive was the mandating of an Inter-Executive Energy Committee (IEC) to investigate the energy balance of its Member States.¹⁰⁸ It took them until 1962, however, to present their research, which recommended a massive shift of sovereign power to the EEC's supranational authority.¹⁰⁹ The Member States responded by reducing the IEC's tasks to identifying opportunities for more "pragmatic coordination". While the Member States wanted a common energy policy, none was prepared to relinquish sovereign control.

Although the then six Member States agreed on the need for such an integrated approach and the Commission demanded more coordination in the energy area, it took the IEC another two years to come up with an appropriate proposal. In early 1964, it delivered a series of recommendations that led to a "Protocol of Agreement" that included objectives such as cheap and secure supplies, cost stability, fair competition, and the 'progressive development of substitute products'.¹¹⁰ Vague as these recommendations were, the presence of the notion of substitution was indicative of EU's early recognition of its importance to energy security.

¹⁰⁸ The IEC consisted of executives from the Commissions of the EEC, Euratom and ECSC.

¹⁰⁹ The report was titled "Memorandum on a Common Energy Policy". Willenborg, Tonjes and Perlot (2004) site Lefeber and van der Linde (1987) on this.

¹¹⁰ The formal title was the "Protocol of Agreement on energy problems, reached between the Governments of the Member States of the European Communities at the 94th meeting of the Special Council of Ministers of the European Coal and Steel Community held on 21 April 1964 in Luxembourg"; See *Official Journal* 069, 30/04/1964 P. 1099 – 1100. It is important to note that *substitution* in this case implied the ability to switch between coal and oil. Willenborg, Tonjes and Perlot (2004) translate the original text to read 'flawless substitution'. However, a later EEC document (Com (68) 1040) specifically uses the term 'progressive'.

It took another three years until hostilities erupted in the Middle East (June 1967) and closed the Suez Canal again for several days that Europe's leaders finally realized the dangerous scope of their earlier omission of oil. The crisis confirmed the need for expanded cooperation in the energy field and a broader supranational perspective.¹¹¹

Within a year (1968), the Commission released its "First Guidelines for a Community Energy Policy" (COM (68) 1040 final) which recognized "serious obstacles to trade within the Community as regards energy products" that if not addressed soon could endanger integration. The Commission laid out a series of important observations and recommendations. Foreign dependency was a strategic problem. Europe's oil and gas industries were emerging as relevant forces while its coal industry was on the decline. And more than half of the Community's energy requirements were being met through imports. The memorandum specifically addressed the need to improve competition because it "stimulates the natural processes of substitution" and explicitly recommended that Member States adopt "measures to be taken in the event of partial interruption of deliveries" (COM (68) 1040:10-12).

In doing so, the EC's actions seem to point to two initial and somewhat contradictory conclusions. Prices were generally cheap and with the exception of short-term interruptions, oil supplies were reliable and free flowing. Hence, according to the model presented earlier, cooperation should be at a minimum, and in fact was, and government intervention in the markets should also be constrained, which it was not. This is because repeated occurrence of interruptions pointed to the need for greater intervention through member state coordination and an increased focus on internal substitution programs. Thus under the extant circumstances of feared constraints to supply (even though prices were generally inexpensive), the Commission recommended that Member States consider "rigorous regimentation" of their respective national energy markets.

This led to the regular reporting of energy forecasts and balances for each Member State allowing greater harmonization of policy.¹¹² It also set forward the idea that every Member State should establish a strategic reserve and make plans to release those reserves to other Member States in the event of any future disruptions. This was codified in a 1968 Directive prescribing all Member

¹¹¹ By that time, the UK had already changed its position on membership. Originally opposed to joining it now wished to reap the benefits of Europe's successful economic coordination. For an analysis of the UK's change of heart, see Bache and George (2006).

¹¹² The Commission's activities were strengthened by the fact that the Merger Treaty had just come into force. The Merger Treaty, which fused the executives of the EEC, ECSC, and Euratom, was signed in April 1965.

States to maintain a strategic reserve of 68 days and came on the heels of an earlier Decision to allow Member States to financially support their coal industries.^{113/114} In addition, the Commission recommended that Member States should use specific policy instruments to harmonize related oil licenses, permits, and taxes, noting that the “differences in taxation of the various forms of energy within a Member State” were hampering attempts to develop substitutes. Therefore, it encouraged increased investments in the energy sector through “direct participation, interest rate ‘subsidies’, [and] loan guarantees” and by strengthening both domestic oil industries and alternative fuel technologies by stimulating research and development (COM (68) 1040:18-19). After two decades of attempted coordination, Europeans were finally beginning to consider overcoming nationalist thinking in the energy field. Unfortunately, just as those ideas were once becoming en vogue, external forces would shock the Europeans back into division.

3.2.1.2. Phase 2: the period of crises from 1970 to 1990

Between 1970 and the late 1980s, Europe’s political landscape underwent a substantial transformation. The Union grew to nine Member States (adding the UK, Denmark, and Ireland in January 1973), then ten (Greece in 1981) and finally twelve (Portugal and Spain in 1986). But what began as a harbinger of greater cooperation (new accessions, the adoption of a plan for greater economic and currency coordination, and new procedures for enhanced foreign policy coordination) quickly deteriorated in to a period of ‘Eurosclerosis’ as internal rivalries, geopolitical struggles, and international economic crises tore at Europe’s unity.¹¹⁵ While energy was not the only factor involved in that deterioration, the problems Europe faced in overcoming the deep divisions between Member States visibly played out in energy politics. Indeed, for most of the period, intra-European cooperation in the energy sector was scant and acrimonious.

Political turbulence in the Middle East and North Africa led to consecutive crises in the supply and pricing of oil and sparked a drive to find alternative fuels with very different results among

¹¹³ OJ 1968/414/EEC, L308/14, 23 December 1968. The rating was based on the previous calendar year’s average daily consumption.

¹¹⁴ OJ 1965/3/EEC, 17 February 1965.

¹¹⁵ In 1965, France boycotted the meetings of the Council for six months in response to the looming (1966) end of the gradual transition from unanimous voting to qualified-majority voting as provided for in the 1957 Treaty of Rome. This led to the so-called empty-chair crisis, which was resolved via the January 1966 Luxembourg Compromise, where Member States agreed to negotiate on issues that were in the vital interests of one or more Member States until all parties could come to an agreement. The end result was that voting in the Council became one of de facto unanimity.

Member States. As a result, emergent progress toward an integrated internal energy policy was placed once again on the back burner in exchange for national interests.

In 1970, oil was cheap and Europe's economies were performing well. This gave rise to the belief that greater European cooperation would make sense. In October, a committee chaired by Belgium's Étienne Davignon produced a report on enhanced political cooperation recommending that Member States should try to speak with a single voice on international issues and his proposals were unanimously approved in an official program called European Political Cooperation.¹¹⁶ This new cooperative albeit flawed spirit of unity quickly deteriorated, however, with the onset of the 1971 currency crisis, when the US broke the gold standard and suspended convertibility of the dollar into gold for foreign holders.¹¹⁷ The crisis sent Europe's economy into a period of uncertainty and recession and divided it largely because its two core currencies were taking different trajectories; France was forced to devalue the Franc while the German Mark was gaining in strength.

Despite their economic troubles, however, European leaders tried to push forward on the energy front. Meeting in Paris in October 1972, they agreed that "there is a need for the Community Institutions to work out as soon as possible an energy policy which ensures a reliable and lasting supply on economically satisfactory terms" (Willenborg, et al., 2004:8). Symbolic of their wavering unity, they watered down the terms of their pricing goals in order to satisfy the reality of the markets and the individual interests of each member. The term 'cheap' used in the 1968 declaration to refer to the goal for energy resource pricing was now replaced with 'economically satisfactory'.

Two months later, the Member States accepted OECD recommendations to raise stock levels to 90 days (Council Directive 72/425/EEC) and in July 1973 obliged Member States to take steps to mitigate difficulties associated with any future supply shocks (Council Directive (73/238/EEC). They were to do this by tapping stocks during disruptions, imposing consumption restrictions, prioritizing the supply of certain groups, and regulating prices. The responsibility of

¹¹⁶ The EPC was the predecessor of the 1993 Maastricht Treaty's Common Foreign and Security Policy (CFSP), which established an informal intergovernmental mechanism to coordinate external policies, and a follow on to the attempts in the early 1950s to establish a European Defense Community (EDC) and European Political Community (EPC) that was ultimately abandoned in 1954 when it became clear that it would be rejected if brought before the French Parliament.

¹¹⁷ European leaders were able to agree in March 1972 to link their currencies in a so-called 'monetary snake' in order to hold fluctuations within a 2.5% margin.

choosing the instruments and the affected actors remained the business of each member state. Europe's common energy policy thus was codified as a policy not of a single market, but rather of many independent markets.

Europe's increasing intergovernmental outlook was highly visible in the energy domain by the time the first major oil embargo occurred in 1973. Because of its strategic nature (the energy sector was essential to the post-war growth of Europe), autonomy over national energy sectors were carefully guarded. Supplies of most domestic energy services in the Member States were inherently uncompetitive, strongly set in the hands of state monopolies. Coordination was further hampered by "the heterogeneity of energy infrastructures across Member States" that included "wide variations in [the] primary energy base, commercial structures, legal frameworks, and regulatory regimes" (Padgett, 1992:53). Indeed, from the perspective of market integration, Europe's early attempts to formulate a coherent energy policy were weak.

This weakness became blatantly evident during the 1973-1974 oil price shock. The October 1973 Arab-Israeli War set off a two-year long oil crisis sending international prices skyrocketing from \$3.29 to \$11.58 (15.89 to 50.41 in \$2009). At the onset of the crisis, more than sixty percent of Europe's primary energy was derived from oil and almost all of it was imported. Not only did the crisis reveal the insight that energy policy is to large degree subject to geopolitics, it also left bare the limited solidarity between the Member States, particularly those that had ignored the 1964 stockpiling directive (68/414/EEC).¹¹⁸

Meeting in Copenhagen two months after the crisis began, EC leaders were unable to reach a consensus on what to do.¹¹⁹ In the Annex to their final declaration (15 December 1973) the Member States explicitly identified that a "prolonged scarcity of energy resources would have grave effects on production, employment and balances of payment within the Community" and as a result each Member should "introduce on a concerted and equitable basis measures to limit energy consumption" (European Communities, 1973). Therefore, when faced with its first major external supply crisis, European leaders agreed on three things: (1) the need to consume less oil; (2) the need to diversify both sources and suppliers of oil; and (3) they agreed that the best strategy was to allow each member state to fend for itself. Thus, the Member States agreed to allow each other to individually enter into negotiations "on comprehensive arrangements

¹¹⁸ OJ 1968 L 308/14.

¹¹⁹ The UK and France pushed for a strong condemnation of Israel in order to protect their oil interests while Germany and the Netherlands fought to rein them in.

comprising co-operation on a wide scale for the economic and industrial development“ of the Arab oil producing states, including large industrial investments in return for stable energy supplies at “reasonable prices” (European Communities, 1973). Because those negotiations were to be undertaken by the individual Member States, it reinforced the rising tendency among them to pursue individual national objectives; France, Italy, and West Germany immediately organized independent supply contracts largely “in exchange for military equipment”. As Willemborg et al (2004:28) puts it, the European Member States decided individually to concentrate “on securing their own energy supply ... instead of coming to the assistance” of their fellow Member States.

Europe's divided response to the 1973 oil price shock was symptomatic of the sclerosis it was facing. Driven by the need maintain national autonomy, Member States immediately branched off into widely different energy policy solutions. France invested heavily in nuclear power. Germany, Italy and others began to look eastward toward the Soviet Union for natural gas; and the UK moved forward with massive investments into exploration off its coast.

Meanwhile, it was Washington, not the EU, that pushed for an organized consumer response. The former sponsored an international energy conference in February 1974, where US Secretary of State Henry Kissinger floated the idea of an ‘Energy NATO’ that foresaw an international oil sharing mechanism between OECD consumers. By November, leading OECD countries had agreed on a new International Energy Program (Paris Treaty) which founded the International Energy Agency (IEA), the purpose of which was to foster the development of emergency stocks to withstand future crises and to reduce overall consumer dependence. In many respects (particularly as pertains to ordering the buildup of stockpiles) the EC was ahead of the US in many of its stated aims. Nonetheless, it could not muster a unified response as France initially refused to join.¹²⁰

Despite their disunity, however, there was no shortage of EU declarations moving forward. In 1974, for example, the Council adopted a “New Strategy for Energy Policy” in which it explicitly set the goal “to increase by every possible means the Community's independence of oil supplies from abroad” (Com(74) 550 Final/2)¹²¹ including the “substitution of other fuels for petroleum

¹²⁰ France joined later in 1992.

¹²¹ Cited from a Commission Information Release, Community energy policy - objectives for 1985. Information [Energy] 79/74 from Archive of European Integration, University of Pittsburg (<http://aei.pitt.edu/12295>).

products where at all possible” (COM (74) 20 Final).¹²² That same year the Commission released numerous brochures on matters such as the role of energy in the EC (67/74), nuclear fuel supplies (76/74), the status of oil and gas use (77/74), as well as proposals for ‘rational use’ of energy supplies (75/74). The Commission also proposed a series of recommendations to coordinate internal and external energy policies (COM (74) 20 final) and delivered reports on the state of energy research and development (SEC (74) 2592 final) and the energy balances of the Member States (SEC (74) 280 final).

By 1975, the Community had identified several core “Objectives for a common energy policy until 1985”; among these were increasing the use of electricity, and with it nuclear power, to raise its share of overall energy consumption to 35% by 1985 from 25% in 1973; to reduce foreign energy dependence to 40% from the 1973 level of 65%; to increase production and imports of coal and natural gas; and to achieve greater overall efficiency through a policy of “technological research and development”.¹²³ One overriding objective lied at the heart of all these recommendations, namely increase efficiency in order to reduce import dependence. But differences between the energy balances among Member States continued to hamper coordination (COM (74) 280 Final) despite several previous steps to develop a Community wide policy on oil and gas.¹²⁴ And the main focus of energy research and development (as well as the very notion of substitution itself) continued to be based on the idea of replacing oil with gas and coal technologies.¹²⁵

Moreover, just as the shock of the oil crisis was receding, another sequence of crises in the Persian Gulf began to severely impact the flow of oil to Europe. By the late 1970s, the Gulf was a major transit area for much of Europe’s oil supplies. When the 1979 revolution in Iran was followed by an Iraqi invasion sparking the decade long Iran-Iraq war, European supplies were acutely endangered. By 1981, Baghdad was attacking Iranian oil ports and complexes. The matter was exacerbated a few years later when Iraq started a sustained three year campaign to attack oil tankers sailing to and from Iran using French combat aircraft armed with Exocet missiles (the so-

¹²² See Archive of European Integration, University of Pittsburg (<http://aei.pitt.edu/5142/>).

¹²³ OJ C153/2, 17 December 1974.

¹²⁴ Com (74) 1961, Com (74) 1962, Com (74) 1964.

¹²⁵ Two reports attached as annexes to its July 1974 report “Energy For Europe : Research And Development” (Com (74) 2592), known as the Della Porta (Annex I) and Lindner (Annex II) Reports, identified several key areas of focus, including new research in the areas of renewables (solar, wind, and hydrogen), the possible replacement of internal combustion with Stirling engines, and advancements in deep sea exploration for fossil fuels. Stirling engines are high-torque, fuel independent, external combustion engines that were considered possible alternatives in the transport industry.

called Tanker War); seventy-one non-military vessels were attacked in 1984 alone.¹²⁶ In a strange turn of events, the weapons used were those sold to Iraq as part of the EU's earlier response to the 1973 crises (Metz, 1988). But even the sum of these combined events provided insufficient impetus for Europe to overcome its inability to cooperate on the energy front.

Before the Iranian revolution, the international oil price was hovering around \$14 a barrel. By the end of 1979 it was over \$30, and by 1981 it had peaked around \$35 a barrel. Despite the spike in prices, however, Member States were no more willing to pass the necessary legislation for the start of a common foreign energy policy, nor for that matter any rules on internal deregulation of their concentrated energy markets (Pollak and Schubert, 2010). About the only thing they could agree on was the need to independently pursue further diversification of sources and expand the use of nuclear power, a key component of their 1985 objectives. The Commission began heavily investing in exploration (particularly offshore technologies) in the petroleum sector. Between 1973 and 1979, the Community invested a little over \$220 million in 140 related projects (Brunner, 1979) and between 1978 and 1979 it invested another 78 million EUA (\$96 million) in energy related research and development (European Communities, 1979).¹²⁷

Many states seized the moment to move forward on nuclear power, with France making the largest investment. Other Member States added to their nuclear portfolio by turning toward Soviet natural gas. In a strategy led largely by Germany, they moved to thaw relations with the Soviet Union and invest in its westward expanding gas pipeline network.

Europe's move to diversify its energy sources and particularly to increase the share of nuclear power ran into a major obstacle on April 26 1986 when the Chernobyl Nuclear Power Plant in the Ukraine exploded releasing a plume of radioactive fallout that drifted across much of continent's central and northern countries. Coming on the heels of a less dramatic, but nonetheless scary 1979 meltdown at a US reactor at Three Mile Island in the US state of Pennsylvania, a skeptical European public quickly turned against nuclear power. The belief of the early 1970s that nuclear energy will solve all its energy problems was no longer considered reasonable. Now it was seen as

¹²⁶ For a detailed account of the hostilities, see Navias and Hooton (1996) and relevant chapters in Cordesman and Wagner (1990).

¹²⁷ The European Unit of Account (EUA) was introduced into 1975 and used by the European Investment Bank, the ECSC and the Statistical Office for the purposes of the fourth Development Fund for the ACP countries. The EUA was based on a basket of Community currencies where individual currencies were weighted according to the Member States' shares of the Community's cross national product, of intra-European trade, and of the currency aid mechanism.

a risk to public health and safety. Yet once again the responses would be uneven across the Community. France, already heavily dependent on nuclear power and much further away from the disaster, was unremitting in its pro nuclear policy. Germany and Italy on the other hand introduced stronger anti-nuclear measures (Liberatore, 1996).

By the mid of the 1980s, many of Europe's best laid plans had fallen victim to national competition and growing environmental concerns. Although it was becoming conventional wisdom that a safe and sustainable energy supply required an effective internal market, Europeans were far from united over the optimal makeup of respective energy mixes. Thus a period which began in the highest spirit of cooperation had by 1986 deteriorated into one of outright national competition. Oil prices were volatile. Germany was overproducing coal and France was overproducing nuclear energy. Member States were taking their own approaches to resolve what they saw as individual needs.

As the decade closed, the average international price of oil began to decline, dropping below twenty dollars, largely due to a decrease in global demand caused by the earlier period of high prices. This led to the beginnings of an economic recovery. But in Europe, where a recalcitrant recession, a nuclear disaster, and a litany of new rules and goals had been established to mitigate the worst effects of the past crises, little had changed in terms of oil consumption among the Community's now twelve Member States. In 1970, the Member States consumed 11 million barrels a day. By 1990, they were consuming 11.4 million barrels a day. Nuclear power was no longer at the center of Europe's consensus.

Against this backdrop, the European Commission and the Member States began to risk timid steps towards liberalization and deregulation in the late 1980s.¹²⁸ Poised for yet another enlargement, Europe was now revisiting its long-standing goal to develop a common internal energy market. When it finally agreed on the Single European Act (1986), that renewed vigor in market building, (largely based on Article 308 TEC) was a fundamental aspect of a new post-crisis European age (Pollak and Schubert, 2010). New issues had also emerged to unite the Member States. Environmental concerns had been growing across the Union, in part because of the 1979 and 1986 nuclear accidents and in part because of the 1980s discovery that energy related emissions were leading to Acid Rain. Thus, when evidence was presented at the World Climate Conference in Toronto in June 1988 linking energy consumption and climate change, the EU received the final

¹²⁸ For an historical overview see Matlary 1996; 1997; Pollak, Schubert and Slominski (2010).

impetus to move forward in a coordinated fashion in an area that all could agree on, the welfare of the planet. Already in a leading position on environmental issues, Member State governments pledged to voluntarily cut CO₂ emissions by 20% by 2005 and the Commission found new ways to tackle old problems by actively using European environmental law to pass energy relevant legislation. In the final years of the 1980s, the EU was well on its way to addressing many of the political problems it faced in the previous decades.

3.2.1.3. Phase 3: The rise of deregulation and progress toward a unified policy (1991-2000).

The 1990s began with dramatic political changes in Europe. The fall of the Berlin Wall in November 1989 and the re-unification of Germany a year later completely altered the landscape of the European Community. Not only was it the first step in the collapse of the Soviet Union (December, 1991), it removed an artificial split across the continent and led many to believe that liberal economics had won the day over socialism. The immediate result was an accelerated push for deregulation and an expansion of what was seen as a new globalized economy.

Moreover, the fall of the Soviet Union and the outbreak of war in Yugoslavia forced Europe to overcome their differences and seek a new level of political and economic cooperation.¹²⁹ Within a period of six short years, the EU expanded to include Austria, Sweden, and Finland, established the Schengen Agreement removing border checks between the original six, witnessed the breakup of Yugoslavia, and negotiated the Treaty on European Union (Maastricht Treaty) creating a single currency and pillared structure of political authority. Europe was no longer an economic union of twelve, but rather an aspiring political union of fifteen with greatly enhanced supranational powers.

In 1990, Ruud Lubbers, then Prime Minister of The Netherlands, suggested the establishment of a European Energy Charter. Four years later the Energy Charter Treaty (ECT) was signed in Lisbon. The agreement established that energy should be traded according to GATT/WTO standards (exploration, production and transport must be non-discriminatory and even in times of conflict, transit must be allowed). In creating the ECT, the EU ported its widely diverse internal energy

¹²⁹ The sudden absence of the Soviet Union also hoisted the US to a status of a unipolar superpower. The first test of that new balance came in 1991 when Iraq invaded Kuwait, threatening to take control of the latter's oil supplies and possibly move into Saudi Arabia, the world, including Europe united behind the US in a joint military operation to dislodge it.

policies into a unified external one. Energy was no longer just a matter of Member States or internal markets. It was now a fundamental aspect the EU's nascent foreign policy. Behind that policy was the endeavor to secure the safety of supplies through the export of EU rules and regulations with its primary intent being to lock Russia into a set of European defined rules for the trade and pricing of its precious energy exports (Pollak and Schubert, 2010).¹³⁰

The rapid developments of the nineties led to an increased willingness to cooperate on the energy front. In October 1996, the Commission published a Green Paper on renewable sources of energy (Com (96) 576 Final). It explicitly pointed to the need to increase "the share of renewable sources of energy in research and development programmes (JOULE and THERMIE)" and set an indicative objective of 12% for the contribution by renewable sources of energy to the EU's gross inland energy consumption by 2010. A year later it, followed up with a White Paper on the "Community Strategy and Action Plan for renewable energy" (COM (97) 599 final) largely based on earlier recommendations to contain the environmental damage associated with energy consumption (COM (97) 481 final) and proposed a series of cooperative energy-related Decisions for the Council.¹³¹

Meanwhile, Cyprus and nine former Soviet bloc countries were knocking on the door seeking entry, each with their own unique set of energy problems and opportunities. Cyprus was entirely dependent on imported oil. The former Soviet bloc countries as well as the former East Germany were all dependent on Russia for oil and natural gas. As a consequence, the next planned EU expansion would not only increase membership to twenty-five, it would change the Union's overall foreign energy dependency structure. Already in the mid 1970s, Europe had begun to substitute natural gas for oil in its electricity and heating sectors. But by the end of the 1990s it had fully switched tables. Instead of being dependent on Arab oil, large parts of the Union were about to become dependent on Russian oil and gas.

In the run-up to its next enlargement, the Member States amended their treaties. The 1997 Amsterdam Treaty solidified decision making procedures and finally established a Common

¹³⁰ For its part, Russia originally signed the Treaty, but it never ratified it and thus the EU's first attempt of rule export in order to increase supply safety did not work.

¹³¹ See COM (97)436 final, 26.08.97. Proposal for a Council Decision concerning the organisation of cooperation around Community energy objectives; COM(97)87 final of 12.3.1997, Proposal for a Council Decision concerning a multiannual programme for the promotion of RES (ALTENER II); and COM (97)550, 18.11.97, Proposal for a Council Decision establishing a multiannual framework programme for actions in the energy sector, and associated measures.

Foreign and Security Policy (CFSP) pillar. Henceforth, the Community's external strategies would be coordinated via the Council, with all the caveats pertaining to national sovereignty that were part and parcel of European integration. A new High Representative for EU Foreign Policy was appointed to work together with the Presidents of the Council and Commission in representing a unified front. While this step marked significant progress in terms of the EU's ability to speak as a single entity, it changed little in terms of its ability to act in such a manner. In fact, the primary tool of state power projection, a common defense system was excluded from the treaty on similar grounds that it failed in the past, namely Member States' need to maintain national autonomy.¹³²

Already since the late 1980s, the EU had been pursuing the ambitious project of liberalizing the continent's network industries, notably telecommunications, electricity, gas, rail and transport, which were long regarded as natural monopolies characterized by public ownership. Indeed, between 1975 and 1990, OECD indexed figures of regulation in energy and transport show significant reductions in public ownership in the UK and Germany and slightly less France and Italy.¹³³ By 1988, the Commission had published its influential working paper "The internal market for energy" (COM (1988) 238 fin.) emphasizing the connection between supply safety and the internal market. At the center of the proposal was the strict application of single market principles to the energy sector (i.e. competition law). Thus, the new emergent energy policy was based on markets that were as free as possible.

In accordance with previous trends, most Member States were initially skeptical, France and the UK being notable exceptions. The former was seeking more opportunities to export its considerable overproduction of nuclear generated electricity and the latter had already underwent a liberalization program under Prime Minister Margaret Thatcher (1979-1990) in the preceding years. Among the most contentious issues were the so-called common carrier principle (opening up existing gas and electricity grids for alternative suppliers in exchange for a fee) and customer rights to choose their own energy suppliers. It took four and half years of protracted discussion until a common directive was finally passed.¹³⁴

¹³² Although it did increase the EU's responsibilities for peacekeeping and humanitarian operations.

¹³³ See Indicators of regulation in energy, transport and communications (ETCR). These indices are based on Conway, P. and G. Nicoletti (2006), "Product market regulation in non-manufacturing sectors in OECD countries: measurement and highlights", OECD Economics Department Working Paper No. 530. The data is available at http://www.oecd.org/document/32/0,3343,en_2649_34323_35791136_1_1_1_1,00.html.

¹³⁴ OJ 1996/92/EC, L027/20, 19 December 1996.

The steady stream of progress (caused largely by external factors) throughout the 1990s changed the internal energy landscape of Europe, as well as that of the world at large. Freed from the shackles of its controlled economy past, Russia emerged both as a major player in the global energy sector and as Europe's primary supplier of natural gas. Also, environmental issues, which had emerged as an important policy area for the Commission at the end of the previous decade, now became a centerpiece of European policymaking. The reduction of CO₂ emissions, investments into renewable energy production, alternative fuels and technologies, and increased energy efficiency have since become the corollary and sometimes even the heart of EU energy politics (Pollak and Schubert, 2010).¹³⁵

3.2.1.4. Phase 4: Climate change and the reemergence of supply security (2000 to the present)

By the beginning of twenty-first century, energy had moved to the center stage of European politics. Now that it was closely tied with environmental concerns, actions on energy flourished. Germany led the way in the electricity sector by introducing new feed in tariffs in 2000 requiring utilities to buy renewable generated electricity (RES). The Commission followed suit in September 2001, by adopting a Directive on the "Promotion of Electricity from Renewables".¹³⁶ That same year, it became abundantly clear to the EU that there was a pressing need to find substitutes in the transport sector.

In its 2001 White Paper 'European transport policy for 2010: time to decide', the Commission reported that it expects CO₂ emissions from transport to rise by as much as 50% by 2010 compared to 1990 (COM (2001) 370 final) implicitly recognizing that continued dependence on oil in the transport sector was threatening economic prosperity and political autonomy. This understanding was explicitly stipulated in a 2003 Directive on the promotion of the use of biofuels and other renewable fuels for transport (2003/30/EC) where the EU recognized the need to decrease its "dependence on imported energy and influence the fuel market for transport and hence the security of energy supply in the medium and long term."¹³⁷ The same directive

¹³⁵ Compare e.g. the directives 2003/30/EC on sustainable resources; 2002/30/EC on biofuels or the White Book on transport policy and the 2005 Green Book on energy savings. See also Commission's 'Renewable Energy Road Map' from 2007 (COM(2006) 848 fin) and the suggestions for the European emission trading system.

¹³⁶ OJ 2001/77/EC, L283/33, 27 October 2001.

¹³⁷ OJ 2003/30/EC, L123/42, 17 May 2003.

recommended that Member States increase their investments in hydrogen research and other key substitute fuels.

The recognition of the need for substitute transport fuels marked an important change of direction for European energy policy. As indicated earlier, mobility is the key to power projection. Although the EU nowhere explicitly states that it has any intention project hard power in the world, the development and ultimately the implementation of substitute fuels carry implications for its external policy behavior. It is not insignificant that parallel to these initial developments, the price of oil had moved above its historical average in 2000 and was rising steadily until the economic fallout of higher prices cut global demand toward the end of the decade.

By 2007, the drive to switch transport fuels was full in swing. In accordance with Directive 2001/77/EC, all of the Member States had already adopted national RES targets for electricity production. Now the EU went one step further publishing a “Renewable Energy Road map” (COM (2006) 848 final) that called for an overall reduction in annual fossil fuel consumption by over 250 Mtoe by 2020, of which approximately 200 Mtoe would have been imported.

The road map specifically recognized the security granting value of renewables. It called them “largely indigenous” and disconnected from “uncertain projections on the future”, and noted that “their predominantly decentralised nature makes our societies less vulnerable” and a it “is thus undisputed that renewable energies constitute a key element of a sustainable future.” By Spring, 2007: EU leaders endorsed a binding agreement to achieve an overall target of 20% RES by 2020 and in 2009 the Council adopted two Directives to achieve it (Directive 2009/28/EC and Directive 2009/30/EC).

After almost fifty years of trying, the EU's diverse and now much larger group of Member States finally agreed that energy independence was essential to its collective political and economic autonomy and found a way to achieve it within the constraints of national sovereignty and competition. The brief period of maximum liberalization in pursuit of globalized interdependent energy relations was ending. While the pursuit of rule export was by no means diminished, it was now being matched by a new internal industrial policy aimed at enhancing energy independence. The internal market was developing, but it would come together as a byproduct of national targets, not by supranational fiat. Most importantly, the need for energy security, driven by higher prices and greater uncertainty of supplies, was pushing the EU to develop domestic substitutes.

The uptick in EU energy cooperation from 2000 forward paralleled several important internal and external developments. Internally, most of the larger EU Member States successfully switched their electricity and heating sectors away from oil following the 1970 price shocks. As per EU targets, the use of nuclear power and increased electricity consumption have been achieved. Externally, Russia's recovery from the economic malaise that beset it immediately following the collapse of the Soviet Union put Moscow in position to become the EU's premier external energy supplier.¹³⁸

In trading Middle Eastern oil for Russian gas, however, the EU positioned itself poorly to handle any disruptions from its eastern neighbor. Approximately 80% of Russian gas bound for EU markets travels through one country, Ukraine, leaving little room for error. The severity of that dependence was recognized in the winter months of 2006, 2008, and 2009 when price disputes between Ukraine and Russia led to brief but painful gas cutoffs. A similar dispute with Belarus in 2007 led to a cutoff of oil supplies. And Russia's 2008 intervention in Georgia led to a temporary stoppage of oil flows through that country.

The Russia-Ukraine energy dilemma is indicative of the geopolitical risks of the EU's energy interdependence and in particular the touchy issue of pipelines and their routes. Pipelines cost large amounts of money and both suppliers and consumers want to maximize direct access because transit states through which the pipelines flow take cash fees or in kind supplies raising costs and reducing profits. When disruptions do occur, everyone loses money and consumers lose energy. Therefore, the choice of routes and transit players affects national and commercial incomes and consumer supply security. As a result, international competition over which lines to build, which routes to follow, and which volumes of supplies to deliver are often the source of bitter debate.

The EU currently depends on three overland pipeline corridors geographically linked to specific suppliers forming interdependent relationships. One originates in the Norwegian and North Seas and runs to the UK, Scandinavia, and the continent and binds the UK, Belgium, and France to Norway. Another runs from North Africa to Southern Europe tying Spain and Portugal to Algeria. But it is the third corridor that matters the most. Running eastward over Belarus and the Ukraine the third corridor carries Russian, Caspian and Central Asian supplies to central and Eastern Europe, binding Germany, Poland, Greece, Italy and the eastern Member States to political

¹³⁸ Together with Algeria and Norway, they supplied 84% of all gas imports and Russia and Norway together accounted for 44% of all EU oil imports; see European Commission. DG-Energy (2008).

machinations of Moscow. Recognizing the need to secure its position of strength, the EU has supported numerous projects to expand its gas pipeline reach (e.g. Nabucco, Nordstream, Transmed, Green Stream). Russia has responded by making deals with its Central Asian neighbors in a bid to lock up gas resources and limit the success of alternative routes that might reduce its profits or exclude it altogether (MEES 2008).

Europe's counter-strategy to break the Russian 'lock' on Caspian gas has been to foster investment into a series of Trans-European Energy Networks (TEN-E). The most important of these are the high priority Nabucco pipeline, also known as Natural Gas (NG) Route Number 3 (NGR3) and the Turkey-Greece Interconnector (TGI). The planned source of both pipelines is Azerbaijan's Shah Deniz gas field. If successful, the new routes would open an important fourth energy corridor to Europe, one that also happens to offer an important link to Iraqi and Iranian gas.^{139/140} The most significant step in this new EU approach came when Brussels broke procedure concerning common rules for the internal market and passed another directive in 2003 (2003/55/EC) to finance half the cost of the feasibility study. It then allocated €200 million from its European Economic Recovery Plan for the Nabucco pipeline. Defying years of discord based on the protection of national champions, Brussels finally established common rules for the internal natural gas market and established a new intergovernmental actor bringing together national energy regulatory authorities in a body called the European Regulators Group for Electricity and Gas liberalization (ERGEG) to serve as the Commission's main advisory body on internal energy issues (2003/796/EC).

The EU's backing for a new route to Caspian energy resources can be traced back to the March 2001 Stockholm Council where the need to invest in energy infrastructure was first identified. It was cemented a year later when the Barcelona Council decided that, "Energy infrastructure should be constructed and maintained so as to enable the internal energy market to operate efficiently" (1229/2003/EC).¹⁴¹ The fact that it has now become a bone of conflict with Russia

¹³⁹ Although it is difficult to pin a date on the onset of the strategy, one can point to 2006 when the Baku-Tbilisi-Erzurum (BTE) began delivering gas from Azerbaijan via Georgia to Turkey. Flows on the BTE were shut down briefly in 2008 when Russia invaded Georgia. The BTE is expected to be upgraded to 20 bcm by 2012. And the Nabucco could connect to it. For a detailed account of Europe's gas pipeline networks, see Pollak, Schubert and Slominski (2010).

¹⁴⁰ The EU reached an agreement with Iraq in 2008 to provide upwards of five billion cubic meters of gas annually (EurActiv 2008) and Iranian gas is already being sent to Turkey through its East Anatolian Natural Gas Pipeline (EANGP) and could thus find its way into the European market via Nabucco. For a discussion of opportunities and problems associated with the Iranian-Turkish gas trade see (MEES 2008).

¹⁴¹ OJ 2003/1229/EC, L176/11, 15 July 2003.

reveals both the risks and the raised stature of energy in EU foreign affairs. Importantly, Brussels is not the driving force behind the Nabucco project. Instead, it is financed and operated almost entirely by private or semi-private commercial interests. Thus, profit and not energy security is driving the EU's cotemporary external energy infrastructure development program. Nevertheless, the pipeline's route is designed specifically to bypass Russia by opening a new pipeline corridor to Caspian countries, freeing them from their reliance on Russia for transit, linking Austria and its Central European distribution facilities with Eastern Turkey, and hence positioning the EU to eventually import gas from the greater Middle East. It is what EU Energy Commissioner Günther Oettinger called "a European project" (Euractiv 2010), a multilateral effort that symbolizes the unity behind the EU's nascent attempt to achieve greater energy autonomy through diversity of suppliers. It is only fitting, therefore, that the pipeline's backers gave the project a symbolic name, *Nabucco*, derived from a Verdi Opera that tells the story of the Babylonian king Nebuchadnezzar and the struggle for freedom and independence.

EU-Russian competition over Caspian resources demonstrates how both Moscow and Brussels increasingly perceive energy as a geopolitical asset; and it serves as a reminder that no matter which targets or policy intentions the EU adopts, the realities of its energy situation tie its domestic welfare to the vagaries of geopolitics. Furthermore, oil prices rose steadily between 2000 and 2007, flattening out toward the end of the decade at a price that makes it economically feasible to invest in substitutes. And that development came just as technological advances in the late nineties led to more efficient means to transport, convert, and store natural gas. The result has been new opportunities for the EU to diversify suppliers and routes which has led to a proliferation of natural gas hubs across Europe able to support regional markets in integrative ways along the lines of original ECSC and very similar to the regional multistate market system existing in the US. In support of these developments, Member States have begun constructing LNG import terminals and in the coming decades plan to quadruple their import capacity through more than triple the number of facilities (Pollak, et al., 2010).

Recognition of the transformations in the market together with the long list of incrementally built rules and regulations passed in previous years were incorporated in the Commission's proposed third legislative energy package of 2007. Not only did Brussels propose to increased liberalization of Member State energy markets through increased unbundling or the establishment of independent systems operators, it specifically identified the need to link energy policies with climate change targets.

In so doing, the EU begun to take an approach to convert its greatest weakness (the divisive protection of national champions) into a powerful asset by harmonizing and strengthening the decision-making authority of national regulators, requiring them to have independent management teams and budgets and legally binding them to cooperate. By 2009, the Member States had hammered out the details of this new package and set an obligatory target date of March 3 2011 for full implementation.¹⁴² Among these were three new Regulations (No 713/2009 establishing an Agency for the Cooperation of Energy Regulators; No 714/2009 setting conditions for access to the network for cross-border exchanges in electricity;¹⁴³ No 715/2009 setting conditions for access to the natural gas transmission networks);¹⁴⁴ and two new Directives (2009/72/EC setting common rules for the internal market in electricity;¹⁴⁵ and 2009/73/EC setting common rules for the internal market in natural gas¹⁴⁶).

These changes came on the heels one successful attempt at treaty reform and one failed attempt at a broader overhaul of the Union. In 2001, the Member States signed the Treaty of Nice, which provided the Council with the power to adopt under conditions of unanimity “measures significantly affecting a Member State's choice between different energy sources and the general structure of its energy supply.”¹⁴⁷ Although energy was not the focus of the treaty (it was rather institutional reform in the run up to the fifth enlargement), the treaty included important aspects concerning intra-EU cooperation on external matters (by lowering the threshold on the number of Member States required for enhanced cooperation) and distributed the funds of the now defunct ECSC, which expired in July 2002, to the Commission to be used for research in sectors related to the coal and steel industry. Also in 2001, the Member States embarked on efforts to draft a Treaty Establishing a Constitution for Europe (TCE). The TCE would have raised the stature of energy policy by providing the EU with significant co-decision making power and making it a new 'shared competence' between the EU and Member State governments through the re-categorization of Union competences (Article I-12). Those shared competences would have included transport, trans-European networks, research and development, and energy. Also, the Constitution would

¹⁴² OJ 2009/713/EC, L211/1, 14 August 2009.

¹⁴³ OJ 2009/714/EC, L211/15, 14 August 2009, repealing Regulation 2003/1228/EC.

¹⁴⁴ OJ 2009/715/EC, L211/36, 14 August 2009, repealing Regulation 2005/1775/EC.

¹⁴⁵ OJ 2009/714/EC, L211/55, 14 August 2009, repealing Directive 2003/54/EC.

¹⁴⁶ OJ 2009/714/EC, L211/94, 14 August 2009, repealing Directive 2003/55/EC.

¹⁴⁷ OJ 2001, C80/20, 10 March 2001. Although the treaty was first rejected in an Irish referendum, it entered into force in 2003 following a second and successful Irish vote.

have established a specific legal basis (Article III-256) for the adoption of laws and measures relating to energy policy, although the new powers would not allow the EU to tell its members which energy sources they could use or decide over the general structure of their energy supply. Hailed as a major breakthrough, the treaty was signed in October 2004. Unfortunately, enthusiasm quickly waned as first the UK, then Denmark, France, Ireland, Luxembourg, the Netherlands, Spain, and Portugal each announced that they would put the Constitution to referendum. In May 2005, the French and Dutch publics rejected it, essentially killing the reforms. In response to this defeat, European leaders regrouped behind former Italian Prime Minister Giuliano Amato, one of the original architects of the Constitution, in order to pave the way forward. Meeting in Rome in 2006, the Amato group began preparing a report on how to proceed. In their final report delivered in June 2007 they proposed writing a new shorter treaty incorporating many of the aspects of the Constitution and using amendments to the Treaty of Rome to account for excluded aspects.¹⁴⁸ Based on their recommendations, the Member States formerly abandoned the Constitution in June 2007, and agreed to negotiate a new Reform Treaty, negotiations for which they completed and signed in Lisbon in December 2007.

Known as the Treaty on the Functioning of the European Union (or simply the Lisbon Treaty), the new structure came into force in 2009. For the first time in its legal history, the Member States agreed to a section on energy (Title XXI, Article 194). The Union was now officially responsible to set policies that ensure the proper functioning of the energy market, secure energy supplies, promote efficiency, savings, and the development of new (substitute) forms of energy, and promote the interconnection of energy networks. The Lisbon Treaty also specifically granted the European Parliament and the Council the authority to establish “measures necessary” to achieve those objectives. Member States still retain the right “to determine the conditions for exploiting” their energy resources as well as their “choice between different energy sources and the general structure” of their energy mix. However, most energy security matters relating to rules and regulations, previously the sole domain of Member State governments, are now considered to be of shared competence and, outside of fiscal expenditures which still require unanimity in the Council, are subject to qualified majority voting in the Council.¹⁴⁹

¹⁴⁸ The text, presented on June 4 2007 was 50 pages shorter than the Constitution and contained 70 articles instead of the original 400.

¹⁴⁹ OJ C 115/134, 9 May 2008.

Taken together, the events since 2000 represent a remarkable shift in EU energy policy. There has been a candid recognition of the dangers of foreign dependence that has gone beyond mere declarations and studies. Through a series of decisions, directives, and coordinated policies, the Union has fostered significant interest and growth in multiple areas of energy policy that directly affect its external policies and in turn are feeding back on its support for internal substitution programs. This has led to the creation of new actors, common rules, and a set of carefully planned exceptions that aim to take advantage of the very same national forces that divided it in the past.

Since 2000, the EU initiated a variety of energy-related cooperation instruments with several countries. It initiated the EU-Russia energy dialogue in 2000 and then launched a new Mediterranean aid program for 2007-13 aiming at integration of the European and Maghrebi gas markets. It extended the EU energy acquis to the Balkans and included Azerbaijan into the European Neighbourhood Policy to reflect its importance in terms of energy resources. In 2004, the EU launched the Baku initiative with the declared aim of developing regional markets and network interconnections in the Caspian and Central Asia and in 2008 launched a Black Sea initiative aimed at the progressive integration of the region into the European energy market.¹⁵⁰ And last but not least, the EU established the Energy Alliance with Africa that explicitly sets the goal of “increased regional and continental interconnectivity”.¹⁵¹

While those efforts aim at the export of European market principles and regulations, they can also be seen as accompanying measures for what amount to a far more pro-active and coordinated energy foreign policy than had been present in previous decades. That coordination, like many of the EU's successes has come with the recognition of the need for compromise between the liberal roots of the Union and the realities of the national interests of its Member States. As the High Representative Javier Solana said, “Market liberalisation is only part of the answer”.¹⁵²

Thus, in dialectic fashion, the EU and its Member States have come almost full circle since the beginning of the twentieth century. Energy is once again at the heart of national foreign policies. This time, however, diplomacy and coordination are the primary instruments instead of colonialism and conquest, and the portfolio of relevant energy sources is far more inclusive. Still,

¹⁵⁰ Based on plans laid out in its report, the “Black Sea Synergy – a New Regional Initiative”(COM (2007) 160 final)

¹⁵¹ See “The Africa-EU Strategic Partnership, A Joint Africa-EU Strategy” Council Press Release 16344/07 (Presse 291).

¹⁵² J. Solana, Address to the EU External Energy Policy Conference, 20 November 2006, Brussels.

the EU's common energy market is far from being completed and its external policy is far from perfectly unified. The specific energy interests of Member States vary as significantly today as they did 1957 and that makes it exceedingly difficult for Brussels to coordinate unity on matters of external energy relations.

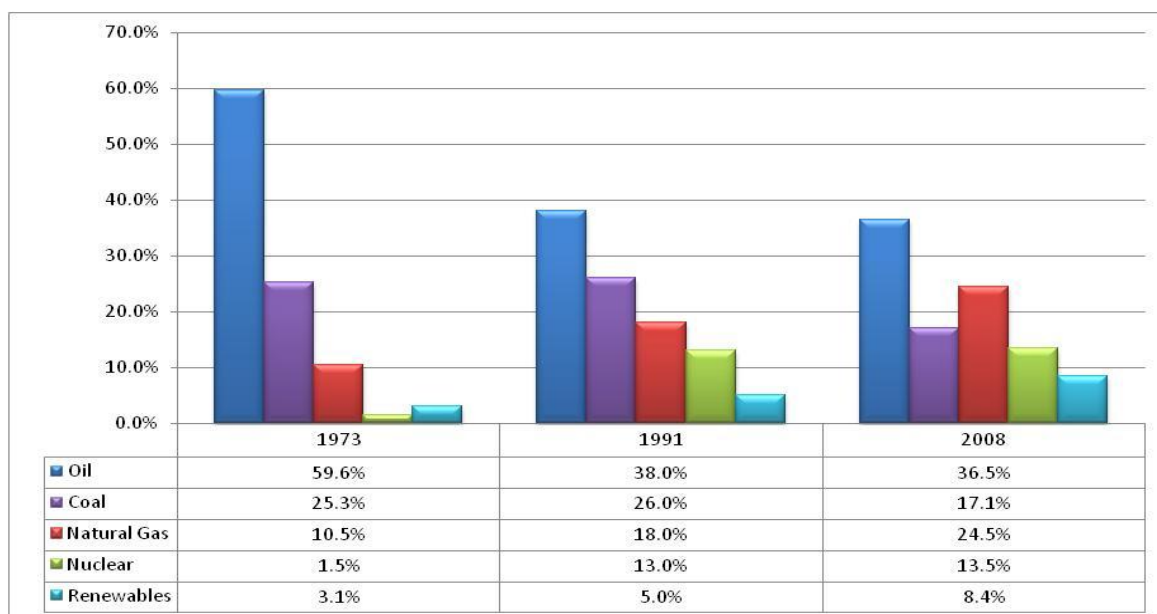
Despite three legislative packages (1996, 2003, 2009), there is still a lack of cross-border trade and interconnections of energy grids, a low rate of supplier change by consumers, no tested evidence of sustainable solidarity between Member States in the case of supply-crises, no formally established crisis-mechanism, and a wide-ranging diversity of competences among national regulatory agencies. The Lisbon Treaty and further development of regional markets may change that in time, but for the moment, the EU is a camp that is easily divided. Member States remain the EU's most powerful actors.

3.2.1.5. Summary tables and charts of the evolution of EU's energy positions

3.2.1.5.1. Comparative energy mixes of the EU 1970, 1991, 2008

The energy mix in the EU has changed significantly since 1973, with oil dropping from almost sixty percent to less than a third in 2008, largely due to the increase in the use of nuclear power and natural gas in its electricity sector. Over the same period, however, the use of all renewables (including biofuels) only increased its share from 3 to 8.5 percent, and almost all of that was used for electricity. Presented below is data from 1973, 1991, and 2008. The reasons for the specific date selection are twofold. First, the 1973 data comes from the last edition of the International Energy Agency's *Energy balances of OECD Countries* (IEA, 2001) to explicitly refer to the EU as a group, then consisting of 15 countries. Later reports refer to the OECD-Europe group, which does not include all 27 Member States of the EU following the fifth enlargement. The data for 1991 and 2008 covers all 27 Member States and comes from the European Commission (2009) and Eurostat (2010a) respectively. Second, the three dates represent important milestones in the evaluation of the EU's energy policy. 1973 marks the beginning of a spike in prices and threats to the flow of supplies; 1991 marks the beginning of a low-price-free-flow period; and 2008 provides a recent snapshot of energy balances following several years of high prices and increasingly tight supplies.

Figure 7: The EU's energy mix, 1973-2008



3.2.1.5.2. EU Oil consumption 1955-2007

Between 1955 and 1973, when the first oil price shock occurred, the EU experienced rapid growth in the consumption of oil. Since then, consumption has remained fairly steady largely due to successful efforts to find substitutes in electricity generation and the implementation of increased efficiency standards in the transportation sector. The data from 1955-1964 comes from multiple *BP Statistical Reviews up to 1974* as reported in Jenkins (1989:141-3). In those years, values for the EU are approximated based on the inclusion of Eastern Europe's planned economies. The years 1965-2009 come from BP (2010).

Figure 8: EU oil consumption, 1955-2009

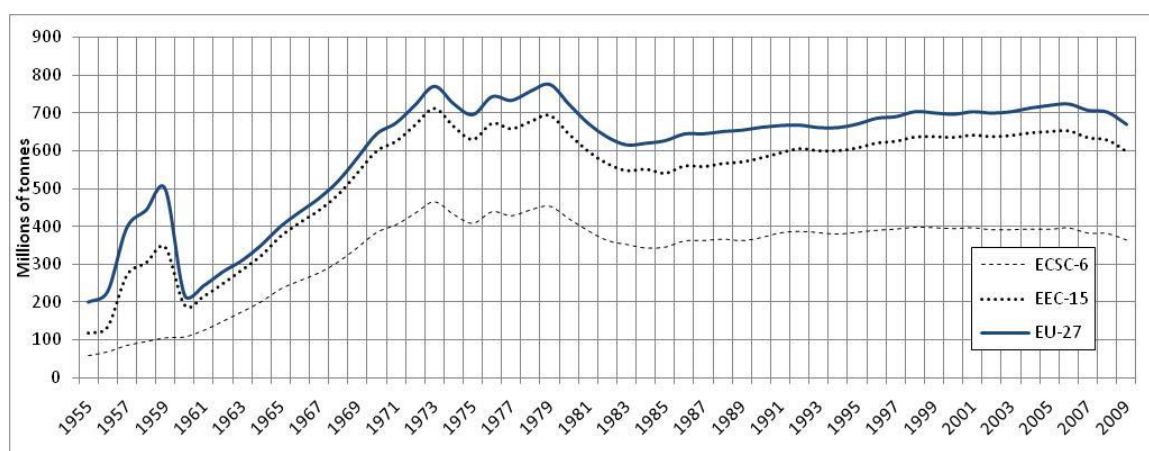


Table 3: EU oil consumption, 1955-2009

	EEC-6	EC-15	EU-27		EEC-6	EC-15	EU-27
1955	57.9	116.8	199.1	1983	352.6	547.1	616.3
1956	68.0	133.0	227.0	1984	343.1	550.9	620.8
1957	85.0	270.0	397.0	1985	345.5	540.1	627.7
1958	95.0	303.0	443.0	1986	362.2	559.6	645.4
1959	105.0	344.0	499.0	1987	363.1	557.9	645.7
1960	107.4	191.5	217.8	1988	366.8	566.1	651.9
1961	124.9	214.3	242.8	1989	363.0	570.2	655.5
1962	149.1	247.8	279.8	1990	371.0	580.9	663.1
1963	174.3	284.3	309.8	1991	383.4	594.2	667.8
1964	201.0	322.6	350.7	1992	387.8	605.1	668.7
1965	234.7	373.2	400.1	1993	383.7	599.8	662.2
1966	256.7	409.5	438.6	1994	380.2	599.9	662.2
1967	277.5	442.0	474.7	1995	385.1	607.5	671.8
1968	306.4	484.2	520.9	1996	390.3	620.2	686.9
1969	344.6	541.4	582.6	1997	393.5	625.0	691.4
1970	384.8	599.3	645.8	1998	398.3	636.2	704.6
1971	405.0	624.6	674.7	1999	397.0	637.2	701.3
1972	435.7	668.4	722.6	2000	394.8	635.2	697.7
1973	465.9	711.9	771.9	2001	396.8	641.1	704.3
1974	432.2	664.3	725.5	2002	391.5	637.3	700.8
1975	408.8	629.6	696.8	2003	391.8	640.4	704.3
1976	439.5	672.4	744.5	2004	393.4	647.2	714.4
1977	428.7	658.0	734.5	2005	392.8	650.6	721.3
1978	444.4	677.0	758.8	2006	396.5	652.3	724.9
1979	453.9	693.4	776.7	2007	382.7	634.3	707.9
1980	420.7	643.5	724.1	2008	381.5	628.1	703.4
1981	388.9	598.2	673.5	2009	364.3	597.5	670.8
1982	363.0	565.4	637.1				

3.2.1.5.3. EU natural gas consumption 1955-2007

The EU has seen a steady growth in its consumption of natural gas since 1955, but there is a acceleration in the growth of its use in the early 1970s. Also, the following graph and data reveals that the original Six ECSC Member States continue to account for about half of all consumption. The data from 1955-1964 comes from *BP Statistical Reviews up to 1974* as reported in Jenkins (1989:141-3). In those years, values for the EU are approximated based on the inclusion of Eastern Europe's planned economies. The years 1965-2009 come from BP (2010). Information on Lithuania between 1965 and 1984 is not included and all other entries where the consumption was less than 0.05 Mtoe have been set to null.

Figure 9: EU natural gas consumption, 1955-2009

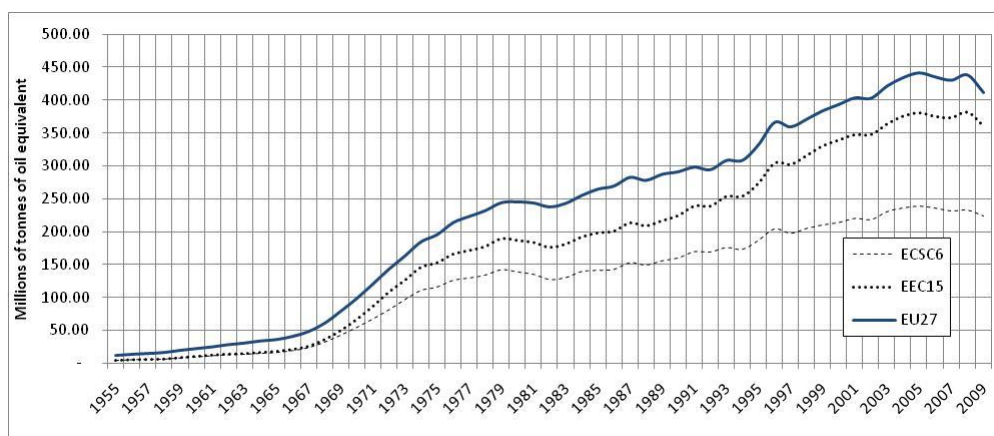


Table 4: EU natural gas consumption, 1955-2009

	ECSC6	EEC15	EU27		ECSC6	EEC15	EU27
1955	4.15	4.85	11.25	1983	130.06	181.49	242.56
1956	5.25	6.00	13.00	1984	139.42	192.23	254.58
1957	5.70	6.45	14.25	1985	141.05	198.39	264.17
1958	6.20	6.95	15.75	1986	142.57	201.11	268.83
1959	7.90	9.10	19.00	1987	152.72	213.63	282.13
1960	9.55	11.05	21.65	1988	149.20	209.18	277.63
1961	11.35	12.95	24.25	1989	155.64	216.95	286.77
1962	12.85	14.55	27.65	1990	160.04	224.72	290.54
1963	13.55	15.25	30.05	1991	169.42	239.15	297.60
1964	15.05	16.95	33.35	1992	169.06	239.02	293.78
1965	16.22	18.60	35.38	1993	175.66	253.64	307.75
1966	19.16	21.64	40.21	1994	173.05	254.02	308.09
1967	23.52	26.42	47.56	1995	186.86	274.07	331.96
1968	32.05	36.59	60.26	1996	204.13	304.22	365.77
1969	42.61	50.21	78.49	1997	197.37	302.38	358.86
1970	54.40	67.28	97.93	1998	204.87	315.93	370.66
1971	67.17	86.96	119.85	1999	210.19	330.48	383.50
1972	81.10	108.69	142.47	2000	213.72	339.25	392.99
1973	96.77	126.56	162.60	2001	220.07	347.51	403.06
1974	110.59	146.27	184.08	2002	218.15	347.53	402.40
1975	115.74	153.15	194.92	2003	230.25	363.77	421.05
1976	125.99	166.16	213.29	2004	235.96	375.58	433.78
1977	129.48	171.74	222.70	2005	238.67	380.59	441.02
1978	133.95	177.88	231.47	2006	235.65	375.10	434.76
1979	142.05	189.67	243.59	2007	231.37	373.24	429.86
1980	138.74	186.90	244.83	2008	232.62	381.46	437.82
1981	134.99	183.96	243.13	2009	223.63	360.44	411.11
1982	127.22	176.56	237.25				

3.2.1.5.4. EU oil import dependence (%) 1970, 2000, 2008 and dependence on oil-based transport fuels (1970, 2007)

The following table shows the changes between 1970 and 2007 in the key transport/oil related areas of oil import dependency, the dependency of oil in transport, and the on-road fuel intensity. The latter is presented in gallons per mile and not liters per kilometer because that is how the data was originally published. Also, the on-road fuel intensity data is limited to those countries reported in Sovacool and Brown (2009); unfortunately, neither the OECD nor the EU publish consolidated reports on on-road fuel intensity and neither yet includes such figures in their annual reports on energy statistics. Still, it is notable that the on-road fuel intensity reported in Sovacool and Brown declined in all the countries where data from 1970 was available. This demonstrates that fuel efficiency programs are working. However, several Member States have seen their import dependence increase and in several cases so has the share of oil in transport, meaning that they have failed to increase the share of substitute fuels. The data for the share of oil in transport and oil import dependence is derived from multiple sources, although the latter is incomplete because data for certain countries were not reported in the early 1970s. The data for oil import dependence from 1970 comes from the International Energy Agency (1984; 1991) as reported in Sovacool and Brown and the data for Romania in 1970 comes from Hudson (1980). The data for the import dependence in 2000 and 2008 come from Eurostat (2010b) and thus is complete for all 27 Member States. Sovacool and Brown provided only a limited snapshot for the oil in transport and on-road fuel intensity percentages for 1973 and 2007. The figures were unavailable for the every Member State in the respective years. However, using data from the International Energy Agency's *Energy Balances of OECD Countries* (IEA, 2006; 2010a) and *Energy Balances of non-OECD Countries* (IEA, 2010b), we were able to fill in much of the missing data for the share of oil out of total energy consumption in the transport sector of all 27 Member States.

Table 5: EU petroleum dependency, 1970-2008

	Import dependence			Oil in transport		On-road fuel intensity	
	1970	2000	2008	1970	2007	1970	2007
EU (27)	..	75.8	84.3	92.6	95.2	..	..
Austria	57	89.5	93.5	94.3	96.3	0.048	0.32
Belgium	100	100	98.8	98.4	98.1	0.045	0.34
Bulgaria	..	95.6	99	84.5	88.1	..	..
Cyprus	..	100	100	100	100	..	..
Czech Republic	..	94.5	97.5	86.3*	95.5	..	..
Denmark	99	-80.9	-51.3	98.1	97.7	0.042	0.033
Estonia	..	77.4	63	97.6 [†]	100	..	..
Finland	100	100	100	97.7	98.1	0.045	0.34
France	98	98.9	97.9	96.3	98.1	0.036	0.031

	Import dependence				Oil in transport		On-road fuel intensity	
	1970	2000	2008		1970	2007	1970	2007
Germany	92	94.5	95.5		96.4	98.1	0.042	0.034
Greece	99	100	101		98.3	98.1	0.048	0.034
Hungary	..	77.5	81.7		70.8	97.1	..	..
Ireland	98	98.8	99.8		97.2	98.1	0.045	0.034
Italy	97	96.1	91.5		98.7	97.5	0.036	0.034
Latvia	..	94.4	98.9		95.4 [‡]	99.2	..	..
Lithuania	..	100	92.6		98.9 [‡]	95.5	..	..
Luxembourg	..	100	100		95	97.7	..	..
Malta	..	100	100		100	100	..	..
Netherlands	97	99.7	97.9		98	98.1	0.040	0.033
Poland	..	97.1	96.4		45.9	95.2	..	..
Portugal	99	99.1	102.2		98	98.1	0.043	0.034
Romania	14.6	34.9	51.6		100	95.2	..	..
Slovakia	..	89.4	91.7		97.2*	75.2	..	..
Slovenia	..	101	101		97.8 [‡]	98.3	..	..
Spain	99	101	100		97.3	98.1	0.037	0.032
Sweden	100	100	100		97.5	98.1	0.050	0.036
United Kingdom	100	-54.5	8.8		97.7	96.3	0.048	0.032
* 1971 data.								
‡ 1990 data.								
.. No data.								

3.2.1.5.5. Fuel Switching and R&D into substitutes

3.2.1.5.6. Biofuel production and solar power panel installation (1990-2008)

The following table shows the growth in EU biofuel production and solar power panel installation between 1990 and 2008. Earlier data was unavailable. While solar power panel installations have risen steadily over the period, there are significant jumps in biofuel production in 2000 and 2006. Data is taken from Eurostat's online database, table nrg_114a, Infrastructure - renewables - annual data (Eurostat, 2010c).

Table 6: EU biofuel and solar panel deployment, 1990-2008

EU (all 27 Member States)	Biofuel production (1000 tonnes)	Solar Panels (1000 m ²)
1990	0	3846
1991	0	4163
1992	0	4634
1993	0	5263
1994	0	5880
1995	0	6569
1996	0	7352
1997	0	8129
1998	0	9031
1999	694	9251

2000	1017	10622
2001	1347	12324
2002	1464	13295
2003	2013	15363
2004	2187	16815
2005	4480	18928
2006	11503	21869
2007	14998	24673
2008	21000	28896

3.2.1.5.7. Energy R&D, 1980-2007

The following and graph compares indexed growth/declines in total energy research and development (ERD) between 1970 and 2008 for 19 Member States and the US alongside an indexed view of the rise and fall of international oil prices. The table contains expenditures in €2008 and exchange rates for total ERD for the 19 Member States between 1974 and 2008 and contains an additional partial breakdown in percent of the focus areas. The 19 EU Member States Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, Netherlands, Poland, Portugal, Slovak Republic, Spain, Sweden, and the UK. Oil prices are indexed at their 1974 value in order to align with the onset of ERD data and in order to illustrate the enormous spike that occurred in the price between 1973 and 1974. Data for research and development expenditures between 1974 and 2008 come from the International Energy Agency's online table of "R&D Budgets" in their Energy Technology R&D Statistics database (IEA, 2010c). Oil price values are set in \$2009 and come from (BP, 2010).

Figure 10: EU energy R&D (ERD), 1980-2007

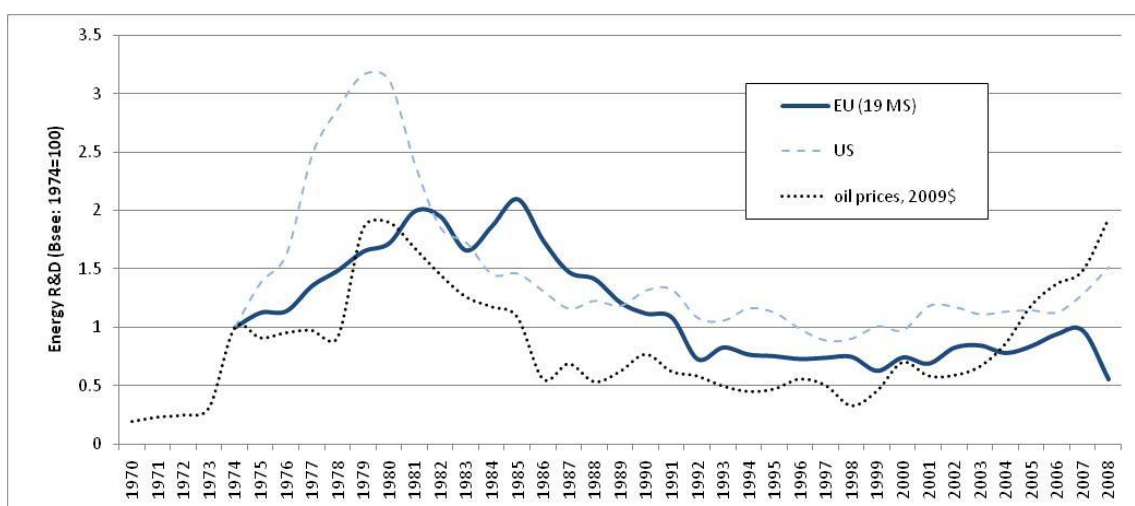


Table 7: EU energy R&D in €2008, 1974-2008

	EU 'Total Energy R&D'	Of which in specific areas:			
		Transport Biofuels	Hydrogen/Fuel Cells	Fossil Fuel R&D	Energy Efficiency
1974	2496.94			14.5%	3.0%
1975	2810.44			17.5%	8.2%
1976	2845.22			25.1%	8.6%
1977	3385.78			31.7%	11.4%
1978	3710.98			36.3%	13.1%
1979	4120.35			34.7%	13.5%
1980	4294.74			41.4%	17.7%
1981	4979.21			34.2%	13.0%
1982	4863.29			20.8%	11.3%
1983	4142.42			20.2%	15.6%
1984	4660.14			17.7%	13.0%
1985	5234.62			15.2%	11.2%
1986	4345.69			17.4%	12.4%
1987	3678.48			17.2%	13.3%
1988	3527.36			21.9%	11.9%
1989	3027.03			23.9%	13.4%
1990	2791.77			39.7%	16.6%
1991	2709.96			34.2%	19.9%
1992	1820.32			29.5%	26.3%
1993	2069.50			24.5%	27.4%
1994	1915.92			30.3%	32.6%
1995	1882.52			20.6%	36.9%
1996	1823.08			21.9%	34.2%
1997	1850.50			12.8%	32.2%
1998	1867.59			12.0%	33.6%
1999	1569.39			15.9%	38.5%
2000	1855.67			13.5%	34.7%
2001	1723.78			22.0%	40.7%
2002	2065.18	0.2%	1.2%	29.5%	34.6%
2003	2109.56	0.1%	1.4%	27.2%	25.0%
2004	1950.83	0.9%	9.4%	27.6%	25.3%
2005	2099.35	1.2%	10.8%	23.6%	23.5%
2006	2356.41	2.4%	12.8%	21.7%	26.4%
2007	2428.30	2.4%	14.1%	20.0%	28.0%
2008	1387.03	2.4%	21.1%	29.5%	40.4%

3.2.1.5.8. Major market players

Major market players are those commercial actors that have a large stake in the development of alternatives and the response to policy initiatives that lead to fuel substitution. Large companies (national champions) collectively invest vast sums of money into research and development in ten major energy related industries. These companies can and do play a role in national responses to energy needs. The industries include Aerospace/defence, oil/gas producers, oil equipment/service /distribution providers, mining, chemicals, automobiles/parts, industrial transportation, commercial vehicles/trucks, electricity producers/distributors, and gas and other utilities. The data provided below lists the top ten companies in 2005 in terms of net sales (mio €) and with research and annual development budgets of over €5 million in each these industries. It thus provides a snapshot of European commercial energy relevant research and development. The source of the data is EU's 2009 industrial R&D investment scoreboard (Joint Research Centre, 2009). The reports and data are available via the JRC website (http://iri.jrc.ec.europa.eu/research/scoreboard_2009.htm).

