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„Why the Propositions of Behavioral (Law and) Economics
Should be Considered in the Process of Renewable
Energy Regulation and Policy Making“

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I. INTRODUCTION

1.1. MOTIVATION

Many alternative policies focused on environmental protection have already been elaborated to address current issues of sustainability. A matter that might promptly arise refers to the specifics of the mechanisms used. It is a common observation that the majority of these policies rest on the assumptions of consumers exhibiting stable preferences and acting under specific constraints. The initial assumption in this paper is set to build upon this, and respectively to show that the regulation following a behavioral economic approach leads to different results than the regulation following a standard economic approach. That is how I immediately face the following question:

- ***Do the propositions of behavioral economics have to be taken into consideration in order to improve the effectiveness of renewable energy policies?***

It is not an easy task to arrive at a direct conclusion on this matter, so it is definitely worthwhile to decompose this main research question into two smaller “subsidiary” questions and attempt to answer them as intermediate steps throughout the analysis:

- ***Did some of the policies achieve lower results in their goals because they rested strictly and solely on the neoclassical theory of consumers’ actions?***
- ***Do consumers’ actions in reality fit the conventional concept of rationality or the behavioral element prevails to make them boundedly rational actors?***

This research is concentrated on consumers, the people who make choices daily and who are subjects to environmental regulation. Protection of environment is an issue gaining increasing popularity in the public space. It therefore corresponds with personal emotions, concerns and perceptions. This is why turning to behavioral economics seems very appropriate when considering alternative regulatory and policy measures. It does not preclude the widespread use of the broader neoclassical approach but rather contributes to a further explanation of the economic reality.

The research in this paper is built pursuant to the propositions of behavioral economics in order to contribute to the identification of effective policy instruments in the sphere of renewable energy. Drafting legislation, regulation or policies purely based on cost-benefit analysis, ignoring some specifics of human behavior and hoping that all economic actors would be rational might lead to some unpleasant surprises or lack of success for the government or the policy maker. This conjecture is supported by Robinson and Hammitt (2011) who point out that not considering the aspects of behavior might make it more difficult to take optimal decisions regarding social welfare. The purpose of this research is not directly related to costs and benefits but may contribute to the subsequent estimations in this regard by adding the effects of behavioral considerations.

This work is structured by first outlining the hypotheses to assert throughout the research. Chapter II focuses on notable literature which conveys the main concepts of behavioral economics, renewable energy regulative tools and the connection between them. An analysis of the policies recently applied in Austria and Bulgaria is presented in Chapter III in order to assess the level to which behavioral economics has been integrated in policy making so far. The empirical analysis in Chapter IV involves namely the issues of regulating renewable energy because it enables me to draw conclusions on which specific policy instruments are superior or better welcomed. This is done by illustrating the summary statistics and findings as well as by implementing the relevant statistical testing procedures. The data is obtained through a survey of energy consumers' preferences and choices. Chapter V presents the concluding remarks on all findings and provides some policy considerations.

1.2. HYPOTHESES

Pursuant to the logic of the research questions described in the preceding section, I formulate the following hypotheses:

- **(Main) Hypothesis 1:**

I assert in my main hypothesis that ***compliance to regulation would be better achieved when its design and approach are in compliance with the propositions of behavioral economics.***

This statement contains two essential aspects:

- 1) It can be inappropriate to construct an environmental policy on the basis of purely rational behavior of consumers; and
- 2) As an alternative, behavioral economics can be a reliable source of insights on this matter.

Therefore, the established policy would be expected to show successful results if it is coordinated with the viewpoint and behavior of its subjects in the first place. This is in line with the analysis of the UK National Consumer Council (NCC 2008), where it is emphasized that the participation of the users in the legislative process is important due to the fact that they are actually the subjects experiencing this legislation on a daily basis. Therefore, compliance of subjects to environmental policies can be compatible with the assumptions of behavioral economics and considering this particular area is dictated by objective needs. This is a matter to be ascertained by empirical research and hypothesis testing further on.

