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Karl Johann Stelzer Wien, 26.6.2017

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# 1. A short history of the European Union

One of the main goals of the European Union is the preservation of peace among the member states. The European Coal and Steel Community (ECSC), as the Union was named at the beginning, wanted to unite the states of Europe both economically and politically. A counterweight that fortifies peace after the Second World War was necessary in order to stabilize world politics during the cold war. The Treaty of Rome introduced the European Economic Community. [1]

As a preparation for the Treaties of Rome the Spaak Report or the Brussels Report on the General Common Market is well known. An intergovernmental committee consisting of the six Foreign Ministers of the member States of the ECSC focused on two main topics. These questions had to be dealt with in order to push the further development of the Coal and Steel Community. One topic was the idea of a common market and its creation. The second topic was about the establishment of a community dealing with the peaceful use of atomic energy.

The common market soon became a core issue of the committee which then came up with the idea of getting rid of trade barriers in order to make a common market possible between the member states. Additionally to facilitated trade the report also mentions a social and financial harmonisation between the member states, the administration shall be done by common institutions and special customs arrangements need to be established with third countries in order to boost trade with the community. The Spaak report represents the basis for the discussions that were held at the Intergovernmental Conference for the common Market and Euratom in Brussels in 1956.[2]

The Spaak report suggested using a horizontal integration instead of a sector-by-sector one for the economies of the Union. The abolishment of trade barriers was the easier way to create a customs union. On the other hand the integration of the different energy sectors of the member states seemed to be much more difficult. For the nuclear energy sector the desire for integration was mainly driven by the high costs that were involved with the relatively new technology of nuclear power. Not each state has to deal with the costs on its own. Development should happen on a supranational level in order to share costs and to increase efficiency.[3]

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[1] European Union (2016)
[2] CVCE (2016)
[3] CVCE (2016a)

The advantages of nuclear power were very interesting for this young European Union to achieve the goal of economic advancement. Due to cheaper energy and the independence from imports of hydrocarbon resources the vision of being the worldwide leading exporter of goods and products got more realistic. Coal and oil as energy sources were already managed primarily by global companies and therefore weren't able to be integrated by the Union. It seems a bit funny that the topic of the integration of the electricity- and fuel gas sectors was neglected by the Spaak report as these sectors were mainly handled as national monopolies. [4] [5]

In 1957 the Treaties of Rome were signed, resulting in the establishment of the European Economic Community and the European Atomic Energy Community.

The next important step for the creation of a common market happened in 1986 when the Single European Act was signed. The main goal of this act is the creation of a "Single Market" after a six-year long programme that systematically deals with trade barriers and provides better trade flow across European borders. The "Single Market" eventually became reality in 1993 when the so called four freedoms are completed. These agreements guarantee a quite non-bureaucratic and easy movement of goods, services, people and money within the European Union.[6]

The common energy policy experienced a boost when in 1988 a very important working paper called The Internal Energy Market depicts the setup of competitive markets for each source of energy. The vision was about a pan-European trade with different forms of energy like coal, natural gas, crude oil, nuclear power and electricity. The paper was part of the central policy of the Community in the 1990s about the creation of a total internal market. Following these ambitious plans the European Parliament and the Council released two Directives that deal with an European energy market. The First Electricity Directive (96/92 EC) from 1996 and the Second Electricity Directive (2003/54/EC) will be discussed in more detail later.[7]

We also have to appreciate the contribution of the Lisbon Strategy in 2000 to the creation of the European energy markets. The strategy pointed out that an increased competitiveness of the energy markets within the Union is necessary in order to preserve the high level of dynamic and knowledge the European economy is known for.[8]

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[4] CVCE (2016a)
[5] Spaak P.H. (1956)
[6] European Union (2016)
[7] Van Danwitz T. (2006) p. 434
[8] Karan M.B., Kazdagli H. (2011) p. 13

In 2009 the latest efforts in building a common energy market were published as the Third Energy Package which consists of five main documents. It also covers five major changes that will be pointed out later.[9]

In this short general history of the European Union we see that the idea of creating a common market was quite a driving factor in the treaties and agreements that form the Union till now. A common market has the advantage of bundling the power of all member states in order to cope with the fierce competition on the global market. Although the European Union has a united stance the differences within the community are quite big. It is understandable that such important sectors like the domestic legislation or the tax systems are difficult to harmonize throughout the member states. Other sectors however have successfully been harmonized. The Spaak Report already mentioned the necessity of an integrated energy sector spanning all member states of the community. How could an integrated market for energy be established?

## 2. The liberalisation of the energy market

In order to realize the idea of a common market in the European Union the member states knew that more harmonization and integration needs to be done. Among the most important things that are very important for a strong industry within a union of states are stable and low energy prices, energy autarky from foreign states and free movement of goods, people and services within the Union. A strong industry should guarantee the European Union a dominant position in global negotiations about trade and politics.

The availability of energy nowadays is quite an important topic. We often only think about ourselves as the everyday-consumer that wants to have access to cheap electricity and energy but we aren't quite aware of the group with the biggest hunger for energy, the corporations and factories that produce our daily products. Organisations are also keen on saving money by simply finding the right energy supplier for them. Having access to electricity or any other source of energy that has a low and also stable price gives a company a big benefit for its business activities. Production can be done cheaper than that of ones competitors and with the right source of energy or the right delivery contract there are no insecurities about possible future supply shortages.

[9] Dutton J. (2015) p. 9

A common market for energy within the European Union with the ability to trade electricity across borders and to offer lower prices due to competition would provide benefits for both consumers and the industry. Liberalising the energy market throughout the Union is a quite ambitious plan. The national states have their own sorts of energy network which can differ very much from each other and are also sometimes keen on saving their public utilities from competition.

Additionally the electricity market has some characteristic features that don't allow the legislature to treat it like any other company that buys goods or sells its products. The most obvious disadvantage of electricity is that it can't be easily stored in big amounts as you can store gas or oil for example. With the progress in newest storage battery technology and some other fascinating storage prototypes we might have one day the ability to produce electricity and keep it on stock for some time. Nowadays electricity is generated and used instantly which is quite challenging for utilities.

They have to match supply and demand throughout the day and have to work with a variety of different electricity sources in order to provide stability on the one hand and flexibility on the other. Extra costs for electricity suppliers are a result of the spare capacity that is needed in order to cope with usual or unusual demand peaks that might occur.

The next peculiarity is the need for a transmission network. Electricity gets transported via a network that has usually been built up by state-owned utilities. Third parties might also install a transmission network in order to transport their supply of electricity but such an approach would be quite costly and complex. In a liberalised market all supplier need to have the opportunity to transmit their electricity over the already installed network. They also have to be sure about the reliability, the provided maintenance and the geographical coverage of the network provider.

The volatility of electricity prices is another problem. Demand elasticity is very low and at a high demand the supply gets very inelastic. In other words the changes in electricity prices have hardly an effect on the demand. At a certain level of electricity needed, further changes of the demand have barely influence on the supply of electricity. The power generator can't provide more electricity all of a sudden if he is already using all of his resources to generate the maximum of electricity. [10]

[10] Heddenhausen M. (2007) p. 4

Electricity plays such a vital role in our life that we are dependent on a reliable supply of it. For a lot of cases of application there are no useful substitutes for electricity yet.
If we look back to at the beginnings of the electricity era we see that the first pioneers that supplied small and regional areas with their networks were soon ousted by upcoming big national transmission networks that were vertically integrated. It became a state's duty to supply its citizens with electricity. A lot of modern conveniences became possible due to the security of supply and the expansion of transmission networks provided by state-owned utilities. Electricity supply was a natural monopoly with the utilities having all stages of production under their control. Experts argue that only few sectors of the production and distribution chain of electricity should be free from competition and held under regulation whereas other parts like the generation and retail can be operated under competition. The separation of these sectors is necessary in order to not let large utilities take advantage of their vertically integrated structure.[11]
They would benefit from their market and financial power and could subsidise certain sectors to corrupt the competition.

## 3. The legal framework

Nearly all of the Member States of the European Union were convinced that a competitive energy market couldn't work out. The importance of supply security, the complexity of the value chain and the high capital intensiveness were regarded as only manageable by governmental resources. Rethinking occurred at the beginning of the 1990's when the realisation of the European Common Market happened and the disadvantages of differing energy prices between member states became obvious. Nations realized that energy prices are an important coefficient for the attractiveness of their country as a location for many companies. With the four freedoms the movement of organisations got much easier and they took or would take their chances to relocate production or headquarters to member states with lower energy prices. Now many states had a common interest in reforming and integrating the electricity sector in order to lower and stabilize prices within the European Union. France for example didn't agree with these new interests and feared that the focus lies too much on the economic aspects of a liberalisation rather than the importance of keeping the quality of public service at a high level. [11]

[11] Heddenhausen M. (2007) p. 4-5

Numerous utilities put much effort in the prevention changes and tried to preserve the status quo. Large industrial customers were persuaded to not file complaints at the European Commission about the prevention of freedom to switch your supplier by just offering them generous discounts on their electricity prices.

Besides these attempts, the negotiations to define the upcoming liberalisation of the electricity markets went on and were even boosted by the success stories of the United Kingdom, the United States, New Zealand and Norway.

Some supply companies even got caught by their own double standards. They used the reformations in Eastern European countries' electricity markets to enter them and start business as the new players whereas they put much effort in the prevention of market liberalisation in their home markets. [12]

[12] Heddenhausen M. (2007) p. 5

## 3.1 The first Electricity Directive

After five years on December 19th 1996 the Council of Ministers could agree on a position called “Directive of the European Parliament and of the Council concerning common rules for the internal market in electricity” (96/92/EC)

Europe’s first Electricity Directive went into force in 1997 on February 19th and needed to be transposed into national law within two years.

Four main areas were meant to be reformed in the member states. [13]

### *3.1.1 Construction of new generation capacity*

Before new electrical power plants are constructed in the member states each state needs to define Transmission System Operators (TSO) who are responsible for the operation and maintenance as well as the supply security in a given area. There also needs to be one or more Distribution System Operators (DSO) who are responsible for the supply in a given territory. Both types of operators might be autonomous organisations or they might also be departments of bigger companies that are already operating in the energy market. For the latter case the Directive commands separate precautions that need to be followed.[13]

### *3.1.2 Unbundling*

It might be the case that vertically integrated electricity companies also undertake the tasks that are done by a TSO or a DSO. In such a case these companies have to make sure that separate accounts are being made for their production, transmission and distribution sectors. In order to prevent cross-subsidization, an unfair competition or discrimination the transmission and distribution operators need to act independent from the rest of the firm. The directive describes this necessity in cases of vertical integration as unbundling.[13]

Due to recommendations from the European Court of Human Rights and the German Federal Constitutional Court and the opposition from some states the need for an ownership transfer was cancelled and the sole segregation of management and accounting between network operations and the transmission and distribution activities of vertically integrated companies was chosen.[14]

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[13] Heddenhausen M. (2007) p. 5-6

[14] Van Danwitz T. (2006) p. 436

### *3.1.3 Access to the network*

As mentioned above the TSOs and DSOs have to act completely non-discriminatory and have to grant access to the electricity network to who is entitled to. The member states could choose between three different types of procedures that allow third parties to access the network.[15]

The **negotiated access** represents basically a contract that is negotiated between the generators, the system operator and the retail suppliers.[15]
This option is the most commercial one with voluntary agreements. The costs of network-access aren't regulated beforehand but will be controlled afterwards by antitrust authorities.[16]
An ex ante system which allowed access at already **published tariffs** to entitled parties was a stricter option. [16]
In order to appease France the third option was implemented. With the **single buyer procedure** the member state can define a legal entity that is the single buyer for a certain territory controlled by the system operator. This legal person is within the system responsible for the transmission system. The duty might also contain the centralized purchasing and selling of electricity.[17]

### *3.1.4 Retail competition*

In order to slow down competition and to protect the market as a whole the opening was conducted stepwise. First of all only consumers with a demand of more than 40 GWh per year could be supplied by the new scheme. These mostly large industrial customers represented about 22% of the national electricity markets. The next level of opening happened in 2000 when the barrier was lowered to 20 GWh per year. In 2003 even customers with a minimum demand of 9 GWh per year were able to benefit from the new scheme. In article 26 of the Directive the possibility is mentioned that further liberalisation could take place in 2006.[17]

Most of the member States transposed more than just the minimum requirements from the Directive into national law and often opted for the more liberal alternative. Two thirds of the electricity market had already been competitive by 2000. 80% of the member states chose the legal unbundling option for integrated electricity [17]

[15] Heddenhausen M. (2007) p. 6
[16] Van Danwitz T. (2006) p. 437
[17] Heddenhausen M. (2007) p. 6

companies in order to separate their generation and distribution activities rather than the unbundling of just the management.

The negotiated network access option had been chosen by Germany whereas the other states opted for the third party access alternative. Another strong evidence for the success of this first Directive was the average decline of electricity prices in the Union by 6% from 1996 to 1999. The Commission was quite optimistic when they agreed on the following "Acceleration Directive" (2003/54/EC) that had to be transposed by July 2004.[18]

### 3.2 The Second Electricity Directive (Acceleration Directive)

The new Directive goes on with its work on liberalization and has the intention to create an electricity market which is open for all customers after July 1st 2007. This fixed market opening needs to be done in order to prevent distortions of competition due to otherwise varying market opening standards across the member states. The focus also lies on the improvement of the competitive market which means that some regulations are necessary.

Member states have the right to command obligations that are of public interest to electricity companies. For governments the supply security is quite important but also other topics get more and more attention these days. Electricity companies might get forced to increase their energy efficiency or to put more effort in climate protection.

States have to deal with obligations too. It is the states duty to guarantee an adequate supply with electricity at appropriate and transparent prices to the end-users. Such a guarantee for a minimum level of energy supply to serve economic interests is a new point in the common electricity plan.

The national regulatory authorities are monitoring the balance between the national demand and supply and have to plan ahead for the expected demand in the future and the needed capacity. Also the quality and maintenance level of national networks need to be checked. The monitored data along with intended measures have to be reported to the European Commission.[19]

#### *3.2.1 Stricter Unbundling*

The Second Directive also extends the regulatory tools in order to make competition decent for the now liberalized electricity market. While with the first Directive there [19]

[18] Heddenhausen M. (2007) p. 6-7
[19] Van Danwitz T. (2006) p. 438-440

had only been the need for the commercial unbundling of vertically integrated electricity producer whereas now a legal separation is needed.
Transmission and distribution system operators need to have their own legal form and entity so that they are completely independent from the rest of the departments of a vertically integrated company. Most important of all is that they have to be able to make decisions on their own without any influence from a third party. [20]

### *3.2.2 More regulation for the access to the network*

The three options for the elaboration of the access to networks have been decimated so that access is only possible via the regulated system concept.
Germany was the only state that opted for the negotiated system. Here the parties negotiate the conditions and charges for the use of the network on their own. The lawmaker trusts the network operators and third parties enough to let them reach a consensus without his involvement. In Germany a system of "consensus of branches" evolved where the proceedings were done in a quite effective way. Basically two coalitions represented the transmission and distribution network operators (Verband der Elektrizitätswirtschaft, Verband kommunaler Unternehmen) and two others take care of the interests of the third parties (Bundesverband deutscher Industrie, Vereinigung industrieller Kraftwirtschaft). The criteria for the calculation of charges and the network access are written down in these "consensus of branches" agreements. Legislation approves of these practices and declares the resulting arrangements as binding. Some experts are praising this kind of self-administration whereas others doubt the fairness of criteria that get arranged by companies that are directly involved in the energy market.
With the conversion to the regulated access only possibility these debates have come to an end. Conditions and prices for the network entry are now given by a regulatory board. Luckily community law only insists on an ex-ante authorization of charges, the methods that are used to calculate them and the criteria for network access. This gives member states the freedom of choosing from several different approaches for the calculation and the access criteria.
National regulatory authorities can either review and maybe adopt an already existing charging and access scheme and then accept it or they might even come up with a framework themselves. [20]

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[20] Van Danwitz T. (2006) p. 439-441

With this new approach the commission solved the problem of a possibly compromised charging and access system and of a quite narrow bodice of predefined definite tariffs. Only the calculation methods and criteria for entering the network are authorized which leaves enough room for negotiations and consent for the parties involved in the electricity market. [21]

### *3.2.3 The calculation of tariffs*

The Second Directive provides just a loose guideline on how to calculate the charges for the access to the network. The criteria are quite general like the prices need to be objective, based on the real costs and shouldn't discriminate anyone. Additionally regulatory authorities have to consider that the charges should also allow the network operators to invest in maintenance, expansion and the quality of the distribution networks.

Charges based on too high costs will lead to an unfair competition due to the discrimination of smaller, not so financially strong competitors that don't own the necessary infrastructure and therefore have to pay for the access to third-party networks. These distortions of the transmission level will eventually also influence other parties of the value chain down to the customer.

If charges are based on too low calculations the parties seeking for access will benefit but the network operators won't have any incentive to invest their small profits in the network. Without proper funding the quality of services, supply security and intentions of expansion will decrease.

We can see how vital the work of the regulatory authority is and how difficult the development of a catalogue of guidelines and criteria is that will guarantee a fair calculation of prices. The costs which are taken into account from the authority need to allow charges that satisfy both the network operators and the parties that rely on the access to external networks.[22]

### *3.2.4 Efforts in climate protection*

A quite important topic for the European Union is the protection of the environment and therefore also of the climate. Besides all the effort that is put into the realization of an integrated energy market member states are following their own ideas and agendas to protect the climate. The individual states are of course allowed to have their own plans on how to get rid of environmental pollution. The Union always

[21] Van Danwitz T. (2006) p. 441-442
[22] Van Danwitz T. (2006) p. 442

encourages its members to fight pollution and there are numerous acts dealing with it. In the field of electricity production and supply a very prominent tool in order to protect the climate and save energy is the use of renewable energy sources. Many member states are taking advantage of the geographical possibilities they have to generate power from renewable sources. Subsidisations and publicity campaigns are often used by governments to boost the share of renewable energy. Some of these schemes might be controversial and could threaten the idea of an integrated electricity market.

Germany adopted a law that makes it necessary for operators of transport systems to also have energy from renewable sources in their mix. The supplied electricity has to contain at least a certain amount of alternative electricity. This kind of electricity is obtained at higher productions costs than electricity from sources like crude oil or natural gas. We know that renewable energy is a more expensive option customers might be willing to pay in order to help protect the environment. The German model however leaves no room for individual choices and so the operators are including their additional costs in the prices for the consumer. Some people might prefer lower prices than to protect the climate, use and promote renewable energy sources. The consequences are that the energy prices are quite high in Germany which leads to rising costs for the production industry and the consumer. It is difficult to find the advantages and disadvantages for the economy of this promotion scheme but Germany's approach is fully confirmed by Community law. In the case C-379/98 of PreussenElectra against Schleswag AG before the European Court of Justice in 2001 the court declined the categorization of the German model as a national subsidy for producer of renewable energy. According to the court the freedom of movement of goods is not compromised by this approach. [23]

Only German producer of alternative electricity benefit from the law because the network operators are obliged to buy from them which makes the model a discriminating threat to inner-Community trade.

The court justifies its sentence by underlining that one of the main objectives of the Policy of the Community is the environmental protection and therefore also the promotion and development of renewable sources of energy. By the time this case was negotiated the court could only refer to the First Electricity Directive. [23]

[23] Van Danwitz T. (2006) p. 444

With the Second Directive things have changed a bit due to the importance it puts on the complete opening of the electricity market.
Member states still have the possibility to grant certain or exclusive rights to companies that will fulfil services which are of general economic interest but the excessive use of this possibility will eventually lead to the return to national energy markets. National authorities have to consider these outcomes when they are evaluating and allowing such national promotion schemes.[24]

### 3.3 Further progress for a common energy market

This chapter relies mainly on the statements of Joseph Dutton (2015) p. 7-8. The EU Presidency of the United Kingdom in 2005 boosted the liberalisation of the energy markets significantly. Priorities were the strengthening of open and competitive European energy markets, supply security for the future and the coping with climate change. The second point was achieved by empowering relations between the Union and energy supplying third countries. Dialogue with Russia as one of Europe's main supplier was intensified and south eastern European states became part of the common market by the adoption of the European Energy Community Treaty. Ties with the OPEC were also intensified.
Tony Blair, Prime Minister of the UK, urged for a Union-wide security policy before the background of high oil and gas prices, Europe's increasing need for energy, the dangers of climate change and the import dependency of European electricity producer. His speech at the Hampton Court Informal Heads of State or Government meeting in October 2005 became even more urgent when the relations between Russia and the Ukraine worsened from 2004 to 2005 and were at an all time low when Russia shut down its gas deliveries to the Ukraine in January 2006. After the Hampton Court summit a green paper was produced by the Commission. The content of "A European Strategy for Sustainable, Competitive and Secure Energy" identifies six key points which are important to prepare for future challenges.
The paper also deals with topics concerning climate change besides the main objective of establishing an internal energy market.

[24] Van Danwitz T. (2006) p. 444-445

The goals are:

- Creation of functioning internal gas and electricity markets
- Unity between member states concerning energy supply
- Supply security and competitiveness of energy
- A common front against climate change
- Support for innovations
- A unified position concerning external energy questions

In order to control the success of the Second Energy Directive from 2005 the Commission started a survey among people involved in the energy sector in order to find possible disadvantages or shortcomings of the Directive. The decision to such a survey was based on the indications of consumer and companies just entering the market regarding increasing prices. Findings of the survey were published in January 2007 and relate to the gas and electricity market.

- Market concentration in national markets
- Unsatisfying liquidity
- Lack of linkage between European national markets
- Quite poor transparency
- Insufficient unbundling

The commission took these findings as an occasion to work on a new Directive that will get rid of these distortions of competition. This work summated in the release of the Third Energy Package in 2009.

### 3.4 The Third Energy Package

The following statements rely heavily on the findings of Joseph Dutton (2015) p. 9.This Package is not only a new Directive but consists of two Directives and three regulations. The older directives concerning common rules for the gas and electricity trading scheme got replaced by the Directives 2009/73/EC and 2009/72/EC. Newly introduced regulations EC/715/2009, EC/714/2009 and EC/713/2009 dealt with the access to transmission networks for natural gas, the access and conditions regarding transboundary exchange networks for electricity and the creation of the new agency ACER.

After this short introduction to the legal basis we can identify the main subjects of the new package:

- Network operators and energy suppliers/generators need to be unbundled
- Regulators become more independent
- Introduction of ACER (Agency for the Cooperation of Energy Regulators)
- Augmented TSO cooperation across borders (establishment of ENTSO-E, European Network of Transmission System Operators for Electricity)
- The need for more transparency in retail markets

The instructions on unbundling became now stricter and Article 9 used the new term of “structural separation”. Segregation now happened between the transmission system operators and the activities of generation, production and supply in order to prevent conflicts of interest and to increase transparency. The conditions commanded by Article 9 had to be met by member states until March 2012 whereas the remaining content of the Package had to be transferred into national law by March 2011.

### 3.5 The European energy market

This chapter refers to the work of Joseph Dutton (2015) p. 11-12.The completion of the internal energy market (IEM) was expected by the Commission to happen by 2014. The model of the IEM is being made possible by the deployment of a wide variety of integration instruments but relies on two principles.

- Markets only deal with energy and measure their revenues by the price paid for a supplied unit of energy.
- A European virtual market is built up by the linking together of day-ahead spot markets.

The latter principle leads to the European Pricing Coupling mechanism that can forecast volumes and prices for all zones by taking demand and supply data into account and the marginal pricing principle. This mechanism and also the establishment of a transboundary European transmission network are led by ENTSO-E with support from ACER, the transmission system operators and CEER (Council of European Energy Regulators).

The CEER also started the European Regional Initiative (ERI) to boost the coupling of national electricity markets around Europe and the resulting single market. ACER pursued a similar goal when it formed the “EU Energy Work Plan for 2011-2014”

together with national regulators. The main idea contained the implementation of several ideas which are helpful for a single market.

- Need for a unified European price market coupling model
- Establishment of a transboundary European intraday trading system
- Harmonised rules for the receipt of long and medium-term transmission rights and a single distribution platform for them
- Implementation of methods for a coordinated capacity calculation and a flow-based allocation procedure for very reticulated networks

In order to make a first step towards a single market seven regional electricity organisations were formed. It is easier to implement the four ideas mentioned above into a smaller, more characteristic market than trying to change the whole European market at once. With their feature characteristics each regional organisation had to deal with other deficiencies and benefits. When the organisations managed to establish an own internal market according to the European Scheme, the connection of them would form a single market.

### *3.5.1 Network codes*

The following remarks are based on the statements of Joseph Dutton (2015) p. 12-14.The software needed for the completion of the common market consists of several network codes. They basically act as operational rules for the technical and commercial access to the energy networks. With their help standardised and barrier-free trade between the member states should become possible.

The codes are an invention of ENTSO-E that wants to develop ten different codes that will affect the three categories of the harmonisation process. These include the grid connection, the system operation and the markets.

Development started with three codes:

- Capacity Allocation and Congestion Management (CACM)
- Forward Capacity Allocation (FCA)
- Network Balancing (NB)

As a result of the significance the CACM code plays in transboundary trade and the creation of interconnectors, the Commission prioritized its development in October 2014. It should structure the mode for distributing capacity based on day-ahead and present trading timeframes and the calculation of capacity between states and the regional markets. Release is expected to take place in the second quarter of 2015.

Delays have overthrown the timetable of ACER, ENTSO-E and the Commission from 2011 where the comitology process for 8 codes was estimated to take place in the first quarter of 2014.

Only two other codes, Requirements for generators (RFG) and Demand Connection (DCC) were mature enough to enter the comitology stage in January and March 2014.

Priorities are now put on the progress of the codes dealing with the easing of short-term trading and the advancement of supplementary services for new market entrants. The transparency and level of information provided by the wholesale market received a big improvement when ENTSO-E completed its REMIT (Regulation on wholesale Energy Market Integrity and Transparency) page in January 2015.

### *3.5.2 Interconnections*

This chapter utilizes the findings of Joseph Dutton (2015) p. 14-16.

National electricity grids already started to work together in 1951. The idea was to connect electricity systems so that the benefits of different markets can be exploited. A central organisation was established to coordinate the trade, the Union for the Co-ordination of Electricity Generation and Transmission (UCTE). The key data for each transboundary trade of electricity had to be negotiated individually between the generators and the supplier. Contracts were usually arranged for long-term capacity. The UCTE grew from initially eight members to 20 transmission system operators by the year 2000. The European Union started its development of an Internal Electricity Market and realized the potential interconnectors offered.[25]

On July 1st 2009 the UCTE was ousted from its business and its tasks are now done by ENTSO-E. During the last year of operation UCTE represented 29 TSOs from 24 different states of continental Europe.[26]

The Commissions idea of interlinking different electricity markets will equalize prices across them. Regions with lower prices will sell their energy to the distributors that live in areas with higher price level. As this goes on over some time a common wholesale price for the involved regions will evolve and diminish the risk of price peaks. The increase in market coupling is heavily forwarded by the establishment of interconnections between markets.