Table 8: Major energy relevant market players in the EU

Aerospace & defence

Company name	Country	Capital expenditure (mio €)	Net sales (mio €)	Number of employees	R&D investment (mio €)
EADS	NL	2354.00	34206.00	113210	2367
BAE Systems	UK	463.00	16037.00	74000	2108.88
Finmeccanica	IT	359.00	11166.00	52844	1746
Thales	FR	227.00	10263.00	53367	503.6
Rolls-Royce	UK	361.00	9610.00	35600	512.3
SAFRAN	FR	301.00	8692.00	51918	470
Smiths	UK	166.00	4391.00	28509	209
Dassault Aviation	FR	80.00	3428.00	12109	284.56
SAAB	SE	34.00	2057.00	12006	89.9
Cobham	UK	56.00	1587.00	10715	62.44

Oil & gas producers

Company name	Country	Capital expenditure (mio €)	Net sales (mio €)	Number of employees	R&D investment (mio €)
TOTAL	FR	8208.00	122618.00	112877	676
Royal Dutch Shell	UK	13256.00	260028.00	109000	498.47
BP	UK	10841.00	211481.00	102700	425.57
ENI	IT	6558.00	73728.00	71303	202
Repsol YPF	ES	3173.00	49368.00	35239	63
OMV	AT	1277.00	15604.00	55633	12.19
BG	UK	1688.00	8168.00	5363	10.19

Oil equipment, services & distribution

Company name	Country	Capital expenditure (mio €)	Net sales (mio €)	Number of employees	R&D investment (mio €)
Compagnie Generale de Geophysique	FR	125.00	870.00	3952	39.3
Tenaris	LU	224.00	5711.00	17693	29.42
Technip	FR	167.00	5377.00	20898	29.4
Sondex	UK	3.00	75.00	350	8.33
SBM Offshore	NL	338.00	1288.00	2253	8.24

Mining

Company name	Country	Capital expenditure (mio €)	Net sales (mio €)	Number of employees	R&D investment (mio €)
Anglo American	UK	2859.00	24952.00	195000	33.91
BHP Billiton	UK	3942.00	25082.00	36468	27.98
Boliden	SE	142.00	2177.00	4530	21.2
Rio Tinto	UK	2113.00	16135.00	27824	16.96
LKAB	SE	282.00	1527.00	3563	16.94
Hoganas	SE	25.00	489.00	1572	14.06

Chemicals & petrochemicals

Company name	Country	Capital expenditure (mio €)	Net sales (mio €)	Number of employees	R&D investment (mio €)
Bayer	DE	1292.00	27383.00	93163	1886
BASF	DE	2188.00	42745.00	80992	1086.3
AKZO Nobel	NL	514.00	13000.00	61400	837
Solvay	BE	555.00	9053.00	28730	477
DSM	NL	378.00	8195.00	22839	290
Linde	DE	715.00	9501.00	42081	227
ICI	UK	223.00	8459.00	32530	213.94
Wacker-Chemie	DE	288.00	2756.00	14434	146.9
L'Air Liquide	FR	931.00	10435.00	35900	141.1
Rhodia	FR	258.00	5399.00	19444	134

Automobiles & parts

Company name	Country	Capital expenditure (mio €)	Net sales (mio €)	Number of employees	R&D investment (mio €)
DaimlerChrysler	DE	6621.00	149776.00	386465	5649
Volkswagen	DE	12376.00	95268.00	323831	4075
Peugeot (PSA)	FR	2927.00	56267.00	208500	2151
BMW	DE	9610.00	46656.00	103546	3115
Fiat	IT	2684.00	45818.00	170071	1318
Robert Bosch	DE	2925.00	42016.00	250862	2931
Renault	FR	3223.00	40412.00	126584	2264
Michelin	FR	1267.00	15590.00	127319	565

Testing the Model

Continental	DE	844.00	13837.00	81085	590.4
ZF	DE	525.00	10833.00	53940	559

Industrial transportation

Company name	Country	Capital expenditure (mio €)	Net sales (mio €)	Number of employees	R&D investment (mio €)
Deutsche Post	DE	1366.00	44594.00	388859	175
SNCF	FR	2527.00	20994.00	205839	55
BAA	UK	2129.00	3311.00	15337	39.3
Finland Post	FI	90.00	1348.00	23946	29.5
La Poste	FR	729.00	19329.00	303405	28
Bollore Investissement	FR	99.00	6338.00	31931	23.5
Autostrade	IT	852.00	2957.00	9106	21.9
BBA	UK	116.00	2199.00	13318	15.72
Vossloh	DE	25.00	996.00	4732	14.8
ASF	FR	489.00	2474.00	7255	11.5

Commercial vehicles & trucks

Company name	Country	Capital expenditure (mio €)	Net sales (mio €)	Number of employees	R&D investment (mio €)
Volvo	SE	1210.00	25625.00	81184	1124.98
Scania	SE	823.00	6846.00	29869	295.6
Wartsila	FI	62.00	2639.00	12049	70.1
Claas	DE	42.00	2175.00	8122	59.93
Jungheinrich	DE	176.00	1645.00	8930	40.22
JCB Service	UK	59.00	1601.00	4631	39
Same Deutz-Fahr	IT	16.00	937.00	2697	19.23
LDV	UK	70.00	175.00	856	14.65

Electricity

Company name	Country	Capital expenditure (mio €)	Net sales (mio €)	Number of employees	R&D investment (mio €)
AREVA	FR	415.00	10125.00	58760	408
Electricite de France	FR	5839.00	51051.00	156765	402
Vattenfall	SE	1296.00	13758.00	32231	114.72
British Nuclear Fuels (now British Nuclear Group Sellafield)	UK	597.00	3441.00	23016	80.05
Energie Baden	DE	579.00	10817.00	17926	24
Union Fenosa	ES	1302.00	6099.00	18485	23.04
Pohjolan Voima	FI	766.00	601.00	938	21.5
Enel	IT	3037.00	35525.00	60084	20
Fortum	FI	335.00	3877.00	8939	14

Gas & multi-utilities

Company name	Country	Capital expenditure (mio €)	Net sales (mio €)	Number of employees	R&D investment (mio €)
RWE	DE	3869.00	40518.00	86426	127
Suez	FR	2154.00	41489.00	157639	84.8
Gaz De France	FR	1991.00	22394.00	52958	73
Veolia Environnement	FR	1668.00	25245.00	241627	62.9
E.ON	DE	3162.00	51854.00	77347	24

3.2.2. *Salience of SAPP*

Given that the EU was founded largely as a peace project between historical rivals, it is safe to assume that the EU should represent an ideal case of low SAPP, at least when understood as a group. This is not to say that the relative importance of SAPP was or even is uniform across Member States. Indeed, manifest distinctions of the strategic importance of power projection between Member States are visible in a number of areas including their use of military force, the size of standing forces, and annual military expenditures. It is not unimportant that several of the Member States controlled vast holdings of colonial property at the end of World War II. Nor is it illogical that those states that have been at the center of Europe's internal competition for dominance would place a higher priority than lesser powers on maintaining large and mobile militaries.

An analysis of every Member's individual attitude toward SAPP would be superfluous. Many (Bulgaria, the Czech Republic, Slovakia, Hungary, Poland, Romania, and East Germany) were part of the Warsaw Pact for much of the EU's early history and thus greatly restricted in their ability to execute autonomous military operations even had they wanted to. Others (Austria, Finland, Ireland, Malta, and Sweden) claim neutrality or are constitutionally restricted (Germany) from offensive foreign military adventures and thus cannot ever be expected to prioritize SAPP.¹⁵³ Instead, we can assume that the best way understand the status of SAPP for the EU is to evaluate the behavior of those Member States that by virtue either of their historical disposition toward power projection or their sheer economic size are most likely to engage in military activities.

The term 'armed conflict' refers to the UCPD definition presented in Harbom (2010) as "a contested incompatibility that concerns government and/or territory where the use of armed force between two parties, of which at least one is the government of a state, results in at least 25 battle-related deaths in a year". In the context of European SAPP, France and the UK are standouts. Both maintain nuclear arsenals and both have engaged unilaterally in several armed conflicts since the 1950s, many of which were directly related to the anti-colonial struggles. The Netherlands and Portugal engaged in fewer but similar conflicts over the same period. Despite its

¹⁵³ Although not entirely prohibited in its Basic Law, Art. 26 (1) of the German Constitution bans any preparation for a war of aggression as unconstitutional and Art. 87a (2) limits the Bundeswehr to territorial defense. A series of Constitutional Court cases in the 1990s led to the interpretation that Germany may not deploy forces outside of NATO territory without a specific resolution of parliament. Since then, over a 1,000 German sailors had participated in Operation Atalanta and some 5,000 have seen duty in northern Afghanistan.

early rearmament and membership in NATO (1955), Germany has been absent from any degree of material power projection because of the constitutional restrictions. Nevertheless, between 1949 and 2009, France, Germany, Italy, the Netherlands, Spain, and the UK combined to invest more than \$12 trillion in constant 2008 dollars in their militaries.¹⁵⁴ By comparison, the remaining Member States spent less than \$2 trillion over the same period and the US spent over \$25 trillion. When all EU military expenditures are summed together, the overwhelming burden of cost lies on the shoulder of a just a few powerful Member States (See Figure 11 below) and they have engaged in multiple wars and minor armed conflicts since the late 1940s (See Figure 12 below).

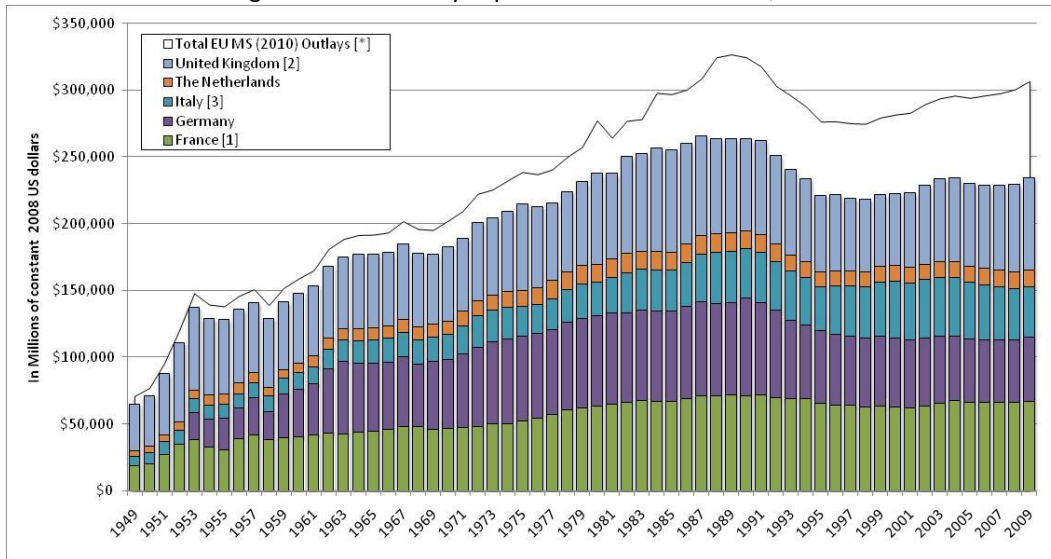
Among states, there is a hierarchy and the most powerful ones, i.e. those with the greatest capacity to project power are often called major powers. They are distinguished from 'central' powers, which play an active role in international affairs and are still highly relevant, and 'peripheral' powers, which while members of the international system carry little weight in shaping its affairs. In their seminal work on the study of the correlates of war (COW), Small and Singer (1982) point out that there is no absolute consensus as to what constitutes a so-called major power. It seems clear that post-war Germany and Japan are powerful economic players. However, it would be erroneous to call them military powers as well. In their work, Small and Singer identify China (since 1950), Russia (since 1922), France and the UK (since 1816), and the US (since 1899) as members of the major powers club.¹⁵⁵ Although one may disagree with the authors' terms and associations, their contribution to the scientific study of states and war is incontestable, and their labels provide a reasonable point of departure.¹⁵⁶ Moreover, their ranking and method provide a transparent means by which to measure the power projection of a state based on the number of foreign armed conflicts in which it engages.

¹⁵⁴ Data for five Member States (Austria, Cyprus, Finland, Ireland and Sweden) are only since 1988. Data extracted for NATO members are from the Stockholm International Peace Research Institute database on NATO military expenditures and the data (1988-2009) for Austria, Cyprus, Finland, Ireland and Sweden come from the SIPRI Military Expenditure Database, available at <http://www.sipri.org>.

¹⁵⁵ Austria-Hungary ceased being a major power 1918. Netherlands, Belgium, Spain Portugal, Italy all where at one time so-called 'central players' but never major powers. Germany and Japan were considered great powers until 1945 and Turkey until 1919.

¹⁵⁶ Based on their work, the Department of Peace and Conflict Research at Uppsala University maintains and provides extensive online databases on the quantifiable correlates of war.

Figure 11: EU military expenditures 1949-2009 in \$2008



Source: Stockholm International Peace Research Institute.

Notes: Figures are for calendar years and notes are the originals that came with the SIPRI dataset as follows: "[1] The figures for France from 2006 are calculated with a new methodology due to a change in the French budgetary system and financial law. [2] From 2001, the UK moved from a cash based accounting system to a resource based system. The figures for the UK from 2001 are based on the "Net Cash Requirement" figures given in the Annual UK Defence Statistics, which are closest to the old cash definition. [3] The figures for Italy include spending on civil defense, which typically amounts to about 4.5% of the total."

Historical analysis of the importance of power projection among EU powers reveals a waning over time. Both France and the UK experienced the unwanted dismantling of their colonial holdings and reduced their unilateral (non-UN sanctioned) military operations to a trickle. Importantly, it cannot be said that France or the UK were prepared in the early 1950s to willingly forfeit their position as global powers, even if the economic and military facts of the early post-war periods demonstrated otherwise. In fact, France and the UK sent forces into over 100 unique conflicts between 1946 and 2009 (Harbom, et al., 2010). Most of those conflicts involved areas of former colonial holdings and only three were in some way directly connected to the flow of energy supplies.¹⁵⁷ By the end of the 1980s, however, those conflicts had passed. Not only were there no more colonial holdings worth fighting for, the EU's most powerful states had begun to increase cooperation in their foreign and security policies, the material evidence of which can be found in the increasing number of coordinated multilateral peace missions collectively undertaken by the Union.

¹⁵⁷ These include the 1951 UK intervention in the Suez, the 1956 French-UK intervention in the Suez, and the 1991 engagement in the first Gulf War with Iraq over Kuwait. Klare (2001) cites numerous territorial disputes in areas containing oil or natural gas, but not one includes an EU Member as a belligerent since the 1950s.

Figure 12: Quantity of dyadic armed conflicts fought by EU Member States 1946-2009

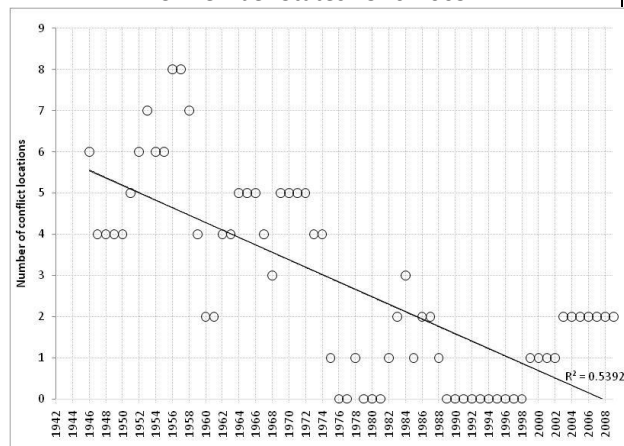
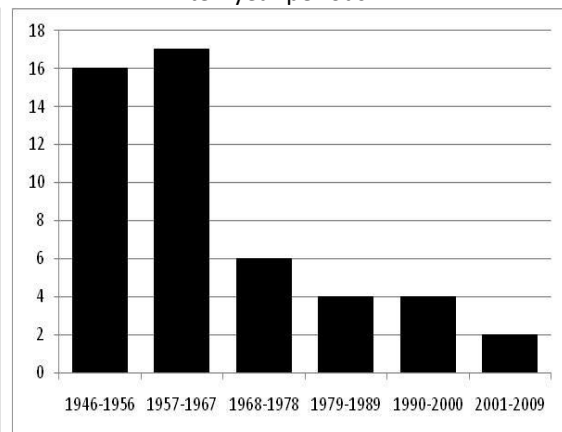


Figure 13: Distribution of unique conflict areas in ten-year periods



Source: the UCDP Dyadic Dataset, version 1-2010

Notes: Internal armed conflicts occurring between the government of a state and one or more internal opposition group(s) without intervention from other states have been excluded. Each conflict listed had a minimum of at least 25 battle deaths. Actual figures may be slightly higher because cases where foreign mercenaries, colonial forces, or private security companies fought on behalf of states or governments in foreign countries are excluded.

Why did Europe move from a collection of competing powers with vested interests in maintaining their status as 'great powers' to a collective Union of lesser powers? How did they transform their individual orientation toward power projection? The answers to these questions inform the shift of the EU from the initial idea of a new and united European global power to a wealthy, but largely soft power player; and the process was neither easy nor particularly quick.

From the moment that Winston Churchill famously warned in 1946 that, "From Stettin in the Baltic to Trieste in the Adriatic, an Iron Curtain has descended across the Continent" (Churchill, 1946), a new post-war military realignment began as Europe moved toward building a western union to stem the spread of Communism. By 1948, the foreign ministers of Belgium, France, Luxembourg, the Netherlands and the UK had agreed on the "Brussels Treaty of Economic, Social and Cultural Collaboration and Collective Self-Defence"¹⁵⁸ a move countered by the Soviet Union with a blockade of Berlin. Within a year (April 1949), much of what remained of free Western Europe had joined the US and Canada in forming the North Atlantic Treaty Organization (NATO). At the core of the new alliance was the notion of mutual defense, codified in Article 5 which stated that "an armed attack against one or more of [Member States] in Europe or North America

¹⁵⁸ For a detailed account of the early post-war years of military cooperation and the founding of NATO see Ismay (1954). The full text of the Brussels Treaty can be found online at the NATO Archives: <http://www.nato.int/archives/1st5years/chapters/1.htm#f>.

shall be considered an attack against them all.” Although untested until September, 2001, NATO’s Article 5 has become the standard by which collective security in Europe has been understood.

The creation of NATO achieved three important things. First, it tied West European security to that of the US. Second, it created a clear geographic distinction between its free-market oriented countries and those under Soviet-styled planned economics. Third, it left a buffer zone of countries that would claim neutrality between the two sides. Thus, in the immediate years following the war, divisions in Europe were formalized, and in the process, sparked a drive among its western units to establish a new unified global power.

In October, 1950, French Prime Minister Rene Pleven led the charge with a bold proposal to create a European Defense Community (EDC) between France, Italy, the Benelux countries and West Germany.¹⁵⁹ He asked for “a complete fusion of all the human and material elements” of war among European powers creating a European army under the control of the political institutions of a new united Europe (Ismay, 1954:Chapter IV). Under the Pleven plan, an intergovernmental “European Assembly” would appoint a single European Minister of Defense. The new supranational European army would have a single common budget “placed at the disposal of the unified Atlantic force”.

Pleven’s plan was watered down significantly over the course of the next four years and never made it to a vote in the French Parliament in 1954 when it became clear that it could not pass. In the absence of the EDC and its goal of new unified European power, West Germany joined NATO in 1955. Almost immediately thereafter, Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland and Romania formed the Warsaw Pact. Far from creating a new and powerful player to balance the emergent US and Soviet Union, Europe’s first attempts re-enter the ranks of great powers failed. Indeed, the division of Europe was complete.

Europe’s lack of military integration allowed nationalist interests to guide events in the subsequent years. Already burdened by the heavy costs of reconstruction and a military buildup to offset Soviet gains in the East, France and the UK faced immediate losses of their colonial holdings. Europe’s first post-war energy crisis came about as they tried to prevent losing control of the Suez Canal, which had become the main artery for eastern oil flows to Europe. Therefore,

¹⁵⁹ The UK was neither included nor willing to entertain placing its armed forces under what amounted to French control.

when Egypt nationalized the canal in July 1956, both the UK and France faced a direct threat to their economic and military power projection capabilities.

France, which was engaged in defending its rule in Algeria, considered Egypt's president Nasser to be "responsible for assisting the anti-colonial rebellion" and saw the seizure as strengthening the forces opposing Paris (Risse-Kappen, 1995:85).¹⁶⁰ Also France's Compagnie Francaise Des Petroles (CFP), now known as Total Oil, had just joined a consortium deal forming the Iranian Oil Participants Limited with the government of Iran to drill for oil.¹⁶¹ For its part, the UK feared the seizure would endanger the kingdom's ability to meet military obligations under the anticommunist alliances established in the 1954 Manila and 1955 Baghdad Pacts in the Middle East.^{162/163} In an influential report on the status of the canal in 1954, Donald Watt (1956) highlighted its strategic importance noting that the canal had been used in the past to transport troops from the "Dominions of Australia and New Zealand" during wars in Europe. He also highlighted the economic consequences that would result from the loss of oil if the canal traffic were disrupted. In his concluding remarks, he noted that "the possibility of the Canal being closed to troopships makes the question of the control and regime of the Canal as important to Britain today as it ever was" (Watt, 1956:8).

The result was a coordinated, but misguided and failed tripartite attack (together with Israel) to seize control of the Canal in October 1956, which not only led to sever disruptions along the canal, it also led to a deep division in transatlantic relations between the France and the US, which had vocally opposed the intervention.¹⁶⁴ Following the crisis, France turned inward toward increased cooperation with its neighbors and the UK became the US' junior partner in military operations

¹⁶⁰ It may be argued that France was far more interested in seeking revenge upon Nasser for his role in fomenting rebellions in French North Africa than they were securing energy resources or for that matter access to the canal as a support line for eastern holdings. Paris had already forfeited control of Indochina in the 1954 Geneva Agreements, nullifying its territorial claims. For a discussion of French motivations to intervene in the Suez see Chapter 4 "Unworthy and Unreliable" (pages 83-104) in Risse-Kappen (1995).

¹⁶¹ The consortium consisted of British Petroleum, Exxon, Socony, Texas Oil, Socal, Gulf, Royal Dutch/Shell Group, and CFP.

¹⁶² Created the Southeast Asian Treaty Organization (SEATO) between France, the UK, the US, Australia, New Zealand, Thailand, Pakistan, East Pakistan (Bangladesh), and the Philippines; dissolved on June 30, 1977

¹⁶³ Created the Central Treaty Organization between Iran, Iraq, Pakistan, Turkey, and the UK; dissolved in 1979.

¹⁶⁴ It has been argued that the Suez Crisis provided the impetus for the Soviet Union to invade Hungary just as the latter was beginning to express its desire to join its western neighbors. See footnote 75 on page 57.

around the world. Thus, between the end of World War II and the birth of ECSC in 1957, both the aims and the reach of Europe's former great powers were dramatically reduced.

The waning of Europe's approach toward power projection took a further hit in 1961, when the Soviet Union raised the Berlin Wall dividing the former German capital in two. At the time, France, the UK, and the US each had one brigade stationed there to defend the city. But instead of responding in a concerted effort to support one of its own, the Member States were forced to rely on the US to intervene. On August 20, 1,500 heavily armed American soldiers in a column of 491 vehicles and 160 kilometers long, began marching from West Germany through East Germany en route to West Berlin.¹⁶⁵ The rapidity and dimensions of that response, along with the lack of substantial French and UK support, illustrated what was now quickly becoming a paradigm shift in European military thinking; individual national interests prevailed over collective ones, and no Member was actually prepared to directly risk conflict with a great power state. Moreover, France was mired in a losing conflict in the Algerian War (1954 to 1962) and undergoing a Gaullist resurgence at home and just three years later withdrew its commitments to NATO altogether booting the allies and their headquarters out of the country.¹⁶⁶

Europe's failure to unite under a common defense strategy in the early 1950s and subsequent failures of its former great powers to stake out an equal position in world affairs exacerbated an underlying flaw in European integration process. Whether it was De Gaulle's desire for an independent or lead role for France or a resurgent Germany under the reins of Willy Brandt pushing a new agenda of Ostpolitik eloquently presented in a famous article in *Foreign Affairs* (Brandt, 1967), Europe was as divided as ever and as a result, its parts, as well as the whole, were weakened.

When Soviets tanks rolled into Czechoslovakia in August 1968 to suppress the Prague Spring, European leaders were in no position to muster a united response and instead "worked individually rather than collectively to avert military action in Eastern Europe through the use of quiet diplomacy" (McGinn, 1999:112).¹⁶⁷ The situation was complicated by divisions among European leaders as to their future path together with the UK and Germany favoring stronger

¹⁶⁵ The exact same exercise was repeated every three months by one battalion for the next three years.

¹⁶⁶ They relocated within a year to Belgium.

¹⁶⁷ West Germany's State Secretary Rolf Lahr even lobbied US Secretary of State Dean Rusk not to use any form of public diplomacy for fear that "rash words could only be counterproductive". See Memcon, Secretary of State Rusk and West German State Secretary Rolf Lahr, Washington, DC, 10 May 1968, NSA, SFC, Box I.

Atlantic ties and Gaullists pushing for a continentally centered European Europe (Brzezinski, 1968; Camps, 1968).¹⁶⁸

By the early 1970s, the perception toward power projection by both France and the UK had changed dramatically. After fighting in four inter-state wars (Egypt, North Korea, Tunisia, and Thailand) engaging in three internationalized internal conflicts (Cameroon, Gabon, and Chad) and an additional seven extra-systemic wars in its colonial holdings (Laos, Cambodia, Vietnam, Malagasy, Morocco, Algeria, and Mauritania) France's standing as great power and the reach of its influence had been shrunk significantly.¹⁶⁹ Paris continued to maintain ties to the Francophone world, but both its ability and its will to project power unilaterally and globally had been seriously abridged. The same is true of the UK, which had fought in four inter-state wars (Albania, North Korea, Egypt, Indonesia), intervened in two internal conflicts (Oman and Malaysia), and engaged in six extra-systemic wars (Palestine, Malaya, Kenya, Cyprus, North Borneo, and South Yemen) since 1946. And by 1970, troubles in Northern Ireland began to occupy much of its military focus.

Thus, between 1950 and 1970, Europe's former great powers had tried and failed to reestablish their position as primary players on the international stage. During that time, SAPP was important for at least France and the UK. Indeed, the former had doubled its annual military budget and the latter had increased its by 50 percent (SIPRI, 1980:21), but both had lost most of their foreign holdings along the way. By 1973, most of their efforts had come to naught and neither had the unilateral capability to project hard power wherever and whenever they wanted. Across the 1960s their military manpower dropped significantly from a combined 1.3 million in 1960 to 855 thousand by 1972. This was followed by a five year period of reductions between 1969 and 1974, that saw the UK's Air Force shrink by 100 combat aircraft, its submarine fleet by twenty, and its navy by one less operational aircraft carrier.¹⁷⁰ Over the same period, France reduced its combat aircraft by a hundred and reduced its aircraft carrier fleet to one (IISS, 1969; 1973). Intriguingly, these changes came concurrent (1969-1974) with huge spikes in oil consumption in both countries; from 71.8 to 121 million tonnes in France and 89.8 to 105.3 million tonnes in the UK

¹⁶⁸ Also relevant is the fact that there was growing domestic turmoil and violent student protests spreading in France, the UK, Italy, and Belgium, at the time. The reasons for this were many, but not least among them was a strong opposition to the US-led war in Vietnam. Various chapters of Fink, Gassert and Junker (1998) provide an in-depth analysis of the 1968 movements in various Western countries.

¹⁶⁹ See Harbom and Wallenstein (2010); data from the UCDP Dyadic Dataset, Version 1-2010 (http://www.pcr.uu.se/research/UCDP/data_and_publications/datasets.htm)

¹⁷⁰ For a detailed account of the UK's long period of relative economic decline during the post-war years and its plane to 'punch above its weight' militarily see Chalmers (1985).

respectively. Despite their increased oil dependence, the importance of SAPP had actually appeared to decline. If Europe was to project hard power in the future, it would have to do so multilaterally.

The crises that would occur in the 1970s, from increased oil prices to splits within Europe over the stationing of nuclear missiles in Belgium, Germany, Italy, the Netherlands, and the UK, would further work toward pushing Europe further away from its early post-war attitudes toward power projection. These were followed by another set of crises in the 1980s including the Iran-Iraq War and the subsequent tanker wars in the Persian Gulf that threatened the stability of EU oil supplies. Amidst the latter crisis, several European flagged vessels were either directly attacked or suffered damage from mines laid by Iran and Iraq. The UK and France moved quickly to protect their vessels. But it took several years before European leaders decided to coordinate their military presence in the Gulf. Ultimately they did agree to loosely coordinate plans to secure shipping in the area and by November, 1988, there were 21 West European warships in the Gulf and German support ships in the Mediterranean (Cordesman and Wagner, 1990). The newly coordinated efforts came on the heels of a 1987 decision to adopt a broad "Platform on European Security Interests" based on the principles of prevention of war through deterrence (nuclear and conventional), the promotion of disarmament, and a continued US presence in Europe (Hill, et al., 2000:189).

This new spirit of European-centered cooperation was encapsulated in Chancellor Helmut Kohl's proposal to France to form a joint Franco-German brigade as the first step towards a joint European fighting force. Because the former could only act in self-defense or under UN authority and then only in non-combat operations, Europe's new emerging idea was not one of power projection, but one of security promotion through multilateral mandate.

Almost a decade later (1995), when NATO forces launched Operation Deliberate Force to compel Serbia to end violence in Bosnia and Herzegovina, European forces flew 388 sorties (17%) and later (2004) took over policing operations there under an extended UN mandate. This latter approach would become the symbolic hallmark of the EU's new approach to power projection. Europe will act together so long as the operations are not offensive in nature and are authorized by the UN.

By the end of the 1990s, the EU had begun to unify its approach to security and defense, reinitiating what it had started back in the 1950s, only this time with a new understanding of power projection based on multilaterally authorized crisis management. At the Helsinki European Council meeting in 1999, leaders set a 'Headline' goal of 2003 to establish European Rapid

Reaction Force essentially to increase the Union's capability to carry out the 1992 established 'Petersberg tasks' of humanitarian and rescue missions, peacekeeping, and the tasks of combat forces in crisis management and peacemaking.¹⁷¹

In September 2003, the EU joined the UN in a Joint Declaration on EU-UN co-operation in Crisis Management setting up joint consultative mechanism for coordinating international peacekeeping missions. Then, in July 2004, the Council established the European Defence Agency "to support the Council and the Member States in their effort to improve the EU's defense capabilities in the field of crisis management and to sustain the ESDP as it stands now and develops in the future" (JOINT ACTION 2004/551/CFSP).¹⁷² A year later, leaders met informally at Hampton Court to discuss ways in which to increase financing, research, and development in the military sector among Member States. They also agreed to coordinate planned and future crisis management operations. On the capabilities front, the leaders agreed to focus on ways to enhance Europe's capabilities for "Strategic Lift, Air-to-Air Refueling and C4ISTAR (Command, Control, Communication, Computing, Intelligence, Surveillance, Target Acquisition and Reconnaissance)". In short, the EU was beginning to plan for increased use of military forces worldwide.

France, Italy, the Netherlands, Portugal, and Spain have since established the European Gendarmerie Force (EGF), a rapid deployment (30 days) European intervention force to respond to international crises.¹⁷³ Fifteen new European battle-groups have been established.¹⁷⁴ And in March, 2009, France officially rejoined NATO'S integrated military command structure. In the last decade alone, the EU has engaged in 24 different security missions (police and military).¹⁷⁵

Such measures could be understood as a strengthening of the EU's perception of SAPP. However, in a 2006 strategy paper, the EDA made scant reference to energy merely noting that "bio- and

¹⁷¹ The Petersberg tasks were set out in the Petersberg Declaration adopted at the Ministerial Council of the Western European Union (WEU) in June 1992; The tasks are explicitly stated in the Treaty on European Union (Article 17).

¹⁷² ESDP stands for 'European Security and Defence Policy'; Financial matters and amendments were added in 2005 (DECISION 2005/821/CFSP) and 2007 (DECISION 2007/643/CFSP).

¹⁷³ They were sent to Haiti in 2010 following the earthquake.

¹⁷⁴ Active since January 2007, the European Union Battle Groups (EUBG) consist of circa 1500 soldiers which can deploy under the authority of the European Council by unanimous decision.

¹⁷⁵ In Somalia, Guinea-Bissau, Congo, the DRC, Darfur, TCHAD, Bosnia and Herzegovina, Kosovo, the FYROM, Georgia, Afghanistan, the border between Moldova and Ukraine, Iraq, Indonesia, and the Palestinian Territories. See: <http://www.consilium.europa.eu/showPage.aspx?id=268&lang=en> for a complete list of missions.

material sciences and energy technologies will provide modern Armed Forces with great advantages”, adding the platitude that , “Europe is becoming increasingly dependent on the rest of the world, especially for energy” (EDA, 2006). The same was true for a later Solana report (S407/08, 2008) on the implementation of the 2003 European Security Strategy. The military may be growing in importance for the EU, but talk of EU militarization of energy security, particularly as pertains to supply availability for power projection is pure speculation.

Nevertheless, defense related research and development has become a primary focal point of contemporary EU interest, and that does at least point to some change in the orientation of European power projection, if not quite its contemporary perception of SAPP. In fact, in 2005, the EDA’s head, High Representative Javier Solana, implied as much by placing EU military R&D in the context of a competition with the US. In a letter to the Council, Solana wrote, “The US is out-spending Europe by 5:1 in defence R&D. Calls for urgent action have been made by industry to increase the proportion of the whole spent collaboratively in Europe from less than 5% to 20%” (S416/05). And in 2007, the EDA’s Ministerial Steering Board set the goal of a R&D share of collective defence expenditures at two percent. As of 2008, however, the EU was still spending less than 1.25% of its collective military budgets on research and technology, which is less than the 1.32% it was dedicating in 2006 (EDA, 2010) and was still far behind the US in terms of its overall military expenditures and military R&D between 2006 and 2008.¹⁷⁶

Table 9: Defense and research expenditures in Europe and the US, 2006-2008

	Europe*				US**			
	Defense Expenditure (share of GDP)	Defense Expenditure (10 ⁹ €)	R&D Share	R&T Share	Defense Expenditure (share of GDP)	Defense Expenditure (10 ⁹ €)	R&D Share	R&T Share
2006	1.8%	201	4.8%	1.3%	4.7%	492	11.8%	2.2%
2007	1.7%	204	4.7%	1.3%	4.5%	454	12.4%	2.1%
2008	1.6%	200	4.3%	1.3%	4.8%	466	11.6%	1.6%
* 26 EDA participating Member States; **Euro/Dollar exchange rate average for 2008: 1.470; Source: (EDA, 2010)								

Finally, the Lisbon Treaty in 2010 has solidified the role of the two cores elements of SAPP with EU politics. Both the common security framework and energy security have been given specific

¹⁷⁶ R&T is a subset of R&D. Research and Development (R&D) figures include any R&D programmes up to the point where expenditure for production of equipment starts to be incurred. Research and Technology (R&T) refers expenditures for basic research, applied research and technology demonstration for defence purposes.

attention. However, despite their common presence in treaties and speeches, the two are not necessarily linked. The EU no longer maintains any colonial holdings that can force it into internationalized internal conflicts, even if such conflicts beg for intervention as in the cases of Darfur, Afghanistan, Chad, and the Congo. Its military, even with the early buildups under the threat of the Warsaw Pact are in no position to attack and seize territory abroad, or for that matter even secure vital energy transit routes on their own. The presence of European naval forces off the coast of Somalia and in the Gulf of Aden is testimony to both the spirit and limitations of EU naval power.

Although SAPP was once important for two of the Member States of an earlier EU, today's Union sees power projection in a different light. The EU as a group now prioritizes military operations only under the auspices of international legal authority, notably the UN, and because of the combination of the diverse makeup of its Member States' military capabilities together with its commitment to multilateralism, we can assume that the EU now collectively fits the model of an international actor with low SAPP.

3.2.2.1. SAPP relevant data

Since the core military projection capacity of the EU rests with only few players, the following SAPP related charts will focus on their role.

3.2.2.1.1. EU military expenditures / personnel

The following charts show the growth of EU military expenditures from 1949 to 2009 in constant \$2008 and active military personnel between 1950 and 2007. For comparative purposes, three EUs are identified in the military expenditures chart: one includes the original six; a second includes the nine Member States following the first enlargement; and a third incorporates all 27 Member States. The reasoning behind this approach is that when expressed as a complete group (its 2010 status), the share of overall military expenditures by the original six never exceeds 70% of the total. The nine Member State group, however, never drops below 84% of overall military expenditures. Thus one can assume that these nine Member States (in fact eight because Ireland's military budget is negligible) are most representative of EU military investments prior to fifth enlargement in 2004. These three groups are then juxtaposed to the price of oil (set on the secondary, right axis) for context.¹⁷⁷ Active military personnel are presented in two groups, the

¹⁷⁷ An analysis of the relationship between price and military expenditures can be found on page 168.

Testing the Model

first being for the nine Member States after the first enlargement and the second being the total active personnel for the current Union. Military expenditure data comes from the Stockholm International Peace Research Institute Database on NATO military expenditures, available at <http://www.sipri.org> and SIPRI's Full Military Expenditure Database from 1988-2009. Personnel data comes from the Correlates of War Project originally published and updated in (Singer, 1987; Singer, et al., 1972).

Figure 14: EU military expenditures, 1949-2009

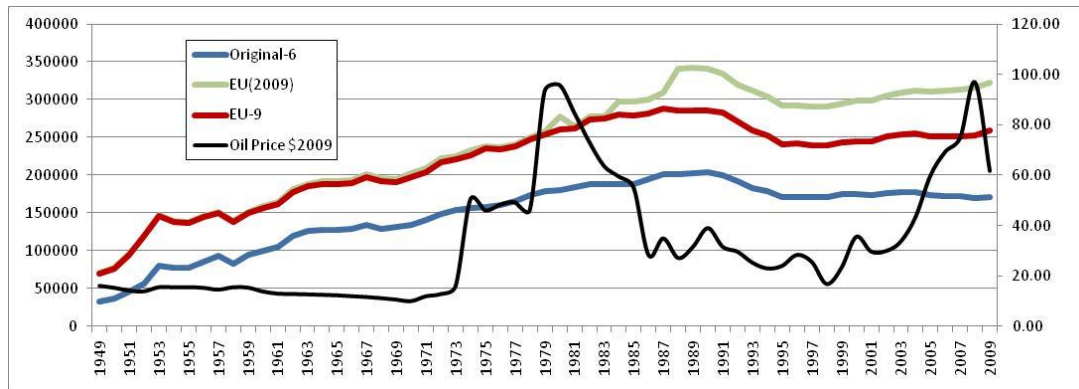
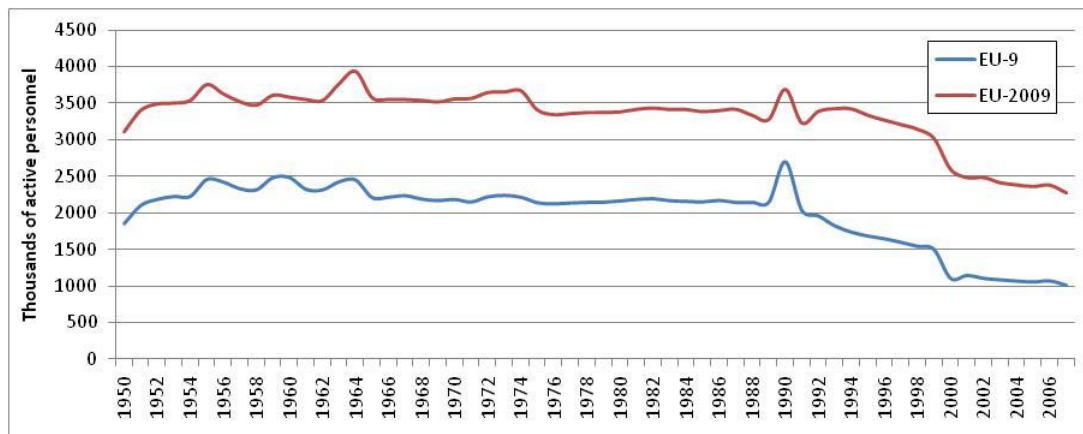


Figure 15: EU active military personnel, 1950-2007



3.2.2.1.2. Estimated inventories of energy dependent military hardware

The following table presents an estimated assessment of the total energy dependent active military hardware in the arsenals of France, UK, Germany, the Netherlands, and Spain in selected years between 1960 and 2005. The reason for the limited country selection is that of the EU's western Member States, including those that were also part of NATO, only the five identified above had equipment levels and the necessary manpower to be considered as offensive

capabilities. The selection is based on a subjective assessment of the military value of their hardware. Only weapons systems that are practical for offensive power projection are included. Transport ships and planes, minesweepers are not included. Principle surface fighting ships include a broad range of coastal and deep water destroyers, frigates, and escorts; their relevance to offensive power projection was the sole discretion of the author. The table illustrates the steady and consistent balance of air and naval power over the period, with a slight increase in the number of naval vessels many of which were escorts, indicating an overall lack of interest in projecting power. Submarines did increase through 1975, at the height of the Cold War, but have steadily dropped since as the EU has little need for their attack capabilities. Data for the table comes from multiple annual editions of *The Military Balance* (International Institute for Strategic Studies., 1965; 1966; 1969; 1970; 1974; 1975; 1979; 1980; 1984; 1985; 1989; 1990; 2004).

Table 10: Energy dependent active power projection military hardware for selected EU Member States and years

	1960	1965	1970	1975	1980	1985	1990	2005
Aircraft/Helicopter Carriers	8	6	4	6	7	8	8	6
Submarines	156	128	122	151	153	147	147	110
Principle Surface Fighting Ships	100 < x > 120	140 < x > 160	160 < x > 180	170 < x > 190	180 < x > 200	170 < x > 190	170 < x > 190	140 < x > 160
Air Combat / Bombers	1000 < x > 1200	2000 < x > 2200	2000 < x > 2200	2000 < x > 2200	2000 < x > 2200	2100 < x > 2300	2100 < x > 2300	1700 < x > >1900

3.3. The US' Energy Policy

3.3.1. Evolution of US energy policy

The evolution of energy policy in the US is colored by two contradictory traditions inherent in American political culture that at different times have taken priority over one another. The first is that of a hands-off, Laissez-faire approach, rooted in the tradition of free market. The second is one whereby the government intervenes as a coordinator in the name of national security. The dominance of one over another tradition was determined largely by matters of price and the importance of fuel supplies to power projection.

Energy and its associated research and development already were major political issues in the US by the end of World War II. However, that was not the case just a few years earlier. Before the War, energy had been a matter only of economics and competition policy. Oil supplies were abundant. The relationship between the US government and the petroleum industry swung between resentment and acrimony. Despite the fact that the US already had supported the development of biofuels in the early part of the century, government funding for energy related research was limited, spurious, and scattered across multiple pieces of legislation and executive agencies. The events of World War II changed that perspective and did so in three important ways: (1) by raising the importance of oil to national security; (2) by introducing nuclear technology to power projection; and (3) by initiating the idea that research and development required government support and coordination.

World War II was not a war over oil. However, oil was a “critical dimension” in what became a “war for mobility” (Pratt, et al., 2002:x-xi) and oil was central to its outcome. Indeed, cutting off Japan’s petroleum supply lines in East Asia was as much a core component of US strategy in the Pacific War as Germany’s attempts to secure Baku and sink US oil tankers in the Atlantic.¹⁷⁸ Even before the US officially entered the war, the government recognized the growing importance of oil to the Allies war effort. In May 1941, the Department of Interior established an office called the Petroleum Coordinator for National Defense (PCND). Almost immediately, after the Japanese attack on Pearl Harbor, the management of petroleum supplies became synonymous with the war effort. Recognizing its vital importance to its Pacific Fleet as well as Allied forces, President Roosevelt issued an Executive Order (EO) establishing a Petroleum Administration for War (PAW)

¹⁷⁸ And the halting of Rommel’s North African offensive, a vital defeat for Nazi Germany, was directly connected to limits on his supply of oil

in 1942 “to coordinate and centralize the war policies and actions of the Government relating to petroleum” subsuming the previously existing Petroleum Coordinator.¹⁷⁹ The fact that authority was specifically placed under the control of the US Department of Interior (and not the Departments of State or Defense) highlighted both the importance of internal institutional actors in the US and its abundance of supplies. The PCND and PAW managed all wartime issues related to petroleum and with the support of the Petroleum Industry War Council (PIWC), a group of 66 American oil executives that reported directly to the PAW, the US increased its wartime oil production by 30% and developed new and advanced high-octane fuels vital for the air war in Europe.

Born out of the successful cooperation experienced during the war, the US quickly recognized the value in maintaining some degree of coordination over the nation’s fuel supplies. Acting under orders of President Truman, Interior Secretary Julius Krug created in May 1946 a National Petroleum Council (NPC) in order to foster a “close and harmonious relations between government and industry” to “consult and advise” the Interior Department (Pratt, et al., 2002:7). This new organization was unique among American institutions, for although it was federally chartered, it was an entirely industry-financed operation that was assigned a specific mission to enhance the national security, emergency preparedness, and crisis management capabilities of the country through the management of petroleum. Thus, over the course of just a few short years, the politics of energy caused the US to undergo a sea change in its approach to government intervention. In order to meet the immediate needs of war, the US government first overcame a decades-long shadow of mistrust to cooperate with an oil industry that it had loathed. It then emerged from the war with an existing institutional framework for the coordination of oil production and supply directly linked to power projection.

The emergence of oil as a national security factor was only part of a larger, sweeping transformation that occurred in the government’s attitude toward energy during the war years. Another important shift was the centralization of control over energy related resources and its use in industry and foreign affairs (see Table 12 on page 182). The most decisive decision came in

¹⁷⁹ The EO 9276 ‘Establishing the Petroleum Administration for War and Defining its Functions and Duties’ was signed on December 2, 1942 (US Federal Register 7 FR 10091, December 4, 1942). The EO amended previous orders (EO 1965: ‘Providing for the Protection of Essential Facilities From Sabotage and Other Destructive Acts’ of May 19, 1942 and EO 9246: ‘Providing for the Coordination and Control of the Rubber Program’ of September 17, 1942). It was later amended by EO9319 ‘Amending Executive Order No. 9276’. The Administration was terminated on May 23, 1943 by EO 9718 (See 11 FR 4965, May 7, 1946).

1941 when the US established the Lend-Lease program,¹⁸⁰ run out of the Office of the President (EO 8926),¹⁸¹ which supplied the Allies with over \$50 billion (almost \$760 billion in \$2008) of war material through 1945 (Crowley, 1947:858-60); a move that also ended years of US isolation. The Lend-Lease program came on the heels of a 1939 decision to coordinate the import and export of electricity and natural gas (EO 8202).¹⁸² Seeing the centrality of energy in terms of its effect on industrial output, President Roosevelt then issued several additional executive orders establishing an Economic Defense Board (EO 8839), an Office of Defense Transportation (EO 8989), and a War Production Board (EO 9024).¹⁸³ The Reconstruction Finance Corporation (RFC), established through the earlier New Deal Program, created several government-owned corporations (Metals Reserve Company, Rubber Reserve Company, Defense Plant Corporation, Defense Supplies Corporation, War Damage Corporation, U.S. Commercial Company, Rubber Development Corporation, and the Petroleum Reserve Corporation).¹⁸⁴ Even under the circumstances of war, the creation of these new government agencies ran counter to the government's long-standing tradition of staying out of the economy.¹⁸⁵ Joseph Eastman in a famous 1943 editorial in the *Annals of the American Academy of Political and Social Sciences* lamented that there had never before been agencies like these, adding, "I sincerely hope that no occasion will soon arise for creating another one" (Eastman, 1943). The government merged or abolished many of these agencies shortly after the war. However, the controversy about their establishment and lessons learned by the US government remained; and by 1950, the US government recognized the importance of staying actively engaged in the petroleum sector.

¹⁸⁰ The formal law was titled 'An Act Further to Promote the Defense of the United States' and was signed into law on 11 March 1941. See Public Law 77-11, 55 Statute 3034, of Bill H.R.1776. See United States (1942) pages 31-33.

¹⁸¹ Executive Order 8926 'Establishing the Office of Lend-Lease Administration in the Office for Emergency Management of the Executive Office of the President', October 28, 1941. See US Federal Register, 6 FR 5519, October 30, 1941.

¹⁸² Executive Order 8202, July 13, 1939. See US Federal Register, 4 FR 3243, July 15, 1939.

¹⁸³ 8839 (See US Federal Register, 6 FR 3823, August 1, 1941); EO 8989 (See US Federal Register, 13 FR 59, January 6, 1948); EO 9024 (See US Federal Register, 7 FR 329, January 17, 1942); Amended by EO 9040 (US Federal Register, 7 FR 527, January 27, 1942), EO 9125 (US Federal Register, 7 FR 2719, April 10, 1942).

¹⁸⁴ The RFC was established by the Reconstruction Finance Corporation Act, January 22, 1932 (47 Stat. 5) and abolished in 1953 and fully were liquidated by 1957 (Reorganization Plan No. 1 of 1957; The Reconstruction Finance Corporation Liquidation Act (67 Stat. 230) of July 30, 1953). For a full accounting of the RFC's records see Records of the Reconstruction Finance Corporation, Record Group 234, available at <<http://www.archives.gov/research/guide-fed-records/groups/234.html>>.

¹⁸⁵ For a contemporary critical handling of the government's steps, see Eastman (1943).

The war also drove developments in another key area of energy, namely atomic power. Shortly before Germany invaded Poland in 1939, Albert Einstein wrote a letter to President Roosevelt informing him “the element uranium may be turned into a new and important source of energy in the immediate future” imploring him to assign an official to both take the lead on developing atomic technologies and materially support academic research in the area.¹⁸⁶ Roosevelt responded by establishing an Advisory Committee on Uranium and then in June 1940 incorporated it into the highly secret National Defense Research Committee (NDRC) before moving it a year later into the Office of Scientific Research and Development (OSRD) under his direct control.¹⁸⁷ Government support for atomic research was first tentative and skeptical, but then accelerated in 1941 when the UK MAUD commission produced a secret report about the feasibility of producing an atomic bomb. Vannevar Bush, the acting head the NDRC, seized the moment and proposed the US move forward with just such a project. The fact that the US was fully engaged and losing the Pacific War in mid-1942 provided the impetus for support. Bush began organizing secret laboratories in Chicago, Tennessee, Berkeley, and Manhattan and by the close of the year the President approved the plans. The Manhattan Project was born.¹⁸⁸

The Manhattan Project was more than just a weapons program. It also was a full-blown cooperative research program between the government, the military, universities, and key industrialists. The output of the program was not only a weapon, but an advancement in the knowledge of energy physics that would alter the historical path of the country itself. The detonation of the country's only two functional bombs in August 1945 brought about Japan's surrender and ended the war. It is in this light that Manhattan Project became the paradigmatic organizational model for future grand scientific endeavors, from putting a man on the moon to achieving energy independence. The advancements also had one other effect. It introduced the notion of an almost inexhaustible source of energy that could drive engines at sea. Thus, shortly after the conclusion of the war, the US embarked on a massive program to build a nuclear navy (see chapter on US SAPP, page 198) and in so doing took control of the seas for the remainder of the twentieth century. Indeed, there is no better example of how the control of energy altered the ability to project power.

¹⁸⁶ The letters between Einstein and Roosevelt are widely available in the Public Domain. A facsimile of the original letter is available from the US National Archives: <http://media.nara.gov/Public_Vaults/00762_.pdf>.

¹⁸⁷ The office was terminated during 1947. For a complete account of the developments of the OSRD and early US government stewardship of scientific research see Stewart (1948), Stewart (1980).

¹⁸⁸ For a full and detailed accounting of the Manhattan project, see Gosling (1999).

With the genie now out of the bottle and the war past, the US Congress moved quickly to restore the country's old hands-off tradition and wrest control from the executive branch. In 1946, it passed the Atomic Energy Act, which transferred all atomic related research and materials from the military to civilian control, including the development of nuclear bombs and power, and it created a specialized agency, the Atomic Energy Commission (AEC) to coordinate it, placed under their oversight.¹⁸⁹

The combination of the successful Manhattan Project and the coordinated efforts of temporary centralized agencies setup during the war solidified the bond between the US government and the civilian scientific community. The US had already begun supporting war related scientific research and development during World War I when it worked together with the UK and France on ways to detect German submarines. The most important figure of the time was Vannevar Bush. Already an active member of the National Research Council (NRC) in 1917, he coordinating thousands of American scientists, became the first presidential science adviser, and in 1939 became chairman of the influential National Advisory Committee for Aeronautics (NACA), the forerunner to the future National Aeronautics and Space Administration (NASA). Bush had originally proposed creating another influential agency, the National Defense Research Committee (NDRC), and when it was incorporated into the Office of Scientific Research and Development (OSRD), in 1943 he became its director and thus ultimately controlled the development of the Manhattan Project until the Army took it over. As the country's chief researcher, Bush orchestrated a seemingly united front of American scientists that led not only to the atomic bomb, but to sonar and radar technologies and amphibious landing vehicles. His previous successes, however, were nothing compared to what he initiated in 1945.

In July 1945, Bush delivered a report to President Truman titled *Science, The Endless Frontier*.¹⁹⁰ Noting that, "In this war it has become clear beyond all doubt that scientific research is absolutely essential to national security", he proposed that the US government establish a "National Research Foundation" in order to

"develop and promote a national policy for scientific research and scientific education, [that] should support basic research in nonprofit organizations, should

¹⁸⁹ President Truman finalized the transfer in Executive Order 9816 (US Federal Register 12 FR 37, January 3, 1947). The agency was later abolished by the Energy Reorganization Act of 1974, which divided responsibilities between the Energy Research and Development Administration and the Nuclear Regulatory Commission.

¹⁹⁰ The full text of the report is available at <<http://www.nsf.gov/about/history/vbush1945.htm>>.

develop scientific talent in American youth by means of scholarships and fellowships, and should by contract and otherwise support long-range research on military matters.” (Bush, 1945).

Responding to his call, Congress passed a law in 1947 to establish just such a foundation, but Truman vetoed it because it lacked provisions for proper government oversight. Science promotion was good, but not when left entirely to scientists. Despite the failure to pass, Congress did reorganize the post-war military in the National Security Act of 1947.¹⁹¹ The act merged the Departments of War and Navy into a National Military Establishment and created the Air Force by separating it from the Army's Air Forces, all under the control of the Secretary of Defense. It also transformed the Army and Navy's Joint Research Development Board (JRDB), chaired at that time by Bush, into the Research and Development Board (RDB) with a budget of almost \$500 million, the purpose of which was to promote research through the military until a National Science Foundation could be established.¹⁹² It took three more years of debate, but finally in 1950, the Congress passed and the President signed Public Law 81-507, creating the National Science Foundation (NSF). In so doing, it also established a governing board, the so-called National Science Board (NSB) appointed by the President. Bush was not on the board.¹⁹³

The establishment of the NSF was the final spoke in the new wheel of American political traditions toward cooperation between science and government. With its establishment, the US laid the groundwork for decades of dominance in the area of public-private partnerships in research and development. With a new and improved relationship with oil companies, the introduction of nuclear power, a new technical enterprise emerged that married the military, industry, and academia to a degree and depth that transformed the traditional hands-off, Laissez-faire orientation of government to one of coordination and investment, all in the name of national security. The shift in tradition, however, was incomplete and temporary. Despite the impending surge in naval nuclear propulsion, the vast majority of energy used for mobility, so vital in the victory of the previous war, was still based on oil; and oil was cheap and fully in the hands of private corporations.

¹⁹¹ Pub. L. No. 235, 80 Cong., 61 Stat. 496, 50 U.S.C. ch.15

¹⁹² For an insightful record of Vannevar Bush's career and his efforts to promote government backed scientific research, see Zachary (1999).

¹⁹³ Bush continued to serve as the President of the Carnegie Institution until 1955 and then went on to serve on the boards of AT&T and Merck and Co., two of the country's largest research intensive corporations.

By 1950, the US tradition of non-interference in the economy, which had been temporarily traded for one of cooperative collaboration in the area of energy during the war, reemerged. Having established an institutional mechanism to allow oil industry executives and the government to cooperate, it soon became clear to the government (and those that advised it) that overregulation was unwanted, if not unnecessary. Meanwhile, nuclear power, used originally for war purposes, was now put to the task of creating global peace. Although supplies and technology had to be controlled, the notion that nuclear power could solve most of the world's energy problems was taking hold. The US economy was booming and with it so too the consumption of electricity and motor fuel. Thus, just at the time when the US was entering into a Cold War with the Soviet Union in a global battle between Capitalism and Communism, the wartime tradition of cooperation gave way to the forces of free enterprise. Energy policy in the US underwent a proverbial reset.

3.3.1.1. The post-war reset and foreign oil

Within 24 hours of the Japanese surrender, the US government lifted its wartime gasoline-rationing program sparking a run on car sales. Demand for motor fuel exploded and oil's share of the country's total energy consumption quickly began to outpace that of coal (Yergin, 1991:409). Also, by the end of the war America's great suburbanization had already begun. Between 1944 and 1950, new housing starts rose from an annual 114,000 to 1.7 million and by 1954 some 9 million Americans had moved to the suburbs. Two decades later, the number of Americans living in the suburbs surpassed those living in cities or rural areas.¹⁹⁴ The essential tool of this new life was the automobile. There were 26 million cars in service in the US in 1945. By 1950 that number exceeded 40 million. The numbers would only explode from there as the country's new interstate highway system (introduced under the Eisenhower administration) connected all of the country's major cities. To pay for this new transportation infrastructure the government introduced a tax on gasoline.

This massive increase in the consumption of fuel only exacerbated concerns about supply raised during the war effort. In order to maintain superiority in future conflicts, access to more oil in as many places as possible would be necessary. Based on its successful experience in developing new technologies, optimism was growing that the country could develop synthetic fuels that would replace the need for oil altogether (Jaffe, 1948) and thus the Department of Interior requested \$10 billion in Manhattan Project form to research synthetic fuels. The assumption at

¹⁹⁴ See Yergin (1991) pages 550 to 554.

the time was that gasoline made from coal would cost the same as from oil; an assumption that proved wrong, and came concurrent with advances by US oil companies in gaining concessions in the Middle East.¹⁹⁵ New domestic discoveries¹⁹⁶ and the successes of America's oil majors ultimately killed the program.¹⁹⁷ Indeed, a US government policy review in 1948 may have put the final nail in the alternatives coffin by arguing that access to apparently limitless supplies of Middle Eastern oil would allow the US to shut-in domestic production, i.e. implement a production cap lower than available output, effectively creating a military stockpile. The idea of letting others produce in order to secure the country's strategic resource assets would become a subliminal theme in the country's future attempts to formulate an energy policy. The DOI ultimately received less than \$60 million for its synthetic fuels project. The US' first attempt at substitution failed. The new strategy was to gain access to Middle Eastern oil.

At the height of the World War II, the U.S. government had little interest in Arabia. Washington's official presence across the entire Arab world was so limited that in 1941 President Roosevelt flatly rejected advice to provide aid to Saudi Arabia with the comment, "This is a little far afield for us!" (Duncan and LIFE, 1949).¹⁹⁸ Although relations between the two countries were established in 1939, no American diplomat was resident in the kingdom;¹⁹⁹ nor was any Saudi representative stationed in Washington. Thus, the only way to conduct business between the two was through the Standard Oil Company of California, which was operating concessions in the kingdom, thus establishing an American precedent of high-level inter-state communications through industrialist interlocutors. For its part, Saudi Arabia sought improved relations with Washington because it wanted nothing to do with the UK, and in 1945 sent two of the kingdom's princes, Faisal and

¹⁹⁵ The US also made advances in Latin America, but its largest producers, Mexico and Venezuela, not only appeared less perspective in their future output, but were also deeply mired in domestic political turmoil and held a particularly course relationship with American oil executives. For a more complete telling of all US private oil operations after the war, see Yergin (1991) pages 430-498.

¹⁹⁶ In 1947, the first domestic off shore well struck oil. Also, as part of its post war decentralization program, two massive cross country oil pipelines from southwest to northeast were sold to private companies. Although they were eventually converted into gas pipelines, the process of re-privatizing the country's small internal producers and distributors was well under way and allowed domestic producers in Texas and elsewhere to start flooding the domestic market.

¹⁹⁷ As Yergin (1991: 428) succinctly puts it, "Imported petroleum killed synthetic fuels"..

¹⁹⁸ The US sent its first resident envoy to Jeddah in April 1942, (James Moose). At the time Saudi Arabia was suffering under serious food shortages, SOCAL executives was active urging Washington to provide assistance lest the king revoke American concessions. Later, under the urging of his Interior Secretary and wartime oil administrator, Harold Ickes, Roosevelt did declare Saudi Arabia vital to the nation's defense and therefore eligible for aid.

¹⁹⁹ That responsibility fell under the U.S. minister to Egypt stationed in Cairo.

Khalid, to Washington where the President welcomed them with a state dinner.²⁰⁰ So enamored were they and the President that Roosevelt chose to meet privately with King Abdul Aziz Ibn Saud aboard a US navy warship following the Yalta Conference in 1945 (Lippman, 2005). And a year later, the US began laying the seeds of a strategic relationship: the US Export-Import Bank lent the Kingdom \$10 million for various infrastructure projects, the U.S. Geological Survey (USGS) sent a team to look for water and vital energy resources, and the US mission was upgraded to full embassy status.

That relationship would be tested quickly with very positive results for US strategic energy interests. Between 1947 and 1948, the price of oil spiked as the run on gasoline exceeded refinery capacity. Refineries were still converting back from the wartime practice of producing high-octane aviation fuel.²⁰¹ By the end of 1948, consumption had risen so much that it exceeded imports for first time in the country's history introducing the notion of 'foreign oil' to American politics. Moreover, just as these events occurred, three major developments unfolded in the Middle East. American companies had just formed Aramco to exploit concessions in Saudi Arabia and Gulf of Texas had just agreed to work with Royal Dutch Shell in Kuwait.²⁰² The Soviet Union was moving forces to retain parts of northern Iran in order to control its oil assets and secure Baku by supporting the Communist Tudeh party in Tehran, which was fomenting strikes and raising concerns that Iran might be lost to the Soviet sphere. And in Palestine, the Jews were claiming a state, raising the ire of Ibn Saud. On the day that Israel declared its independence, the Saudi king reportedly told an Aramco executive (who quickly passed the message on to Secretary of State Marshall) that he "may be compelled, in certain circumstances, to apply sanctions against American oil concessions" (Yergin, 1991:426).²⁰³ Saudi Arabia neither cut-off oil supplies nor revoked American concessions. Nor did the US lose access rights in Kuwait. For the Arab leaders, there was a clear and distinct division between the US government's policies and those of its industrialists. The workings of America's old tradition thus saved US strategic interests and allowed US companies to continue operating without problem. For the oil rich Arab leaders, the

²⁰⁰ Both would later become kings.

²⁰¹ Instinctively, Americans blamed oil companies accusing them of conspiring to raise prices, sparking investigations by congress. See Yergin (1991) pages 410-420.

²⁰² Paul Getty won a concession in the neutral zone between Saudi Arabia and Kuwait in 1948, but he would only discover oil in 1953.

²⁰³ The US quickly commissioned a study that determined the US could withstand such a disruption with little problem. For a review of the events and the report see Miller (1980).

American companies were not the colonial rulers of years past; they paid well and often in cash or gold.

The example of Saudi Arabia illustrates the delicate balance between division and cooperation between government and industry that took hold in early post-war years. The US had become what Fehner and Holl (1994:3) called a “reluctant manager and guardian” of energy that “acted more as a broker among diversified interests than as a master planner, leaving the task of long-range planning and energy utilization to private industry or state, local and regional authorities.” Where Americans might accept government intervention in wartime, the role for government in peacetime was limited to monitoring energy data, coordinating research and development, and regulating where necessary. Nor would that position change even as foreign oil exporting countries began to take control of their oil exports.

The process toward foreign nationalization began in America's backyard but quickly spread elsewhere. US companies had already lost access to Mexican reserves in 1938 when the country nationalized its oil. Those companies did not want to lose their rights Venezuela, which had played a major supply role during the war. Unfortunately, the US government was not interested in lending its companies the support they wanted. Instead, recognizing the need for oil producing countries to generate income and thus reduce the need for US foreign aid, the government pushed for a new deal whereby oil companies would recognize foreign ownership of resources and share profits.²⁰⁴ Although contrary to the US's liberal traditions, this new deal initiated a process that ultimately pushed privately owned international oil companies out of their controlling position and brought state ownership in. Venezuela's success was contagious. Saudi Arabia followed suit in 1950 by taxing Aramco, again with US government support. In rapid succession, Kuwait then Iraq demanded similar deals. While the change disturbed its private companies, the US government was relieved that it did not have to throw money at Latin America or the Middle East at a time when it was bleeding funds to pay for Europe's reconstruction. The shift, however, had its dark sides, particularly in Iran and Egypt.