Each policy has a supply and demand side so this facilitates the provision of an equilibrium analysis which would result in a “legislature’s equilibrium level of aggregate support” (Keohane, Revesz, and Stavins 1998, p.362). Of course, through different regulation approaches it is mostly the supply side to be treated. But does the demand side react accordingly? My intention is to emphasize namely on demand as a force to be regarded by policy makers and legislative bodies. The assertion I pursue is that the interaction between both parties should be optimized and enhanced to the greatest possible extent in order to achieve more efficient results in regulation (NCC 2008). Let us imagine two courses of interaction between regulators and consumers (through the producer or supplier of electric power):

Figure 1: Communication Patterns between Regulators and Consumers

Figure 1.1.

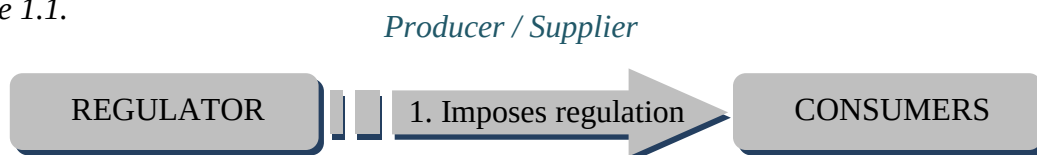
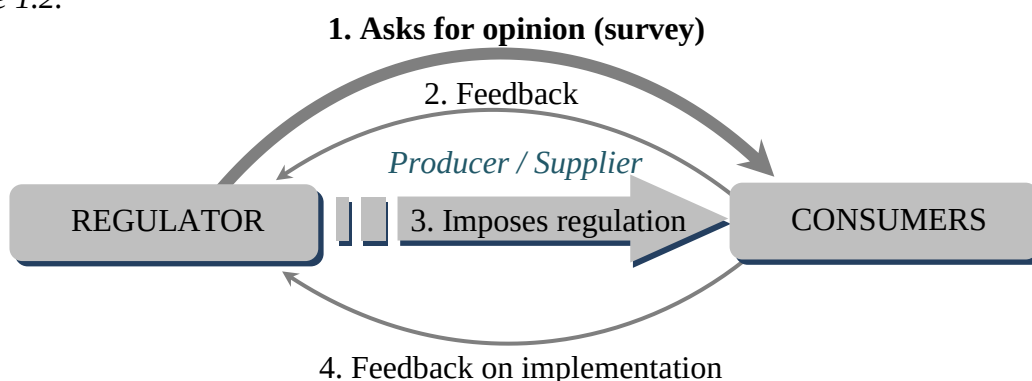


Figure 1.2.



Source: Own elaboration

The first one can be too simplified and insufficient, namely due to the lack of sophisticated communication mechanism clarifying consumers' behavioral characteristics. The second suggestion, on the other hand, might be more costly but it takes into consideration the potential and the actual reaction of people through the established feedback network. It is important that the initial link (indicated with a thicker line to emphasize the difference) established with consumers is not related to the undertaking of a paternalistic approach against the views of consumers as defined by Grüne-Yanoff (2009) but rather refers to being inquisitive about the personal opinion as a preliminary step. This hypothesis can be supported by analyzing the existing mechanisms both in Austria and Bulgaria and by comparing them to the findings of the survey. Results would facilitate the identification of problems, new areas for improvement and possible modifications.

- **Hypothesis 2:**

I assert that ***behavioral economics has been ignored in the policy-making procedures even though it plays a central role in consumers' actions with regard to renewable energy***. Attempts to support this hypothesis will be made by duly reviewing the available literature and by developing a case study with policies that have been put in place. The work of Venkatachalam (2008), for example, is set in accordance to this assertion because of the claim that most policies are based on the standard rationality assumptions but behavioral economics starts to gain larger use. Accepting this statement would imply that regulators should take the suggestions and conclusions resulting from this discipline into careful consideration when deciding on which instruments to adopt in order to guarantee higher effectiveness of their application (Weber and Johnson 2012).

- **Hypothesis 3:**

I assert that ***respondents to a survey on a renewable energy payment topic would exhibit biases which do not fully correspond to the predictions of conventional economics*** (e.g. Kahneman and Tversky 1979; Sunstein 1997). By means of empirical research, I explore the possible biases through the performance of comparisons and hypothesis testing. Furthermore, I seek if certain biases differ or match with respect to place of residence – in this particular case Bulgaria or Austria – providing further insights on feasible policies at a country level. My intention is to concentrate on the main biases themselves, i.e. to test for any differences exhibited by the groups of respondents and to interpret them in a regulative perspective.