[25] Ottaviani M., Inderst R. (2005) p. 4
[26] ENTSOE (2015)

Within interconnected sectors the supply and demands of their individual parts are matched together regardless of the sector they are coming from. The aim is to grant all members of the coupled market a surplus. This surplus will vanish over time as the capacity of the interconnectors reaches its limit or when the prices approximate.[27]
The opposite of market coupling is its splitting which is used in areas that are managed by Nord Pool spot. This single big power exchange operator controls the uniform price of some regions creating a de facto coupled market.[28]
In order to improve the energy infrastructure across Europe the Commission prepared a list of Projects of Common Interest (PCIs) in October 2013 in regulation C(2013)6766. The advances however are quite negligible. Seven projects were still under construction and only one had been commissioned by October 2014. Of the remaining projects 51 needed to be permitted, 40 were tested for feasibility and 28 were waiting for their Front End Engineering Designs. Currently the Commission is expecting to be able to empower 28 schemes by 2017, even 77 in the period from 2017 to 2020 and 33 projects after 2020.
The strict timetable of the Commission might be overthrown as the PCIs are facing some problems like the question of permissions from national authorities, public understanding of the projects, incompatibilities of cross-border plans and insufficient financial support.
In order to fasten up the implementation of PCIs the Commission included Article 10 in the TEN-E regulation 347/2013 which orders member states to accelerate their permitting procedure for projects of common interest. The application and permission procedures of the states should be done within 42 months. Longer procedures are “unacceptable” as phrased by the Commission. Unfortunately by the third quarter of 2014 11 member states still lacked the required one-stop shops for accelerated procedures of PCIs. Due to too little effort the level of interconnection between member states is quite low as mentioned by the Commission in April 2015. At the end of 2014 there were 14 of the 28 member states that had interconnection levels of less than 10 percent.
Projects of interconnection seem to have low priority in national agendas despite the fact that the Commission is constantly pointing out their importance for a functioning wholesale market. Interconnections represent the hardware whereas the network codes are the software that are necessary for and are enabling transboundary trade

[27] Belpex p. 1
[28] Moffat Associates (2007) p. 6

and capacity balancing. As vital parts of the Third Package they should prepare Europe for a future Energy Union. A first benefit of the European energy market was presented by the Commission in January 2015 when it was shown that wholesale prices of electricity fell by 33% in the period of 2008 to 2012. Two events coincided with the price fall. The strong increase in electricity from renewable sources and the diminishing of electricity demand from 2008 to 2012 by 3 percent need to be mentioned.

Member states and their markets are being connected so that they can operate as one and react to cross-border supply and demand data.

In the next chapter we will have a look at the feature characteristics of some national electricity markets and how they managed to fulfil the requirements of the numerous Directives and regulations in order to prepare their energy sector for the pan-European project.

## 4. The gas market in Europe

Since 1998 restructuring happened to the gas markets in Europe due to less domestic resources and the different geographical characteristics of the countries. On the one hand the Union wants to harmonize the gas markets but on the other it also wants to offer individual solutions for each country that has to deal with peculiarities of its market. The largest volume dealing gas hubs in Europe are the Bunde-Qude, Zeebrugge and Baumgarten hubs. Liberalisation faced the same obstacles in the gas market as it did in the electricity one but today gas supplier can be chosen freely by consumer in most European countries. Monopolistic gas companies are still quite influential like their electricity counterparts but had and have to deal with declining market shares as new competitors enter the market. To defend their power many of them expanded in Central and Eastern Europe or took the opportunity to set foot in other markets like electricity, water or telecommunications.

An inquiry by the European Commission revealed market distortions despite the recent progress. The lack of unbundling well-established vertically integrated companies support a high level of power concentration in the market. Infrastructure is often too weak to deal with additional market participants. Some gas markets are even bankrupt and cross-border competition still very weak. [29]

[29] Karan M.B., Kazdagli H. (2011) p. 17-18

More improvements need to be done for the exchange of trustworthy information and better transparency.[30]

The market structure of gas differs from that of electricity as we know that gas isn't always produced and consumed in the same country. A network of pipelines across Europe makes sure that gas flows to its consumer. Before the liberalisation a point-to-point system combined with long-term contracts was used to transport and trade gas. Tariffs considered the differing infrastructure costs and property rights from point to point. The European Commission saw the dangers of this practice to liberalisation. Long-term contracts created a protected market for European gas importer and their foreign supplier that could make it nearly impossible for new participants to enter the market. Gas prices were also distorted by artificially binding them to oil product prices. [31]

Entry-exit zones (EEZs) were created to cover the territory of a country and lower transaction costs. Within an EEZ the price is unified and transportation and service costs are shared equally among all users of the EEZ. The size of an EEZ might be problematic. Zones need to be big enough to form an attractive market for supplier, trader and buyer but they shouldn't be too large to create excessive costs in case of too much congestion. The unified price across an EEZ is also useless to identify bottlenecks or areas of notorious congestion. Investments for new pipelines or an expansion of capacity should be dictated to TSOs by the regulator. The head of the Austrian regulator E-Control, Walter Boltz, sees the need for regulators to have the power to decide on long-term or cross-border investments. Due to this problem EEZs won't get enlarged and will probably stay country-sized.

The only market with the potential for multinational size is the Central European gas hub. It connects Russia as a supplier with Austria, Germany and Italy with the possibility of including the Czech, Slovakian and Hungarian market.

Realization of interconnectors to support cross-border trade and market coupling happens slower than in the electricity sector. The gas industry is not very keen on being treated the same way as it was possible with the electricity sector. A convergence to the electricity market however is not probable as the transport costs are often neglected there whereas having a big influence in the gas market.

Long-term contracts include the extraction and transport over several countries making the end-customer pay for other foreign networks and his domestic one. [31]

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[30] Karan M.B., Kazdagli H. (2011) p. 18

[31] Buchan D. (2013) p. 36-40

A big part of gas prices is influenced by transportation cost but also by congestion costs. These overloads might originate from real capacity divergences at cross-border interconnectors but also from contractual congestion where a contract reserves more capacity than in reality and creates an available but invisible one.
The European Commission often identified this behaviour as strategic hoarding of capacity. Maybe congestions should be provoked and prices corrupted by an artificial scarcity. In a monitoring of 7 interconnectors in 2011 ACER and CEER found out that their fully used and booked capacity was actually only utilised by 42 to 92 percent. Their central value of capacity in use was around 60%.
Network codes coping with congestion were designed to improve service and supply security as well as to deal with capacity hoarding.

- Unused capacity can get used by other market members that need to transport gas. Congestion Management Principles CMP
- When a TSO identifies available capacity he has to offer it to the market for further use. As a consequence of CMP the Capacity Allocation Methodology CAM directs the release to the market
- Market balancing for day-ahead and intraday trade is in the responsibility of the network user. Balancing[32]

## 5. Characteristics of national electricity markets

Among the different markets for energy in the European Union, the electricity market is the biggest one despite its competition problems amid the member states. Europe can be classified into three major markets for electricity. There is the United Kingdom, the Nordic countries and Continental Europe. With the Third Energy Package the formation of regional markets happened. It is better and easier to cope with fewer medium markets than with many small ones. These seven Electricity Regional Initiatives (ERIs) might evolve in a step-by-step plan to the desired single European energy market.[33]

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[32] Buchan D. (2013) p. 36-40
[33] Karan M.B., Kazdagli H. (2011) p. 14-15

The following table depicts the seven regions and the countries that are part of them. Sometimes a state is divided and its parts get managed by more than one ERI. The German territory for example is very big and therefore gets split up into four regions which are member of four different Initiatives like Central East, Central South, Central West and Northern. Austria and Slovenia aren't that vast and can be categorized geographically into the ERIs Central East and Central South. Other states can be unified as a whole into one region like Belgium, Luxembourg and the Netherlands or the Baltic states.[34]

| Region | Country of lead regulator | Members solely represented in this ERI | ERI Members with membership in other ERIs |
|---|---|---|---|
| **Baltic** | Latvia | Estonia<br>Latvia<br>Lithuania | |
| **Central East (CE)** | Austria | Czech Republic<br>Hungary<br>Slovakia | Austria<br>Germany<br>Poland<br>Slovenia |
| **Central South (CS)** | Italy | Greece<br>Italy | Austria<br>France<br>Germany<br>Slovenia |
| **Central West (CW)** | Belgium | Belgium<br>Luxembourg<br>Netherlands | France<br>Germany |
| **Northern (N)** | Denmark | Denmark<br>Finland<br>Norway<br>Sweden | Germany<br>Poland |
| **South West (SW)** | Spain | Portugal<br>Spain | France |
| **France-UK-Ireland (FUI)** | United Kingdom | Ireland<br>United Kingdom | France |

*Table 1: The seven Electricity Regional Initiatives (ERIs), Everis (2010) p. 26*

### 5.1 The United Kingdom

As the first member state that started the liberalisation of its electricity supply industry the United Kingdom can act as a blueprint for other European countries struggling with reforming their electricity sectors.

[34] Everis (2010) p. 26

The reorganisations began with the Electricity Act of 1947 and led together with further changes in 1955 and 1957 to the introduction of the Central Electricity Generating Board (CEGB) for England and Wales. This board managed the generating and transferring of Power as a monopoly.[35]

The Electricity Council as an umbrella organisation was responsible for the development and maintenance of the industry and counselled the government on questions of the future evolution of the electricity industry. Besides three permanent members it also consisted of the current representatives of the CEGB and the chairmen of the 12 area boards.[36]

The control and setting of the electricity prices fell in the jurisdiction of the Office of Gas and Electricity Markets (OFGEM) and the whole market was vertically integrated. Oversight and coordination concerning the CEGB and the 12 Area Board was done by the Electricity Council. The CEGB did the generation of power, its transmission and sold the electricity to the 12 Area Board which distributed it to the final customers. A crisis in the 1970s showed the government that many problems within the electricity sector existed and couldn't be solved by just some minor changes. It was confident that private organisations are more able to cope with the difficulties of the market and to offer benefits to customers such as lower prices, better service and a faster introduction of innovations. Restructuring needed to be done and the electricity act of 1989 provided the necessary legislation for it. The main objectives were to deconstruct the CEGB and create separate incorporations for the market areas of generation, distribution, transmission and supply. The liberalization should be done with 3 stages. First of all only large customers with a demand of more than 1MW were allowed to change their supplier. The quantity was changed in 1994 to include user with more than 100KW of demand. At the end of 1998 all companies and also domestic consumer were allowed to choose their individual supplier.[36]

The generating of power was now done by three companies, National Power, Power Gen and Nuclear Electric which bundled all nuclear power stations.

The transmission sector was overtaken by National Grid Company, a new organisation owned by the 12 area boards that were privatised and became Regional Electricity Companies (REC). Their shares had been sold to private investors in [37]

[35] Heddenhausen M. (2007) p. 8
[36] Rotaru D. V. (2013) p. 268-270
[37] Heddenhausen M. (2007) p. 9-10

1990 The National Grid Company is a transmission system operator who sells the electricity it receives from the power pool of the three generators to supplier. National Grid was put on the stock exchange in 1995.[38]

The government saw the necessity of protected sectors despite all its liberalization efforts. Certain amounts of electricity from nuclear power generators, renewable and non-fossil sources had to be bought by the RECs in order to decrease the Kingdoms dependency on fossil fuels.[38]

The Office of the Director General of Electricity was established in order to observe the leftover monopolies in the transmission and distribution sectors and the liberalized generators. It also acquired the surveillance of the gas market in 1999 and was renamed as the Office of Gas and Electricity Market (Ofgem). [39]

Mach 2001 marked a big step of the liberalisation efforts of the electricity market. The tool of the New Electricity Trading Arrangements (NETA) was deployed. Generators and supplier were now able to trade energy in both directions. Forward contracts to sell capacity in advance could now be concluded on a daily, weekly, monthly and yearly basis. A Balancing Mechanism for the system operator was introduced and made it possible to raise or reduce the generation of power in order to match short-time fluctuations in demand and supply. The mismatches are bought or sold by the operator and later charged to the market. About 2% of the supply is influenced by this mechanism. Generators had now the possibility to make long-term forward contracts in order to insure against price volatility and the financial risks of long-term projects. In case of miscalculations the shortage or superset had to be traded at Power Exchanges. NETA finally completed the liberalisation of the energy market in the UK. In its first year prices for the base load fell by 20% and peak prices by 27%.[40]

The Scottish electricity market liberalized quite similar to that of Wales and England and they were unified in 2005. National Grid Company is in charge of the Scottish transmission network while there are still two vertically integrated, private electricity corporations Scottish Hydro-Electric and Scottish Power. Scottish Nuclear was adopted by the state owned Nuclear Electric which was later renamed to British Energy and privatised in 1996. [41]

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[38] Heddenhausen M. (2007) p. 9-10
[39] Heddenhausen M. (2007) p. 10
[40] Ottaviani M., Inderst R. (2005) p. 3
[41] Heddenhausen M. (2007) p. 9-10

The generation market by 2006 had 8 companies with market shares over 5% and 39% of the capacity were provided by British Energy, E.ON and RWE.[42]

### *5.1.1 The prices*

We are going to have a short look at the historical evolution of prices of some fuel components in the United Kingdom. The whole picture is a bit confusing but the electricity prices will be discussed in more detail.

The following chapter utilizes statements from Dempsey et.al. (2016) p. 4-5 and 9.

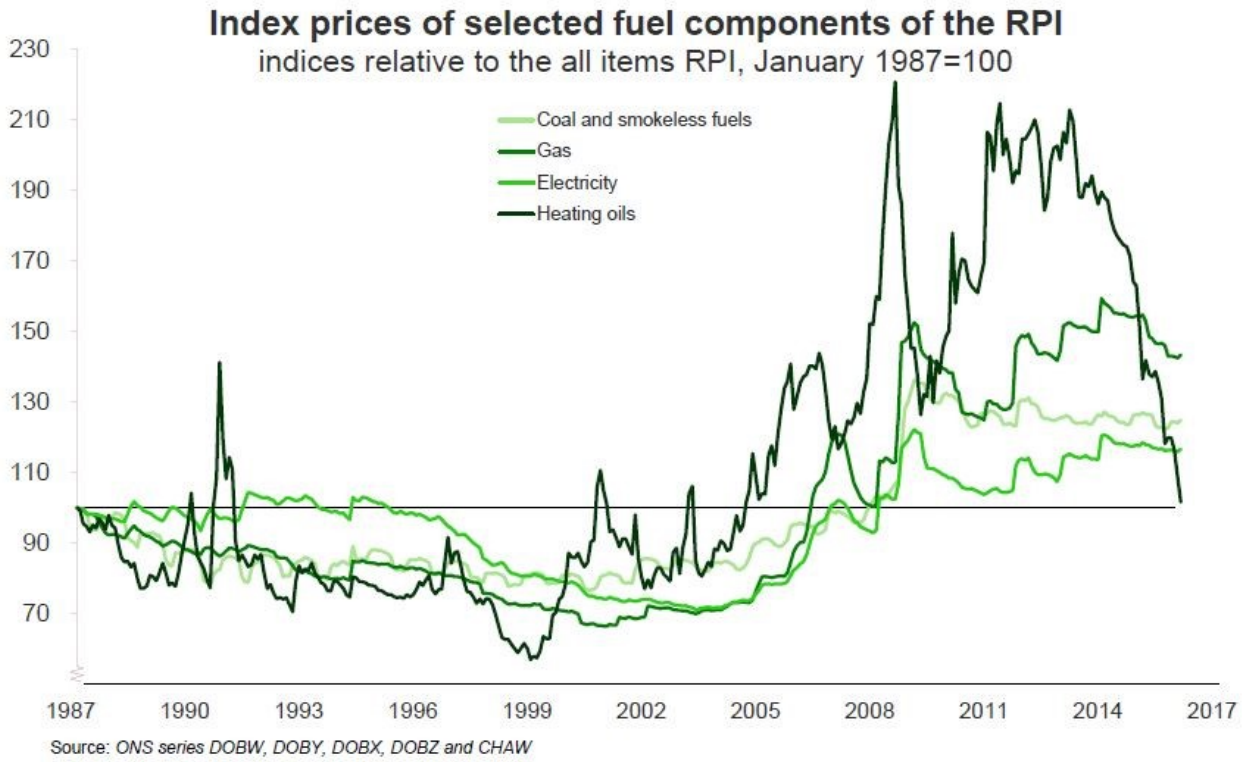


*Figure 1: Index prices of selected fuel components of the RPI, Dempsey et.al. (2016) p. 4*

The components are depicted with the Retail Prices Index (RPI) which measures the alterations of costs of a certain good or service. The timeline starts in 1987.

For the electricity prices we can see that they remain quite stable until 1995 and then start to continuously fall. Controls from the regulating authorities and an increasing competition made the decline in prices possible. In 2003 the costs increased again and resulted in a small peak in 2007. The price was only 5% over that after the privatisation in January 1991 but very high considering the 44% increase compared to the low of 2003. Costs carried on to slowly climb with peaks in the winters of 2008/2009 and 2013/2014. Since a last high in 2014 they are falling again.

[42] Heddenhausen M. (2007) p. 9-10

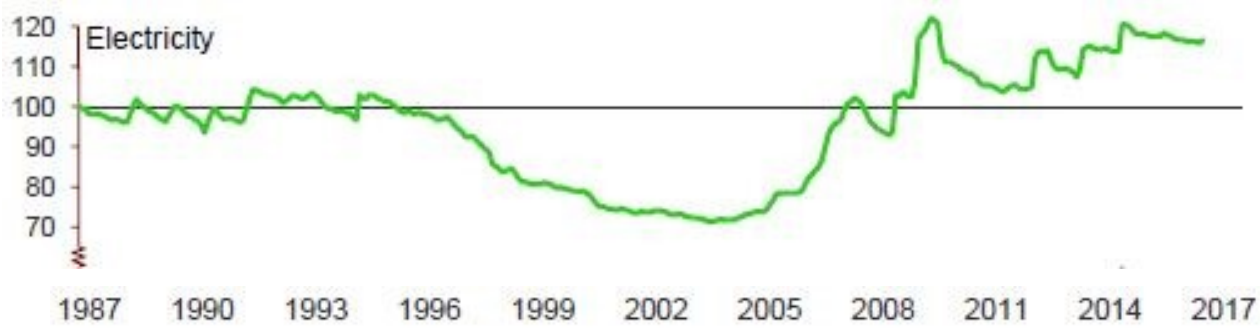


*Figure 2: Index prices of electricity of the RPI, Dempsey et.al. (2016) p. 5*

In order to see the whole picture one must not only look at the prices but also at the impact they have on consumer. In 2014 all households of the UK spent 13.5 billion pounds on electricity which is quite equal to 13.1 billion spent on gas. The total expenses rose from the consumer friendly 15 billion pounds in 2003 to 28.4 billion pounds in 2014. The picture will turn if we have a look at the proportion of total consumer expenditures on all sorts of fuels. In Figure 3 we see that the percentage fluctuates between 4 and 5% of consumer expenses spent on sources of energy. A peak of 5.4% marks the beginning of a decline that stops in 2003 at 2.1%. This low might correlate with the low prices of gas and electricity as we have seen in Figure 1. The share of expenditures spent on energy increases again and reaches in 2009 with 3.3% the threshold of 1995. After small fluctuations a new decline starts in 2012.
According to the Retail Prices Index we can see that fuel components benefitted at first from the privatisations but other influences from the world economies and insecurity boosted prices again in 2003/2004. Some of them are stable now and others are declining. More important for consumer is the fact that they are able to spend a smaller share of their expenses on energy. Many factors are responsible for that but the government put much effort in the abatement of negative social effects that had been feared by many as a consequence of the privatisation.

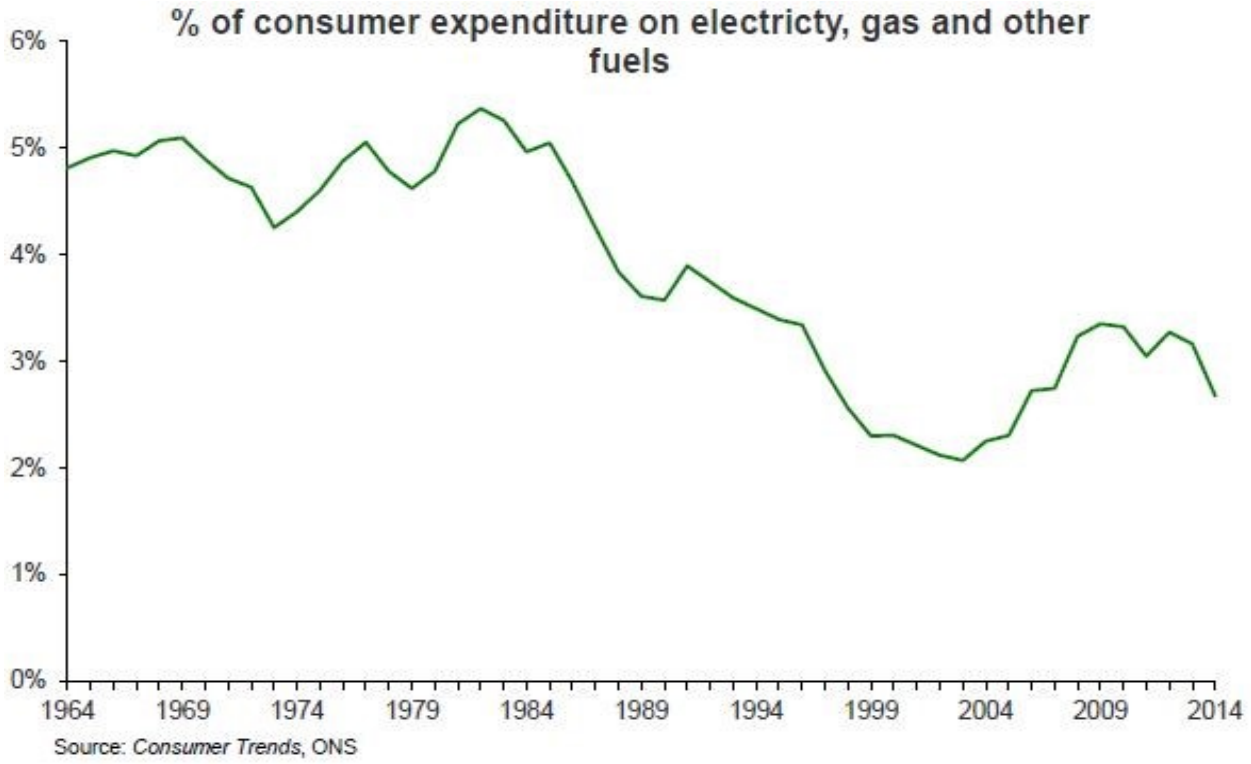


*Figure 3: Percentage of consumer expenditure on different fuels, Dempsey et.al. (2016) p. 9*

### *5.1.2 Social effects*

The main concerns about the liberalisation of the energy market in the UK were:

- Loss of service quality
- Fuel poverty and its lack of importance for private companies
- Cutting down the number of employees due to savings and competition

These points are quite important to the population and therefore need to be dealt with by the government. Liberalisation often leads to more efficiency resulting from the pressure of competition. As a consequence production costs and eventually prices should fall and benefit domestic consumer and other sectors of the industry. Overall competitiveness of the economy gets enhanced which is benefitting for competing in global markets. Acceptance from the population for the ambitious plan of a competitive energy market in the UK and later for the European Single Market is vital. In order to fight the first concern the energy regulator (Ofgem) sets the standards for the quality of service for distribution and supply market members. The compliance of the standards gets controlled and regulations are constantly altered to improve the quality. [43]

[43] Department of trade and industry (2000) p. 1-2, 8

Some services that are monitored are the quick reconnection after faults, the timeliness in case of an appointment, new customer connection, meter reading, rapidity of return calls, convenience of supplier change.

The distribution sector managed to decrease the count of interruptions by 30% and the minutes customers are off the grid by one third compared to the values of 1990. Other measures improved the response ratio of companies to customer requests or the creation of rules and guidelines for selling methods supplier are using.

The situation of poor households improved due to the changes of energy prices and an increasing consumer income. The number of households being hit by fuel poverty fell by 2 million from 1991 to 1996 and is estimated to have been fallen by another million since 1996. Additional ideas from the government to help the poor are the financial support to increase the energy efficiency of poor households and the relief payments to pensioners' fuel bills. In September 2007 the VAT on domestic energy consumption was lowered from 8 to 5%. A Ministerial Group was also set up in order to coordinate and maximise current programmes against fuel poverty, to establish an own policy and to survey the progress of fighting fuel poverty.

As a result of the decreased demand for coal many mines closed and 80.000 workers lost their jobs.[44]

The UK government and the European Union started programmes and packages to support miners to find jobs in other areas or to start work in other fields of the industry. Cuts in personnel also occurred in the gas and electricity industry due to increasing productivity from 1990 to 1997. 60.000 electricity and 30.000 gas employees lost their job. They received a higher pension, early retirement packages and had the opportunity and support to start alternative careers. New opportunities occurred when the need for more employees in the service sector increased over the last 10 years. The industry had to earn back its employees trust and therefore the quality of the work environment had to be improved. Share ownership models for employees were expanded, financial reward systems were introduced and the possibilities for further education and education in alternative fields got enhanced.[45]

### 5.2 France

Liberalisation of the French electricity industry was and will be quite difficult if we consider its history and structure.

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[44] Department of trade and industry (2000) p. 8-11, 16

[45] Department of trade and industry (2000) p. 16-17

The French had a very deep trust in public service provided by a centralised government. It was a symbol for continuity, equality and solidarity best depicted by the large publicly owned enterprises such as EDF (Electricité de France). EDF was created in 1946 by a big merger of privately owned electricity corporations and its following nationalisation. This decision resulted from the behaviour of the private corporations prior to the nationalisation. They took advantage of their monopolies, often set too high prices and neglected areas that aren't bankable enough. Therefore EDF put its focus on supply security, price stability and the development of access to electricity in rural areas. The central government controlled with EDF the generation and distribution with a more than 90% market share and the transmission sector with a legal monopoly. [46]

French government favoured nuclear power plants and started to invest in the technology in the 1950s. In 1990 the EDF France produced 75% of its power with 57 nuclear stations. EDF benefitted heavily from the advantages of nuclear power production and could offer an electricity price to the industry and domestic customer that was below average of other European countries. The capacity needed in the future was overestimated at the time nuclear electrification was planned and EDF was able to export 12% of its output even on reduced production.[47]

After long debates and many protests the parliament finally managed on June 29th 2004 to permit the partial privatisation of the national utility. Many feared the abolishment of work privileges, social security and social innovations as a result of a flotation and change in shareholders and management.