In 1951, Iran's Tudeh party led by Mohammed Mossadeq's came to power and quickly nationalized the UK's Anglo-Iranian Oil Company, effectively halting Iranian oil exports. Fearful of Iran falling into the Soviet sphere, both Truman and then Eisenhower tried to negotiate a

²⁰⁴ The final deal (1943) called for a 50-50 share of the profits, which became the new standard of international oil deals. Only a few years later, the Venezuelan government started to sell oil directly on the open market essentially changing the international market forever.

settlement. After failing, the US and UK orchestrated a sloppy but successful coup in 1953, the so-called 'Operation Ajax'.²⁰⁵ Unfortunately, for the Eisenhower administration, American oil companies simply were not interested in Iran. They already had enough oil in Saudi Arabia, and Ibn Saud did not like Iran. Moreover, just as the State Department was pushing the oil majors to invest there, the Justice Department was busy building yet another anti-trust case against them over their international activities based on a damning government report titled "The International Petroleum Cartel".²⁰⁶ Although the President might have thought otherwise, the US government was divided and despite his efforts to the contrary, Eisenhower was forced in 1953 to file a civil case against them.²⁰⁷ By ultimately reducing the case to civil matter from a criminal one, the President was able to convince the companies take a minority stake in the new arrangement, ostensibly to shore up Iranian exports and thus keep the Shah in and the Soviets out.²⁰⁸ While the internal political mechanics of the deal were messy, the foreign policy outcome was simple. The US, and not the UK or France, now controlled access to most of Middle East's vast oil reserves. Three years later, when France and the UK would make one last attempt to shore-up their regional assets (see page 130), Eisenhower saw the move as a threat to the new post-war order and American dominance. While he did not want Nasser and his Socialist movement to become more important than they already were, he was not prepared to let the Europeans slip back into a position of regional power. When their attempts failed, largely through the opposition of the US, European influence in the region was almost exhausted.

The pendulum like swings in Washington's relationship with its oil industry took on yet another dimension towards the end of 1950s. The US slipped into brief recession in 1958, which sapped domestic oil demand just as the world's oil market were being flooded with new supplies, collapsing prices and harming the countries smaller domestic producers. Powerful oil-rich states like Texas claimed that protecting America's producers was a matter of national security. Secretary of State Dulles was unconvinced. In a reported conversation with Attorney General Herbert Bronwell, he is said to have claimed that "this business about national security is a good

²⁰⁵ For a complete set of documents pertaining to the Iranian coup, see the National Security Archives, Electronic Briefing Book No. 28, at George Washington University. The full archive is available at: <<http://www.gwu.edu/~nsarchiv/NSAEBB/NSAEBB28/index.html>>.

²⁰⁶ See United States. Federal Trade Commission. (1952).

²⁰⁷ Yergin (1991) provides a detailed account of these events. See pages 471-475.

²⁰⁸ The new consortium consisted of Anglo-Iranian and 5 American companies (totaling 40%). They agreed to buy all Iranian output, now managed by the national Iranian Oil Company. They were later forced to share that stake with four other small American oil companies in order to comply with US antitrust laws.

deal of window dressing" (Yergin, 1991:538). Nevertheless, Eisenhower eventually succumbed to domestic interests and in 1959 issued the country's first foreign oil import quotas.²⁰⁹ The decision had the immediate effect of helping small American producers (US output increased by almost 30% over the next nine years) and demonstrated how weak the large American oil companies were in comparison to the interests of smaller domestic producers and their powerful state representatives. It also set in motion the wheels of an international response.

At the time of Eisenhower's decision, some 40% of Venezuelan oil exports were heading to the US and the new quotas severely hurt its income. In response, Perez Alfonzo, the Venezuelan Minister of Mines and Hydrocarbons, called for a multilateral agreement with the Western Hemisphere producers and consumers to form a government controlled cooperation system. After Eisenhower refused to even entertain the idea on the basis of his long-standing animosity toward government-industry cooperation in the oil sector, Alfonzo travelled to Cairo to join the Arab Oil Conference (originally started in 1955) where he met with his Saudi counterpart Abdullah ibn Hamoud Tariki and together they hatched the idea of an international oil exporting cartel. One year later, after OPEC was founded, Washington was still unfazed. Just two months after OPEC's founding, a secret CIA National Intelligence Estimate on Middle East Oil dedicated only four lines to the new organization.²¹⁰ Thus, at the beginning of the 1960s, just as the US was beginning to lose its dominance of the world oil market, the government was hardly aware of its precarious condition.

3.3.1.2. The emergence of nuclear power

As where the oil industry had a complicated and unstable relationship with the White House, the government's approach to nuclear power took on an entirely different narrative. In fact, it alone constituted the bulk of post-war research and permeated the country's first real energy policy. Oil and coal were both cheap and abundant and thus there was no pressing need to control it. However, nuclear power was unproven and untested and its military importance placed it squarely at the center of national security.

In the early post-war years, the US government perceived energy through the lens of specific fuels and not energy as such. Indeed, in almost every area of energy research, management, and

²⁰⁹ President Kennedy would later tighten those controls before Johnson would reduce them amidst the Vietnam War.

²¹⁰ The reference to this report is made in Yergin (1991) on page 523 in footnote 4. According to Yergin's notes, the file is on microfilm. This author was unable to acquire original source.

control, programs were spread across multiple departments of government. While the Departments of State and Defense focused on acquiring local and foreign sources of oil, separate offices in the Department of Interior focused on promoting markets for the various fossil resources and the Bureau of Mines oversaw the workings of a distributed coal industry. Although federal support for hydroelectric power was rigorous in the Columbia and Tennessee River Valleys, management was in fact regionally staffed and distinctly separate from other related institutions. The Federal Power commission was responsible for seeking fair prices in the trade of gas and electricity between the states, but the Federal Trade Commission was tasked with the job to promote energy competition within both related energy technologies. Hence, when it became clear that atomic power needed to be controlled and promoted for the national interest, the federal government dedicated almost all its resources to this one new promising area.

The focus on atomic energy began as a project of war. In June of 1946, the US tried to make it a tool of peace. Earlier that year, the new United Nations had passed its very first resolution establishing the UN Atomic Energy Commission. At its first meeting in June, the US together with the UK and France proposed a plan to share and control atomic technologies, eliminate atomic weapons, and establish a system of inspections to enforce compliance. The Soviet Union immediately rejected the plan. It was undertaking a rapid development plan to build its own arsenal, a target they achieved August 1949. In response to its diplomatic failure and the Soviet success, President Truman ordered the development of a more powerful thermonuclear bomb and set aside \$1.4 billion to upgrade and expand the civilian controlled Atomic Energy Commission's facilities, setting the atomic war project back on track, and taking with it the entire focus of US energy policy.

Progress on the research front was rapid. By 1951, the US had moved beyond pure military applications by producing its first electric power-generating reactor. A breeder reactor, it was capable of producing more fissile material than it consumed. A year later, Truman's weapon target was reached as the US detonated its first thermo-nuclear device (10.4 megatons). Atomic technology was taking off and it appeared that a new permanent solution to the world's energy needs was just around the corner. Thus, it was in the context of this backdrop that the newly elected President Eisenhower resurrected the notion of the atomic peace project. Speaking before the 1953 UN General Assembly, he elaborated on the destructive dangers of the new atomic weapons age proclaiming that

The United States [...] is instantly prepared to meet privately with such other countries as may be principally involved, to seek an acceptable solution to the

atomic armaments race which over shadows not only the peace, but the very life, of the world. [...] It is not enough to take this weapon out of the hands of the soldiers. It must be put into the hands of those who will know how to strip its military casing and adapt it to the arts of peace.²¹¹

In so doing, Eisenhower introduced the Atoms for Peace program whereby nuclear technology and information was provided to hospitals and schools, at home and abroad. But peace was only part of the program. The very notion that atomic power could to produce seemingly endless amounts of electricity had direct consequences for military mobility. The first to recognize this was the US Navy. Within a year of Eisenhower's speech, the US Navy launched its first nuclear-electric-powered submarine, the *Nautilus* and before he would leave office, another six nuclear-powered submarines and one guided missile cruiser would enter into service. The military advantages of nuclear power were twofold. Its engines were quieter than combustion based versions and thus were harder to detect under water, and once at sea, a nuclear powered ship could extend its sailing period without returning to dock for refueling for months, even years at time. As the military increased its interest in atomic power the money started flowing. Huge portions of the US scientific community turned their focus to developing faster propulsion systems based on nuclear power; and weapons production skyrocketed as the US and the Soviet Union entered into a full scale nuclear arms race.

Nevertheless, Eisenhower was sincere in his goal to find peaceful uses for atomic power. In 1954, he worked together with Congress to pass the Atomic Energy Act to finance and coordinate together with private industry the building of a civilian atomic power station. By 1957, the first commercially operated plant came online in Pennsylvania. That same year he ordered a moratorium on all future nuclear weapons tests (after a few more scheduled tests). Still, Eisenhower discovered against his better judgment that the genie was not out only of the bottle, it was also out of the hands of the President. By the time he left office, he was saddened by the fact that atomic power had become an asset upon which the powerful interests of American companies, the military, and the various agencies of his own executive vied for political power. In his farewell speech to the nation, he lamented,

“Our military organization today bears little relation to that known by any of my predecessors in peacetime, or indeed by the fighting men of World War II or

²¹¹ The full text of the speech is available in the public domain. An easy access source is available through the International Atomic Energy Agency < http://www.iaea.org/About/history_speech.html>.

Korea. Until the latest of our world conflicts, the United States had no armaments industry. [...] But now we can no longer risk emergency improvisation of national defense; we have been compelled to create a permanent armaments industry of vast proportions. [...] We annually spend on military security more than the net income of all United States corporations.

This conjunction of an immense military establishment and a large arms industry is new in the American experience. The total influence – economic, political, even spiritual – is felt in every city, every Statehouse, every office of the Federal government. We recognize the imperative need for this development. Yet we must not fail to comprehend its grave implications. Our toil, resources and livelihood are all involved; so is the very structure of our society.

In the councils of government, we must guard against the acquisition of unwarranted influence, whether sought or unsought, by the military-industrial complex. The potential for the disastrous rise of misplaced power exists and will persist.”(Eisenhower, 1961).

Eisenhower’s concerns would go unheeded and his testing moratorium would last only until shortly after John F. Kennedy came to power, when the Soviet Union began testing again. Shortly thereafter, the US observed Soviet missile encampments on Cuba. For the first time in its recent history, the US was suddenly under direct threat of attack to its mainland. The crisis that ensued: the blockade, the threats, and the looming danger of a devastating nuclear war exemplified all the dangers of the nuclear age and the ongoing Cold War with the Soviet Union.²¹² Despite the fact that the US, the UK and the Soviet Union would sign a limited test ban treaty two years later, Eisenhower’s portents of the nuclear age were now a matter of record.

The ensuing, albeit brief, Kennedy years were filled with crises involving domestic turmoil, labor strikes, fights between and within the aviation and rail industries, and international arms control. He set into motion new rules pertaining to emergency management of the energy and transport sector and left an indelible mark, both directly and indirectly on US energy policy.²¹³ Kennedy was a powerful advocate of the country’s coal industry and strongly believed that U.S. energy

²¹² For a complete handling of the Cuban missile crisis, see Allison (1971).

²¹³ See Executive Order 10997 on emergency response authorities in the transportation sector and EOs 11003, and 11047 on aviation.

resources needed to be managed to promote economic growth. Concerned that more than 70,000 jobs had been lost in the coal sector since 1948, then Senator Kennedy running for President in 1960 called for increased use of coal “burned at the mines and transmitted over huge cables” into homes “as electric power.”²¹⁴ Once President, he announced a proposal to develop vast coal slurry pipelines, to facilitate interstate transportation leading to the construction of the world’s longest water-slurry pipeline capable of moving five million tons of coal per year from Northern Arizona to an electric power plant in Nevada (Glennon, 2002:155).

On the reform front, Kennedy recognized that “the widely scattered resource policies of the Federal Government” were hazarding efforts at coordination. Pointing to the problems present in previous administrations, he criticized policies that “overlapped and often conflicted” with one another causing an enormous waste of spending “on competing efforts” (Kennedy, 1961a). In the nuclear domain, he pushed for increased civilian power projects and ordered the Atomic Energy Commission to take a “hard look at the role of nuclear power” in the economy and directed it to cooperate with the DOI, FTC, and private industry to develop a coherent strategy.²¹⁵ He specifically pointed to the Hanford plutonium manufacturing facility, a sprawling complex along the Columbia River. He wanted its excess steam to be used to generate electricity²¹⁶ and actively pursued the extension of rural electrification. As a result of his initiatives, the US expanded construction of its electricity infrastructure throughout the next decade.²¹⁷

Kennedy’s most important contribution to US energy policy was, however, indirect. On May 25, 1961, in an urgent message to Congress, he called upon the nation to undertake a new Manhattan Project style program stating, “I believe that this nation should commit itself to achieving the goal, before this decade is out, of landing a man on the moon and returning him safely to the earth” (Kennedy, 1961b). A new grand project was under way. Over the course of the next fourteen years, the US government would spend over \$96 billion in \$2007, a full 2.2% of all

²¹⁴ See Kennedy (1960) ‘Remarks of Senator John F. Kennedy at Morgantown, West Virginia’, Apr. 18, 1960, at the John F. Kennedy Presidential Library & Museum, online records, <http://www.jfklibrary.org/Historical+Resources/Archives/Reference+Desk/Speeches/JFK/JFK+Pre-Pres/1960/002PREPRES12SPEECHES_60APR18B.htm>

²¹⁵ See Letter from John F. Kennedy, President of the United States, to the Chairman of the Atomic Energy Commission, *The Development of Civilian Nuclear Power*, (March 17, 1962).

²¹⁶ Built in 1944, Hanford produced the bulk of the plutonium for the U.S. nuclear weapons program.

²¹⁷ His efforts lasted until 1975, when investments in the country’s electric infrastructure declined sharply and continued to decline until 1998. See ‘Press Release’, Federal Energy Regulatory Commission (FERC), Commission Proposes Transmission Pricing Reforms to Increase Power Grid Investment’, (Nov. 17, 2005) <<http://elibrary.ferc.gov/idmws/common/OpenNat.asp?fileID=10882511>>

federal outlays, and almost 0.4% of its GDP (Stine, 2008). The massive project cost almost double the funds and ran three times the duration of the Manhattan Project. Like the program to build the atomic bomb, Apollo was the perfect project. It had a specific goal and was driven by military and security concerns. Its success and the advances it brought in aviation and rocketry on top of what the Manhattan project had brought would become the litmus test to guide the US' future Energy Technology Program, which would be launched in the mid 1970s.

3.3.1.3. The first warning signs

The Assassination of Kennedy in November 1963 brought Lyndon Johnson in to office and with him came new priorities and problems for the United States. The Kennedy legacy left the US deeply embroiled in a costly quagmire in Vietnam. The same internal political rumblings that Europe experienced were rocking the US as well. Energy consumption was becoming unsustainable and the country's demand for electricity was exploding far beyond its capacity to maintain steady supplies.

Johnson did not focus much on energy policy. While he did promote environmental conservation, urban renewal, and mass transportation legislation, such as the Urban Mass Transportation Act of 1964, military matters abroad mired his time in office. Also, his authority to act on energy was limited by all the problems pointed out by his predecessors. The temporary closure of Suez Canal amidst a brief 1967 Arab-Israeli War had little impact on price, supply availability, or policy. Indeed, given the prevailing conditions of the time, creating an energy policy in the climate of the mid-1960s would have been equivalent to a government program to herd cats. Power and authority were scattered, the market for electricity was fraught with horse-trading between the coal and nuclear industries, and the price of oil was holding steady at under \$2 barrel (circa \$12 in \$2009). The fact is that there was little incentive to look toward any new technology other than expanded nuclear power.

In November 1965, with demand for heating stressing the network to the maximum, a surge at a US hydroelectric power plant tripped a security circuit and the entire network came cascading down, leaving millions without electricity for almost half a day. American officials moved quickly to fix the situation and created a new institution, the Northeast Power Coordinating Council (NPCC), to make sure it never happened again. The blackout occurred just at a moment when the promise of nuclear power was at its height. The Atomic Energy Commission, had already fast-

tracked a program to build a new advanced type of liquid metal fast breeder reactor.²¹⁸ But the damage was already done. Steady energy supplies no longer could be taken for granted.

When Richard Nixon arrived in the White House three year later, the country was facing social chaos. The costs of the war in Vietnam were spiraling out of control. Energy politics were all over the place and no single agency or authority had control of anything. Ten months after he took office, a brown out swept across the Northeast, this time caused by Americans' excessive demand for air conditioning. Within a year, he announced that the AEC plans to cooperate with industry to build its long-sought liquid metal reactor by 1980; and by 1972, they had selected a location. But time was running out. America needed either more electricity or it needed to consume a great deal less.

The sixties were watershed years in terms of the reality of the country's energy condition. In the early part of the decade, most Americans thought their energy problems were a thing of their past. Continuous supplies of cheap oil had allowed demand to skyrocket. States and domestic regional groups that had replaced the federal government in the management and regulation of fuel were forced to loosen their grip in order to accommodate for growing demand. As a result, the US began to lose its position of swing producer in the world. Where it had maintained a surplus of some 4 million barrels per day in the early 1960s, it was around only one million in 1970, and that was despite new discoveries including a massive field in Alaska's North Slope in 1968. Meanwhile, nuclear power usage was increasing in the electricity sector, and so too was the use of coal to meet runaway demand. All the signs were pointing to a disaster. A country that was able to withstand multiple, albeit minor, price shocks and supply shortages (1948, 1951, 1956, and 1967) was no longer in the position to do so. Across the world, oil-producing countries were beginning to take on oil distributing companies, and the former was winning. By the end of the 1960s, the US was heading full steam toward an energy calamity; and few in the government saw it coming (Yergin, 1991:566-569).

²¹⁸ Such systems had been used for years already in naval ships, but had not been seriously considered for commercial use until 1965.

3.3.1.4. Crises, controls, and the pursuit of energy independence

In 1970, everything began to fall apart. The problems began when Libya started pushing western oil companies out of the country, which in turn set in motion a rapid succession nationalizations and oil seizures by Arab exporting states. Cooperation between suppliers that had until then been merely a myth, was beginning take shape. OPEC was coming of age. By mid 1970, President Nixon saw the clouds coming and proposed a cabinet level position for an energy chief, but the public was not interested. As Fehner and Hall (1994: 5) put it, “Americans could not perceive of an energy crisis when there was ample supply of cheap gas for their cars, electricity and fuel for their homes, and power for their industries and businesses.” Besides, America would soon go through a debt crises in 1971 forcing Nixon to set price controls and freeze wages across the country. Amidst the turmoil, the public had little interest in something as obscure and distant as an energy policy.

Oil was a primary target of those price controls. International oil prices were on the rise (25% on average over the previous year according to BP, 2010). This would not have mattered in the past, but the US was now a major importer.

The controls froze prices just as the international market was undergoing dramatic changes. Congress tried to insulate the US market by imposing new regulations, including the Emergency Petroleum Allocation Act of 1973 (EPAA), turning control of existing domestic oil production to federal regulators while deregulating oil from new discoveries. Imported oil, which was more expensive, was not subject to any price controls. Since most large American oil companies were operating internationally, they listed their prices at the higher international price, while refineries were buying up local production at a cheaper rate, creating windfall profits. The EPAA actually created an incentive for companies to hoard domestic oil precisely at the moment when more supplies were needed. In April, Nixon warned the country that its energy demands had grown beyond supplies, and that it might face higher prices and energy shortages in the immediate future. In what amounted to the clearest assessment yet of the country’s energy dilemma he wrote,

“Over 90 percent of the energy we consume today in the United States comes from three sources: natural gas, coal and petroleum. Each source presents us with a different set of problems. Natural gas is our cleanest fuel and is most preferred in order to protect our environment, but ill-considered regulations of natural gas prices by the Federal Government have produced a serious and increasing scarcity of this fuel. We have vast quantities of coal, but the extraction and use of coal

have presented such persistent environmental problems that, today, less than 20 percent of our energy needs are met by coal and the health of the entire coal industry is seriously threatened. Our third conventional resource is oil, but domestic production of available oil is no longer able to keep pace with demands. In determining how we should expand and develop these resources, along with others such as nuclear power, we must take into account not only our economic goals, but also our environmental goals and our national security goals. Each of these areas is profoundly affected by our decisions concerning energy." (Nixon, 1971a).

After signing the EPAA into law, Nixon went on to request that the Congress establish a Department of Energy that would consolidate and manage national energy priorities and research and development; and then he took the extraordinary step to establish a Special Energy Committee of senior advisors and a National Energy Office to coordinate analysis between agencies. When his legislation stalled in Congress, the President established another group, the Energy Policy Office, which combined and expanded the previous two. For the first time since 1945, energy issues would now to be planned and executed out of the White House. He further proposed centralizing the various activities of government (including the highly competitive Department of Interior and Atomic Energy Commission's research wings) into one Energy Research and Development Administration with the goal of developing new energy technologies. By September, Congress had still not acted, but Nixon would not be deterred. He began pushing four separate bills to pay for the construction of an Alaskan pipeline, deepwater ports, the deregulation of the gas market, and new and looser mining standards (Nixon, 1971b). All of his efforts were, unfortunately too late. On October 6, 1973, Washington discovered that it had waited too long. A new Arab-Israeli war unleashed a series of events that sent prices skyrocketing, America's economy into the doldrums, and reminded everyone that energy and international politics had become permanent bedfellows.²¹⁹

The Arab oil exporting countries immediately imposed an oil embargo on among others, the US. By November, it was experiencing the most acute shortage it had encountered since World War II (Anders, 1980). As motorists lined up to buy gasoline, Americans finally realized that energy was in fact a national issue and directly affected the well-being and survival of the country. Nixon

²¹⁹ For a detailed handling of the US involvement in the October 1973 War and how close it came to setting off a nuclear conflict with the Soviet Union see Kissinger (2003).

responded with a televised message where he presented “Project Independence”. Drawing on the traditions of the Manhattan Project and the Apollo Program, his goal was no less than to achieve “energy self-sufficiency” by 1980. He provided another candid assessment of America’s energy situation:

“Now, some of you may wonder whether we are turning back the clock to another age. Gas rationing, oil shortages, reduced speed limits--they all sound like a way of life we left behind with Glenn Miller and the war of the forties. Well, in fact, part of our current problem also stems from war--the war in the Middle East. But our deeper energy problems come not from war, but from peace and from abundance. We are running out of energy today because our economy has grown enormously and because in prosperity what were once considered luxuries are now considered necessities.” (Nixon, 1971c)

Shortly thereafter, Nixon ordered an increase in domestic heating oil production, closed gasoline stations on Sundays, and established the Federal Energy Office (FEO) in the executive Office of the White House (Executive Order 11748).²²⁰ The age of energy abundance was over.

Nixon’s executive order was the first legal institutionalization of a response to oil shortages in the post-war period. All previous efforts dealt with coordination, production, even research, but none had been given the task of allocating oil supplies to refiners. The US government now controlled the supply of oil on the US market and set prices, squarely placing America’s hands-off tradition in the back seat. The FEO quickly consolidated control, taking leading staff from the Departments of Interior, Treasury, and Internal Revenue; and played the lead role in guiding Project Independence. It set speed limits and diverted funds from highways to mass transit. It prioritized conservation and research into alternatives and substitutes. It doled out allotments to industries and coupons to customers; and established new rules for the distribution of domestic oil between refineries.²²¹ Despite all the evidence and concerted action, however, Americans remained unconvinced that a crisis existed. Almost 50% continued to blame the government and oil companies for the country’s shortages and virtually no one believed that supplies were limited.²²²

²²⁰ US Federal Register, 38 FR 33575; December 6, 1973; Revoked in 1974 by Executive Order 11790, Federal Register, 39 FR 23185; June 27, 1974.-

²²¹ That exacerbated the situation by creating even more incentive for refineries to go out and buy unregulated imported oil.

²²² See Gallop (1974).

In May 1974, Nixon's FEO became the Federal Energy Agency (FEA) after he signed into law the Federal Energy Administration Act. Nixon tasked the new agency to develop "new methods of producing energy, such as the commercial use of geothermal energy and oil from our vast oil shale reserves" and announced support for "research and development to find new and better ways of using our abundant coal resources and to capture the benefits of solar energy and nuclear fusion" (Nixon, 1974a). Substitution was back on the table.

With a new internal program in place, the Nixon administration raised energy to the domain of foreign policy. Secretary of State Henry Kissinger first delivered the message in December. Speaking before the influential Pilgrims Society in London, he reshaped the energy crisis into an opportunity to become the "the economic equivalent of the sputnik challenge of 1957".²²³ Noting that the crisis itself was not merely a product of the Arab-Israeli War, but rather "the inevitable consequence of the explosive growth of world-wide demand outrunning the incentives for supply", he argued for a massive, coordinated international effort to increase supplies, decrease consumption, and to develop alternate energy sources. He then proposed a formal international institutional framework, an Energy Action Group, to coordinate international research and development of new energy technologies.

Three months later, the US convened a three day Washington Energy Conference of thirteen principle oil consuming nations (11-13 February, 1974) including senior officials of the EEC and OECD.²²⁴ In his opening words to the meeting, Kissinger told the delegates, "the energy situation poses severe economic and political problems for all nations" adding that "isolated solutions are impossible".²²⁵ He accentuated the need to develop non-oil sources of energy and proposed plans for a joint allocation system to be made available in times of supply emergencies and the development of a common system to define the criteria of just such an emergency, noting "we cannot leave our security or our national economies to forces outside our control". He further proposed that the group try and coordinate with oil-producing nations to guarantee stable supplies.

The meeting proved to be a success as the US proposals were in large part accepted by all attendees except France, which refused to cooperate and almost scuttled the agreement. But the

²²³ Reproduced in *USA Documents*, Public Affairs Office, United States Mission to the European Communities, No. 61, 1973, p. 8.

²²⁴ The event was actually only scheduled for two days.

²²⁵ See Washington Energy Conference Document No. 6, p. 2.

US failed to secure a common agreement on a code of conduct to regulate the efforts of individual consumer states to secure special deals with Middle Eastern producers, particularly those tied to weapons sales.²²⁶ The fact that the US had secured its own secret deals with Saudi Arabia did not particularly engender cooperation on that front. Still, the acerbity of French Foreign Minister Jobert's comments set the tone for greater US-EU cooperation uniting the remaining eight EEC Member States and the US in their resolve.²²⁷ Elements of a February 11th telephone conversation between Kissinger and Nixon reveals the extent of its effect:

K: Mr. President.

N: Hi. How are you, Henry.

K: I just wanted to bring you up to date on how that conference went.

N: Yes. Fine.

K: [...] We just laid out the problem. Then Ohira, everybody gave talks supporting our position. [...] Schmidt spoke for Germany because Scheel represented the European Community. Schmidt was superlative, and if you have a chance to say something to him tonight you might mention that. Home was pretty good [...] well to make a long story short, everybody was good. Except Jobert, who was a bastard. He made a really vicious speech, in fact people were groaning [...] it was awful.

N: Yes. We'll just ignore that.

K: [...] if the other eight Europeans stand up to Jobert we can have a good communiqué, if they don't [...] then I think we should say the hell with it and that we met and had a nice meeting. I don't think we should fake a success because the Saudis have now come to us and offered bilateral deals and we shouldn't bind ourselves [...] Incidentally I hardly dare tell you but we have _____ assurance.

N: Al told me, I got that.

K: And also the Egyptians are going to announce that restoration of diplomatic relations with us shortly after that.

N: That's good, well, I just hope the Europeans will stand up to this fellow, but who knows.

[...]

K: Well, Mr. President, if anybody has been pro-French, it's been you.

N: God, yes.

K: What have we done to these people. If they did this to Kennedy, that's one thing, but I suppose French domestic politics, and if you look at French history.

N: Well we'll see, they can change too. I don't know whether they will, but I hope.

[...]

²²⁶ France was already negotiating with Saudi Arabia, Kuwait, and Libya.

²²⁷ As noted in the chapter on the evolution of EU energy policy, France was distraught over its ongoing loss of global influence and its loss of internal European influence to Germany and the UK.

K: You might flatter Scheel a little bit. He'll probably sit next to you, because he is the ranking member.

N: Yes, I know.

K: He'll respond, he's been pretty good, he's a weakling.

N: I know.

K: But we need him to get that communiqué through.

N: Right, OK. I'll give him a little pat on the back. Thank you Henry and get a rest.

K: Right."

[END] (Kissinger and Nixon, 1974)

Later that night, Nixon addressed the leaders at dinner. Speaking in frank manner he told them that

the US "can and will become totally independent, we believe, of any outside source for energy" by 1980 and that "the purpose of our Project Independence, let me emphasize, is not isolation", but rather to be "self-sufficient." He implored them to cooperate, telling them that, "We can have no real security in the world unless we are all secure and unless we all cooperate". And then directly broached the subject of independent deals saying it was "understandable" that each country present might "go into business for itself [and] seek to make a bilateral agreement with the oil-producing nations", but such action would in fact be "possibly good short-term politics, but disastrous long-term statesmanship". Inevitably, he argued, it would "drive the prices of energy up, it will drive our economies down, and it will drive all of us apart." Finally, heeding Kissinger's advice he singled out President Scheel for the only toast of the night.²²⁸ When the ministers left Washington, they had agreed on a deal. Nine months later, they signed a treaty under framework of the OECD establishing the International Energy Agency, headquartered in Paris. It marked the first multilateral success of Nixon's emergent US energy policy, but he was not around to take credit for it. He had resigned in August under the disgrace of the Watergate scandal.

Henry Ford served out the remainder of Nixon's term. In his first press conference, Ford promised to accelerate Nixon's Project Independence.²²⁹ He then established a national energy board to

²²⁸ All quotes from the dinner come from remarks made at the State Dinner on February 11, 1974 at the White House. See Nixon (1974b). German Foreign Minister Scheel was acting in his capacity as President of the Council of Ministers of the European Communities. Before the toast, Nixon joked that "before I found that we could get the Army Chorus free, that we might call on Mr. Scheel to perform, but having sold 400,000 records, his price was simply too high--we could not afford him tonight" In December of 1973, while he was Foreign Minister of the Federal Republic of Germany, Walter Scheel recorded a folk song for the benefit of several charitable organizations in Germany.

²²⁹ He would later push the goal of independence forward to 1985. See State of the Union Address, 1975.

develop one single encompassing policy for all fuels across the entire country. In October, he signed the Energy Reorganization Act, which abolished the Atomic Energy Commission and established two new institutions in its place, the Energy Research and Development Agency (ERDA) and the Nuclear Regulatory Commission (NRC). Ford's energy board was formalized as the Energy Resources Council and given a temporary mandate until Congress could pass planned legislation to create a full-blown department of energy.

The ERDA was designated to achieve two goals: to bring together all the various ERD programs of the government into one unified agency to promote the rapid development of new technologies and to disconnect civilian nuclear regulatory activities (now the task of the NRC) from the development and production of military nuclear power and weaponry. It received most of the AEC's former substantial budget including all its offices and laboratories, took over all the coal research from the Department of Interior, the solar and geothermal programs of the National Science Foundation, and the Environmental Protection Agency's research projects on advanced automobiles (Abbasi, 1975). In its first year of operation the ERDA published a comprehensive research plan and strongly encouraged early commercialization of synthetic fuels.

With the worst part of the crisis behind and fuel supplies easing, Ford moved to decontrol domestic oil prices and get a tax on imported oil. Finishing what Nixon had started he submitted to Congress a bill called the Energy Independence Act. After a year of negotiations, particularly over price controls, which many wanted to keep for the profits and low fuel prices, Congress produced the Energy Policy and Conservation Act of 1975 (EPCA). The Act extended price controls through 1979, but mandated fuel standards for new cars and authorized construction of a one-billion barrel strategic petroleum reserve (SPR). Imperfect as it was, Ford signed the legislation and declared, prematurely, that the time had "come to end the long debate over national energy policy" (Ford, 1975a).

However, Ford neither could nor did end the debate.²³⁰ Warning Congress about the growing foreign dependence problem, he sent a letter in February 1976 cataloging the fact that Congress had passed only 4 of his 18 energy requests (Ford, 1975b). In August, Congress sent him back the Energy Conservation and Production Act mandating him to submit his recommendations, as well as a complete documentation of the Project Independence Evaluation System computer model. It also established an Office of Energy Information and Analysis and a National Energy Information

²³⁰ He would continue pushing for legislation to eliminate price controls, ease automobile emission standards, deregulate the natural gas market, and even authorize private enrichment of uranium.

System to assure the availability of credible information to the public.²³¹ Ford had little time to respond. He was amidst a tight Presidential race, one in which he would lose. Moreover, as the winter set in, a massive cold wave swept the country's northeast, driving up demand for natural gas beyond the breaking point and forcing schools and businesses across multiple states to close. In his Farwell message, Ford argued that "we should not seek to eliminate all energy imports, because generally it will be in the Nation's best interest to continue importing energy when it can be obtained at lower cost" (Ford, 1977). The debate about energy independence had indeed come to an end, and like the President, the notion of energy independence had lost.

When Jimmy Carter entered office, he immediately took action. He assigned James R. Schlesinger, a former chairman of the AEC and director of the CIA, the task of addressing the national gas shortage. He then submitted to Congress an emergency request for additional powers "to ensure that no portion of our country must go without essential services" and received that authority in record time (Carter, 1977a).²³² He then declared a natural gas emergency and addressed the public in a televised "fireside chat" declaring "The amount of energy being wasted which could be saved is greater than the total energy that we are importing from foreign countries. [...] All of us must learn to waste less energy" (Carter, 1977b). Adding that he would now expedite the development of coal in an "environmentally sound way" as well as solar and renewable sources, Carter reintroduced the goal to harmonize all the government's ERD activities into one cabinet level department "to bring order out of chaos". Despite all the efforts of his predecessors, energy management was still split among more than 50 different offices of the federal government. By April, after cancelling the national emergency, Carter sent Congress his plans for the new department. Calling it the "the moral equivalent of war" he argued that the country's struggle to change its approach toward energy "will test the character of the American people and the ability of the President and the Congress to govern this Nation" (Carter, 1977c). By July, Congress had approved most of his requests and on August 4, 1977, Carter signed into law the Department of Energy Organization Act (Public law 95-91) finally establishing a cabinet level Department of Energy.

Moving away from supply management toward efficiency, conservation, and the development of alternatives, Carter proposed massive changes in US internal energy policy. He abandoned the notion of energy independence and replaced it with the more modest goal of containing energy

²³¹ See Public law 94-385.

²³² It took one week for Congress to prepare, debate, and pass the 1977 Emergency Natural gas Act.

growth. His proposals led to the installation of insulation and solar panels in millions of homes and businesses. His administration added new and complex regulations to make limited resources stretch further and began to reduce domestic oil price controls. And his new Energy Secretary, Schlesinger, moved quickly to consolidate the Energy Department's authority. Research foci were changed from a fuel specific orientation to division between basic and applied research.²³³ As all basic research was placed under the authority of the Office of Energy Research, accountable Undersecretaries would oversee the development of applicable technologies in respective markets. Research programs would now move between authorities according to their evolution, all under the control of the Secretary of Energy. A new Federal Energy Regulatory Commission (FERC) was established within the Department to regulate and license electricity production and transmission, natural gas transportation and sales, and the operation of gas and oil pipelines.²³⁴ The Department established two administrations: the Economic Regulatory Administration to manage oil pricing, allocation, and imports;²³⁵ and the Energy Information Administration to consolidate the government's diverse energy data systems. The new Department also inherited all the offices and laboratories of the various agencies it superseded (see map of DOE facilities, Figure 27 on page 195). It was a massive reorganization of the country's intellectual and managerial assets in the realm of energy and the prize achievement of the Carter Administration.²³⁶ After almost ten years of trying, the US finally had an energy policy and a coherent institutional framework to achieve it.

Carter's progress ran into obstacles in late 1977 because Congress could not agree on his comprehensive national energy plan beyond the reorganization. After a year of horse-trading, Congress passed the National Energy Act of 1978, a huge bill that included five distinct Acts to accommodate the various state and industrial interests in the country.²³⁷ It added taxes on gas

²³³ Basic research was placed under the Office of Energy Research. Fuel specific research was placed under the control of an Undersecretary for energy technology.

²³⁴ FERC took over most of the responsibilities of the 1920 founded Federal Power Commission and the pipeline controls of the Interstate Commerce Commission.

²³⁵ These were the programs setup during the 1973-1974 oil embargo under the Emergency Petroleum Allocation (EPAA) formerly under the authority of the now defunct Federal Energy Administration.

²³⁶ Virtually every energy related function was moved from the Departments of Agriculture, Commerce, Housing and Urban Development, and Transportation as well as the four power marketing administrations from the Interior department and Defense Department's Navy Oil Reserves and Oil Shale Reserves.

²³⁷ These were The National Energy Conservation Policy Act (NECPA, Pub.L. 95-619) based on the energy demand management programs enacted earlier in Wisconsin and California; (2) The Powerplant and Industrial Fuel Use Act (PIFUA, Pub.L. 95-620) based on more than thirty complex rulemakings; (3) The Public Utilities Regulatory Policy Act (PURPA, Pub.L. 95-617) creating mandatory feed-in tariffs to promote renewable energy use by public utilities ; (4) The Energy Tax Act (Pub.L. 95-618) to promote fuel efficiency

guzzling cars, gave credits to families that installed solar and other renewables for their homes, forced feed-ins of renewable sources by electric utilities, and began a phase out of price ceilings for interstate gas trade in order to foster investment. However, it did not contain the one item Carter wanted the most, a petroleum tax to bring domestic oil prices in line with international market prices, reduce imports, and force Americans to reduce consumption. He simply could not get the support of the public or the oil industry. Having failed to get an oil tax, Carter took it upon himself to begin lifting price controls in April. His actions together with unfolding international events would send the price of oil and gasoline through the roof.

In January, amidst increasing protests and strikes, the Shah of Iran fled his country. Iranian oil exports had already declined from six to less than two million barrels a day and as a result the price of oil on the international market began rising rapidly. By February, the spot selling price of West Texas Intermediate (WTI) rose by 6% from \$14.8 to \$15.8 (in nominal dollars).²³⁸ Within a month of Carter's easing of controls, the price was at \$18, by June just over \$21 and over \$32 (circa \$94 in \$2009) by the close of the year. The tightening of the international market forced US producers to ramp up production, but in the interim, there were serious shortages. Carter requested permission from Congress to issue gasoline rationing coupons and tax the windfall profits of oil companies while the Department of Energy called for voluntary conservation, but Congress rejected all the proposals. Rapidly rising prices sent the public into a panic. Long gas lines, like those in 1973, reappeared. Despite the reorganization and a big new plan, America fell into another deep energy crisis.

In July, after an emergency meeting with his IEA partners, the President arranged a domestic summit of national leaders at Camp David to come up with a coordinated solution. Carter delivered his recommendations in a infamous 'Malaise Speech' speech where he told Americans that "the true problems of our Nation are much deeper than gasoline lines or energy shortages, deeper even than inflation or recession. [...] It is a crisis of confidence [...] that strikes at the very heart and soul and spirit of our national will." Adding, "Beginning this moment, this Nation will never use more foreign oil than we did in 1977" he claimed, "every new addition to our demand for energy will be met from our own production and our own conservation" (Carter, 1977d). He set out to reintroduce import quotas and establish an "energy mobilization board" akin to the

and renewable energy use by consumers through taxes and credits; and (5) The Natural Gas Policy Act (Pub.L. 95-621) to establish a three-stage elimination of price ceilings for certain categories of gas.

²³⁸ Source: Dow Jones & Company, Historical Spot Prices Table.

War Production Board of World War II “to cut through the red tape, the delays, and the endless roadblocks to completing key energy projects”. This would take form in an Energy Security Corporation, a government owned business to produce oil substitutes. Unfortunately, Carter was running out of time. Elections were just around the corner. The Three Mile Island Nuclear accident in March sapped public support for nuclear power. Energy prices were skyrocketing out of control. And then, when it seemed that the situation could not get any worse, his trusted ally Schlesinger, resigned as Secretary of Energy. Carter replaced him with Charles Duncan, a Texas oil engineer. The DOE was now being run by an oil man.

Duncan immediately pushed for further deregulation to allow market forces to regulate price and demand and made it clear that Department of Energy “should not be in the Energy business” (Fehner and Holl, 1994:30). Its proper role should instead be to foster “appropriate incentives” for private investment. He reversed Schlesinger’s evolutionary approach to research and reinstituted fuel specific research programs. As Duncan took control of the DOE, the President was forced to turn his attention elsewhere; in November American diplomats were seized in Tehran. Congress would go on to pass a windfall profits tax on oil companies. Americans got used to higher prices; and domestic production increased. Congress also passed the Energy Security Act (ESA) which authorized \$20 billion to establish the Synthetic Fuels Corporation to promote private industry investment (through loans and subsidies), added financial incentives for the private development of biofuels and other renewable energies, and authorized the President to rapidly fill the Strategic Petroleum Reserve by 100,000 barrels a day.²³⁹ Despite his legislative successes, however, the many domestic and international crises he faced doomed his re-election bid. Carter came into office at the end of one energy crisis and left at the end of another. In the process, he created a new cabinet level position to guide America’s energy future, a massive investment in alternatives, and killed the dream of energy independence.

3.3.1.5. *The old tradition strikes back*

The Reagan-Bush-Clinton years witnessed a wholesale reversal of the country’s energy policy, from government control to stewardship and from energy independence to energy interdependence. Ronald Reagan entered office in 1981 as the champion of America’s old hands-off tradition. Although energy was not a major theme of his campaign, he advocated abolishing

²³⁹ This ESA included the U.S. Synthetic Fuels Corporation Act, Biomass Energy and Alcohol Fuels Act, Renewable Energy Resources Act, Solar Energy and Energy Conservation Act, Solar Energy and Energy Conservation Bank Act, Geothermal Energy Act, and the Ocean Thermal Energy Conversion Act.

the Department of Energy altogether arguing that it had not “produced a quart of oil or a lump of coal or anything else in the line of energy” (Carter, 1980:2494). He also took the position that government interventions “consistently discourage discovery and production” emphasizing that “America has an abundance of energy” (Kneeland, 1980). Over the course of his eight-year term, Reagan redirected the nation’s energy programs away from the activists years Nixon, Ford, and Carter.

Reagan eliminated programs that he considered better suited for private industry, including most of the government’s regulations and price controls on gasoline, propane, and crude oil and rescinded Carter’s restriction on building-temperature controls. Instead of focusing on the development of commercially viable technologies, Reagan instead turned funding towards long-term, high-risk programs in which private enterprise either would not or could not invest. By the end of its first term, the Reagan administration was pushing for substantial investments into basic research to explore the frontiers of energy science and technology, from superconductivity to magnetic fusion.²⁴⁰ Meanwhile, Reagan appointed James Edwards, a leading Republican energy expert, to become the third Secretary of Energy and tasked him to reorganize the DOE. Following in Duncan’s footsteps, Edwards finished the job of moving research and management back from evolutionary development into fuel specific areas.

With major shortages behind them and restrictions gone, the price of oil held steady and then dropped dramatically (and with that drop, the incentive to invest in alternatives declined). Edwards setup a 22-member Energy Policy Task Force in February 1981 comprised of leading energy industrialists and public officials to advise him on writing Reagan’s energy plan, the country’s third national energy plan since the founding of the DOE. The plan, *Securing America’s Energy Future*, was a severe break from the past. Based on the key principles of reduce spending, taxes, and regulation and letting the market decide what the best energy decisions should be, the report called for the government to open up the outer continental shelf to private exploration, the termination of energy subsidies, and boldly claimed, “All Americans are involved in making energy policy” (United States, 1981:1). Thus, within the first 100 days of his administration, Reagan returned the US to its pre-1970s role as manager and steward of the nation’s resources and took the position that the very reason for earlier shortages was in fact government

²⁴⁰ In 1987, Reagan approved the construction of a super-colliding superconductor at an estimated cost of around \$4 billion.

intervention itself (Fehner and Holl, 1994:36). In late 1982, when Edward retired, he declared the national energy crisis a thing of the past.

Edward's successor, Donald Hodel, tried to build a consensus between the President and Congress, cancelling plans to dissolve the department. His main concern was the country's growing dependence on foreign oil, now a matter of national consensus. In its 1983 energy plan, the administration called for a balanced and mixed energy resource base and proposed to support it through a package of continued research, deregulation, and conservation. The budget of the DOE did not change much between 1982 (\$12.6 billion by Carter) and 1985 (\$12.8 billion for Reagan), but the distribution of funds did dramatically. Reagan's 1985 energy budget cut the 'energy' budget line by half and doubled expenditures for nuclear weapons.²⁴¹ To promote the nuclear power industry and support the buildup of its expanding nuclear weapons program, the administration proposed and won landmark legislation to coordinate the storage and disposal of nuclear waste (the Nuclear Waste Act of 1982).²⁴²

In early 1985, Reagan reshuffled his cabinet. Hodel moved to Interior and John Herrington became the country's fifth Energy Secretary. Herrington immediately introduced a new notion, that of 'energy strength'. Given the changes in consumer behavior and the growth of the Strategic Petroleum Reserve, he argued that the key to America's future lie in an 'energy triad' of reduced overall oil dependence, increased coal and nuclear use, and the massive potential of energy efficiency and conservation. Declaring "I think coal is where our future is", he ushered in a resurgence of the country's private coal industry through the promotion of 'clean coal' technologies (Fehner and Holl, 1994:42) and eliminated the government run Synthetic Fuels Corporation.²⁴³ By 1986, the price of oil had collapsed (now selling at around \$14 or circa \$28 in \$2009), and government investment in synthetic fuels made no economic sense. By late 1988, the country's economy had undergone almost five and half years of uninterrupted expansion, or as

²⁴¹ See notes of fiscal budgets and expenditures in Fehner and Holl (1994), notes 102 and 103.; Also, Congress responded by allocating funds for conservation, renewable and fossil fuels beyond the President requested.

²⁴² Although Congress and the President would wrangle over the sensitive issue of site location, the government settled on a location at Yucca Mountain in Arizona as the only site to be built. Congress also used the negotiations to cancel funding for the Clinch River Breeder Reactor, the same one they had been funding since the Nixon administration, forcing the government to change direction and focus on smaller reactors.

²⁴³ Because support for coal was mixed, largely as result of concerns over acid rain, the administration announced an \$850 million plan in 1987 to match industry proposals to build and install pollution control devices. Also see America's Clean Coal Commitment, a 1987 Department of Energy Report cataloging 37 projects underway or planned for clean coal demonstration facilities.

Herrington put it, “the longest peacetime economic expansion in U.S. history”. In large part, this was seen to be the direct result of cheaper oil prices and reduced government, leading him to conclude “our economic and energy security is inextricably tied to the fate and fortunes of our domestic petroleum industry” (Fehner and Holl, 1994:46-7). Congress could hold out no longer. Bending to Reagan’s repeated demands, it repealed the windfall profits tax placed on oil companies passed during the Carter administration. The repositioning of private enterprise to the forefront of America’s energy strategy was complete and the lion’s share of Department of Energy’s budget was now dedicated to defense-related activities. In Ronald Reagan’s last budget, defense accounted for 60% of the Department’s ERD programs (United States, 1989)

President Bush continued Reagan’s hands-off approach to energy policy, but because he oversaw the end of the Cold War and dismantling of the Soviet Union, he also redirected the Energy Department’s efforts away from defense centric activities. The US stopped building new nuclear weapons lowering the defense share of the DOE budget to less than 38%. The Department instead turned toward cleaning up the damage caused by decades of weapons production. Focus moved to environmentalism, efficiency, a concerted research effort based on new scientific data over global warming, and increasing support for basic research. The President began pushing for green technologies and advanced ERD and Energy budget allocations increasingly favored conservation issues. In his 1993 budget, Bush requested more than \$500 million for clean coal technologies, more than \$800 million in materials and superconductivity, and \$210 million in renewables (double the amount from 1990).²⁴⁴ One of the core new objectives was the development of advanced electric storage opportunities for automobile through the private Advanced Battery Consortium, a quasi-public institution that worked to combine the technical and financial resources of the DOE, the country’s automakers, and its national laboratories.²⁴⁵

The administration created a Global Climate Change Executive Committee within the DOE and spent \$1 billion on global warming research in 1992, despite Congressional efforts to water down the Global Warming Treaty recently negotiated at the Rio Earth Summit. But in keeping tack with the resurgent tradition of free enterprise and the need reduce the country’s dependence on foreign oil, the Bush administration also pushed (unsuccessfully) to open up the Arctic National Wildlife Preserve (ANWF) and the outer continental shelf to new exploration and tried to defend

²⁴⁴ See pages 49-75 in United States. Department of Energy (1993).

²⁴⁵ Part of the United States Council of Automotive Research (USCAR), the ABC is comprised of Chrysler, Ford, and General Motors. It funds pre-competitive electrochemical energy storage R&D.

the expansion of nuclear power. However, not a single new plant was ordered under Bush's term in office and he was the last President to oversee the completion of one in 1996 (see Table 11 below). By the time he left office in 1993, the two nuclear backbones of American energy policy (weapons production and commercial power) were no longer front and center. The Environmental protection Agency, and not the Department of Energy, was the key player on energy issues and the DOE was, in fact, no longer capable of building producing nuclear weapons on its own (Fehner and Holl, 1994:76-8).²⁴⁶

Table 11: US nuclear reactor construction 1968-1996 (operating and license year)

License Year	Reactors Licensed	Share of Reactors	Closed Reactors	Operable Reactors	Share of Operable
1968-74	38	33.6%	6	32	30.8%
1975-78	23	20.4%	3	20	19.2%
1979-96	52	46.0%	0	52	50.0%
Total	113	100.0%	9	104	100.0%

Source: US Department of Energy, "Nuclear Power: 12 percent of America's Generating Capacity, 20 % of the Electricity" available at <http://www.eia.doe.gov/cneaf/nuclear/page/analysis/nuclearpower.html>

Bill Clinton came into office as a reformer and jobs creator. He saw energy as the "Achilles' heel" of the American economy that instead should be used as a means to stimulate the sagging economy. Like his predecessors, he saw foreign oil dependence as a danger to the country, pointing out in 1992 that the country had just "fought a war, at least in part, because of our dependence on foreign oil".²⁴⁷ He moved quickly to put his stamp on US energy policy. He appointed Hazel O'leary the country's first female Energy Secretary and tasked her with the job of outsourcing energy research by expanding implementation of Bush's 1989 National Competitiveness Technology Transfer Act (Public Law 101-189). That Act created more than 300 Cooperation Research and Development Agreements (CRADAs) to transfer technology from the Department of Energy to academia and industry. Clinton also changed the research direction back to applied, agreeing to kill the super collider program, launching the Partnership for New Generation Vehicles (PNGV)²⁴⁸ with the country's big automakers to produce a prototype car three times more fuel-efficient by 2004, and initiating an openness program to declassify DOE documents and research studies.

²⁴⁶ This was partly due to opposition and a lack of support from the administration, but mainly because new safety regulations enacted in 1992 required a Presidential proclamation of emergency to overcome them, something for which Bush had no interest and no need.

²⁴⁷ Cited on page 78 in Fehner and Holl (1994) from page 5 of Clinton (1992).

²⁴⁸ The PNGV later became the Freedom Car Program under George W. Bush. Recent achievements are updated on the DOE website: <<http://www1.eere.energy.gov/vehiclesandfuels/about/index.html>>.

Two of Clinton's top priorities were an energy tax and Corporate Average Fuel Economy (CAFE) standards.²⁴⁹ Clinton's energy tax was based on the BTU heat content so as not to alienate any specific sector and was proposed via an omnibus budget bill. A broader solution than the unpopular carbon tax, which would be "too hard on the coal States" and an equally unpopular gas tax, which would be "too tough on people who drive a long way to work" (Clinton, 1993), the proposal unleashed a firestorm of acrimony and debate. When it finally passed the House, Northeastern States had exacted exemptions on heating oil and Midwesterners on ethanol and methanol. It underwent further revision in the Senate (Cloud and Rubin, 1993; Hager and Cloud, 1993). In the end, Clinton's broad energy tax was thrown out altogether and replaced with an almost cynical gasoline tax of 4.3 cents per gallon (Cloud and Hager, 1993a; 1993b).²⁵⁰

Still, Clinton set the wheels in motion for legislation that accelerated the use of alternative energies. This included a \$30 stimulus bill that contained \$200 million in energy related expenditures and a government program to purchase alternative fuel vehicles. Overall, he planned for as much as \$5 billion in energy related programs, \$1.9 billion for conservation and \$263 million in natural gas research. He pushed and won the Energy Policy Act of 1992 (Public Law 102-486), which introduced the Production Tax Credit (PTC), which established a ten-year subsidization program for independent power producers (\$0.15 per Kwh) that used renewable sources. The Act established efficiency standards for commercial heating and air-conditioning equipment, electric motors, and lamps, liberalized tax breaks for oil and gas, and began the process of deregulating the electricity markets by removing obstacles to wholesale power competition in place since the 1935 Public Utilities Holding Company Act (PUHCA).²⁵¹ He later signed into law two tax revisions that reduced taxes on alternative transport fuels and raised them on fossil fuels, further tilting the regulatory balance in favor of alternatives.²⁵² In essence, Bill Clinton thus finished the process of liberalization of America's energy market begun by Ronald Reagan began in 1981.

Clinton also tackled the thorny issue of global warming, but when Congress balked on new emissions standards, the President proposed a system of voluntary cooperation with business,

²⁴⁹ During the 1992 election, Bush accused Clinton of wanting raise taxes so high that it would "break the auto industry" See pages 74-75 in Fehner and Holl (1994).

²⁵⁰ See Omnibus Budget Reconciliation Act of 1993 (Public Law 103-66)

²⁵¹ For a full account of the history of PUHCA, including a complete register of all US Public holding companies over its 57 year history, see United States. Energy Information Administration (1993).

²⁵² See Taxpayer Relief Act of 1997 (Public Law 105-34) and the Tax Relief and Extension Act, enacted under Title V of the Ticket to Work and Work Incentives Improvement Act of 1999 (Public Law 106-170)

much to the dismay of environmentalists, calling for an investment of \$1.9 billion by 2000, 60% of which would come from private industry (Clinton and Gore, 1993). He negotiated and signed the Kyoto Protocol (1997), but never submitted it Congress for ratification.²⁵³ Meanwhile, he poured money into alternative energies, budgeting \$789 million for efficiency programs in 1994 (35% over previous year) and \$327 million for solar and renewables (a year on year increase of 30%) and used his executive authority to close off lands that Republicans wanted to open for fossil fuel exploration.²⁵⁴ Clinton's concerted emphasis on efficiency, conservation, renewables, and natural gas, all driven by private industry and guided by Federal policy was so ubiquitous that by the time he left office in 2001, the energy policy, efficiency standards, and environmental protection had become both synonymous and commonplace.

However, when the price of US crude dropped to lowest level since 1976 (\$11.28) on December 1, 1998, it seemed once again that the country's energy woes were outdated. Indeed, between 1986 and 1999, oil prices in the US averaged around \$17 a barrel. As a result America's domestic producers were losing income, its oil refineries were making a killing, and public consumption was growing (Lazzari, 2007:8). This led to a decline in private investment into alternative technologies and fuels and created a disincentive to conserve. In fact, despite repeated proclamations to reduce oil consumption over the past decades, by 2001, Americans were consuming more oil than ever (19.6 million barrels a day in 2001 versus 17.23 million in 1993 and 16 million in 1980 (BP, 2010).

3.3.1.6. Energy independence reemerges and fuses with national security

Oil prices started to swing upward in early 1999. By March, the price rose to \$14.66 and by the end of the year oil prices closed above \$27 and continued upward until the November election. Prices had dropped slightly (just under \$30) by the time George W. Bush entered the White House, but with international demand growing, an electricity crises crippling California, and consumption at home expanding, oil prices returned to the agenda. Against this backdrop, Bush tasked Vice President Cheney to chair a National Energy Policy Development Group to "develop a

²⁵³ In July 1997, the Senate unanimously passed a resolution indicating that it would oppose any treaty that did not also require developing countries (India and China particularly) to reduce to similar levels. See the unanimous Byrd-Hagel Resolution (S.Res 98) of July 25, 1997.

²⁵⁴ He cleverly drew on the Antiquities Act of 1906 to declare vast areas as national monuments, including Utah's 1.7 million acres Grand Staircase Escalante National Monument which, according to a New York Times report, held "the largest known coal reserves in the nation: an underground bank of nearly seven billion tons of coal worth up to a trillion dollars." See Egan (1996).

national energy policy designed to help the private sector, and [...] promote dependable, affordable, and environmentally sound production and distribution of energy for the future” (National Energy Policy Development Group, 2001:viii).²⁵⁵ The NEDP almost exclusively negotiated with fossil interests (Suskind, 2004:146-7) and its final report warned that within 20 years, the country will be importing two out of every three barrels of oil from states that work against the country’s national interest.

Bush subsequently introduced his controversial national energy policy in May 2001. Convinced that the real issue of oil was not its price, but the national security consequences of foreign dependence, Bush noted that “we haven't built a refinery in years and we should have” and proposed expanding domestic production and opening up the Arctic National Wildlife Refuge (ANWR) to leasing (Bush, 2001a). He also proposed opening the Rocky Mountains and Gulf of Mexico to oil exploration, easing regulations on pipelines and new power plants, increasing the use of nuclear and coal power to diversify electricity generation, fund clean-coal research, extend eminent domain rights for power line ‘right-of-ways’ to incentivize industry to upgrade the electricity infrastructure, and set newer, higher standards on electric appliances. The centerpiece of his plan, however, was the conclusion that energy security results from a combination of expanded domestic oil production and a full court press to ‘grow’ energy at home in the form of biofuels. Speaking before an audience of energy engineers in Iowa in May, Bush confirmed,

“We face a shortage of energy [...] So today I've laid out an initiative that said, first and foremost, [...] we need to conserve. We need to be wise about how we use energy. [...] And secondly, no matter how well we conserve, we're still going to need more energy.[...] And one of the keys to energy security in America, and national security, is to have a diversified energy base. That means oil; that means gas; that means safe nuclear energy; that means clean coal technologies to make sure the abundance of coal that we use is done in a friendly—environmentally friendly way. But it also means interesting new opportunities such as biomass [...] I can't think of anything better for national security than to replace barrels of oil that come into the country from nations that can't stand America— some of them don't—with products that we grow here in America. I can't think of— I would

²⁵⁵ The highly controversial report was accompanied by accusations of oil industry influence. In 2004, documents came out showing that Cheney’s Committee had studied maps of the Middle East’s oil fields causing Michael Klare to suggest that the Bush-Cheney plan all along was to conquer the region and seize its oil. See Klare (2004).

much rather replace oil from Iraq with corn products from Iowa, and it's getting within our reach." (Bush, 2001b)

The Bush initiative set off a stream of debates, but his efforts were interrupted by the 9/11 terrorist attacks. As the country moved swiftly to a war footing, energy reform took a back seat to national security concerns. Nevertheless, Bush slipped in incentives for biofuels production into the 2002 Farm Security and Rural Investment Act (Public Law 2002). In his 2003 State of the Union message, President Bush pledged "to promote energy independence for our country" and pledged \$1.2 billion to develop hydrogen-fueled vehicles (Bush, 2003). But, it would take another two years and his re-election before Bush would get many of his originally desired reforms through.

In August 2005, he signed the Energy Policy Act (Public Law 109-58), a sweeping program that provided extensive loan guarantees and tax breaks to energy producers and changed the focus of the country's energy policy from advanced research to commercialization of substitute fuels.²⁵⁶ Upon signing the bill, Bush claimed, "It's an economic bill, but [...] it's also a national security bill" and "every time we use a home-grown fuel, particularly these, we're going to be helping our farmers and, at the same time, be less dependent on foreign sources of energy" (Bush, 2005). The Act authorized subsidies for wind energy producers and consumers that buy hybrid cars and for the first time legally defined wave and tidal energy as renewable and thus available for public funding. After almost a decade of attempts, the government finally had the authority to begin issuing leases for exploration on the outer continental shelf. The US now had a federally mandated Renewable Fuel Standard (RFS) just as oil prices were topping \$60 a barrel and together with costs of war, draining the US economy.

Almost immediately afterwards, Hurricane Katrina struck, temporarily shutting down refinery production and oil flows into Louisiana. Although the government's response to the human side of the disaster was widely subject to criticism, the government averted an extended price spike when the EPA temporarily lifted fuel standards and some crude was released from the Strategic Petroleum Reserve keeping price spikes to a minimum. Years of preparation for government emergency response in the oil sector finally paid off.

²⁵⁶ The Act set mandatory target for the share of biofuel in gasoline market to 4 billion gallons by 2006 and 7.5 billion gallons by 2012.

Then in early 2006, prices started to rise again and by 2007, with oil approaching \$90, a Democratic controlled Congress passed two important bills, one at the President's request the other in the face of timid resignation. The first was the America COMPETES Act, which established the Advanced Research Projects Agency – Energy (ARPA-E) modeled on the Defense Advanced Research Project Agency (DARPA) that had ushered in technologies such as the Internet, stealth aircraft, and Gallium Arsenide, the core ingredient in wireless communications chips.²⁵⁷ ARPA-E was tasked to develop new energy technologies to reduce the country's energy imports by coordinating grants and cooperation agreements for research and development. The second piece of legislation was the Energy Independence and Security Act (Public Law 110-140) increasing CAFE standards to 35 mpg by 2020, providing additional incentives for hybrids, higher shares of biofuels (36 billion gallons by 2022), and new funding for small businesses to enter into the renewable fuels market.²⁵⁸ Strong as they were, the incentive programs could not offset the skyrocketing price of oil. By June 2008, at the height of the election season, West Texas Intermediate peaked at \$133.9 and with it, the American economy tanked, its citizens reducing driving for the first time in decades, and car sales slumped to all time lows.

When he left office in 2009, Bush had effectively altered the US approach from loose stewardship of resources to a quasi-mandated industrial program to create a home-grown green economy under the banner of national security.²⁵⁹ The economy was in shambles. The country was embroiled in two wars. And energy independence, a notion loathed and ridiculed by his supporters in industry, was now firmly back on the agenda, and this time it was financially backed with a technology program aimed at finding substitutes.²⁶⁰

From the moment he entered office, Barack Obama placed energy at the heart of his agenda to rebuild the country's sagging economy and disintegrating infrastructure. In his inaugural address he claimed, "each day brings further evidence that the ways we use energy strengthen our

²⁵⁷ See Public Law 110-69 §5012. The full name of the law is "The America Creating Opportunities to Meaningfully Promote Excellence in Technology, Education, and Science Act of 2007".

²⁵⁸ The Act's full title says it all: "An act to move the United States toward greater energy independence and security, to increase the production of clean renewable fuels, to protect consumers, to increase the efficiency of products, buildings, and vehicles, to promote research on and deploy greenhouse gas capture and storage options, and to improve the energy performance of the Federal Government, and for other purposes".

²⁵⁹ Over the next few years various additional energy tax breaks were attached to otherwise innocuous pieces of legislation. See, for example the Food, Conservation, and Energy Act of 2007 (Public Law 110-246), also known as the 2008 Farm Bill.

²⁶⁰ For examples of industrialist and party critiques, see National Petroleum Council (2007).

adversaries and threaten our planet". He called for "action, bold and swift" in order to "build the roads and bridges, the electric grids and digital lines that feed our commerce and bind us together". And he promised to "restore science to its rightful place" by harnessing "the sun and the winds and the soil to fuel our cars and run our factories" (Obama, 2009c). Pointing to the failures of past programs to achieve a reduction in imports, he announced that "it will be the policy of my administration to reverse our dependence on foreign oil, while building a new energy economy that will create millions of jobs" (Obama, 2009a).

The vehicle by which he would initiate the country's new green economy was a massive stimulus proposal. With unprecedented speed, the President pushed through the American Recovery and Reinvestment Act (ARRA) of 2009 (Public law 111-5), which marked an abrupt turn away from the country's free market tradition toward a decidedly Keynesian, even protectionist, approach.²⁶¹ Announcing his proposal, he promised to "ensure that the fuel-efficient cars of tomorrow are built right here in the United States of America" (Obama, 2009a). The new Act allocated more than \$120 billion in energy related investments including \$30 billion in direct energy related grants to be managed by the Department of Energy, a package of energy related tax credits worth \$70 billion, and an additional set of 'green energy loans' worth another \$27 billion.²⁶² For the first time since the Kennedy administration, the Federal Government committed financial support for commercial modernization of the nation's electrical grid and directly invested in upgrading the country's automobile fleet. Obama ordered the EPA to implement new higher standards on automobile efficiency (Obama, 2009b) and, to reinvigorate the auto industry, worked with Congress to pass a \$3 billion program to promote the sales of newer more efficient vehicles, the so-called Consumer Assistance to Recycle and Save (CARS) or "cash for clunkers" program (Public Law 111-32).²⁶³

²⁶¹ A special Buy American provision (Section 1605) required that "none of the funds appropriated or otherwise made available by this Act may be used" for public infrastructure or assets "unless all of the iron, steel, and manufactured goods used in the project" were made in the US. The full text of the law is available at <<http://www.gpo.gov/fdsys/pkg/PLAW-111publ5/html/PLAW-111publ5.htm>>.

²⁶² Grants included \$16.7 billion for projects to increase efficiency in buildings, expand the domestic renewable energy industry, and restructure the Transportation industry; \$6.0 billion to clean up legacy nuclear waste; \$4.5 billion to lower electricity costs and liberalize the electricity market through grid modernization; \$3.4 billion for demonstration projects to prove that carbon capture and sequestration can be commercially viable; and \$2.0 billion for advanced energy technology research. See the DOE's Recovery Act grant distribution map at <<http://www.energy.gov/recovery/breakdown.htm>>.

²⁶³ In the program's one month lifetime (July 24, 2009, until August 25, 2009), some 700,000 gas guzzling cars were traded in for more fuel-efficient vehicles. For a detailed account of the program including vehicle listings and rebate rates see Yacobucci and Canis (2009).

By the beginning of 2010, Obama's recovery plan was slowly beginning to take hold. Seizing the moment, he announced that The Recovery Act had been broken "the trajectory of [the] recession" largely because the new clean energy sector it created had opened new "jobs of the future, jobs that pay well and can't be outsourced". According to Obama, those jobs were the key to reducing the country's "dangerous dependence on foreign oil" and the means by which the US "will combat the threat of climate change and leave our children a planet that's safer than the one we inherited" Cautioning against the risks of allowing other nations to beat the US in the race to produce the next generation of clean energy technologies, he introduced a \$2.3 billion new clean energy manufacturing initiative to "close the clean energy gap that's grown between America and other nations." (Obama, 2010a). The initiative authorized tax credits for manufacturers of wind turbines, solar panels, and batteries. Summing it up succinctly, Obama declared,

"I don't want the industries that yield the jobs of tomorrow to be built overseas. I don't want the technology that will transform the way we use energy to be invented abroad. I want the United States of America to be what it has always been, and that is a leader—the leader—when it comes to a clean energy future." (Obama, 2010a).