II. LITERATURE REVIEW

2.1. DEFINITION OF BEHAVIORAL ECONOMICS

I turn to literature first in order to track the path of development of behavioral economics and find the most appropriate ways in which it can be implemented to my analysis. The concept of behavioral economics could be perceived as an oxymoron by some standard perceptions of economics. As Pollitt and Shaorshadze (2011, p.20) point out: “Economics studies how agents interact and allocate limited resources. In essence, economics is about behavior by definition.” This is quite logical given that economics itself is a social science dealing very closely with complex decisions and actions. Nonetheless, until recently it seems like traditional economic analysis has been focused more on how agents are willing to or supposed to behave (Cash and Schroeter 2010) in order to be rational and reach the optimal state in equilibrium. This is extremely valuable when afterwards observing the actions in reality and comparing them with the “perfect” situation.

The present paper, however, deviates a bit from this type of analysis. It seeks to emphasize the importance of how agents proceed in reality (Jolls, Sunstein, and Thaler 1998) as well as what factors and incentive systems predetermine this in legally regulated circumstances. Now it becomes a matter of behavior predisposing economic events and not economics predisposing agents to behave within a certain pattern. That is how the concept under consideration is no longer an oxymoron and it is worthwhile to go into further details.

A necessary starting point of the long and challenging way from individual behavior of consumers to the elaboration of sustainable and efficient regulatory rules that appear fair to all agents is the definition of the concept which is an interesting mixture of economics and psychology – namely behavioral economics. As Camerer (1999, p.10575) profoundly states:

«“Behavioral economics” improves the realism of the psychological assumptions underlying economic theory, promising to reunify psychology and economics in the process. Reunification should lead to better predictions about economic behavior and better policy prescriptions.»

If agents are no longer considered purely rational in the neoclassical sense, then what drives their decisions and how can their actions be defined? The concept of bounded rationality comes in to tackle these issues.

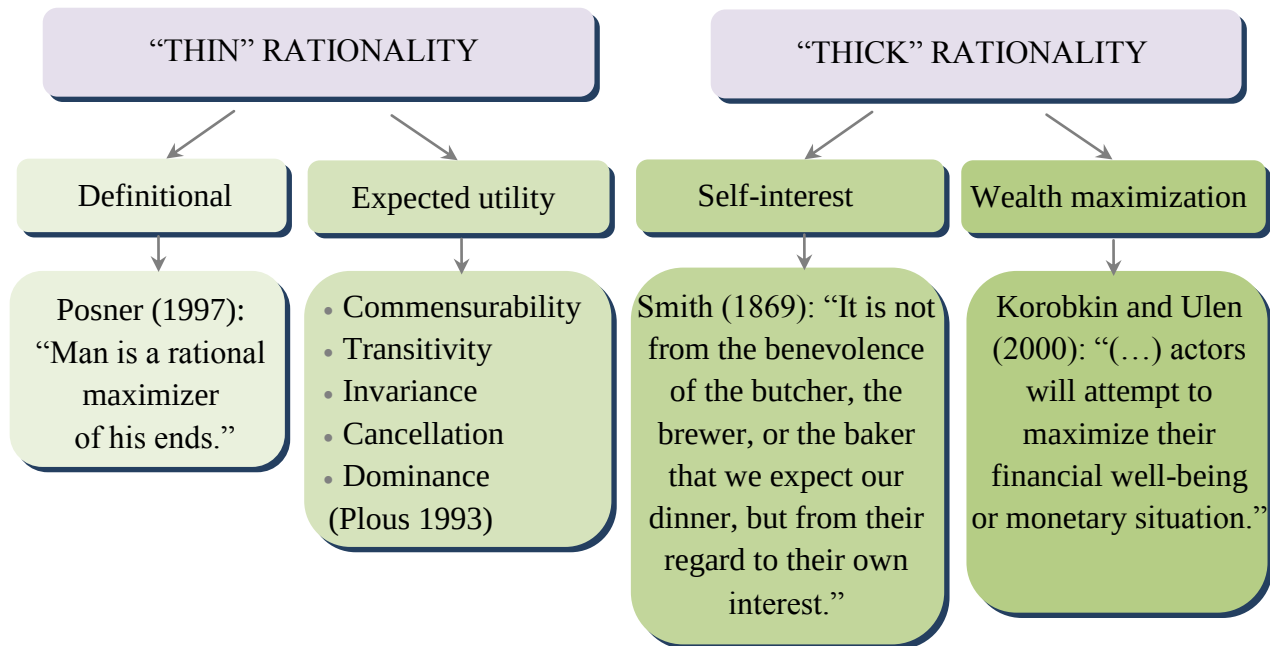
2.2. RATIONALITY AND BOUNDED RATIONALITY