Some customers might be grateful for the liberalisation of EDF as one could see in 2001. When France was overdue with the transposition of the first electricity directive it had to open at least 30% of its market in 2000 after receiving political pressure from the Union. The loss of clients of the opened industrial power market rocketed from 5% in 2001 to 25% in 2003.

In order to counteract the probable losses resulting from a market opening, EDF already looked in 1998 for a strategy to withstand financial damage. Productivity was increased and the structure modernized while also following an expansion plan abroad. [48]

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[46] Heddenhausen M. (2007) p. 17
[47] Ottaviani M., Inderst R. (2005) p. 3-4
[48] Heddenhausen M. (2007) p. 18-19

The French government reluctantly agreed on the claims of the unions and limited the part of shares sold to 15% which will be sold preferably to EDF employees and pensioners. Also a long-term public service contract had been signed with EDF were the company assured its unified transmission price for all citizens, a five year long price fixation for households and a supply security for recipients of housing benefits during winter. In a public offer shares were sold in November 2005 and 10.8% were bought by private and institutional investors while EDF employees bought a total of 1.9%.[49]

### 5.3 Sweden

Sweden had a completely different model of the electricity sector than France or the UK. It is quite similar to the Swedish industrial relations model and relies on the principle of cooperation between the government, municipal parties and private parties. The governmental bodies involved bear the risks of national connections and the local parties had to cope with the regional chances. Communication between the parties involved was quite informal. In order to improve the electricity system the Vattenfallsverket started a tight relationship with ASEA (Allmänna Svenska Elektiska Aktiebolaget) a company specialised in electrical engineering. [50]

With financial support from the government ASEA followed a long-term plan to modernize the electricity system. The development of infrastructure led to the idea of self-operating small markets. Clubs (klubbar) established as associations of corporations that either produced or distributed electricity. These clubs were responsible for the evolution and adjustment of their reach. Although Vattenfallsverket always had a chair in the clubs it granted them enough freedom for their decisions. A big part of the national transmission and distribution system was soon managed by the two largest clubs Samkörnigsklubben and Stamnätsklubben, a predecessor of Svenska Kraftnät. Over time a concentration of influence and ownership developed due to the “survival of the fittest” as the supplier had to meet efficiency criterions that got stricter and stricter. Starting with about 1.500 companies involved in the electricity sector in the mid-1950s the number decreased to 100 producer and 270 grid owner in 1992 before the deregulation started. 90% of the electricity output came from only three producer from which Vattenfallsverket is one of them and responsible for over 50% of it. [50]

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[49] Heddenhausen M. (2007) p. 19
[50] Andersson M., Thörnqvist C. (2006) p. 1-2

These three producers, Vattenfall, Fortum and Sydkraft, could consolidate their positions and are responsible for 85% of the electricity produced in Sweden in 2003. This concentration seems strange if we consider that a liberalisation happened but many new powerful companies from Norway, Finland and Germany bought themselves into the top dogs. [51]

Transmission net owners are integrated into the governmental power mains, Svenska Kraftnät. To be able to run, build or develop their networks the owner need to be authorized by the Energy Authority, Energimyndigheten. This practice creates regional monopolies and the three biggest ones, Vattenfall, Fortum and Sydkraft, are also the main producer of electricity. [51]

Large-scale trader of electricity buy from the producer and either sell the transformed electric power to retail companies or to large-scale consumer. The latter ones buy their electricity either from the power exchange Nord Pool or via bilateral contracts. Market concentration here didn't decrease but since the three major producers are also selling electricity the rate of foreign participation increased.[51]

How could this simultaneous increase in external shareholders and preservation of monopolies happen?

In the early 1990s the privatization started with the government selling its shares of 35 state-owned companies. Many administration bodies were restructured into companies. Some remained state-owned others became partially privately owned. From 1998 to 1999 distribution operators for gas, electricity and water were privatized. The electricity sector also needed to be separated into the three segments production, transmission and retail trade. As mentioned above the transmission market is a de facto regulated monopoly that emerged due to different national, geographical and local causes that made it a "natural" monopoly.

How was the evolution of the prices? First of all it depends on the type of customer. Is it for residential, commercial or industrial use and further variance is caused by the source of energy it was created from. From the end of the 1970s to 2011 the average prices rose despite the effort that was put in the reduction of vertical integration and the obstacles of entering the market. Public ownership level also remained the same as the government is still involved in the biggest electricity companies. The Energy Agency is stabilizing the network tariffs after deregulation and sets the price so that [52]

[51] Andersson M., Thörnqvist C. (2006) p. 3-4
[52] Rodigari S. p. 5-9

producer can cover their costs. Therefore new entrants won't be able to operate at prices that fit the low costs of production of the three commanding producer. The biggest part of the price gain over the last years happened due to raised charges and taxes. Sweden's effort in boosting renewable energy led to the introduction of the green electricity certificates in 2003 and the unified electricity certificate market of Sweden and Norway that was introduced in 2012.

As liberalization progresses the rates rise. The same odd trend of rising prices can be seen in Finland and Norway although the prices there aren't that high. It can't be the customers' fault as half of the households renegotiated their contracts or changed their supplier in 2004 despite only minor price gaps.[53]

A public investigation of the government, Regelutredningen, came to the conclusion that the liberalization happened due to several small changes of the system. Not a single Swedish cabinet can be made responsible for the transformation of the infrastructure but it was found that crisis were main reasons for starting reformations. For example in the early 1990s Sweden experienced a minor growth of their economy, high inflation, low productivity and small national savings.[54]

Maybe with more movement and resistance from the demand side the Swedish electricity market that is operating quite monopolistic might increase its competitiveness and productivity. The barriers for new market entrants are de facto abolished but exist indirectly due to the break even like pricing and the influence of the three market dominating electricity corporations.

### 5.4 Germany

The German electricity sector differs from the monopolistic and state-owned models of France and the United Kingdom. It is quite similar to the Swedish one with a mix of privately- and state-owned companies. Energy supplier agreed on a system of "territorial monopolies" in which they only operate within their assigned areas and don't pirate in other territories. This scheme was established after World War one and was strengthened by the National Energy Act of 1935. Over time municipal utilities started to cooperate and participate with energy supply companies. These interrelations were stabilised and controlled by the Anti Trust Law of 1953 that also regulates the security of supply and the fair share for both the municipal utilities and the energy companies. [55]

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[53] Rodigari S. p. 7-9
[54] Andersson M., Thörnqvist C. (2006) p. 8-9
[55] Brandt T. (2006) p. 3

The structure of the electricity sector before the liberalisation in 1998 was separated into three parts.

The highest level was the supra-regional one which consisted of 8 energy supplier that were responsible for 79% of the supplied electricity in 1997. Their area of operation was still limited to their territorial monopoly but their individual value chains differed. All are involved in the transmission sector but 5 of them, RWE, VEW, EnBW, BEWAG and HEW, control all sections from production to delivery to the end consumer. The remaining 3, PreussenElektra AG, Bayerwerk AG and VEAG, are only producing and transmitting.

On the regional level the distribution to end consumer and to the municipal utilities was done by 80 regional suppliers that were on the one hand buying electricity from the large producer and were on the other hand also responsible for 10% of electricity production.

The local level consisted of 900 municipal utilities that provided end consumer with electricity, gas or district heat. They also produce the remaining 11% of electricity.

Municipal utilities were autonomous but might have small shares of large supplier.

On the other hand supply corporations often had long-term contracts with each other or owned due to investments regional supply companies. The model of territorial monopolies combined the production, transmission and distribution and gave it to the large network supplier whereas the municipal utilities could only profit from them by owning capital shares. [56]

The monopolies of supplier within a certain area also established because of the power of local authorities. Construction of transmission lines from electricity firms needed to be granted not by the state but by the local authority of the respective territory. With them individual licence agreements had to be agreed upon so that the developing supply company was able to build up and operate long-distance transmission networks. The companies received with these agreements the exclusive right of way within the network in return. Electricity corporations additionally signed treaties between themselves that limited their operations to their respective areas in order to strengthen their monopolies.[57]

Liberalisation was overdue but the German legislature had to overcome some unique obstacles of the German system when they were creating a legal structure for it. [58]

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[56] Brandt T. (2006) p. 3-4
[57] Heddenhausen M. (2007) p. 14
[58] Van Danwitz T. (2006) p. 445

The federal states usually monitored the energy supplier and didn't want to lose their power after the restructuring of the energy sector. As middle way they managed to obtain the supervision over smaller companies whereas the newly founded federal agency for electricity, gas, telecommunication, postal services and railroads monitors the large-scale enterprises. [59]

This solution might result in alternate interpretations and executions of directives and benchmarks given by the law. On the other hand the monitoring of 800 different transport system operators seems unfeasible by only one authority.[59]

In 1998 the German government transformed the EU directive 96/92/EC into national law and implemented the National Energy Act of 1998. The plans were quite ambitious as the complete liberalisation for all sectors of the electricity industry should be done by 1999 and territorial monopolies should be abolished immediately. It is not very surprising that large energy supplier started to secure their power long before the restructuring began.[60]

A wave of big-scale merger took place in the mid 1990s in order to concentrate power like in Sweden for example. In 1997 the two companies Badenwerk and Energieversorgung Schwaben formed the new energy supplier EnBW which later operated on national and European level. The behaviour of market participants at such an early stage suggests that the large energy supplier used their influence and gathered inside knowledge in order to be able to use the altering legislation to their benefit.[60]

### *5.4.1 Market structure*

Encouraging for the merger of the mid-1990s were also the privatisations of municipal utilities that were popular at the same time. The Federal States and local authorities saw the possibilities to gain additional income for their public coffers and to recapitalize their budgets. The state-owned shares of big vertically integrated corporations were sold and by 2007 only the state of Bavaria still held a 2% share of E.ON AG. Several municipalities also managed to keep their overall share of 50,88% of EnBW AG. On the contrary also energy companies took the chances and expanded in the distribution sector by buying or taking over local supplier. Private shareholder gained traction in 45% of the public utilities of the largest cities in 2003.[61]

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[59] Van Danwitz T. (2006) p. 445
[60] Brandt T. (2006) p. 6
[61] Heddenhausen M. (2007) p. 16

The following examples show the development of the different segments of the value chain after the liberalisation in 2004.
The number of electricity producer halved from 8 to only 4 supply companies. RWE and E.on were responsible for 65% of the production. Also the number of energy supply companies that are involved in the transport of energy reduced.
The market for selling energy to end consumer on the other hand condensed. In 1995 the market shares of sales were evenly split between five network supplier and the regional supplier with their 900 municipal utilities. The number of utilities declined to 700 over the years and in 2004 the market shares for the regional companies and their utilities stood at about 27% whereas four network suppliers controlled 73% of the market.
Two electricity exchange markets were introduced in 2000 and fused in 2002 to the European Energy Exchange in Leipzig. 21% of the German electricity consumption was traded on its spot market in 2004. Price- and market transparency increased.
Looking at the international energy market we can see two developments that happened. The concentration on the markets has either declined like in the United Kingdom and other northern European countries or it increased as in the remaining European states. Investments and expansions are made throughout Europe by the four largest energy companies RWE, E.on, Vattenfall and EnBW which is under control of EDF. By operating in large markets like Germany, the United Kingdom and Eastern Europe RWE became the third biggest supplier in Europe. E.on as the second largest is trying to expand to South American markets by absorbing the Spanish supplier Endesa.
The interweaving of politics, lobbyists and the electricity industry is the main barrier for a fully functioning liberalised market. [62]

### *5.4.2 Regulations*

The European acceleration directive 2003/54/EC was transformed into the National Energy Act of 2005 and was concerned with the regulation of the energy transport and the competition in electricity retail and supply. Within the federal ministry of economics a new agency was established to monitor and unbundle the transport of electricity and gas. The Bundesnetzagentur operates on a national level whereas [63]

[62] Brandt T. (2006) p. 8-9
[63] Brandt T. (2006) p. 14

the respective ministries of economics of the federal states received their own federal agencies, the Landesregulierungsbehörden.

Until 2008 the Bundesnetzbehörde had to authorize new entrants to the net and control or even lower the net prices. It also had to promote the legal unbundling of integrated firms. The Landesregulierungsbehörden have the same responsibilities but focus on transport companies with less than 100.000 clients and operate only within their federal states.[64]

The Bundesnetzbehörde also came up with a new pricing model that will incentivise network operators to increase their efficiency. A basis for the predefined revenues is calculated out of the operating costs of the network and an efficiency increase of the company. The national and respective federal agencies are then determining the maximum revenues of the operator on a yearly basis for the next five years.

By increasing efficiency and lowering operating costs the company might stay under the defined revenue cap and is allowed to keep the difference as a bonus.

No predefined detailed instructions have to be followed or specific methods need to be used. Operators can restructure their system, alter operations or implement innovative technologies in order to achieve efficiency boosts. Operators are also rewarded if they meet the targeted revenue. A rate of return is put on the capital invested and implied in the authorised revenue. [65]

Regulations of the retail and supply sector were done by the Landesregulierungsbehörden that monitored the end consumer prices until July 2007. Criticism from consumer organisations and a few politicians followed but won't change much about the main problem of the high market concentration that prevents price competition.[66]

## 6. The situation in Austria

During my research I came across an article from 2014 on the website of the Tiroler Tageszeitung about the opening of the energy market in Austria and the price reductions for electricity. Since the liberalisation end customer saved about 1.2 milliard Euros. Industrial customer received 1 milliard of these savings. The CEO of the E-control criticized that only the industry profited by the competition and

[64] Brandt T. (2006) p. 14
[65] Bundesnetzagentur (2015)
[66] Brandt T. (2006) p. 14-15

increased efficiency but not domestic customer. For domestic user the electricity invoice consists of three parts, 40% represent the energy itself, 25% are for the regional grid charges and 35% are taxes and other charges. Changing the energy supplier will save money but only 11% embraced the opportunity till now. Industrial electricity prices were at their low in 2001/2002 but increased again due to high oil and gas prices in 2003. Nevertheless did the industry and the state profit from the liberalisation. An economic research institute came to the conclusion that the gross domestic product would have been 1% lower in 2011 without the liberalisation. 5.000 workplaces within the electricity industry were axed but in other fields like the supply sector 8.000 new ones were created.[67]

The article is quite short and jumps to conclusions that might need a bit more explanation and background knowledge. I am now trying to draw a picture of the energy market in Austria, its structure, the liberalisation and want to find out if savings for end customer really occurred.

### 6.1 The market structure

The structure of the Austrian electricity market was defined mostly by the second nationalisation act (2.Verstaatlichungsgesetz) in 1947. A segmentation of the market happened were you had one nationwide organisation the Vebundgesellschaft, nine provider companies for the federal states, five state capitals who received their own provider and several major power station operator. Also the responsibilities were assigned with the act and this allocation existed nearly unaltered till the liberalisation of the system. The Verbundgesellschaft built and operated large power stations and was responsible for the transmission of electricity on a national level. Regional supplier had to manage the distribution and the supply within their designated areas. They were also allowed to build and operate small power stations in case the geographical circumstances made it necessary to guarantee the security of energy supply. This option made it possible for regional supplier to become vertically integrated regional monopolies under public ownership.

After an amendment of the second nationalisation act in 1987 the possibility of privatisation of some of the companies was introduced. Nevertheless 51% of the shares needed to remain state owned. By the end of 2001 only three regional companies of the federal states of Upper Austria, Tyrol and Vienna and three [68]

[67] Tiroler Tageszeitung (2014)
[68] Haberfellner M. (2002) p. 2

providers for the capitals Linz, Innsbruck and Klagenfurt were still fully owned by the respective authorities.

The pricing was done ex ante from a commission within the Federal Ministry for Economics and Labour. They were set as an economic upper limit after considering the situation of the producer and of the end consumer and should satisfy both parties. In fact they mostly copied the costs of the regional supplier and therefore offered no incentive for improvements of efficiency or the production method. Prices increased over the years and before the liberalisation Austria had compared to other European countries the quite high electricity prices for the industrial sector. Electricity bills could make up to 20% of the overall costs of a company.

A competitive market for electricity became more and more important for the economy. [69]

The First Electricity Directive (96/92/EC) was eventually transferred into national law in Austria by the Electricity Business and Organisation Act ElWOG 1998 (Elektrizitätswirtschafts- und organisationsgesetz) which came into force on the 1st of January 1999. First it was planned to introduce a stepwise opening of only 35% of the electricity market till 2003 but due to concerns and protests of small and medium-sized businesses who pointed out their disadvantage to large companies an amendment was made. Domestic households also highlighted that they wanted to benefit from the beginning of the liberalisation and not just after some years. With the amendment a total liberalisation of the market was realized on the 1st of October 2001. As a result of its premature opening Austria became a pioneer in market liberalisation like the United Kingdom and the Scandinavian states. [69]

The value chain of electricity also received the new segment of trade. The generation, trade and supply are competitive areas of the market whereas the transmission and distribution remain regulated. The last two sectors form a natural monopoly due to the high fixed costs of operating a grid and the economically pointless construction of competing networks. In Austria the transmission system was portioned into territories. The Verbundgesellschaft in the east of Austria operates a high-tension network that transports 90% of the electricity whereas in Tyrol there is the TIWAG (Tiroler Wasserkraft AG) and in Vorarlberg the VKW (Vorarlberger KraftwerkeAG). The legal unbundling of vertically integrated organizations required [70]

[69] Haberfellner M. (2002) p. 2-4
[70] Hofbauer I. (2006) p. 3

by the acceleration directive (2003/54/EC) led to the restructuring of many companies and the establishment of holdings that combine many companies which are individually operating in the electricity value chain.
Liberalisation went on but the electricity market still suffered from the heavy influence of the traditional companies. They often preserved their dominance and didn't have to fear new entrants because of the small Austrian market and therefore its lack of attractiveness to foreign competitors. Another advantage of the Austrian market is its high amount of hydroelectric energy which is cheap in production and enables costs that can't easily been undercut by foreign supplier. We see that the production sector is hard to enter but the new area of electricity trading appeared and is developing. [71]

### *6.1.1 Power generation*

The main actors in the production of electricity remain the large Verbundgesellschaft, the nine federal companies and the five state capital organisations. With some exceptions mainly all power stations belong to the Verbundgesellschaft which had to unbundle them and is now managing them with two subsidiaries, Austria Hydro Power (AHP) and Austria Thermal Power (ATP). The 15 companies mentioned above were responsible for generating 95% of the electricity in the public net of 2003. The mix of energy generated in 2001 was roughly about two thirds from hydropower and one third from thermal power. In order to boost efficiency and save costs the development of eco-power plants and the investment into gas-fired powerhouses increased.[71]

### *6.1.2 Power supply and trade*

The market concentration is not only increasing in the production sector but also in the supply branch as the number of suppliers is decreasing. The end consumer market of electricity can be separated into those customers that demand less than 2GWh per year like domestic households or small businesses and the industry. Regional or provincial electricity suppliers are still the first choice among the small customer. Their long-term monopoly established some kind of popularity and familiarity in their areas and made it difficult for new market entrants to break into the market. Some Regional suppliers also recognized the potential threats of the liberalisation and started to extend their presence. Subsidiaries were incorporated [72]

[71] Hofbauer I. (2006) p. 3-5
[72] Hofbauer I. (2006) p. 5

that offer lower prices or more attractive contracts and would also expand to other territories.

Quite well known are Unsere Wasserkraft from the Estag, MyElectric from the Salzburg AG and Switch from the Energie Allianz an alliance of the federal state supplier of Vienna, Lower Austria and the Burgenland.

But there are two new entrants that managed to establish themselves while offering subsidised electricity from renewable energy sources, the Ökostrom AG and the Alpen Adria Energie AG.

There is also a lack of new provider for the market of large-scale consumer. Foreign companies see more potential in the indirect access to Austria via investments in large domestic supplier. [73]

| | ***Before liberalisation*** | ***After liberalisation*** |
|---|---|---|
| **Verbundgesellschaft** | Generation, Transmission, Distribution | Generation (AHP, ATP), Transmission (Austrian Power Grid), Distribution, Supply |
| **Federal state companies** | *(partly Generation, Transmission)* Distribution, Supply | *(partly Generation, Transmission)* Distribution, Supply |
| **State capital organizations** | *(partly Generation, Transmission)* Supply | *(partly Generation, Transmission)* |
| **Discount subsidiaries** | | Supply |
| **Eco-electricity provider** | | Supply |

*Table 2: Development in the power supply and trade sector, Hofbauer I. (2006) p. 6*

### *6.1.3 Electricity exchange*

Like in the Netherlands, Germany or France the liberalisation in Austria supported the establishment of an energy exchange. Especially the connections to Eastern European countries made Austria a perfect location for its 2001 founded Energy Exchange Austria (EXAA). The following figure shows the network structure. Neutral participants are the System and Network operators as well as the EXAA and the Balance Group Coordinator. Companies that are involved in generating, trading and supplying are represented by the Balance Group Responsible and the Balance [74]

[73] Hofbauer I. (2006) p. 5-6
[74] Kawann C.P., Jauk W. p. 1

Group Supplier. The lines depict with whom each market participant has to communicate. Customers are free to choose any supplier they want but also have to have a contract with the network operator who is responsible for their respective net. The EXAA is utilizing an auction system in order to create a neutral trading place. A daily auction takes place where a buy and sell order can be placed simultaneously. This Double-Auction-Bidding scheme makes it easy to access the market and cuts down transaction costs. At the one auction per day the orders for the day-a-head contracts are collected from 8:00 to 10:00 o'clock by the Trading System in a closed orderbook. Afterwards the prices and volumes are calculated and the participants are notified. Now the confirmations and billing data's are gathered and the system operators obtain their schedules and the clearing for the participants is done. The whole auction usually takes only from 8:00 to 11:00 o'clock.[75]

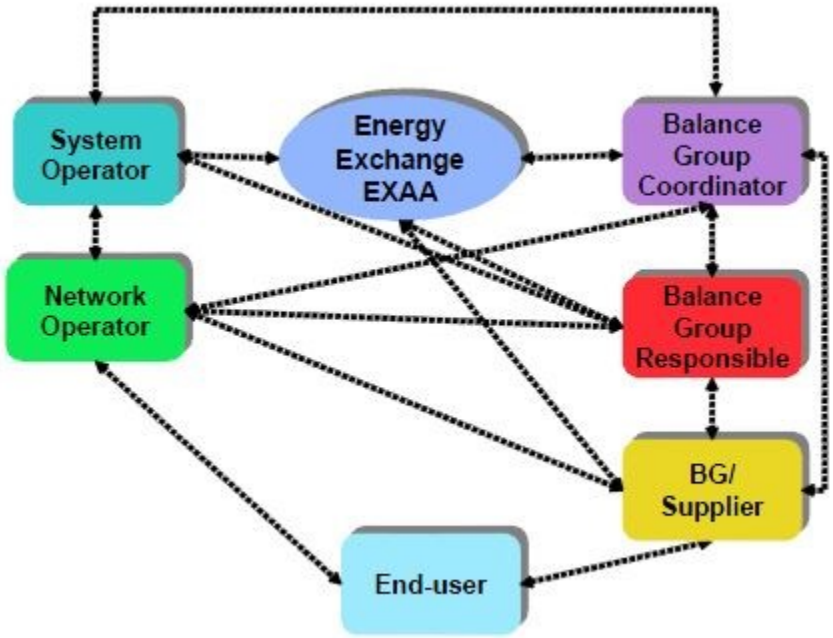


*Figure 4: Electricity network structure, Kawann C.P., Jauk W. p. 1*

As the Austrian Market is separated into three trading areas the system has to coordinate these three markets. Bottlenecks are identified and the supplies and demands are balanced throughout the three areas. The system operators also have to provide information about the maximum capacity available for exchanges two days in advance. In case they are differing between the areas the trading zones are split up and each zone receives its own clearing price. Congestions therefore don't lead to deviations between the prices of the zones and the unconstrained market price.[75]

[75] Kawann C.P., Jauk W. p. 1-3

EXAA had a quite good start and is planning to strengthen its position in Central Europe and to even include the Eastern European markets.[76]

### *6.1.4 Regulating the competitive market*

The main goal of the government after the war was the rebuilding of the infrastructure and the expansion of the generating capacity. Austria should have a stable electricity network without being dependent on foreign electricity imports. It was logical to take advantage of the vast amount of hydro power the country offers and build many hydroelectric power stations. Besides the generating and transmission of power the electricity companies were also involved in communal duties.[77]

As mentioned above the pricing was done by a commission that set the prices to a level so that not only the costs of electricity were covered but also the additional public tasks. There existed also a graduation of prices as some consumer were subsidised like households, agricultural plants or the aluminium industry whereas others like small and medium businesses had to pay high prices.

After the liberalisation the unbundling and the segmentation of the value chain made a restructuring of regulatory work necessary. The monopolies transmission and distribution are still regulated while the competitive segments generating, trade and supply are just monitored. The ElWOG contains a list of all the tools and actions the regulators are allowed to utilize. These means are unbundling, fixing of network tariffs, regulating the network access, supervision of the competitive segments, subsidies for eco-friendly products and supply security.

In the field of transmission the non-discriminatory access to the networks needs to be guaranteed. All new participants need to be treated equally with their long-established competitors.[78]

The E-Control Commission defines the network tariff which consists of a fixed price and the network-use charges. The tariff displays the costs of transmission and is a component of the overall electricity price. Network-use charges are fixed by the Commission while additional surcharges and taxes are defined by the ministry or state governments.[79]

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[76] Kawann C.P., Jauk W. p. 4
[77] Hofbauer I. (2006) p. 10
[78] Hofbauer I. (2006) p. 10-11
[79] Haberfellner M. (2002) p. 11

In order to boost incentives for modernizations the Rate-of-return regulation had been replaced by an incentive-oriented scheme. It uses an upper price limit and considers efficiency increases to make it desirable for companies to reduce costs.
Regulation in the generating segment is limited. Construction and operation of a power station need several permissions.
Supplier can join the market by just joining an existing or establishing a new balancing group that needs to keep a record of the amount of electricity that enters and exits the network. Security of supply is controlled by the E-Control with the "balance group administration". Supplier need to inform their balance group about their number of customers and the supply security.
Making the changing of supplier easier, expanding transparency and the behaviour of market members are further priorities of the regulator.[80]

### 6.2 The gas market

Despite the fact that the European gas consumption decreased the need for imported gas increased. Austria has a quite high amount of stored gas compared to its demand. Since the liberalisation also gas consumer have the option to freely choose their supplier on the market. Similar to the electricity market an incentive based tariff system for gas distributors exists since 2008. The tariffs consist of several different factors of which one is based on the mean of the last three years volume and should display a trend of demand.
In order to guarantee the service and supply investments need to be done. The focus lies on the expansion of the network and the maintenance or renewal of older parts of it. Here the regulator offers, like in the electricity market, incentives for investments that increase efficiency. Charges for storage services are expensive compared to those of other Union members of 2014/2015. New entrants and more competition since 2010 draw a confident picture of the future and put plans for a regulated market to a halt.[81]
Liberalisation in 2002 allowed third parties to access the storage facilities in Austria regulated by the Natural Gas Act which is a transposition from EU directives. The Guidelines for Good Practice for Storage System Operators (GGPSSO) created in 2005 contain rules for the non-discriminatory access, the design for [82]

[80] Hofbauer I. (2006) p. 11-12
[81] E-Control (2015) p. 82-83, 87, 89
[82] E-Control (2016a)

storage products and the needed transparency. The companies RAG AG and OMV AG are the biggest storage operator and assign storage capacity based on the first come first serve principle. Most storage capacity is used by domestic wholesalers and distributers. Their main customers are large consumers as well as power stations and local suppliers. [83]

Capacity is also used as temporary storage opportunity for foreign companies that use it for transit or for flexible supply to gas trading points in Central Europe.[83]

### 6.3 E-Control

In Austria two different authorities are monitoring the electricity market.