In recasting the energy debate from Bush's helping America grow to a new central role as the backbone of the future, Obama took the policy started Bush one step further. And then he took it another. In a March 31, 2010 speech to military audience at Andrews Air Force base, he announced that he was considering "potential areas for development in the mid- and south Atlantic and the Gulf of Mexico while studying and protecting sensitive areas in the Arctic." Recognizing the firestorm this would create with his political base, he chastised those who opposed drilling anywhere and those that want it everywhere. He countered that he was taking a broader view, one that would move the US "from an economy that runs on fossil fuels and foreign oil to one that relies more on homegrown fuels and clean energy." And there, standing in front of the Navy's 'Green Hornet', a biofuel retrofitted fighter jet capable of flying faster than the speed of sound, he lauded the military for its "leadership" in developing biofuels.

In his closing remarks, President Obama took the country that one necessary step further, the step that no other nation was yet prepared to make, to begin the transformation of its military infrastructure to biofuels. With clarity and honesty, the President told his audience,

"Now, the Pentagon isn't seeking these alternative fuels just to protect our environment; they're pursuing these homegrown energy sources to protect our national security. Our military leaders recognize the security imperative of

increasing the use of alternative fuels, decreasing energy use, reducing our reliance on imported oil, making ourselves more energy efficient. And that's why the Navy, led by Secretary Mabus, who's here today, has set a goal of using 50 percent alternative fuels in all planes, vehicles, and ships in the next 10 years. That's why the Defense Department has invested \$2.7 billion this year alone to improve energy efficiency.

So moving towards clean energy is about our security. It's also about our economy. And it's about the future of our planet. And what I hope is, is the policies that we've laid out—from hybrid fleets to offshore drilling, from nuclear energy to wind energy—underscores the seriousness with which my administration takes this challenge. It's a challenge that requires us to break out of the old ways of thinking, to think and act anew. And it requires each of us, regardless of whether we're in the private sector or the public sector, whether we're in the military or in the civilian side of Government, to think about how could we be doing things better, how could we be doing things smarter so that we are no longer tethered to the whims of what happens somewhere in the Middle East or with other major oil-producing nations.” (Obama, 2010b).

After decades of failed attempts, by 2010 the US was once again trying to become energy independent. Instead of doing it by rationing, taxing, over producing at home, setting quotas, or turning off lights, elevators, and air-conditioners, a new more complex project had been unveiled. More similar to the Manhattan Project than either Apollo or Project Independence, the laws passed in the Bush and Obama administrations set the basis for a transformed economy, one led by the country's most important player in terms of its national security. For the first time, the military was on board.

Between 1942 and 1946 the US spent \$21 billion (in \$2007) on the Manhattan Project (or about \$4 billion per fiscal year). Between 1960 and 1973, it spent \$96 billion on the Apollo Program (or \$7 billion per fiscal year). Both resulted in success. Both were driven by military security concerns. However, for the country's energy program, run through what collectively might be known as the DOE Energy Technology Program, the government spent more than \$115 between 1974 and 1980 (less than \$3 billion per fiscal year) and much of that was in nuclear technologies (Stine, 2008). After 35 years of energy programs, the US was more, not less dependent on foreign oil. The reason? The military had no need, incentive, or guarantee that alternatives would be available.

Between 2009 and 2010, with more money spent on alternative energy programs than the funds allocated to all the previous national security initiatives combined, the military began to play an increased role. Thus in its most recent evolution, US energy policy merged the two notions of energy independence and national security. The two were now synonymous.

3.3.1.7. Summary tables and charts of the evolution of US energy policy

3.3.1.7.1. Key energy related Executive Orders and related institutions during World War II

Table 12: Key wartime energy related EOs and institutions

Executive Order Number / Date	Effect
6777 / June 30, 1934	Established the National Resources Board, which planned and coordinated public works related to conservation and use of national resources and, after 1939, performed special duties related to the national defense. Abolished in 1943. ²⁶⁴
8202 / July 13 1939	Authorized Federal Power Commission to manage transmission of electricity and natural gas between the US and foreign countries. ²⁶⁵
8807 / June 28, 1941	Advised the President on status of scientific research relating to national defense, coordinated all related federal government research, and maintained defense mobilization lists of scientific personnel and resources. It was abolished in 1947 by EO 9913.
8339 / July 30, 1941 ²⁶⁶	Established an Economic Defense Board consisting of the VP, Secretaries of State, Treasury, War, Navy, Agriculture, and Commerce and the Attorney General. Advised the President on economic defense measures to be taken deemed essential to the effective defense of the country and to coordinate the policies and actions of the various related executive departments and agencies including ways to protect the US trade positions. ²⁶⁷
8926 / October 28, 1941	Established the Office of Lend-Lease Administration in the Office for Emergency Management of the Executive Office of the President.
8942 / November 19, 1941	Requisitioning of Property Required for National Defense.
8989 / December 18, 1941	Established the Office of Defense Transportation, which coordinated the utilization of domestic transportation facilities during World War II and operated seized transportation properties Abolished in 1949 (EO 10065) and succeeded by the Interstate Commerce Commission.
9024 / January 16, 1942	Established the War Production Board, which exercised general direction over federal war procurement and production programs. Abolished in 1945 (EO 9638), it was succeeded by the Civilian Production Administration (CPA), OEM (1945-46), Office of Temporary Controls (1946-47), and ultimately the Department of Commerce (1947).
9380 / September 25, 1943	Established the Foreign Economic Administration in order to centralize foreign economic functions. Abolished in 1945. ²⁶⁸

²⁶⁴ Abolished and replaced by the National Resources Committee under authority of EO 7065, June 7, 1935. Functions of National Resources Committee and FESO consolidated in NRPB, 1939.

²⁶⁵ The Federal Power Commission came into existence under the 1920 Federal Water Power Act (41 Stat. 1063; 16 U.S.C. 791-823).

²⁶⁶ Amended by EO 8900 (September 15, 1941; 6 FR 4795, September 19, 1941) and EO 9128 (April 13, 1942, 7 FR 2809, April 15, 1942).

²⁶⁷ Its name was changed to the Board of Economic Warfare by Executive Order 8982 (1941) and abolished by Executive Order 9361 in 1943. Its functions were transferred to the Office of Economic Warfare (OEM) and then subsumed into the Foreign Economic Administration in 1943.

²⁶⁸ Succeeded by Department of State's lend-lease and activities in liberated and enemy countries program, the Department of Commerce's export control administration, the Department of Agriculture's various

9718 / May 3, 1946	Terminated the Petroleum Administration for War together with the offices of Petroleum Administrator and Deputy Petroleum Administrator. ²⁶⁹
9791 / October 17, 1946	Provided for a Study of Scientific Research and Development Activities and established the President's Scientific Research Board, which was terminated by EO 9841 in 1947.
National Security Act of 1947 (Public Law No. 235, 80)	Created a National Military Establishment, headed by the Secretary of Defense and established, the National Security Council, the Central Intelligence Agency, the Joint Chiefs of Staff, and the Joint Research Development Board (JRDB), headed by Vannevar Bush to act as a temporary agency to coordinate military research until a more permanent institution was established.

3.3.1.7.2. Comparative energy mixes of the US 1949-2009

The following section present three charts displaying the change in US TPES since 1949. The first chart compares the energy mix at three fixed points (1973, 1991, and 2009) and shows a steady change since 1973. The share of oil dropped slightly from 46 percent to just over a 37 percent in 2009, largely due to the increase in the use of nuclear power and coal in its electricity sector. Over the same period, however, the use of all renewables (including biofuels) increased its share only from approximately 6 to 8.2 percent. While most was in the electricity sector, an increasing share was occurring in the transport sector. The second chart displays the linear change in the total consumption of energy sources normalized in billions of BTU since 1949. The third chart places the other two in context by comparing the growth in primary production of fossil versus renewable fuels indexed at 1949=100 and shows several distinct changes in the direction of renewable production. The data presented below for all years comes from the US Department of Energy's 2010 released Annual Energy Review (United States. Department of Energy, 2010a). The data excludes net electricity imports, which were negligible ($x < 0.1\%$) in the years represented; and 2009 data is preliminary.

food programs, and the Reconstruction Finance Corporation's foreign procurement and development programs and preclusive buying operations.

²⁶⁹ See US Federal Register, 11 FR 4965, May 7, 1946.

Figure 16: The US energy mix, 1973-2009

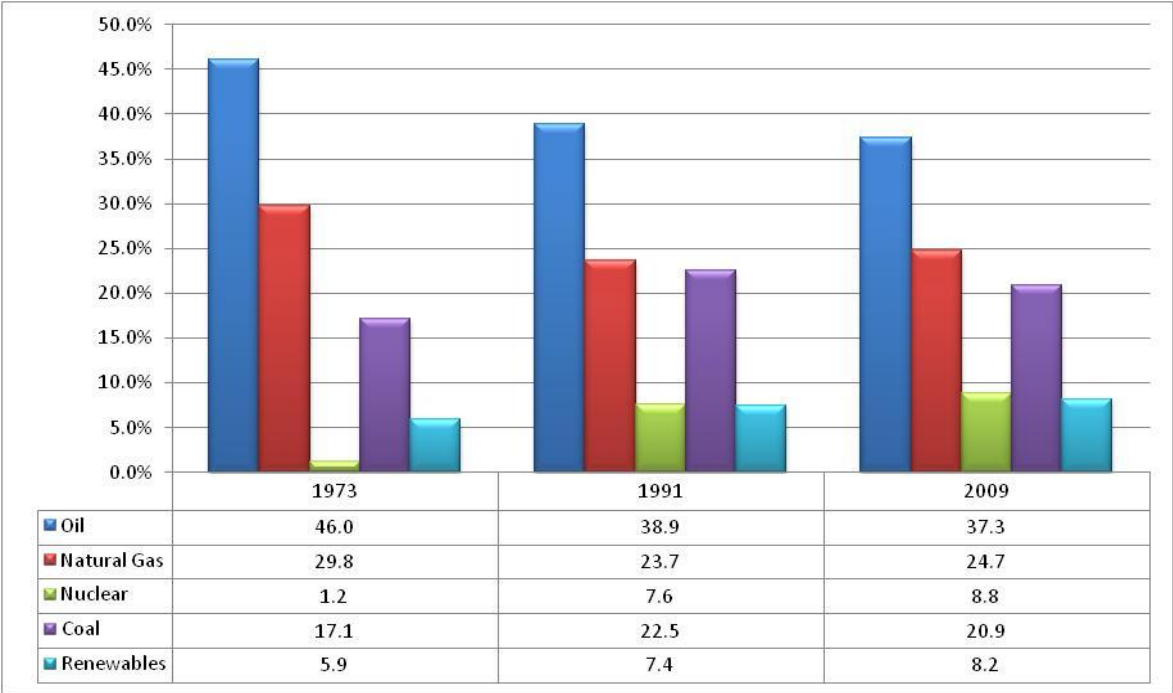


Figure 17: Comparison of total US energy consumption by fuel source (heat content) 1949-2009

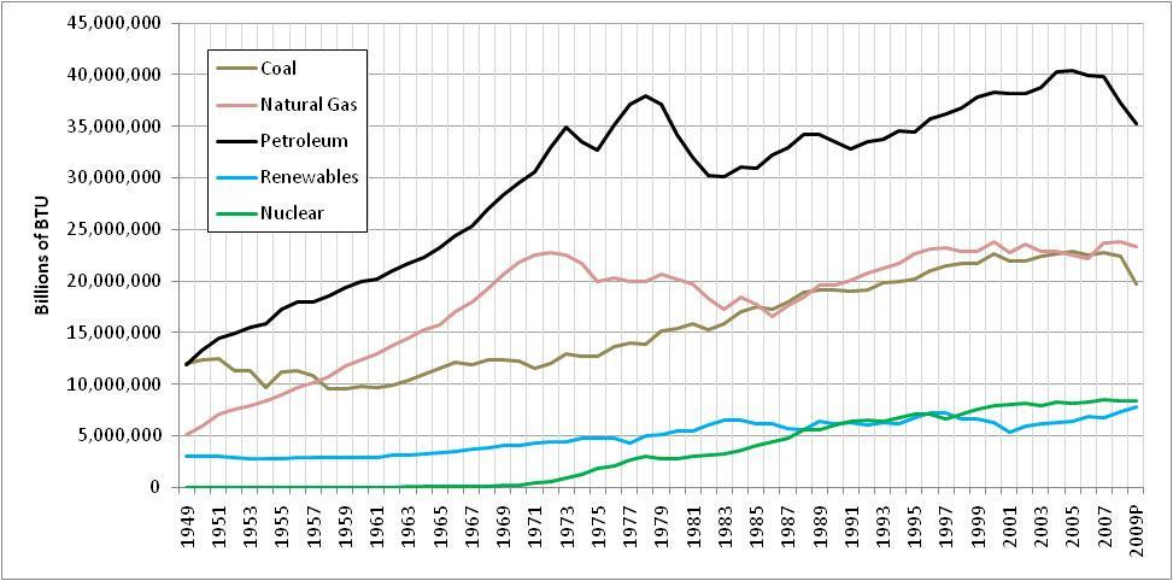
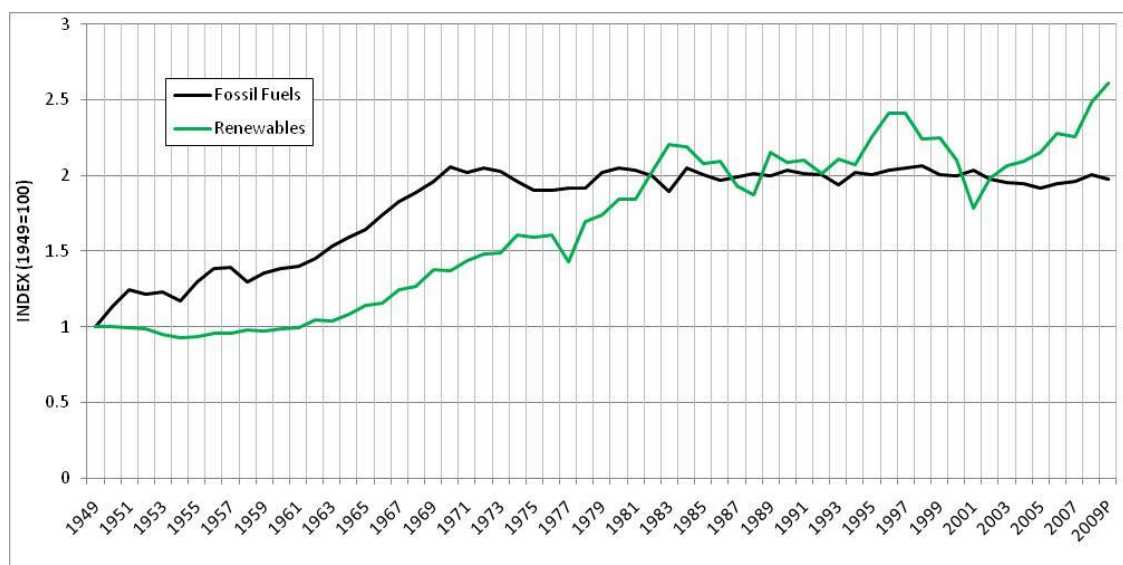


Figure 18: Change in primary production (fossil vs. renewable fuels) 1949-2009



3.3.1.7.3. US oil and gas consumption of oil US 1949-2009

Between 1955 and 1973, when the first oil price shock occurred, the US experienced rapid growth in the consumption of both oil and natural gas. Although demand for oil and gas tapered off slightly in the wake of the 1973 crisis, oil continued to rise in the run-up to the 1979 crisis, before dropping to 1971 levels in the early 1980s. It then travelled a steady upward path until 2005. After its initial drop in 1973, gas consumption declined fairly steadily until 1986, when it began a steady climb until the late 1990s, where it has held steady since. As the graphs and tables show, despite all efforts to the contrary, oil consumption increased across every Presidential administration since Truman, except for Carter, whereby an economic recession sapped demand. The gas case is less volatile as its use was largely limited to the heating sector for most of the period; the demand for which one might expect to remain fairly steady. The increase from the 1980s forward is due to its introduction into the electricity sector. The data from 1955-1964 comes from multiple *BP Statistical Reviews up to 1974* as reported in Jenkins (1989:141-3). The years 1965-2009 come from BP (2010).

Figure 19: US oil and gas consumption, 1949-2009

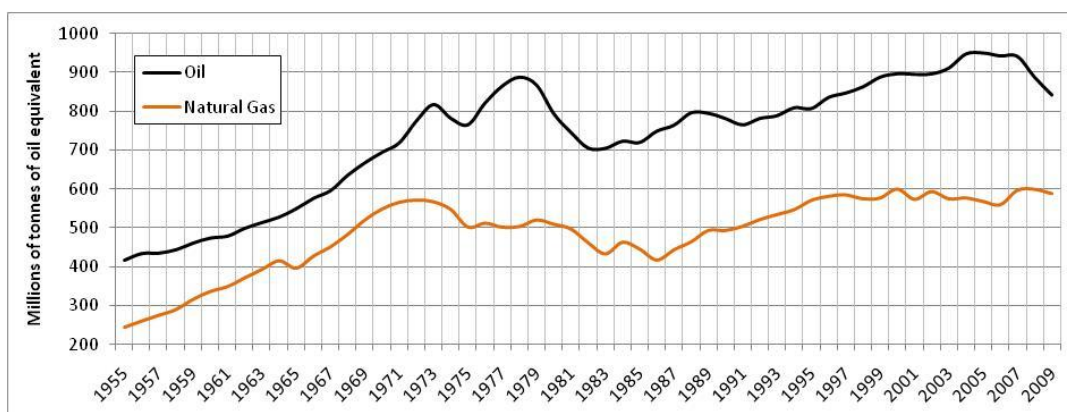


Table 13: US oil and gas consumption, 1949-2009

	Oil	Natural Gas		Oil	Natural Gas
1955	415.60	245.60	1983	704.89	433.96
1956	433.00	261.60	1984	723.28	463.51
1957	434.00	276.50	1985	720.17	446.12
1958	443.00	291.20	1986	749.34	418.10
1959	460.00	317.50	1987	764.79	444.52
1960	473.10	337.50	1988	796.74	464.89
1961	478.10	350.00	1989	795.31	493.95
1962	498.20	372.30	1990	781.82	493.99
1963	513.00	394.10	1991	765.58	504.82
1964	527.20	416.00	1992	782.25	521.97
1965	548.93	397.37	1993	789.35	534.96
1966	575.66	428.27	1994	809.78	547.54
1967	595.76	452.21	1995	807.73	571.30
1968	635.45	484.08	1996	836.55	581.72
1969	667.79	521.08	1997	848.02	585.20
1970	694.59	549.22	1998	863.76	575.31
1971	719.27	566.21	1999	888.89	577.30
1972	775.84	571.98	2000	897.64	600.35
1973	818.03	567.29	2001	896.07	573.86
1974	782.55	547.64	2002	897.36	593.66
1975	765.90	502.68	2003	912.26	575.33
1976	822.36	512.69	2004	948.75	577.30
1977	865.86	502.25	2005	951.37	568.53
1978	888.85	503.99	2006	943.80	560.04
1979	868.03	520.77	2007	942.30	597.28
1980	794.11	509.92	2008	888.48	599.52
1981	746.00	497.62	2009	842.89	588.71
1982	705.54	462.57			

3.3.1.7.4. US oil import dependence (%) 1970, 2000, 2008 and dependence on oil-based transport fuels (1970, 2007)

The following tables and graphs illustrate the changes that have occurred in the US since the early 1970s in the key transport/oil related areas of oil import dependency, the dependency of oil in transport, on-road fuel intensity, and efficiency. On-road fuel intensity is presented in gallons per mile and not liters per kilometer because that is how the data was originally published. Notably, it has declined only very slightly. However, the fact that the actual number of vehicles on the road has increased substantially from approximately 74 million in 1960 to 255 million in 2008 while oil consumed in the transport sector has increased from 228 million TOE to 563 million TOE over the same period, indicates significant success in fuel efficiency programs. All the data in Table 13 'US petroleum dependency' comes from International Energy Agency (1984; 1991) as reported in Sovacool and Brown (2009) except for the years 2000 and 2008 in the import dependency columns, which come from the US Energy Information Administration, *September 2010 Monthly Energy Review* (United States. Department of Energy, 2010b). The vehicle data for Table 14 and Figure 17 comes from the US Bureau of Transportation Statistics (United States. Research and Innovative Technology Administration (RITA), 2010) and the data for oil consumption in the transport sector comes from IEA (2010a) as does the data for the country's Strategic Petroleum Reserves. Finally, the data for US oil imports comes from United States (2010b).

Table 14: US petroleum dependency, 1970-2008

Import dependence			Oil in transport		On-road fuel intensity	
1970	2000	2008	1970	2007	1970	2007
22%	53%	57%	95.1%	97.1%	0.077	0.500

Table 15: Oil, cars, and efficiency

Year	Registered vehicles	Oil in transport sector (mtoe)	TOE/vehicle
1960	74,431,800	228.15	3.07
1970	111,242,295	346.00	3.11
1980	161,490,159	414.29	2.57
1990	193,057,376	476.68	2.47
2000	225,821,241	574.32	2.54
2008	255,917,664	565.30	2.21

Figure 20: Oil, cars, and efficiency

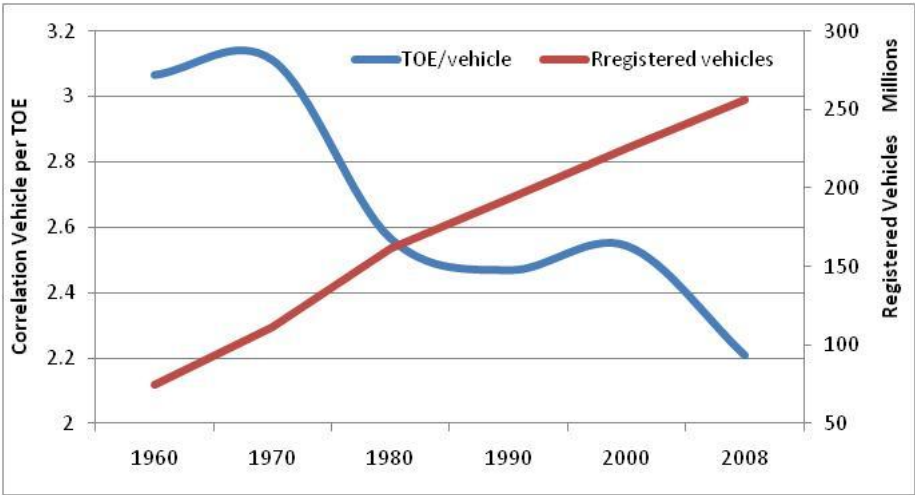


Figure 21: US petroleum imports (1000s of barrels /day) and OPEC and Persian Gulf shares

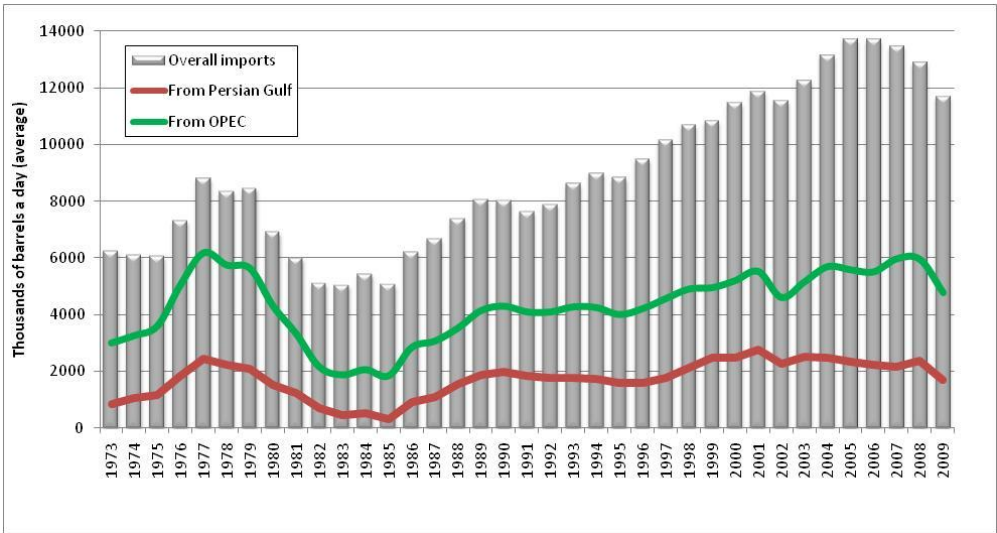
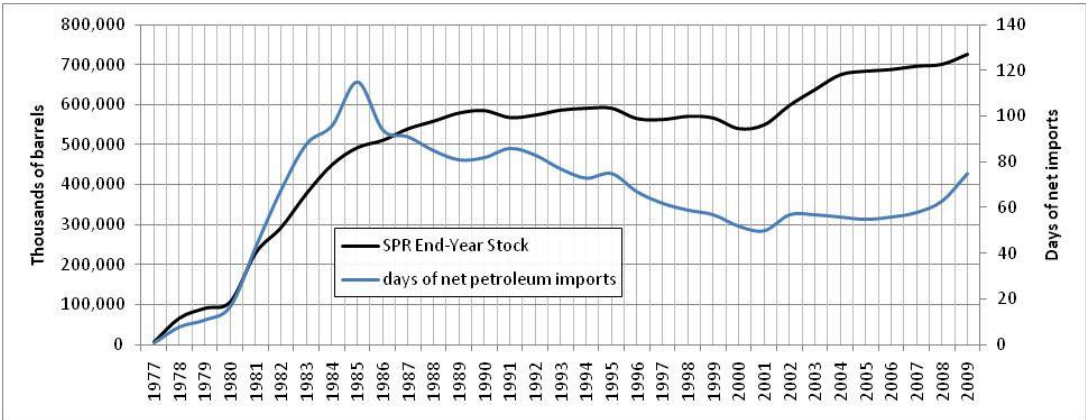


Figure 22: Strategic petroleum reserves and available days of net imports



3.3.1.7.5. Fuel Switching and R&D in substitutes

The following table shows the amount of total US investment into ERD between 1974 and 2008. The data demonstrates the fossil fuel research peaked twice (in 1981 and in 1990). It also shows that energy efficiency's share rose steadily until 2002, the first fiscal year of the G.W Bush administration and declined since. Meanwhile, biofuel and renewable fuel research soared between 1974 and 1981 then tapered off significantly. Not included is the data for 2009 and 2010 under the Obama administration. Also not included in the table are all those ERD programs related nuclear power, nuclear weapons and non-fuel related research, such as other kinetic weapons designs and defense technologies. Although unpublished in their entirety, it is safe to assume that nuclear power and weapons account for much of the missing shares. Data for total research and development expenditures between 1974 and 2008 comes from the International Energy Agency's online table of "R&D Budgets" in their Energy Technology R&D Statistics database (IEA, 2010c). Finally, a comparison of indexed overall US and EU ERD expenditures and international oil prices are represented in Figure 10 on page 120.

Table 16: US energy R&D, 1974-2008

	EU 'Total Energy R&D'	Of which in specific areas:			
		Renewables including Transport Biofuels	Hydrogen/Fuel Cells	Fossil Fuel R&D	Energy Efficiency
1974	1952.53	1.2%		9.4%	0.2%
1975	2698.04	3.7%		11.3%	0.7%
1976	3168.80	6.0%		15.8%	1.1%
1977	4827.13	9.7%		16.5%	3.4%
1978	5599.84	12.6%		17.5%	3.9%
1979	6171.01	15.5%		15.3%	4.8%
1980	6074.78	17.2%		21.7%	7.5%
1981	4676.65	20.1%		24.5%	6.8%
1982	3610.72	12.5%		14.2%	5.4%
1983	3362.78	10.1%		10.6%	8.1%
1984	2834.38	9.8%		12.4%	7.2%
1985	2845.37	9.0%		12.7%	9.2%
1986	2550.60	7.5%		14.1%	8.3%
1987	2260.27	7.7%		13.2%	8.4%
1988	2390.51	5.7%		19.9%	6.7%
1989	2307.76	5.2%		20.8%	7.3%
1990	2563.98	4.4%		34.5%	7.3%
1991	2579.62	5.8%		29.5%	8.3%
1992	2108.81	5.9%		18.1%	13.1%
1993	2059.30	5.5%		18.2%	14.2%
1994	2265.60	9.1%		19.9%	17.5%
1995	2191.72	11.3%		12.5%	21.0%

	EU 'Total Energy R&D'	Of which in specific areas:			
		Renewables including Transport Biofuels	Hydrogen/Fuel Cells	Fossil Fuel R&D	Energy Efficiency
1996	1918.46	9.5%		16.0%	19.2%
1997	1726.49	10.0%		8.4%	19.7%
1998	1757.94	12.1%		8.8%	20.8%
1999	1963.22	11.3%		8.7%	20.9%
2000	1899.31	9.3%		9.2%	23.8%
2001	2302.93	8.9%		12.5%	20.7%
2002	2289.56	8.7%		14.9%	20.3%
2003	2165.66	8.8%		15.1%	14.2%
2004	2210.32	8.4%	5.7%	14.9%	13.2%
2005	2232.24	8.3%	6.2%	12.1%	12.0%
2006	2197.60	7.7%	7.6%	12.1%	13.6%
2007	2507.05	11.6%	8.8%	10.2%	12.6%
2008	2952.85	10.3%	9.1%	10.7%	11.6%

3.3.1.7.6. Biofuel production and solar power panel installation (1990-2008)

The following table shows the growth in US biofuel production, solar installations, and alternative fuel vehicles in the US for different periods beginning in 1974. All figures are annual and show considerable growth since their introduction. Domestic solar thermal installations began following first crisis as part of the Nixon Project Independence program, but took off following Carter's targeted plans to expand home solar heating. Numbers are presented in surface area (meters squared) as is standard for the industry. Data for domestic solar photovoltaic sales was available only from 1982 forward. The numbers represent both Crystalline Silicon and Thin-Film Silicon models, the two photovoltaic technologies commonly used. Biofuels production and consumption are listed in billions of BTU (heat content). Alternative fueled vehicles refer to accumulated acquisitions, less retirements, at the end of each calendar year, but do not include concept and demonstration vehicles. The data includes vehicles that drive on the following fuels: electricity, liquefied petroleum gas, compressed or liquefied natural gas, 85% and 100% methanol, 85% and 95% ethanol, and Hydrogen. No biodiesel vehicles were reported in the data. All the data is from United States (2010a). Although the numbers are listed by a different standard than those provided for the in chapter on EU biofuel data, they nevertheless indicate clear growth trends over the period. To illustrate this, an addition set of charts follows the table below.

Table 17: Alternative energy indicators

Domestic Solar Thermal Deliveries m2(note)		Solar PV Sold (in Peak Kilowatts)		Biofuels Production (Billions of BTU)	Biofuels Consumption (billion of BTU)	Alternative-Fueled Vehicles in Use (Estimated)	
1974	118,358	No data reported		No data reported	No data reported	No data reported	
1975	347,736						
1976	538,931						
1977	958,016						
1978	930,888						
1979	1,244,529						
1980	1,698,546			12,720	12,724		
1981	1,891,692			34,404	34,415		
1982	1,687,677	6,897		63,143	63,163		
1983	1,548,601	12,620		77,302	77,326		
1984	1,564,766	9,912		93,151	93,179		
1985	N/A	5,769		107,099	107,133		
1986	848,762	6,333		122,725	122,763		
1987	658,404	6,850		124,058	124,096		
1988	744,711	9,676		125,378	125,417		
1989	1,023,884	12,825		110,867	110,902		
1990	1,037,170	13,837		128,000	128,040		
1991	579,901	14,939		145,005	145,051		
1992	628,954	15,583		169,336	169,116		30,352
1993	609,165	20,951		188,391	188,451		45,848
1994	670,946	26,077		197,737	199,862		60,472
1995	662,956	31,059		141,284	142,835		493,710
1996	665,372	35,464		186,315	183,686		530,012
1997	720,835	46,354		202,474	201,099		560,410
1998	687,111	50,562		210,809	209,035		590,060
1999	747,498	76,787		233,146	235,789		644,604
2000	730,032	88,221		254,453	252,721		789,328
2001	961,454	97,666		308,118	303,405		850,914
2002	1,022,305	112,090		402,048	403,876		942,196
2003	1,015,059	109,357		487,311	499,537		1,067,998
2004	1,235,703	181,116		564,094	577,027		1,130,984
2005	1,363,817	226,916		720,308	771,145		1,184,250
2006	1,814,675	337,268		977,678	991,310		1,269,124
2007	1,279,925	517,684		1,387,251	1,372,407		1,391,532
2008	1,367,161	986,504		1,561,841	1,544,751		1,551,334

Figure 23: Solar installation deliveries, 1974-2008

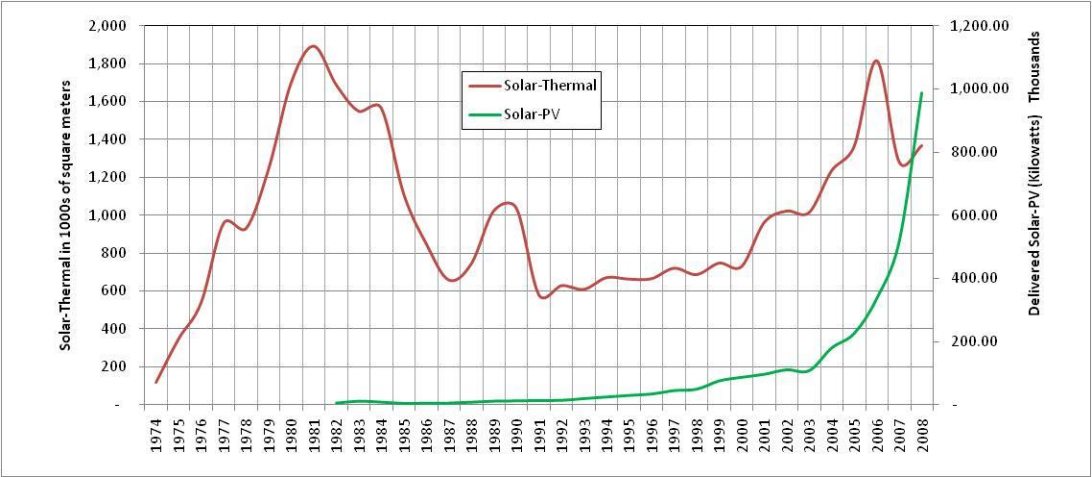


Figure 24: Biofuel production and consumption, 1980-2008

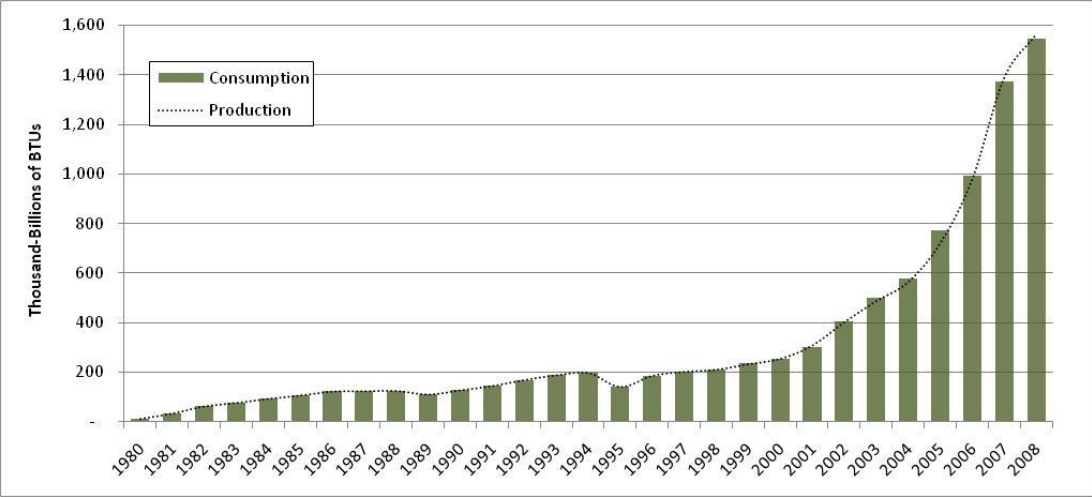
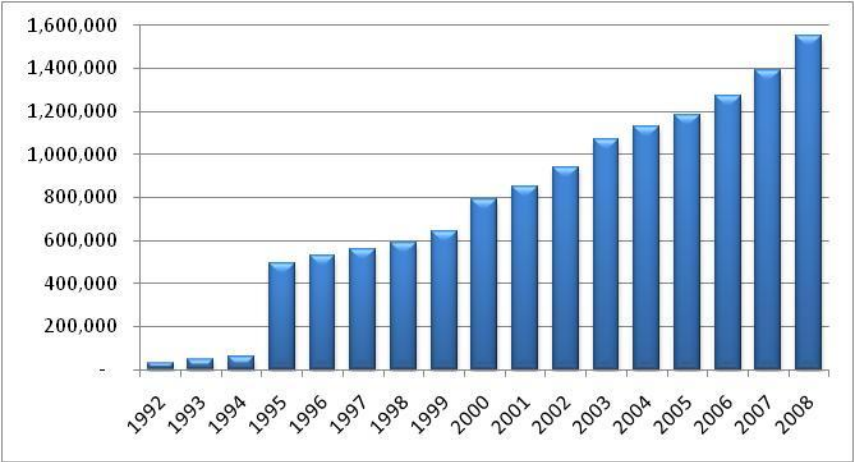


Figure 25: Alternative fuel vehicles on the road, 1995-2008



3.3.1.7.7. A comparison of the Manhattan Project, Apollo Program, and US ERD

The following table compares the funding for three major US technology programs. The table is a near facsimile of that reported on page 7 of Stine (2008) with the addition comments indicating mission targets and evaluative estimate of success or failure. It excludes funding allocated in 2009 during the Obama administration. It is simply too early to estimate if the funding will be sustained, spread across years or decades, or cancelled before all commitments are fulfilled. Nevertheless, the table below illustrates the intensity of investments made by the government to achieve three projects of utmost importance to the national interest as deemed by the respective administrations in power. Following the Stine Table is her graphical representation of annual funding for Manhattan Project, Apollo Program, and DOE Energy Technology R&D Program. A map of major US Department of Energy facilities follows, the source of which is the DOE's online interactive list.²⁷⁰

Table 18: Cumulative and Annual Average Program Year Funding for the Manhattan Project, the Apollo Program, and DOE Energy Technology R&D Program

See footnote for original source note. ²⁷¹	Cumulative Funding (in billions of \$2007)	Length in Fiscal Years	Annual Average Funding (in billions of \$2007)	Percent of Federal Outlays During Peak Year of Funding	Percent of GDP During Peak Year of Funding
The Manhattan Project (1942-1946) - Mission: Military Superiority; End Result: Success	\$21	5	\$4	1	0.4
The Apollo Program (1960-1973) - Mission: Military Superiority; End Result: Success	\$96	14	\$7	2.2	0.4

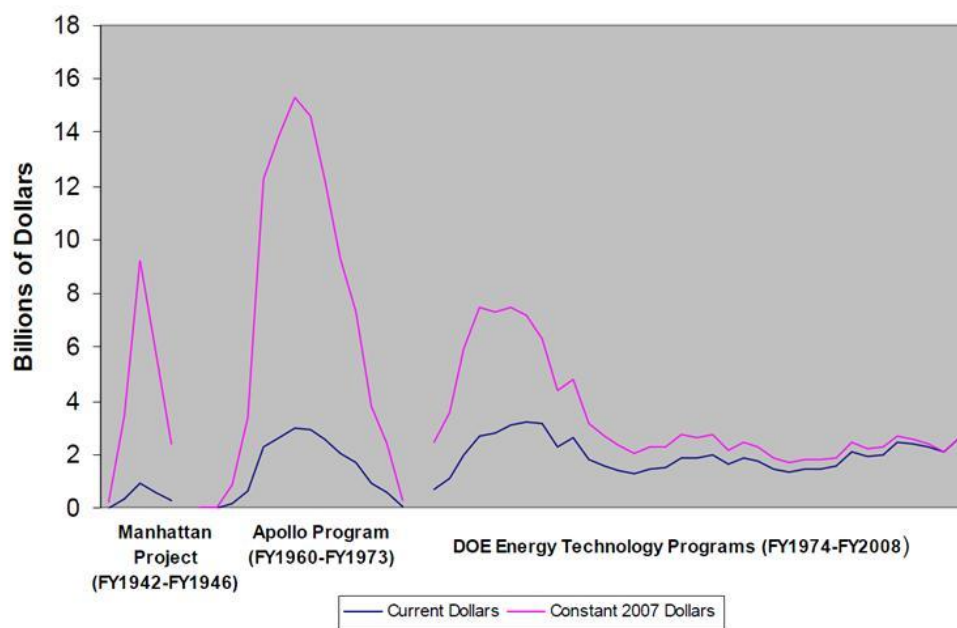
²⁷⁰ See < <http://www.cfo.doe.gov/strategicplan/doelabs.htm> >.

²⁷¹ Original source note: "Source: Congressional Research Service. Manhattan Project data: Richard G. Hewlett and Oscar E. Anderson, Jr., A History of the United States Atomic Energy Commission: The New World, 1939/1946, Volume I. Apollo program data: Richard Orloff, Apollo By The Numbers: A Statistical Reference, NASA SP-2000-4029, 2004 web update. DOE data: CRS Report RS22858, Renewable Energy R&D Funding History: A Comparison with Funding for Nuclear Energy, Fossil Energy, and Energy Efficiency R&D, by Fred Sissine. Federal Outlay and Gross Domestic Product (GDP) data: Office of Management and Budget, Historical Tables, Budget of the United States Government FY2009. Peak year of funding (in current dollars) for Manhattan project was 1946, for Apollo program, 1966, and for DOE Energy Technology R&D programs, 1980. The greatest annual funding (in constant dollars) for DOE energy technology programs took place from 1975-1980."

Testing the Model

DOE Energy Technology Programs (1975-1980) [Peak Funding] - Mission: Economic Independence; End Result: Failure	\$41	6	\$7	0.5	0.1
DOE Energy Technology Programs (1974-2008) [Long-Term Funding] - Mission: Economic Independence; End Result: Failure	\$115	35	\$3	0.5	0.1

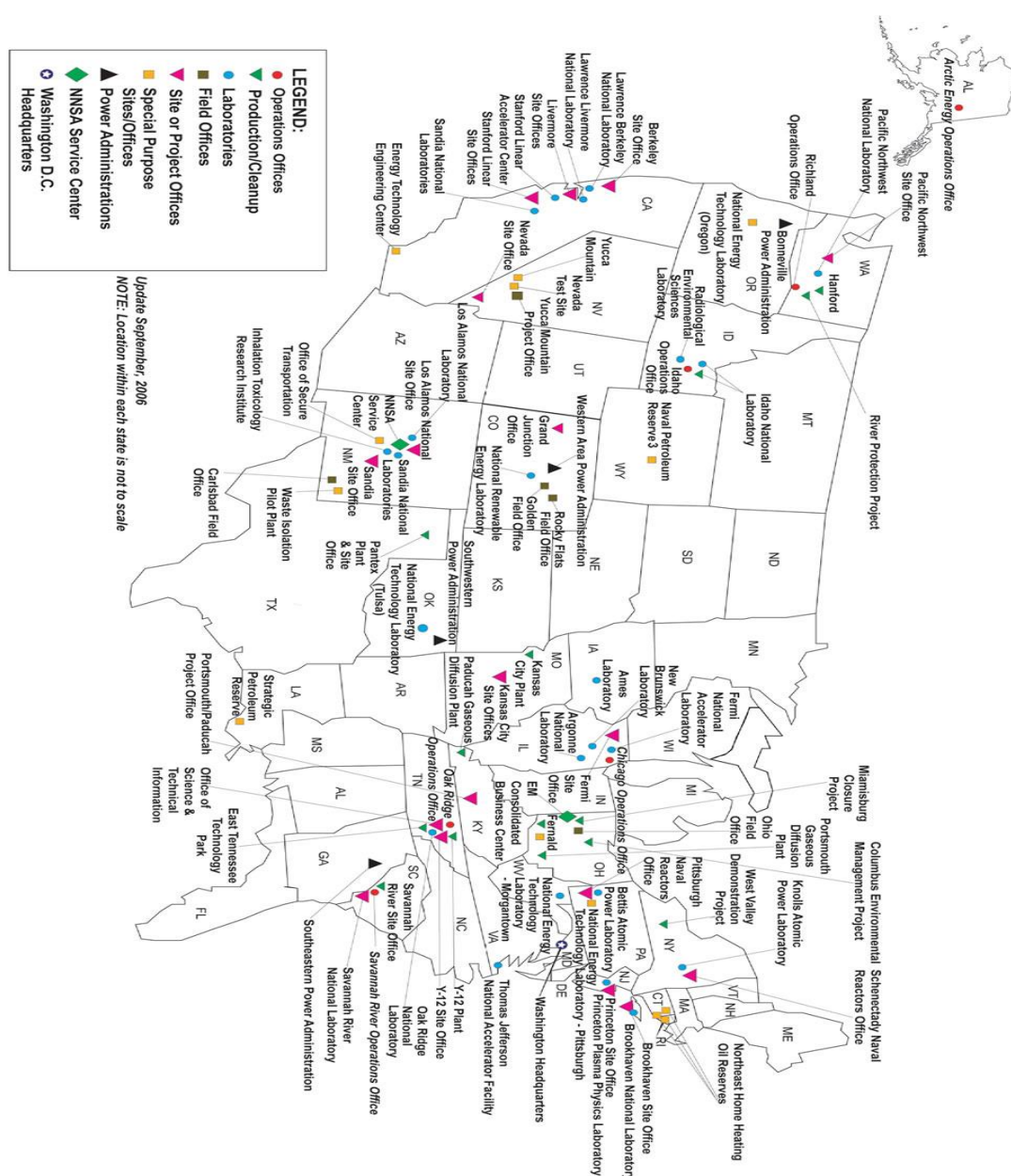
Figure 26: Annual funding for Manhattan Project, Apollo Program, and DOE Energy Technology R&D Program



Source: Stine (2008).²⁷²

²⁷² Stine's original source text reads "Source: Congressional Research Service. Manhattan Project data: Richard G. Hewlett and Oscar E. Anderson, Jr., *A History of the United States Atomic Energy Commission: The New World, 1939/1946, Volume I*. Apollo program data: Richard Orloff, *Apollo By The Numbers: A Statistical Reference*, NASA SP-2000-4029, 2004 web update. DOE data: CRS Report RS22858, *Renewable Energy R&D Funding History: A Comparison with Funding for Nuclear Energy, Fossil Energy, and Energy Efficiency R&D*, by Fred Sissine.

Figure 27: Map of major DOE installations and facilities



3.3.1.7.8. Key commercial market players

The following tables identify the major commercial actors that have a large stake in the development of alternatives and the response to policy initiatives that lead to fuel substitution. The data source for the ten major energy related industries listed here is the same as used in the chapter on the EU's major market players, the EU's 2009 industrial R&D investment scoreboard (Joint Research Centre, 2009). The reports and data are available via the JRC website.²⁷³ For the

²⁷³ See <http://iri.jrc.ec.europa.eu/research/scoreboard_2009.htm>.

sake of clarity, the industries included are Aerospace/defence, oil/gas producers, oil equipment/service/distribution providers, mining, chemicals, automobiles/parts, industrial transportation, commercial vehicles/trucks, electricity producers/distributors, and gas and other utilities. The data provided below lists the top ten companies in 2005 (and 11 cases in the Chemicals area because by the author's discretion not to exclude Monsanto with its over €400 million annual research budget) in terms of net sales (mio €), but unlike their European counterparts, with research and annual development budgets of over €25 million in each these industries. Likewise, there were only nine companies in the commercial vehicles & trucks sector that met the above standards, only four oil & gas producers, and only one in the gas, water & multi-utilities and industrial transportation sectors respectively. That said, it provides a snapshot of US commercial energy relevant research and development.

Table 19: Major energy relevant market players in the US

Aerospace & defense

Company name	Capital expenditure (mio €)	Net sales (mio €)	Number of employees	R&D investment (mio €)
Boeing	1268	46494	153000	1869.27
United Technologies	788	36220	222200	1158.86
Lockheed Martin	733	31547	135000	883.35
Northrop Grumman	699	26043	123600	456.08
Raytheon	287	18560	80000	426.41
General Dynamics	237	18009	72200	291.62
L-3 Communications	102	8007	59500	55.7
Goodrich	183	4582	22600	226.26
Rockwell Collins	94	2920	17100	206
Alliant Techsystems	55	2727	15200	43.66

Automobiles & parts

Company name	Capital expenditure (mio €)	Net sales (mio €)	Number of employees	R&D investment (mio €)
General Motors	6934	163278	335000	5679.86
Ford Motor	6372	150228	300000	6781.92
Johnson Controls	563	23295	114000	351.81
Delphi	1003	22844	184200	1865.03
Goodyear	537	16720	80000	309.43
Lear	482	14487	115000	147.51
Visteon	496	14391	49575	681.58
TRW Automotive	426	10718	63100	172.09
Dana	252	8348	44000	233.13
ArvinMeritor	124	8321	29000	148.35

Chemicals

Company name	Capital expenditure (mio €)	Net sales (mio €)	Number of employees	R&D investment (mio €)
Dow Chemical	1354	39256	42413	909.63
El du Pont de Nemours	1136	22583	60000	1132.58
Lyondell Chemical	211	15773	10000	77.14
Huntsman	287	11009	10800	80.96
PPG Industries	244	8648	30800	261.95
Ashland	322	8359	20900	38.15
Air Products and Chemicals	788	6904	20200	112.5
Rohm and Haas	282	6777	16519	231.43
Praxair	743	6490	27306	67.82
Eastman Chemical	291	5984	12000	137.33
Monsanto	238	5336	16500	498.47

Commercial vehicles & trucks

Company name	Capital expenditure (mio €)	Net sales (mio €)	Number of employees	R&D investment (mio €)
Caterpillar	2047	30155	85116	918.95
Deere	435	18038	47400	574.17
Paccar	719	11549	21900	99.86
Cummins	158	8408	33500	235.67
Navistar International	195	8026	14800	175.48
AGCO	75	4620	13000	103.17
Terex	30	4255	16800	39.25
Oshkosh Truck	37	2509	7960	28.31
Sauer-Danfoss	81	1312	8600	49.74

Gas, water & multi-utilities

Company name	Capital expenditure (mio €)	Net sales (mio €)	Number of employees	R&D investment (mio €)
Nalco	63	2808	10900	49.68

Industrial transportation

Company name	Capital expenditure (mio €)	Net sales (mio €)	Number of employees	R&D investment (mio €)
Westinghouse Air Brake Tech.	19	886	5229	27.81

Oil & gas producers

Company name	Capital expenditure (mio €)	Net sales (mio €)	Number of employees	R&D investment (mio €)
Exxon Mobil	11732	269074	106100	603.59
Chevron	7376	146539	59000	267.89
ConocoPhillips	9851	136861	35600	105.97
Sasol	1745	9255	30004	30.34

Oil equipment, services & distribution

Company name	Capital expenditure (mio €)	Net sales (mio €)	Number of employees	R&D investment (mio €)
Schlumberger	1350	12130	60000	428.54
Halliburton	552	17797	106000	204.31
Baker Hughes	405	6091	29100	159.55
Weatherford International	446	3691	25100	91.02
Smith International	151	4730	14697	62.39
BJ Services	274	2749	13600	45.95
FMC Technologies	78	2735	10000	43.66

3.3.2. Salience of SAPP

It is difficult to argue with the assumption that the US prioritizes power projection. Across the span of a little more than six decades since the end of World War II, the US has spent over \$25 trillion on its military, formally declared war against foreign nations eleven times (in five overall wars), conducted seven undeclared wars, and executed well over a hundred brief military expeditions.²⁷⁴ Since 1950, more than 130,000 of its soldiers have died on foreign battlefields, 45,000 of which have fallen since 1980 (Leland and Oboroceanu, 2010). Indeed, power projection and the marshal tradition to secure its national interests or protect its citizens by the use of uncompromising military force has been a major component of American political thinking since the country's foundation in 1776 and as the country's industrial power base expanded, so too did the importance of securing its interests through the projection of strength.²⁷⁵ Proclamations of its political elites evidence this. Ronald Reagan noted in 1989 that "common sense also told us that to preserve the peace, we'd have to become strong" as did Secretary of State George Shultz five years earlier declaring, "Diplomacy not backed by strength will always be ineffectual at best, dangerous at worst" (Reagan, 1989; Shultz, 1985).

²⁷⁴ The five official wars, (and 11 declarations and their dates) include: (1) the war with Great Britain (1812); (2) the war with Mexico (1846); (3) the war with Spain (1898); (4) the First World War (Germany and Austria-Hungary (both in 1917); (5) and World War II (Japan, Germany, and Italy in 1941 and Bulgaria, Hungary, and Rumania in 1942). Undeclared major wars include the Naval War with France (1798 to 1800); the First Barbary War (1801 to 1805); the Second Barbary War (1815); the Korean War (1950-1953); the Vietnam War (1964 to 1973); the Persian Gulf War (1991); the global war against foreign terrorists (Afghanistan and global, 2001-), and Iraq (2003-2010). All of these actions, except the Korean War had formal Congressional authorization short of a formal declaration of war. For a comprehensive listing see Grimmert (2010).

²⁷⁵ For a detailed analysis of the historical role of power projection and competing forces behind US foreign policy see Kagan (2006).

This marshal theme of US behavior was evident early in its history as the country grappled with its post-revolution loss of UK naval protection for its merchant fleet.²⁷⁶ When the Barbary powers of North Africa began pirating US trade vessels in the 1780s, then minister plenipotentiary Thomas Jefferson declared, “We ought to begin a naval power, if we mean to carry on our own commerce” (Boyd, et al., 1950:511-13).²⁷⁷ As President, Jefferson sent the country’s nascent marine force first to blockade the port of Tripoli, then to bombard it, and finally to capture the Pasha’s second biggest city.²⁷⁸ In the ensuing decades, the US would conduct similar missions *inter alia* in the Gulf of Mexico, in Algeria, in Oregon (a future US state that the UK and Russia claimed), and in Argentina, Cuba, Greece, Panama, Peru, Puerto Rico, Nicaragua, China, and Somoa. US Presidents Monroe and Roosevelt would go on to issue doctrines to claim suzerainty over the entire western hemisphere and send a battle fleet around the world merely to demonstrate the country’s growing reach, capability, and will.²⁷⁹

The country’s ability to project power grew visibly the nineteenth century. However, the US was little more than a second-rate power for much of its pre-World War I history. A snapshot of comparative hard power capabilities over the period between 1820 and 1900 reveals its relative weakness (see Figure 28 below). Hard power in this case specifically refers to the widely used Composite Index of National Capability (CINC) consisting of annual values for total population, urban population, iron and steel production, energy consumption, military personnel, and military expenditures. Originally established by Singer et al. (1972), updated by Singer (1987), CINC scores measure these six factors as a share the world total, and establishes an index, of which the world total is one. The formula for calculating CINC is as follows:

$$CINC = \frac{\frac{P_c}{P_w} + \frac{U_c}{U_w} + \frac{I_c}{I_w} + \frac{E_c}{E_w} + \frac{M_c}{M_w} + \frac{X_c}{X_w}}{6}$$

Where the variables *c* and *w* represent country and world respectively, P=total population and U=urban population (population living in cities with a population >

²⁷⁶ Before the revolution, American merchant marine vessels were flagged with the Union Jack and thus afforded UK naval protection.

²⁷⁷ Already in 1794, President Washington requested and received funding to build four frigates to send to the Mediterranean. The ships were built, but never sent because the country reached a tribute agreement with the Barbary powers and paid them not to attack their vessels over a subsequent period of 20 years.

²⁷⁸ The original mission was a disaster as the flagship, the frigate Philadelphia, ran aground in shallow waters.

²⁷⁹ See the Monroe Doctrine of 1823, the Roosevelt Corollary of 1904, and the sailing of the Great White Fleet (1907-1909).

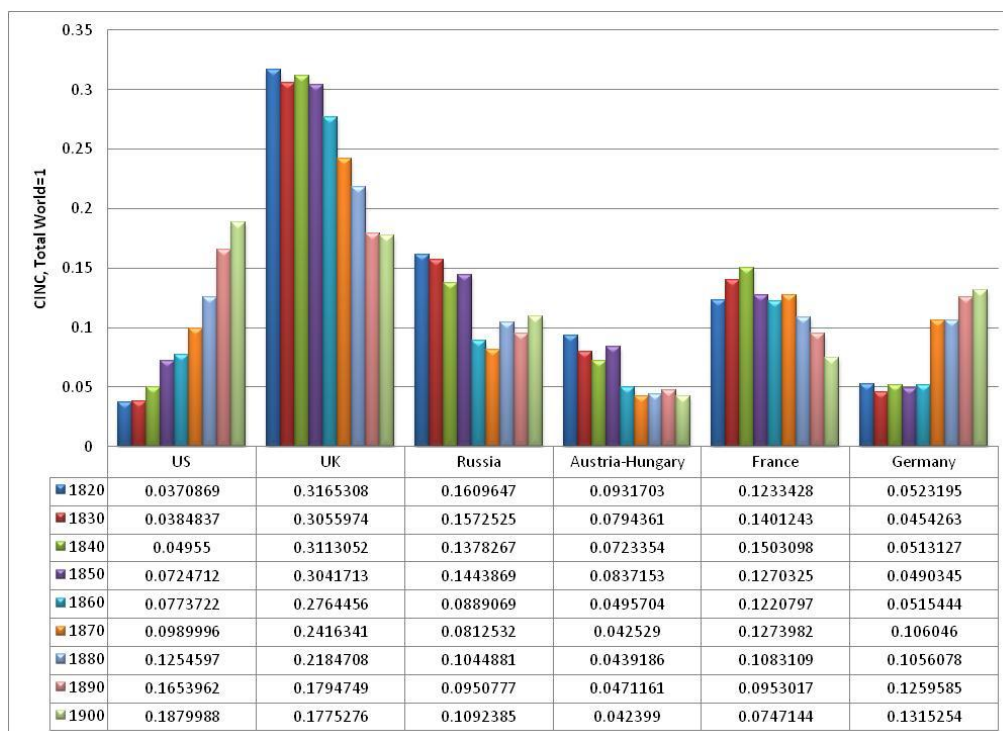
Testing the Model

100,000) both measured in thousands; I=Iron and steel production (1000s of tons), E=primary energy consumption (1000s of tons of coal equivalents), M=military manpower (1000s) and X=military expenditures (1000s of current year UK Pounds (1816-1913) or US dollars (1914 forward)).

In 1820, the US hard power capabilities (.037) were on par with the Netherlands (.040) and the Two Sicilies (.031), but far below that of Austria-Hungary (.093), Germany (.052), France (.123), and Russia (.161), not to mention the UK, which with a CINC score of .316 commanded almost a third of all global power capabilities. This relative balance of power changed significantly over the subsequent 80 years as the UK, France, Russia, and Austria each declined sharply and Germany and the US emerged as new industrial powers.

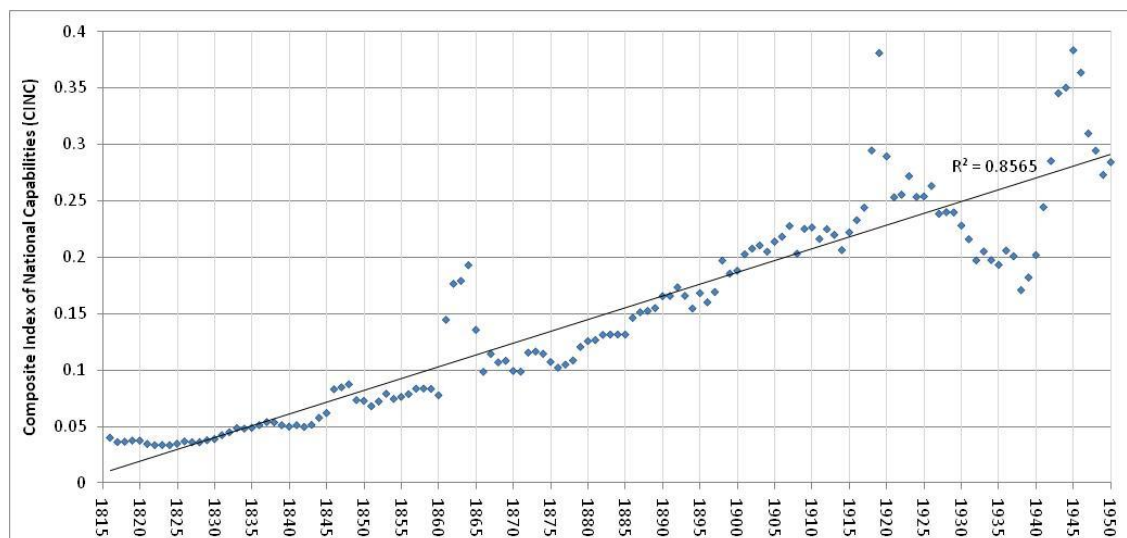
The balance shifted further in the US favor by 1950. Not only did the two World Wars arrest Germany's growth and eliminate Austria-Hungary from the club of states, together with the Bolshevik revolution and the loss of Europe's colonial holdings, the changes shattered the relative power positions of the European powers. Beginning in 1941, the balance turned decidedly toward the US, which was already on steep trajectory to increased hard power dominance (See Figure 29 below). By the end of World War II, the US had supplanted the UK by controlling almost a third of all global power capabilities.

Figure 28: Relative national material capabilities of leading/emerging powers 1820-1900



Source: Singer et al. (1972) and updated by Singer (1987)

Figure 29: Growth in US hard power 1816-1950



Source: Singer et al. (1972) and updated by Singer (1987)

Having emerged as the proverbial 'last man standing', the US was poised in 1945 to reshape the world to its liking; and it did not hesitate doing so. Presidents Roosevelt then Truman ushered in watershed changes to the international system, founding the United Nations and establishing the Bretton Woods international financial institutions. However, just as the war ended, the US and the Soviet Union squared off over the future trajectory of Iran (1946), Turkey (1947), and Greece (1947).²⁸⁰ Fearful of the specter of Communism and the spread of Soviet influence, Truman and consecutive US Presidents enacted a policy to contain Soviet expansion and defend Europe. The resulting Cold War led to stand offs that tested not only US resolve, but directly challenged its ability and will to project power. When the Soviet Union blockaded Berlin (1948-1949), the US cooperated with the UK to create an air bridge into city. The so-called Berlin Air-Lift transferred not only food, but also troops, fuels, and armaments to the city buried deep inside Soviet occupied Germany. Thus, in its first challenges of the Cold War and newfound position as a superpower, the US demonstrated both its will and its ability to project conventional power rapidly thousands of miles from its shores; and it provided a preview of the vital importance that global mobility would play in determining future conflicts.

The combination of the early post-war military confrontations with the Soviet Union, the need to rebuild and defend both Europe and Japan, and its long developing trajectory towards increased power led the US to make two vitally important decisions about its post-war military posture.

²⁸⁰ See the Truman Doctrine (1947)

First, after failing to get an international agreement to curtail the use of the same nuclear weapons that the US had used to win the Pacific War and followed by the successful Soviet detonation of an atomic device in August 1949, the government rapidly moved to expand its nuclear arsenal. This set into motion a program of cooperation between the country's newly founded Atomic Energy Commission, major US engineering companies such as Westinghouse and General Electric, and the military to construct new nuclear based weapons and systems. Second, to combat the Soviets, and more importantly to secure the country's interests as it had been doing for the past century, Washington needed to dominate the seas and the skies. Although it already had the largest naval and air fleets of all remaining powers, World War II had demonstrated that both were vulnerable to fuel shortages. Thus, in order to secure its position, it needed either new sources of fuel to supplant production at home or to change the fuel it was consuming. This did not pose a serious problem for the newly formed Air Force because petroleum supplies were abundant, under US or allied control; and there were few cost-effective alternatives for use in aircraft. For the navy, however, the energy question was an entirely different matter.

The Navy's dependence on diesel fuel was seen as serious problem because of the limitations that it placed on how far ships could travel before requiring refueling, a problem that was multiplied by the country's increasing reliance on petroleum-based combat aircraft stationed on carriers. Likewise, in the case of the increasingly important submarine, diesel engines posed two additional problems. They were loud and thus detectable and those same refueling requirements limited their ability to execute long and secret missions, essentially negating their attack value. The navy needed a newer, faster fleet that it could deploy for longer periods at sea. Hence, it turned to nuclear power.

The Navy asked for and received permission and funding to design nuclear propulsion systems in 1951 and after a brief period of reorganization and trial and error, the US began constructing its first nuclear powered submarine, the *Nautilus*, in 1952. Two years later, it was deployed to sea, travelling immediately from Connecticut to Puerto Rico in less than a day, submerged the entire time. The *Nautilus* not only revolutionized naval strategy with its exceptional speed and submersible duration, six years later, when it conducted a submerged transit underneath the North Pole, it demonstrated that there was no place on earth outside of the US military's reach. Between 1954 and 1967, the US commissioned another 57 nuclear-powered submarines in multiple phases of technological evolution and increased energy efficiency, including 29 attack submarines capable of launching ballistic missile strikes (Hewlett and Duncan, 1974). The navy also developed nuclear power for surface ships, launching a missile cruiser (1961), an aircraft

carrier (1961), and a frigate (1962). By the time Kennedy took office, the US had a functioning nuclear navy, and while many ships still relied on diesel fuel, the military's adoption of this new energy source had secured the country's global dominance of the seas.

The timing could not have been more propitious. A heightening of tensions between the US and the Soviet Union quickly followed Kennedy's entry into office and reached an apex in October 1962 with the Cuban Missile Crisis and the subsequent US naval blockade. Faced with increasing competition from the Soviets and enabled by its new high speed, long-haul navy, the US began extending its reach via the sea into distant lands in the 1960s. The US deployed forces and engaged in armed conflict against a variety of state and non-state actors in Laos, Cambodia, and North and South Vietnam, all supported by the Soviet Union. It provided transport and logistics for France and Belgium in the Congo and expanded both its air and naval forces in a huge military buildup. By the end of 1970, the US had an active arsenal of 15 aircraft carriers, 102 submarines, between 180 and 200 principle surface fighting ships, and approximately 7,000 combat aircraft including long range bombers (and excluding helicopters).²⁸¹ Its military budget had grown from \$330 billion (in \$2008) to \$442 billion.²⁸² The post-war plan to dominate the seas and the skies were well underway.