The consideration of rationality and bounded rationality in the context of my analysis is conceptually equivalent to comparing the primary principles of traditional to behavioral economics. A person who has been dealing long enough with the rational assumptions of neoclassical economics might be surprised or rather suspicious of the propositions made by behavioral economics.

First of all, what does it mean to be rational? This is a considerable building stone of this analysis because only after understanding the general economic explanation of rationality is it possible to justify the emergence of the concept of bounded rationality.

I find it very important to mention some of the summarizations made by Korobkin and Ulen (2000). It is interesting that the authors distinguish the so-called “thin” and “thick” concepts when defining rationality and questioning its applicability to law. They assert that “thin” concepts, such as perceiving this theory as definitional or the players as maximizers of expected utility still leave some tiny space for behavior to appear compatible. Korobkin and Ulen (2000) argue that if people comply with some behavioral standards (listed in Figure 2 below), then they do not act against rationality in the sense of expected utility maximization. The authors further mention the self-interest as an even more tightly defined element of rationality. They point out that it provides evidence for researches which might assist predictions of behavior and not only decisions. Finally, Korobkin and Ulen (2000) refer to the wealth maximization goal as the definition of the highest level of “thickness.”

Figure 2: “Thin” and “Thick” Rationality



The chart above is compiled from Korobkin and Ulen (2000) together with the references to Posner (1997), Plous (1993), and Smith (1869) made by the authors throughout the analysis.

As a possible outcome stemming from these definitions I could assume for my further research that the “thicker” the design of rationality considered, the “greater” the deviation from pure rationality by energy consumers is to be presumably ascertained.

Korobkin and Ulen (2000) do not stop here though; they further analyze the reasons for which the credibility of rationality concepts might prove to be arguable. For example, the authors point out that actors could deviate from the optimal decision and exhibit heuristics instead. Nonetheless, they manage to smoothen up these differences by coming across another concept – bounded rationality.

Bounded rationality is a matter of huge interest ever since its first formulation by Simon (1957) in his famous work “Models of Man” which means that its significance for the advance of economic and psychological science has already become evident (Grüne-Yanoff 2007). In his subsequent work, Simon (1987) specifies bounded rationality as a concept which should “designate rational choice that takes into account the cognitive limitations of the decision-maker – limitations of both knowledge and capacity.” The knowledge part of this statement appears important for the research later on, especially in the aspect of information availability.

Jolls, Sunstein, and Thaler (1998) also contribute to the explanation of bounded rationality as applied in legal settings. They refer to the remarkable work of Simon (1955) who sets the basics of this concept by stating that people sometimes exhibit limited abilities with regard to calculation (of the relevant costs, for example). As Jolls, Sunstein, and Thaler (1998) clarify, the term is called “bounded” because it refers to someone acting optimally in the situation of constrained calculation proficiency, memory, or other human ability in the attempt to minimize the costs arising both from taking this decision and from admitting a mistake.

This brings me to the research of Weiss (2009) who redefines bounded rationality to a certain extent by claiming that this concept does not necessarily dare the credibility of rationality. He asserts that if a decision is substantially small for an actor, then it would pay for her not to do the calculation due to the relatively high calculation costs and just agree to be within the scope of bounded rationality. Even though it might not seem quite intuitive at first sight, namely such course of action would be her rational decision according to Weiss (2009).

A significant step towards accepting the implications of behavioral economics is made by Kahneman and Tversky (1979) with the elaboration of the so-called prospect theory as opposed to the expected utility assumption of rationality. Kahneman and Tversky (1979, p.263) define it as follows: “An alternative theory of choice is developed, in which value is assigned to gains and losses rather than to final assets and in which probabilities are replaced by decision weights.”