One authority works ex-post and is concerned with any kind of market abuses and distortions. The Federal Competition Agency controls certain merger that will result in market domination and tries to prevent and resolve cartels. [84]

The ex-ante regulation is done by the newly found independent E-Control GmbH that is operating exclusively in the energy sector. Both authorities have their own fields of works but are meant to cooperate in questions concerning the energy sector.[84]

The main tasks of a regulator are the supervision of non-discrimination of market participants, the unbundling of corporations, the pricing of network charges and the compliance of a minimum level of quality of service. The structure of such an authority was included in the ElWOG and led to the foundation of the E-Control in March 2001.[85]

It consists of the E-Control GmbH and the Energy Control Commission. In order to advise the Ministry for Economic Affairs and Labour on questions concerning new regulations and other issues of the electricity and gas market the electricity and natural gas council was created. The ministry as the owner of the E-Control GmbH still has control over it whereas the Energy Control Commission is autonomous of any influence from the government or businesses. A main part of the work done by the E-Control GmbH is the reprocessing and preparation of information for the Commission that rests its major decisions upon it. Subjects concerning network access or the tariffs for it nevertheless need the word of command from the ministry.[86]

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[83] E-Control (2016a)
[84] Böheim M. (2005) p. 150-151
[85] Haberfellner M. (2002) p. 6
[86] Hofbauer I. (2006) p. 13

Before the liberalisation the regulators and the market participants built a catalogue with rules concerning the competition and the general terms and conditions for the network operators. In the first three months of liberalisation 49 cases of unjustified deny of access to the network and market abuses were closed. Half of the network operators were controlled and got their tariffs altered.
Due to the new possibility for customers to compare their current electricity prices with other supplier about 20,000 customers changed their provider in these first three months.[87]

### 6.4 E-Control and the German-Austrian price zone

Quite impressive is the fact that the common electricity market between Germany and Austria became a success model for tightly integrated markets. Since the liberalisation both countries benefitted from this biggest common market in Europe.[88]
Its construction started long ago with the set-up of a compatible generation and transmission network. Austrian power stations that operate close to the border are able to support the German net in times of peak demand and network problems. As a surprise came the comment of ACER on the 23rd of September 2015 that would prefer a separation of the cross-border pricing zone between Germany and Austria. The reason for this statement results from the outcome of a review that was requested from the Polish regulator URE. After reviewing the decisions concerning the Capacity Allocation Methodology (CAM) of several Middle European regulators, ACER and URE came to the conclusion that the missing of a CAM between Germany and Austria distorts and lowers the capacity available for cross-border trade. Especially the trade between Germany and Poland lacks capacity.
In a reaction to the accusations the E-Control explains that no structural bottleneck can be found at the German-Austrian border that would make the adoption of a CAM necessary. Furthermore would an introduction barely help to resolve the situation at the German-Polish border. The problem that lies beneath results from a structural problem within Germany. With the Energiewende an increase in wind power stations in Northern Germany happened quite fast without considering that the additional capacity needed to transmit the electricity to the industrial South of Germany is more time consuming to realise. Insufficiencies of the North-South connection make it necessary to reroute the electricity from Northern Germany over Poland, the Czech

[87] Haberfellner M. (2002) p. 8-9
[88] E-Control (2015a) p. 31-32

Republic and Austria to Southern Germany. Till the upgrades of the inner German network are completed provisional solutions such as the redirection and methods of limiting the flow between Germany and Poland have to be used. E-Control appealed against the statement of ACER before the European Court of Justice due to procedural misbehaviour of ACER. Advocacy groups of the energy sector and the industry, the Federal Economic Chamber and the Verbundgesellschaft support E-Control and joined the complaint. All these groups favour the common price zone with Germany.

Restrictions of the electricity trade between Germany and Austria would lead to welfare losses up to 140 million Euros per year. Studies suggest that a separation of the zone will decrease competition and the number of supplier in the Austrian market. Old-established market members could take advantage of the higher market concentration it and raise their prices.[89]

Different scenarios depict a rise in wholesale prices for electricity threatening the competitiveness of the domestic industry.

Regulators and TSOs in Germany and Austria have to go on and use alternative methods to guarantee the transmission and supply for some time. Advances in modernizing and extending the German network and the interconnectors between Germany and Austria are made and will decrease the flow through Eastern countries and ease the situation.

## 7. Prices

In 2011 after 10 years of liberalisation the E-Control announced that electricity prices rose over the last years. They followed the common trend in Europe. In the first half of 2001 the kWh cost 13.25 cent and climbed to 19.67 cent in 2010. Austria being known for its upper price range exceeds average gross electricity prices of all EU-15 by 10% and of all EU-17 members by 15%. When liberalisation started in 1998 the electricity prices for industrial customer fell but due to the high crude oil prices since 2004 they climbed rapidly.

Gas prices for households however are quite similar to the European average. In the last decade the gross gas prices rose by 40%. The situation is more difficult for [90]

[89] E-Control (2015a) p. 32-33
[90] E-Control (2011) p. 43

Industrial consumers whose prices fluctuated around the European average but increased after a few years and were 10% higher than for German competitors.
These numbers are quite disappointing but there must also be positive effects of the liberalisation.
If the liberalisation didn't happen industrial consumers would have to bear electricity costs which are 56% higher. The increase for households would have been 13%. It is the same scenario if we look at the gas prices. Industrial consumers save 42% and households 15% of their costs due to liberalisation. One explanation for the bigger impact of the liberalisation on industrial prices than on small consumer might be the higher willingness to switch supplier based on their prices. The Austrian switching rate for small consumer was only 1.7% in 2010 which is very low compared to other European countries. The E-Control is trying to animate households to get informed about more suitable supplier for them and boost the competition on the market.[91]
In its report from 2015 the E-Control refers to an increase in gas consumption of 7.1% and in electricity consumption of 1.8%. Subsidised electricity from renewable sources amounts to 14.5% of the overall consumption and the generation if it was increased by 14.8% in 2014.[92]
It is quite positive for end-consumer that 48 Electricity supplier cut their prices by 2 to 20 percent in 2015 which generates savings for a standardised household up to 65 Euro. The cheapest supplier sold the kWh for 2.98 cent to its customer which is a reduction of more than 30% compared to last year's price of 4.35 cent/kWh. On average the electricity prices in Austria could only decrease by 4% from 7.24 cent/kWh to 6.95 cent/kWh. Industrial consumer benefitted from a higher reduction of 7% due to the tighter correlation of their prices to the wholesale market.
The situation on the gas market is also pleasant for end customer as 9 out of the 33 supplier reduced their prices by 3 to 10%. The prices in December are 5% lower this year than in the same month last year. Industrial gas prices are lagging behind the import prices and increased by 3% in the first half of 2015. Household consumer had the chance to switch to the cheapest supplier in November 2015 with a price of 1.79 cent/kWh. Gas prices of other supplier reached from 2.99 cent to 4.01 cent per kWh. Savings are very likely if consumer switch as the gas market became quite competitive in the last two years.[93]

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[91] E-Control (2011) p. 43-44
[92] E-Control (2015b) p. 12, 15
[93] E-Control (2015b) p. 23-27

I would like to depict now what the prices are consisting of and how these elements originated.
According to the E-Control the prices can be divided into three main parts. There are the system charges that cover the costs of the system operator, the energy price itself that the supplier receive for their products and the public part which includes taxes and surcharges the state, federal authorities and municipalities receive.

## 7.1 Taxes and surcharges

Consumers of electricity support the state and authorities with four different charges. All prices for electricity and gas include the 20% value added tax.

### *7.1.1 Energy charge*

In Austria all sources of energy are taxed because of their ability to be transformed into other forms of energy.
These energy charges on electricity and gas were introduced in 1996 in order to create additional income for the state and to add an ecological aspect to the tax system. In reality a consideration of an environmental steering effect never took place. The main parties that have to deal with this charge are normal households and not the industry due to the possibility of a return of the charge for commercial energy consumer. The charge for electricity is quite high compared to that for gas and coal.
Following laws introduced the charges:

Electricity (Elektrizitätsabgabegesetz) BGBl. Nr. 201/1996, the original charge per kWh was 0.10 Schilling (~ 0.007 €) and was altered in BGBl. I Nr. 71/2003 to 0.015 €/kWh.

Gas (Erdgasabgabegesetz) BGBl. Nr. 201/1996, the first charge per m³ was 0.60 Schilling (~ 0.0436 €) and was altered with BGBl. I Nr. 71/2003 to 0.066 €/m³.
Coal (Kohleabgabegesetz) BGBl. Nr. 71/2003, amount of 0.050 €/kg
The following figure covers only a short period of time in which all charges and the returns are depicted. [94]

[94] Rechnungshof (2006) p. 27-28

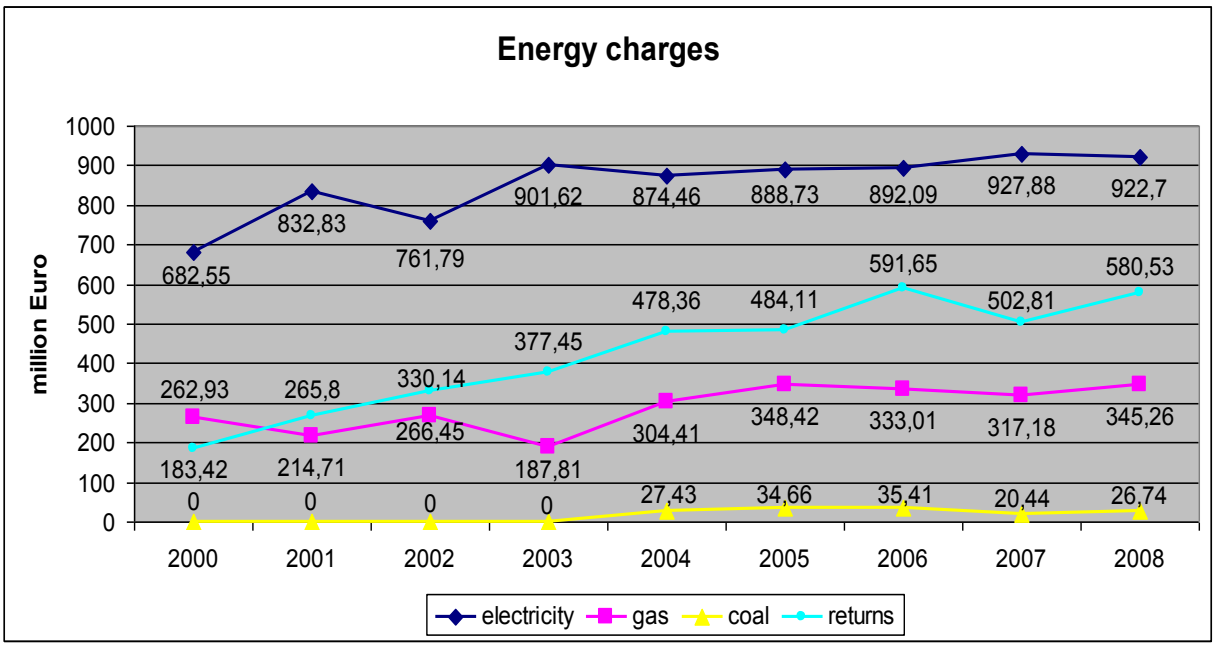



*Figure 5: Energy charges, Rechnungshof (2006) p.28 and Rechnungshof (2009) p.59*

We can see that the percentage of returns is growing over the years from around 19 to 46 which is a good example for the negative critiques the system of returns faced over the years.[95]

### *7.1.2 Community levy*

The community levy can be charged by municipalities for the use of their public territory or airspace by power lines. According to article 14 of the Finanzausgleichsgesetz 2008 (FAG 2008) the local authorities are responsible for it but the federal state authorities have to specify its criterions and upper limit. A common overview over the respective levies in all municipalities is quite difficult as there is no centralised acquisition of them. The federal states also differ in their declaration of the levy on the electricity bills of the consumer. In Vienna, Salzburg and some municipalities of Styria and Tirol the clearing of the levy is detached from the system operating costs whereas the remaining municipalities include it in the operating costs.[96]

[95] Rechnungshof (2006) p. 27-28
[96] E-Control (2017)

Despite the high level of freedom the states and municipalities have regarding this charge there are three main variants that are used.

- There is no need for a levy but municipalities are allowed to charge a price under private law.
- The extent of use of public territory is the assessment basis for the levy.
- Local suppliers are paying a fixed levy whose assessment bases are the suppliers' proceeds. The upper limit is a certain percentage of the proceeds.

**Burgenland** and **Vorarlberg** are the federal states that don't have a federal law regarding their community levies.

In **Carinthia** the federal law LGBl. Nr. 2/1959 deals with the possibility of municipalities to charge their own supplier of electricity, water and gas a certain amount for the use of communal ground and airspace. Supply companies who have more than 50% of their shares held by a municipality are affected. The levy can be calculated as a percentage from the companies' gross earnings but has an upper limit of originally 3%. This limit was altered in 2010 (LGBl. Nr. 85/2010) to 6%. All-inclusive agreements are also possible.

The situation in **Styria** is quite similar. The parties concerned by the levy are defined in LGBl. Nr. 5/1954 (its latest version LGBl. Nr. 87/2013) and resemble those from the Carinthian law. Supplier of electricity, gas, water, heat and public transport might be charged up to 3% of their gross earnings by their municipality. All-inclusive agreements aren't possible.

The legal regulation in **Tirol** is also quite the same but has some other approaches regarding the assessment basis. Taxable companies have the opportunity to calculate and declare their levy on their own and make prepayments at defined periods. LGBl. Nr. 78/1992 and its amendment LGBl. Nr. 110/2002 limit the levy to not more than 6% of the assessment basis.

**Salzburg** offers in its LGBl. Nr. 21/1992 and its latest version LGBl. Nr. 107/2013 a detailed definition of affected parties and supplier but keeps to the structure utilized by other federal states. The levy isn't allowed to exceed 6% of the gross earnings.

The law in **Upper Austria** is still valid in its original version from LGBl. Nr. 9/1967. It is quite compact and charges up to 3% of the companies' gross earnings. [97]

[97] E-Control (2017)

The regulations in **Lower Austria** (latest version LGBl. Nr. 17/2015) and **Vienna** (LGBl. Nr. 20/1966 and its latest version LGBl. Nr. 61/2016) are very detailed and treat many more cases than the other federal laws mentioned above. In Lower Austria the use of communal ground needs to be declared by the parties concerned and sometimes also granted by the municipality. An extensive catalogue of levies for the different cases of use had been elaborated by the lawmaker. The Viennese law is quite similar to the Lower Austrian one.[98]

### *7.1.3 Support for renewable electricity*

In order to support electricity from renewable sources the state adopted the green electricity act or Ökostromgesetz 2012 BGBl. Nr. 75/2011. In October 2006 the OeMAG was established in order to handle the system of funding and supporting power plants that use renewable sources of energy. This authority checks whether a newly planned production site deserves funding or not and will also make contracts with operators of green power plants to buy their electricity. System operators have to distribute this electricity by their networks. The power plant owners receive feed-in tariffs for their produced and provided electricity. Since 2012 the funds for the support of renewable energy are moneyed by the flat rate renewable charge, the renewable contribution and the fees for guarantees of origin, those fees are paid by the electricity retailer.

End consumers are involved in this system by the flat rate renewable charge which is a fixed annual amount and the renewable contribution which is a certain percentage of the system charge and the grid losses charge.[99]

[98] E-Control (2017)
[99] E-Control (2017a)

| flat rate renewable charge | | | | | contribution | guarantee of origin fee |
|---|---|---|---|---|---|---|
| | *Tier 1-4* | *Tier 5* | *Tier 6* | *Tier 7* | | *€/MWh* |
| **2017** | € 104.444,00 | € 15.517,00 | € 955,00 | € 33,00 | 26,80% | € 0,93 |
| **2016** | € 104.444,00 | € 15.517,00 | € 955,00 | € 33,00 | 37,11% | € 0,50 |
| **2015** | € 104.444,00 | € 15.517,00 | € 955,00 | € 33,00 | 30,76% | € 1,00 |
| **2014** | € 35.000,00 | € 5.200,00 | € 320,00 | € 11,00 | 32,65% | € 1,00 |
| **2013** | € 35.000,00 | € 5.200,00 | € 320,00 | € 11,00 | 24,07% | € 1,50 |
| **2012** | € 35.000,00 | € 5.200,00 | € 320,00 | € 11,00 | 15,40% | € 1,50 |
| **2011** | € 15.000,00 | € 3.300,00 | € 300,00 | € 15,00 | | |
| **2010** | € 15.000,00 | € 3.300,00 | € 300,00 | € 15,00 | | |
| **2009** | € 15.000,00 | € 3.300,00 | € 300,00 | € 15,00 | | |
| **2008** | € 15.000,00 | € 3.300,00 | € 300,00 | € 15,00 | | |
| **2007** | € 15.000,00 | € 3.300,00 | € 300,00 | € 15,00 | | |

*Table 3: Charges to support production of renewable energy (2017)*

In order to keep the feed-in tariffs under control the E-Control is obliged to publish the quarterly market price for electricity. It represents the wholesale baseload price.[100]
In the following figure we can compare this market price to the feed-in tariffs over time. In order to support the production of electricity from renewable sources the tariffs the producers receive are often higher than the average wholesale baseload price. Especially photovoltaic power gets heavily subsidised compared to geothermal and wind power. In 2010 the tariffs for wind power and biogas increased whereas they decreased for forms of biomass energy. Newer amendments to the support scheme lowered the tariffs for solar power and altered the range of kWpeak that are needed to receive the feed-in tariff. Most of the tariffs were quite stable over the years except the decrease for solar power and liquid biomass and the increased support for biogas, wind power and solid biomass. Market prices were slightly falling from the 2nd quarter of 2011 till the 2nd quarter of 2016. Since the last three quarters they seem to rise again.

[100] E-Control (2017a)

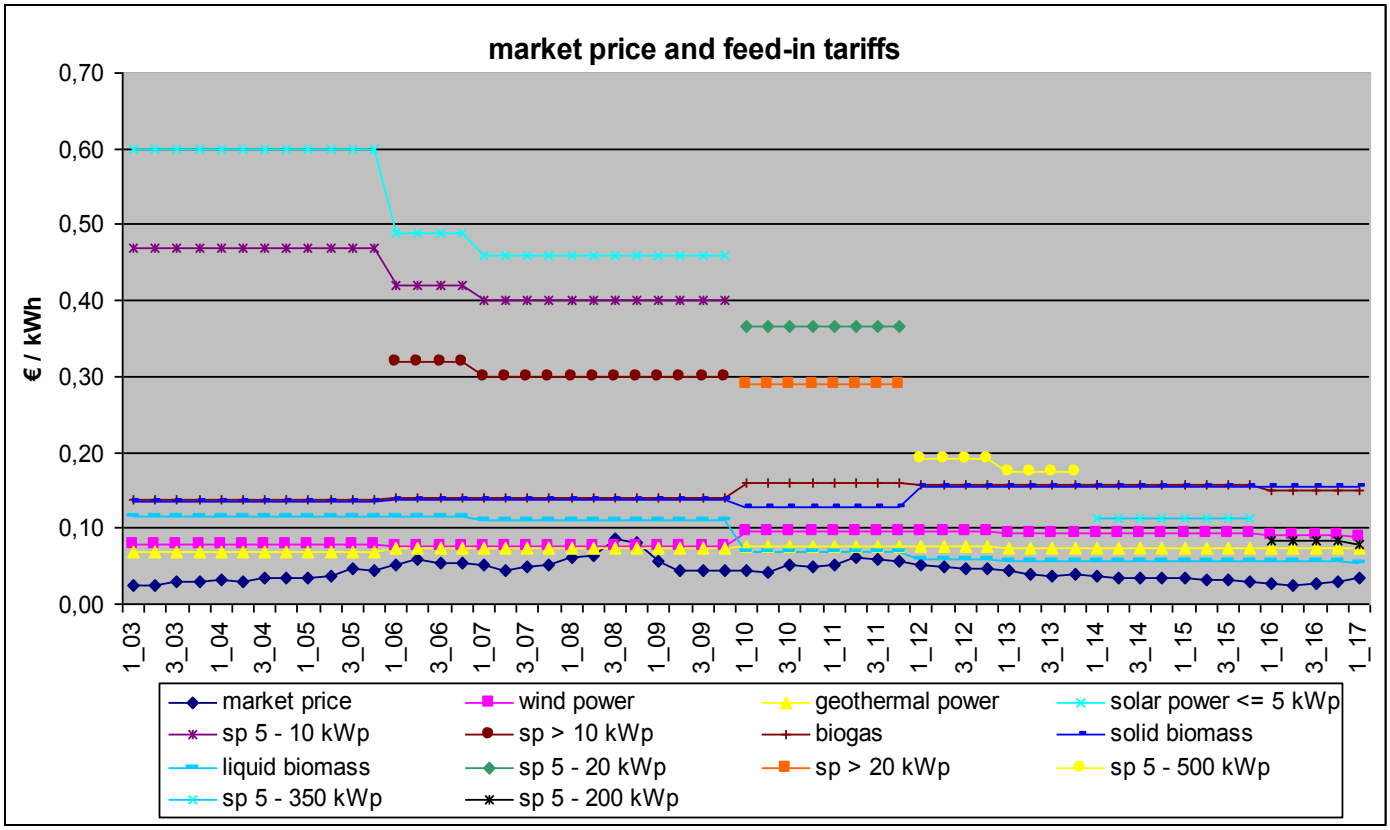



*Figure 6: History of feed-in tariffs and the average wholesale market price (2017)*

### 7.2 System charges

Consumer prices also include charges that are received by the network operators in order to compensate them for the use of their network, its construction, maintenance and expansion. The grid utilisation charge consists of charges calculated by the E-Control that are published in the Systemnutzungsentgelte-Verordnung which is updated annually. One fee is based on the capacity rate of the network, another on the actual flow of energy through it and a third one compensates operators for the grid losses. During the transmission of energy from the plant through the network to the consumer a proportion of it gets lost.[101]

Considering the differences in costs, scale and capacity of various networks there are individual charges for 7 distinct tiers.