After the 1960s, the US continued to expand its military and significantly increased its activities overseas engaging in a growing number of unique territories. In so doing, it followed the opposite trajectory of Europe, which saw that number decline (Compare with Figure 12 and Figure 13 on page 129). Although the US avoided large-scale occupations in the decades following its withdrawal from Vietnam, the US was not shy about using its military. It launched missions in six unique locations in the eighties and nine in the nineties (see Figure 31 below). In addition to the more traditionally registered large-scale battles, the US also stepped up evacuation missions, supported the militaries of foreign government, provided logistics to allies and the UN, and launched several numerous short-term bombing runs on countries such as Libya and Iraq. Because such conflicts often resulted in high property damage, but little loss of life, they are not present in the UCDP dyadic set of international conflicts. Therefore, we have added them to accentuate the case that the US does in fact prioritize power projection. The source of the

²⁸¹ Based on data gleamed from multiple editions of IISS' annual *The Military Balance*. See International Institute for Strategic Studies (1968, 1969, 1970)

²⁸² Stockholm International Peace Research Institute database on NATO military expenditures, available at <http://www.sipri.org>.

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additional conflict data comes from various historical accounts including Presidential submissions under the US War Powers Act gleaned from (Grimmett, 2010).

Figure 30: Quantity of dyadic armed conflicts fought by US 1946-2009

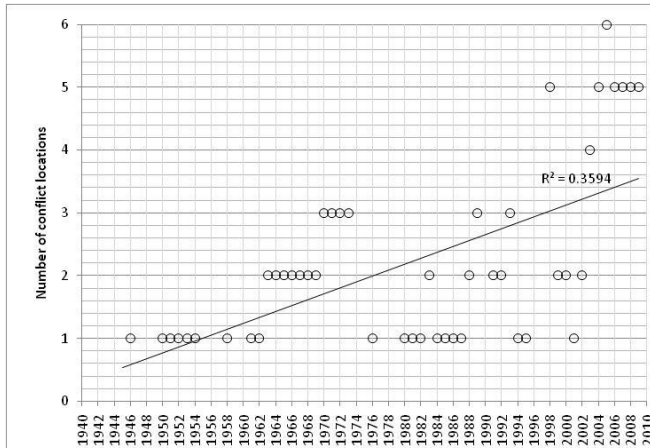


Figure 31: Distribution of unique conflict areas in ten-year periods

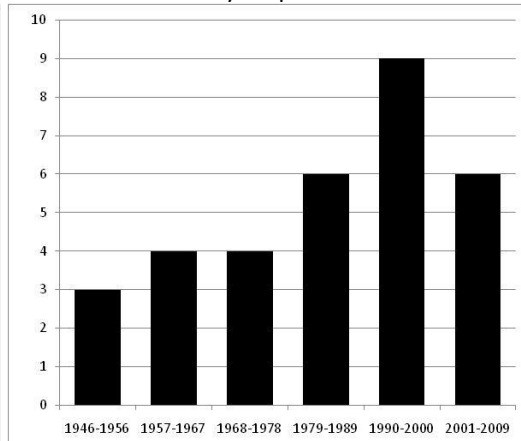


Figure 32: Revised quantity of dyadic armed conflicts (including minor engagements) fought by US 1946-2009

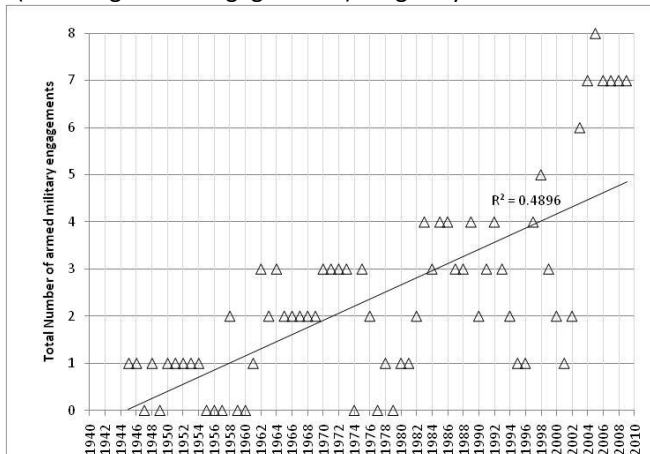
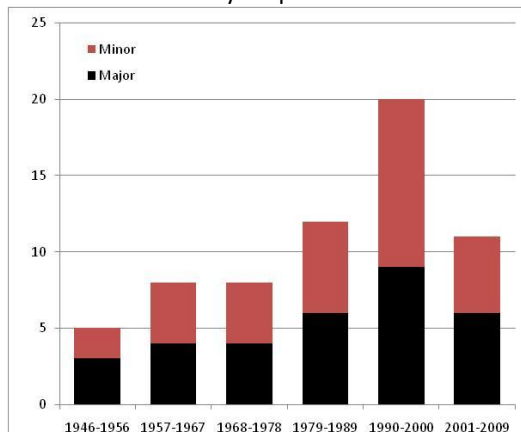


Figure 33: Revised distribution of unique conflict areas (including minor engagements) in ten-year periods



Source: UCDP Dyadic Dataset, version 1-2010 and Grimmett (2010).

Although the shift to a nuclear navy opened up new opportunities to conduct distant missions, allowing it to effectively control the world's seas, control of the skies as well as the ability to fight ground wars remained entirely dependent of petroleum-based fuels. Supply of those fuels was the responsibility of the Navy.²⁸³ This posed a recurrent problem because endemic inter-service

²⁸³ The Navy had been managing three major oil fields located in California and Wyoming and oil shale reserves in Utah and Colorado for decades. Faced with a supply crisis in 1976, Congress passed the Naval Petroleum Reserves Production Act of 1976 (Public Law 94-258) ordering the Navy "to commence a vigorous production program from the three naval petroleum reserves located in California and Wyoming". The act also reassigned the Navy's fourth petroleum reserve in Alaska to the jurisdiction to the Department of the Interior. In 2000, the last and largest of the three Oil Shale Reserves administered by the Naval

rivalries plagued efficient cooperation. Further expansion of US force deployments, and thus fuel needs, quickly made the situation untenable. In 1961, the Defense Department established the Defense Supply Agency (DSA), later called the Defense Logistics Agency (DLA), which centralized the supply of US forces, implemented a new national contracting system, and assumed responsibility for the worldwide procurement and distribution of coal and petroleum. In 1986, Congress moved to restructure the military through The Goldwater-Nichols Department of Defense Reorganization Act of 1986 (Public Law 99-433). In addition to reorganizing the chain of command, it also formally consolidated the shared procurement of technologies and fuels under the management of the DLA. Its energy wing, the Defense Energy Support Center (DESC) or the DLA-E, now supplies all services with their fuel needs.

Still, the consolidation of the US military's fuel supply chain was only part of the transformation that occurred in its handling of energy issues. The crises of the 1970s also demonstrated the need to consolidate the types of fuel being used. Thus, in 1988 the Defense Department issued Directive (DODD 4140.413) ordering field commanders and weapons designers, to "minimize the number of fuels required in joint and combined operations and maximize the use of locally available fuels" (Stucker, et al., 1994:53-6). It further ordered the adaptation of aircraft and combat vehicles to use multiple fuels, i.e. allow immediate in theatre fuel switching, and ordered the DLA to be prepared to introduce alternative fuels to the battlefield if the need arises. The Directive marked a serious departure point in US military energy thinking. It now sought fuel flexibility and initiated a serious effort to acquire those fuels as close to operational theatres as possible.

It did not take long for the DESC and the new rules to be tested. The 1991 Gulf war with its massive forward positioning of ground and air forces required enormous amounts of fuel. Between August 19, 1990 and May 31, 1991 (Operations Desert Storm/Shield), US forces consumed 1,883 million gallons (7,172 million liters) in total of eight different liquid petroleum-based fuels, 58% of which was Jet A-1, Air Force fuel. Of this, host nations Saudi Arabia, the United Arab Emirates, and Oman supplied 1,779.5 million gallons (or roughly 94%). On average, the ODS mission consumed more than 20 million gallons (75 million liters) a day according to

Petroleum and Oil Shale Reserves (NOSR), No. 2 in Utah, was transferred to the Ute Indian Tribe. NOSRs-1 and 3 have been transferred to the U.S. Department of the Interior.

USCENTCOM data (Stucker, et al., 1994:111-31).²⁸⁴ By all accounts, the new organization of fuel supplies was a smashing success. Although, the 'locally available fuels' mentioned in the 1988 Directive were plentiful in the Arabian Peninsula and hypothetically would be less available further from the source, the US has faced few strategic problems in fueling subsequent wars. In the years since the conclusion of the Gulf War, the US military has increasingly focused on a two-track strategy to keep its ships, planes, and combat vehicles fueled and ready for action. It maintains a global supply chain for petroleum based fuel deliveries and is actively investing in alternative substitute fuels.

The US military operates an extensive international network of suppliers for oil, coal, and natural gas, which the DESC buys and resells (through budget line transfers) to operational command centers when and where they need them; and to account for possible disruptions, it plans and stockpiles. Between 2007 and 2009, DESC purchased more than 400 million barrels of petroleum fuels (circa 63 billion liters) and as of September 2009 held 59 million barrels (circa 9.3 billion liters) in stock (DESC, 2010:24-5). Its commercial purchases are both geographically and financial risk distributed, with no single supplier above 12% and thus minimizes situations where conflicts of interest could disrupt supplies.²⁸⁵ In fact, to keep the military running, the DESC operates some 179 vehicle filling terminals around the world, an additional 149 installations in 96 countries for aviation needs, and over one billion dollars worth of contracts at 87 ports in 61 countries. This is in addition to 625 different support locations, eight of which are operated by foreign governments.²⁸⁶ The magnitude of these efforts points to one conclusion. The US places an extremely high salience on supply availability for power projection.

Meanwhile, the US is increasing its efforts and pouring funds into alternative energy research programs, including batteries and flexible solar technologies to allow for less liquid fuel dependency in forward land deployments and is actively investing into liquid synthetic and biofuel programs to find alternative mixes for aviation fuels. Renewable energy targets (5% by 2010) for government agencies established the Energy Policy Act of 2005 have provided the legal basis for the Department's push for demonstrative evidence that alternative fuel mixes will work and can be produced at home at stable and reasonable prices. The DESC itself has begun to develop

²⁸⁴ See Stucker, Schank, Dombey-Moore, United States. Dept. of Defense. Office of the Secretary of Defense. and National Defense Research Institute (U.S.) (1994), a detailed Rand Report that provides complete tables of as reported by the services, agencies, and countries mentioned here.

²⁸⁵ Its two largest suppliers are the foreign owned BP and Shell.

²⁸⁶ The DESC provides a map of these on page 44 of DESC (2010).

alternative fuel supply chains by purchasing multiple contracts for hydro-treated renewable jet (HRJ-8,) which is a biofuel drop in replacement for JP-5 and JP-8, and in 2009, awarded numerous contracts to purchase over 200,000 gallons of biofuels (DESC, 2010). While still a drop in the bucket compared to its overall needs, the military is taking an active role in freeing itself from fossil fuels, with a special focus on aviation fuels; a logical approach given that the latter makes up the largest portion of fossil fuel annually consumed by the military. As Kristin Blackwell observes,

“In Fiscal Year 2005, DOD consumed roughly 125 million barrels of oil — approximately 1.2% of the nation’s total. About 74% of that was used to power mobility vehicles — Air Force aircraft, Navy ships, and Army ground vehicles. Over half (roughly 52%) was aviation fuel” (Kristine E. Blackwell, 2007).²⁸⁷

Costs are a big part of the story. Dependence on oil, foreign or domestic is extremely expensive and volatility in the markets can greatly increase the cost of military operations and drain the US budget. According to Blackwell (2007:2) a \$10 increase in the price of a barrel of oil, translates into an operating cost increase of close to \$1.3 billion (in \$2007). Thus, it is not difficult to understand why the military wants to seek alternatives, which even if they are more expensive in short term, may prove to be less volatile in the long term and hence advantageous for strategic planning.

The US military began researching alternatives in earnest in 2001 when the Defense Science Board Task Force delivered a report recommending the implementation of greater efficiency in the military’s weapons systems and the development of alternative fuels (United States. Department of Defense, 2001). That report gave the impetus for products currently coming online and set-off a flurry of activity in the defense industry both in support and opposition to the use of substitute fuels.²⁸⁸ Irrespective of the debate, the Department has taken its approach to a future

²⁸⁷ Military aviation fuel is also used in other systems including tanks and generators in order to reduce logistics requirements on the battlefield and adhere to DOD Directive 4140.413 among others.

²⁸⁸ The latter case was made in a JASON (2006) Report that concluded that despite any price fluctuations, shortages should not be expected in the near future, and thus there was no need to rapidly invest in alternatives. JASON is an independent scientific advisory group established in 1960 that provides consulting services to the US government on matters of defense science and technology. It has produced numerous public and secret reports. The Federation of American Scientists provides a list of unclassified JASON reports on its website. See < <http://www.fas.org/irp/agency/dod/jason/>>. For additional reports, see Air Force Scientific Advisory Board (2006) ‘Quick Look, Technology options for improved air vehicle fuel efficiency’; Air Force Studies Board (2007) ‘Improving the Efficiency of Engines for Large Nonfighter Aircraft’; Army Corps of Engineers (2005) ‘Energy Trends and Their Implications for U.S. Army Installations’; The Defense Advanced Research Projects Agency (2005) ‘Petroleum-Free Military Workshop’; and Naval Research Advisory Council (2005) ‘Study on Future Fuels’.

switch toward renewable fuels seriously. In 2006, it established a Defense Energy Security Task Force with goal of reducing its combat vehicle fuel intensity (United States. Energy Security Task Force, 2007). In 2009, the task force became the Office of the Director of Operational Energy Plans and Programs with authority to “oversee operational energy plans and programs, establish and implement an energy strategy, coordinate all the branches’ energy plans and research-and-development investments related to operational energy demand and supply technologies”(PEW, 2010:10). The military has also begun working closely with DARPA to develop demand-side technologies to be deployed on multiple defense weapons platforms and vehicles.

Finally, the Department singled out the importance of increased energy efficiency and laid out its plans to develop a “green carrier strike group” in its 2010 Congressional mandated Quadrennial Defense Review Report (United States. Department of Defense, 2010). The QDR, one of the most important US military strategy documents, places energy squarely in the context of operational security: “Energy security for the Department means having assured access to reliable supplies of energy and the ability to protect and deliver sufficient energy to meet operational needs” (QDR:87). In military terms, energy efficiency is now recognized as “a force multiplier, because it increases the range and endurance of forces in the field and can reduce the number of combat forces diverted to protect energy supply lines, which are vulnerable to both asymmetric and conventional attacks and disruptions” (QDR: 87).

As was predicted in our model, the military has taken the lead among US government agencies on renewable energy. It has set high targets including posturing the Air Force “to cost-competitively acquire 50 percent of its domestic aviation fuel via an alternative fuel blend” and to deploy “a ‘green’ carrier strike group using biofuel and nuclear power” both by 2016 (QDR:87-88). It also is working to invent, test, and deploy technologies and fuels to achieve them. The Navy commissioned the first all electric-drive amphibious assault ship, USS *Makin Island* and tested an F/A-18 engine on camelina-based biofuel, both in 2009. The military’s engagement in developing non-petroleum substitutes makes perfect sense given the high priority that the US places on supply availability for power projection; and hard power projection remains a vital instrument of its foreign policy. President Obama summed it succinctly: “For decades, we’ve talked about the risks to our security created by dependence on foreign oil”, but “here at home, as politicians in Washington debate endlessly about whether to act, our own military’s determined that we can no longer afford not to” (Obama, 2010b).

3.3.2.1. SAPP relevant data

3.3.2.1.1. US military expenditures / personnel

The following charts show the growth of US military expenditures from 1949 to 2009 in constant \$2008 and active military personnel between 1950 and 2007. It is juxtaposed to the price of oil (set on the secondary, right axis) for context. The chart illustrates that military expenditures have spiked during the Korean, early Vietnam Wars, Reagan buildup, and post 9/11 periods. However, it also shows a decline in the later Vietnam years, even as US military activity was increasing. This may indicate that in the high mobility costs of initially moving forces into theatre. Personnel numbers dropped off significantly towards the end of Vietnam. The US terminated compulsory military service in 1972. Since then, voluntary signups have declined slightly. Military expenditure data comes from the Stockholm International Peace Research Institute Database on NATO military expenditures, available at <http://www.sipri.org> and SIPRI's Full Military Expenditure Database from 1988-2009. Personnel data comes from the Correlates of War Project originally published and updated in (Singer, 1987; Singer, et al., 1972).

Figure 34: US military expenditures, 1949-2009

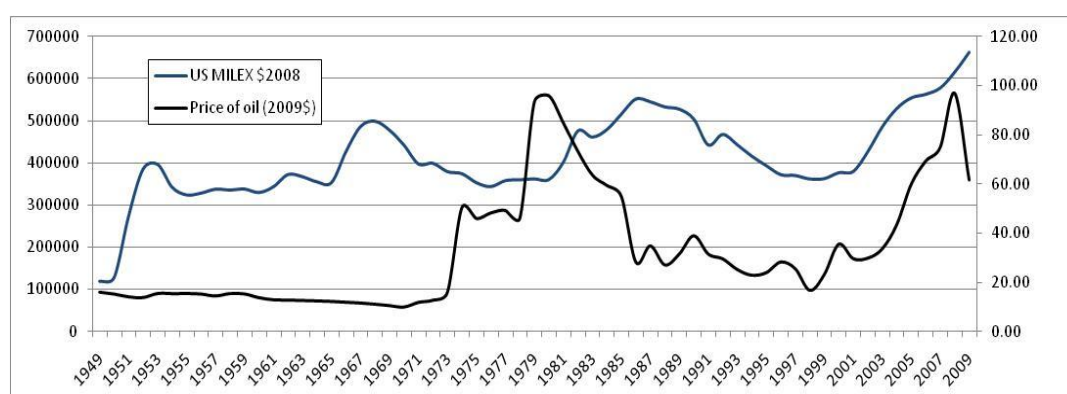
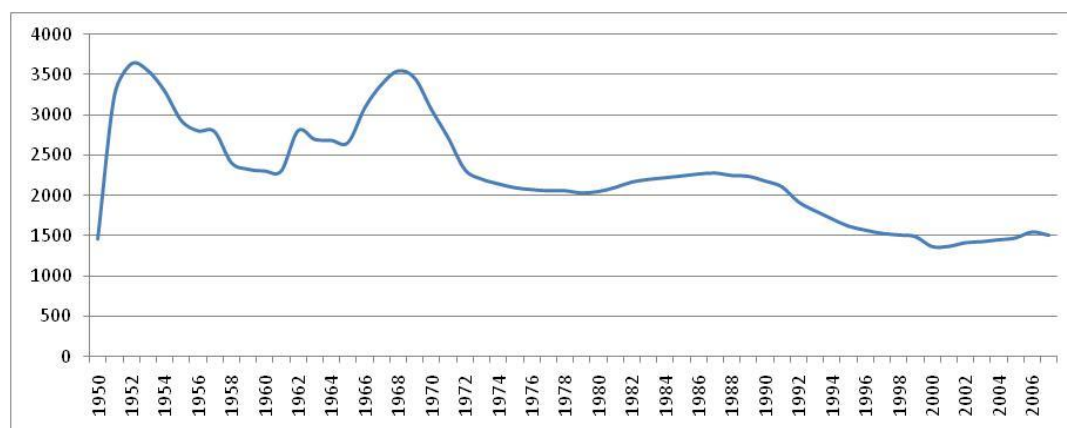


Figure 35: US active military personnel, 1950-2007



3.3.2.1.2. *Estimated inventories of energy dependent military hardware*

The following table presents an estimated assessment of the total energy dependent active military hardware in the US arsenal in selected years between 1960 and 2005. The selection of hardware is based on a subjective assessment of its military value. Only weapons systems that are practical for offensive power projection are included. Transport ships and planes, minesweepers are not included. Principle surface fighting ships include a broad range of coastal and deep-water destroyers, frigates, and escorts; the determination of their relevance to offensive power projection is the sole discretion of the author. The table illustrates the enormous arsenal of air and naval power that the US amassed by 1965 and its continued expansion through 1970. Although the quantity of aircraft carriers and submarines declined since, the US continues to maintain a commanding array of power projection assets. Data for the table comes from multiple annual editions of *The Military Balance* (International Institute for Strategic Studies., 1965; 1966; 1969; 1970; 1974; 1975; 1979; 1980; 1984; 1985; 1989; 1990; 2004).

Table 20: Energy dependent active power projection military hardware for selected years (US)

	1965	1970	1975	1980	1985	1990	2005
Aircraft/Helicopter Carriers	4	15	15	13	14	15	12
Submarines	35	102	73	80	97	96	72
Principle Surface Fighting Ships	60	180	220	170	210	210	160
	< x > 80	< x > 200	< x > 240	< x > 190	< x > 230	< x > 230	< x > 180
Air Combat / Bombers	c. 5000	c. 7000	c. 7000	c. 5000	c. 6000	c. 7000	c. 6000

3.4. Hypotheses

Based on the assumptions that energy is vital to power projection, that states must not always prioritize power projection, and that initial states of autonomy and investments into substitutes modify state behavior under different price and resource flow conditions, we can begin to propose several hypotheses about EU and US behavior. By looking at that behavior under different price and supply availability conditions, we should be able to see a set of common and distinctive behaviors and link them to their levels of energy autonomy and the importance they place on supply availability for power projection. An analysis of the divergent evolutionary paths of EU and US energy policies largely, but not entirely, supports our nine overriding assumptions linking internal energy policies, external outcomes, and the intervening variables of price and supply availability for power projection.

A brief appraisal of those assumptions in the context of our initial findings is helpful in establishing three broad groups of hypotheses about how states behave externally toward each other, internally toward substitution, and how the two interact in a feedback loop. Based on how EU and US energy policies evolved to their present condition, particularly the historical politicization of energy as it shifted from irrelevance to economic and military importance and assumptions about supplies swung between presupposed abundance and scarcity, we can posit nine hypotheses in three broad categories. The first hypothesis pertains to the actions of states when energy supplies are cheap and easy to access; the next four pertain to the opposite, when energy supplies are expensive and difficult to access; and the third pertains to the feedback loop between external outcomes and internal energy policies.

In both the US and EU case there appears to be some predictable behavior concerning the supply of energy. Long periods of sustained low prices generally were accompanied by less government intervention specifically and increased liberalization generally (Assumption 1). However, when prices rose, the expected opposite reaction of increased government action did not always occur. The duration of price swings, domestic politics, and the availability of domestic resources appear to have played a significant role in determining when and how each state reacted to the exogenous factor of price and ease of supply. When the theme of substitution did arise, it usually was associated with the notion of autonomy or independence (Assumption 2). The longer prices remained low, the less sensitive became the issues of supply availability and energy autonomy; and with that decline, so too did active support to find alternatives (Assumption 3). Finally, no matter how distant the achievement of energy autonomy may appear at present, both the US and the EU were entirely energy independent throughout their pre-industrial history. The US was

energy autonomous right up until middle of the twentieth century. This supports the argument that energy autonomy, while an ideal, is achievable (Assumption 4). Recent advancements in biofuels for transport, electricity generation, and storage support show that this is not only possible, it also is the ultimate target that states would like to reach.

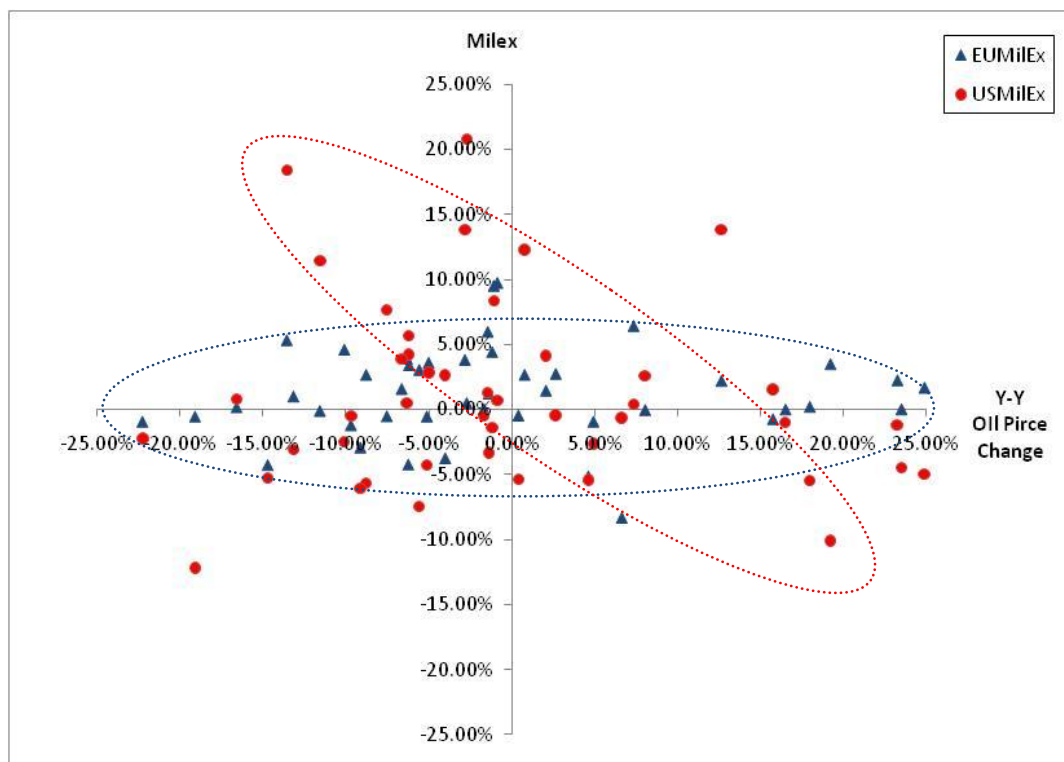
Further, the importance of energy is linked to the ebb and flow of EU and US orientation towards power projection. As the US rose in terms of military dominance and as the EU declined, the importance of supply availability moved with them (Assumption 5). As of 2010, we can safely conclude that the orientation of European powers toward hard power projection, and thus the need to fuel a vast military machine, has declined significantly from the pre-World War era. Conversely, the US orientation toward power projection has increased dramatically. Thus, supply availability for power projection (SAPP), the second key intervening variable, is visibly evident.

However, this does not mean that military expenditure, a real measure of the importance of power projection, is in any way correlated to the price of oil. In fact, an analysis of the year on year change in the price of oil and military expenditures reveals that in the long-term view it is not. Between 1955 and 2009, Pearson correlates of changes in oil prices and military expenditures for both a group of five core EU Member States (France, Germany, Italy, the Netherlands, and the UK) and the US are insignificant and uncorrelated (0.046 and -0.064 respectively; see Table 21 below). However, upon closer examination of specific periods with high or low prices (1955-1972, 1973-1982, 1983-1998, and 1999-2009), certain tendencies do appear to exist. While never strong, the correlates jump in all periods for the US and are consistently negative. In the selected EU case, there is no discernable pattern at all while US expenditures show some extreme year on year shifts (see Figure 36 below). The evidential lack of tendency linking oil price and military expenditures for the EU group and the greater extremes in the US case makes it safe to assume that price does not affect the power projection orientation of low SAPP countries, but does in some way effect those of high SAPP countries. Importantly, however, it does not guarantee that high SAPP countries will increase spending as price rises. Why is this so? One possible explanation is that high SAPP countries invest in energy savings more rapidly than low SAPP countries in order to minimize the excessive costs of the military activities and that this can sometimes increase or decrease year on year spending. Another, more logical conclusion is that there simply is no relationship between the two on an annualized basis. Indeed, the only certainty one can derive from the evidence is that the spikes in the price of oil do not guarantee increased military investments in either high or low SAPP countries, a rather unflattering conclusion for the proponents of resource-war theorists.

Table 21: Analysis of relationship between changes in oil prices and military expenditures, 1955-2009

Range:	1955-2009; N=110		
Variables:	Milex.Change (US/EU): %-change in y-on-y milex OP.Change: %-change in y-on-y average price of oil		
Extremes:	OP.Change	EU.Milex.Change	US.MilexChange
	Max: 217.26%	Max: 9.75%	Max: 20.79%
	Min: -48.60%	Min: -8.34%	Min: -12.17%
	STDV: 0.397	STDV: 0.025	STDV: 0.071
Pearson Correlations (1955-2009)			
0.046		Change in EU.Milex to oil price	
-0.064		Change in US.Milex to oil price	
Pearson Correlations for select high-low periods			
Price-class	Period	EU	US
Low	US-55-72	-0.066	-0.297
High	US-73-82	0.021	-0.262
Low	US-83-98	0.141	-0.218
High	US-99-09	-0.417	-0.168
Source data for above table and chart below: Stockholm International Peace Research Institute (SIPRI) Database on NATO military expenditures; Pearson correlations calculated with SPSS.			

Figure 36: Analysis of relationship between changes in oil prices and military expenditures, 1955-2009



Note: the above chart excludes extreme year-to-year (Y-Y) movements in oil prices in excess of 25% for visual effect. This occurred 10 times over the 55 years of measured data (19%) of the cases. However, 7 of the 10 (or 12% of the cases) occurred during the period from 1999-2009, meaning that the excluded extremes only occurred in 5% of the cases for the preceding 44 years.

The cheap and easy hypothesis.

Combining these factors, we can begin to assess when and how the intervening variables of price and supply availability for power projection are likely to affect both internal and external state behavior and how that behavior in effect requires a constant reassessment of the value of those variables. Between 1950 and 2010, the governments of the EU (and by this is meant the Member States) and the US changed their practical orientation toward energy on several occasions. When energy was cheap and abundant for sustained periods, both eschewed interstate cooperation, indicating that price is the stronger variable than SAPP when it is low. Hence, it appears that countries will adopt a Market Commodity Approach (MCA), i.e. execute a minimum of internal reforms and interventions and limit international cooperation, when prices are low (Assumption 6).

Because we can assume that both the EU and US share a similarly high salience on supply availability for their economic well-being, we can also assume that neither the US nor the EU will take significant internal or external action to alter current circumstances when prices are low and access is easy. Hence the first hypothesis (the cheap and easy hypothesis) is:

H1: Both the US and the EU will adopt market-commodity approaches under low-price-free-flow circumstances.

The expensive and difficult hypotheses

The next four hypotheses extend from the assumption that there are differences in the degree to which power projection is prioritized between the US and EU. We have shown that over time the former has placed a higher priority on SAPP than the latter and that this difference should effect external approaches. Together we may call these four the *expensive and difficult hypotheses*.

The historical record shows that even when disruptions occurred, EU Member States generally increased cooperation with other states, both consumer countries like the US and supplier states. This in part confirms Assumption 8 that even under the condition of disruptions states with a low salience of SAPP are more likely to seek cooperation rather than conflict. Likewise, the US with its high salience of SAPP turned to its European partners to coordinate an international response in forming the IEA under the stress of the 1973-1974 oil crises. This leads to the second hypotheses:

H2: Under high-price-restricted-flow circumstances, both the EU and US will employ a cooperation strategy.

However, there is a caveat here. When major disruptions occurred in 1973-1974, EU Member States were able to cooperate with the US and Japan, but were unable at the time to bring France into line. There may be many reasons why the EU generally sought cooperation under such conditions, not least of which is a philosophical disposition to eschew military force borne out of its recent warring past. Still, the EU's material inability to project force, evident through their military budgets and arsenals, seems to be an equally if not relevant explanation. During the years that France and the UK did prioritize power projection (shortly after World War II), they plotted together to use military force to secure transit routes for fuels considered vital to their military and economic capabilities. Such actions declined significantly in later decades. Conversely, the US underwent a massive military buildup after World War II. Power projection was a central component of its external strategy and remains so today. A quick glance at the average dimensions of the military arsenals of the US and selected EU Member States (UK, France, Germany, the Netherlands, and Spain) between 1965 and 2005 shows that the US placed a special focus on aircraft carrier battle fleets and air power. In other words, it built a military machine designed to project force globally, while the EU Member States designed theirs to defend their coastlines and support escort missions, a clear indication of lesser salience of SAPP.

Table 22: Average military projection capacity of selected EU Member States and the US, 1965-2005

	EU		US	
	1965-1980	1980-2005	1965-1980	1980-2005
Aircraft/Helicopter Carriers	6	6.75	11.75	13.5
Submarines	139.25	140.25	72.5	86.25
Principle Surface Fighting Ships	152.5	175	167.5	197.5
Air Combat / Bombers	1850	2050	6000	6000
Source: Multiple IISS (1965-2005) with estimations from the author.				

When disruptions or even the threat of disruption of oil flows did occur, the US intervened, sometimes with direct aggressive force (1991) and at others with defensive measures (the mid 1980s during the Persian Gulf Tanker Wars when oil shipments were endangered by Iraqi and Iranian mines). This confirms Assumption 7, which posits that states which prioritize SAPP are more likely to enter into conflict, and leads to the three additional hypotheses:

H3: Under high-price-restricted-flow circumstances, the US, which places higher salience on SAPP, is more likely than the EU or its Member States to resort to military means and even armed conflict to secure either access or flow.

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H4: Under high-price-restricted-flow circumstances, the EU, which places lower salience on SAPP, is less likely than the US to resort to military means and even armed conflict to secure either access or flow.

In fact, because the EU places a relatively low salience on SAPP, and because low SAPP assumes lower power projection capabilities and thus higher risks associated with any such action, we can go one step further to claim a third hypothesis:

H5: The EU will never seek conflict even when prices are high and flow is restricted.

The feedback hypotheses

Following the latest jump in oil prices beginning in the late 1990s, both the US and EU stepped up efforts to invest in alternatives. Such action was not new to either party. However, recent efforts and the sums invested by the US far outstrip that of the EU. Indeed, despite the EU's recent adoption of 2020 targets to achieve increased energy efficiency and shares of renewable supplies, the scale and speed of the effort appears to be of a lesser magnitude than similar activities underway in the US. According to the evidence collected so far, it is difficult to assess the precise amounts that the EU invested in the 1970s following the first oil crises. Open records have made it easier to examine the US approach. What is certain is that the US spent more. Moreover, the fact that the US military now plays such a central role in the development of new fuels and practical uses of non-petroleum energy supplies indicates that states that place a high salience on SAPP are likely to invest more than low SAPP salience countries when the situation arises that warrants such investments. While this does not fully confirm the supposition in Assumption 9 that lower salience of SAPP equals less investment in substitute technologies, the claim apparently seems credible. Thus, together with assumptions made about the need for states to enhance their energy autonomy, we have the basis for two feedback related hypotheses.

H6: Both the US and the EU will increase investments into substitutes when prices are high and flow is restricted

and

H7: Both the US and the EU will dramatically reduce investments under conditions of low prices and free flow.

The null hypotheses

And finally, for logical completeness we can posit two null hypotheses that would disprove the relevance of the intervening variables altogether and disregard any form of determinant relationship between those variables and internal policies toward substitution.

H8: Both the US and the EU never enter into conflict in energy rich areas when energy prices are high or disruptions are imminent.

H9: Both the US and the EU do not change their investments strategies toward substitutes when conditions of prices and flow change.

If either of these two are confirmed in the case studies, then it would indicate that the intervening variables of price and SAPP are at least weak, if not irrelevant. With these nine hypotheses in hand and a broad set of initial findings, we can now move to test them against four common cases involving the US and EU.

4. Four Cases

4.1. Case selection

The broad analysis provided in Part 3, 'Testing the Model', provides a foundation for several hypotheses about the relationship between international energy prices, external state behavior and the internal energy substitution programs in the context of the US and the EU. Initial findings point to three important preliminary conclusions, namely prices matter, SAPP salience effects their relative importance, and the US with its high-salient SAPP should act quicker and with greater effort whenever energy supplies are threatened or costs increase.

When international prices are low, both the EU and US should be expected to reduce both their levels of cooperation and their efforts to find substitute fuels because doing so is expensive and requires long temporal horizons; two factors negatively affected by domestic politics. However, when prices are high, both can be expected to seek cooperation with other states in order to mitigate negative economic effects. The salience of power projection changes the relative importance of prices. The US places a comparatively high level of importance on its ability to project power and, therefore, should be more likely at least to deploy its military in order to secure the free flow of energy resources internationally, including in situations where its own supplies are not threatened. Why? Because its claim of global power status obligates it to protect its own interests as well as those of lesser capable states. Conversely, the EU places a relatively low salience on power projection, evidenced by its smaller and less capable military arsenal. The EU simply does not have the capability or reach to wage sustained operations far from home and, therefore, should rarely resort to armed force, and if so only in cooperation with other equally powerful states or a single more powerful one such as the US.

Finally, no matter how important energy supplies are for either economy, supply availability should always be of greater importance to the US because of its fuel intensive military. Therefore, when prices rise, we should be able to observe that the US invests greater effort with greater urgency to develop alternative fuels for its military. The primary historical example of this is the development of its nuclear navy between 1950 and 1965. Have there been cases of this since? Has the EU deployed military force unilaterally to protect its energy flows? Have the two really developed discernable patterns in response to common energy crises that substantially differ in the short to medium term of few years to a decade? To answer these questions, we will now examine four common cases.

4.1.1. *Focus on common cases and on oil*

Because the EU and US are such very different international actors, it is helpful to identify common cases where incidences of energy price shifts and supply availability have a similar economic effect on both parties. To do this we must focus our efforts on energy themes that are common to both. Petroleum provides the best standard of measure for two reasons. First, both the US and the EU are almost entirely petroleum dependent for their commercial transport sectors and military mobility. While both rely on various mixes of fuels for their electricity and residential heating, and do so in vastly different mixes between their Member States, oil dependency largely is uniform across both parties. Second, since the first ships began transporting oil through the Suez Canal in the late nineteenth century, oil has increasingly become an international commodity. When oil futures trading opened in New York in 1983, the transformation was completed. Major disruptions in any large producing country, as well as increases in international or seasonal demand will spike prices everywhere.

This is not the case for other major energy commodities. Electricity and natural gas are largely regional matters, the vast majority delivered through lengthy transmission networks and transnational pipelines respectively. Disruptions of gas flows in Russia may affect prices in Europe, but they have little effect on US prices, and breakdowns in Canada or the US electricity grid has no direct effect on Europe. Importantly, the gas sector is changing. Recent advancements in liquefaction and shipping have introduced a new international market in the trade of Liquefied Natural gas (LNG). However, the LNG market was only in its nascent stages in the mid 2000s and there is not yet enough data to make a sound comparison with oil or coal as a shipped commodity. Coal is incompatible for our needs for different reasons. It is similar to oil in that it is mined in numerous countries and shipped around the world. However, more like gas, it is not used to power the industrial world's mobility, but rather its electricity and heating sectors. Coal to liquid technologies may change this if they are successfully commercialized in the future.

For the moment, however, oil is the unambiguous common denominator to compare EU and US responses to changes in pricing and supply flow. There are several recorded cases of oil supply disruptions and more than a few cases where oil prices have either been cheap or expensive for extended periods of time. To select appropriate cases, therefore, we must first make a simple division between cases of high price and low price and then set some temporal and geographic markers.

Time constraints and two low price cases

Temporal constraints require us to exclude all cases prior to the 1970s. The logic behind this is rooted in the distinctive differences in the importance of foreign oil to Europe and the US and nature of the political relationship between the EU's most powerful Member States. To begin with, the US only began importing significant amounts of oil in the late 1940s, and it only became relevant in 1948 when domestic consumption in the US exceeded imports for the first time (see page 148). Thus, no case prior to World War II can be considered as common for the EU and US, and that excludes quite a few incidences where the lack of oil was an essential component of domestic political decision making in the UK, France, and Germany.

We also can exclude all cases prior to Europe's first attempts to unify its political and military spheres under a common banner. It is impossible to refer to Europe as a group prior to the period of 1950 to 1954, when France pushed for political and military union (see page 130). That attempt failed and two years later France joined future EEC Member, the UK, in attacking the Suez Canal (see page 130), which in turn soured relations between the US and France. A little over year later, the EEC was born. Hence, we can exclude all cases involving the EU and its predecessors prior to January 1958. Further, over the course of the subsequent two decades, France and the UK lost most of their colonial holdings and the US became mired in a war in Vietnam; two very distinctly different paths. Indeed, it was not until the early 1970s, when the UK joined the EEC and many of the major oil exporting countries (excluding the US and Soviet Union) began to expropriate American and European petroleum assets that we begin to see a common basis to compare the two. By 1973, the economic playing field between the US and the EEC was leveling. Both had become sorely dependent on foreign oil from the Middle East; and Europe's post-war recovery was well underway. Therefore, our starting point to look for cases cannot predate 1970.

As presented initially on page 69, the price of oil exceeded or fell below the historic average a total of 18 times since 1861. During more than a hundred of the years on record, the price settled below the historic average. When it fell below the marker in 1921, it remained there until 1973. It would drop again in the mid 1980s and edge just above the average for a few short years until dropping again in the 1990s, before beginning its most recent climb in 2000. Because we want to check whether the EU and US reduce cooperation and cut energy research budgets during times of cheap prices and free flow, we can therefore initially identify two common cases of relatively cheap prices. These would be (1) the mid 1980s (the years of declining oil prices and endangered flows) and (2) the 1990s (the years of low oil prices and free flows).

4.1.1.1. Shared versus unique playing fields and the two high price cases

In addition to the temporal factor, we also have to consider geography. While the EU and US share some common playing fields, there are several areas of the world that are either of unique value to each party or of such lesser importance in terms of their core interests that they do not constitute a common basis for comparison. What we are looking for then are cases where both the US and the EU have a common denominator of interests.

By the 1970s, both Europe and the US relied heavily on the Middle East for oil. Throughout the 1950s and 1960s, European and American companies invested fortunes into concessions in Iran, Iraq, Libya, and Saudi Arabia and French companies invested heavily in Algeria. Outside of the region, there were other sources of oil, but none where Europe was so heavily engaged or reliant. This is not true for the US, which received vast amounts of oil from Venezuela and Mexico. When we add power projection into the equation, our list of possible common cases shrink even further. Europe was in no position after World War II to project force outside of its immediate neighborhood. Thus, we can exclude all cases that are outside of Europe's reach, including the 2004 crisis in the oil market caused by general strikes in Venezuela. Even had Europe made a concerted effort to act then and there, it would not have been able to bring military force to bear. The same is true for the ongoing territorial disputes over the resource-rich Spratley Islands in the South China Sea and alleged conflicts over Arctic are just that; they have not yet occurred.

The limited geographic reach of Europe and the global reach of the US makes Europe's access to and dependency on specific oil producers the common denominator for identifying our common high price cases. The list is long despite this constraint. We could draw from multiple brief periods of disruptions in Nigeria and Algeria, the 1980s American boycott of Libya, the run-up on oil demand caused by the emergence of China and India, and the EU's open competition with Russia for access to Caspian oil. However, in order to observe changes in state behavior not only towards increased international cooperation, intervention, or restraint as well as internal change in the support for energy research and development, we need to look at longer periods of sustained pricing and supply availability. The best extended case on record for high prices and restricted flows is the period from 1973 to through 1980 when first the OPEC boycott and then the Iranian Revolution cut off supplies and sent oil prices skyrocketing to historic highs. Thus, our third overall case and first high price case will be (3) the two oil crises of the 1970s (the years of high prices and restricted flows).

Finally, to allow us to examine the most recent evidence of EU and US behavior in relation to high prices, we will examine the Post 2003 high price period (the years of rising oil prices – and

endangered flows) as our fourth (4) and final case. Doing so opens the analysis to the maturation of Europe's political union (1993), its numerous enlargements (1973, 1981, 1986, 1995, and 2004-2007), and allows for changes in US or EU orientation toward power projection in the extended post-Cold War and immediate Post-911 eras. Furthermore, because of its recent nature, extended period, and relationship the world's most recent wars and trouble zones, it provides the most up-to-date test of our model.

4.1.2. Case order, grouping, and components

Our four cases are divided into two groups. Each group consists of two cases. In one group, the price of oil was cheap or on the decline and in the other, it was high or on the rise. Importantly, we must recognize that none of the periods are perfect price case matches. Because prices are never constant, we must allow for spikes and drops within each period. For example, during the 1973-1981 period of high prices, year on year price changes ranged between 200 and -12 percent, but notably these were toward the beginning and end of the period. Further, consumption patterns tend to change with price. An analysis of oil prices in one year versus the change in consumption in the following year between 1965 and 2009 reveals that higher prices lead to lower consumption about 29% the time worldwide and about a third of the time in the US and EU. The relation is even stronger in the year on year changes in consumption and production patterns, where an increase in worldwide consumption in year one leads to an increase in worldwide production in year two about 70% of the time.

Table 23: Relationship between oil price in Y(1) and ...

Consumption of oil in Y=1+1		
	World	-29.00%
	US	-33.5%
	EU Majors	-38.10%
Production of oil in Y+1		
	World	69.60%
Source: Based on BP (2010) data; EU Majors refers to France, Germany, Italy, and the UK.		

Each group contains one case with lasting seven or eight years and one case each of relative high and low price volatility (the standard deviation of year to year price fluctuations). Also, across those cases where prices were low or declining, world production and consumption tended to increase above 10%; and in the years where it was expensive neither production nor consumption grew by more than 8% (See Table 24).

Table 24: Case overview

Class	Start	End	Duration	Price Change (\$2009)	STDV.P	World Production	World Consumption
low / declining	1982	1989	7	-57%	\$18.21	12%	13%
low / declining	1991	1999	8	-27%	\$4.34	11%	13%
high / rising	1973	1981	8	434%	\$0.76	2%	7%
High / rising	2002	2009	7	107%	\$22.49	7%	8%

Each case study presented below will consist of four parts. The first part presents an overview of the case period beginning where necessary with a brief background on the preceding years for context and an examination of what happened to price and supply availability over the period. This is followed by an analysis of the EU and US responses in terms of their respective external strategies and internal approaches to substitution. Each case is concluded with a summary of findings as relate to our nine hypotheses.

4.2. The low price-cases

4.2.1. 1980s (dropping oil prices – increasing flow)

The early 1980s were years of recession and collapsing oil prices. They were also years of heightened Cold War tensions, a massive military buildup by the US and USSR, and the outbreak of the Iran-Iraq war and subsequent tanker war in the Persian Gulf. The decade began with the world reeling from the two oil crises of the 1970s, which had sent prices skyrocketing and severely damaged supply flows. The world responded to those shocks in three important ways.

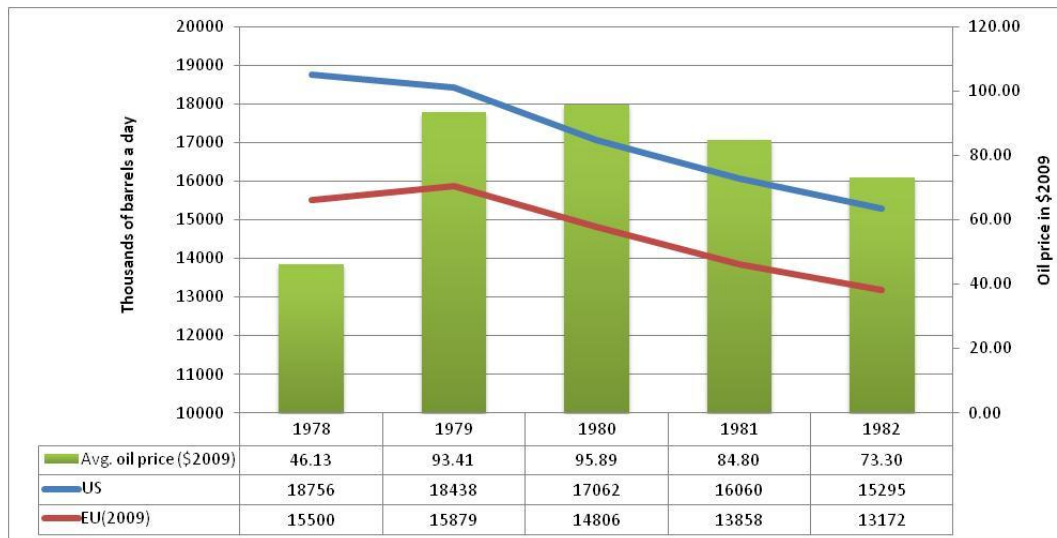
First, global energy consumption declined by 2.8% between 1979 and 1982 and global oil consumption declined by 9.7% over the same period (OECD, 2010).²⁸⁹ This was accompanied by a worldwide recession, which saw an annual increases in overall OECD GDP²⁹⁰ decline for each of the four years and by 0.3% overall between 1980 and 1982, the first such decline on record. By 1981, the nominal price of oil (\$35.93) rose to 992% of its 1973 departure point of \$3.29 (434% from \$15.89 to \$84.80 in \$2009). Spot prices peaked in October 1982 at just over \$35. The

²⁸⁹ All GDP related figures presented here and in subsequent paragraphs is from the OECD (2010).

²⁹⁰ Measured in millions of Current Prices and Current Exchange Rates in USD

prolonged price spike sapped demand for oil in both the US and the six Member States of the then EEC as higher energy costs drained their respective economies. Between 1982 and 1989, EEC oil consumption declined by as much as 2 million barrels a day and US consumption by as much as 1.2 million.²⁹¹

Figure 37: Oil prices and consumption 1978-1982

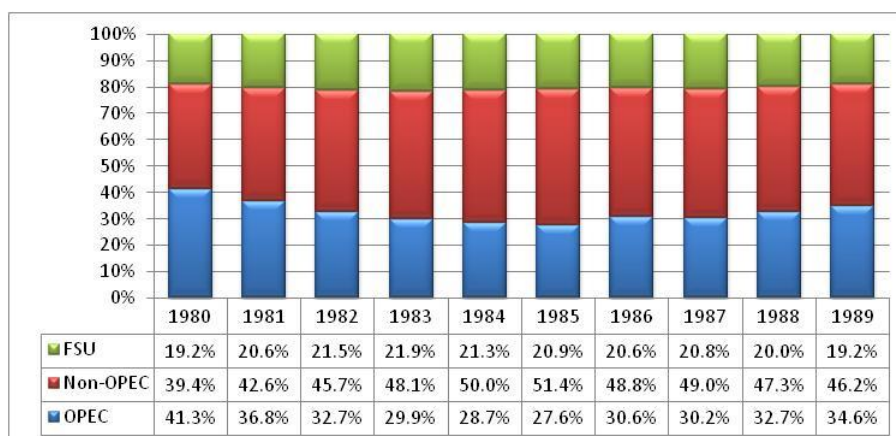


Source: BP (2010)

Meanwhile, higher prices made it economically feasible to begin exploration of harder to reach resources. North Sea oil, aggressively explored in the 1970s because of the higher profitability resulting from higher prices began flowing into the market. The UK and Norway together were producing 2.6 million barrels a day in 1982. By 1989, they were producing almost 3.5 million barrels a day. Although US production declined over the period, worldwide production exploded. By 1982, non-OPEC producing countries had begun to replace OPEC's 1970s reductions, adding 4.5 million barrels a day in comparison to 1977. They now accounted for 67% of world production, almost double the share from 1973. Moreover, non-OPEC production continued to climb through 1985, sending OPEC's share of world production to a nadir of 27%. Finally, the previous period's higher prices split OPEC as its producers sought to rake in the enormous rents. Instead of cutting production to offset those increases, Iraq, Kuwait, and Oman added two million barrels a day between 1982 and 1985. The result was that by the middle of the 1980s, the world oil market was literally flooded with surplus.

²⁹¹ All energy pricing, consumption, and production figures come from BP (2010) unless otherwise specified.

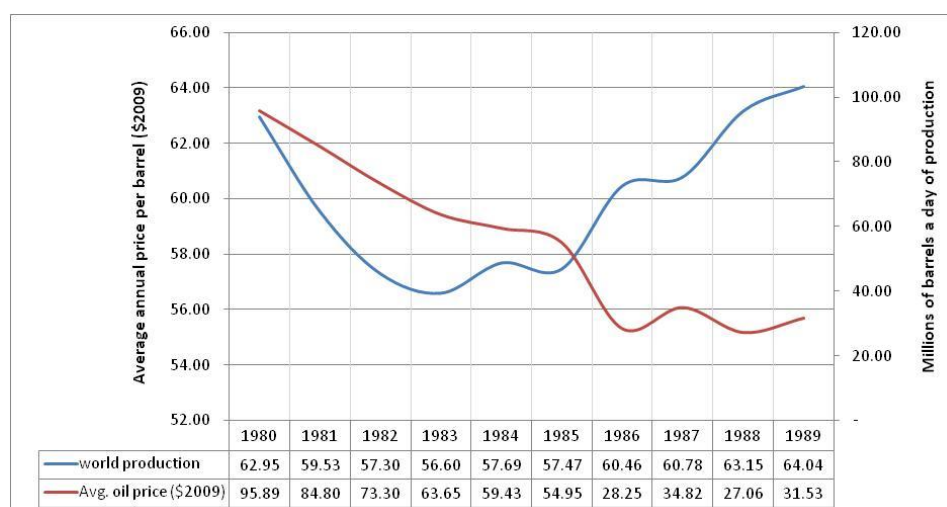
Figure 38: Distribution of global oil production 1980-1989



Source: BP (2010)

In addition to changes in production and consumption, the market itself changed. New suppliers emerged, both as a result of new production and the expropriation of western oil companies in the Middle East and South America, creating new opportunities to trade oil free from the vagaries of Arab politics. In late March 1983, the New York Mercantile Exchange (NYMEX) introduced the option to buy and sell crude oil future contracts, essentially transferring price-setting powers to free market control. By the time futures trading began, spot prices had already dropped off 8% from their 1982 peak. Despite efforts by OPEC to raise the well-head price, the damage of a flooded and far more diverse market prevented it from effectively increasing the price. Over the course of the next three and a half years, the price of oil collapsed by another 62% and between February 1986, when future prices fell below \$20 for the first time, and November 1989, when they started to rise again, the mean future was around \$17.22 and its standard deviation was \$2.47. Oil had become dirt-cheap and it was literally pouring into the market.

Figure 39: Oil production and prices 1980-1989



Source: BP (2010)

Finally, the equalizing effect of new production largely marginalized the power of Arab oil producers, but it in no way reduced their geopolitical relevance. The war between Iraq and Iran spun rapidly out of control in the early months of the conflict. Both sides began attacking the other's oil facilities in order to weaken their opponent's war-making capabilities. By one account (Stagliano, 2007), the first three months of that conflict resulted in a three-month long disruption of as much as three million barrels a day. As the war progressed, and the ground war stalemated in 1984, the principle combatants began mining the Persian Gulf in order to cut off the other's revenue flows. Although little oil was actually lost during this period of heightened tensions, the mere threat that mines could disrupt flows out of the region was enough to provoke a military response. Both the US and the EU sent escort ships to the region. The US also reflagged Kuwaiti and other vessels. As the conflict wore on, Iran threatened to close the Strait of Hormuz, which in turn provoked the Reagan administration to establish a permanent naval presence in Gulf. Altogether, there were over 300 separate Iraqi or Iranian attacks (including mines, air strikes, and surface ship attacks) on international oil tankers between 1980 and 1989. Therefore, not only does the 1982-1989 low price case provide us with an example to test behavioral changes toward substitution, it provides an excellent case to test the hypotheses pertaining to external cooperation patterns in the form of responses to explicit threats to supply availability.

4.2.1.1. EU response

As oil prices started to decline and flows began to increase in 1982, the impetus for coordination that had existed in the previous decade rapidly receded. Although the foundational idea of a common energy policy had been laid during the dual 1970s crises, Member States had made little progress in enacting a common response, and progress toward internal deregulation of their respective concentrated energy markets had fallen victim to divergent national priorities. Each Member had followed its own path forward making progress toward achieving the 1975 established goal of increasing the use of nuclear power. However, differences between their respective national energy balances continued to hamper coordination. France emphasized nuclear power; as did Germany until the mid decade Chernobyl accident dampened public support for further development, and the UK focused on increased oil production in the North Sea (see Table 25 below). However, EU energy consumption patterns between 1982 and 1989 were most remarkable in the overall reduction of oil consumption (see Table 26 below).

Table 25: Nuclear power consumption in annual terawatt-hours

	1979	1981	1983	1985	1987	1989
France	40.0	105.3	144.3	224.2	265.6	304.0
Germany	52.1	65.5	78.1	138.7	141.7	161.7
UK	38.3	38.0	49.9	61.1	55.2	71.7
EU(2009)	192.5	306.6	398.3	616.0	691.5	793.1
Source: BP (2010)						

Table 26: Oil consumption in thousands of barrels a day

	1979	1981	1983	1985	1987	1989
Germany	3380	2788	2592	2670	2747	2593
France	2434	2059	1881	1792	1846	1879
UK	1947	1559	1531	1630	1608	1744
NL	857	743	623	635	706	735
BE/LUX	560	499	434	431	489	502
Ire	129	104	84	82	88	83
Greece	248	238	232	244	269	305
Italy	2081	1940	1821	1732	1851	1931
Subtotal	11636	9930	9196	9214	9604	9770
EU(2009)	15879	13858	12820	13114	13537	13764
Source : BP (2010)						

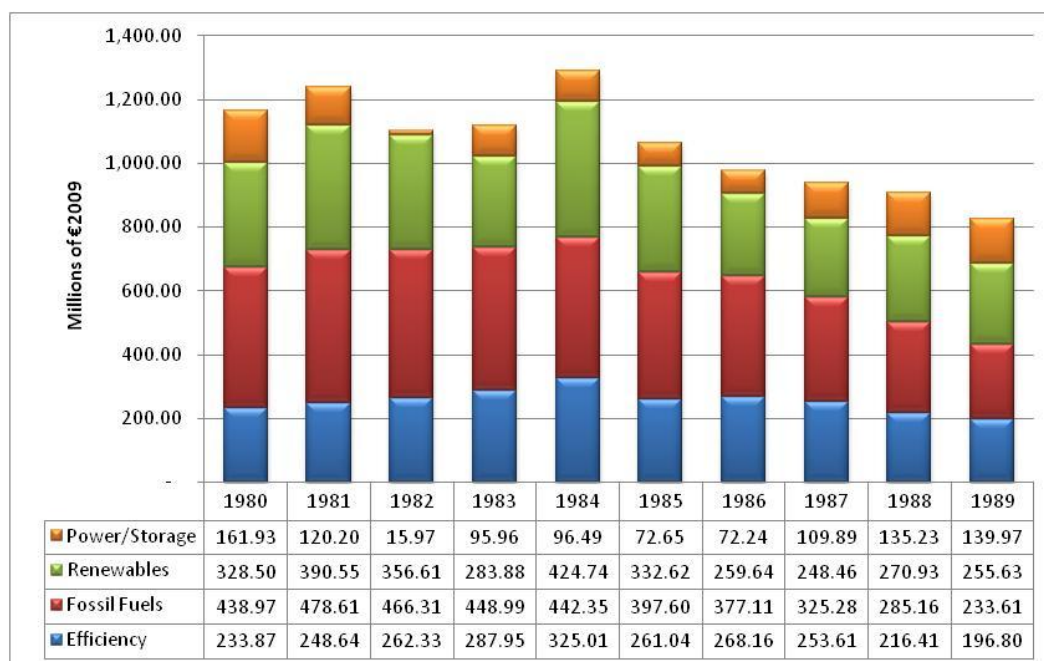
Thus as the decade wore on, oil was becoming cheaper, there was more of it flowing in the international market, and Europe was consuming less of it. Although consumption began to rise again in the mid 1980s, the EU was consuming less oil on a daily basis in 1989 than it was in 1979. Further, as the economic woes of the early 1980s took hold, Europe's Member States focused inward, cooperation between the Member States decreased as each sought first to address their own domestic economic needs. Indeed, throughout the 1980s the EU demonstrated very little internal or external multilateral cooperation on the energy front beyond setting intentions. This affirms the EU half of the first hypothesis (H1) that both the US and the EU will adopt market-commodity approaches (i.e. the lowest common denominator of cooperation) under low-price-free-flow circumstances.

Still, it is important to note that the terms of hypothesis one (H1) are not fully met by the EU case. Indeed, the wording itself may be misleading. Throughout the period, the Member States may not have cooperated, but France certainly intervened in its own energy infrastructure, pushing increased nuclear power through national mandate. Conversely, the UK under Prime Minister Margaret Thatcher began liberalizing her country's economy opening up expanded opportunities to drill and produce oil off the English coast. Thus, it is somewhat misleading to argue that the EU

developed a 'Market-Commodity Approach' in the broader sense of its meaning. Still, if we examine the EU as a whole, and consider that as a group there was little cooperation and virtually no coordinated top-down intervention and rule making, we can broadly say the EU did uphold the principle if not the spirit of a reduced interventionist approach.

A similar trend is revealed in the area of energy research and development (ERD). In fact, the 1980s evidenced two trends in the EU's approach. First, overall ERD investments in non-nuclear ERD tailed off by €337 million (in €2009) between 1981 and 1989 (a decline of 29%) while the total including nuclear and other non-specific research fell by over €1 billion (a similar 28%). Nuclear ERD accounted for 68% of total funding over the period, but annual funding for nuclear fission and fusion declined by 40% by over the period. Meanwhile, the distribution of the reduced ERD changed. Fossil fuels research declined from 10.9% of all funding in 1981 to 8% in 1989 and from 34% to 18% of non nuclear ERD. Investments in energy efficiency rose in the early part of the decade in the aftermath of the 1970s crisis, but then began to decline from 1985 onward, finishing the decade 16% below where it started in 1980. Research funding for renewables also declined by 22% from beginning to end of the period (see Figure 40 below). In fact, the only area that received increased funding was the category of 'other', which primarily included energy systems analysis (see Table 27 below). The record shows that as oil prices declined over the period, so too did EU interest in developing substitutes. This seems to confirm half of the seventh hypothesis (H7) that the EU will reduce ERD investments considerably under conditions of low prices and free flows. The fact that there is a demonstrable decline in EU ERD during a period of declining prices and increasing flow also falsifies the EU half of hypothesis nine (H9), one of our null hypotheses, that the EU or its Member States will not change their investments strategies toward substitutes when conditions of prices and flows change.

Figure 40: EU non-nuclear ERD in the 1980s



Source: International Energy Agency (IEA) (2010c)

Table 27: EU ERD funding in the 1980s

EU-12 1980s			
	1980	1989	Change
Efficiency	233.87	196.80	-16%
Fossil Fuels	438.97	233.61	-47%
Renewables	328.50	255.63	-22%
Nuclear Fis./Fus.	2,730.80	1,638.68	-40%
Hydrogen/Fuel Cells	-	-	
Power/Storage	161.93	139.97	-14%
Other and Analysis	117.35	433.32	269%
Total ERD	4,011.45	2,897.99	-28%
Annual share			
Efficiency	5.8%	6.8%	16%
Fossil Fuels	10.9%	8.1%	-26%
Renewables	8.2%	8.8%	8%
Nuclear Fis./Fus.	68.1%	56.5%	-17%
Hydrogen/Fuel Cells	0.0%	0.0%	
Power/Storage	4.0%	4.8%	20%
Other and Analysis	2.9%	15.0%	411%
Annual share of non-nuclear			
Efficiency	18.3%	15.6%	-14%
Fossil Fuels	34.3%	18.6%	-46%
Renewables	25.7%	20.3%	-21%
Hydrogen/Fuel Cells	0.0%	0.0%	
Power/Storage	12.6%	11.1%	-12%
Other and Analysis	9.2%	34.4%	275%

Source: International Energy Agency (IEA) (2010c)

What is particularly interesting about the 1980s is that not only did oil prices decline and flows increase, there also were serious threats to Europe's oil supplies and this did cause a military response by at least some EU Member States. The actions of the EU Member States during the so called 1980s Tanker War at least in part contradicts hypothesis five (H5) that posited the EU will never seek conflict even when prices are high and flow is restricted. Still, we cannot dismiss the hypothesis in its entirety. While EU Member States acted individually, there is not enough evidence to point to a unified EU response.

In the mid 1980s as the ground element of the Iran-Iraq War reached a stalemate, the two countries began mining the Persian Gulf and attacking international tankers in order to cutoff each other's source of income. European ships became targets (See Table 28 below). In response to those attacks, several EU Member States sent warships and minesweepers to the Persian Gulf in order to escort tankers. The UK and France deployed armed helicopters, equipped with advanced countermeasures to the region (Cordesman and Wagner, 1990:XIV, 23). Since France's ships were attacked exclusively by Iran, Paris took sides with Iraq, first loaning five Exocet (anti-ship missiles) armed Super Entard fighter jets and then selling some thirty Exocet-equipped Mirage F-1 fighters in 1984. One of those planes later attacked the US Guided Missile Frigate, the *USS Stark*, in 1987. Germany, which was legally restricted from sending forces abroad, relied on the US and others to protect its ships, while it stationed several warships in the Mediterranean to make up for their allies' relocation. In short, the 1980s provided an intriguing situation whereby oil prices were cheap and flows were generally plentiful, but had periods where threats to that flow existed; and in response, the EU did not sit passively by and ignore the situation. When its energy supplies were threatened directly by military force, the EU responded in kind, if only defensively.

Table 28: EU flagged ships targeted by Iran and Iraq, 1979-1987

Flagged Vessel	Attacked by Iran	Attacked by Iraq
France	5	0
Greece	10	22
Italy	1	1
Netherlands	0	2
Belgium	1	0
Spain	3	0
Germany	1	4
Source: Cordesman (1990:Chapter XIV, p.7)		

Finally, the EU's behavior in response to the threat of disruptions caused by the 1980s Tanker War indicates that we can initially evaluate two more of our hypotheses. Hypothesis eight (H8), a null

hypothesis which claims that both the US and the EU will never enter into conflict in energy rich areas when energy prices are high or disruptions are imminent is at least in part falsified. The EU response (or the sum of actions carried out by its Member States) proves one important aspect to be false. Although prices were never high during the period and disruptions only occurred at the onset of the Iran-Iraq War (1980-1981), the threat of disruptions resulting from attacks on tankers sailing the Gulf did in fact lead to EU military intervention.

It is important at this juncture to restate the difficulty in referring to the EU as a unified or single international actor.²⁹² Security and foreign policy decision making remained squarely under the sovereignty of the individual Member States and we can hardly refer to the actions of individual Member States as equaling EU action. Nevertheless, the Council did express 'concern' in 1984 that increasing tensions between Iran and Iraq could "endanger the freedom of navigation in the Gulf" (European Communities, 1984). Given that the EU itself lacked the legal framework to jointly coordinate foreign military activities, the Member States turned to the dormant Western European Union (WEU) in order to coordinate their activities. In October 1984, they agreed to reactivate cooperation under the WEU framework via the Rome Declaration. Four years later, the Member States launched a two-year, coordinated minesweeping effort in the Persian Gulf.²⁹³ Hence, although we cannot say that the EU acted as a single player, six of its Member States did in fact coordinate their military actions under the auspices of another accompanying alliance.