The above points make it clear that there are a few noteworthy assumptions and theories contradicting the various aspects of pure rationality. It is essential to point out that one of the main distinctions between neoclassical and behavioral economics is the assumption of fixed preferences in the first case. Therefore, an important summary to make based on the above review of sources connected to the topic is:

- Neoclassical economics => rationality, preferences are given and fixed;
- Behavioral economics => bounded rationality, preferences are not fixed.

The literature presented above shows that there have been extensive studies supporting the reliability of bounded rationality as an important occurrence in economic research.

2.3. BOUNDED WILLPOWER AND BOUNDED SELF-INTEREST

My challenge to later describe the development of environmental policies set in a more comprehensive perspective that includes behavior makes it imperative to also distinguish between bounded willpower and bounded self-interest.

Jolls, Sunstein, and Thaler (1998) mention bounded willpower and bounded self-interest along with bounded rationality because these also affect behavior in ways going astray from the general definition of rationality. The researchers state that individuals have bounded willpower when they act in a specific manner despite their understanding of its non-compliance with their interests in the future. Mullainathan and Thaler (2000) provide a definition of bounded willpower by outlining that it refers to the promptness of persons to undertake choices which contradict their interests in the long term. Another important point is made with regard to policy making, and namely that people sometimes try to “protect” themselves from their own or someone else’s bounded willpower by supporting a given policy and thus influencing the supply and demand for legislation (Jolls, Sunstein, and Thaler 1998).

The concept of bounded self-interest contrasts to one of the “thick” definitions described by Korobkin and Ulen (2000) and already mentioned above. As the name suggests, persons are not led solely by their own interests when taking a decision. Mullainathan and Thaler (2000) define it as the characteristic according to which people would ignore their own pursuits in the name of others achieving theirs. Jolls, Sunstein, and Thaler (1998, p.1479) state: “They care, or act as if they care, about others, even strangers, in some circumstances.” The authors also relate the concept of self-interest to fairness matters. It is assumed that in the presence of fairness people would be more extreme in their reactions, i.e. react more favorably if they feel fairness and more negatively if they feel unfairness compared to the setting of rational assumptions (Jolls, Sunstein, and Thaler 1998).

All these new considerations when analyzing economic behavior would lead to various biases unforeseen by rationality in the generally accepted economic sense.

2.4. MAIN COMPONENTS AND BIASES OF BEHAVIORAL ECONOMICS

It is important to outline the main features of behavioral economics as an interdisciplinary concept in order to summarize the differences with traditional economic approach. This would contribute to emphasizing the applicability and appropriateness of considering behavioral economics in the context of regulation and policy making. At the same time, I make some preliminary remarks on the relevance of these matters to the case study of renewable energy regulation established hereinafter in the present thesis.

The paper of Sunstein (1997) and the more recent one of Tor (2008) appear notable and quite detailed, with a very important influence in the sphere of behavioral economics strictly referred to law and regulation. The authors' research on agents' behavior led to the comprehensive elaboration of a group of biases often exhibited when taking decisions. The list below is compiled from Sunstein (1997), Tor (2008) and other researchers who have contributed in this regard.

- ***Endowment effect***

Tor (2008) designates this bias as being of high importance to the analysis in law. The author describes it as being the result of persons' promptness to appreciate something under their possession more than other things that they do not own. Given this bias, they might not agree to exchange what they have for the corresponding amount of money. By providing examples from experiments or real practices, Tor (2008) asserts that people who own some product value it more than the rationally derived value and they might require a higher amount of money to let go of it.

Relevance: It is possible to find a logical connection between this particular bias and the situation in which people are about to make a decision on their plan for consuming electricity. It is definitely important to bear in mind that if such a deviation from rationality is exhibited people might be willing to pay less for a different plan which would be something new and would replace a plan that they are familiar with or used to.

- ***Loss aversion***

It is a well-known and observable occurrence that people usually seek to avoid losses and this prevails over the pursuit of the respective gains. In other words, Sunstein (1997) argues that an

individual would be approximately twice more unhappy from a loss compared to the same amount of gain. This assertion is confirmed by Kahneman (2003) who makes a connection between loss aversion and the endowment effect (mentioned above) by referring to Thaler (1980) and thus highlighting the differences in perceiving the value of an asset when it is to be sold or bought.