[101] E-Control (2017b)

Tier 1 represents maximum voltage transmission lines with 220 to 380 kV and at least 200 MW of power. Tier 2 is the transformation from tier 1 energy to the high voltage level of 110 kV. The transmission of high voltage power with a minimum of 5000 kW is tier 3 and its further transformation to medium voltage with 10 to 30 kV is tier 4. Transmission of medium voltage is classified as tier 5 with a minimum power of 400 kW. Next tier substations alter the voltage to a lower tension of 400V and at least 100 kW of power. Tier 7 is the lowest level of the network and represents vast end-consumer level.[102]

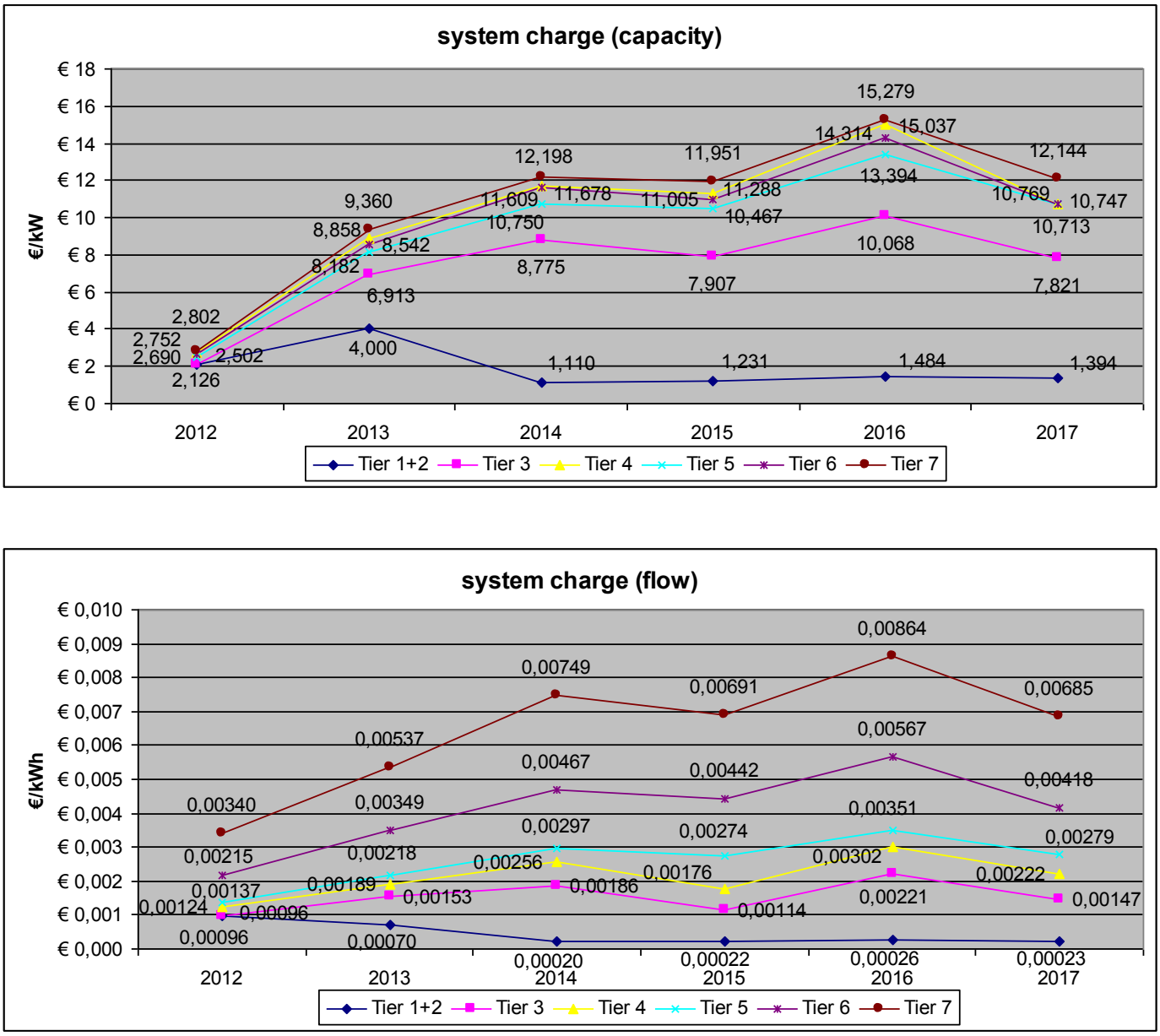



*Figure 7-8: System charges (2017)*

[102] E-Control (2016) p. 8-10

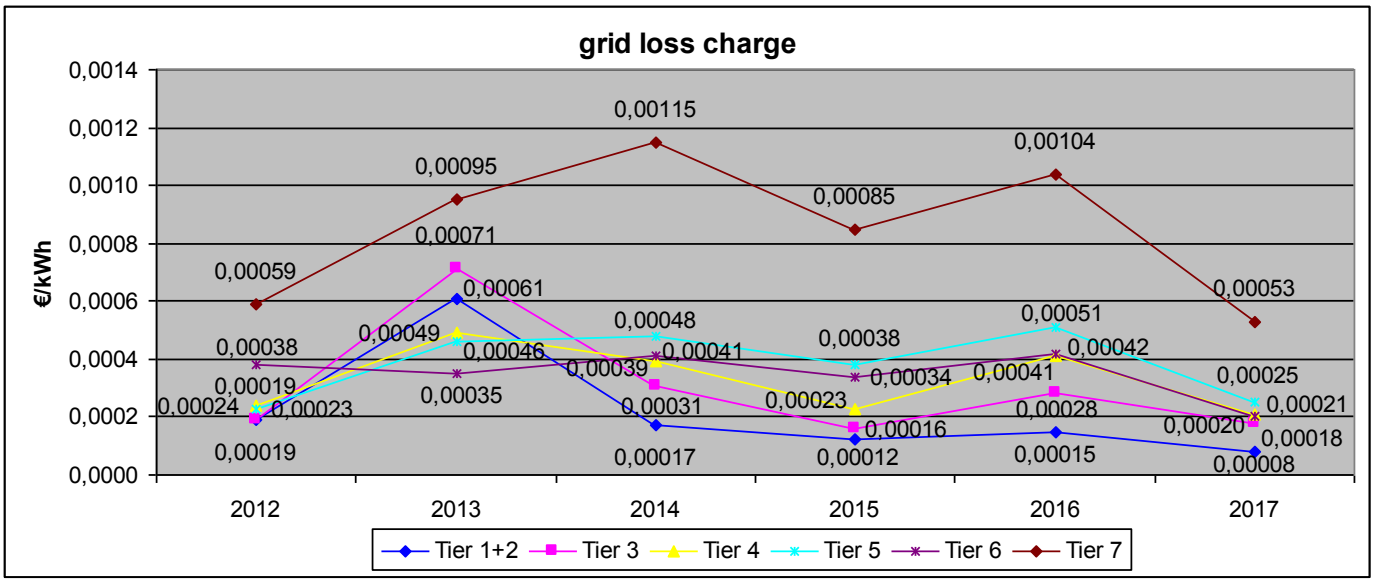



*Figure 9: Grid loss charge, System charges (2017)*

We can see that the system charge per kW of capacity that is possible in the specific network developed quite similar for the tier 4 to 7 networks and reached its peak in 2016. Tier 3 charges follow the trend but increased their distance to the higher tiers over time. Tiers 1 and 2 remain stable at a low level after their peak in 2013.

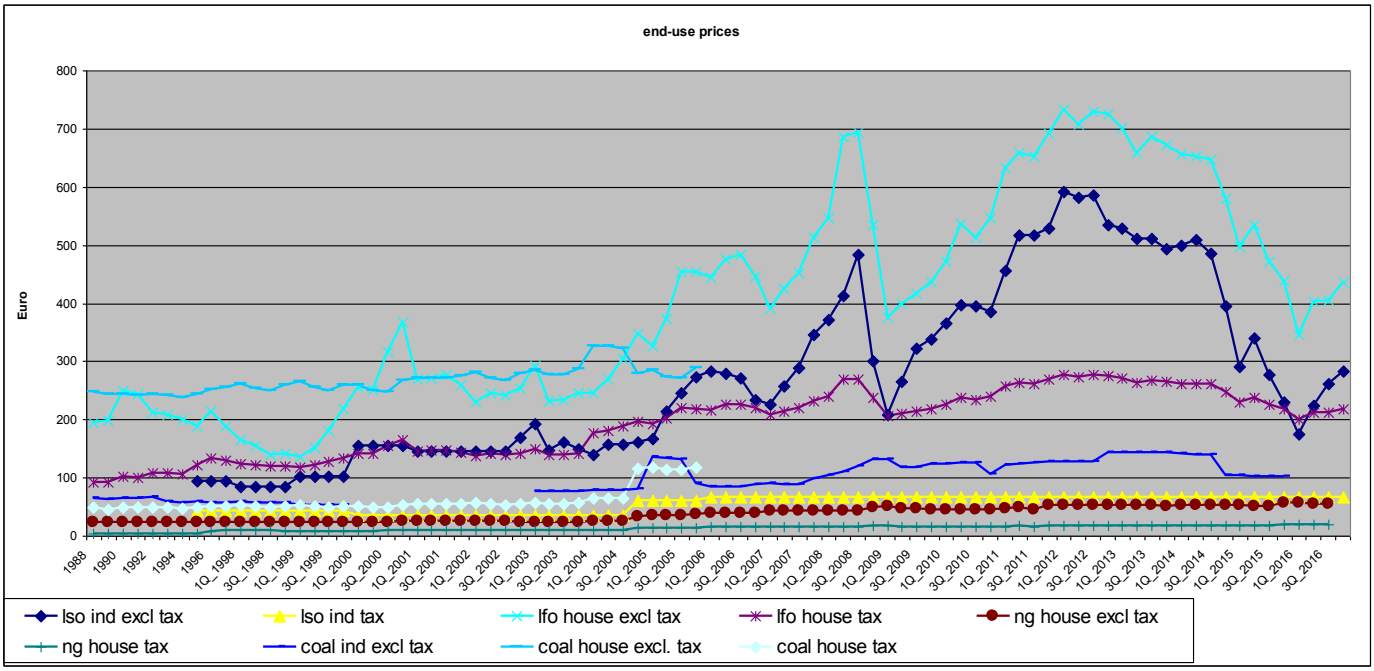
The price diversification between the tiers is more distinct if we look at the system charges for the actual flow of kWh through the networks. End users are paying the highest charges whereas the other tiers are imitating the development on lower price levels. It is clear that those charges are debiting parties equally as the level of capital investments are very different. Lower tiers provide higher amounts of capacity and energy flow than the household or commercial user.

Also the grid loss charges reflect these thoughts as we consider a fixed percentage of lost energy per amount of transmission. Lower tiers suffer from greater losses than household customers. Tiers 1 to 6 are charged quite similar sums whereas tier 7 parties operate on a much higher level.

As these charges were introduced in 2012 we can see that the people in power had to approximate a meaningful split of charges. In the first year all tiers start with nearly the same charges. The next year the segmentation between the tiers became more obvious and remained that way for the following years.

### 7.3 Energy price

The following graphs reflect the evolution of energy prices of different sources of energy over the years. The data was extracted from the quarterly statistics of energy prices and taxes recorded by the International Energy Agency. In order to create a graph that is readable only sources of energy whose price range is similar are depicted in the same graph. The period of time is the same and therefore the developments of prices can be compared.



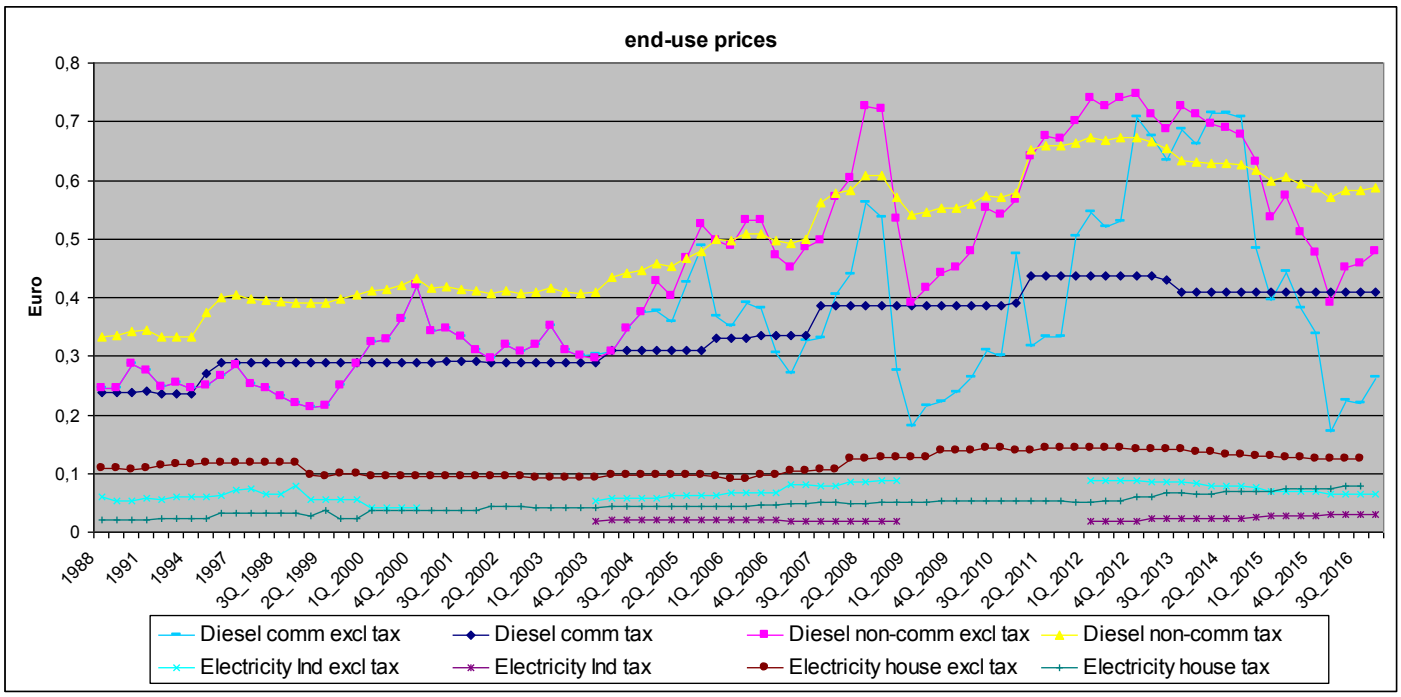




*Figure 10-11: End-use prices of different energy sources, IEA (2017)*

In the first figure we can see the development of different sources of energy over time. Low sulphur oil Industry (lso ind, €/tonne) is slowly growing in price till it starts to jump up in 2005 and again in 2007. After a steep fall by the end of 2008 prices climb up again from 2009 to 2012 and eventually fall again till the first quarter of 2016. The taxes are quite stable and only increase by the end of 2004 and 2005. The curve for light fuel oil for households (lfo house, €/1000litres) is similar but the price level is higher. Taxes for light fuel oil are also higher and more volatile. A gentle increase gets harsher in 2004 but relaxes in 2016 after a peak and wide hill to the level of 2007. Natural gas for households (ng house, €/MWh) has a quite stable price at the level of light fuel oil and experiences the same upward trend by the end of 2004. The prices remain very stable since then. Gas taxes are steady with only small increases in 1996 and 2004. Prices of Coal for industrial use (coal ind, €/tonne) are at a quite low level but increased over the years till a recent decrease in 2014. Data of coal for households (coal house, €/tonne) ends unfortunately at the end of 2005. The price level is comparable to the one of natural gas but instead of a rise in 2004 it falls to its level of 2003. Taxes are consistent even after an abrupt increase by the fourth quarter of 2004.

The second figure contains Diesel (€/litre) and electricity prices (€/kWh). As expected the forms of Diesel for commercial and non-commercial use have a very similar history of prices. They are identical till the third quarter of 2004 with only the taxes giving them a difference in prices. Both consumer types of Diesel pay a tax that is nearly as high as the Diesel price excluding taxes. A steep fall in prices in 2008 ends the strong upward trend that started in 2004 but the peak is reached again in the first quarter of 2012. Stability remains till a price drop starting in the third quarter of 2014 and coming to a halt at the beginning of 2016. Prices are currently rising again. Non-commercial Diesel taxes are more volatile but share their commercial twins increases at the end of 2003, in the middle of 2007 and at the fourth quarter of 2010.

Electricity prices for the Industry have two big gaps but what we can see is a consistent growth till the end of 2012, from then on prices are slightly decreasing. Taxes on industrial-used electricity are also stable but start to rise in 2014. Households have to cope with a higher level of prices for electricity. In 1999 a valley of smooth prices evolved which existed till prices rose from 2008 to 2013. In the last years they are slightly decreasing whereas taxes rose since the end of 2012. Before that taxes on electricity held their level over the years.

Electricity prices manage to decrease in recent years whereas prices of other sources of energy both for non-commercial and commercial use are increasing or at least languishing.

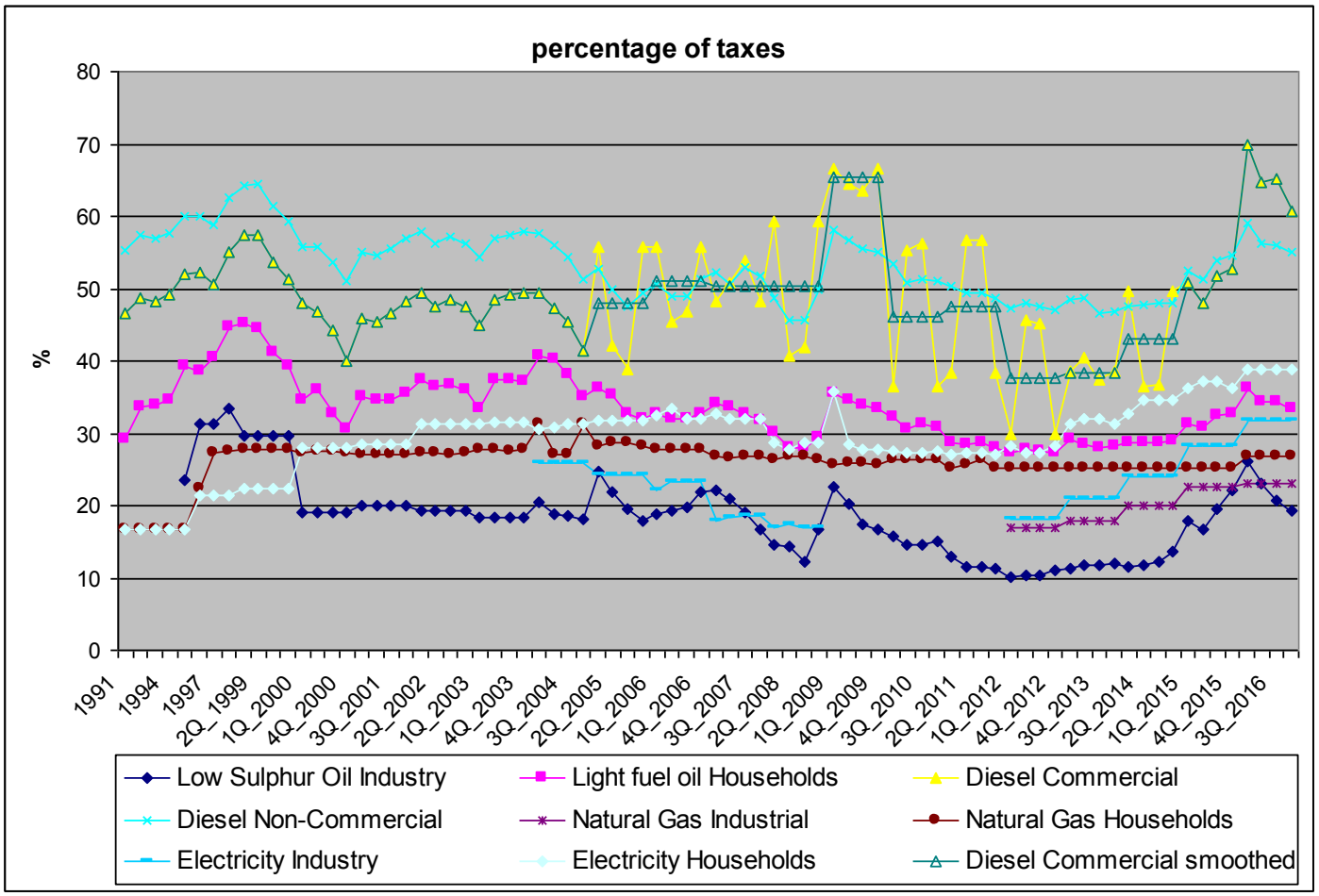



*Figure 12: Share of tax of the prices of different energy sources, IEA (2017)*

Figure 11 depicts the amount of taxes that are included in the prices of different sorts of energy. For low sulphur oil the amount of taxes decreased over time and reached their lowest point in the first quarter of 2012. After a short rise they decrease again since 2016. Light fuel oil for households has quite the same curve than Diesel for non-commercial use but on a lower level. Both products are basically the same but the lawmaker wants to subsidize households that are heating with light fuel oil and therefore the share of tax is smaller than for the car fuel. Diesel for commercial use has a volatile curve and can vaguely be compared to that of non-commercial Diesel. As we have seen from the figure above the price levels of both forms of Diesel differ as well as their taxes. It can be seen now that the amount of taxes is similar as intended by the lawmaker. For commercial Diesel there is a smoothed curve as the values from 2005 to 2014 have strong variations. From 2006 to 2010 and since 2016

the taxes of commercial Diesel have even a bigger share of the price than their non-commercial counterparts. The share of taxes for natural gas for households is very steady. For industrial natural gas data starts in 2012 and show a rise since its stabilization in 2015. The tax share data for industry-used electricity is incomplete but after a decline from 2004 to 2008 the share is growing annually since 2012. If we look at household electricity the amount of taxes in the prices grew strongly till 2000 and managed to drop after an even course in 2008. After some years of stability it started to increase again by the end of 2012 and make up 38.9 percent of the electricity price in 2016.

These percentages have to be looked at in comparison with the history of prices. It is an interaction of prices and the taxes. As I mentioned before the electricity prices for households and the industry both declined in the last years whereas the taxes increased. In the gross price the share of taxes grows as both lines approach each other. In case of Diesel fuels the prices are more volatile than the taxes leading to an erratic percentage of taxes in gross prices. Taxes on Diesel are also quite high. They are often as much as the net prices and sometimes even higher. A quite smooth curve can be seen for natural gas for households. If we look at the price graph a consistent distance between the net prices and the taxes exist and create a fixed percentage of taxes within the gross prices.

Before commenting on the wholesale prices from the Energy Exchange Austria (EXAA) I have to explain their method of pricing. The prices are for end consumer without taxes, charges and network charges. At the spot market or day-ahead-market, electricity is traded at an hourly basis and delivered the next day. The arithmetic mean of all hourly prices represents the daily base index whereas the peak index is the mean of the prices traded between 8 and 20 o'clock.[103] Since 2012 green electricity is also traded at the exchange but its trading volume is quite negligible compared to the whole amount traded. I summed up the daily values to an annual average in order to see any trend and making the graph more readable.

Some kind of pattern can be seen that reproduces a peak every 2 to 3 years. The highest one in 2008 plummets back to the values of 2007 the next year and prices start to rise again till 2011. Then a constant downfall starts. The prices for green energy are most of the time slightly above the ones of normal electricity which might be the case due to their marginal volume. Their highest share in total amount of

[103] E-Control (2017c)

traded electricity was 1.736% at the end of December 2013 and their mean being at 0.277% of traded volume. Development of the EXAA is also remarkable in terms of the increase in trading volumes. The top 20 values reach from 37,970 MWh to 47,475.10 MWh, most of the top capacity was traded in 2013. The overall average is 13,242.321 MWh which increases to 21,579.334 MWh if we look at the period of 2010 to 2016.

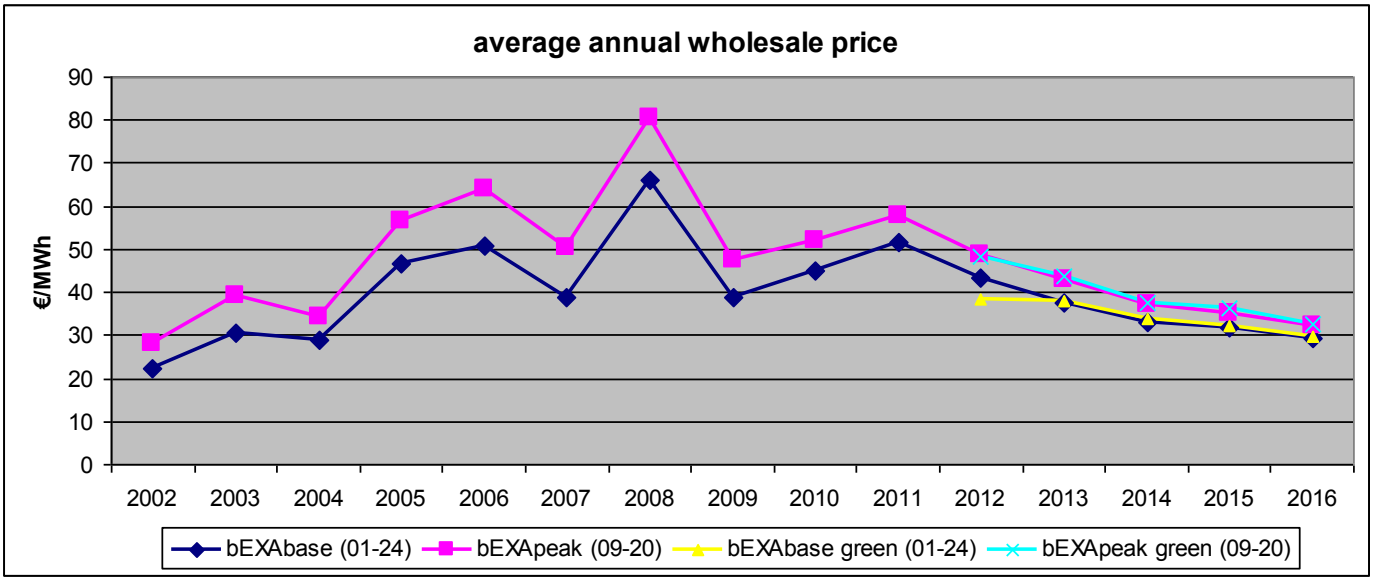



*Figure 13: Annual average wholesale prices, EXAA (2017)*

Due to my curiosity I looked up the data from my own household and extracted the data in order to compare the development of prices between a small domestic consumer and the wholesale market or the price data from the Energy Agency.

In the next figures I once more wanted to depict the prices of different sources of energy according to Eurostat. The categories are a bit more diversified than from the International Energy Agency but I tried to pick those sources that are meaningful for a regular consumer. Gas prices for households and the industry are very alike except the difference in the price level. In 2000 a slow increase in prices started but it came to a halt at the beginning of 2001 and remained stable. Electricity for both users is linear with only a slight decrease in 2002. Gasoil is volatile as we have seen in graphs before and there is a significant gap between industrial prices and those for households due to the different taxation. Unfortunately for the following years the categorization of consumers changed and the data available from Eurostat's database is incomplete for the period of 2008 to 2010. Gas prices for households and the industry are increasing till 2007. Household prices must have fallen in the missing period because in the second half of 2011 they are standing at 20 Euro per GJ and

are rising a bit till the second half of 2013 where they decline again. Industrial gas is a bit more expensive than in 2007 and develops similar to its domestic use and reaches its 2007 price again in 2016.

Electricity prices are quite stable till 2007 where they jump up a bit and might keep on growing till 2011. Although the categories have been altered prices increased. It is interesting that electricity for households excluding taxes and levies gets slightly cheaper over time but the prices including taxes stay around the 0.2 Euro/GJ level. This development can also be seen by the industrial prices whereas it is not that obvious.