Despite the evidence that EU Member States did in fact militarily cooperate in response to supply threats from the Persian Gulf, their limited response in relation to that of the US, which sent a full fleet to the region and directly engaged in hostilities with Iran, initially demonstrates that part of hypothesis four (H4) seems to be correct. Hypothesis four posits that under restricted-flow circumstances, the EU, which places lower salience on SAPP, would be less likely than the US to resort to military means to secure either access or flow. Given the nature of the EU's response (or

²⁹² For a further explanation of the difficulties in analyzing the EU as a unified or solitary international actor and comparing it to the US see pages 59 to 60.

²⁹³ Their actions were taken under the authority of Article VIII (3) of the Brussels Treaty. Labeled 'Operation Cleansweep', the navies of Belgium, France, Italy, the Netherlands, and the UK cleared a 300-mile stretch of sea lanes around the Strait of Hormuz; and Germany, otherwise restricted from foreign military operations, sent ships to the Eastern Mediterranean to relieve its allies' redeployments. A year after the Iran-Iraq War ended (1989) the Member States continued their cooperative efforts in executing humanitarian actions during 'Operation Safe Haven' in Northern Iraq (1991). For a detailed discussion of the role of the WEU in the Tanker War see Duke (2000), particularly Chapter Two, 'The Rebirth of European Security' and specifically pages 77-79. Also see Gnesotto, Roper and Western European Union. Institute for Security Studies. (1992), particularly pages 162-167; and for a specific accounting of EU Member State naval deployments see Cable (1988).

more precisely the coordinated efforts of six of its Member States) to limit their actions to minesweeping, this seems to be affirmed. This does not mean, however, that H4 is affirmed in full because for that to be so, we would need to test a case where prices were both high and flows restricted; and throughout the 1980s prices were low, despite increased threats to the flow of supplies.

4.2.1.2. *US response*

The US responded to the 1980s decline in oil prices in a predictable manner according to our hypotheses. As the price declined and flows increased, the US reduced both the level of external energy cooperation and largely liberalized its domestic energy sector. As mentioned in the chapter on the Evolution of US energy policy, the Reagan-Bush-Clinton years witnessed a wholesale reversal of the country's approach to energy policy. Emphasizing the country's strong natural inheritance of fossil energy resources, the US lifted almost all regulations and price controls and redirected ERD investments away from substitutes into basic research. Although the US did pour money into ERD, almost all of it went into developing military technologies, from nuclear weapons to anti-ballistic missile lasers. It decommissioned the government-run Synthetic Fuels Corporation, the paradigm of an attempt to promote substitute fuel, and repealed its windfall profits tax placed on oil companies during the late 1970s.

Similar to the EU, in the early years of the decade Americans were consuming less oil. However, this would change in the mid of the decade as prices became so cheap that consumers again began to ramp up consumption (see Table 29 below). By the end of the decade the US was consuming almost 14% more oil than it had in 1983.

Table 29: US oil consumption 1983-1989

	1983	1984	1985	1986	1987	1988	1989
Thousands of barrels a day	15235	15725	15726	16281	16665	17283	17325
Source BP (2010)							

As oil became cheaper and more of it flowed on the international market, the US economy started to grow and Americans began consuming more. Meanwhile, the focus of the new Reagan administration was unabashedly oriented toward reduced government intervention at home and reduced economic cooperation worldwide, unless that cooperation was oriented toward an overall reduction of government intervention everywhere. Indeed, during the 1980s the EU-US

relationship weakened significantly, while the US-UK relationship expanded. Both were led by politicians seeking to liberalize their economies; and the US was primarily focused on a massive military buildup to counter the Soviet Union. To a certain extent, this affirms the second half of the first hypothesis (H1) that both the US and the EU will adopt market-commodity approaches (i.e. the lowest common denominator of cooperation) under low-price-free-flow circumstances. Indeed, that is precisely what happened in the US case throughout the 1980s price decline period. Still, the evidence is not sufficient enough to proclaim causality. While the US clearly adopted an MCA approach during the 1980s, the cause need not only have been lower prices and expanded flows of oil. The ideological orientation of the Regan administration seems to be a far more important factor in the calculation. Thus, we find in the US case that there appears to be a correlation between lower prices, free flows, and reduced international cooperation on the energy front (i.e. little to no serious cooperative engagement on the issue).

In terms of ERD, the US showed a similar pattern to that of the EU, dramatically reducing its overall ERD investments by 51% in the 1980s from €5 billion in 1981 to €2.5 billion in 1989 in €2009. Similar to the EU, the US consistently reduced its support for nuclear research, even though it was pouring funds into the development of nuclear weapons. While funding for the nuclear ERD areas was cut in half, funding for ERD into renewables was reduced by 87%, fossil fuels by almost 60%, and investments into efficiency improvements by almost 50%. Over the course of the 1980s, as the US first faced a recession, then experienced a massive liberalization of its energy sectors, and oversaw the initial commercialization of energy futures, the US virtually shut down public financial support for the search for substitute fuels. Moreover, if one excludes nuclear and nuclear-military related investments and then examines the investments in efficiency, fossil fuels, and renewables, one sees a clear indication that the US prioritized ERD in the area of fossil fuels and energy systems analysis (other). In other words, the only non-nuclear areas essential to power projection, the discovery and development of fossil fuels and coal to liquids, became the focus of US research (See Table 30 and Figure 41 below).

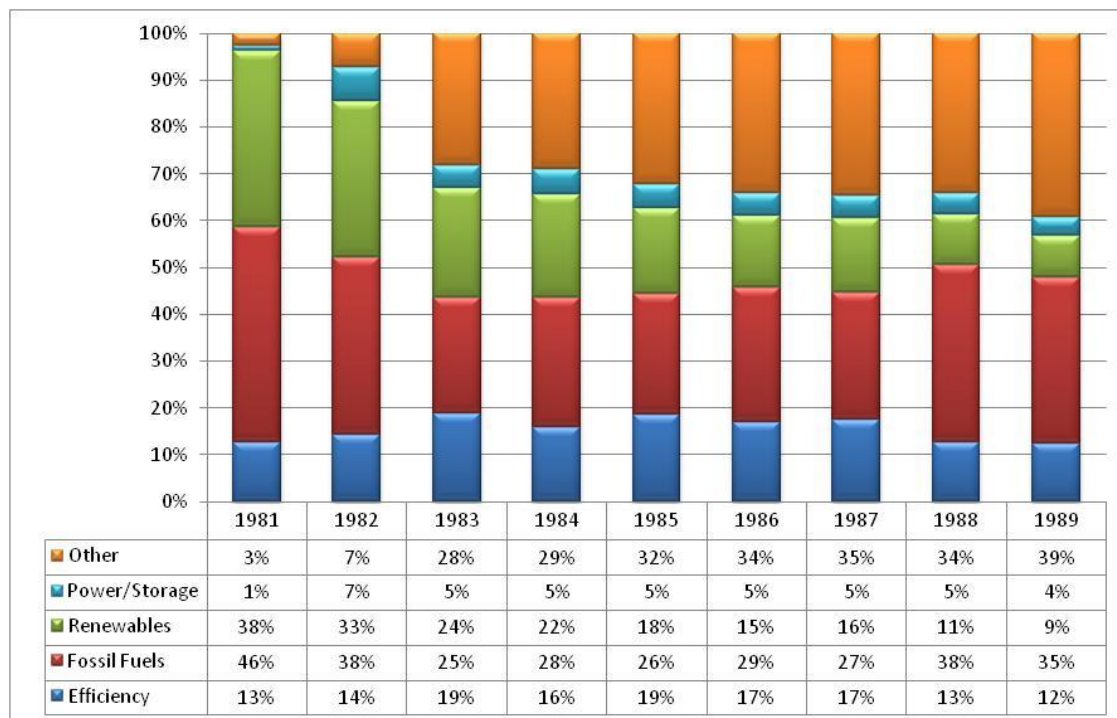
Therefore, in terms of its investments into substitutes, the US response completes the affirmation of the seventh hypothesis (H7) that the US will dramatically reduce investments under conditions of low prices and free flows. It also affirms the falsification of the ninth hypothesis (null hypothesis H9) that the US will not change its investments strategy toward substitutes when conditions of prices and flow change.

Table 30: US ERD focus 1981-1989 in millions of €2009

	1981	1982	1983	1984	1985	1986	1987	1988	1989	Change
Efficiency	341	207	290	217	280	226	203	170	180	-47%
Fossil Fuels	1228	547	381	375	386	385	319	507	513	-58%
Renewables	1005	482	364	298	274	203	185	146	129	-87%
Nuclear Fis./Fus.	2324	2414	2051	1675	1537	1395	1245	1209	1018	-56%
Hydrogen/Fuel Cells										
Power/Storage	30	103	75	74	78	65	54	60	56	84%
Other	73	105	434	392	485	455	405	459	569	684%
Total ERD	5000	3859	3595	3030	3040	2730	2411	2551	2465	-51%
Y_Y Change		-23%	-7%	16%	0%	-10%	-12%	6%	-3%	
Annual share										
Efficiency	7%	5%	8%	7%	9%	8%	8%	7%	7%	7%
Fossil Fuels	25%	14%	11%	12%	13%	14%	13%	20%	21%	-15%
Renewables	20%	13%	10%	10%	9%	7%	8%	6%	5%	-74%
Nuclear Fis./Fus.	46%	63%	57%	55%	51%	51%	52%	47%	41%	-11%
Hydrogen/Fuel Cells										
Power/Storage	1%	3%	2%	2%	3%	2%	2%	2%	2%	272%
Other	1%	3%	12%	13%	16%	17%	17%	18%	23%	1490%
Annual share of non-nuclear										
Efficiency	13%	14%	19%	16%	19%	17%	17%	13%	12%	-2%
Fossil Fuels	46%	38%	25%	28%	26%	29%	27%	38%	35%	-23%
Renewables	38%	33%	24%	22%	18%	15%	16%	11%	9%	-76%
Hydrogen/Fuel Cells										
Power/Storage	1%	7%	5%	5%	5%	5%	5%	5%	4%	240%
Other	3%	7%	28%	29%	32%	34%	35%	34%	39%	1350%

Source: International Energy Agency (IEA) (2010c)

Figure 41: Shares of US non-nuclear ERD, 1981-1989



Source: International Energy Agency (IEA) (2010c)

Finally, the US response to the 1980s Tanker War in the Persian Gulf seems to affirm several of our hypotheses and falsifies both of our null hypotheses. Although prices remained low throughout the period, the US responded to the mere threat of disruption by sending ships not only to protect US flagged vessels, but by 1986 began reflagging Kuwaiti vessels as well. In 1983, the Reagan administration took Carter's Rapid Joint Defense Force (RJDF) setup in the aftermath of the Iranian revolution and US hostage crisis, and established a special military command (Central Command) to oversee activities in the region and introduced new ships and technologies. The US navy began flying remotely powered vehicles over the Gulf (a forerunner to today's unmanned aerial vehicles (UAVs)). In 1987, the intense US presence and hostile relationship with Iran broke out in the form of an Iranian air strike on a US frigate using a French-made anti-ship missile, killing more than 37 sailors. The ship, which had been stationed in the Gulf since 1984, was severely damaged. Although the US did not immediately respond, it did do so when another warship struck a mine in 1988. The US then launched an attack on two Iranian oil platforms, destroying an Iranian frigate and several missile boats (de Risse and Kemp, 2009).

The massive US military response to a mere threat to the free flow of oil affirms that part of hypothesis three (H3), which pertains to US responses under circumstances of restricted flows, the US, which clearly places a premium on SAPP, demonstrated that it is clearly more likely to resort to military means and even armed conflict to secure either access or flow of energy resources when they are threatened. Still H4 is not affirmed in full because for that to be the case, we would need to test a case where prices were both high and flows restricted. The US' behavior in response to the mere threat of disruptions also indicates that we can at least in part falsify null hypothesis eight (H8), which claims that both the US and the EU will never enter into conflict in energy rich areas when energy prices are high or disruptions are imminent. At least part of this hypothesis is proven incorrect by the US response. Although prices were never high during the period and disruptions only occurred in the early 1980s, the continued threat of flow disruption from the oil rich Gulf did indeed lead to explicit US military engagement.

4.2.1.3. 1980s Summary

An analysis of EU or the cooperative actions of its most important Member States (see page 231) and US responses to the decreasing oil prices and increasing flows of the 1980s, as well the nominal threat to supplies which occurred during the Persian Gulf Tanker War allow us to initially assess several of our hypotheses. We were able to confirm one hypothesis, falsify three, and partially confirm another three. It seems safe to conclude on the basis of the 1980s case that the

US and will adopt a minimal intervention or MCA strategy when prices are low or declining and supplies flow freely (H1). In the EU case, this is less clear as Member States chose to intervene internally while not cooperating externally. However, the evidence suggests that both the US and the EU will in fact reduce their investments in ERD when prices drop and supply flows ease (H7). Likewise, this allows us to reject the null hypothesis positing that neither the US nor the EU will exhibit any change at all in the attitudes toward developing substitution fuels as manifested by their related investments (H9).

In both the EU and US cases, the predicted orientation toward military behavior (H3 and H4) seems to hold true. However, since the hypotheses only posit increased or decreased military intervention under the conditions of high prices and free supply flow, they cannot be affirmed definitively. Nevertheless, because both acted within the predictable parameters of behavior when supplies seemed threatened, we can initially assess both positively. Meanwhile, hypothesis five (H5), which predicted that the EU would never seek conflict when supplies become restricted and prices rise, must be rejected because the EU did in fact respond militarily to the threat of disruptions, even if it was of a more limited scale than the US. Likewise, this allows us to reject the null hypothesis positing that neither the US nor the EU will ever intervene militarily in energy rich areas when prices are high or disruptions are imminent (H8).

Table 31: Summary of affirmed/falsified hypotheses in Case 1

Hyp.#	Topic	US	EU	Evaluation
H1	MCA approach	True	Partly True	Partly True
H2	Coop approach			n/a
H3	US > military likelihood	Partly True		Partly True
H4	EU < military likelihood		Partly True	Partly True
H5	EU Never use military		False	False
H6	EU/US Increase ERD			n/a
H7	EU/US reduce ERD	True	True	True
H8	Null-never military	False	False	False
H9	Null-no change in ERD	False	False	False

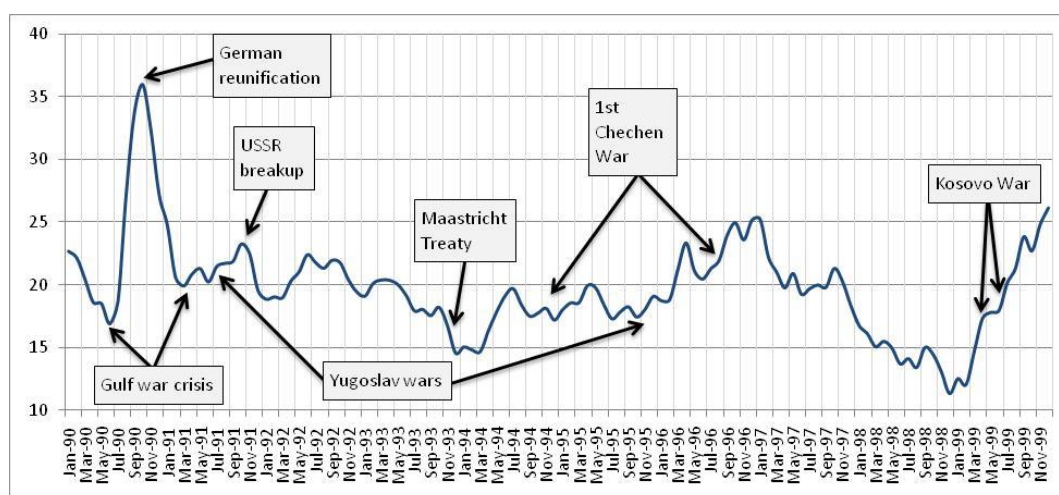
4.2.2. 1990s (low oil price – free flow)

Throughout most of the 1990s prices were low. In seven out of ten years, the international oil price hovered below the historical average. However, the 1990s were by no means docile years in the international energy markets as the global political landscape underwent significant changes. The disintegration of the Soviet Union in December 1991 brought about some of the most dramatic changes. Riding on the coattails of the end of the Cold War, proponents of liberalization

claimed that globalization had not only won, but that it had become universal.²⁹⁴ Unfortunately, this universal globalization was accompanied by almost universal chaos as conflicts erupted in Yugoslavia (1991-1995), Kosovo, (1996-1999), and Chechnya (1994-1996); even Afghanistan fell to the Taliban.

In Europe, major changes were the only constants. In early 1990, Margaret Thatcher resigned in the UK after more than a decade of leadership, ushering in a new era of UK-EU relations. The reunification of Germany, also in 1990, changed the internal EU balance of power, the recognition of which was manifested in a new treaty (1993, Maastricht) and another enlargement of the EU. Despite starting the decade in recession, by its close many of Europe's economies, Germany's in particular, were expanding steadily. Meanwhile, the US underwent one of its longest periods of economic expansion and joined with Mexico and Canada in the North American Free Trade Agreement. Its stock markets boomed as millions invested into technology and Internet companies. Indeed, after a rocky start to the decade, both Europe and the US were growing by mid decade and oil prices were very cheap (see Figure 42 below).

Figure 42: Nominal oil prices (NYMEX Futures-C1) and events in the 1990s



Source: United States. Energy Information Administration (2010)²⁹⁵

The decade began with a sudden and sharp but short-lived oil price shock caused by the August 1990 Iraqi invasion of Kuwait. Iraq had accused Kuwait of stealing its oil and overproducing its own, hence flooding the market, sinking prices, and ruining Baghdad's chances to successfully

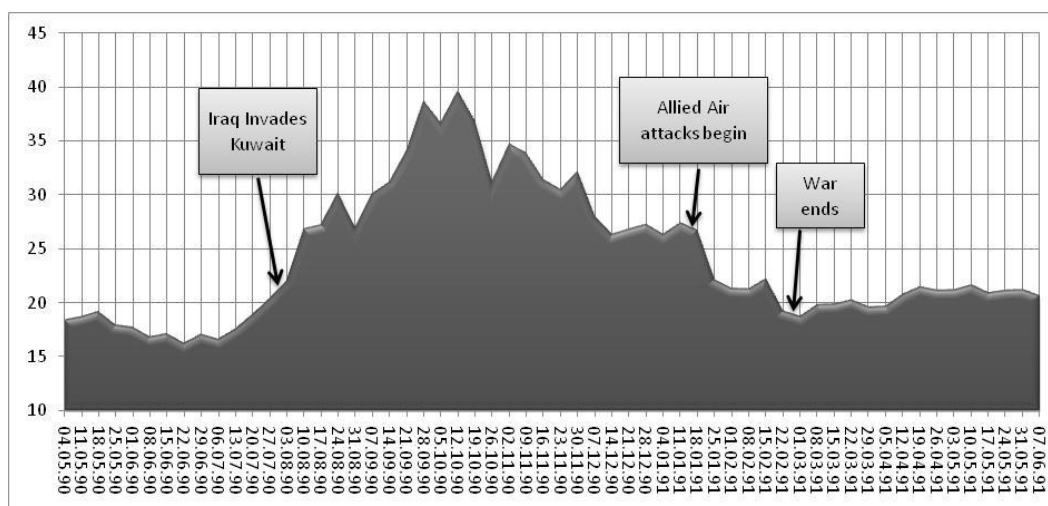
²⁹⁴ See Fukuyama (1992) and Friedman (2005) for versions of this narrative.

²⁹⁵ NYMEX Future C1 refers to the settlement price on the day listed (averaged per week) for the earliest delivery date, which in the case of crude oil is the third business day prior to the 25th calendar day of the month preceding the delivery month, or approximately one week before the start of every new month.

recover from its war with Iran. Within two weeks of the invasion, the nominal price had risen by 24% and by October, it was up 67%. Iraq's invasion of Kuwait not only threatened neighboring suppliers among the Emirates and Saudi Arabia. According to Stagliano (2007), it directly removed more than five million barrels a day from the market for a period of almost ten months, a shortfall filled by those most worried about Iraq's intentions, its immediate neighbors. Once again, both the US and at least some Member States of the EU met the threat to supplies with armed force, albeit to vastly different degrees.

After reaching a peak in December 1990, however, prices began to decline just as sharply as they had risen (see Figure 43 below). By January 1991, the nominal price had fallen below \$25, a threshold it would exceed only twice more and each only for brief periods at the end of 1996 and again in December 1999. In fact, nominal oil prices exceeded \$25 a barrel in only three out of the decade's 120 months. The Gulf war notwithstanding, the nineties thus present an almost perfect case of low prices and easy flows.

Figure 43: Nominal oil price changes (NYMEX Futures-C1) around the 1990-1991 Gulf War



Source: United States. Energy Information Administration (2010)

Three additional factors are important in understanding the context of the 1990s low price free flow period. First, while prices remained low, global production exploded (see Figure 44 below). By 1999, there were in excess of seven million barrels a day more on the market than in 1991 (see Table 32 below), including a one third increase in EU oil output; and all of that growth came alongside significant reductions in Iraqi exports and a decline in US production over the period. Second, efficiency programs installed in the previous two decades were working in the sense that US and EU consumers were doing more with every single barrel of oil they were consuming. Thus as time progressed, every increase in consumption was actually resulting in greater economic

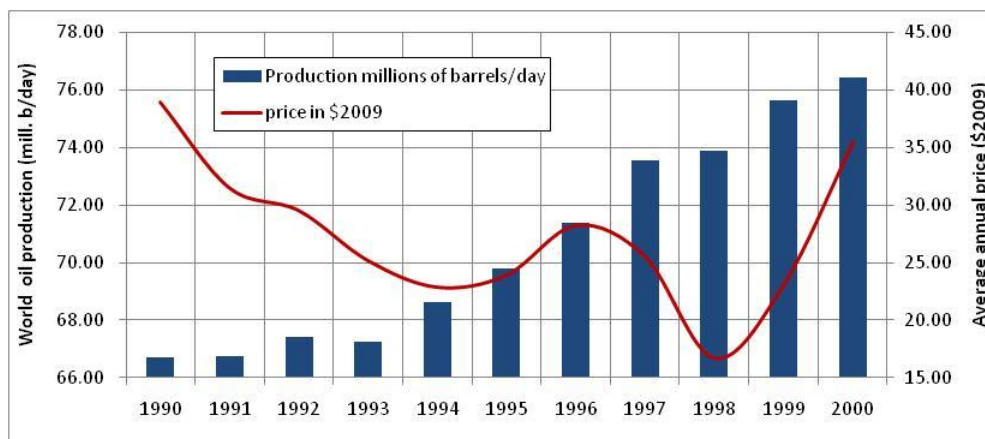
output.²⁹⁶ Third, by the middle of the decade, global warming had formally taken its place as a major international political issue and it increasingly was being tied to energy issues. Starting in 1995, the United Nations Framework Convention on Climate Change (UNFCCC) began to coordinate international efforts to reduce carbon emissions through annual summits on climate change. Through that development, the EU in particular found an issue that its Member States could agree on, and thus the Union began to take the lead on pushing an environmental agenda closely tied to energy security. The combination of all these factors (a changed political landscape, particularly the addition of new state actors, increased efficiency, a direct challenge in the Gulf to the control of oil supplies, and the fusing of environmental and energy issues) amplified the importance of energy in international relations. Indeed, energy supplies, routes, and mixes became focal points of US and EU strategies to stabilize and integrate the emerging economies of the post-Soviet world.

Table 32: Prices, production and consumption levels, 1990-1999

	Prices			Production millions of barrels/day				Consumption			
	Nominal Price \$	2009\$	range	EU 1995	EU 2009	US	World	EU 1995	EU 2009	US	World
1990	23.73	38.94	High	2.14	2.67	8.91	65.46	12.25	13.93	16.99	66.69
1991	20.00	31.51	High	2.15	2.65	9.08	65.27	12.53	14.03	16.71	66.74
1992	19.32	29.54	High	2.23	2.71	8.87	65.77	12.73	14.04	17.03	67.43
1993	16.97	25.20	Low	2.38	2.84	8.58	66.03	12.65	13.93	17.24	67.26
1994	15.82	22.90	Low	2.96	3.44	8.39	67.10	12.65	13.94	17.72	68.61
1995	17.02	23.95	Low	3.04	3.50	8.32	68.10	12.82	14.16	17.72	69.82
1996	20.67	28.26	Low	3.06	3.48	8.30	69.90	13.05	14.44	18.31	71.39
1997	19.09	25.52	Low	3.06	3.45	8.27	72.18	13.19	14.58	18.62	73.55
1998	12.72	16.74	Low	3.16	3.55	8.01	73.54	13.42	14.85	18.92	73.90
1999	17.97	23.14	Low	3.31	3.68	7.73	72.32	13.46	14.81	19.52	75.65
2000	28.50	35.50	High	3.12	3.49	7.73	74.82	13.38	14.69	19.70	76.43
Source: BP (2010)											

²⁹⁶ This is often referred to as the energy intensity index. Metcalf (2008) provides an analysis of energy intensity and its determinant at the state level. Likewise, the US Department of Energy provides a detailed explanation of the concept and the formula it uses for calculation. See: http://www1.eere.energy.gov/ba/pba/intensityindicators/total_energy.html.

Figure 44: Oil prices in \$2009 and worldwide production , 1990-2000



Source: BP (2010)

4.2.2.1. EU response

At first glance, the 1990s pose a series of contradictions for our model. The decade was filled with examples of increased not decreased cooperation on the part of the EU and its Member States. Upon closer examination, however, much of that cooperation occurred as part of a response to the changed political landscape that it faced. How should the Member States respond to a much larger Germany? What should Europe do to secure the economic independence of the new post-Soviet states? Many of these countries, the Caspian littoral states in particular, were rich in oil and gas. Ukraine, Georgia, and Belarus were all vital transit corridors for western flowing resources. Russia was weak and NATO was inching eastward, partially as a result of western policy and partially because the newly freed Eastern European states were clamoring for entry to secure their independence from Russia. Indeed, the early 1990s presented the EU with a litany of reasons to increase cooperation; and energy issues in particular provided a logical basis upon which to proceed.

Still, the cooperation that did occur took on a curiously Market-Commodity Approach. The seeming victory of market over controlled economies led to the unified promotion of liberalization. Thus, the increased cooperation practiced by the EU in the energy area in the 1990s was in fact a cooperative effort to reduce government intervention and not to increase it. Moreover, the fall of the Soviet Union, a larger Germany, and the breakup of Yugoslavia, which raised the ugly specter of further chaos occurring on its Eastern borders, literally forced Europe to at least try and overcome their differences and seek a new level of political and economic cooperation. The 1992 Treaty on European Union (Maastricht Treaty) addressed precisely such issues, creating not only a single currency, a goal that had been pursued for years, but also a new

level of political unity and created a single High Representative for EU Foreign Policy. Nevertheless, the increased cooperation largely was internal in nature and thus not fully applicable to our model. If we understand the actions of each EU Member State independently, then indeed we would have to conclude that the first hypothesis (H1) that predicts the EU will decrease cooperation in times of lower prices and free flows is false. Understood as a group and its cooperation with outsiders, however, the formal formation of the EU in 1993, its fourth enlargement in 1995, and the internal agreements made by the Member States to individually liberalize their energy sectors through collective decision, can be taken as cooperation in the sense that is posited by our hypothesis.

What can be understood in this light is the collective EU strategy to capitalize on the fall of the Soviet Union in order to gain access to the East's vast energy reserves and the use of liberalization of the energy sectors in those respective countries. The EU wasted little time to do just that. Already in 1990 at the Dublin European Council (June 1990), Ruud Lubbers floated the idea of establishing a framework for international cooperation to develop the energy potential of central and Eastern Europe to secure EU energy supplies. Within a year, the Commission proposed the European Energy Charter, an agreement that would codify legal guarantees concerning investments, transit and trade of energy resources from East to West, and within a year of that had signed up 51 countries in support. The success of the ECT in many ways marks the best example yet of the EU following a cooperative external strategy to secure its interests. After two more years of continued promotion and the inclusion of energy efficiency and environmental components, the EU convinced many of its neighbors to upgrade the Charter to a full-blown international treaty. The EU's success in promoting the ECT formally raised the profile of energy from an internal market issue to a fundamental aspect the EU's nascent foreign policy. Unfortunately, the EU could not get the most important party, Russia to ratify it, but here we are concerned not with a measure of the EU's success, but rather the attempt to cooperate.

The ECT seemingly demonstrates that *ceteris paribus* the EU sought increased cooperation and not less during a period of low prices and free flows, thus contradicting hypothesis one. However, there is one more issue here to consider, before we refute the hypothesis completely, namely that all other things were not the same. The assumption presented here is that the 1990s was a case period of low prices and free flows. While it is clear that prices were in fact low for much of the period, they were exceedingly high in the last months of 1990 and early months of 1991, just as the EU launched the idea of an Energy Charter. The cause of that spike was the Iraqi invasion of Kuwait, which directly challenged the security of flows from the Persian Gulf, and saw many Member States supply military support in armaments and personnel to dislodge Iraq. Likewise,

the fall of the Soviet Union, the chaos that ensued in Yugoslavia, and the economic crisis that befell Russia, all pointed to serious and legitimate concerns about the security of energy supply flows. Hence, the establishment of the ECT was in fact a reaction to higher prices and the fear of restricted flows and not the other way around. Europe's energy security was being challenged in multiple explicit ways, and the Union responded with concerted action. Thus, the early cooperation of the 1990s does not necessarily disprove our first hypothesis, but rather validates the EU half of the second hypothesis (H2) that states the EU and US will employ cooperation strategies under higher prices and restricted flows. While helpful for our overall analysis, it also demonstrates a weakness in this particular case selection as one of purely low price and free flows in nature.

Nevertheless, the EU explicitly demonstrated continued willingness to cooperate on the energy front throughout the nineties. While it is safe to assume that this largely is the result of the increased role of its supranational institutions stemming from the fragile roots of political union introduced in the Maastricht Treaty, it is a pursuit of international cooperation nonetheless. The Commission's 1996 Green Paper on renewable sources of energy (Com (96) 576 Final), the unilateral establishment of renewable supply objectives by 2010, and its 1997 Action Plan for renewable energy (COM (97) 599 final) all point to heightened level of cooperation at a time when prices were in fact low and in practice supplies were flowing freely. Thus, despite the fact that other factors played a role in instigating cooperation, its continuation significantly weakens the strength of the argument that the EU will always eschew cooperation under low price-free flow conditions. Therefore, based on the case of 1990s, we must reject hypothesis one as it currently stands.

The nineties case also challenges the hypothesis (H5) that the EU will never seek conflict even when prices are high and flow is restricted and successfully disproves the null hypothesis (H8) that predicts that the EU will never enter into conflict in energy rich areas when energy prices are high and flows are restricted or threatened. In response to the Iraqi invasion, a number of EU Member States (UK, France, Greece, Italy, the Netherlands, Spain, Sweden, and Denmark) and future perspective Member States (Czechoslovakia, Hungary and Poland) joined the US and nineteen other countries in executing a war to dislodge Iraqi forces. In fact, collectively seen, almost 70,000 EU military personnel took part. Importantly, the basis for the action was UN Security Council Resolutions 600 and 678, ordering Iraq to leave Kuwait. Importantly, the EU's actions were neither unilateral, as was the case during the 1956 Suez crisis or the 1980s Tanker wars, nor initiated by the EU as a group, but rather by the US. In fact, the EU probably could not have acted alone as it lacked a common defense system. Thus, we cannot conclude with certainty that the EU

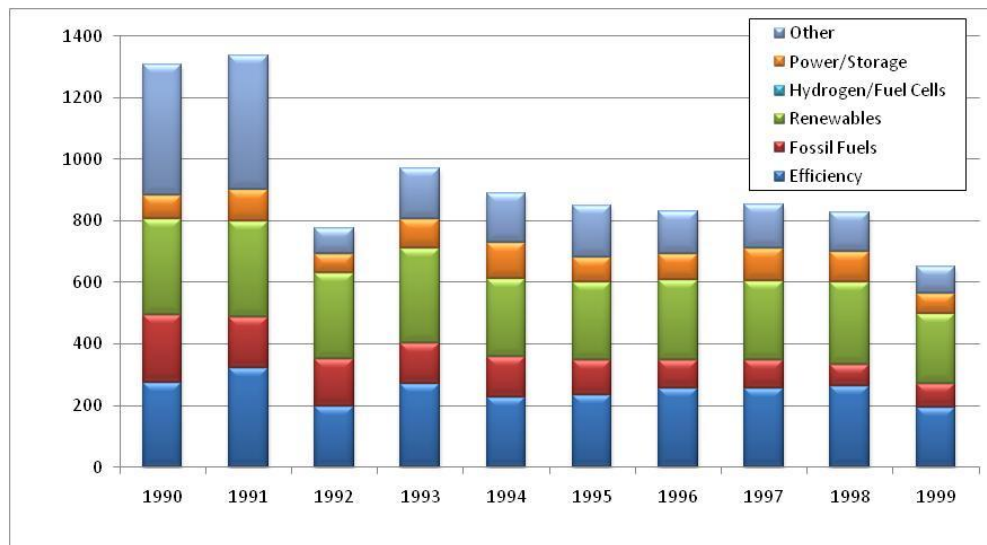
will engage in conflict unilaterally when energy supplies are at risk. However, the significant involvement of EU military personnel demonstrates that hypothesis five cannot be affirmed. The makeup and leadership of the forces, and the requirement of the UN sanction, also in part confirms the hypothesis (H4) that the low-SAPP EU is less likely than the high-SAPP US to resort to military means to secure energy flows. Without the lead role of the US, it seems unreasonable to think that the EU's Member States would have unilaterally intervened.

In terms of ERD, the 1990s case confirms our assumptions about the predicted low-SAPP EU response to longer periods of low prices and free flows. Again, the Gulf crisis, notwithstanding, the 1990s were years of generally low prices and free flows, even if the perception of risk was greater than the reality. Between 1990 and 1999, the combined ERD efforts of the EU's 1995 fifteen Member States declined from €2.77 billion to €1.56 billion in €2009 (see Table 33 and Figure 45 below). Even more revealing is the fact that non-nuclear related ERD also declined, particularly investments into developing renewables and fossil fuels. This makes sense given that Europe already had begun to substitute natural gas for oil in its electricity and heating sectors after the 1970s and exchanged it with an increasing dependency on Russian natural gas. By the end of the nineties, Russia had emerged as a major player in the global energy market. The fact is that EU energy supplies in the 1990s were for the most part safe and secure and, apparently, there was little need to invest heavily in finding alternatives to oil, despite the rhetoric and diplomacy to the contrary.

Table 33: EU ERD trends in millions of €2009 across the 1990s

[illegible]

Figure 45: EU non-nuclear ERD investment expenditures



Source: International Energy Agency (IEA) (2010c)

EU ERD investment patterns across the 1990s thus confirms the EU half of the hypothesis that the EU and US will dramatically reduce investments into substitutes under conditions of low prices and free flows (H7). It also further rejects the null hypothesis (H9) that both the EU and US will not change their investment strategies toward substitutes when prices and flow conditions change. Indeed, during the extended period of declining prices and increasing worldwide production, the EU dramatically reduced its substitution related investments.

4.2.2.2. US response

The US response to the 1990s low price free flow period is revealing in multiple ways. Because the period began with a direct threat to supply security and a subsequent spike in prices, we would assume that the US would be more likely to cooperate with others on energy issues and respond militarily. That is precisely what happened in the case of the Gulf War. When prices then started to decline in early 1991, the US government then reduced its role in the energy market and cut its overall investments into ERD. Thus, the nineties case reveals that the high-SAPP US once again behaves in accordance with most of our related assumptions.

To begin with, the 1991 Gulf war has to be considered in the context of the disintegrating Soviet Union, the disappearance of which hoisted the US to a status of unipolar superpower. Iraq's invasion of Kuwait was the first test not only of that new global alignment, but also of measures taken by the US in the 1980s to revamp the way in which it fuels its military. Recalling our analysis

of the high salience of SAPP for the US, the US had implemented structural changes in order to fuel foreign military operations. The Gulf war tested this new structure, as its military required some seven billion liters of fuel to execute its mission, relying largely on 'locally available fuels' from the Arabian Peninsula. The massive military response of the US to the Iraqi seizure of Kuwait is a clear affirmation of hypothesis three (H3) that the US is more likely to act militarily when supplies are at risk. We can safely conclude that this is because of the high salience that the US places on power projection in general and SAPP specifically. The former component is borne out by the rise of the US to unipolar status and the direct challenge to the regional status-quo posed by Baghdad. The latter is demonstrated not only by the enormous amounts of fuel used in the conflict, but also by the extensive and well laid plans to acquire local sources of fuel in order to carry out the conflict. Once again, we can also falsify our null hypothesis that the US would never enter into conflict in energy rich areas when prices are high or disruptions are imminent (H8). If that were the case, the US would never have engaged in the conflict.

The Gulf War represents the only explicit US example of successful energy-related coordination with other states in the nineties. Although the US would use the 1990s to finalize NAFTA, and within that context secure access and further development of Canadian heavy petroleum and natural gas supplies, the US largely eschewed any form of international coordination on energy issues that did not entail the liberalization of energy markets, international trade, and the expansion of petroleum exploration. Even in the area of climate change, a theme championed by the Clinton administration, the agreements the US signed onto internationally, were never implemented because Congress refused to subject the US economy to international regulation. Thus, because words do not equal deeds, we cannot argue reasonably that US efforts to pass energy-relevant international emission standards constitutes increased cooperation. Even on the military front in the Gulf, the level of US cooperation changed immediately following the termination of hostilities. In fact, by then mid of 1991, most coalition members had recalled their forces from the region. Only the US and UK remained in any significant quantity and over the course the next eight years, the US would singlehandedly push through and then more-or-less-unilaterally implement two separate no fly-zones over Iraq and build up a semi-permanent military presence in airbases in several Gulf states. In short, the US implicitly claimed suzerainty over the entire oil producing region, and this under an administration that was perceived by many to be less military oriented than the previous Reagan administration. Moreover, the US continued to do this while prices were sinking and global production was increasing. There simply is no better example for the effect of high SAPP on the external actions of states than the US in the Persian Gulf in the 1990s.

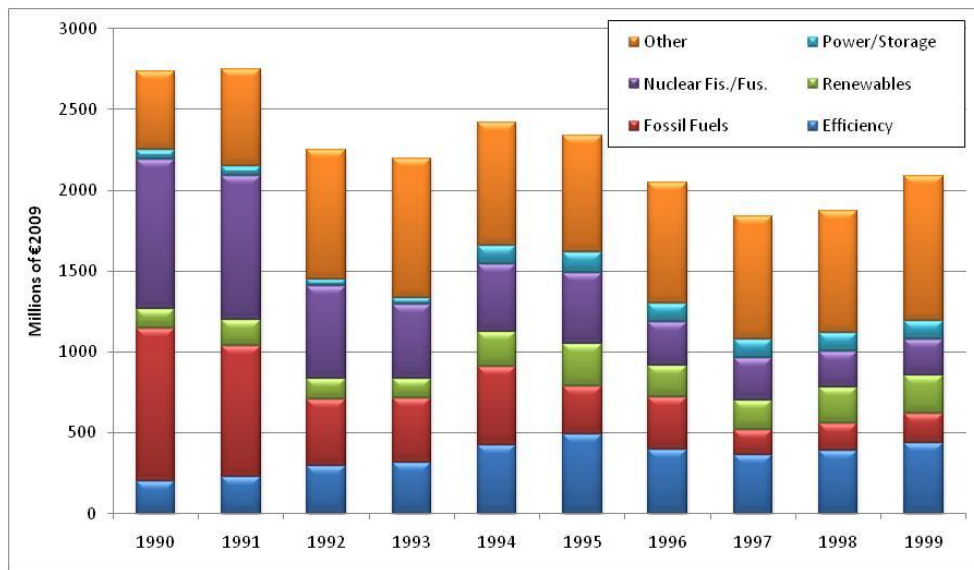
In terms of its internal response, the US government not only removed itself from the energy marketplace through deregulation, it actually transferred responsibilities for energy research to the private sector and placed the country's automobile manufacturers in charge of developing more fuel-efficient vehicles. While the Clinton administration invested over \$200 million in energy related areas in its initial stimulus package to pull the country out of an early 1990s recession, much of the later focus was placed conservation and the development of fossil fuels. What efforts were made in developing renewables were almost entirely in the electricity sector, including the Energy Policy Act of 1992 that introduced subsidies for renewable electricity suppliers. Hence, we can conclude that the central theme of US internal energy policy in the 1990s was a concerted emphasis on efficiency, conservation, renewables, and the expanded development of North American fossil fuels, all driven by private industry. US ERD investment patterns reveal the magnitude of that change.

Between 1990 and 1999, total US ERD declined by almost €700 million in €2009 or 24 percent and government investments in fossil fuels dropped off by over 81 percent. Concurrent with this decline in fossil based research, however, was a demonstrable increase in government backed research in renewables and increased energy efficiency. It should be noted that at its maximum US investments in renewables barely exceeded the EU's minimum investments for the period, and the latter had experienced consecutive years of decline. One has to be cautious to read too much into the increase in US investments in renewables in the nineties, however, because the starting amount of €119 million in 1990 was negligible in comparison €945 million spent on fossil fuels. More important is the clear change that occurred in the focus of US ERD toward efficiency, which expanded from €199 million in 1990 to €438 million in 1999 (see Table 34 and Figure 46 below).

Table 34: US ERD trends in millions of €2009 across the 1990s

[illegible]

Figure 46: US non-nuclear ERD investment expenditures in €2009 across the 1990s



Source: International Energy Agency (IEA) (2010c)

The decline in overall US ERD coupled with the clear preference towards efficiency and the rather small, albeit increasing, investments in renewables, largely affirms our hypothesis predicting a US decline in investments in substitute fuels when prices are low and resources flow freely (H7). Although investments in renewables did increase, we must recognize that the category includes both renewable liquid fuels as well as alternative sources of electricity. Taking that into account and reviewing the other figures, it is clear that efficiency was an important focal point of US efforts during the 1990s outside of others and systems analysis. As in the case of the 1980s, ERD data also denies the null hypothesis (H9) that the US would not change its investment pattern during years of low prices.

4.2.2.3. 1990s Summary

The 1990s case was largely defined by low prices and free flows. However, it also contained a brief time period where prices spiked and disruptions were threatened. The unique circumstances of the 1990s allowed us to test different assumptions laid out in our model. We were able to confirm two hypotheses, falsify three, and partially falsify one other.

It seems safe to conclude on the basis of the 1990s case that the US will adopt a minimal intervention or MCA strategy when prices are low or declining and supplies flow freely (H1) and will adopt a cooperative (H2) or even conflictual/interventionist (H3) approach when those conditions are reversed. What was particularly intriguing is that the US continued to act militarily

after the threat of disruption disappeared and even as prices declined. This would seem to confirm our assumptions about the high level of salience the US places on SAPP. However, in retrospect, it weakens support for hypothesis three (H3) insofar as it does not allow for the possibility that the US with its high SAPP may be more likely to intervene militarily even under conditions of low price and the mere perception of possible future threats to supply flows.

In the EU case, the evidence is not as clear. Taking into consideration the changes that occurred during the decade, the EU increased external cooperation in the energy sector even as prices were declining. This would seem to falsify hypothesis one. Similar to the case of US actions that illustrate the explanatory limits of our third hypothesis, EU actions in the 1990s weaken support for the formulation of our first hypothesis, which does not include the possibility of the EU also taking a cooperation strategy under conditions of low prices and free flows. Given that there were so many other extenuating circumstances (powerful intervening variables such as a changing political landscape), we can nevertheless conclude that H1 is only partly falsified. If we further consider that EU external cooperation in 1990s was oriented toward promoting liberalization, i.e. the EU increased cooperation in order to decrease its partners' interventionist strategies, then H1 seems to be confirmed in principle, if not practice. In terms of predicted orientation toward military engagements, the active involvement of EU Member States indicates that EU will in fact intervene militarily when supplies are threatened. This might seem to falsify hypothesis four (H4). However, upon further examination it becomes clear that the Member States only acted under UN authority and behind the lead of the US. It is safe to assume that they would not have acted unilaterally, even though they were more dependent on Persian Gulf Supplies than the US. Thus, we can also affirm at least in part our hypothesis (H4) that the EU is less likely than the US to resort to armed conflict to secure flows. As in the 1980s case, we can again falsify hypothesis five (H5). It predicted that the EU would never seek conflict when supplies become restricted and prices rise. Their actions allow us to fully falsify the null hypothesis positing that neither the US nor the EU will ever intervene militarily in energy rich areas when prices are high or disruptions are imminent (H8).

On the ERD front, the evidence of the 1990s suggests that both the US and the EU do in fact reduce their investments when prices drop and supply flows ease (H7). This allows us concurrently to falsify the null hypothesis positing that neither the US nor the EU will exhibit any change in their attitudes toward developing substitution fuels as manifested by their related investments (H9).

Table 35: Summary of affirmed/falsified hypotheses in Case 2

Hyp.#	Topic	US	EU	Evaluation
H1	MCA approach	True	Partly True Partly False	Neutral
H2	Coop approach	True	True	True
H3	US > military likelihood	True		True
H4	EU < military likelihood		Partly True	Partly True
H5	EU Never use military		False	False
H6	EU/US Increase ERD			
H7	EU/US reduce ERD	True	True	True
H8	Null-never military	False	False	False
H9	Null-no change in ERD	False	False	False

4.3. The high-price cases

4.3.1. Two oil crises (OPEC, Iranian Revolution) of the 1970s (high price -restricted flow)

The dual oil crises of the 1970s provide an excellent case to test EU and US responses to conditions of high prices and restricted flows. Over the course of the decade, the price of oil rose from an annual average of \$9.94 in 1970 to \$93.41 in 1979 (in \$2009).²⁹⁷ At two separate points, late 1973 and again in 1979, the price skyrocketed as international crises in the Middle East led to shut-ins, shutdowns, and an embargo (See Table 36 and Figure 47 below). The result was a noticeable increase in efforts by our two actors to cooperate multilaterally a common response as well as to negotiate bilaterally, particularly through the use of arms deals in exchange for secure fuel supplies.

The early 1970s brought watershed changes to the geopolitical landscape and the global energy balance of power. Toward the end of the sixties, new sources of oil had been discovered in Alaska's North Slope (1968) and the North Sea (1969) and global production had continued to rise, increasing by 16.5% between 1969 and 1970 (BP, 2010). However, beginning in 1970, a currency crisis in the US and the subsequent devaluation of the dollar sparked severe recessions in both the US and the Europe. The economic downturn in the early years of the decade was paralleled with political upheaval as the rise of socialist governments in the oil-rich Middle East and North Africa changed the geographical landscape of the Cold War.²⁹⁸ The region's increasingly

²⁹⁷ All average annual prices come from BP (2010) unless otherwise stated.

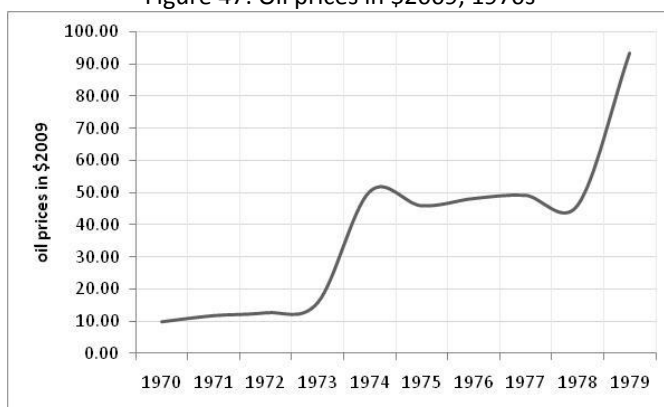
²⁹⁸ Socialist coups and revolutions occurred in Egypt (1952), Iraq and Syria (1963), and Libya (1969).

empowered governments began raising the posted price of their oil and increasing excise taxes midway through 1970. In 1971, OPEC agreed to a new formula on oil pricing, one that included a 55 percent tax on all its oil exports, and backed it up with threats to embargo any company that refused to pay.²⁹⁹ After decades of low prices and tight control by western oil companies, oil prices began to rise rapidly. The days of cheap oil were over.

Table 36: Nominal and \$2009 oil prices, 1970s

	Nominal price	\$2009
1970	1.80	9.94
1971	2.24	11.85
1972	2.48	12.72
1973	3.29	15.89
1974	11.58	50.41
1975	11.53	45.98
1976	12.80	48.25
1977	13.92	49.24
1978	14.02	46.13
1979	31.61	93.41
Change:	1656.1%	839.7%
Source: BP (2010)		

Figure 47: Oil prices in \$2009, 1970s



Source: BP (2010)

As the decade progressed, OPEC continued to push the price of crude upwards to offset the continuing decline in the US dollar. In 1973 alone, it increased the selling price on two separate

²⁹⁹ Acting on behalf of its partners Algeria, Iraq, and Saudi Arabia, in April 1971, Libya raised the price of oil sold at Mediterranean ports, up to \$3.45. By the end of the year, the country had nationalized its major oil fields, and together with a falling US dollar caused enormous upward pressure on the price of oil.

occasions, once by five percent and then by another eleven percent; increases that came on the heels of a wave of nationalizations that led to the wholesale transformation of the international oil market.³⁰⁰ Midway through the decade and for the first time since the commercialization of petroleum in nineteenth century, a cartel of governments controlled most of the world's supplies and its flow onto the market. The nominal price of Saudi Light crude (\$1.21 in 1970) was selling for more than \$11 by the end of 1974 (Adelman, 1990:3). Europe was particularly vulnerable to these changes as it depended on the region's suppliers for more than eighty percent of its oil consumption. Although the US was far less dependent on the region's oil (at around eighteen percent of its imports and six percent of its overall oil needs), the impact of decreased supplies and higher prices could not have come at a worse time. The US economy was in the doldrums, its currency was collapsing, and its military was orchestrating a rapid evacuation of Vietnam.

Meanwhile, the new socialist regimes of the Middle East were turning to the Soviet Union for aid and arms. The regional anti-Soviet alliance, built up in the early 1950s and stretching from Afghanistan to Turkey, was gone and with it US and European orientation and influence in the region changed. Under pressure from its oil suppliers, France had stopped supplying Israel with weapons in the late 1960s and instead started selling them to Arab oil exporters. Under different pressures, the UK surrendered its remaining Persian Gulf colonial holdings, evacuating the Trucial Coast sheikdoms in 1971; setting the stage for an Iranian invasion of three of the islands near the entrance to the Strait of Hormuz and giving birth to the United Arab Emirates.³⁰¹ For its part, the US was showing increasing interest in the area as it moved its focus away from East Asia and toward new and stronger alliances with Israel, Iran, and Saudi Arabia, which unlike its fellow OPEC members had decided to buy out rather than expropriate western oil companies.

Against this backdrop of increasing empowerment of Middle Eastern oil producers, a sinking US currency, and a new thrust by the Soviet Union to gain influence in the region, an Arab coalition led by Syria and Egypt attacked Israel in early October 1973.³⁰² The subsequent 19-day war ended

³⁰⁰ Nationalizations of different foreign held concessions occurred in Algeria in 1971, Libya 1971 and 1973, Iraq in 1972 and 1973, Iran in 1973, Venezuela and Kuwait in 1975. In addition to the nationalizations, the geography of access changed as well. Following closure of the Suez canal during the 1967 Arab-Israeli War, and an eight-month shut down of the Trans-Arabian Pipeline that carried oil from Saudi Arabia, over Jordan and Syria to the port city of Sidon in Lebanon due to bomb attacks, access to Gulf oil became a matter distance to port, which raised transport costs.

³⁰¹ The islands were the Abu Musa, the Greater Tunbs, and the Lesser Tunbs.

³⁰² To be precise, the Egyptian-Syrian led coalition of forces arrayed included additional expeditionary forces from Iraq, Jordan, Morocco, Saudi Arabia, Libya, Kuwait, Algeria, and Sudan as well as outsiders from Pakistan, Cuba and North Korea.

in a stalemate, but in the process pushed the US and the Soviet Union dangerously close to the brink of nuclear war and ushered in a five-month long oil embargo, the first of the decade's two very serious oil crises.³⁰³ Operating under the threat of a feared Israeli defeat, the US began an emergency airlift of weapons and ammunition to Tel Aviv (Operation Nickel Grass) via Dutch territory on October 14. That same day, Israelis forces encircled the Egyptian army in the Sinai and began bombarding Damascus. The Arab members of OPEC responded by quadrupling their base oil price and committed to cut production by as much as 10% by the end of 1974. When at the height of the conflict President Nixon authorized some \$2.2 billion in aid and arms to Israel, Libya and Saudi Arabia declared an embargo first against the US and then together with other Arab OPEC members against the Netherlands (and later Portugal).

The ensuing 1973-1974 Arab oil embargo took almost 1.6 million barrels a day off the market for approximately five months (Stagliano, 2007) and by the time it was lifted in March 1974, the nominal price of oil had risen from less than \$3.00 to more than \$11.00 (from \$15 to \$54 in \$2009). The crisis prompted not only a flurry of bilateral diplomatic activity between importers and exporters, but it also increased cooperation between consumer states, and set in motion a wholesale reassessment by US and EU leaders over the role of energy in international politics. As Henry Kissinger later noted, "we have learned that the energy crisis is not a mere problem of transitional adjustment; it is a grave challenge to the political and economic structure of the free world" (Kissinger, 1982). At the highest levels of government, access to oil or an alternative to it, became a central theme of international politics, one explicitly caged in the vernacular of national security.

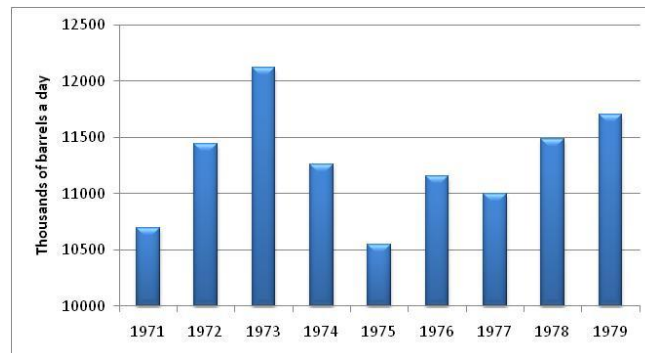
In the aftermath of the first crisis and throughout much of second half of the decade, the price of oil remained steady, but high; although regional events continued to plague energy markets and raise the geopolitical profile of the Middle East.³⁰⁴ Both the EU and the US reacted to the crisis years by creating strategic petroleum reserves, increasing external cooperation, and initiating the search for alternative fuels and suppliers. Nevertheless, little could be done to mitigate the

³⁰³ Originally, the war (October 6 to 25, 1973) was proceeding in the Arab's favor. However, as the tide turned in Israel's favor following the arrival of US aid, the Soviet Union threatened to send troops to the region to support Damascus and Cairo to beef up its military advisors already on the ground. For a full accounting of the 1973-1974 crisis and the role of the superpowers see for example Rabinovich (2004) and Wehling (1997); and for historical background of superpower politics in the region through the 1960s see Gerjes (1994).

³⁰⁴ Nationalization continued. OPEC members continually tried to coordinate further increases in excise taxes and well-head prices. And in early 1976, oil exports from Iraq were slowed for two months when the trans-Lebanon pipelines were shut down amidst the country's exploding civil war.

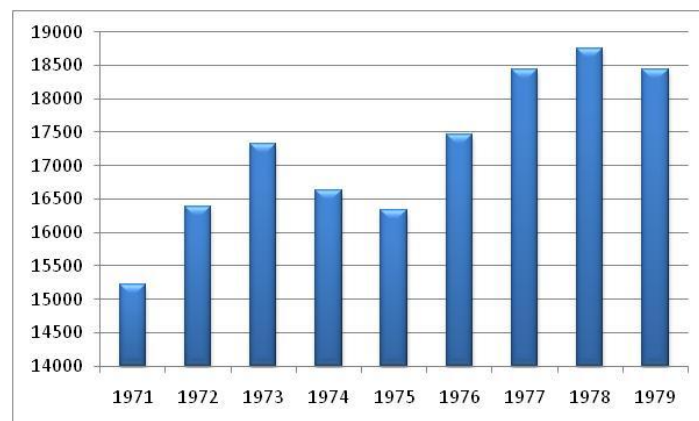
damage as the price shock dampened economic growth and subsequently sapped EU and US oil consumption through 1975, when it began to rise again (see Figure 48 and Figure 49 below).

Figure 48: EU oil consumption, 1970s



Source: BP (2010)

Figure 49: US oil consumption, 1970s



Source: BP (2010)

Then in 1979, another oil crisis sent prices skyrocketing once again. The Shah of Iran was already losing control of his country in 1978, but as student protests turned violent, provoking an evacuation of foreign oil workers, the situation spun out of control. With its foreign engineers gone, Iran experienced a sharp drop in production, down to 500,000 barrels a day in December, a far cry from the 1.5 million being produced just a month earlier and the 5.7 million it produced daily in 1977. The price impact was substantial. Across the twelve months between the Decembers of 1978 and 1979, the average nominal price of oil rose by 119% from \$14.85 to \$32.50 (or almost \$95 in \$2009); and the situation deteriorated from there. By the end of 1979, Iran was under the control of Islamic government and US diplomats were being held hostage in their embassy, ending a decades-long courtship between Iran and the West. Shortly thereafter, the US stopped importing Iranian oil altogether and Iran countered by cutting all contracts with the US. Then, seizing a rare opportunity to expand its own oil assets and export capabilities, Iraq

moved to occupy the Shatt al-Arab waterway, initiating the Iran-Iraq War, launching another crisis that would spike prices even higher, and send much of the world into another recession.

4.3.1.1. EU response

The 1970s began as period of cheap oil solid economic growth in Europe, raising hope for greater cooperation among Member foreign and energy policies and EU leaders were able to make some progress on the energy front (raising petroleum stock levels and establishing basic rules to respond internally to external supply shocks). The spirit of political unity quickly deteriorated, however, in 1971 when the US currency crisis sent many of Europe's economies into a recession.³⁰⁵ By the time the first oil crisis hit, Europe had not one, but rather many independent energy markets, each carefully guarded as a precious national asset. The embargo thus tested the limits of European solidarity. In response to the events unfolding in the Middle East, European leaders tried and failed to reach a consensus on joint action. The Union was divided. The UK and France, with their vast oil interests in the region at stake, argued in opposition to Germany and the Netherlands about the cause of the crisis. What they could agree on was that they needed to consume less oil, diversify their sources, and do so not as a group but as individual independent states (European Communities, 1973). As a result, the Member States began to enter independently into negotiations with the Arab oil producing states, organizing independent supply contracts and major arms deals (see Table 37 and 38 below).

A few years later, just as the initial shock of the oil the 1973-74 crisis was receding, a revolution in Iran shut down the country's production. As the data on EU arms sales indicate (see Table 39 on page 259) throughout the period, the EU considered Iran as a pro-Western stabilizing force in the Persian Gulf, an ally worth supporting. In fact, Iranian oil production between 1970 and 1978 had increased from 3.8 million to 5.3 million barrels a day and much of it was heading to Europe. By the end of 1979, in the wake of recent events, Iranian production had dropped below 3.3 million barrels daily and a year later after Iraq launched an invasion, production fell to below 1.5 million. Finally, throughout the 1970s, Western Europe was the single biggest regional oil importer in the world. In 1973, Europe was importing a little more than 10 million barrels a day from the Middle East and by the end of the decade the Gulf had become a major transit area for much of Europe's oil supplies. Thus, when Iran stopped producing, European supplies were acutely endangered.

³⁰⁵ See Council Directives 72/425/EEC and 73/238/EEC and the discussion on page 75.

Table 37: Classes of weapons systems sold by EU to key parties after 1973 crisis

	1973	1974	1975	1976	1977	1978	1979	Totals
Air Dominance Weapons	59	63	44	33	84	4	0	287
Air/Ground Support	60	61	80	28	36	76	20	361
Anit-Aircraft Weapon Systems	n/a	36	n/a	n/a	0	0	0	36
Land Dominance	n/a	690	1220	2241	2000	670	360	7181
Naval Dominance	3	22	14	90	28	9	0	166
Totals	122	872	1358	2392	2148	759	380	
Source: Multiple editions of IISS <i>The Military Balance</i> (1974, 1975,1976,1977,1978,1979)								

Table 38: EU Arms deals with oil providers, 1973 combatants (excl. Israel), 1973-1979

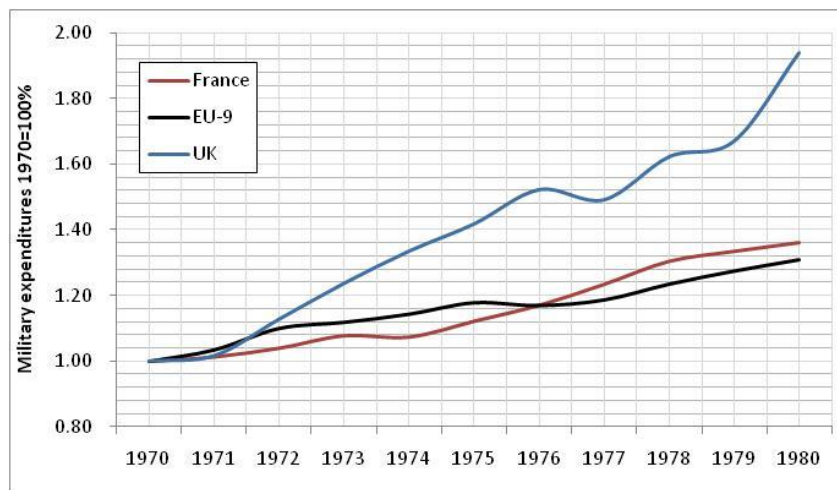
	1973		1974		1975		1976		1977		1978		1979		Totals	
	D°	C*	D	C	D	C	D	C	D	C	D	C	D	C	D	C
France	6	4	12	6	9	6	6	4	7	6	6	4	2	2		12
Germany	1	1							1	1	2	2				4
Italy	1	1	5	5	6	5	4	4	4	4	5	3				11
UK	2	2	14	5	8	4	9	6	5	3	2	2				9
Netherlands			1	1			1	1	1	1						2
Austria							1	1	1	1						2
Totals	10	7	32	9	23	11	21	12	19	8	15	9	2	2		14
D stands for "Deals" and C stands for "Countries"																
Source: Multiple editions of IISS <i>The Military Balance</i> (1974, 1975,1976,1977,1978,1979)																
The countries in question include Abu Dabai, Dubai, Egypt, Iran, Iraq, Kuwait, Lebanon, Libya, Oman, Qatar, Saudi Arabia, Syria, Tunisia, and the United Arab Emirates.																

There are two possible interpretations of the EU's approach to selling arms for oil. The first takes such action as a sign of a lack of cooperation and coordination, whereby each Member acted on independent initiative and interest. However, given that the Member States had earlier agreed on such an approach, we also can draw the contrary conclusion that the multiple independent arms deals were in fact a semi-coordinated response to enhance the overall interest of the Union by strengthening the respective positions of each Member State.

Moreover, the actual event of a bilateral deal is precisely the form of activity that we would expect to see as one manifestation type of a cooperation strategy. In this case, the EU is cooperating with its suppliers in order to secure its interests. In fact, in response to debates arising in early 1975 about the use of military force to secure Western interests in the oil-rich Middle East, Armin Grünewald, a spokesman for Helmut Schmidt's government put it succinctly, "We are not interested in any kind of confrontation with the oil countries, but rather in cooperation" (New York Times, 1975). This would seem to affirm our hypothesis about EU likelihood to increase cooperation under conditions of high prices and restricted flows (H2). Further, with the significant exception of the UK, the EU did not respond with any specific military

buildup or even threat of one. Over the years subsequent to the first crisis, the annual rate of growth of EU military expenditures was both steady and fairly low at about three percent (see Figure 50 below).

Figure 50: Index EU9 military expenditures, 1970s



Source: SIPRI's Full Military Expenditure Database (1988-2009)

The fact the EU and its Member States (outside of the UK) neither made any military moves outside of cooperative deals to secure their oil nor substantially changed their military investment behavior to plan for such action, would seem to affirm our hypothesis (H5) that predicted that the EU will never seek conflict when prices are high and flow is restricted. If taken out of context it also could affirm the null hypothesis (H8) that the EU will never enter into conflict in energy rich areas when prices are high or disruptions are imminent. Indeed, West German Chancellor Helmut Schmidt explicitly warned in late 1974 against "the irrational use of force" to secure oil supplies that could instead be had through negotiations (Yergin, 1975). However, we also could understand the willingness to sell arms to active combatants of a conflict that resulted in higher prices and disruptions of oil flows as at least tacit engagement in the conflict. Indeed, there was almost uniform support for Iran, Oman, and Saudi Arabia. However, based on the dyads of weapons supplier to buyer, the various Member States of the EU also allied themselves with different combatants, including the initiators of the 1973 hostilities (Egypt and Syria), and their respective national oil suppliers (See Table 39 below).

Table 39: Dyadic set EU-Middle East arms deals in the 1970s

	FR	UK	IT	DE	NL	AT
Abu Dabai	+	+	+			
Dubai		+	+			
Egypt	+	+	+			
Iran	+	+	+	+	+	
iraq	+					
Kuwait	+	+		+		
Lebanon*	+	+	+			
Libya	+		+			
Oman	+	+	+		+	
Qatar	+	+				
Saudi Arabia	+	+	+	+		
Syria	+		+	+		+
Tunisia			+			+
UAE	+		+			
* Lebanon provided a major Mediterranean termination point for Iraqi and regional pipeline exports to Europe. Source: Multiple editions of IISS <i>The Military Balance</i> (1974, 1975, 1976, 1977, 1978, 1979).						

What is remarkable about the period is the boldness of France to act alone, even in opposition to its partners in the Union. Beside the number of unique arms deals it made and the variety of partners it made them with, France's independent ways were demonstrated in its refusal to join the other eight Member States in forming the International Energy Agency (IEA) with the US.³⁰⁶ Notwithstanding the French exception, the EU did in fact agree to the establishment of an international Energy Program that at its base created an international consumer alliance whereby its signatories would be prepared to build, store, and share stockpiles in the event of future disruption. The establishment of the IEA is the most substantial evidence so far that the EU will seek cooperation under conditions of high pricing and restricted flows (H2). Immediately after founding the IEA, the EU also moved to begin coordinating energy policies internally with a specific focus of not only reducing their dependence on Arab oil suppliers, but achieving a higher degree of overall energy autonomy (see Com(74) 550 Final/2) including substitution fuels (COM (74) 20 Final). By 1975, the EU had laid several new objectives for the coming decade including increases in nuclear power, coal production and imports, and natural gas.

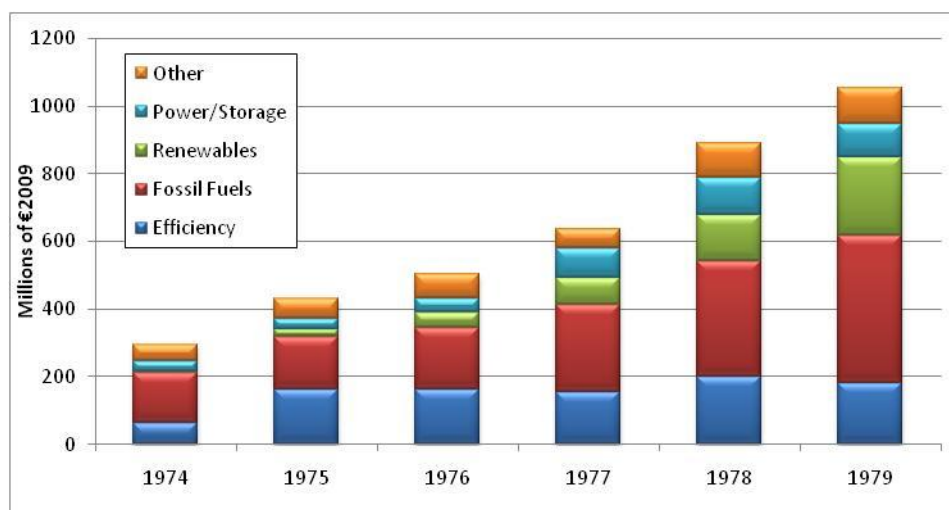
³⁰⁶ Once again, we face the dilemma of treating the EU as a single entity, where at least in the case of the 1970s, its lack of unity was about the only thing that unified it.

The change of focus to find substitutes was evident in EU ERD spending. While nuclear and weapons related ERD continued to take up the lion's share of Member ERD (78% of all funding for the period between 1974 and 1979), the EU invested heavily in renewables, efficiency, and fossil fuels, altogether €2.93 billion (in €2009) over the period. Investments in renewables saw the largest growth from almost nothing (€3 million) in 1974 to €233 million by 1979. However, in terms of shares of non-nuclear related ERD, continued investments in fossil fuels was, in financial terms, the EU's most important focus area (see Table 40 and Figure 51 below), if not in percentage figures. This carries two important implications for our hypotheses. First, the EU did in fact increase its ERD when faced with conditions of high prices and restricted flows (63% between 1974 and 1979), which supports the EU half of hypothesis six (H6) that predicts exactly such behavior. It also provides another falsification of the null hypothesis, which predicts that the EU would not change its ERD investment patterns when price and flow conditions change (H9). The evidence demonstrates that they did just that in the area of renewables.

Table 40: EU ERD investments (in €2009) in the 1970s

	1974	1975	1976	1977	1978	1979	Changes
Efficiency	62	163	161	153	198	183	192.6%
Fossil Fuels	149	155	183	261	343	434	191.5%
Renewables	3	22	45	80	136	233	6794.9%
Nuclear Fis./Fus.	1943	2069	2040	2425	2413	2597	33.6%
Power/Storage	33	33	41	87	111	98	201.1%
Other	48	58	73	57	100	107	122.4%
Total ERD	2238	2499	2543	3062	3302	3651	63.1%
Y_Y Change		11.6%	1.8%	20.4%	7.8%	10.6%	
Annual share							
Efficiency	2.8%	6.5%	6.3%	5.0%	6.0%	5.0%	79.4%
Fossil Fuels	6.6%	6.2%	7.2%	8.5%	10.4%	11.9%	78.7%
Renewables	0.2%	0.9%	1.8%	2.6%	4.1%	6.4%	4126.9%
Nuclear Fis./Fus.	86.8%	82.8%	80.2%	79.2%	73.1%	71.1%	-18.1%
Power/Storage	1.5%	1.3%	1.6%	2.8%	3.4%	2.7%	84.6%
Other	2.2%	2.3%	2.9%	1.8%	3.0%	2.9%	36.3%
Annual share of non-nuclear							
Efficiency	21.1%	37.8%	32.0%	24.0%	22.3%	17.3%	-18.0%
Fossil Fuels	50.4%	36.0%	36.3%	40.9%	38.6%	41.1%	-18.4%
Renewables	1.1%	5.1%	9.0%	12.5%	15.3%	22.1%	1831.3%
Power/Storage	11.0%	7.6%	8.2%	13.7%	12.5%	9.3%	-15.7%
Other	16.3%	13.5%	14.4%	8.9%	11.3%	10.2%	-37.7%
Source: International Energy Agency (IEA) (2010c)							

Figure 51: EU investment in non nuclear/military ERD, 1970s



Source: International Energy Agency (IEA) (2010c)

4.3.1.2. US response

Both the external and internal US responses to the oil crises of the 1970s supports several of our hypotheses, but in terms of foreign policy the results are less definitive than in the low price free flow case. In the years following the 1973-1974 oil embargo, the US floated the idea of military intervention, but in fact took no related action. Instead, the US pushed for and won cooperation not only from its allies in Europe and Japan to establish something akin to a consumers union, but also tacit support from key Gulf suppliers to increase production, first to offset the crunch of the mid 1970s and then again toward the end of the decade. Concurrent with those efforts, the US also began investing heavily into alternatives and efficiency.

Coming on the heels of price controls and the general economic malaise of the previous years, the embargo caused serious shortages in the US. With motorists famously lining up to buy gasoline, President Nixon announce a new massive energy program, “Project Independence” to achieve “energy self-sufficiency” by 1980 (Nixon, 1971c). Through executive actions, the President seized control of the domestic supply of oil, reversing decades of an internal Market Commodity Approach. In May 1974, Congress passed the Federal Energy Administration Act, setting into motion a strategy to develop the country’s vast oil shale and coal reserves and began investing into solar energy and nuclear fusion. Yet internally, the US faced other dilemmas, including the disastrous Watergate Scandal that abruptly ended the Nixon Presidency and brought Gerald Ford into power who quickly established a national energy board, signed into law the Energy Reorganization Act and the Energy Policy and Conservation Act, and established an Energy

Research and Development Agency (ERDA) to coordinate national ERD priorities. Ford also reshuffled his staff, bringing in oil industry stalwarts Senator Nelson Rockefeller as his new Vice President, Congressman Donald Rumsfeld to run his Office of Economic Opportunity (later as Counselor and then NATO Ambassador), and hired George H. W. Bush first as Liaison to China and then to run the Central Intelligence Agency. By the time the second oil crisis arrived in 1979, the US had built up substantial strategic reserves and begun the process of phasing out oil prices controls.

Externally, the US responded to the first crisis with a complex cocktail of divergent, but reinforcing approaches that included multilateral cooperation, bilateral arms deals, the threat of force, and a push for peace. The US stepped up efforts to cooperate with industrialized consumers countries by calling for an international conference of consumers to coordinate a response. Part of that response would be to coordinate international research and develop new energy technologies and non-oil sources of energy. The focuses, however, were to establish a joint allocation system to be made available in times of supply emergencies and a plan to coordinate with oil-producing nations to guarantee stable supplies. At the same time, the US was convinced that Europe would only go so far in its cooperation with the US, choosing instead to go it alone where it could, largely because it was incapable as a group to take definitive policy actions. As Kissinger noted in a 1975 interview, "Why are the Europeans so hostile to the United States? I think they suffer from an enormous feeling of insecurity. They recognize that their safety depends on the United States", a feeling Kissinger said led to a feeling of political "impotence" that produced "a certain peevishness which always stops short of policy actions" (Gwertzman, 1975). During the quickly assembled Washington Energy Conference in February 1974, Nixon implored his allies not to "go into business" for themselves by making bilateral agreements with oil producers (Nixon, 1974b). Then the US did exactly that, establishing a series of arms deals with key Middle East suppliers (see Table 41 below). Over the course of the subsequent five years, the US made 59 separate deals with 11 oil-relevant Middle Eastern countries (see Table 42 below).

Table 41: Classes of weapons systems sold by the US to key parties after 1973 crisis

	1973	1974	1975	1976	1977	1978	1979	Totals
Air Dominance Weapons	2580	60		3349	12	110	47	6158
Air/Ground Support	2	18	52	6	68	94	6	246
Anti-Aircraft Weapon Systems				12	n/a	n/a	72	84
Land Dominance		10	18	250		1200	2143	3621
Naval Dominance		6	103		4			113
Totals	2582	94	173	3617	84	1404	2268	
Source: Multiple editions of IISS <i>The Military Balance</i> (1974, 1975, 1976, 1977, 1978, 1979)								

Table 42: US Arms deals with oil providers, 1973 combatants (excl. Israel), 1973-1979

1973		1974		1975		1976		1977		1978		1979		Totals	
D	C	D	C	D	C	D	C	D	C	D	C	D	C	D	C
2	2	9	4	8	3	15	5	10	4	5	3	10	5	59	11
D stands for "Deals" and C stands for "Countries"; The countries in question include Abu Dhabi, Algeria, Egypt, Iran, Kuwait, Lebanon, North Yemen, Oman, Qatar, Saudi Arabia, and Tunisia. Source: Multiple editions of IISS <i>The Military Balance</i> (1974, 1975, 1976, 1977, 1978, 1979)															

Unlike Europe, however, the US took a much more focused approach delivering the bulk of its supplies to two parties (see Table 43 below), Iran and Saudi Arabia, delivering some 280 attack-aircraft, 6 destroyers, and thousands of missiles to the former and hundreds of air-to-air and anti-ship missiles and some 250 tanks to the latter.³⁰⁷

Table 43: US-Middle East arms deals in the 1970s

	1973	1974	1975	1976	1977	1978	1979
Abu Dhabi	+						
Algeria							+
Egypt				+		+	+
Iran	+	+	+	+	+		
Kuwait		+		+			+
Lebanon*			+				
North Yemen							+
Oman		+					
Qatar					+		
Saudi Arabia		+	+	+	+	+	+
Tunisia				+	+	+	
* Lebanon provided a major Mediterranean termination point for Iraqi and regional pipeline exports to Europe. Source: Multiple editions of IISS <i>The Military Balance</i> (1974, 1975, 1976, 1977, 1978, and 1979).							

Those sales came on the heels of a delicately, but successfully implemented third tangent of raising the specter of a US military attack on oil producers if they ever implement such an embargo again. A coordinated, heated, and very public debate began in the US in late 1974 as to whether or not the US should use military force to bring OPEC suppliers back in line with US interests. At the time it was assumed that three divisions, some 45,000 troops would be sufficient

³⁰⁷ Weapons sales and counts come from various editions of IISS *The Military Balance* between 1973 and 1979.

to seize and hold two key fields on the western shores of the Gulf, allowing the US to pump its oil and take it back to the US.³⁰⁸ The debate began at a senior level meeting of the President and his advisors late in 1974 where OPEC's use of oil as a political weapon was described as a *casus belli* (Yergin, 1975). A few weeks later, Henry Kissinger publicized the idea in an interview where he laid out the difference between "a dispute over price" and "actual strangulation of the industrialized world" leaving the option of military force open by adding, "there's no circumstances where we would not use force" (Gwertzman, 1975). As the debate increased, tensions spread around the world, causing angst in Europe and the Middle East.

In the end, the US neither attacked the oil producers nor even raised its military readiness. The public nature of the debate moved from an argument over the pros and cons of military force, to the advantages of removing economic and military support for oil exporting regimes. In a famous article on the topic, Daniel Yergin (1975) observed "the conservative leaders around the Persian Gulf have chosen to forget that their only effective guarantee against external and internal enemies is the West, particularly the United States. If these guarantees should be weakened, if consuming countries led by the United States indicate that the price of oil is a more vital interest than the preservation of monarchies, then the renewed recognition of their political vulnerability may give these rulers significant pause." It had become clear that a policy of squeezing was better than seizing. Finally, the Nixon administration made a concerted effort to resolve both the Middle East conflict and reduce US-Arab tension resulting in the reopening of diplomatic relations with Egypt and Syria and the reopening of Suez Canal, a much needed transport route for petroleum. Those moves also laid the groundwork for future peace negotiations between Egypt and Israel under the Carter administration, in exchange for which would be massive economic and military aid.

The US response thus composed a combination of multilateral and bilateral cooperation imbued with the tacit threat of force and active peacemaking. This approach strongly confirms a couple of our hypotheses about US behavior under circumstances of increased prices and restricted flows. It confirms both that the US will employ a cooperation strategy under such conditions (H2) and that, as a country which places a high salience on SAPP, is also more likely than the EU or its Member States to resort to military means or at least threaten to do so (H3). The fact that the US subsequently responded by identifying and massively supporting two proxies in the region in

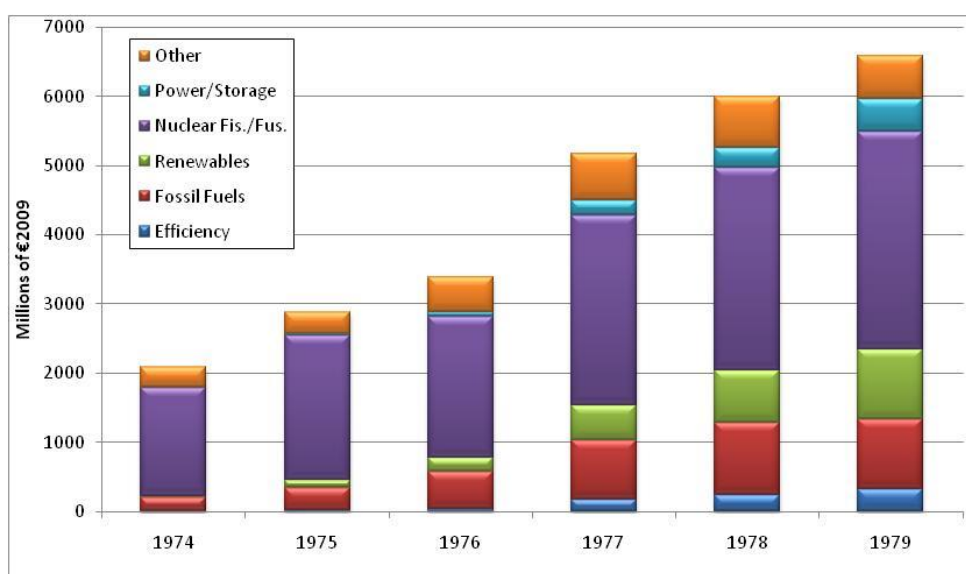
³⁰⁸ For a contemporary discussion of the pros and cons argued about the use of force option see Middleton (1975) and Yergin (1975).

Saudi Arabia and Iran also in part falsifies the null hypothesis eight (H8) that the US will never enter into conflict in energy rich areas when disruptions are imminent because threatening force and arming combatants qualifies at least in an indirect manner.

In terms of ERD, the 1970s crises also support our hypotheses pertaining to US responses toward the search for substitutes. The sustained increase in the price of oil had made non-oil energy sources “economic” literally creating “an energy rush” (Yergin, 1975). The result was a massive national effort aimed at achieving, not just a reduction in foreign imports, but rather the full scale achievement of energy independence. To achieve that goal, the US instituted a massive research program spending the equivalent of over €26 billion (in €2009) between 1974 and 1979. Although circa 55% of that money went into nuclear (and nuclear weapons related ERD), the share of nuclear related ERD declined from 75% in 1974 to 48% by 1979. Further, funding for efficiency and renewables skyrocketed with the former being 81 times greater in 1979 than in 1974 and the latter following a lesser but nonetheless impressive increase of 38 times over the same period.

In terms of actual monetary values, funding for renewables and efficiency exceeded funding for fossil fuels by the end of the decade. In fact, the US outspent the EU in every area of ERD except for efficiency. In the renewables area alone, the US spent five times as much as the EU between 1974 and 1979 and in the last year of the decade, renewables accounted for 29.6% of its non-nuclear ERD as opposed to 22.1% among its European allies.

Figure 52: US investment in non nuclear/military ERD, 1970s



Source: International Energy Agency (IEA) (2010c)

Table 44: US ERD investments (in €2009) in the 1970s

	1974	1975	1976	1977	1978	1979	Changes
Efficiency	4	20	39	178	236	318	8133.8%
Fossil Fuels	196	326	537	851	1048	1010	414.9%
Renewables	26	106	205	500	753	1023	3830.7%
Nuclear Fis./Fus.	1561	2084	2037	2757	2924	3135	100.8%
Power/Storage	8	32	62	216	298	477	5689.0%
Other	288	312	510	660	738	622	115.8%
Total ERD	2084	2882	3389	5162	5995	6586	216.0%
Y_Y Change		38.3%	17.6%	52.3%	16.2%	9.9%	
Annual share							
Efficiency	0.2%	0.7%	1.1%	3.4%	3.9%	4.8%	2505.6%
Fossil Fuels	9.4%	11.3%	15.8%	16.5%	17.5%	15.3%	62.9%
Renewables	1.2%	3.7%	6.0%	9.7%	12.6%	15.5%	1143.9%
Nuclear Fis./Fus.	74.9%	72.3%	60.1%	53.4%	48.8%	47.6%	-36.5%
Power/Storage	0.4%	1.1%	1.8%	4.2%	5.0%	7.2%	1731.9%
Other	13.8%	10.8%	15.1%	12.8%	12.3%	9.4%	-31.7%
Annual share of non-nuclear							
Efficiency	0.7%	2.5%	2.9%	7.4%	7.7%	9.2%	1147.0%
Fossil Fuels	37.5%	40.9%	39.7%	35.4%	34.1%	29.3%	-22.0%
Renewables	5.0%	13.3%	15.1%	20.8%	24.5%	29.6%	495.3%
Power/Storage	1.6%	4.1%	4.6%	9.0%	9.7%	13.8%	776.8%
Other	55.2%	39.2%	37.8%	27.4%	24.0%	18.0%	-67.3%
Source: International Energy Agency (IEA) (2010c)							

Analysis of the evidence demonstrates that US not only reacted to high prices and restricted flows by increasing its ERD, affirming H6, and changing the focus of that research, hence falsifying null hypothesis eight (H8), the US also did so in more extreme fashion. This supports the argument that governments that place a high salience on SAPP (which is clearly the case for the US) are more likely to act with greater urgency and effort in finding substitutes. Finally, although it is not explicitly revealed in the data above, the US made serious efforts to specifically address the issue of substitute transport fuels particularly in the latter part of the decade via the institutionalization of a government coordinated Synthetic Fuel Corporation (see page 168). This implies that the US, with its high salience of SAPP understood that it needed alternative fuels not only to reduce foreign dependency, but also to secure its ability to continue maintaining a highly mobile power projection capacity.

4.3.1.3. 1970s Summary

The 1970s were years of transformation for the politics and economics of oil. Nationalizations, expropriations, price hikes, an embargo, and finally a massive shut down of Persian Gulf supplies defined a decade of rising prices and decreased stability in the flow of supplies. Both the US and

the EU responded to these events with increased levels of multilateral and bilateral cooperation. As expected the US included as part of its response portfolio the threat of force, even though it did not use it. The events also resulted in direct increases in ERD and changes in ERD focus in the both the US and EU. Therefore, the 1970s high-price, restricted flows case allows us to confirm five of our hypotheses and falsify both null hypotheses.

The evidence substantiates that both the EU and the US will increase international cooperation when prices are high or rising and supplies are restricted or threatened (H2). This is comprehensible for no other reasons than the founding of the International Energy Agency, the coordinated building of domestic stockpiles, and the establishment of an international emergency sharing mechanism, not to mention the failed attempts to coordinate a floor on prices that would decrease consumption and increase private investments in exploration and alternatives. The evidence further demonstrates that the US is more likely than the EU to adopt a conflictual/interventionist (H3 and H4) approach under those conditions. The efforts put forward by European leaders to counter US threats of force as irrational and at the same time to secure special commitments from suppliers in exchange for aid and armaments deals further supports the hypothesis that the EU with its low SAPP salience will eschew any sort of conflict whatsoever (H5). Indeed in contrast to the 1990s low price free flow case, EU Member States eschewed active involvement at precisely the moment when supplies were threatened. One could argue that the EU's arms deals with the 1973 combatants, the same ones that caused the crisis in the first place, amounts to engaging in the conflict. However, the fact of the matter is, the EU's arms deals seem more driven by the Union's disunity, as witnessed by the spread and diversity of deals made by individual Member States, particularly France. Conversely, the US supplied mainly two countries and did so in a rather uniform fashion, by first supplying Iran with offensive air and sea power and then Saudi Arabia with air and sea defenses and offensive land power weapons in a bid to establish a regional balance of power in the Persian Gulf and secure US interests there. Likewise, the many arms deals, specifically the carefully orchestrated US threat of force if any second embargo would ever occur, provides a reasonable enough basis to falsify the null hypothesis positing that neither the US nor the EU will ever intervene militarily in energy rich areas when prices are high or disruptions are imminent (H8). Although neither intervened directly, there was certainly enough activity to suggest engagement in the conflict, not least of which was a concerted effort of the US to make peace between the warring parties and the combined efforts of the EU and US to resolve tensions with Gulf suppliers.

On the ERD front, both the US and EU reacted sharply and predictably to conditions of higher prices and restricted flows. Both dramatically increased their investments; and hence confirmed

hypothesis (H6) that they in fact will both do exactly that. Along with their increased investments, the focus of funding also changed as efficiency and renewables received an enormous push and nuclear related research, while still increasing, consumed a lesser overall share. This falsifies the null hypothesis (H9), which posited that neither the US nor the EU would change their investment strategies toward substitutes under high prices and restricted flows.

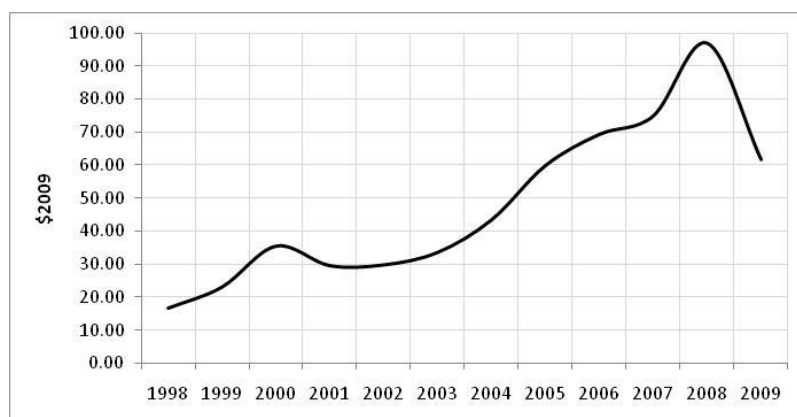
Table 45: Summary of affirmed/falsified hypotheses in Case 3

Hyp.#	Topic	US	EU	Evaluation
H1	MCA approach			
H2	Coop approach	True	True	True
H3	US > military likelihood	True		True
H4	EU < military likelihood		True	True
H5	EU Never use military		True	True
H6	EU/US Increase ERD	True	True	True
H7	EU/US reduce ERD			
H8	Null-never military	False	False	False
H9	Null-no change in ERD	False	False	False

4.3.2. Post 2003 (rising oil prices – restricted flows)

Following almost two decades of sustained lows, the international oil prices began to rise again in late 1998 sparking years of rather consistent growth and high volatility. Besides being the most recent case of high prices on record, the 2000s and specifically the period after 2003, provide an excellent example to test EU and US responses to conditions of high prices and restricted flows. In terms of both pricing and supply availability, the period was saturated with events that in a broad sense came together at the worst possible moment, creating a perfect storm of high prices, restricted flows, economic disaster, and war.

Figure 53: Average annual oil prices (in \$2009), 1998-2009



Source: BP (2010)

Throughout the latter half of the 1990s, the price of oil was low but steadily rising as the world's economies began a recovery from the decade's early recession. A financial crisis in Asia in 1997 dampened the previous years' growth in global consumption creating a glut on the market and instigating three consecutive OPEC production cuts between July 1998 and April 1999. By the mid of 1999, OPEC had removed almost three million barrels a day from the market. Nevertheless, with the US economy expanding coupled with sharp growth in Chinese and Indian and consumption, global demand continued to rise. Between 1995 and 2001, average annual oil consumption in China grew from 3.4 million barrels a day to almost 4.9 million barrels; in India, it grew from 1.6 million to 2.2 million. Meanwhile, the US was consuming an additional one million barrels. Only the EU's consumption patterns held steady. Despite growth in world production by almost 10% over the period (See Table 46 below), an expanded and sustained run on oil had begun. OPEC tried to reverse the trend with production increases in 2000, but their efforts were too late. By the middle of 2001, the US economy had turned sour as the country's tech bubble burst and higher oil prices put the squeeze on consumers.³⁰⁹ The incongruent timing of OPEC cuts and a slowing US economy sent prices downward causing OPEC to respond with more production cuts, once again taking more than three million barrels off the market by September 2001.

Table 46: US, EU, China and India oil consumption and world production, 1995-2001

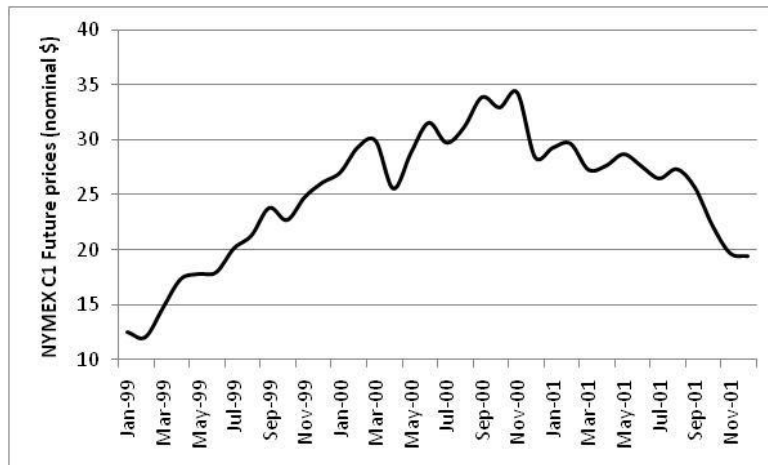
	1995	1996	1997	1998	1999	2000	2001	Change
US	17.72	18.31	18.62	18.92	19.52	19.70	19.65	10.9%
EU	14.16	14.44	14.58	14.85	14.81	14.69	14.86	5.0%
China	3.39	3.70	4.18	4.23	4.48	4.77	4.87	43.5%
India	1.58	1.70	1.83	1.96	2.13	2.25	2.28	44.5%
World Production	68.10	69.90	72.18	73.54	72.32	74.82	74.81	9.9%
Source: BP (2010)								

On September 11, 2001, Al Qaeda forces launched a coordinated multi-target attack on the United States. The attackers specifically identified US and European presence in the oil-rich regions the Islamic Middle East and their support for corrupt governments and monarchies as cause for their actions. Years of oil diplomacy and cold war machinations had resurfaced in a fury. In addition to numerous actions specifically aimed at reducing energy dependence in the region, the US responded with an October invasion of Afghanistan, the host nation of the attackers. For the first time in its history, NATO activated its Article 5 protocols sending European air forces to the US to come to its defense. The shock of the events sent an already slowing US economy into a

³⁰⁹ The US also underwent a sharp economic crisis when the driving force behind the US expansion of the 1990s, a massive growth in technology stocks, came to an abrupt end.

tailspin. Between August and November 2001, US gasoline consumption dropped by over four million gallons (16.5 million liters) a day, a decline of almost 7%, and the first serious drop in decades. As a result, oil prices once again began to decline sharply. This time, however, OPEC refrained from cutting output, given the sensitive political environment, causing an even more massive decline in prices; in the six months between August 2001 and January 2002, NYMEX future prices for next month deliveries declined almost 28% (See Figure 54).

Figure 54: NYMEX next month future price, 01.1999 to 11.2001



Source: United States. Energy Information Administration (2010)

OPEC could no longer resist. In January it set out to cut production by 1.5 million barrels and was joined by Russia, which agreed to cut an additional half million. Prices began to rise again. Strikes in Venezuela in late 2002 took another half million barrels off the market pushing prices even higher. By early 2003, the price of oil was back up to \$35 a barrel.

Then in March 2003, the US invaded Iraq, shutting down almost a million barrels a day of the country's oil production. The reduction of Iraqi output, together with previous cuts, shut-ins, and continued growth in global demand, removed much of what was left of the world's excess production capacity. By mid 2003, that excess capacity was down to 2 million barrels a day, a sharp decline from mid 2002, when it was around six million. Within two years of the Iraq invasion, global spare capacity fell below one million barrels a day. Despite Russia's reemergence as a global energy player (expanding its output significantly between 2000 and 2002), growth in global demand outpaced non-OPEC production increases every year between 1990 and 2006. Indeed, by 2004, global demand had increased by as much as 16 million barrels a day in comparison to 1990 and non-OPEC increases amounted to only 6 million. The margin for error in the market was slipping away rapidly. Therefore, OPEC, and particularly the Arab and Gulf producers were left to make up the difference, resulting in a gradual decline in OPEC spare

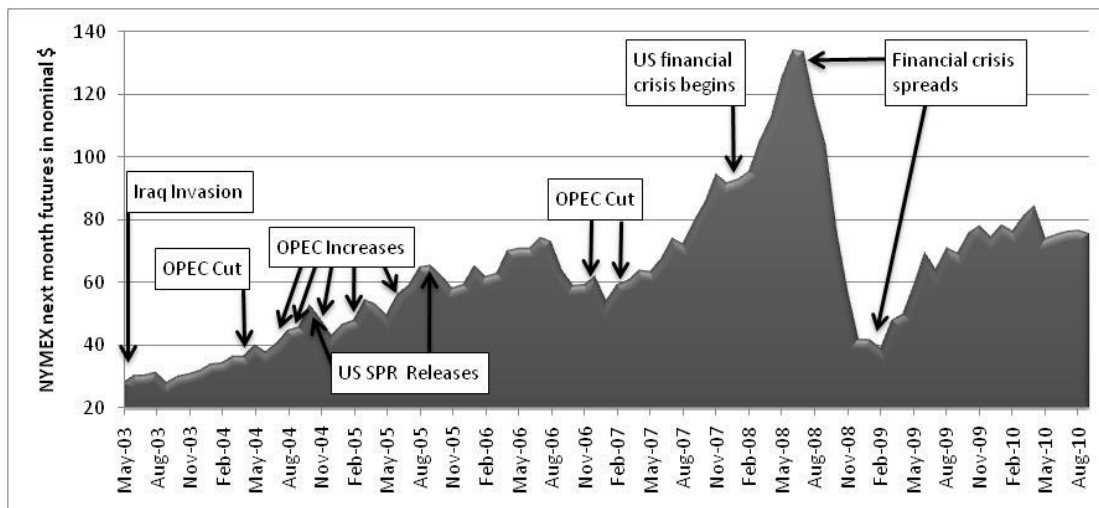
production capacity (Fattouh, 2006). Hurricanes Ivan (2004) and Katrina (2005) which temporarily shut down US refinery output, leading to a temporary release of five and nine million barrels respectively from the US strategic reserve together with another OPEC production increase sank prices briefly. However, the steady decline in the strength of the US dollar over the decade added to the overall upward forces already present in the market. Oil prices continued to rise.

The pressures of increasing global demand, the resulting decrease in spare capacity, and the US's global war on terrorism, including the invasions of the Afghanistan and Iraq, its massive forward positioning of armed forces in the Persian Gulf and increased tensions with Iran and Venezuela, combined to form a perfect storm. By the end of 2003, the price of oil was rising rapidly and, with the exception of several short dips, continued to rise steadily through October 2008 (see Figure 55 below). Meanwhile, higher energy prices and continuously increasing demand from China pushed up commodity prices across the board. The negative effects of these increases reached a breaking point in late 2007, when consecutive real-estate and financial crises hit the US as the market for mortgage-backed securities, developed in the wake of 1990s deregulations, collapsed. The crisis spread rapidly throughout the industrialized world, forcing Europe and the US to spend over a trillion dollars in stimulus spending to revive their sinking economies. Oil demand, which had already begun declining in the US by 2006, started declining in Europe in 2007. By 2009, US was consuming 10% less oil than in 2005 and Europe was consuming 7% less. By comparison, world consumption grew a sluggish 0.7%, largely due to a massive increase of 23.6% of the combined demand of China and India (see Table 47 below). Even more rapidly than prices had risen in the previous years, they plummeted in October 2008, falling to \$40 by February 2009 before beginning to rise again and settle at an average of around \$77 in the first nine months of 2010.

Table 47: Year on year consumption patterns 2005-2009

	Change from previous year				
	2006	2007	2008	2009	2005-2009
World	1.02%	1.48%	-0.44%	-1.36%	0.7%
EU	0.37%	-2.19%	-1.01%	-4.27%	-7.0%
US	-0.55%	-0.03%	-5.72%	-4.16%	-10.2%
China/India	4.57%	6.19%	5.18%	5.83%	23.6%
Source: BP (2010)					

Figure 55: NYMEX one-month futures, May 2003 to September 2010



Source: United States. Energy Information Administration (2010).

The period from 2003 to 2008 thus marks one of the most substantial periods of price rises in the history of oil trading and marks the first extended period of gains after the establishment of oil futures trading in the early 1980s. The period's price gains were paralleled by increasing demand from the expanding economies of China and India and a tightening of OPEC's spare production capacity. Thus, the period represents a case where prices were high and rising and supply availability became increasingly under threat.

4.3.2.1. EU response

In response to rising prices and restricted flows of oil, the EU ramped up its efforts to develop alternative fuels and increased the level of its international cooperative activity. Although several Member States joined the US in its military attacks on Afghanistan and Iraq, the Union was divided over its ally's military responses throughout the period. However, when piracy attacks began to expand in the Gulf of Aden, endangering first food aid shipments and then later commercial traffic including oil flows en route to the Suez Canal, the EU responded with a coordinated naval defense program to secure shipping in the region.

EU external political and economic cooperation increased significantly in the years following the Iraqi invasion. Energy had moved to the center stage of European politics early in the decade as internal cooperation in the area expanded. Already in 2001 at the Stockholm Council the EU decided it needed to invest in energy infrastructure and a year later at the Barcelona Council decided build such a network in order to enable growth in its internal energy market (1229/2003/EC). Further, increasing prices and supply vulnerability strengthened the Union's drive to find a substitute for oil. In 2003, it passed legislation requiring greater use of biofuels and

other renewable transport fuels (DIRECTIVE 2003/30/EC).³¹⁰ Then in its 2006 “Renewable Energy Road map” (COM (2006) 848 final) it called for an overall reduction in annual fossil fuel consumption, most of which was imported. Within a year, EU Member States agreed to overall renewable targets (see Directive 2009/28/EC and Directive 2009/30/EC). After almost fifty years of trying, the EU finally equated energy autonomy with its collective political survival. Although oil still was a problem area, the dilemmas of the 2000s were not those of the 1970s. Europe no longer relied heavily on oil for electricity and heating. Instead, it relied on natural gas, large amounts of which were being imported from its rising eastern neighbor Russia. The switch away from oil between 1970 and 2003 is an important indicator of the longer-term ramifications of high prices and restricted flows. It created a situation whereby oil, although vital for transport, meant less to the European economy. Gas was the new fuel of choice wherever possible and Russia was now the political focal point; and notwithstanding occasional problems with gas and oil deliveries, this new dependence, particularly of Germany, began to tip key EU allegiances eastward. Finally, the entry of climate politics into the European energy debate bound the two issues together and coupled the internal and external dimension of the Union’s energy policy. In 2007, when the Member States agreed in Lisbon to the Treaty on the Functioning of the European Union, the Union became officially responsible to ensure the integrity of its energy market, to secure external energy supplies, and to develop of substitutes.

Externally, the EU coordinated multiple energy-related deals with a wide range of countries, including Russia, the Mediterranean coastal states, and African energy suppliers.³¹¹ It extended its energy *acquis* to the Balkans, included Azerbaijan into the European Neighbourhood Policy, launched the Baku initiative to develop fuel links with the Caspian littoral states, and a Black Sea initiative aimed at integrating its regional neighbors directly into its energy market.³¹² The EU tried with limited success to condition its bilateral aid on successful reform of the receiver’s domestic economy, while multilaterally pursuing a course of global standardization in the oil industry. Energy was key component of the EU’s regional developments programs covering the former Soviet Union (TACIS), accession countries in Eastern Europe (PHARE), and the Mediterranean area (MEDA). In the oil domain, the EU led the way in promoting transparency and liberalization of its

³¹⁰ The original Commission proposal can be found in OJ C 103 E, 30.4.2002, p. 205 and OJ C 331 E, 31.12.2002;

³¹¹ See “The Africa-EU Strategic Partnership, A Joint Africa-EU Strategy” Council Press Release 16344/07 (Presse 291).

³¹² Based on plans laid out in its report, the “Black Sea Synergy – a New Regional Initiative”(COM (2007) 160 final)

primary oil suppliers. Two examples of the latter include the Joint Oil Data Initiative (JODI) and the Extractive Industries Transparency Initiative (EITI). The EU is a major player in both organizations.³¹³ The former has led to improved statistical systems in many oil-producing countries and the latter pairs the Union with a complex club of companies and organizations active in the oil industry, including France's Total, the UK's BP, and the Netherlands' Royal Dutch Shell as well as is the EBRD, OECD, World Bank, UBS, Merrill Lynch, ING, and Deutsche Bank.³¹⁴

All of the EUs actions since the latest upturn in oil prices began indicate that the Union has been extremely active in promoting its energy interests, and most importantly, it has done so through international cooperation and not unilateral actions. This seems to confirm the EU half of our hypothesis pertaining to EU and US behavior under conditions of high prices and restricted flows.

The post 2003 case also substantiates our hypotheses pertaining to EU military behavior. Despite claims by French and British leaders at their joint 1998 summit in Saint-Malo that the EU "must have the capacity for autonomous action, backed up by credible military forces, the means to decide to use them, and a readiness to do so, in response to international crises", the Union as whole did not substantially engage in military activities to secure its oil interests during the case period.³¹⁵ While it is true that the EU did establish a European Defense Agency in 2003 to coordinate defense related research, the EU as a group was either absent or only part of a larger UN authorized coalition throughout the period.

Moreover, while several EU Member militaries joined the US as junior partners in the Afghan and Iraq wars, one cannot claim they did so over oil, but rather in the former case out of treaty obligation and in the latter out of political path precedence (the UK had been jointly operating the US managed, UN mandated no fly zones). In fact, in the run-up to the US invasion of Iraq, key EU Member States France and Germany went to great lengths to delay if not prevent the attack.

³¹³ JODI is an international reporting mechanism coordinated by the International Energy Forum Secretariat and supported by the European Union's own Statistical Office, Eurostat. Unfortunately, because the initiative is solely a statistical standardization movement, it has little power to implement any changes in producer countries and membership and performance remain voluntary. Nevertheless, Eurostat's high profile role as a founding member makes the European Union a primary player in JODI and creates opportunities for an increased EU role in standardizing data quality and reporting requirements in the oil sector. For a detailed discussion of JODI see Schubert (2007).

³¹⁴ Like JODI, the EITI is voluntary and does not include Russia or any country from the Middle East. The EITI was founded in late 2002 by UK Prime Minister Tony Blair at the World Summit on Sustainable Development. For an analysis of the group and its operations see Schubert (2007).

³¹⁵ The full text of the joint statement of the Heads of State and Government of France and the United Kingdom can be found in the public domain. See for example: < <http://www.atlanticcommunity.org/Saint-Malo%20Declaration%20Text.html>>.

France even put forward a resolution in the UN Security Council removing the term “material breach” in relation to Iraq’s behavior toward UN weapons inspectors in order to eliminate any legal justification the US might use to initiate hostilities. Indeed, the combined efforts of Germany and France, together with Russia, Turkey, and Saudi Arabia, all point to the first post-Cold War example of international power balancing against the US.³¹⁶ It would appear that the EU, faced with a direct threat to its oil supplies out of the Persian Gulf, intriguingly caused by the US, chose a new method of balancing, one not based on offensive or defensive weapons buildups, but rather on international cooperation and obstruction. The EU’s response to the Iraq crisis thus corroborates our hypotheses about expected EU caution in engaging in military activity when prices are high and flows restricted (H4). That said, it also must be noted that EU did partake in the US’ war in that it allowed over-flights and basing operations. However, given the general support for the ‘war on terror’ and the fact that the US justified the invasion of Iraq with the alleged existence of weapons of mass destruction and ties to Al Qaeda, EU Member States faced a policy dilemma. The fact that overall EU participation in the events was so limited is testimony to the EU’s general unwillingness to use of armed force.

Nevertheless, the EU’s intervention in the Gulf of Aden, known as Operation ATALANTA provides a less severe but contradictory example. Launched in 2008 in support of several UNSC resolutions (1814, 1816, 1838 and 1846), EU Member navies joined an international fleet to deter acts of piracy off the coast of Somalia. What was originally based on the protection of WFP food supplies in 2007 became a full-blown operation to protect international shipping, not least of which included oil tankers.³¹⁷ Although there have been few direct attacks on oil tankers in the region (one in 2008 and another 2009), the area around the coast of Somalia is a vital choke point for international shipments to Europe. The EU’s willing engagement may indicate the beginning of a change in EU behavior towards its SAPP. However, the fact that their involvement required first UN authorization and second cooperation with an international fleet, provides ample evidence of the limited nature of the EU’S response. Therefore, we cannot take the presence of EU forces in the Gulf of Aden as falsifying our fourth hypothesis. Indeed, Europe’s lack of military response and

³¹⁶ Although no formal anti-US alliance was established, the 2003 Iraq war, which directly affected the oil markets, presented a perfect example soft balancing, whereby an alliance of opposing powers withhold their support for a leading power. For an analysis of pre-Iraq war soft balancing see Pape (2005).

³¹⁷ It was also the first EU joint naval operation under the framework of the EU’s Security and Defence Policy (ESDP). By 2010, it included contributions from Italy, Netherlands, Germany, France, Spain, Belgium, Luxembourg, and Greece as well as technical support from Irish, Finnish, Maltese, and Swedish military personnel.

its increase in international cooperation seem to affirm it. The same cannot be said for our fifth hypothesis (H5) which posits that the EU will never seek conflict even when prices are high and flow is restricted. The initial role of the UK in Iraq, the later role of EU policing and training forces there, and the EU's naval engagement in the Gulf of Aden, all point to the fact that either the EU or an increasing number of its Member States are willing to engage in conflict under those conditions. Thus we can once again falsify hypothesis five. Likewise, we can equally falsify half of our similar null hypothesis claiming (H8) that the both the EU and US will never enter into conflict in energy-rich area when under high price, restricted flow conditions.

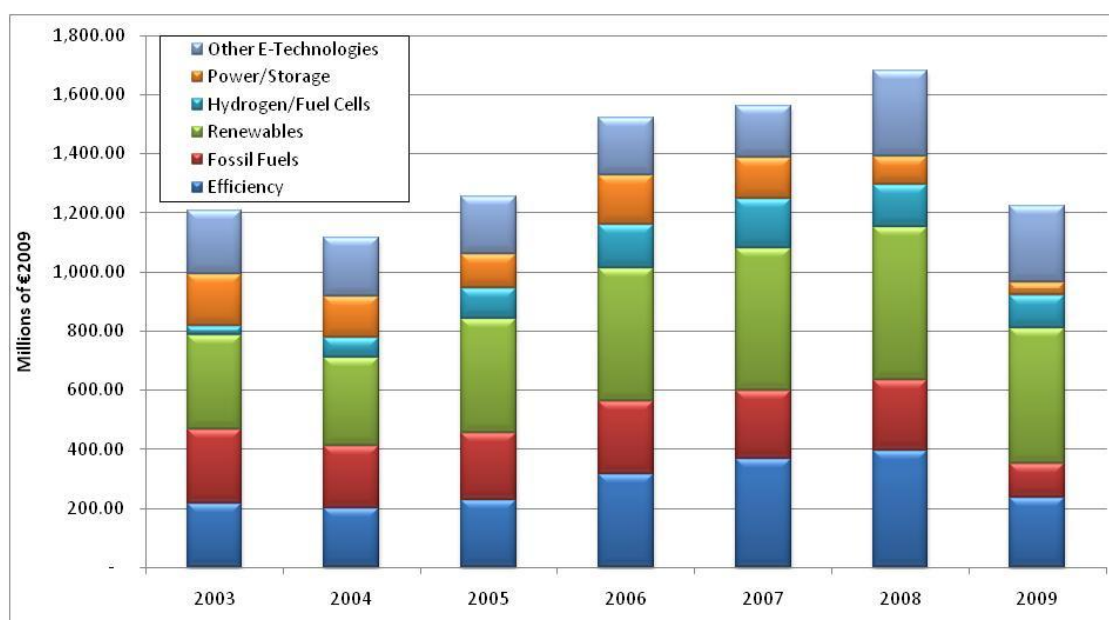
In terms of ERD, the post-2003 case fails to confirm, but does not completely falsify the EU component of our hypothesis about internal behavior toward substitutes; and it falsifies our null hypothesis of about changes in funding priorities. Total EU ERD declined €467 million (in €2009) between 2003 and 2008, a reduction of 22% (see Table 48 below).³¹⁸ However, most of that decline in terms of real values was in nuclear related research funding, which was reduced by €491. There were also sharp declines in funding for fossil fuels, which were cut in half, and power storage programs were cut by more than 70%. This development at first seems at odds with the stated policy of the EU over the period to greatly enhance its non fossil fuel exposure. However, reductions in those three areas amounted to a savings of €800 million, leaving more than €330 million to be distributed in other programs, which is precisely what happened. Concurrent with its overall reductions, the EU ramped up efforts in hydrogen and fuels cell technologies, increasing funding by as much as 279% over the period; and research into renewables (and with it biofuels) grew collectively by almost €140 million or 43% over the period. The visible shift in ERD research priorities has aspects that point to a strategy of seeking petroleum substitutes, despite an overall reduction in funding (see Figure 56 on page 277).

Still, the EU in fact did decrease its overall ERD spending at precisely the moment when oil prices began to rise and serious security threats to the flow of oil began to emerge. This presents a conundrum. Does cutting overall ERD, but then taking the savings and actually increasing the funding for substitution-specific research qualify as a valid change in "investments into substitutes" as posited in hypotheses five and six? Or must we reject the hypothesis out of hand because the EU's approach failed to meet the letter rather than the principle of those

³¹⁸ IEA data for the EU for the period is only available for 19 EU Member States, but those 19 constitute the largest spenders in the Union and thus provide a reasonable overview of EU ERD strategies. Those countries include Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, Netherlands, Poland, Portugal, Slovak Republic, Spain, Sweden, and the United Kingdom.

hypotheses? In the other three cases, there were definitive overall increases or decreases, which were accompanied largely by similar changes in the majority of focus areas. Here we have a definitive overall decrease, but an increase in four of seven focus areas.³¹⁹ This indicates that our hypothesis about the EU increasing funding for ERD during periods of high prices and restricted flows (H6) is either not always true, if indeed false in the post 2003 case, or partially affirmed, if understood in principle. In the face of blatantly higher energy costs and direct threats to its long-term supply of oil, the EU simultaneously cut overall ERD spending while increasing funding for specific oil substitutes. Thus, we can conclude EU behavior in the period as both a partial rejection and partial affirmation of H6. The change in EU priorities is more explicitly evident and thus falsifies our null hypothesis (H9), in that there was a clear change in the ERD investment strategy over the period favoring renewables and hydrogen technologies.

Figure 56: EU investments into non-nuclear ERD



Source: International Energy Agency (IEA) (2010c)

³¹⁹ There are several possible explanations for the post-2003 overall decline in EU ERD. It could be that the severity of the economic impact coupled with the high cost of the EU's fifth enlargement sapped national ERD budgets. It could also be that there was a large quantity of ERD funding by the Member States that either went unreported to the International Energy Agency, or that an increasing amount of funding was indirect in the form of tax incentives that favor private investments and are therefore not translated into actual government reported outlays, but rather a reduction in tax income. Queries to the IEA and Commission did not reveal specific answers to these questions. However, according to the IEA, nationally submitted data follows a standard set of forms and methodology from the OECD. A cross-check of the IEA's figures with a Commission report on scientific research trends (see subsequent note) confirm our overall findings; the numbers accurately reflect the ERD behavior for the period.

Table 48: EU ERD investments 2002-2008 in €2009

	2003	2004	2005	2006	2007	2008	2009	Change
Efficiency	217.56	201.44	227.22	314.62	369.07	395.11	236.61	8.8%
Fossil Fuels	247.75	209.96	227.55	246.12	229.70	239.86	113.40	-54.2%
Renewables	320.81	296.85	387.87	450.06	480.35	517.53	461.05	43.7%
Nuclear Fis./Fus.	917.28	844.86	850.62	866.06	862.85	909.68	425.57	-53.6%
Hydrogen/Fuel Cells	29.26	68.50	102.99	149.90	167.10	144.04	111.09	279.7%
Power/Storage	175.76	138.83	113.19	166.95	139.52	95.05	41.68	-76.3%
Other E-Technologies	216.29	201.06	195.11	192.12	177.29	289.76	260.01	20.2%
Total ERD	2,115.93	1,953.94	2,104.55	2,385.81	2,425.88	2,591.04	1,649.40	-22.0%
Y_Y Change		-7.7%	7.7%	13.4%	1.7%	6.8%	-36.3%	
Annual share								
Efficiency	10.3%	10.3%	10.8%	13.2%	15.2%	15.2%	14.3%	39.5%
Fossil Fuels	11.7%	10.7%	10.8%	10.3%	9.5%	9.3%	6.9%	-41.3%
Renewables	15.2%	15.2%	18.4%	18.9%	19.8%	20.0%	28.0%	84.4%
Nuclear Fis./Fus.	43.4%	43.2%	40.4%	36.3%	35.6%	35.1%	25.8%	-40.5%
Hydrogen/Fuel Cells	1.4%	3.5%	4.9%	6.3%	6.9%	5.6%	6.7%	387.0%
Power/Storage	8.3%	7.1%	5.4%	7.0%	5.8%	3.7%	2.5%	-69.6%
Other E-Technologies	10.2%	10.3%	9.3%	8.1%	7.3%	11.2%	15.8%	54.2%
Annual share of non-nuclear								
Efficiency	18.0%	18.0%	18.1%	20.7%	23.6%	23.5%	19.3%	7.3%
Fossil Fuels	20.5%	18.8%	18.1%	16.2%	14.7%	14.3%	9.3%	-54.8%
Renewables	26.6%	26.6%	30.9%	29.6%	30.7%	30.8%	37.7%	41.8%
Hydrogen/Fuel Cells	2.4%	6.1%	8.2%	9.9%	10.7%	8.6%	9.1%	274.6%
Power/Storage	14.6%	12.4%	9.0%	11.0%	8.9%	5.7%	3.4%	-76.6%
Other E-Technologies	17.9%	18.0%	15.6%	12.6%	11.3%	17.2%	21.2%	18.6%
Source: International Energy Agency (IEA) (2010c)								

4.3.2.2. US response

International oil prices were already on the upswing when George W. Bush entered the White House in 2001. Asian energy demand was growing rapidly, a charge led by China and India to gain access to the world's remaining untapped reserves. Russia was re-emerging as a major energy player and together with China they were actively using state-run oil companies as tools of their foreign policy. Energy mercantilism seemed to be growing. Meanwhile, the US Air force was actively engaged in the decade long Southern Watch operation to control Iraqi air space, run out of air bases in Saudi Arabia; and the shipping lanes of the Persian Gulf were protected by the US Fifth Fleet, based out of Bahrain. When the President's commissioned National Energy Policy Development Group warned early in 2001 that the country was moving rapidly toward an untenable posture of depending on suppliers that may ultimately work against the country's national interest, the Bush administration pushed the national security consequences of foreign dependence to the top of its agenda.

An April 2001 report by the influential James Baker Institute and the Council on Foreign Relations observed that “chances are greater than at any point in the last two decades of an oil supply disruption that would even more severely test the nation’s security and prosperity” and issued an ominous warning: “we are reaching the beginning of an extensive period of sporadic supply shortages and periodic price hikes” requiring “a reevaluation of U.S. policy approaches” (Morse and Jaffe, 2001:34). The influential report put forward several recommendations for the new administration including enhancing international cooperation on the energy front by developing diplomatic programs with the Gulf Cooperation Council and OPEC to stabilize prices in times of turmoil, diffuse tensions in the Arab-Israeli conflict, expand international oil forums, establish a North American energy agreement, engage China in the IEA, join transparency initiatives, and consider adopting the EU’s Energy Charter. It also recommended a review all of current US sanctions and policies toward Iraq to “eventually ease Iraqi oil field investment” (Morse and Jaffe, 2001:46).

The Bush administration acted immediately on the recommendations. It began pushing for increased refineries, expanded domestic production in Alaska, the Rocky Mountains, the Gulf of Mexico, and the outer continental shelf as well as expanded use nuclear and coal power to diversify electricity generation, and began to fill the Strategic Petroleum Reserve, internal actions that it took unilaterally. Internationally, the US took a dual approach actively pursuing oil agreements with Venezuela, Colombia, several countries in West Africa, the Caspian and even Indonesia; and signed free trade agreements with Bahrain and Oman. On issues of security, however, the administration acted in a decidedly unilateral fashion. In its 2002 National Security Strategy, the administration codified a strategy of preemptive intervention against hostile acts by adversaries. Pointing to Iran’s nuclear program as a major threat, the US unilaterally withdrew from the 1972 Anti-ballistic Missile Treaty with Russia in late 2001 and began working with select EU allies to build European based missile shield. Thus, in the face of high prices and increased risks to supply availability, the US initiated cooperation where it was feasible, and took unilateral action whenever its interests were not served.

Back home, the administration used virtually every tool at its disposal to seek alternatives to petroleum, placing incentives for biofuels production in a 2002 Farm Bill, initiating a \$1.2 billion hydrogen-fueled vehicles program in 2003, providing extensive loan guarantees and tax breaks to domestic energy producers and taxpayer incentives to buy hybrid cars in 2005. It received from Congress the authority to issue leases for exploration on the outer continental shelf and when faced with immediate disruptions caused by Hurricanes Ivan and Katrina, the administration lifted fuel standards and opened its Strategic Petroleum Reserves to keep prices stable and supplies

flowing. As the price of oil continued to rise throughout the decade, the administration oversaw the establishment of the Advanced Research Projects Agency – Energy (ARPA-E) specifically designed to develop new energy technologies and reduce the country's energy imports, increasing automobile mileage standards to 35 mpg, and set the highest standards on record for minimum shares of biofuel mixes in all the gasoline sold in the country.

When the country was attacked by Al Qaeda in September 2001, energy became an even higher priority. Although most of the deaths and damage occurred in New York, it did not go unnoticed in Washington that the Pentagon had been singled out for attack. Almost instantly, the US moved to a war footing. It implemented massive security changes at home and began deploying forces all over the world. The President requested and received Congressional authorization to use force in Afghanistan. He would later get similar permission to attack Iraq based on President Clinton's 1988 Iraq Liberation Act which required the government to seek regime change there. Defense Secretary Paul Wolfowitz later told Congress that the country's oil would more than pay for its reconstruction (United States. Congress, 2003:26791). Although much of the world acquiesced to US action in Afghanistan, the US faced a concerted diplomatic effort to thwart its efforts in Iraq. Thus, it essentially acted alone in Iraq, albeit with support from a wide coalition of junior partners.

By early 2003, the US was embroiled in two wars. Energy independence was firmly on the agenda and financially backed with a technology program aimed at finding substitutes. Barack Obama picked up in 2009 where Bush left off and accelerated the rush toward substitutes. Adding to previous efforts, Obama injected billions in to alternative energy and fuels, initiated a national infrastructure renewal program, and like Bush, made the reduction of foreign dependency on oil the centerpiece of his energy program. The 2007-2008 financial crises and the extreme spike in oil prices of the previous years had drained consumers' pockets and sent the country into a deep recession. Obama called for and passed a massive stimulus package, one that invested hundreds of billions in energy related investments including grants, tax credits, and 'green energy loans'. Despite Obama's declared proclivity for increased international cooperation, he too used his executive authority to act unilaterally at home raising efficiency standards on automobiles and establishing a program for consumers to trade-in old cars for new, more efficient vehicles. Altogether, the Obama administration spent over €8 billion equivalent in 2009 alone on ERD, almost double what was spent yearly on the Manhattan Project. By the end of the decade, the US had allocated almost €30 billion to find a ways to reduce its foreign dependence on oil and much of that was through hidden tariffs, subsidies, and direct protection of American industry.

Notwithstanding the powerful forces of war that drove much of US policy after 2001, the actions of the US under conditions of high prices and restricted flows point to a selective use of cooperation where it required little compromise and unilateral action where it did not. While neither the Afghan nor Iraq campaigns were initiated because of oil, both contained key energy aspects. Iraq was a major producer. Its past behavior had demonstrated that it could and would disrupt oil flows if it had the capacity; and Afghanistan has long been discussed as a possible transit route for Caspian and Iranian oil and gas. Most intriguing among the military-oil related events of the post-2003 era was the US withdrawal from Saudi Arabia in late 2003 and its repositioning in Qatar. The US also transferred leadership on the Iran nuclear problem to the EU as it continued to try to pacify Iraqi and Afghan resistance. Finally, George W. Bush, who campaigned against the foreign nation building of his predecessor, had done just that.

Although the fight against Al Qaeda marked the turning point in US external behavior and brought about new deployments of US forces in oil rich areas from Asia to Africa, the Iraq war and the promise of a stable, new, oil-rich ally in the Persian Gulf and the source of most conflict in the region since the 1980s, was the surest demonstration if not the most disastrous test of its resolve. All of these events, including both the multilateral agreements and unilateral attacks and policy actions strongly support hypotheses two (H2) and three (H3), which predict that the US will increase cooperation and be more likely to resort to military means to secure energy flows respectively under conditions of high prices and restricted flows. Even the repositioning of US forces from Saudi Arabia to Qatar demonstrates this latter point. Although one could argue that it proves the opposite in that the US evacuated a key regional base, the flexibility it demonstrated in terms of moving those bases and redeploying ships to account for power changes unfolding in the region are testimony to the salience the US puts on SAPP. Indeed, when asked to evacuate Saudi Arabia following the attack on Iraq, the US could have left the region entirely; because of its high salience on SAPP, it did not. Finally, the US actions in Iraq completely falsify our null hypothesis (H8) positing that the US will never enter into conflict under high-price-restricted-flow conditions.

On the ERD front, US actions match those predicted by our hypotheses. The US not only increased ERD after 2003, it did so in dramatic fashion. Between 2003 and 2009, the US increased overall ERD spending by €1.6 billion (in €2009), an increase of 70% in six years, and that is excluding an addition €4 billion spent in 2009 alone as part of the Obama stimulus package (see Table 49 below). Including the stimulus, the US spent more than €24 billion in ERD between 2003 and 2009. Further, in every category except power storage (i.e. batteries) US funding increased. Even the reduction in storage related investments over the period were reversed by the stimulus package, which dedicated €531 million to the cause, just short of surpassing the combined efforts

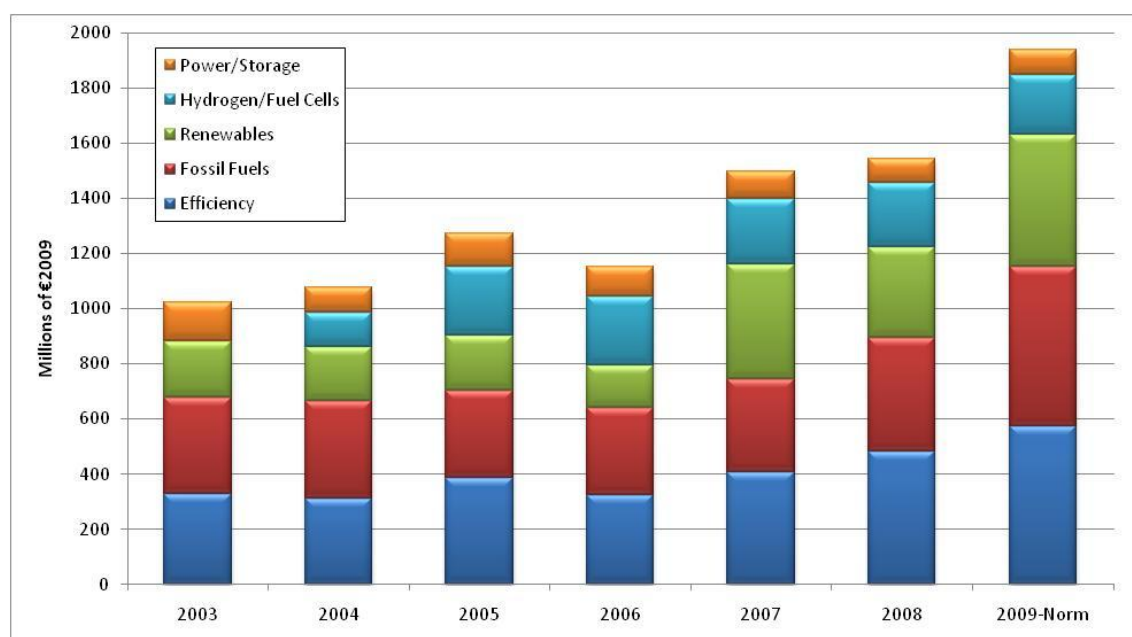
of the previous five years. Thus, the US component of our post-2003 case validates our hypothesis (H6) that the US will increase investments into substitutes when prices are high and flow is restricted.

Intriguingly, the US did not dramatically alter its distribution of funding, at least when one excludes the effects of the 2009 stimulus. It did however make changes (see Table 49 and Figure 57 below). Between 2003 and 2008, US priorities for nuclear and hydrogen research expanded. Support for renewables and efficiency grew only slightly. Fossil fuels declined moderately and battery storage investments fell out of favor. However, more than half of the 2009 stimulus package, some €2.4 billion worth went into fossil fuels, including clean coal technologies, coal-to-liquid, gas-to-liquid, and shale conversion. In short, the US responded to high prices and increasingly endangered flows by investing heavily into research first to replace foreign petroleum and then oil altogether. The enormity of the stimulus package's focus on energy demonstrates the most decisive evidence yet that the US is increasingly prioritizing its energy autonomy. What is not shown in the data are the military non-research related acquisition programs for biofuels discussed on pages 179 to 181. Taken together, these two factors point to the US prioritizing ERD not only to reduce foreign energy dependence, but to increase its political and military autonomy in world affairs, which is precisely what would be expected when prices are high and flows are restricted. Thus, US actions in terms of ERD prioritization falsify the null hypothesis (H9) positing that no such change will occur.

Table 49: US ERD investments (in €2009) between 2003 and 2009

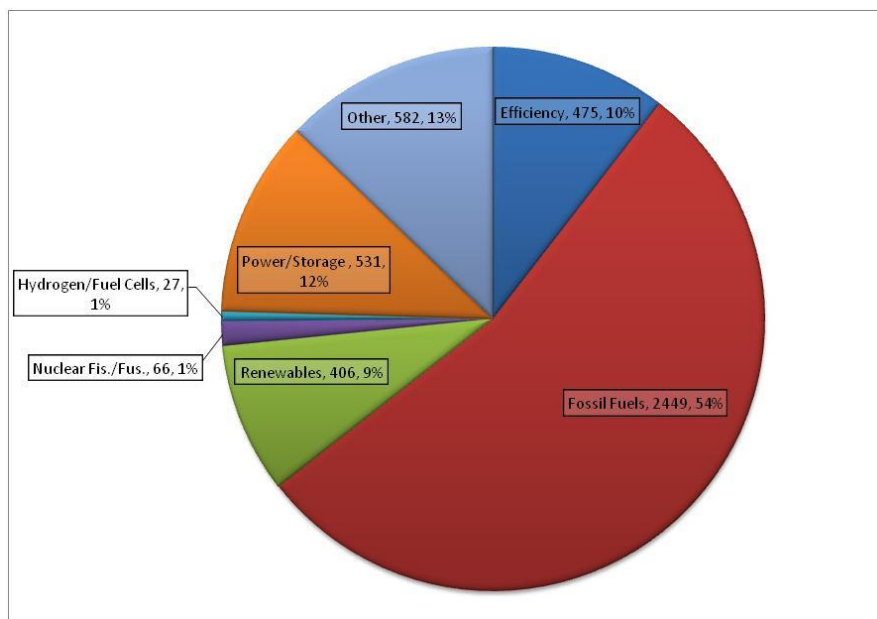
	2003	2004	2005	2006	2007	2008	2009	2009 Stimulus	Change with Stimulus	Change without stimulus
Efficiency	329	311	385	322	408	483	1049	475	218%	74%
Fossil Fuels	350	352	318	316	337	412	3026	2449	765%	65%
Renewables	204	199	198	156	415	327	884	406	333%	135%
Nuclear Fis./Fus.	312	313	591	503	626	704	916	66	194%	173%
Hydrogen/Fuel Cells		122	249	249	239	234	245	27	100%	78%
Power/Storage	138	92	123	111	98	88	622	531	352%	-34%
Other	980	971	749	755	887	949	1725	582	76%	17%
Total ERD	2312	2361	2614	2412	3010	3198	8467	4535	266%	70%
Y_Y Change		2.1%	10.7%	-7.7%	24.8%	6.2%	164.7%			
Annual share										
Efficiency	14.2%	13.2%	14.7%	13.3%	13.6%	15.1%	12.4%			
Fossil Fuels	15.1%	14.9%	12.2%	13.1%	11.2%	12.9%	35.7%			
Renewables	8.8%	8.4%	7.6%	6.5%	13.8%	10.2%	10.4%			
Nuclear Fis./Fus.	13.5%	13.3%	22.6%	20.9%	20.8%	22.0%	10.8%			
Hydrogen/Fuel Cells	0.0%	5.2%	9.5%	10.3%	7.9%	7.3%	2.9%			
Power/Storage	6.0%	3.9%	4.7%	4.6%	3.2%	2.8%	7.3%			
Other	42.4%	41.1%	28.7%	31.3%	29.5%	29.7%	20.4%			
Annual share of non-nuclear										
Efficiency	16.5%	15.2%	19.0%	16.9%	17.1%	19.4%	13.9%	10.6%		
Fossil Fuels	17.5%	17.2%	15.7%	16.6%	14.1%	16.5%	40.1%	54.8%		
Renewables	10.2%	9.7%	9.8%	8.2%	17.4%	13.1%	11.7%	9.1%		
Hydrogen/Fuel Cells	0.0%	6.0%	12.3%	13.0%	10.0%	9.4%	3.2%	0.6%		
Power/Storage	6.9%	4.5%	6.1%	5.8%	4.1%	3.5%	8.2%	11.9%		
Other	49.0%	47.4%	37.0%	39.6%	37.2%	38.0%	22.8%	13.0%		
Source: International Energy Agency (IEA) (2010c)										

Figure 57: US non-nuclear and other ERD (in €2009), 2003-2009 (exc. Stimulus)



Source: International Energy Agency (IEA) (2010c)

Figure 58: US ERD distribution of 2009 stimulus package in €2009



Source: Source: International Energy Agency (IEA) (2010c)

4.3.2.3. Summary of the post-2003 case

The post-2003 years were a period of great stress in international energy markets and world politics; a period of higher prices and both restricted and endangered flows. Tightening global markets together with an increasingly higher risk associated with terrorist attacks, wars, natural disasters, and increasing nationalist oriented energy mercantilism created an atmosphere of instability. Cooperation increased as did US military intervention; and ERD investments took on a somewhat different but nonetheless relevant course of action. An analysis of the price-restricted-flow period between 2003 and 2008 allows us to confirm three of our hypotheses, partially affirm another, and falsify three more including both null hypotheses.