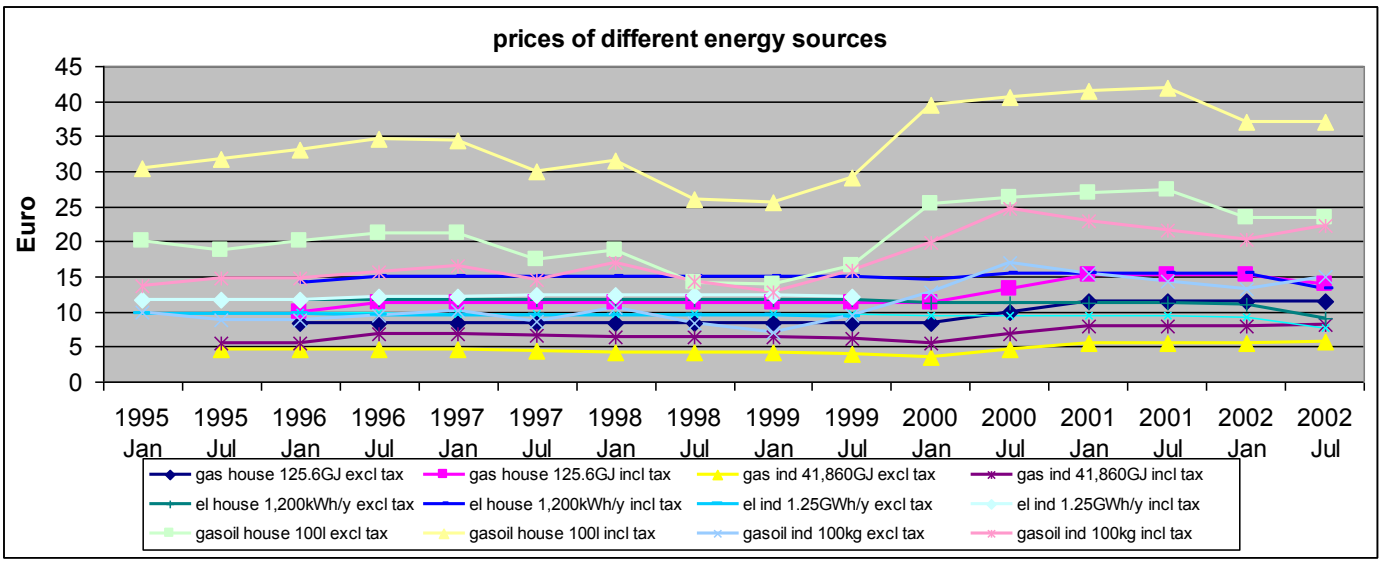



*Figure 14: Energy prices 1995-2002, Eurostat (2017)*

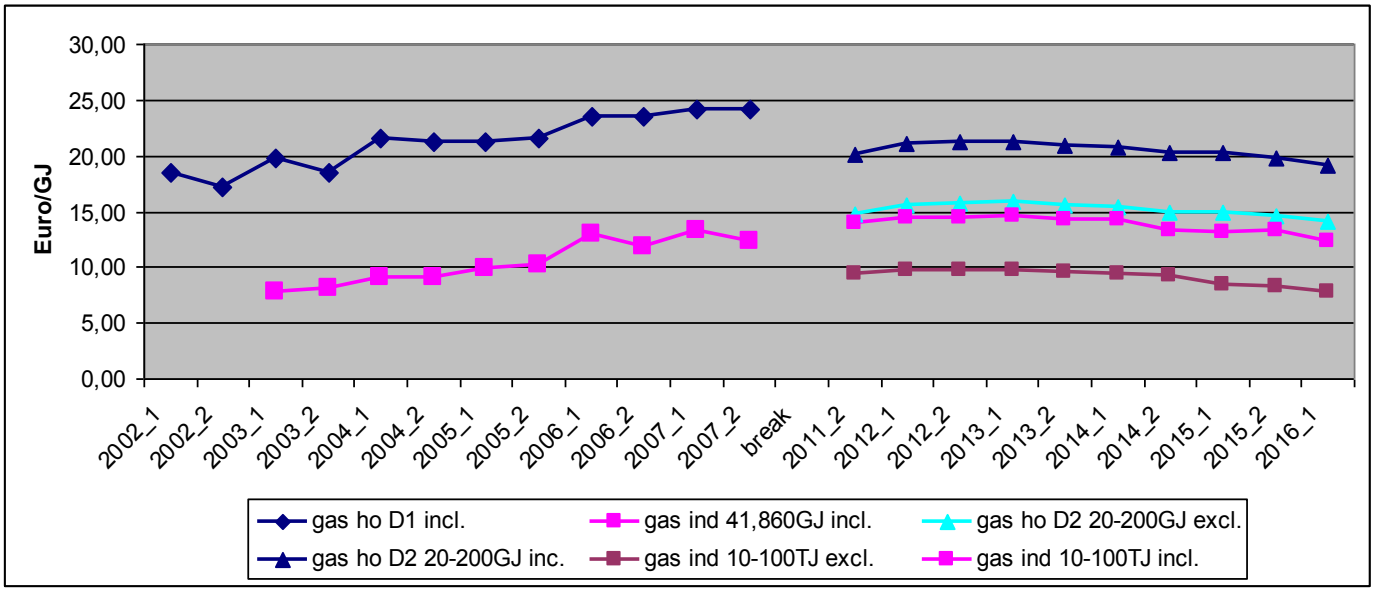



*Figure 15: Gas for households and the Industry 2002-2016, Eurostat (2017a)*

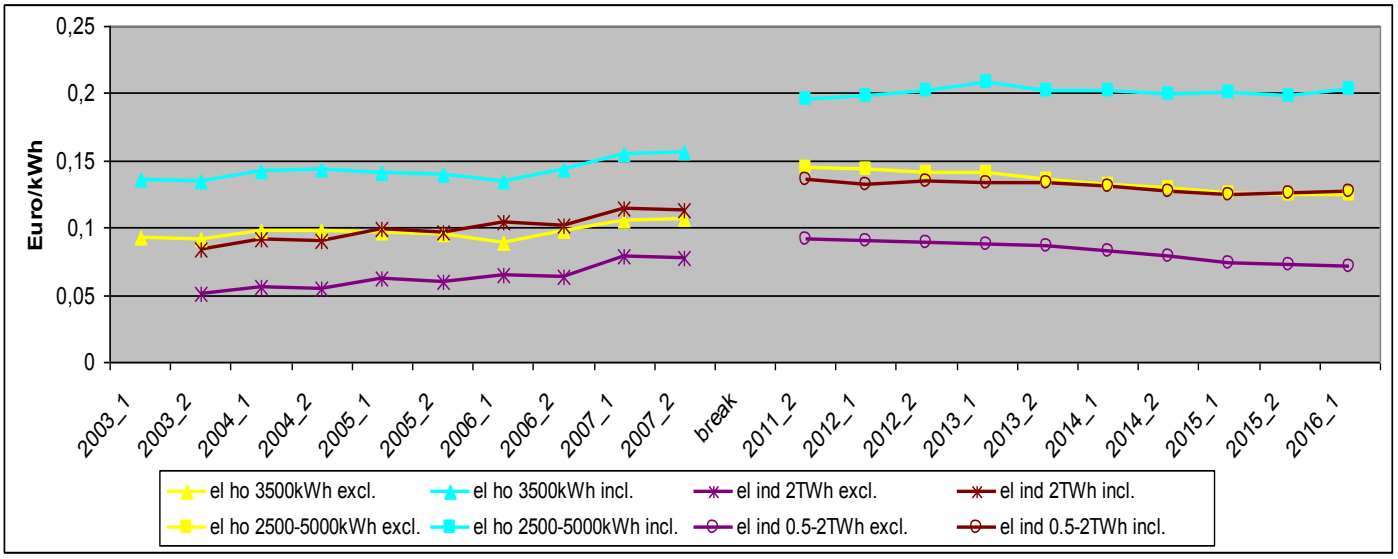



*Figure 16: Electricity for households and the Industry 2002-2016, Eurostat (2017a)*

The quarterly prices for electricity from figure 10 create a quite smooth line with a low price period between 1999 and 2006. A comparable low can be seen in the actual household prices between 1993 and 2003 for the net day prices. In 2008 the average prices started to rise slowly till 2013. For our model household (figure 16) we can see an abrupt increase of costs for daytime electricity in 2004. Price level remain over 0.10€/kWh till they plummet in 2010. According to the Energy Agency's data a slow decrease is going on since 2013 which can also be seen by the net day and night prices of our household. Net night prices are stable till the rise in 2003 and don't climb as rapidly and high as the daytime prices. The price difference between both tariffs shrinks between 1993 and 2003. Especially after the drifting down of prices in 2010 the gap narrows again and nearly vanishes for the 2015 prices. During the period of 1993 and 2003 there had also been introduced a second tariff for the night time. It might have been introduced in order to mitigate the electricity supplier's losses due to the low daytime prices. Annual wholesale prices also show the increasing of prices from 2002 to 2008, a small price peak in 2011 and the subsequent slow decrease. For the household prices these events are postponed by a year. It is quite comforting that trends from the wholesale market are really forwarded to the consumer. Of course the price level is a bit lower and they are a year ahead of the supplier's price adjustments.

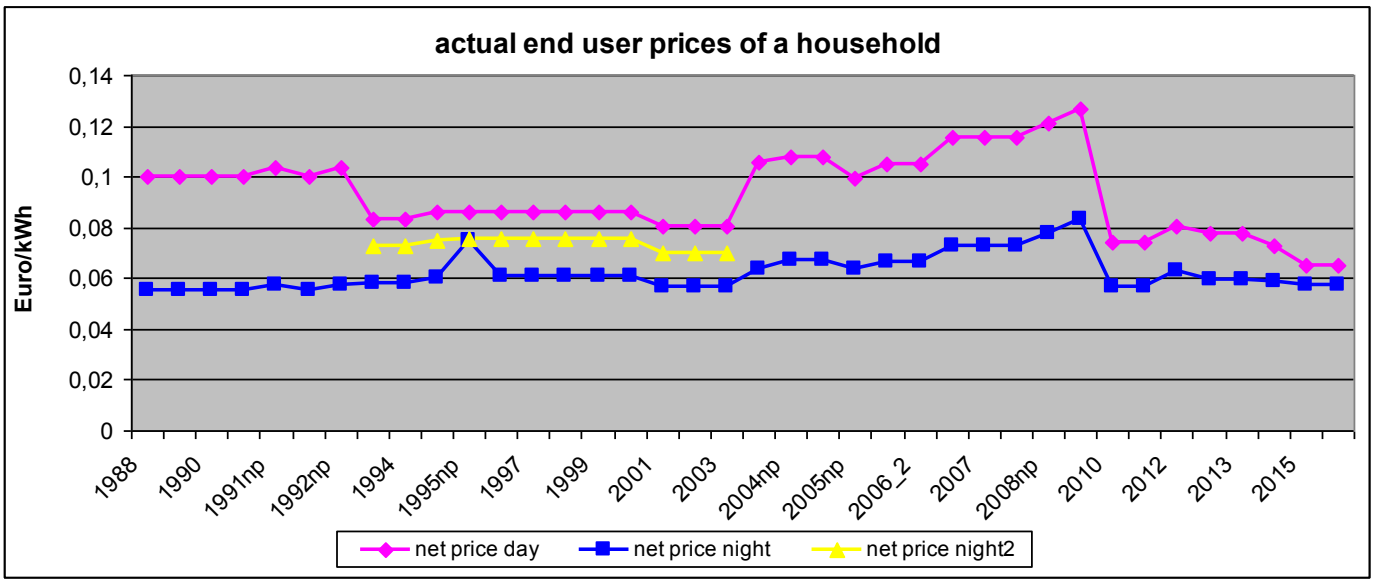



*Figure 17: Electricity prices of an Austrian household*

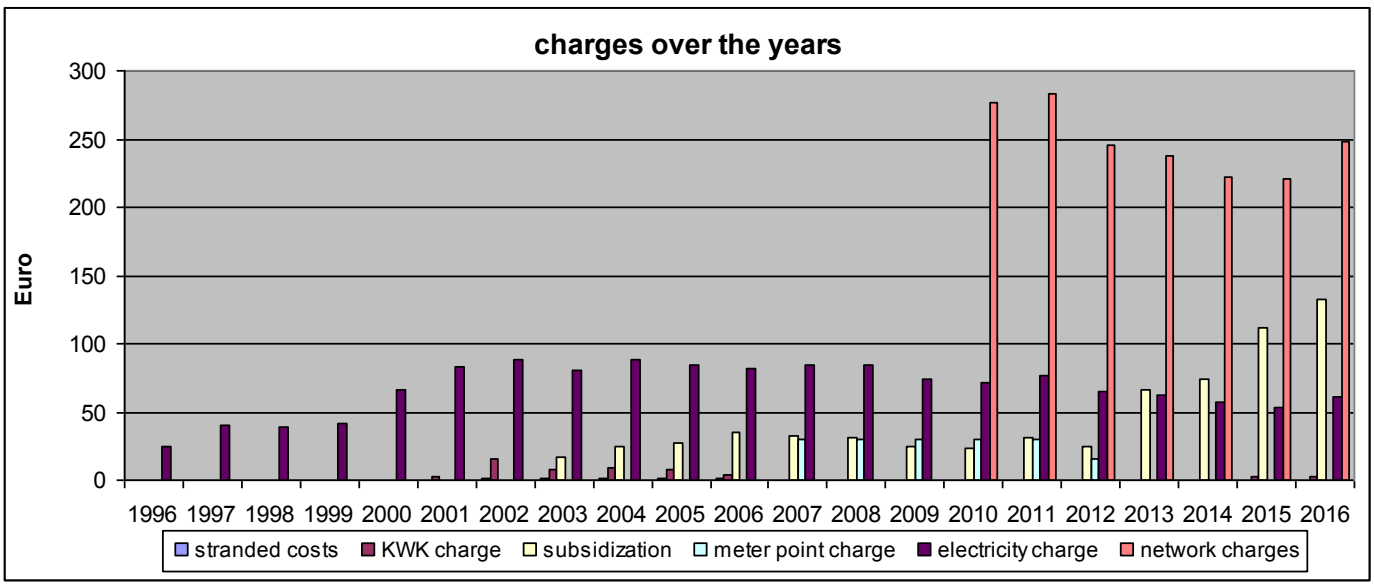



*Figure 18: Charges according to the annual invoices of the household*

Figure 17 depicts the actual charges taken from the annual invoices of my household. Due to the increasing transparency the invoices became much more detailed over the years but are also a bit hard to decipher. Some charges and levies are abolished over time or get integrated into a bigger package of subsidies. We see that the costs for the electricity charge increases in the new millennia but starts to slowly decrease after 2008. This movement is true according to the electricity consumption that has the same development. Stranded costs represent only minor costs and also got integrated into other definitions of charges. The KWK charge only existed between 2001 and 2006 but gets reintroduced in 2015. Subsidizations mostly

include flat rate and other charges for the support of renewable energy and start to contain other small charges like the meter point charge since 2013. Network charges are introduced in 2010 and cover the service costs of network operators. The tremendous increase in costs is weakened by the fact that the energy prices on the other hand plummet in 2010 and start to slowly decrease. This development is connected with the rise in transparency and the high detail of new invoices. Costs linked to the operation of the network are illustrated separately which pulls these fees out of the energy prices and cause them to drop. The overall electricity costs of the household aren't exploding from 2010 onwards as a look at the charges figure would suggest. Electricity prices are decreasing to the level of the night time prices before the year 2000.

## 8. Savings

The next few graphs will depict the savings customer can realize by switching their supplier. E-Control releases detailed reports about the cheapest electricity and gas supplier each month. The savings are the difference between the most common tariff of the traditional supplier and the price offered by the cheapest party operating in this region. The markets are the federal states as well as the big cities Graz, Klagenfurt, Innsbruck and Linz. For the comparison of electricity supplier it is assumed that the consumer is a normal household with a consumption of 3,500 kWh per year. The model household for the gas example has a consumption of 15,000 kWh per year. The regions are Lower Austria (LA), Upper Austria (UA), Burgenland (B), Styria (St), Carinthia (C), Salzburg (S), Tirol (T), Vorarlberg (V), Vienna (Vie), Graz (G), Klagenfurt (K), Innsbruck (I) and Linz (L). Another distinction is the possibility of supplier to offer a discount to new customer and therefore the savings are also split up into discount receiving (d) and no discount (nd) receiving ones.
Due to the fact that monthly data was available and that a depiction of all the values would have led to poorly readable graphs I decided to pick values of three months per year. The savings possible by switching in February, July and December were taken.

In the first figure we see the possible savings for Lower Austria, Upper Austria and Burgenland. A common trend can be seen as the amount of savings by switching your electricity supplier increases over the years. Lower Austria and the Burgenland

are quite similar in terms of values and the difference between savings with granted discounts for new customer and those without discounts. Discounts can range from around 10 up to over 80 Euros per year. Upper Austria and its capital Linz offer more potential for cheaper electricity supplier and is the federal state with the highest savings possibility. An explanation might be the high amount of heavy industry operating in and around Linz and therefore the need for high volumes of electricity. Many suppliers compete for this lucrative high demand area and prices are falling. In the next figure we see once again the trend of increasing savings over the years in Styria, Carinthia and Salzburg. As with Lower Austria and the Burgenland the federal states of Styria and Carinthia are also quite similar in terms of savings and development. Suppliers in Salzburg on the other hand can only offer smaller savings but the situation for customers in Tirol and Vorarlberg started much more slowly. Only since August/September 2013 savings stabilized and customers can profit by switching their supplier. It is quite interesting that in only 7 years competition among electricity suppliers created such a steep increase in potential savings through new tariffs or contracts. As it was mentioned above the main driving force for falling prices are the customer themselves as they can threaten companies by their buying or switching behaviour. Competition among electricity suppliers starts as more and more customers are willing to look for better contracts or tariffs and aren't afraid to leave their traditional supplier and benefit from the products of new market members.

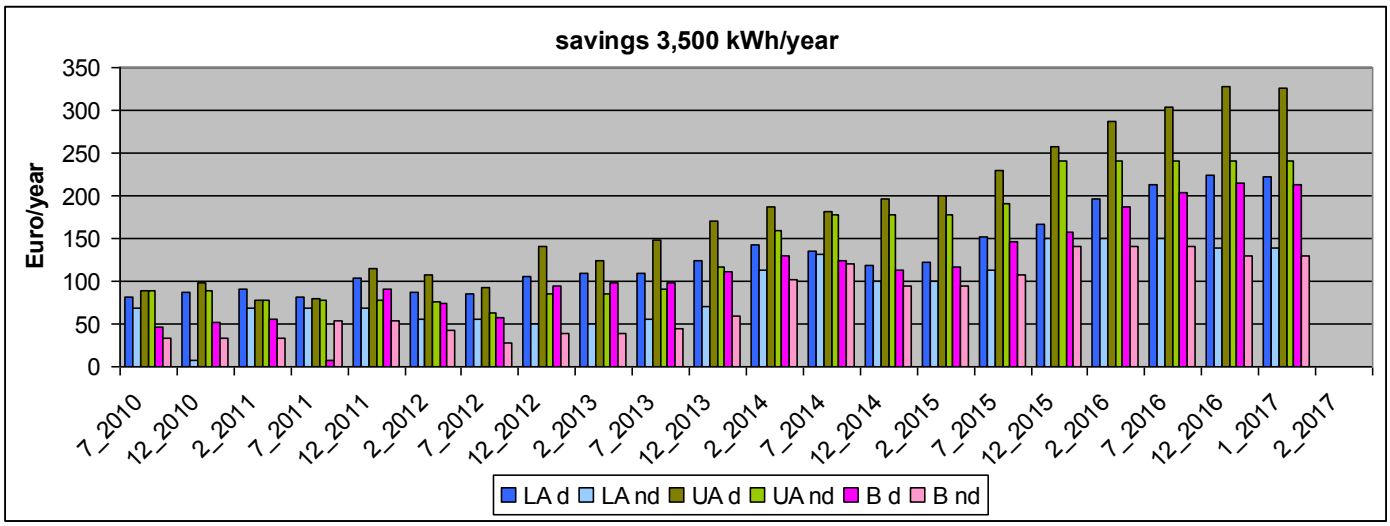
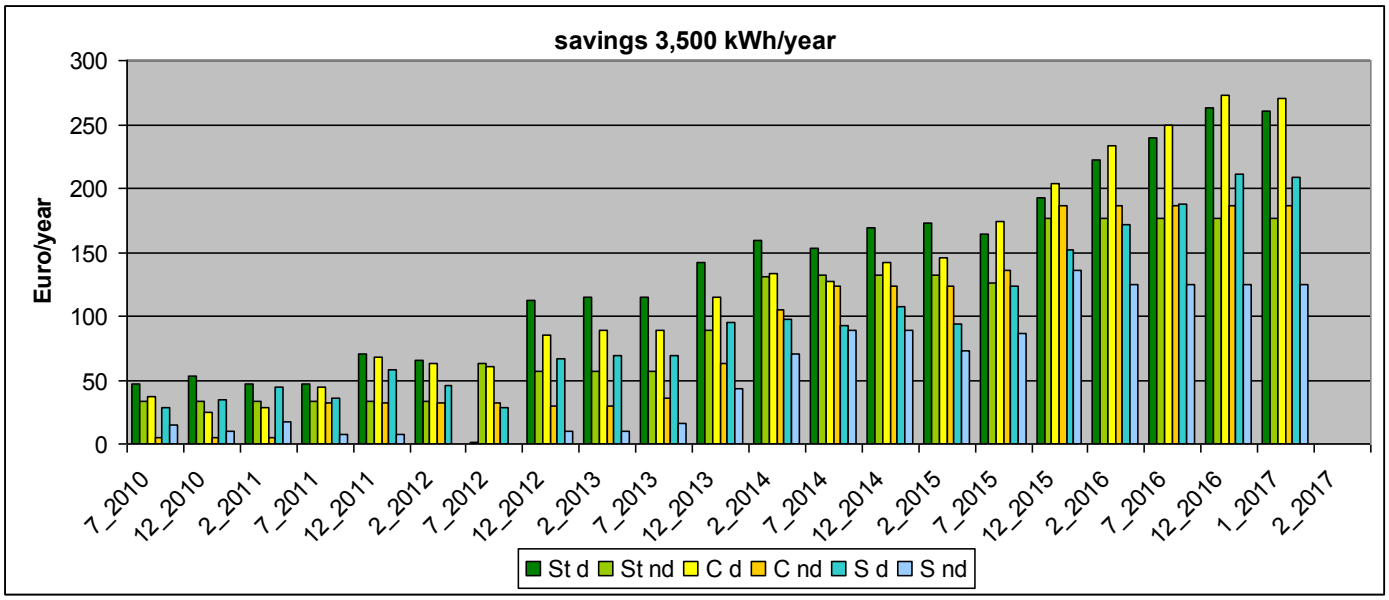
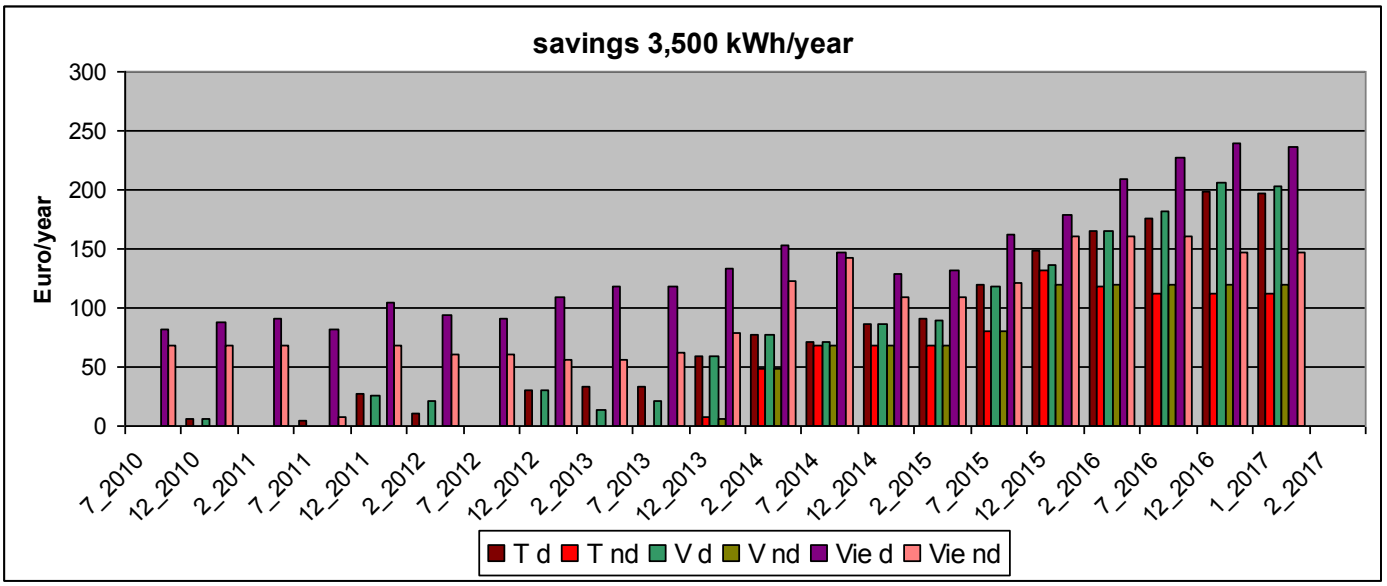



*Figure 19: Savings achievable for household switching their electricity supplier, E-Control (2017d)*



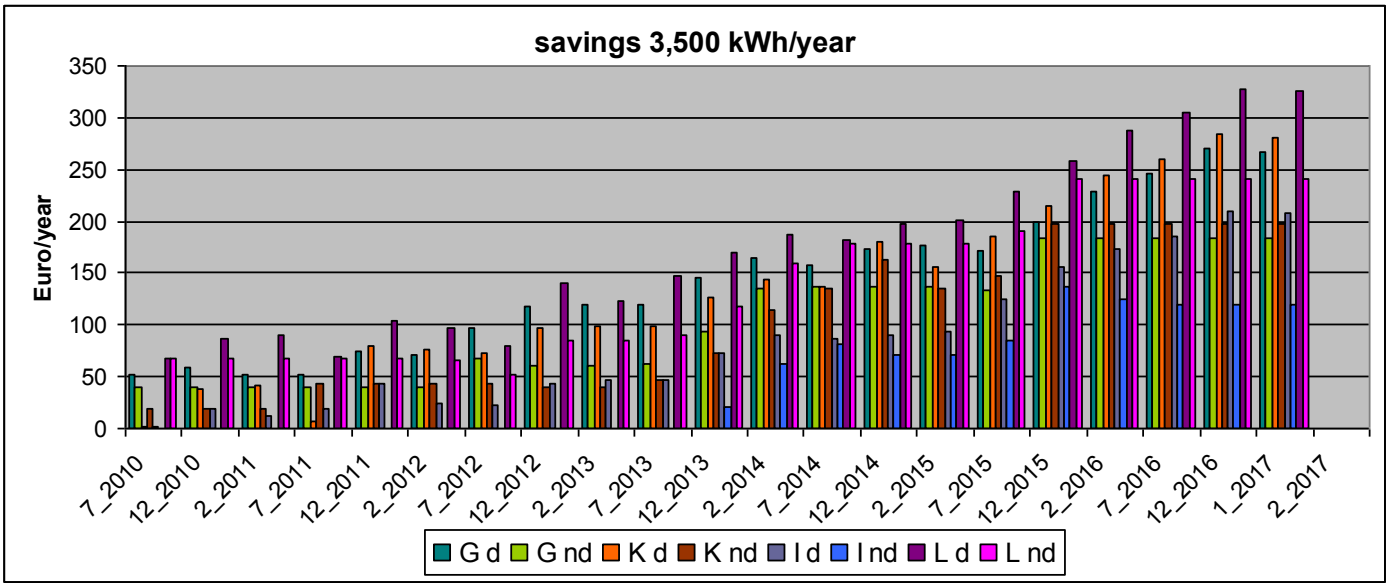
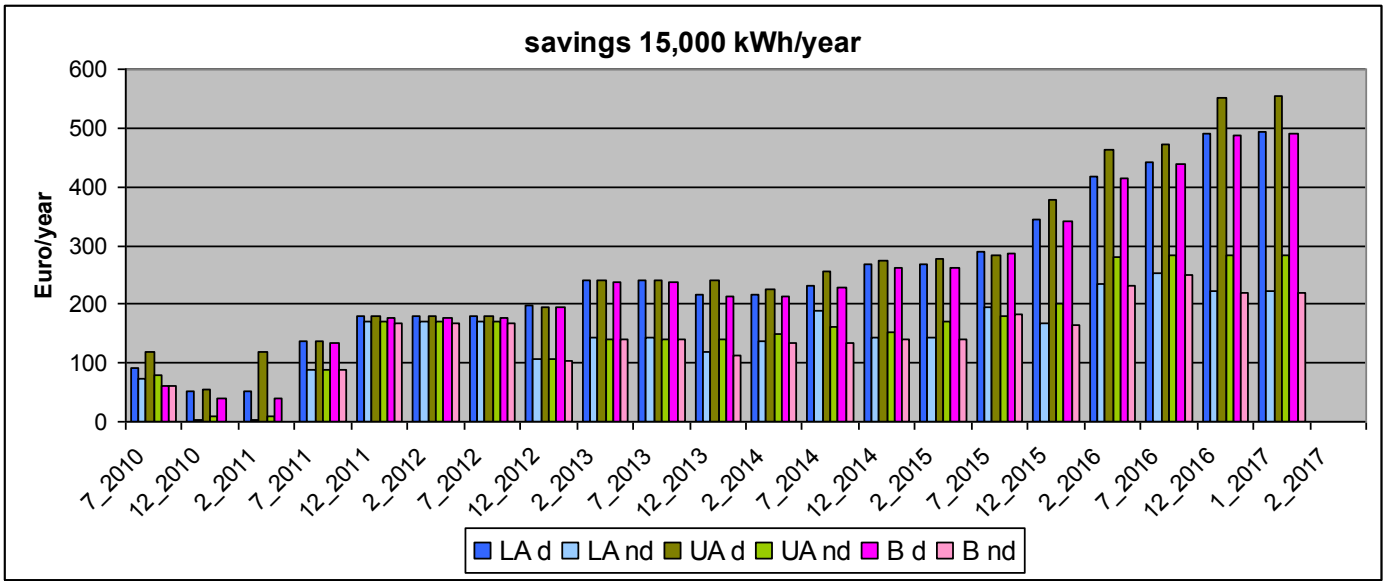




*Figure 20-22: Savings achievable for household switching their electricity supplier, E-Control (2017d)*

Also the gas market makes it possible for customer to easily switch their supplier. Savings can be realized and their development is very similar to that of the electricity market. Here the values are a bit higher but we can see that Upper Austria again is among the areas with the biggest savings possible. Suppliers in Carinthia and Vienna also offer high savings for new customers but the top values can be found in Linz with around 600 Euro/year and Klagenfurt with even nearly 700 Euro of savings per year by the end of 2016. Savings developed quite the same way as for the electricity market except for the last two years. A jump up in values and the start of a continuing rise happened in most of the areas by the second half of 2015. The values nearly doubled from around 300 Euros to nearly 600 or above whereas for the electricity sector the rise that happened during the same period boosted prices from 150-200 Euros up to 270-325 Euros. It seems that competition in the gas market made higher price cuts possible than it did in the electricity sector. If we look at the wholesale prices of EXAA for electricity we can't see a high downfall in prices in 2015 that would explain an increase in cheap electricity offered by suppliers although it can be said that EXAA prices are constantly falling since 2011. Eurostat can't provide an explanation either as gas and electricity prices are only slowly declining since 2013. Such minor changes can also be found within the data of the International Energy Agency. Suppliers might have potential to cut their prices but with only minor competition and customers that are hardly switching their supplier or contract they didn't need to alter their pricing policy. The end user prices for day and night electricity of my household dropped in 2010 to the level of 2003 which seems to be a positive trend. These savings couldn't be realized as on the other hand the additional charges, especially the network charges started to skyrocket in 2010. In the respective section above it was pointed out that these cuts in prices were the consequence of more transparency and detail in invoices. The depicted savings are generated for the whole invoice and not only for the energy costs. Suppliers may find many different ways besides the energy itself to cut down costs and pass these savings on to their products in order to compete on the market. Customers can put their trust in the supply of energy as the regulators are monitoring the service security and quality of market members.


savings 15,000 kWh/year
Euro/year
600
500
400
300
200
100
0
7_2010
12_2010
2_2011
7_2011
12_2011
2_2012
7_2012
12_2012
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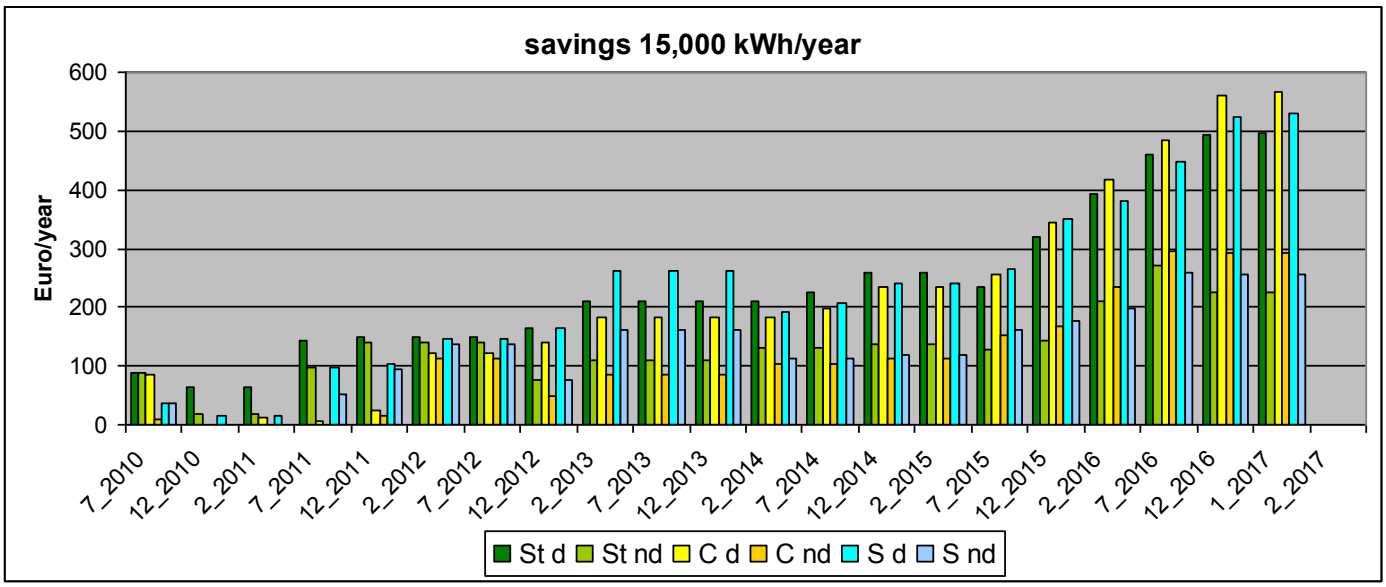
savings 15,000 kWh/year
Euro/year
600
500
400
300
200
100
0
7_2010
12_2010
2_2011
7_2011
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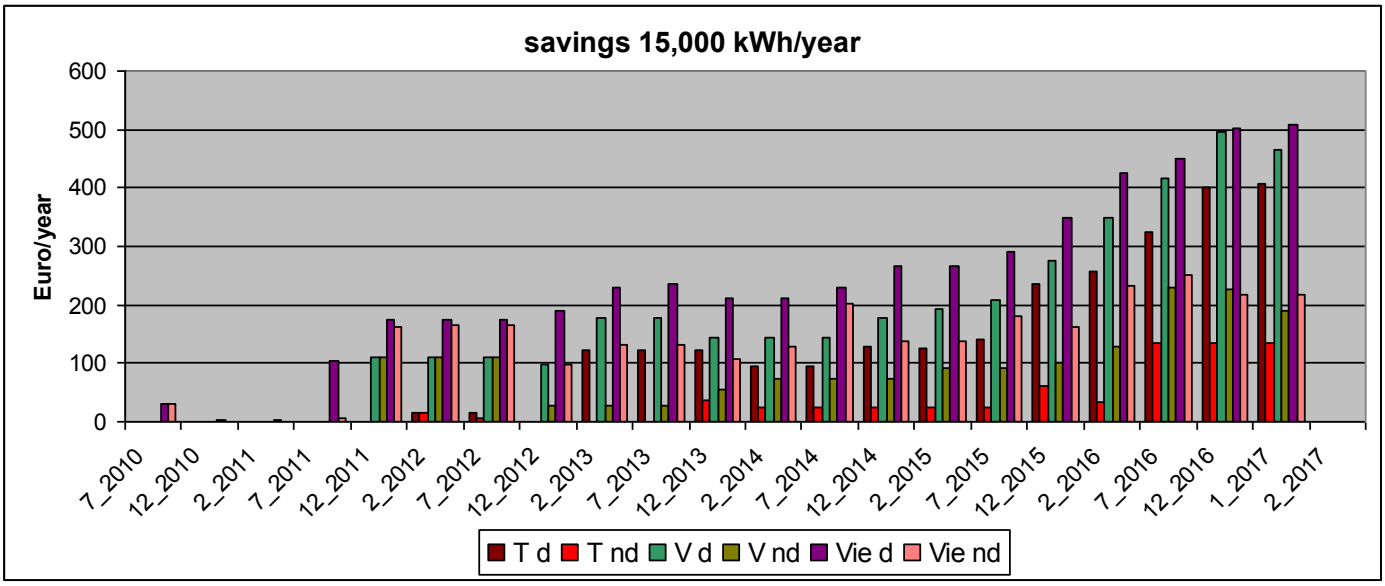
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Euro/year
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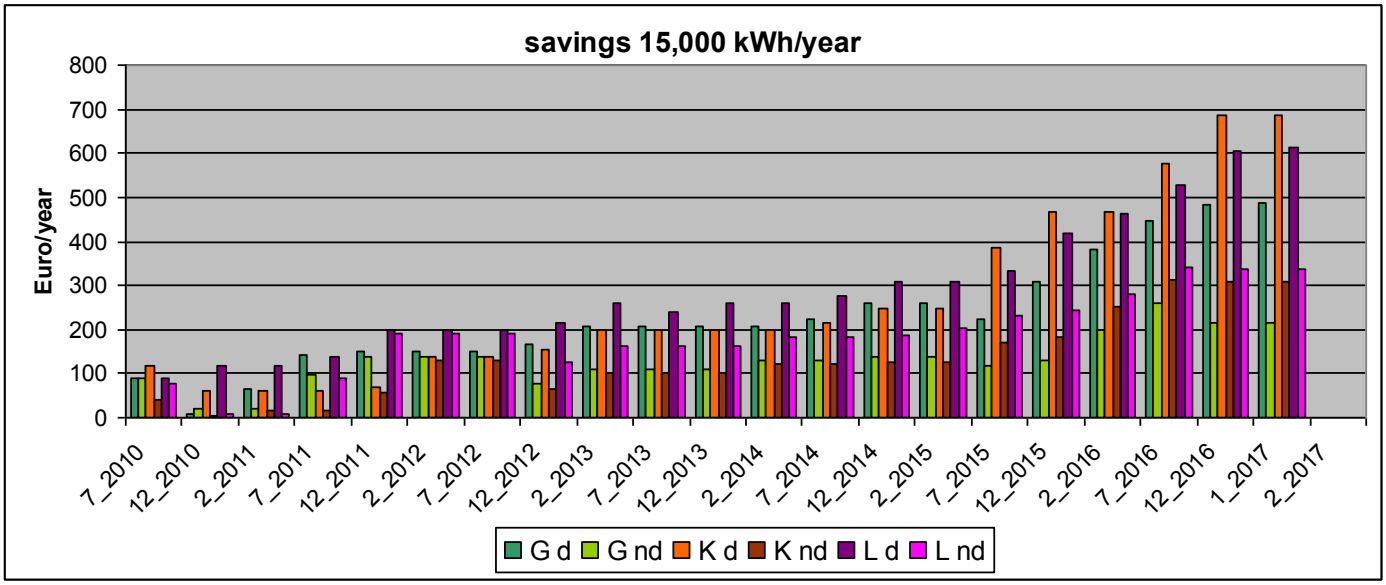


*Figure 23-26: Savings achievable for household switching their gas supplier, E-Control (2017d)*

## 9. Impact of the liberalisation on different margins

In order to have a look at the impact the liberalisation has on the electricity and gas market the margins are a good variable to analyse with respect to the competition within the markets. It is not very helpful trying to interpret the influence of the liberalisation on the electricity and gas market by putting the prices and the development of the respective markets in relation to each other. The prices are affected by many different factors besides the liberalisation and the alteration of the market structure. In order to avoid these uncertainties I came up with the idea of calculating the margins the suppliers are earning. While prices might fluctuate, suppliers and retailers want stable margins or profits and are trying to increase them. With the new competition in the market due to the liberalisation suppliers need to offer attractive prices and contracts to uphold their customer bases and extend them. Competition, falling prices and extensive service might lead to losses suppliers have to bear. Is the liberalisation favourable for customers and suppliers alike or is the development of the market concentration detrimental for suppliers' profits? Can the regression tests proof coherence between the evolution of the markets and the price margins of household suppliers?

The question is:" Do the changes of the market concentration after the liberalisation have an influence on the retail margins of the electricity and gas prices for household customers?" The data of the model household and the quarterly prices for electricity

and gas for households from the International Energy Agency are used to calculate the margins which should represent the difference between the production and the retail prices excluding taxes and charges for non-commercial customer. Prices for the electricity are taken from the Energy Exchange Austria while spot prices for gas are historic data provided by the U.S. Energy Information Administration about Henry Hub Natural Gas Spot Price. These should represent the production prices as producer might have lower costs in reality and would start to buy missing capacity on the spot market if production gets more expensive than it would be available on the exchange market. All prices were adapted according to the inflation where the year 2000 has the index of 100. There is an inflation index available for electricity and gas. With the difference between the household price and the exchange price the margins were calculated. Comparisons between the values of the present and previous year led to the annual growth rate of the margin. These growth rates are then compared to the rate of competition in the electricity and gas market.

The market concentration gets measured with the Herfindahl-Hirschmann-Index (HHI). In order to analyse the competitiveness of a market the presence or lack of market power is measured. The index looks at the companies in the appropriate market and sums up their squared market shares. Other aspects of the market are also considered by the index like the relative size of the firms.[104]

The values are taken from the annual market reports of E-Control. A value below 1,000 indicates no concentration of market power while a moderately concentrated market has a value between 1,000 and 1,800 and a value over 1,800 means that the market power is partitioned among only few firms or might even belong to solely one company. Unfortunately the index wasn't evaluated for some of the years so they had to be calculated under the assumption that the values would have increased or decreased in a linear way.

### 9.1 regression tests

First of all the regression between the market concentration growth rates and the margin growth rates of the electricity prices per kWh excluding taxes and charges of a real household in Austria were tested. Is there a coherence between the changes of the market represented by the market power of the companies and development of the margin this supplier earned by serving this household?

[104] Hausman J. (2007) p. 387-388

The regression test revealed with a P-Value of 0.17351045 that there is no coherence between the growth rates. No significance could be found in the connection between the growth of the market concentration and the growth of the margins of the electricity prices from a local supplier.

| ANOVA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | *Freiheitsgrade (* | *dratsummen (* | *Quadratsumn* | *Prüfgröße (F)* | *F krit* | | | |
| Regression | 1 | 1,53527812 | 1,53527812 | 2,18468138 | 0,17351045 | | | |
| Residue | 9 | 6,3247223 | 0,70274692 | | | | | |
| Gesamt | 10 | 7,86000042 | | | | | | |
| | | | | | | | | |
| | *Koeffizienten* | *Standardfehle* | *t-Statistik* | *P-Wert* | *Untere 95%* | *Obere 95%* | *Untere 95,0%* | *Obere 95,0%* |
| Schnittpunkt | 0,14417287 | 0,26409024 | 0,54592274 | 0,59838823 | -0,45324076 | 0,74158649 | -0,45324076 | 0,74158649 |
| HHI concentr | -2,61299924 | 1,76784925 | -1,47806677 | 0,17351045 | -6,61215208 | 1,38615361 | -6,61215208 | 1,38615361 |
| | | | | 0,05 | | | | |

*Table 4: Regression test of market concentration and household electricity margin growth rate*

In order to test the robustness of the test an Augmented Dickey-Fuller test and a Shapiro-Wilk normality test is done with the standardised residue values given out by the regression test. With the Dickey-Fuller test we can see if our data is stationary or has a unit root and therefore follows a random walk which gives the regression test and further statistical examination of the data set more robustness.

The Shapiro-Wilk normality test can be done additionally to the quantile-quantile plot in order to check if the data has a normal distribution and is therefore reliable for statistical tests and assumptions.[105]

The test looks for deviations from normality and gives a W-value between 0 and 1. A value close to 1 is desirable as it indicates the normality of the data.[106]

```
> adf.test(resffexcl,alternative="stationary")

 Augmented Dickey-Fuller Test

data:  resffexcl
Dickey-Fuller = -1.4774, Lag order = 2, p-value = 0.7714
alternative hypothesis: stationary

> shapiro.test(resffexcl)

 Shapiro-Wilk normality test

data:  resffexcl
W = 0.932, p-value = 0.4311
```

*Table 5: Augmented Dickey-Fuller and Shapiro-Wilk test of regression test market concentration and household electricity margin growth rate*

[105] Razali N., Yap B. (2011) p. 21
[106] Razali N., Yap B. (2011) p. 25

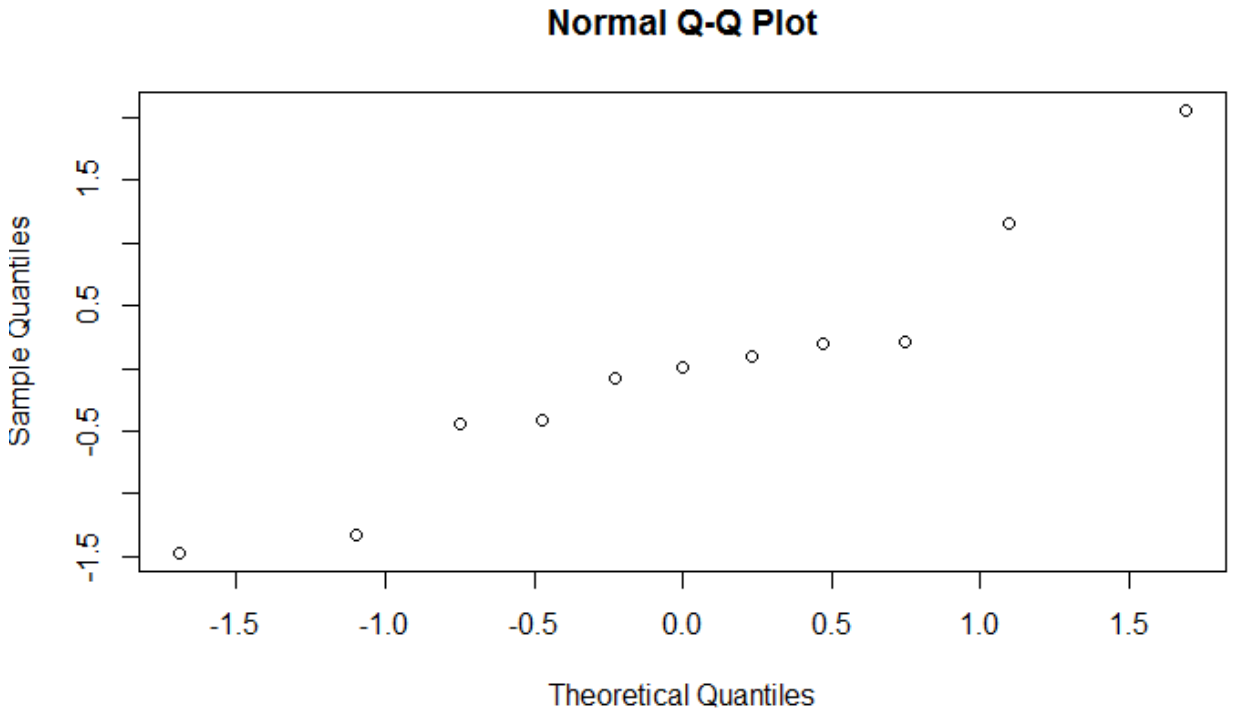


*Table 6: Q-Q plot of regression test market concentration and household electricity margin growth rate*

In the Dickey-Fuller test we stay with the null hypothesis of a unit root as the p-value of 0.7714 is bigger then the threshold of 0.05 and therefore not statistically significant. The Shapiro-Wilk value also indicates the normality of the data with a value of 0.932 close to 1. The Q-Q plot can confirm the normality and therefore the validity of interpretation of the data as the plots define a line with a nearly 45 degree angle.

With the next test results we are looking at the regression of the market concentration and the margin growth rates of the electricity prices for households per kWh excluding taxes and charges given by the International Energy Agency for Austria.

| ANOVA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | *Freiheitsgrade (* | *dratsummen (* | *Quadratsumn* | *Prüfgröße (F)* | *F krit* | | | |
| Regression | 1 | 0,2362978 | 0,2362978 | 1,33441538 | 0,27776831 | | | |
| Residue | 9 | 1,59371676 | 0,17707964 | | | | | |
| Gesamt | 10 | 1,83001456 | | | | | | |
| | | | | | | | | |
| | *Koeffizienten* | *Standardfehle* | *t-Statistik* | *P-Wert* | *Untere 95%* | *Obere 95%* | *Untere 95,0%* | *Obere 95,0%* |
| Schnittpunkt | 0,04027998 | 0,13256754 | 0,303845 | 0,76815335 | -0,25960862 | 0,34016859 | -0,25960862 | 0,34016859 |
| HHI concentr | -1,02512208 | 0,88742175 | -1,15516898 | 0,27776831 | -3,03260955 | 0,98236538 | -3,03260955 | 0,98236538 |
| | | | | 0,05 | | | | |

*Table 7: Regression test of market concentration and IEA household electricity margin growth rate*

```
> adf.test(resieaelec,alternative="stationary")

 Augmented Dickey-Fuller Test

data:  resieaelec
Dickey-Fuller = -1.1434, Lag order = 2, p-value = 0.8987
alternative hypothesis: stationary

> shapiro.test(resieaelec)

 Shapiro-Wilk normality test

data:  resieaelec
W = 0.9442, p-value = 0.5709
```

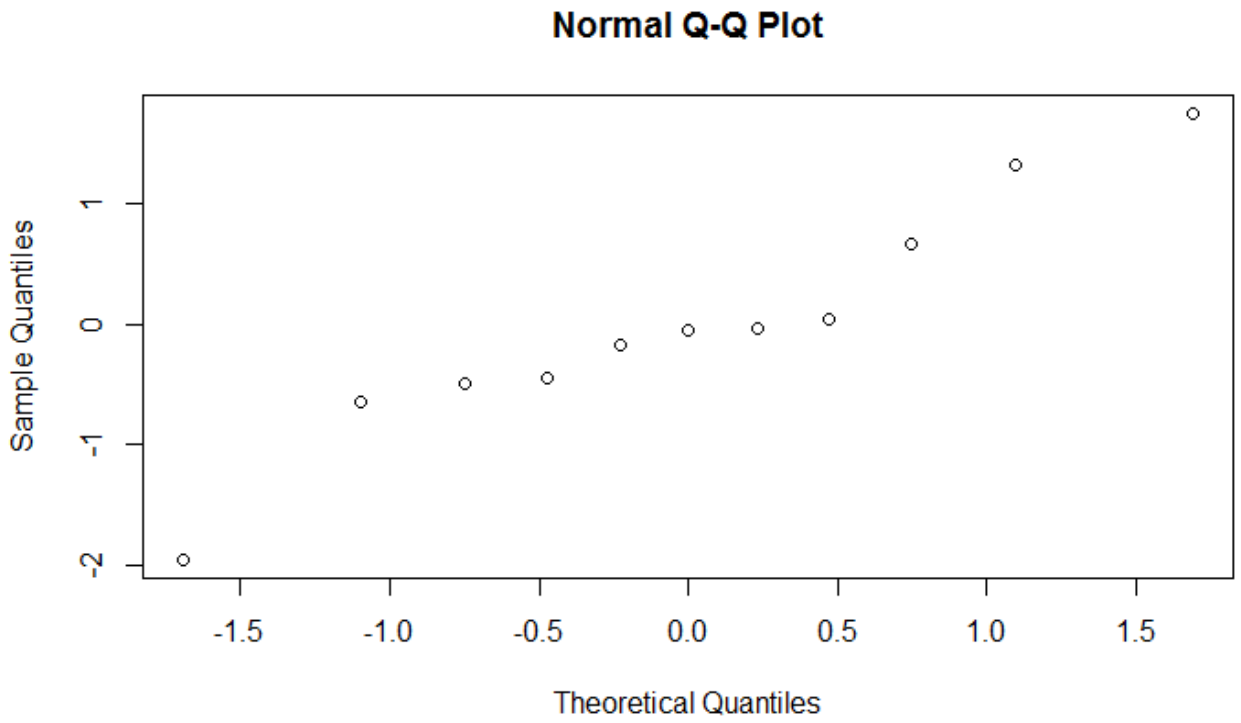


*Table 8-9: Augmented Dickey-Fuller, Shapiro-Wilk test and Q-Q plot of market concentration and IEA household electricity margin growth rate*

With a P-Value of 0.27776831 the regression test reveals that no coherence exists between the growth rates. As seen in the former test no significance could be found in the relation between the growth rates of the market concentration and the growth rates of the margins of the generalised Austrian household electricity prices excluding taxes and charges from the International Energy Agency.

The other checks on the robustness of the data have the same results as the former data set. According to the Dickey-Fuller test we stay with the null hypothesis of a unit root as the p-value of 0.8987 is not significant. Normality is also confirmed with a Shapiro-Wilk value of 0.9442 which is close to the value of 1 for a normal distribution.

The Shapiro-Wilk p-value of 0.5709 is statistically not significant in order to reject the null hypothesis that the tested values are normally distributed. This finding is also supported by the 45 degree Q-Q plot line.

Now the connectedness of the gas market concentration growth rate and the growth rates of the margin of the gas prices for households per kWh excluding taxes and charges given by the International Energy Agency for Austria is examined.