Both the US and the EU responded to these events with increased levels of multilateral and bilateral cooperation, thus affirming that both will increase international cooperation when prices are high or rising and supplies are restricted or threatened (H2). As expected, however, the US included as part of its response portfolio an increased use of military force. Although initial US actions were not in response to any specific threat to oil, its war on terrorism brought it directly into heart of the world's oil production center. Moreover, the US increasingly turned to unilateral decision making both internally and externally to secure its interests. This substantiates that the US is more likely than the EU to adopt a conflictual/interventionist (H3) approach under those conditions. Likewise, the US' invasion of Iraq completely falsifies the null hypothesis positing that neither the US nor the EU will ever intervene militarily in energy rich areas when prices are high or

disruptions are imminent (H8). In fact, the US military action directly reduced supplies on the market. The EU also acted predictably in that it demonstrated that it was far less likely to engage in military activity on its own (H4). Indeed, most EU Member States eschewed active involvement at precisely the moment when supplies were threatened by the US invasion of Iraq, leaving both troubles and spoils to Washington. Still, it too decided to act when international authorization was provided and they could join others in carrying out the mission, which in turn falsifies the proposition that the EU will never seek conflict in a high price-restricted flow environment (H5).

Finally, the post-2003 years also witnessed direct increases in ERD in the US and overall reductions in the EU, but both changed their ERD focus over the period. The predictably strong response of the US confirms its half of the increased funding hypothesis (H6). However, the EU's response is less clear. Despite an overall decrease, which would falsify the hypothesis, the EU increased funding in four of seven focus areas, partially affirming it. Indeed, the EU took an intriguingly dualist approach cutting overall ERD spending while increasing funding for specific oil substitutes. Thus, EU behavior can be taken as cautious but nonetheless partial affirmation of H6. More clear was the combined approach of the EU and US toward the distribution of funding during the period. One of our null hypotheses posed that both the US and the EU will not change the investment strategies toward substitutes under conditions of high prices and restricted flows (H9). Since they did in fact change their priorities, we can consider H9 as falsified.

Table 50: Summary of affirmed/falsified hypotheses in Case 4

Hyp.#	Topic	US	EU	Evaluation
H1	MCA approach			
H2	Coop approach	True	True	True
H3	US > military likelihood	True		True
H4	EU < military likelihood		True	True
H5	EU Never use military		False	False
H6	EU/US Increase ERD		Partly True	Partly True
H7	EU/US reduce ERD			
H8	Null-never military	False	False	False
H9	Null-no change in ERD	False	False	False

5. Conclusion

Does heightened international competition over access to energy resources increase the likelihood of war as suggested by the proponents of energy-resource war theories? Or is it more likely to lead to cooperation? Indeed, do states ever go to war over energy resources? An examination of the evidence behind US and EU behavior to secure access to the free flow of energy resources abroad as well as their internal approaches to developing substitutes reveals that the answer is not uniform across states. Energy does not play the same role everywhere all the time. In fact, states rarely go to war over energy resources. Why is this case? The answer lies in the interaction of two factors, international energy prices and the salience placed by states on the supply availability necessary for power projection (SAPP), which while related, is not the same as energy itself. Despite recent increases in the securitization of energy issues in international politics, the external behavior of states is still driven by traditional pursuits of power and security.

This dissertation examined these questions in the context of international relations. Thus, our primary concern has been the behavior of states. How, why, when, and where are they likely to act or not act in response to energy related events and issues? The internal aspect of our analysis focused on substitution policies and not energy policies in general because the former is relevant to power projection, while the latter is so broad and diffuse that it has little measurable effect on inter-state relations. Countries do not go to war over environmental or efficiency standards, at least not yet anyway. Increased solar power and heating, and more efficient insulation in residential homes and commercial buildings no doubt plays a role in mitigating some foreign energy dependence problems. However, such measures have little impact on the ability of a state to project power abroad; and that is precisely what is at issue in the debate about energy resource wars. Further, mobility is a key factor in power projection, if not the single most important factor overall. Therefore, only those domestic energy programs that aim at increasing the supply or developing alternative transportation fuels have any real foreign policy impact. At present, that boils down to programs aimed at finding substitutes for oil.

The link between internal substitution programs and external cooperation and conflict can be found in the effects of the former on the latter. The development of substitutes leads to increased energy autonomy, which in turn directly affects a state's power projection capabilities and its freedom to act internationally by reducing the negative security impacts of external supply shocks and price hikes. Therefore, success in the former removes both the necessity and the constraints around the latter raising the profile of internal substitution programs beyond that of other internal energy policies.

In evaluating how this relationship plays out in inter-state relations, we established a framework linking internal substitution policy to external behavioral outcomes. The model consists of four components: (1) an internal dimension where energy policies are determined by a limited group of actors, institutions, processes, and available instruments; (2) two key intervening variables of price and supply availability for power projection that shape external policy outcomes; (3) three ideal external policy outcomes including inaction, cooperation, and conflict; and (4) a feedback process whereby external outcomes feed back to the internal dimension by enhancing or diminishing the immediate need to invest in substitutes, which in turn changes the significance of the variables of price and SAPP. We found that internal energy policies differ significantly from other public policies because energy related decisions produce national security and foreign policy consequences. When successful, they change the calculus of government options across the entire spectrum of internal and external policy because they can enhance productivity and alter the technological foundation of a country's industrial base. Substitution policies, therefore, constitute a fundamental component of national security.

When composing internal substitution policies, politicians draw from a pool of voluntary and obligatory financial and legal policy instruments. Most aim at changing market conditions. They target specific fuels or technologies through laws, regulations and incentives that reduce market barriers and increase access to capital financing for energy research, development, and demonstration (ERD). Where conservation and efficiency policies address the symptoms of a larger problem, the development of alternative fuels attacks the cause head on. The results of the former can be observed in the medium-term; the results of the latter only over the long-term. And where the former is often vague (increasing the use of alternatives) and indeterminate (becoming more efficient), substitution policies are very specific and their outputs are reasonably easy to measure through financial cost and market activity.

Even when policy goals are set, funds are committed, and scientists and businesses develop the relevant alternatives, substitute fuels remain irrelevant to international politics unless fuel commodity markets exist to set energy prices and provide for a mechanism to measure through trade whether or not a substitution policy is actually having an effect. The volume of that trade informs us about the economic relevance of the product, the facts of supply and demand. It is in the market, and only in the market, where the underlying competitive basis for a substitute will be set and where essential private financing for further research and development will be found.

Success is a factor of time. Some policy instruments have immediate short-term effect (taxes and rebates), while others lead to a slow evolutionary enhancement of competition (investments,

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regulations, and subsidies) or a minor tweaking of consumer behavior (efficiency and pollution standards). Among all the tools available, however, only direct investments increase future industrial capabilities; and for ERD investments to have a noticeable impact, they need to be substantial and sustained. Unfortunately, time and political reality works against such programs. For example, since oil began selling in significant quantities in the late nineteenth century, it has been fairly abundant and cheap. When it did rise above historic average, it rarely remained there because prolonged higher energy costs sapped economic growth, reducing demand, and sinking the price again. In the process, public support for such programs quickly waned. This poses a serious dilemma for policy makers whose temporal horizons tend to be brief in comparison to those required for sound economic decision-making, particularly in representative democracies where the stresses of public opinion and short electoral cycles render most energy policies incompatible with the vagaries of political expediency.

The legislative procedure behind the budgeting of ERD largely depends on the form and organization of government. Here, the US and EU differ sharply because of their distinctive political structures and procedures. Our analysis of the evolution of EU and US energy policy as well as the four case studies point to the fact that the US is more centralized in its decision making process, while the EU is still in the process of forming a unified approach. Within both political systems, certain key governmental or non-governmental actors are essential to the successful implementation of substitution programs. Senior executives such as heads of governments, Ministers or Secretaries of Energy, National Security, and Defense, each possess some power of fiat and budgets to dole out. In the US, these are most often found in the federal government. In the EU they are largely found in the Member States. Senior legislators can promote or block bills and to some extent control budgetary assignments and can sway the votes of junior legislators through internal party mechanics, institutional procedure, and political largesse. Once politicians do agree to move forward, nongovernmental agents are assigned the task of researching, developing, and commercializing the relevant technologies. Indeed, the inputs from those outside of government are often the most valuable. The scientific, market, and defense related knowledge they provide is essential for sound decision making. Technical experts provide assessments of what is possible. Powerful market actors, provide valuable insight into the commercial viability of those possibilities. And the military sets the bar on the importance of substitution for national security.

When fuels are cheap and abundant, public debates about policy engage a wide array of vested commercial, environmental, civil and government interest groups. However, when prices rise or disruptions occur, debates become increasingly focused, and in the event of war outright muted

as energy issues climb the ladder of urgency and move from market matters to those of national security. When this happens, the quantity of actors involved in the decision making process shrinks rapidly and considerably. Energy not only becomes “securitized”, it becomes synonymous with power and when that happens, the role of the military changes the course of policy.

When countries prioritize hard power projection, their immediate energy needs and the perceived vulnerability to disruptions in international supplies create a nexus of motivations to develop and deploy domestically produced substitutes. For the military, the issue of substitute fuels is simple and direct. A military unable to fuel its ships, planes and vehicles simply cannot project power. Entrusted with the responsibility to protect the state and to project power abroad when and where necessary, the military has the immediate material need for substitute technologies and fuels, possesses the political prestige to win funding for research and development, and maintains the institutional stability to plan and act over long temporal horizons. Most importantly, military institutions carry special weight as consumers. When they fund research, commercial producers know that success will lead to large scale, long-term supply contracts, enhancing the incentive to take risks and produce the volumes necessary to establish a market where it would otherwise not exist.

Heightened security concerns of foreign fuel dependence make internal substitution programs relevant to international relations. They affect the international market by permanently reducing dependency on or altogether delinking an economy from specific globalized markets, and they thus enhance the political and military autonomy of the state. This is not simply a matter of comparative or absolute advantage in economic terms, but rather a source of relative power gain in political terms. The mere perception that substitutes can so significantly increase external power projection options and capacities enhances the role of those actors who are directly engaged in national security and foreign policy, in particular the executive agencies of the government and the military. Thus, substitution policies are driven by fewer actors whose stake in the process tends to be of a higher order than mere market or consumer players.

Support for substitution policies are directly caused by external conditions. The very notion of developing a substitute for an existing fuel occurs either because of the vaguely perceived danger of foreign dependence on a specific fuel or the specific specter of some foreign government using its control of supplies to harm one’s national and economic security. Substitution policies are not created and implemented to save the world, but rather in response to disruptions or the threat thereof. Thus substitution policies can be both dependent and independent variables in the relationship between internal energy policies and international outcomes. Their status as such

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depends on the progress of those programs, the relative importance placed on the ability to project power abroad, and the price and availability of existing external supplies.

In most cases, substitution policies are dependent variables. Assuming that power projection is important, when substitutes are lacking and disruptions occur, internal energy policies will initiate substitution measures and governments will actively pursue external policies to secure external resources. However, once a substitute exists and is competitive with existing fuels in the market, we can expect that higher prices or disruptions will be less likely to require immediate external action, which, *ceteris paribus*, lessens significantly the likelihood of international conflict in the short-term. Hence, substitution policies become an independent variable that shape international outcomes by weakening the pull affect of external conditions. This dual internal-external quality of substitution policies is unlike any area of energy policy, including the use of large strategic reserves, which may mitigate the short-term effects of supply disruptions, but in no way can sustain the prolonged fuel requirements of a modern mobile military.

All of these findings rest on the dual assumptions that states deem autonomy to be important and that most are to some degree interdependent on one another in the supply chain of energy resources. Our two intervening variables (the price of a particular energy resource, in our case oil, and the importance placed on supply availability of that resource for the purpose of power projection (SAPP) by the state or group of states) explain the relationship between internal support for energy substitution programs and external state behavior. Oil prices are affected by actual availability of supplies, which may be free flowing or restricted. The importance of power projection to a state, however, is independent from actual international flows. In combination with perceptions about how current or future flows affect that capability, energy can become a reason for action, if not even a cause for war. Does this then mean that states do go to war over energy resources, as posited by advocates of resource war theories? In theory, that would seem logical. In practice, however, the facts reveal a different story.

Assuming that states wish to maintain the status quo, higher oil prices are in fact more likely to lead to cooperation than conflict. The negative correlation between oil prices and macroeconomic activity is well documented. What is not is the fact that high prices also tend to dampen the likelihood for armed interventions as opposed to enhance them because higher prices raise the transaction costs of military actions and economic sanctions. Indeed, it influences states to choose inaction or appeasement in order to keep prices steady or low in defense of their domestic economies and negatively influences the choice to resort to armed intervention by raising the fuel costs of any such operation. Moreover, as prices rise and substitutes are

developed, market traders will factor in expectations about future technologies and their effect on both supply and demand. Thus, the closer a policy of substitution moves toward success, originally instigated by concerns over price and supply availability (or energy security as some prefer to label it), the quicker oil futures and expected prices will decline, reducing that original economic impetus to continue supporting the program.

Furthermore, underlying the hypothesis that countries wage war over energy resources is the notion that a threat to energy security, that is the availability of supplies at a reasonable price, will naturally drives states into conflict. However, there is scant evidence to substantiate such a claim. Do states really wage war when their supplies are threatened? Our variable SAPP provides some important insights. Supply availability refers to the actual or perceived flow of resources internationally. It is largely a matter of the balance between supply and demand or production and consumption and, without a doubt, is important for internal economic planning and interstate trade relations. However, prioritizing supply availability for internal economic stability is distinctively different than prioritizing supply availability for the purposes of power projection; it is not enough to justify war. When states prioritize power projection, supply availability takes on a different meaning. In that case, we are no longer referring to supply availability per se, but rather supply availability for power projection (SAPP), which specifically refers to the importance placed on the availability of supplies by states for the purpose of maintaining military advantage over others and using that capability to change the behavior of other states through some sort of coercion. SAPP directly affects the ability of a state to use armed force as an instrument of foreign policy, which throughout history has been an essential component of the equation behind state behavior, a material fact that determines a state's ability to wage war. Thus, energy's specific value to international war is located in its centrality to projecting force in a world where comparative military advantage largely determines the balance of power; and the mobility of forces largely determines the ability to do so.

While every energy-importing country is more or less equally affected by higher prices and reduced flows of oil, the status of SAPP varies significantly between states. Power projection is not equally important for all players. Even when it is important, it must not always lead to the use of force. However, in absence of the ability to use hard power, third parties are less likely to succumb to pressure. Thus, those states that prioritize power projection also are likely to invest more resources into military capabilities, the functioning of which is determined by the availability of fuels necessary for its mobility. This makes the prioritization of power projection an essential component of state approaches to the steady supply of energy resources and explains which states are more or less likely to resort to conflict when faced with disruptions. It also takes the

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energy resource war debate and puts it back where it belongs, namely not as the primary cause of conflict driven by commercially influenced governments, but rather as a subordinate variable to the exercise of expanding relative power. Governments that place a high salience on power projection simply cannot ignore the negative impact of high prices and restricted flows on their military capabilities.

Importantly, SAPP is only relevant when prices are high and actual or perceived flows are restricted. Irrespective of its salience, the combined condition of low prices and free flows predicates a reduced incentive for states to take any international action, be it of a cooperative or conflictual nature. There simply is no good reason to spend human, material, or financial resources to secure energy resources that are cheap and freely flowing. However, when prices are high and flows are restricted or disruptions exist or are imminent, the state's orientation toward SAPP determines both its external strategy and its internal approach toward developing substitute fuels. Three ideal type outcomes emerge from this combination of prices, supply flows, and the salience of supply availability for power projection. These are a Market-Commodity Approach, Cooperation, and Conflict. The Market-Commodity Approach (MCA) is a minimalist, *Laissez Faire*, strategy whereby governments eschew any action that might alter or disrupt the free functioning of international energy markets. Cooperation is largely, but not exclusively, a strategy of peaceful interstate coordination. Conflict strategies include a wide array of defensive and offensive military actions that need not lead to armed conflict, but may include threats, forward deployments, escorts, and even arms sales and training. These same factors are reflected internally in terms of government backing of domestic substitution programs. Low-price-free-flow conditions leading to a reduction in international cooperation also removes the impetus to invest public funds into alternatives. Higher prices, restricted flows, or outright disruptions, on the other hand will tend to motivate increased investments. Conflict outcomes have the greatest impact because they raise the urgency of that need. However, states that prioritize SAPP are more likely to invest substantially more than those that minimize SAPP. Likewise, when substitutes are finally developed, the impetus for conflict due to high prices and disruptions are diminished. This feedback loop illustrates the fluid nature the energy-war question. Heightened external tensions over energy resources lead to increased internal efforts to develop substitutes, which ultimately reduce the likelihood for energy resource related conflicts. Therefore, contemporary international competition over energy resources, so-called energy wars, actually leads to decreased tensions down the line. Thus, not only is the energy resource war theory flawed in terms of the variables it defines as important (namely the economic well being of countries as the primary driver); it is also flawed in its assumptions about the outcomes of international competition to secure resources.

These conclusions and the model we have constructed linking internal approaches to substitution programs, external outcome strategies, the intervening variables of price and SAPP, and the feedback loop between them led us to nine basic assumptions about energy and international politics. We can group them into three broad categories; two that pertain to the larger feedback loop; three about autonomy and substitution; and four about intervening variables and outcomes. On the basis of those assumptions, we reviewed the evolution of EU and US energy policy from the politicization of energy that began in the late nineteenth century through the present. Based on that assessment we proposed nine hypotheses, which we tested against four common historical cases, leading to mixed results. Before reviewing those hypotheses and the evidence supporting or falsifying them, it is helpful to review our initial assumptions.

Our first assumption was that a feedback loop exists between internal substitution policies, intervening variables and external outcomes. Every external outcome affects internal substitution policies, which in turn revises the importance of supply availability for power projection over time because the combination of prices, supply flow and outcomes enhance or decrease the need and impetus to legislate and invest in substitution programs. Thus, there is an inverse relationship between government intervention in supporting the emergence of substitutes and the time that prices of existing fuels remain low. Our second assumption was that countries with a lower salience of supply availability for power projection can be expected to invest less in developing and deploying substitute fuels than those with a higher salience. Because militaries play a lesser role when power projection is downgraded, one can safely assume that countries that place a lower salience on SAPP will have smaller military budgets, which will be reflected in fewer available financial resources and market opportunities for the corporate and scientific institutions that they contract. Conversely, when the military pays to develop and deploy a new fuel, there is a much higher certainty that it will end up purchasing large orders. This higher certainty in terms of future sales all but guarantees a higher level of interest and rate of return by those in the private sector charged with developing the substitute in the first place. Therefore, overall public outlays into substitution fuels will be lower in countries where the salience of SAPP is low.

Our third assumption was that the underlying purpose of substitution policies is always energy autonomy, also known by the more politically savvy term, energy independence. Mitigating and ideally eliminating the vulnerability of foreign dependence is not only popular politically, it directly enhances national security. Without the strategic goal of increasing autonomy based on an ideal target of achieving complete energy independence, there would be no strategic rationale to invest substantial resources into developing and deploying costly alternatives. Directly connected to this notion is our fourth assumption that total energy autonomy is an ideal

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possibility, although one that is unlikely in the short term. Before the advent of petroleum, most countries were entirely energy independent. It seems logical to assume that at one point in the future they will be again, at the very latest when oil becomes too difficult to extract and too expensive to consume en masse. In fact, the post 1974 concentration of extended periods of expensive oil indicate that supply availability is in fact becoming more restricted and more expensive with time. In its first hundred years, a barrel of oil cost \$24.13 on average. In the last fifty it averaged \$36.60 and in the last twenty it average almost \$40. This means that the maintenance of military dominance in the world is becoming more expensive and thus increasing the need to adopt measures that reduce those costs if political autonomy is to be secured. Each time that a conflicts occurs the process toward developing substitutes will accelerate, but when prices drop again, countries will revert to a do nothing approach decelerating the process. Since conflicts do not occur perpetually, the evolution toward energy autonomy will be slow, arduous and uneven, but sure enough will occur over a long enough period of time. This led us to the fifth assumption that long durations of cheap prices reduce concerns about supply availability and sap support for substitution programs and do so irrespective of the importance of SAPP. That is precisely what happened during the low price periods of the 1980s and 1990s. In fact, it also explains why no commercially viable alternative to oil has yet been developed. Oil has been abundant since 1861 and periods of cheap oil (that is where prices were below the historic average) lasted twice as long (10 years) as expensive oil (5 years). Indeed, most high price periods lasted for two years or less, way too few to justify a serious investment into alternatives.

Our last four assumptions pertained to the relationship between intervening variables and outcomes. Our sixth assumed that state prioritization of SAPP should be visibly evident through domestic military budgets, physical engagements on the world stage, and official declarations about energy security. This assumption was found to be largely correct, but incomplete because military expenditures, understood as the real measure of the importance of power projection, do not actually correlate to the price of oil. In fact, an analysis of the year on year change in the price of oil and military expenditures reveals that no correlation exists, although the US responded with greater extremes than the EU. Nevertheless, we found that we still could assume that cooperation and conflict outcomes will occur in areas where there are transnational pipelines, maritime choke points, and energy resource concentrations. The geography of energy geopolitics was glaringly evident in the multiple crises faced around the Suez Canal and the Persian Gulf. Given that SAPP should be visible evident, we formulated three more assumptions about how it affects behavior. We assumed that irrespective of their SAPP orientation, large net energy importing states are likely to adopt a Market Commodity Approach during periods of low prices

and free flows because of a reduced impetus to take any sort of action. Under such conditions, there is simply no reason to seek conflict or even to increase cooperation. Doing so might change the outlook on the market, raise prices and thus result in higher transaction costs for every sort of government action. Indeed, the absence of the stress to secure the flow of supplies should be a prerequisite to such a strategy. While states that place a premium on power projection in general may still pursue aggressive actions on the international stage, they will do so because they are interested in increasing their relative power positions and not the specific availability of energy supplies. We also assumed that actual or perceived disruptions will lead to conflict among countries only when one of them places a high salience on SAPP. No state with a low SAPP priority can reasonably be expected to initiate hostilities, choosing instead either to adopt a strategy of cooperation or leave the business of conflict to an ally. In fact, not only are high SAPP states inclined to use force more frequently and earlier than low SAPP ones, they also are more likely to eschew cooperation and pursue unilateral actions. Conversely, we assumed that countries that place a low priority on SAPP are likely to cooperate as a result of disruptions because they place a lower priority on power projection and have lesser capabilities. Even in the extreme event that low SAPP countries are forced into conflict in some manner, such as joining a naval fleet to secure vital transit pathways, they will always choose to pool their resources, rather than act unilaterally. Moreover, it is safe to assume also that because low SAPP countries have reduced military expenditures, their militaries play a lesser role in the formulation of external policies and are less present as a tool of foreign policy. Therefore, the impact of fuel disruptions, while equally felt by the military will be more severely recognized within the economy at large, which inevitably will lead to market intervention.

Based on these assumptions, we examined the evolution of EU and US energy policy both internally and externally. We found that in large measure, we could claim the US places a high salience on power projection in general and thus can be qualified as a high-SAPP actor. Conversely, we found that as the EU has evolved to an increasingly unified entity, the relatively high SAPP salience of its Member States has declined. Today, the EU, with its overall lack of unified military command and a philosophic proclivity to promote international institutions and legal norms qualifies it as a low-SAPP actor. This in turn provided us with two ideal types of actors necessary in order build a series of hypotheses.

Based on our nine assumption, which we may summarize to say that energy is vital to power projection, that states do not always prioritize power projection, and that initial states of autonomy and investments into substitutes modify state behavior under different price and resource flow conditions, we posited nine hypotheses in three broad categories about EU and US

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behavior and then tested them across four case studies of different price and supply availability conditions. The first hypothesis was in a group by itself. We called it *the cheap and easy hypothesis*. The next four pertained to the opposite condition, when energy supplies were expensive and difficult to access, aptly labeled *the expensive and difficult hypotheses*. The next two hypotheses pertained to the feedback loop between external outcomes and internal energy policies. This we called *the feedback hypotheses*. For logical completeness, we posited two null hypotheses that would disprove the relevance of the intervening variables altogether and disregard any form of determinant relationship between those variables and internal policies toward substitution. Our hypotheses were as follows:

The cheap and easy hypothesis.

H1: Both the US and the EU will adopt market-commodity approaches under low-price-free-flow circumstances.

The expensive and difficult hypotheses.

H2: Under high-price-restricted-flow circumstances, both the EU and US will employ a cooperation strategy.

H3: Under high-price-restricted-flow circumstances, the US, which places higher salience on SAPP, is more likely than the EU or its Member States to resort to military means and even armed conflict to secure either access or flow.

H4: Under high-price-restricted-flow circumstances, the EU, which places lower salience on SAPP, is less likely than the US to resort to military means and even armed conflict to secure either access or flow.

H5: The EU will never seek conflict even when prices are high and flow is restricted.

The feedback hypotheses:

H6: Both the US and the EU will increase investments into substitutes when prices are high and flow is restricted

H7: Both the US and the EU will dramatically reduce investments under conditions of low prices and free flow.

The null hypotheses:

- H8: Both the US and the EU never enter into conflict in energy rich areas when energy prices are high or disruptions are imminent.
- H9: Both the US and the EU do not change their investments strategies toward substitutes when conditions of prices and flow change.

With these hypotheses in place, we selected four common international cases to compare EU and US responses. Because the two are in fact such very different international actors, we found it helpful to identify cases where incidences of energy price shifts and supply availability have a similar economic effect on both parties. To do this we needed to limit our cases by product and time. Petroleum provided the best standard of measure for two reasons. First, both the US and the EU are almost entirely petroleum dependent for their commercial transport sectors and military mobility. Second, oil has increasingly become an international commodity. Major disruptions in any large producing country, as well as increases in international or seasonal demand will spike prices everywhere. Temporal constraints require us to exclude all cases prior to the 1970s largely because it was then that the EU actually incorporated all of Europe's leading military powers, and it was also then that the US became critically dependent on foreign supplies. Finally, we also had to consider geography. While the EU and US do share some common playing fields, there are several areas of the world that are either of unique value to each party or of such lesser importance in terms of their core interests that they do not constitute a common basis for comparison. Since, by the 1970s, both Europe and the US relied heavily on the Middle East for oil, we selected all four cases with respect to events that either originated or involved the broader Middle East. We divided our four cases into two groups, each consisting of two cases where the price of oil was either cheap or on the decline or high or on the rise.

Broadly described, our two low-price-free flow cases included the 1980s and the 1990s and our two high-price-restricted flow cases included the 1970s and the years following the 2003 US invasion of Iraq. Each of the cases was imperfect in that there were fluctuations in price and supply availability. However, each also provided for most of the conditions we were looking for. There were several incidents of military engagements and military absence, increased or decreased international cooperation, and changes in domestic substitution programs.

Table 51: Summary of case findings

	CASE1: t=1980s	CASE2: t=1990s	CASE3: t=1970s	CASE4: t>2003	Final Analysis
H1: MCA under low-price-free-flow	Partly True	Partly True			Partly True
H2: Cooperation under high-price-restricted-flow		TRUE	TRUE	TRUE	TRUE
H3: US more likely than EU to use military under high-price-restricted-flow	Partly True	TRUE	TRUE	TRUE	Usually True
H4: EU less likely than US to use military under high-price-restricted-flow	Partly True	Partly True	TRUE	TRUE	Usually True
H5: EU never seeks conflict	FALSE	FALSE	TRUE	FALSE	False
H6: Increase ERD into substitutes under high-price-restricted-flow			TRUE	Partly True	Usually True
H7: Reduce ERD under low-price-free-flow	TRUE	TRUE			TRUE
H8: Null 1 (never use military)	FALSE	FALSE	FALSE	FALSE	FALSE
H9: Null 2 (never change ERD priorities)	FALSE	FALSE	FALSE	FALSE	FALSE

Our investigation delivered mixed results. Both of the null hypotheses (H8 and H9) were rejected in every case. We found that the US and the EU will in fact enter into conflict in energy rich areas when energy prices are high or disruptions are imminent. The US did this on several occasions in the Persian Gulf. The EU joined the US in thwarting Iraq's capture of Kuwait and acted unilaterally to protect its ships during the Tanker Wars that erupted in the Persian Gulf during the height of the Iran-Iraq war. The implications for this are important in so far as they point to the fact that energy is a relevant factor in international politics. Even states that do not prioritize hard power projection may be forced to act when conditions render inaction too costly. It is perhaps this rejected null hypothesis, which provides the strongest evidence in favor of the energy resource war theory. However, it is also the only one.

The second null hypothesis that both the EU and the US (as representative agents of the ideal high and low SAPP type states) do not change their investments strategies toward substitutes when prices and flows change was also rejected. Indeed, in every case, as prices fell or increased, so too did EU and US ERD investment priorities. This shows that factors exogenous to domestic political forces do in fact affect internal policymaking. A closely related hypothesis was the proposition that both the US and the EU will increase investments into substitutes when prices are high and flow is restricted (H6). This proved to be largely, but not always correct. The 1970s and post-2003 years witnessed direct increases in ERD in the US, but increases in the EU only during the 1970s. Intriguingly, the EU reduced ERD spending significantly in the post-2003 years.

At first glance, this would appear to falsify the proposition. However, upon closer examination, the EU took most of its overall reductions in the post-2003 case and shifted them to funding in four of seven focus areas that related specifically to finding oil substitutes. The fact that both the high and low salient SAPP states increased funding for oil substitutes when prices were high and the threat of disruptions was becoming increasingly relevant, further substantiates that there is a direct causal link between international politics and domestic affairs, and perhaps more importantly, that the system-level constellation of the global balance of power does not play a role in that link. Every state seeks energy autonomy and high prices make substitution a viable means to achieve it.

In addition to those already mentioned, only two of our hypotheses proved correct in every situation where they were applicable, while another four proved either only partly correct or correct most of the time. However, one was falsified in three out four cases.

Our proposition that the EU will never seek conflict even when prices are high and flow is restricted (H5) can be rejected entirely. It was based on the notion that the EU places a low salience on SAPP. The fact that the EU did engage in military actions when prices were high indicates one of three possible explanations: (1) there is no connection between SAPP and the proclivity to engage in conflict; (2) the EU prioritizes SAPP more than we considered; or (3) that the EU's military engagements were of an order of magnitude so far below that of the high-SAPP US and committed in cooperation with others such that their actions are testimony to increased cooperation (on the military front) and not increased unilateral action as implied (but not explicitly stated) in the hypothesis. The first explanation seems weak because in almost every other case, including the four case studies presented here, but also revealed in the chapters on the evolution of EU energy policy and the politicization of energy, EU Member States executed more military operations when they prioritized SAPP as when they did not. This is reflected in the reduced number of military engagements and countries where they committed troops since the end World War II just as they were lowering the overall salience of power projection as part of their foreign policies. The third explanation seems more valid because it takes note of the important qualification that the EU's military engagements examined in the four case studies were either done in concert with other high-Salience SAPP actors, or were first authorized by the UN, and in no way demonstrate a proclivity to use force unilaterally. Finally, the second explanation is the most intriguing. We assumed that the EU was an ideal example of a low-SAPP agent. This may not be the case. Indeed, previous to the birth of the circa fifty year old project that is now the EU, several of its most powerful Member States were the instigators of raising energy supply issues to the commanding heights of international politics. Europe's two great wars

pointed to the importance of controlling coal and steel, and the Franco-British attack on the Suez Canal in 1956 exemplified the centrality of energy transit security to the power projection capacities of both great powers. Does the EU really deserve the label of low-SAPP? An analysis of the evolution of EU energy policy and the actions of its Member of the last fifty years indicates that it does. However, this does not mean the EU is not undergoing a change at this very moment. Its Member States have prioritized SAPP in the past. It is impossible to exclude the possibility that they might do so as a group in the future.

The two hypotheses that our investigation fully affirmed were that under high-price-restricted-flow circumstances, both the EU and US will employ a cooperation strategy (H2); and that under conditions of low prices and free flow, both will dramatically reduce investments into substitution programs (H7). In all four cases, both the EU and the US increased their international efforts to cooperate with others during periods of crises. The most obvious examples of this include the founding of the International Energy Agency and the large quantity of bilateral and multilateral agreements they either negotiated or signed onto in the wake of price hikes, market tightening, or supply disruptions. As expected, the US also included in its portfolio increased military efforts during those periods, but that does not negate their efforts to increase cooperation. Meanwhile, the EU exemplified the hypothesis' underlying assumption about the behavior of low-salient-SAPP actors. The EU worked diligently in response to higher prices to negotiate deals with suppliers, establish an international energy community based on its own internal market standards, and engage in multilateral transparency initiatives. Moreover, both the EU and the US demonstrably cut their funding for ERD shortly after price pressures eased and did so in every case where prices declined for extended periods.

Both of these findings lead to conclusions that are very important for the study of international relations. The fact that major energy consuming states demonstrate an inclination to cooperate under conditions of direct stress to their economic well being and the cost and ability to project hard power in the case of those that prioritize power projection indicates that the fundamental argument of the energy resource war theory is flawed. Apparently, states always increase cooperation when their energy supplies are threatened and do so irrespective of their SAPP salience. They do not always go to war. Furthermore, evidence from the cases implies a causal relationship between the exogenous factors of decreased prices and free flows and internal policy priorities. Thus, it provides supporting evidence for the argument that there is not only a relationship between international and domestic politics, but that the struggle for the global balance of power and the relative positions of agents within the international system is manifested domestically in internal energy research and development investments.

The evidence was less substantial for the four remaining hypotheses. We found that they were either correct to some degree all the time or partly correct most of the time. For example, our hypothesis about the adoption of a market-commodity approach under low-price-free-flow circumstances (H1), turned out to be only partly true in the two relevant cases. In the 1980s, the US clearly adopted an MCA strategy. It not only began deregulating its own domestic energy industries, but also began promoting deregulation everywhere and minimized all international discussions over energy to a common denominator of no intervention being the best form of cooperation. The evidence for the EU was mixed as the individual Member States (with the exception of the UK) actually increased government intervention and internal cooperation between governments and their industry champions, but essentially failed to cooperate between themselves. What is intriguing with the EU in the 1980s was not that it eschewed inter-Member cooperation, for it certainly tried to enhance it, but rather that it failed miserably. Throughout the period the EU Member States reduced their overall cooperation levels as well as their interest in beefing up strategic reserves and establishing a model system to exchange oil in times of emergencies. The nineties presented different circumstances that forced the EU Member to cooperate. These had more to do with Member States finding ways to deal with a newly united Germany and the Union's latest enlargement, rather than it did with energy. Likewise, our hypotheses about the US and EU in terms of their respective proclivity (H3) or restraint (H4) in resorting to military means or even armed conflict to secure either access to or flow of resources under high-price-restricted flow conditions proved correct most of the time, but not always. In the wake of the 1970s crises and again in the post-2003 era the US demonstrated a willingness to react sooner and stronger by military means than the EU or any of its Member States under similar conditions. Although the US did not actually engage in military actions in response to the 1973 oil embargo, it certainly floated the idea in a very public manner. It is hard to believe that it is a mere coincidence that this was followed by targeted arms sales to Iran and Saudi Arabia. Similarly, the US showed little constraint in attacking Iraq in 2003, a step that removed more than a million barrels a day from the market and sent already high prices even higher. Conversely, in both cases neither the EU, nor its Member States took unilateral military action. What they did do was increase their arms sales to selected suppliers (and combatants) following the 1973 crises, and in fact worked in large measure to soft balance the US in 2003.

The actions of the EU in these two cases imply the broader finding that states with low-SAPP salience are less likely to engage in military activities in general and take unilateral action specifically. In a unipolar world that translates into a broad global condition defined by its general absence of conflict. However, as the world shifts toward non-polarity, or as some would have it, a

Conclusion

return to multi-polarity, we can expect to see greater competition for regional hegemony and suzerainty. The reintroduction of competing powers, either at the regional or global level, implies an increase in the importance of power projection (and thus SAPP) among regionally distributed actors. The actions of the US, which exemplify the behavior of an ideal high-SAPP state, indicate that the world is likely to see more conflict in the future rather than less as new poles form. That these conflicts may emerge around energy issues, however, should not be mistaken as support for the energy-war thesis. Instead, it should be understood for what it is, namely increasing competition to project power and change the status quo. To do so successfully, new claimants to power will need to upgrade their power projection capacities, and barring the development of homegrown fuels to feed that growth, they will need to secure access to the free flow of energy resources. At one point, even low-salient SAPP states may need to consider revising their approach.

In summation, the overall analysis of the role of energy in international politics reveals some important conclusions. States do not always go to war over energy resources. In fact, they rarely do. The energy-resource war theory contains a great deal of bluster and little practical applicability for the study of international relations. This dissertation has rejected several of its key elements. It has shown that energy disruptions, crises, and the pursuit of secure supplies by states, not only must not lead to war, more often than not they lead to cooperation. Essential to the equation are two important variables. These are price and supply availability for power projection; the former largely, although not entirely, results from market mechanics. The latter addresses the core issue at study in the field of International Relations.

Importantly, SAPP is a subset of power projection itself. States that do not wish to project power will not unilaterally engage in war or hostilities of any kind in order to secure energy flows. Conversely, states that prioritize power projection, including revisionist states that wish to change the status quo at a global or regional level, will do so. However, it would be a mistake to understand conflicts in energy-resource-rich areas as conflicts over energy resources. They are not. They are conflicts over the balance of relative power where energy resources are a prize to be won.

It is true that certain energy resources are strategic goods. However, they only became so over the last century. Previous to that, energy was a communal good, neither excludable nor particularly subject to rivalry. States projected force and managed mobility using renewables. Today, much of the US' naval projection capacity is based on nuclear power and its Air Force and Army are developing renewable substitutes. One day in the not too distant future, power

projection will be significantly less materially dependent on petroleum. As that transformation takes place, many of the acidic debates about rational plausibility of energy independence will dissipate. Those that claim that energy independence is impossible do a disservice to the historical record, rational thought, and the national security of their countries. Nevertheless, their argument is not without solid ground. Energy autonomy is not impossible, but it is very difficult to imagine under the current economic context of the petroleum age; and given the timeframes to develop alternatives, transform the entire global transport infrastructure, and resolve the difficult issues around the peaceful use of nuclear power, it is in fact impossible to put a time line on its demise. For the present and foreseeable future, petroleum remains the key to a state's capability to project power beyond its sovereign territory.

Finally, those that argue that energy independence is vital for peace, largely those that also support the energy competition leads war thesis, make a grave mistake in assuming that energy autonomy will decrease international conflict. They are wrong because they misunderstand the causes for interstate conflict. Contrary to popular belief, states do not wage war over money and oil. It is true that real-estate has value, and that wars can expand territory, which down the line can increase a state's wealth. However, the event of war itself is extremely costly. When states choose to go to war, they do so for far less precise reasons than becoming richer. They go to war over power and the desire to have more of it.

Therefore, removing energy from the calculus of the international competition for power will either have no effect, or much worse, it may free up states to wage war at their will with little or no constraint to hold them back. If the US did not import so much oil, one argument explains, it would have no interest in regional hegemony in the Middle East. That is simply incorrect because power itself knows no bounds. In the end, energy independence will not guarantee less conflict. It will create the conditions to allow for even more of it. A modern world with all its existing technology and no longer interdependent on fuel supplies, i.e. a world of energy independent, industrialized nations, may become the most chaotic and unstable system history has ever known.

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7. Annexes

7.1. Abstract

This dissertation studies how, when, where, and why states' pursuit of energy autonomy affects international cooperation and conflict. Taking the EU and the US as ideal examples, it addresses important questions relating to energy and state behavior. How do internal energy policies affect a state's capability to project power externally? What is the relationship between domestic investments into substitute fuels and international cooperation and conflict? Does heightened international competition over access to energy resources increase the likelihood of war or is it more likely to lead to cooperation? There is little doubt that energy is relevant to international conflict; it plays a role in the ability to project force in a world where comparative military advantage largely determines the balance of power. However, an examination of US and EU behavior to secure access to the free flow of energy resources abroad and their internal approaches to develop substitutes reveals that they rarely go to war over energy resources. Indeed, energy disruptions, crises, and the pursuit of secure supplies more often than not lead to cooperation. This can be explained by the interaction of two variables: international energy prices and the salience of supply availability for power projection (SAPP), a product of a state's inclination to project power externally.

Internal substitution policies and external power projection are linked because the development of substitutes leads to increased energy autonomy, which directly affects a state's power projection capability and its freedom to act internationally by reducing the negative security impacts of external supply shocks and price hikes. Power projection is not equally important for all players. States that do not wish to project power will not unilaterally engage in hostilities in order to secure energy flows. In fact, irrespective of SAPP salience, heightened external tension over energy resources increases internal efforts to develop substitutes and ultimately reduces the likelihood for energy resource related conflicts. Further, a state's focus on developing substitutes is not merely a matter of economic advantage, but also a source of relative political power. When states prioritize hard power projection, their energy needs and the perceived vulnerability to supply disruptions create a nexus of motivations to develop and deploy substitutes creating a feedback loop that illustrates the fluid nature of the energy-war question.

This dissertation presents a four-part model for analyzing the relationship between internal substitution programs and external state behavior. This includes an internal dimension, the intervening variables of price and SAPP, three ideal-type external policy outcomes including inaction, cooperation, and conflict, and a feedback process where external outcomes enhance or

diminish the need to invest in substitutes and thus change the significance of the intervening variables. Based on the assumptions that energy is vital to power projection, states do not always prioritize power projection, and initial conditions of energy autonomy and investments into substitutes modify state behavior under different price and resource flow circumstances, three broad categories of hypotheses are proposed pertaining to the external behavior of the EU (and its Member States) and the US and their respective support for internal substitution programs (as manifested in financial backing of substitution relevant energy research and development (ERD) programs). These include one cheap and easy hypothesis, four expensive and difficult hypotheses, and two feedback-related hypotheses. They are tested across four cases (two groups of two similar cases where oil prices were high in comparison to their historical median and flows were restricted or oil prices were low in comparison to their historical median and flows were uninhibited) leading to several conclusions.

SAPP is relevant only when prices are high and actual or perceived flows are restricted or disruptions are imminent. Under such conditions, high-salience SAPP states are more likely to invest substantially more into developing substitutes than those that minimize SAPP and they also are more likely to enter into conflict in energy rich areas to secure access to the international flow of resources. Conflict type outcomes seem to have the greatest impact on internal substitution programs because they raise the urgency of the need to develop substitutes. However, high prices also tend to dampen the likelihood for armed interventions as opposed to enhance them because higher prices raise the transaction costs of military actions and economic sanctions. In fact, when prices are high or their energy supplies are threatened, states apparently increase external cooperation and do so irrespective of their SAPP salience. They do not always go to war. Conversely, when prices are low or supplies are flowing freely, the role of SAPP in determining external behavior diminishes. States with low-SAPP salience are less likely to engage in military activities in general and are even less likely to take unilateral action specifically. Although states do not eschew cooperation completely under low-price-free-flow conditions, they significantly reduce the depth and effort underlying their cooperation. Likewise, ERD investment priorities decline sharply under low price conditions.

Analysis of the behavior of the EU and US in relation to energy and power projection reveals a fundamental flaw in the energy aspect of the resource war thesis, which suggests that if states go to war over energy resources, then energy independence is vital for peace. However, it is a mistake to assume that energy autonomy will decrease international conflict. States do not wage war over money or oil, but rather for the competition over power and the desire to have more of it. Despite the increased securitization of energy issues in recent years, external state behavior

still is driven by traditional pursuits of power and security. Proponents of the resource-war theory misconstrue conflicts in energy-resource-rich area as conflicts over energy resources; they are not. They are conflicts over the balance of relative power where energy resources are just one prize to be won. Removing energy from the calculus of the international competition for power will either have no effect, or much worse, it may free up states to wage war at their will with little or no constraint to hold them back. Energy independence will not guarantee less conflict; it will create the conditions to allow for even more of it.

7.2. Zusammenfassung

Diese Dissertation untersucht, unter welchen Bedingungen staatliches Streben nach Energieautonomie internationale Beziehungen beeinflusst. Folgende Forschungsfragen bezüglich des Verhältnisses von Energie und (außen-) politischem Verhalten werden am Beispiel der EU und den USA zu beantworten versucht: Wie beeinflusst die innerstaatliche Energiepolitik die Fähigkeit eines Staates, seine Macht nach außen zu projizieren? In welcher Beziehung stehen nationalstaatliche Investitionen in Energiesubstitute und internationale Kooperation/Konflikt? Erhöht stärkerer internationaler Wettbewerb um den Zugang zu Ressourcen die Wahrscheinlichkeit von Konflikt oder führt er vielmehr zu vermehrter internationaler Zusammenarbeit? Es besteht kein Zweifel, dass Energie im Kontext von Konflikten eine Bedeutung hat - in einer Welt, in der hauptsächlich militärische Mittel das Gleichgewicht der Macht bestimmen, beeinflusst die Verfügbarkeit von Energie die Fähigkeit, diese Macht nach außen zu projizieren. Allerdings zeigt eine Analyse der Art und Weise, wie die Europäische Union und die Vereinigten Staaten von Amerika den Zugang zu Energieressourcen im Ausland sichern und intern die Entwicklung von Substituten fördern, dass sie selten aufgrund von befürchteter Ressourcenknappheit in den Krieg ziehen. Im Gegenteil, Störungen des Energiehandels, Krisen und das Streben nach sicheren Lieferwegen führen in der überwiegenden Zahl der Fälle zu internationaler Kooperation. Dies kann mittels der Interaktion von zwei Variablen erklärt werden - der internationalen Energiepreise und der Bedeutung des verfügbaren Energieangebotes für das Militär (*supply availability for power projection, SAPP*). Letzteres ist wiederum eine Funktion der Neigung eines Staates, seine Macht im Ausland zu demonstrieren.

Interne Substitutionspolitik und externe Machtdemonstration sind miteinander verbunden, da die Entwicklung von Alternativen die Energieautonomie erhöht, was die Fähigkeit eines Staates, seine Macht nach außen zu projizieren und seine Freiheit, international zu agieren, direkt beeinflusst, indem sie die negativen Auswirkungen von Sicherheitsrisiken wie externen Lieferschocks und Preissteigerungen reduziert. Machtdemonstration ist nicht für alle Staaten gleichbedeutend. Staaten, die ihre Macht nicht beweisen wollen oder müssen, werden sich nicht unilateral in Feindseligkeiten verwickeln, um den Energiefluss zu sichern. Tatsächlich - und unabhängig von der Wichtigkeit von SAPP - verstärken internationale Spannungen wegen knappen Energieressourcen mit zunehmender Intensität die eigenen Anstrengungen zur Entwicklung von Substituten und reduzieren schlussendlich die Wahrscheinlichkeit von Konflikten, die mit Energieressourcen in Verbindung stehen. Darüber hinaus bedeutet die Fokussierung eines Staates auf die Entwicklung von Substituten nicht nur einen ökonomischen Vorteil, sondern auch eine Quelle relativer politischer Macht. Wenn Staaten ihre Macht bevorzugt mittels der Militärgewalt demonstrieren,

erzeugt ihr Energiebedarf und die wahrgenommene Verwundbarkeit als Folge von Lieferunterbrechungen eine Verkettung von Motivationen, Substitute zu entwickeln und bereitzustellen. Damit wird ein Kreislauf in Gang gesetzt, der die dynamische Natur der Energie-Konflikt-Frage illustriert.

Die vorliegende Dissertation präsentiert ein vierteiliges Modell, um die Beziehung zwischen internen Substitutionsprogrammen und externem Agieren zu analysieren. Es beinhaltet eine interne Dimension, die intervenierenden Variablen von Preis und SAPP, drei idealtypische Möglichkeiten außenpolitischen Handelns - Untätigkeit, Kooperation und Konflikt - und einen Feedback-Prozess, der die vorangegangenen drei Bestandteile des Modells im Bezug auf die Frage, wie internationale Ereignisse die Notwendigkeit von Investitionen in Substitute steigern oder vermindern und so die Bedeutung der intervenierenden Variablen verändern. Basierend auf der Annahme, dass Energie für externe Machtdemonstration entscheidend ist, Staaten diese nicht immer in den Vordergrund stellen und anfängliche Bedingungen von Energieautonomie und Investition in Substitute das Verhalten von Staaten unter verschiedenen Preis- und Lieferbedingungen modifizieren, werden drei wesentliche Kategorien von Hypothesen vorgestellt, welche das außenpolitische Verhalten der EU (und ihrer Mitgliedstaaten) und der USA und ihre jeweilige Unterstützung für Substitutionsprogramme – etwa in der Form der Bereitstellung finanzieller Mittel für relevante Energieforschungs- und Entwicklungsprogramme (ERD) - betreffen. Die erste Kategorie umfasst eine Hypothese des billigen und einfachen Zugangs zu Ressourcen. Kategorie zwei enthält vier Hypothesen, die teure und schwierige Wege diskutieren und die dritte und letzte Kategorie beinhaltet zwei feedback-bezogene Hypothesen. Sie werden mittels vier Fällen getestet, gegliedert in zwei Gruppen zu je zwei Fällen, die zu verschiedenen Schlussfolgerungen führen. Die eine Gruppe basiert auf der Annahme hoher Ölpreise im Vergleich zum historischen Durchschnitt und eingeschränktem Energiefluss, die andere auf niedrigen Ölpreisen relativ zur Historie und uneingeschränktem Energiefluss.

SAPP ist nur relevant, wenn Preise hoch sind und der tatsächliche oder wahrgenommene Handelsstrom beschränkt ist oder wenn Unterbrechungen unmittelbar bevorstehen. Unter diesen Bedingungen investieren Staaten, die SAPP betonen deutlich mehr in die Entwicklung von Substituten als Staaten, für die SAPP von untergeordneter Bedeutung ist. Zudem begeben sie sich auch mit größerer Wahrscheinlichkeit in einen Konflikt in ressourcenreichen Gebieten, um den Zugang zum internationalen Ressourcenstrom zu sichern. Konflikte scheinen den größten Einfluss auf interne Substitutionsprogramme zu haben, weil sie die Notwendigkeit steigern, Alternativen zu entwickeln. Derweil pflegen hohe Preise die Wahrscheinlichkeit bewaffneter Interventionen zu dämpfen, weil sie die Kosten von Militäraktionen und wirtschaftlichen Sanktionen steigern.

Tatsächlich kooperieren Staaten bereitwilliger, wenn die Preise hoch sind oder die Energieversorgung bedroht ist. Sie tun dies wiederum unabhängig von der Wichtigkeit, die sie ihrer SAPP beimessen. Im umgekehrten Fall niedriger Preise und frei zugänglicher Versorgung, schrumpft die Rolle von SAPP in der Bestimmung des außenpolitischen Verhaltens. Staaten, die SAPP geringere Bedeutung beimessen, verwickeln sich im Allgemeinen weniger in militärische Aktionen und unilaterale Aktionen werden unwahrscheinlicher. Obwohl Staaten eine Kooperation unter den Bedingungen niedriger Preise und freier Handelsströme nicht gänzlich vermeiden, reduzieren sie doch deutlich die Ernsthaftigkeit ihrer kooperativen Bemühungen. Ebenso fallen die ERD-Investitionsprioritäten unter Niedrigpreisbedingungen deutlich ab.

Die Analyse des Verhaltens von EU und USA betreffend Energie und Machtdemonstration deckt einen grundsätzlichen Mangel des Energieaspektes der Ressourcen-Krieg-Theorie auf. Die Ressourcen-Krieg-Theorie geht davon aus, dass soferne Staaten wegen Energieressourcen in den Krieg ziehen, Energieautonomie von zentraler Bedeutung für den Frieden sei. Es ist allerdings ein Fehler, anzunehmen, dass Energieautonomie Konflikte verringert. Staaten brechen keinen Krieg wegen Geld oder Öl vom Zaun, sondern vielmehr wegen des Wettbewerbs um Macht und dem Wunsch, mächtiger zu werden. Trotz der in den letzten Jahren gestiegenen Bedeutung von Energiethematiken im Rahmen nationaler Sicherheitsagenden, wird Außenpolitik immer noch vom traditionellen Streben nach Macht und Sicherheit getrieben. Vertreter der Ressourcen-Krieg-Theorie interpretieren Konflikte in Gebieten, die reich an Energieressourcen sind, als Konflikte um Energieressourcen. Die vorliegende Dissertation zeigt auf, dass dies nicht der Fall ist. Vielmehr sind es Konflikte um das Gleichgewicht relativer Macht, in welchem Energieressourcen nur einer von mehreren Preisen sind, die gewonnen werden können. Wird Energie aus der Rechnung des internationalen Wettstreits um Macht entfernt, hat das entweder keinen Einfluss oder es könnte dazu verführen, dass Staaten willentlich Konflikte vom Zaun brechen, da die Fähigkeit zu militärischer Machtdemonstration nicht mehr durch Energieverfügbarkeitsbedenken limitiert wird. Energieunabhängigkeit liefert nicht die Garantie für weniger Konflikte - vielmehr kann sie Bedingungen für mehr Konflikte schaffen.

7.3. Curriculum Vitae

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1990-2000	Senior Policy Adviser and Mission Expert (United Nations).
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2004-2009	Strategic Forecaster/Analyst for Egypt, Jordan, Lebanon, and Syria (Ackerman Associates, Miami).
2004-2007	Fellow & Guest Lecturer (Austrian National Defense Academy, Vienna).
2003-2004	Adjunct Fellow (American Foreign Policy Council, Washington D.C.).
1989-1990	Risk Analyst (Envoyé International, Atlanta).
1985	Project Assistant (National Science Foundation, Washington D.C.).

1984 Campaign Assistant (Ruth Braver for Congress, Chicago).

Education

2008-2010 Ph.D Candidate (Political Science) University of Vienna: Dissertation: "Internal substitution policies and external power projection: How the pursuit of energy autonomy affects international cooperation and conflict: An examination of the United States and the European Union."

2006-2008 M.A. (International Relations) Webster University: Thesis: "A Comparative Analysis of Systemic Opportunities and Constraints in US and UK Energy Policy Formulation: Implications for Inter-State Relations."

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1987-1988 Tel Aviv University: Areas of Focus: Government, politics, economics, culture, and interstate relations of the Arab states and Islamic history.

Recent Publications

Selected Articles, Book, and Conference Contributions by Topic

Energy and International Affairs

- 2010 Die Energiepolitik der EU/ Energy Politics of the European Union (with J.Pollak & P. Smolinski), (Vienna: UTB/Vienna University Press).
- 2010 "Savior or Achilles Heel: Turkish Membership in the Context of EU Energy Policy" (with J. Pollak), Paper present at the 68th Annual Midwest Political Science Association National Conference (April 22-25, 2010 Chicago).
- 2008 A Comparative Analysis of Systemic Opportunities and Constraints in US and UK Energy Policy Formulation: Implications for Inter-State Relations, (Ann Arbor: ProQuest/UMI).
- 2007 Being Rich in Energy Resources – A Blessing or a Curse, Directorate General External Policies of the Union (Brussels: European Parliament).
- 2007 "La política exterior de Estados Unidos", *Bien Comùn Comunicación política*, Número 153.
- 2006 "Revisiting the Oil Curse" *Development*, 49.3.
- 2006 "Revisiting The Oil Curse: Are Oil Rich Nations Really Doomed To Autocracy and Inequality?", *Oil and Gas Business Journal*, Issue: September.
- 2006 "Redefining Deterrence: U.S Plans for Prompt Global Strike and its Implications for International Security" presented at the NATO Partnership for Peace Civil-Military Relations Seminar IX, Strategic Cultures and Interoperability in Transatlantic Relations (Vienna, November 7).

Political Violence

- 2009 "Protecting Cultural Property in Times of War: The non-state actor dilemma" in *Proceedings of the Conference on Protecting Cultural Heritage in Times of Armed Conflict* (Tallinn: Estonian Heritage Society).
- 2009 "The Asymmetric Power of Terrorism" in Schröfl / Cox/ Pankratz (eds.) *Winning the Asymmetric War: Political, Social and Military Responses* (New York, Peter Lang).
- 2007 "In Search of that Valid Terrorist Profile" in Schröfl (Ed.) *Political Asymmetries in the Era of Globalization* (Frankfurt: Peter Lang).
- 2007 "In Search of that Valid Terrorist Profile: Debunking myths behind the violence" presented

- at the 2007 Biennial International Conference of the Inter-University Seminar on Armed Forces and Society (Chicago, October 27).
- 2007 *The asymmetric power of terrorism* [English, German, Russian] (Garmisch: George C. Marshall European Center for Security Studies).
- 2005 "Service and the Cultural Divide in Civil-Military Relations" in Micewski (Ed.) *Civil-Military Aspects (Volume 2): Military Leadership and Responsibility* (Vienna: LWAK).

Academic-Industry Relations

- 2010 "Lodestone, The Spinout Specialists" in Gögl / Schedler (Eds.) *Knowledge Loves Company* (New York, Palgrave MacMillan).
- 2007 "Lodestone, The Spinout Specialists" in Gögle (Ed.) *Wissen schafft Unternehmen - Erfolgreiche Kooperationsmodelle zwischen Universitäten und Unternehmen in Europa* (Bern: Haupt).
- 2007 "Rolls-Royce University Technology Centers" in Gögl (Ed.) *Wissen schafft Unternehmen - Erfolgreiche Kooperationsmodelle zwischen Universitäten und Unternehmen in Europa* (Bern: Haupt).
- 2010 "Rolls-Royce University Technology Centers" in Gögl / Schedler (Eds.) *Knowledge Loves Company* (New York, Palgrave MacMillan).

Newspaper Commentaries

- 2007 "Defining Terrorism", *Vienna Review*, April 2007.
- 2006 "Lebanon: A test case of European Power", *Die Presse (German)*, 29/30.7.2006 Nr.17.541.
- 2006 "America's Realist Revival", *Jugendstil*, Jul-Aug-2006 Vol.4(3).
- 2003 "Outside View: Weapons of Mass Disruption", *UPI, Insight, & Washington Times*, December 10, 2003.
- 2003 "Outside View: Power grid-lock needs fixing", *UPI*, September 22, 2003.

Working papers

- 2010 "EU Dependence on Russian Gas" (Vienna: Webster University).
- 2009 "Being Green: A cluster and factor analysis of the relationship between EU Membership and greenness" (Vienna: University of Vienna).
- 2007 "Systemic Opportunities and Constraints in US & UK Energy Policy Formulation: A comparative analysis of energy policy making in the United Kingdom and the United States" (Vienna: Webster University).
- 2008 "The Evolution of Brazilian Energy Policy: From Dependence to Regional Leader" (Vienna: Webster University).
- 2007 "Idealistic America's Retreat to Realism: An Essay on Trends in US Foreign Policy" (Vienna: Webster University).
- 2005 "Disproving Causal Links Between Low Education and Becoming a Terrorist" (Vienna: Webster University).

Miscellaneous

- 2005 "Holy Land Hotline - The History of the Modern Middle East from 1945 to 2005" as part of the *Meta4vietnam Exhibition* (Vienna).
- 2004-2009 Strategic Forecasts (numerous): Jordan, Syria and Lebanon (Miami: Ackerman)
- 1995 Nuclear Energy Information Resources on the Internet (Vienna: IAEA).

- 1990-2000 Numerous Mission Reports (Vienna/New York: United Nations)
 1996 "Information and Civilization's Third Wave" in Conference Proceedings of the International Federation of Information Professionals (Graz)

Interviews

- 2008 "Die Opec ist unglaublich", *Wirtschafts Blatt* (December 22).
 2008 "US Aussenpolitik nach die November Wahl", *Deutsche Welle Radio* (January).
 2007 "BMD: Georgia's message to Washington signals NATO aspirations", *ISN Security Watch* (May).
 2007 "Terrorists arrested in Vienna", *ATV-TV Aktuell* (12 September).

Teaching Experience

- 2011 POLT 2600 (UG) Research Methods and Approaches in Political Science (Vienna: Webster University).
 2010 INTL 5890 (Grad) Terrorism in World Politics (Vienna: Webster University).
 2010 INTL 4600 (UG) Senior Seminar on Political Violence: Terrorism (Vienna: Webster University).
 2009 Guest lecturer: "EU Foreign Energy Policy " (Jean Monnet European Centre of the University of Trento and the School of Political Science and Sociology, University of Innsbruck).
 2008 Guest lecture: "The history and changing nature of terrorism and political violence" (Garmisch-Partenkirchen: George C. Marshall European Center for Security Studies).
 2008 "Religion and political violence" at the Vienna International Christian Islamic Summer University (University of Vienna).
 2007-2010 Media and Society II & Media & Society IV (Vienna: University of Applied Sciences, FH-Wien).
 2009-2010 Thesis Supervision (Magister) (Vienna: University of Applied Sciences, FH-Wien).
 2004 Guest lecture: "Assessing Political Risk" (Vienna University of Economics, WU-Wien).
 2004-2007 Lecture programs on: "Strategic Cultures (Comparative world views and their implications for interstate relations)", "Asymmetry in the 21st Century", "Who becomes a Terrorist? The search for a valid profile.", "The Asymmetric Power of Terrorism ", and "Cultural divides in civil-military relations" (Vienna: Austrian National Defense Academy).

Recent Academic Conferences and Events

- 2010 Co-Author/Presenter (with Johannes Pollak), 68th Annual Midwest Political Science Association National Conference (April 22-25, 2010, Chicago), Panel: Turkey and the EU.
 2010 Reviewer/Discussant, 6^{8th} Annual Midwest Political Science Association National Conference (April 22-25, 2010 Chicago), Panel: External relations of the European Union.
 2009 Panelist, Seminar On Nuclear Non-Proliferation: Challenges & Opportunities, Thursday, 29 October 2009, Vienna, Austria.
 2008 Presenter, "Protecting cultural heritage in times of war: The non-state actor dilemma" Symposium on Protecting Cultural Heritage In Times Of Armed

- Conflict. Second Protocol To The Hague Convention – How To Make It Work?, International Committee of the Red Cross & Estonian Ministry of Defense, Tallinn.
- 2008 Panelist “Muslims Combat Fundamentalism to Build a New, Inclusive Europe”, *Women Without Borders & Webster University*, Vienna.
- 2007 Presenter, Terrorism: Predicting and Countering at the 2007 Biennial International Conference of the Inter-University Seminar on Armed Forces and Society, Chicago
- 2006 Panelist, *Civil Military Relations as Challenge and Opportunity*, Austrian National Defense Academy Symposium on Comprehensive International Engagement in Conflicts, Vienna.
- 2006 Panelist, *Civil Military Relations as Challenge and Opportunity*, Austrian National Defense Academy Symposium on Comprehensive International Engagement in Conflicts, Vienna.
- 2006 Panelist, NATO Partnership for Peace Civil-Military Relations (CMR) Seminar IX: Strategic Cultures and Interoperability in Transatlantic Relations, Vienna.
- 2006 *Roundtable on Nuclear Terrorism with Graham Allison*, Harvard Kennedy School of Government and the Austrian National Defense Academy, Vienna.
- 2005 Key Note Speaker, “The Asymmetric Power of Terrorism”, Fulbright International Symposium on Asymmetry in the 21st Century, Austrian National Defense Academy and University of Delaware, Vienna.
- 2005 Panel Chair, NATO Partnership for Peace CMR VIII: The Protection of Cultural Property and Military Leadership, Vienna.
- 2004 Panelist, Metaphor Vietnam, A Teach-In, Austrian Institute for International Politics (OIIP), Vienna.
- 2004 Participant, NATO Partnership for Peace CMR VII: Military Ethics Leadership and Responsibility in the Postmodern Age, NATO PFP Seminar, Vienna.
- 2004 Presenter, International conference on the psychology of the suicide bomber, Austrian National Defense Academy, Vienna.
- 2003 Participant, 4th International Conference of the European Military Pedagogy Forum: Ethics in Military Pedagogy, Austria National Defense Academy, Vienna.
- 2003 Panelist, The Transatlantic Drift Debates – Session II, The Global Panel Foundation (US Panel, American Foreign Policy Council), Berlin.
- 2003 Participant, International Workshop on the Identity of the Future European Soldier, Austria National Defense Academy, Vienna

Fellowships, Grants, & Awards

- 2010 Research Grant: Webster University (EU Energy Policy and Turkish Membership).
- 2008-2009 Research Fellow: Webster University.
- 2006 European Parliament Study Grant (EP/ExPol/B/2006/42).
- 2006 Scientific Collaborator: European Regional Development Fund Grant (FP6) – “Landscape of Knowledge”
- 2006-2007 Senior Fellow: Austrian National Defense Academy.
- 2004-2006 Visiting Fellow: Austrian National Defense Academy.
- 2003-2004 Adjunct Fellow: American Foreign Policy Council.

Professional memberships and Civic Activities

- Committee Member (2008), Foreign Policy, Obama for America Foreign Policy Network

- Member, American Political Science Association (APSA)
- Member, International Political Science Association (IPSA)
- Fellow, Inter-University Seminar on Armed Forces and Society (IUSAFS)

References

- Univ. Prof. Dr. Johannes Pollak (Senior Research Professor, Webster University Vienna; Department Head, Political Science, Institute for Advanced studies (HIS).
- Raphael Perl, J.D. (Chief of Antiterrorism Unit, OSCE; Formerly with US Congressional Research Service).
- Eric Frey, Ph.D. (Managing Editor, Der Standard).
- Prof. Donald Abenheim (Professor, Naval Post Graduate School, Hoover Institute, Stanford).

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