ANOVA

| | *Freiheitsgrade (* | *dratsummen (* | *Quadratsumn* | *Prüfgröße (F)* | *F krit* | | | |
|---|---|---|---|---|---|---|---|---|
| Regression | 1 | 0,58422166 | 0,58422166 | 0,00505857 | 0,94470167 | | | |
| Residue | 10 | 1154,91405 | 115,491405 | | | | | |
| Gesamt | 11 | 1155,49827 | | | | | | |
| | | | | | | | | |
| | *Koeffizienten* | *Standardfehle* | *t-Statistik* | *P-Wert* | *Untere 95%* | *Obere 95%* | *Untere 95,0%* | *Obere 95,0%* |
| Schnittpunkt | 4,06556886 | 3,16975462 | 1,28261312 | 0,22855949 | -2,99708452 | 11,1282222 | -2,99708452 | 11,1282222 |
| HHI concentr | 0,38816343 | 5,45758645 | 0,07112364 | 0,94470167 | -11,7720969 | 12,5484238 | -11,7720969 | 12,5484238 |
| | | | | 0,05 | | | | |

```
> adf.test(resieagas,alternative="stationary")

 Augmented Dickey-Fuller Test

data:  resieagas
Dickey-Fuller = -1.6239, Lag order = 2, p-value = 0.7157
alternative hypothesis: stationary

> shapiro.test(resieagas)

 Shapiro-Wilk normality test

data:  resieagas
W = 0.3754, p-value = 2.443e-06
```

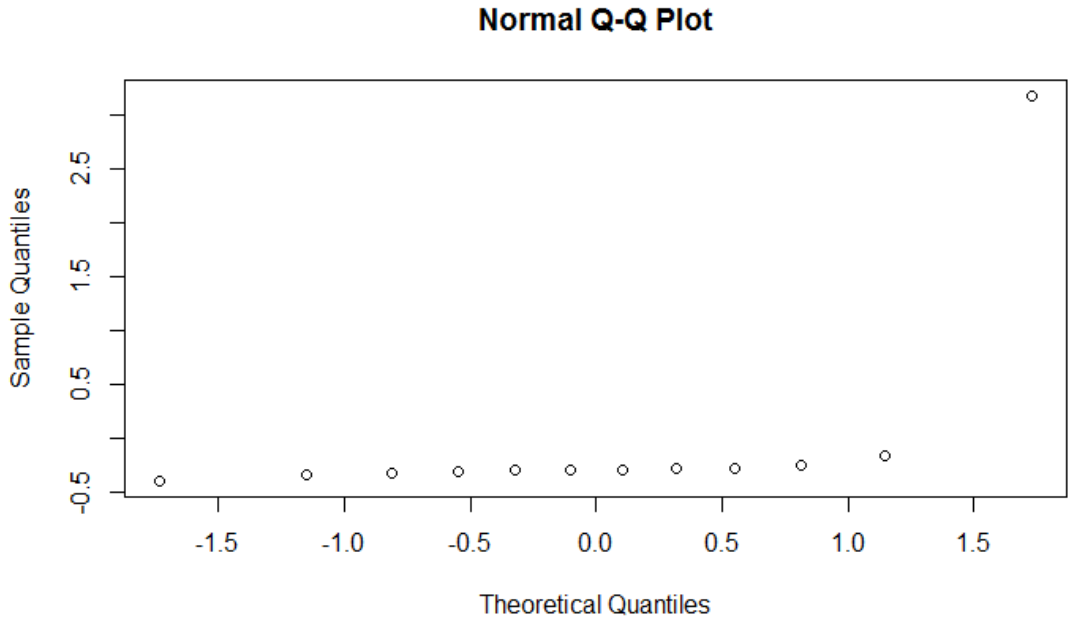


*Table 10-12: Regression test, augmented Dickey-Fuller, Shapiro-Wilk test and Q-Q plot of market concentration and IEA household gas margin growth rate*

The quite high P-Value of 0.94470167 of the regression test indicates no coherence between the growth rates. The rates of the gas market concentration and those of the margins of the generalised Austrian household gas prices excluding taxes and charges from the International Energy Agency are not significantly influencing each other.

On the one hand does the Dickey-Fuller test stay with the null hypothesis of a unit root as the p-value of 0.7157 is above 0.05 and therefore not significant but on the other hand the normality can't be confirmed by the weak Shapiro-Wilk value of only 0.3754 and the shallow and low Q-Q plot line which represents a good example of how a non-normality plot looks like. Furthermore is the p-value of $2.443e^{-06}$ of the Shapiro-Wilk test significant and leads to the rejection of the null hypothesis. The alternative hypothesis of a not normally distributed data set is evidenced by the test and adopted which undermines the reliability of the data.

In the last regression test both the margin growth rates of the electricity and gas prices for households given by the International Energy Agency are compared in terms of their coherence.

| ANOVA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | *Freiheitsgrade (* | *dratsummen (* | *Quadratsumn* | *Prüfgröße (F)* | *F krit* | | | |
| Regression | 1 | 0,56585099 | 0,56585099 | 5,19987055 | 0,04165399 | | | |
| Residue | 12 | 1,30584249 | 0,10882021 | | | | | |
| Gesamt | 13 | 1,87169348 | | | | | | |
| | | | | | | | | |
| | *Koeffizienten* | *Standardfehle* | *t-Statistik* | *P-Wert* | *Untere 95%* | *Obere 95%* | *Untere 95,0%* | *Obere 95,0%* |
| Schnittpunkt | -0,02145172 | 0,09453051 | -0,22692903 | 0,82429879 | -0,227416 | 0,18451257 | -0,227416 | 0,18451257 |
| margin gas g | 0,02193537 | 0,00961941 | 2,28032247 | 0,04165399 | 0,00097646 | 0,04289427 | 0,00097646 | 0,04289427 |
| | | | | 0,05 | | | | |

```
> adf.test(resieagaselec,alternative="stationary")

 Augmented Dickey-Fuller Test

data:  resieagaselec
Dickey-Fuller = -1.8287, Lag order = 2, p-value = 0.6376
alternative hypothesis: stationary

> shapiro.test(resieagaselec)

 Shapiro-Wilk normality test

data:  resieagaselec
W = 0.8993, p-value = 0.1103
```

*Table 13-14: Regression test, augmented Dickey-Fuller and Shapiro-Wilk test of IEA household electricity and gas margin growth rate*

The low P-Value of 0.04165399 of the regression test leads to the rejection of the null hypothesis and the adoption of the alternative hypothesis that confirms the existence of coherence between the growth rates of the margins. Significance could be found in the relation between the margin growth rates of the generalised Austrian household electricity and gas prices from the International Energy Agency. The evidence for the validity of the alternative hypothesis is significant which means that the margins are interrelated to each other.

The Dickey-Fuller test proves its null hypothesis and therefore the robustness of the data with a not significant p-value of 0.6376 that is above the threshold of 0.05. Normality can also be confirmed with a Shapiro-Wilk value of 0.8993 and the p-value of 0.1103 which is not significant and also leads to the retention of the null hypothesis of normally distributed data set. The ascending Q-Q plot line features an angle of nearly 45 degrees and supports graphically the predominant normality of the data found in the Shapiro-Wilk test.

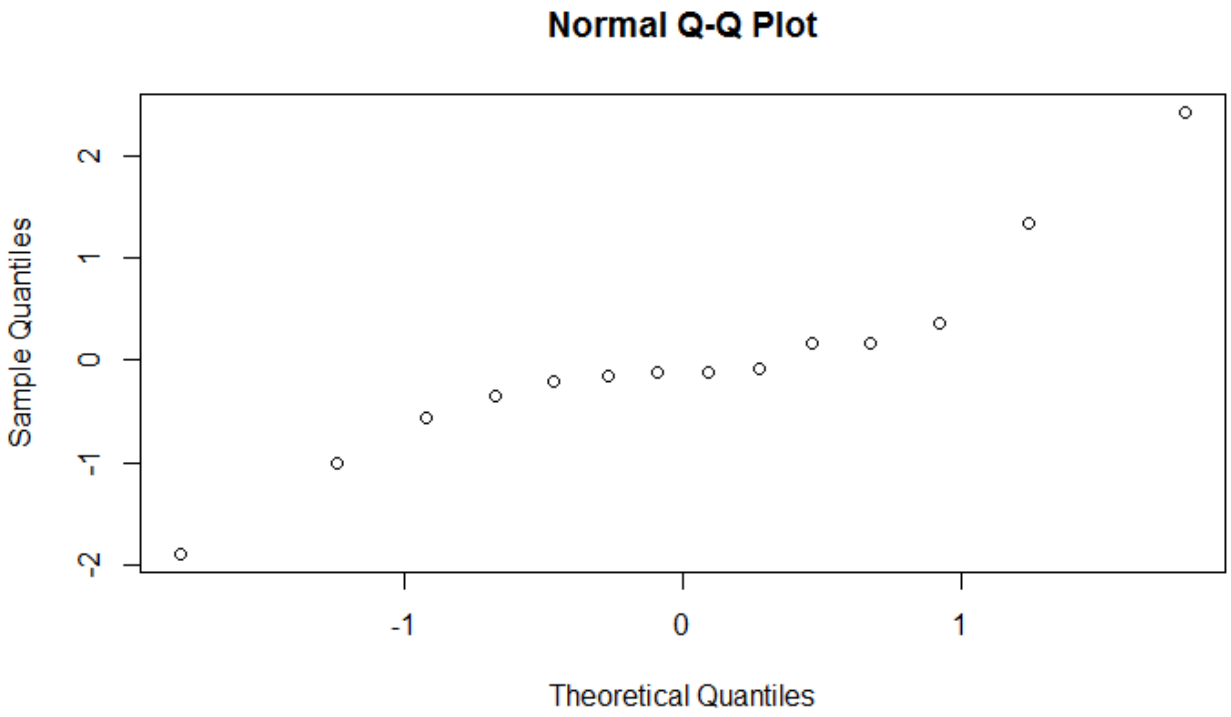


*Table 15: Q-Q plot of IEA household electricity and gas margin growth rate*

In the tests the market concentration and in the last one the gas margin is used as the independent variable. Significance in the coherence was only found in the last test suggesting that the margins of gas and electricity are connected with each other in some way. The idea that gas and electricity prices on the international market are interacting is not very far fetched therefore the outcome of this test wasn't that much

of a surprise. In the other tests no relation between the development of the market concentration and the price margins could be found. It is quite positive that the robustness of all tests and the normality of most of them had been confirmed which adds more viability and quality to the test and their results. From a scientific point of view I have to point out the likelihood that the outcome of these tests might differ when new, different or more data is collected and used. Further research might be able to uncover new connections with bigger data sets.

### 9.2 growth rates and one-tailed t-tests

For further examination of the growth rates a one-tailed t-test was chosen in order to verify some assumptions about the consequences of the liberalisation.

First of all the assumption that the liberalisation led to a decrease in the concentration of the market as more and more companies enter the now open market and start to compete with the already well-established members. Market shares are conquered by new entrants and the market power does not belong to only one or a few big companies. Under this assumption the growth rates of the Herfindahl-Hirschmann-Index for the electricity and gas market should have followed a downward trend after the opening of the markets. A one-tailed t-test with the null hypothesis that the true mean of the data record is above 0 was run for the electricity and gas market concentration.

```
> t.test(concgrowelec,mu=0, alternative="less")

 One Sample t-test

data:  concgrowelec
t = 0.6452, df = 13, p-value = 0.735
alternative hypothesis: true mean is less than 0
95 percent confidence interval:
      -Inf 0.2737534
sample estimates:
 mean of x
0.07310658
```

*Table 16: T-test for the electricity market concentration growth rates*

```
> t.test(concgrowgas,mu=0, alternative="less")

 One Sample t-test

data:  concgrowgas
t = 0.6954, df = 11, p-value = 0.7494
alternative hypothesis: true mean is less than 0
95 percent confidence interval:
      -Inf 0.4269772
sample estimates:
mean of x
0.1191793
```

*Table 17: T-tests for the gas market concentration growth rates*

The test results are not statistically significant and the alternative hypothesis of declining growth rates and therefore only little concentration on the markets is not supported. Due to the p-values of 0.735 for the electricity market and 0.7494 for the gas market the null hypothesis won't be rejected. The concentration of power does not have significantly negative growth rates for both markets. It was assumed that new suppliers are entering the market and that more competition will split up market shares among the members which leads to less market concentration. A look at the figures reveals that the concentration even increased with the liberalisation but eventually decreased again over the years. The decline is happening but it is not very strong and can't make up for the initial jump yet.

Besides the development of the market concentration it is also interesting how the profit margins of the electricity and gas supplier evolved. According to the assumptions about the market concentration the increased competition should have led to better terms for consumers at the expense of the suppliers profit margins. In order to attract new customer and generate more market shares the vendors need to offer more service or lower prices and charges than their competitors. Assuming that all suppliers are obtaining their energy at roughly the same costs and that they are competing with each other at their expenses, the profits must have declined over the years. The t-tests for the margin growth rates should be significant and support the alternative hypothesis which, according to my assumptions, expects the growth rates to follow a negative trend and consequently decreasing profit margins.

```
> t.test(marggrowff,mu=0, alternative="less")

 One Sample t-test

data:  marggrowff
t = 0.8574, df = 13, p-value = 0.7966
alternative hypothesis: true mean is less than 0
95 percent confidence interval:
      -Inf 0.5571247
sample estimates:
mean of x
0.1817425
> t.test(marggrowelec,mu=0, alternative="less")

 One Sample t-test

data:  marggrowelec
t = 0.5554, df = 13, p-value = 0.706
alternative hypothesis: true mean is less than 0
95 percent confidence interval:
      -Inf 0.2359092
sample estimates:
 mean of x
0.05631848
> t.test(marggrowgas,mu=0, alternative="less")

 One Sample t-test

data:  marggrowgas
t = 1.5047, df = 15, p-value = 0.9234
alternative hypothesis: true mean is less than 0
95 percent confidence interval:
     -Inf 7.235773
sample estimates:
mean of x
 3.342046
```

*Table 18-20: T-tests for the electricity of a household (top one), the IEA electricity (middle) and the IEA gas (bottom) margin growth rates*

The null hypothesis that the profit margin growth rates are higher than 0 can't be rejected with the p-values of 0.7966 for the t-test of the margin growth rates of a local supplier, 0.706 for the t-test of the margin growth rates calculated with average household electricity prices given by the IEA for Austria and 0.9234 for the t-test of the margin growth rates calculated with average Austrian household gas prices given by the IEA. All three t-test results are not significant meaning that there is not enough evidence to support the alternative hypothesis and we have to keep to the null hypothesis where the true mean of the values is not less than 0 and the growth rates are not mainly declining.

While the prices per kWh of the local supplier do slightly decline over the years his margins are following this weak trend but are much more volatile. The few downward trends of the growth rate data aren't significant enough to confirm the alternative hypothesis of a negative trend among the growth rate.

The average household electricity prices given by the IEA for Austria maintain a quite stable course with just a low hump from 2008 to 2015. Unstable margins are also found here but after a sharp upward trend between 2007 and 2009 and a shallow one from 2010 to 2012 the last years showed a slow decrease of margins. As for the local supplier the negative growth rates can't outmatch the many powerful increases.

For the average Austrian household gas prices calculated by the IEA the curve is also quite stable since 2004/2005 after an upward jump from 2003 to 2004. The margins show most of the time an increase since they nearly hit bottom in 2005. Small and shallow decreases happened in 2013 and 2016 but it isn't surprising that the null hypothesis of a positive trend in growth rates got confirmed in the t-test.

Some of the assumptions about the liberalisation and its effects on the markets itself and the players acting in it had been proven wrong by the t-tests. The growth rates of the market concentration are significantly positive values as are the growth rates of the electricity and gas margins. As I pointed out above also here these results could differ in case of another test arrangement or calculation approach. Further and more long-term research might be able to draw a bigger picture about the impact on the markets.

## 10. Conclusion

The idea of a European Union was a groundbreaking one but a lot of effort was needed to make it come true. A lot of legal frameworks lead to the realization of this pan European peace project that started as the community of coal and steel and evolved into an economic union.

The step towards a Common Market was suggested by the Brussels Report that showed the advantages but also the difficulties that had to be dealt with. As a consequence of the introduction of the Single European Act the necessity of an Internal Energy Market became obvious. In order to use the power of the European industry and trade optimally a cross-border utilization of energy resources had to be realized. The liberalisation of the domestic energy markets of the different member states seemed to be an impossible task at first due to their diverse structuring.

Some examples of the liberalisation process in assorted countries had been shown. Different starting situations and obstacles made a common but yet in some points diversified energy market possible. The United Kingdom acted as a pioneer in the field of liberalisation as it started to restructure its domestic market well before the idea of a common energy market arose. France's heavily monopolistic state-owned market was quite difficult to liberalise as the politicians faced public concerns of decreasing service quality and zoning. After years of EDF's focus on supply security, price stability and the development of access to electricity in rural areas the government agreed to bit by bit market openings and a partial privatisation of the state owned Energy Corporation. A sign of acceptance of the new situation is the increasing number of people switching their supplier.

In Sweden the liberalization of its energy sector happened due to several small changes of the system. A crisis was often a main reason for starting reformations. The market is nevertheless de facto enclosed for new members who are gathering shares from one of the three market owning big corporations instead. Due to a high level of support and subsidization for renewable energy the electricity is quite expensive. Maybe with more movement and resistance from the demand side the Swedish electricity market that is operating quite monopolistic might increase its competitiveness and productivity. The barriers for new market entrants are de facto abolished but exist indirectly due to the break even like pricing and the influence of the three market dominating electricity corporations.

The situation in Germany is similar as a wave of big-scale merger took place in the mid 1990s in order to concentrate power. It is assumed that large energy supplier used their influence and gathered inside knowledge in order to be able to use the altering legislation to their benefit. There are two developments happening at the international energy market. The concentration on the markets has either declined like in the United Kingdom and other northern European countries or it increased as in the remaining European states. In Germany consumer organisations and a few politicians criticised the government's attempt of regulating the market as the main problem is the high market concentration that prevents price competition. These regulators include the Bundesnetzbehörde that authorizes new entrants to the net, controls net prices and also promotes the legal unbundling of integrated firms. On another level there are the Landesregulierungsbehörden that have the same

responsibilities but focus on smaller clients and operate only within their federal states.

In the aftermath of the total opening of the Austrian energy market in 2001 the new segment of trade became more important within the energy sector. Generation, trade and supply are competitive areas of the market whereas transmission and distribution remain regulated. In Austria the regulating and monitoring of the market is done by the E-Control. Its Commission defines the network tariff which consists of a fixed price and the network-use charges. In order to boost incentives for modernizations an incentive-oriented pricing scheme was introduced. Expanding transparency and the indiscriminative behaviour of market members are further priorities of the regulator and should make it easier for customers to switch their supplier.

In 2011 the E-Control announced that electricity prices rose over the last years and followed the common trend in Europe. When liberalisation started in 1998 the electricity prices for industrial customer fell but due to the high crude oil prices since 2004 they climbed rapidly. Gas prices for households however developed quite similar to the European average. Industrial consumers' prices fluctuated around the European average but increased after a few years and were 10% higher than for German competitors.

Looking at different sources of data for energy prices showed a decrease in one aspect of the prices and an increase in another one.

Electricity prices for the Industry faced a rise till the end of 2012 and slightly decreased from then on. The corresponding taxes stable but start to rise in 2014. Households have to cope with a higher level of prices for electricity but they slightly decreased in recent whereas their taxes rose since the end of 2012. It was also shown that prices of other sources of energy both for non-commercial and commercial use increased or at least languished. Wholesale prices of the Energy Exchange Austria show a slow downfall in prices since 2011.

The share of taxes for natural gas for households is very steady as it is also for industrial natural gas since it stabilized in 2015. The tax share data for industry-used electricity is growing annually since 2012. The amount of taxes in the prices of household electricity grew strongly till 2000 and managed to drop after an even course in 2008. After some years of stability it started to increase again by the end of 2012 and make up 38.9 percent of the electricity price in 2016.

The data from Eurostat distinguished between including and excluding taxes and levies and showed a phenomenon that has also been found in the data of the International Energy Agency and within the history of electricity costs of a domestic household.

It is interesting that electricity for households excluding taxes and levies gets slightly cheaper over time but the prices including taxes keep to a certain level. This development can also be seen by the industrial prices whereas it is not that obvious. A slow decrease according to the Energy Agency's data is going on since 2013 which can also be seen by the net day and night prices of our household. The difference between both tariffs shrinks between 1993 and 2003. Annual wholesale prices also showed the increasing of prices from 2002 to 2008, a small price peak in 2011 and the subsequent slow decrease. For the household prices these events have been postponed by a year.

Due to the increasing transparency the invoices became much more detailed over the years. Stranded costs represent only minor costs and also got integrated into other definitions of charges. The KWK charge only existed between 2001 and 2006 but gets reintroduced in 2015. Subsidizations mostly include flat rate and other charges for the support of renewable energy and start to contain other small charges like the meter point charge since 2013. Network charges are introduced in 2010 and cover the service costs of network operators. The tremendous increase in costs is weakened by the fact that the energy prices on the other hand plummeted in 2010 and started to slowly decrease. Costs linked to the operation of the network are illustrated separately which pulls these fees out of the energy prices and cause them to drop. The overall electricity costs of the household aren't exploding from 2010 onwards as a look at the charges figure would suggest. Electricity prices decreased to the level of the night time prices before the year 2000.

In the data presented by the E-Control about the potential savings a household can achieve by switching its supplier we saw that a lot of potential lies in the competitive market.

In only 7 years competition among electricity suppliers a steep increase in potential savings through new tariffs or contracts had been realized. The main driving forces for falling prices are the customer themselves as they can threaten companies by their buying or switching behaviour. Competition among suppliers starts as more and more customers are willing to look for better contracts or tariffs and aren't afraid to

leave their traditional supplier and benefit from the products of new market members. Competition in the gas market made higher price cuts possible than it did in the electricity sector. A look at the wholesale prices of EXAA for electricity reveals no downfall in prices in 2015 that would explain an increase in cheap electricity offered by suppliers. Eurostat and the International Energy Agency can't provide further explanation as gas and electricity prices are only slowly declining since 2013. Suppliers might always have had the potential to cut their prices but with only minor competition and customers that are hardly switching their supplier or contract they didn't need to alter their pricing policy. The end user prices for day and night electricity of my household dropped in 2010 to the level of 2003 which seemed to be a positive trend but the savings couldn't be realized as on the other hand the additional charges skyrocketed in 2010. Suppliers may find many different ways to cut down costs and pass these savings on to the market.

The possibility of switching to a more suitable and maybe cheaper supplier is a driving factor of the market opening and the resulting optimization of costs for producer, distributer and consumer. A vital part of the liberalisation is the increase in transparency. Pricing mechanics are observed and prices are displayed without any hidden charges. The additional actions of subsidizations and support for renewable sources of energy are a bit counteracting the decline in wholesale or net energy prices but are socially welcome in order to increase the use of alternative sources of energy.

The planned small amendment for the Austrian law about ecological electricity started a discussion among different renewable energy groups about the future of alternative energy. Whilst the amendment is generally accepted as everyone involved anticipated an update some parties have concerns. The umbrella organization for the renewable energy community in Austria disagrees with the supposition of some critics that the amendment will result in higher prices for electricity. The charges for renewable energy are lower than possible savings achievable by renegotiating contracts or switching supplier. The government has to embrace the opportunity to boost the investments in expansions of renewable energy production again. Criticism arises as the new amendment lacks ambition and incentives for an enhancement of the ecological energy production. A too weak signal for the expansion or the new construction of plants for alternative energy [107]

[107] Erneuerbare Energie Österreich (2017)

will cause a slowdown of the ecological energy sector. Increasing dependencies on other forms of energy such as nuclear or coal need to be fought against.[108]

In the previous chapter regression tests and t-test were conducted in order to examine the coherence between different key figures and data provided by official and private sources and to verify some assumptions about the effects the liberalisation might have on the electricity and gas market in Austria. Coherence among the relation between market concentration and the realisable margins of suppliers was not found. The expected even distribution of market power on the electricity and gas sector had been proven wrong as the t-tests revealed a significantly positive growth rate of the market concentration in both sectors. As the concentration is slowly decreasing again since the initial rise during and shortly after the opening of the markets an overestimation of the importance of the accretion of market power among few companies might be an explanation for the missing coherence. The opening didn't attract as many new suppliers as expected and big, well established companies took action in order to secure their amount of shares and gather more before new entrants could compete with them. The profit margins developed unimpressed by the market concentration as more factors besides the competition have influence on them. Despite acting quite volatile the t-tests revealed that their true mean is not below 0. The market can maintain a slightly positive trend for their margin growth rates and consumer should also profit from the open market by comparing offers, taking advantage of discount campaigns and realising savings.

After the Liberalisation prices for electricity and gas did decrease but were also influenced by economic trends and urgent events. The new market structures brought advantages for the European Union, corporations involved and the consumers. The latter ones have the opportunity to help shape the market as their consumer behaviour boosts competition. Besides the quest for cheaper energy our main focus should become the utilisation and exploration of ecologically sustainable, sound and forward-looking sources of energy.

[108] Erneuerbare Energie Österreich (2017)

## Abstract

The liberalisation of the electricity and gas market in Europe is initially depicted by its legal framework. Afterwards the national characteristics and transfigurations of the energy markets before and after the liberalisation of the United Kingdom, France, Sweden, Germany and Austria are presented.

The main part of the thesis deals with the market structure of Austria and how the prices are compound. According to the Austrian regulator savings can be achieved within the new market but is there statistical proof for an effect on prices caused by the liberalisation?

Regression tests are made in order to pursue the question:" Do the changes of the market concentration after the liberalisation have an influence on the retail margins of the electricity and gas prices for household customers?" The robustness of the data is verified by Augmented Dickey-Fuller tests, Shapiro-Wilk normality tests and quantile-quantile plots. Significance in the coherence was only found in one test suggesting that the margins of gas and electricity are connected with each other in some way.

One-tailed t-tests are done in order to check the assumptions that the liberalisation led to decreasing market concentrations and profit margins for suppliers. Results showed that the growth rates of the market concentration are significantly positive as are the growth rates of the electricity and gas margins.

# Zusammenfassung

Zunächst wird der rechtliche Rahmen der Liberalisierung des Strom- und Gasmarktes in Europa dargestellt, der zu ihrem Wiederaufbau führt. Danach werden die nationalen Merkmale und Wandlungen der Energiemärkte des Vereinigten Königreichs, Frankreichs, Schwedens, Deutschlands und Österreichs vor und nach der Liberalisierung vorgestellt.

Der Hauptteil der Arbeit beschäftigt sich mit der Marktstruktur Österreichs und wie die Preise zusammengesetzt sind. Laut der österreichischen Regulierungsbehörde können Einsparungen im neuen Markt erzielt werden. Gibt es jedoch einen statistischen Nachweis für eine durch die Liberalisierung bedingte Wirkung auf die Preise?

Regressionstests werden durchgeführt, um die Frage zu beantworten: "Haben die Veränderungen der Marktkonzentration nach der Liberalisierung einen Einfluss auf die Einzelhandelsmargen der Strom- und Gaspreise für Haushaltskunden?" Die Robustheit der Daten wird mithilfe von Augmented Dickey-Fuller-Tests, Shapiro-Wilk Normalitätstests und Quantil-Quantil-Plots überprüft. Eine Signifikanz der Kohärenz wurde jedoch nur in einem Test festgestellt. Dieser deutet auf einen Zusammenhang zwischen den Margen von Gas und Elektrizität hin.

Einseitige T-Tests werden durchgeführt, um die Annahmen zu überprüfen, ob die Liberalisierung zu sinkenden Marktkonzentrationen und Gewinnspannen für Lieferanten führte. Die Ergebnisse zeigten, dass sowohl die Wachstumsraten der Marktkonzentration als auch die Wachstumsraten der Strom- und Gasmargen signifikant positiv sind.

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