In the regulative spectrum this effect is tightly related to the reference point used. The choice of a reference point can be essential for the success of a specific regulative approach in decreasing loss aversion. The relevance of this comment to my research is confirmed by Sunstein's example in the scope of environmental policies. He implies that if a policy is designed so that it commits to recovering an element of the environment as it was in a certain previous point in time, then it would be able to induce individuals to comply. I give more details in this regard under the separate paragraph related to anchoring further on. Sunstein (1997) also adds that the regulative instruments chosen may affect the level of loss aversion.

Relevance: Let us take a look at the implications of this potential effect in the situation of energy supply and renewable energy regulation. Based on the above, a surveyor should be prepared to expect that agents may react differently to the provision of a subsidy motivating them to comply with the policy pursued as opposed to the imposition of a fine or penalty.

- ***Aversion to extreme cases***

The willingness to make compromises is evident when a person is facing two extremes. As Sunstein (1997) ascertains, the presentation of alternatives is crucial for the outcome of a given choice dilemma. The comparison between two objects may be changed by including a third one which is in the extreme. This is probably the psychological aspect of choosing the “golden mean” which might affect decisions and consequently the policy setting. Also, in his interview for Qualtrics (2013)¹, Ariely provides some very useful insights on matters that are more closely related to the technical part of obtaining data, i.e. to the design of surveys. He points out that in the presence of this aversion type, a larger range of possible answers might lead to more reliable data despite that answers in the middle range would prevail.

¹ The interview is published on the website of the research company Qualtrics. For further details, please refer to the relevant entry in the reference list.

Relevance: In renewable energy regulation, the consideration this bias might prompt regulators design their instruments in such a way as to provide a set of detailed alternative plans enabling the agent to make the proper comparison and thus emphasizing the benefits of the aimed regulation.

My interest in this bias is mainly related to the choice of a suitable design of the survey. As seen already in Qualtrics (2013), there are opinions that in the presence of people exhibiting extremeness aversion it is more appropriate to construct a survey with a broader range. This is a very good basis for my consideration of a survey in which there is a significant probability of ascertaining aversion to the extreme negative or extreme positive answer. More specifically, I would expect respondents to generally avoid answering with “strongly agree” or “strongly disagree” but rather choose “agree” or “disagree” respectively, which is my argumentation for including the two extreme options as well.

- ***Self-serving bias***

Agents sometimes overestimate their contribution, i.e. there is a discrepancy between their perception of the rewards they are entitled to and other agents’ perception of the same matter. As Sunstein (1997) points out, if two individuals are asked about their role in the accomplishment of a certain activity, then the answer might often exceed 100 percent. In addition, Shepperd, Malone, and Sweeny (2008) explain that people quite often describe successes to a large extent as a consequence of their own actions, whereas in the opposite case they might partially deny this and allocate some of the reasons in the group of factors which are not within their control, i.e. various externalities.

According to Sunstein (1997), this implies that the self-serving bias impedes the smooth negotiation process and could be considered as a factor for increased negotiation costs on the way to achieving mutual agreements.

Relevance: Referring back to my specific research, this bias might appear as the individuals’ opinion that they contribute enough to the environment and do not have to be further charged for energy supply coming from renewable sources according to the adopted environmental policy.

- ***Unrealistic optimism and overconfidence***

In research it is important to consider the degree to which optimistic expectations correspond to reality. Sunstein (1997) refers this behavioral feature to individuals' optimistic risk assessment regarding some unfortunate effects. They think this would not happen to them, i.e. rely on subjective probabilities. Analogously, Jolls (2009) comments on unrealistic optimism by asserting that individuals perceive the risks for themselves as being lower than for the others, even though they have been warned about the level of the relevant risks. The author adds that in case these warnings are in the form of a rule set out by law, then this rule would not accomplish the tasks if it was designed under the traditional assumptions of economics and ignored the effects introduced by unrealistic optimism.

Relevance: Once again, these biases can have logical connection with environmental and renewable energy matters. For example, when surveyed, users of conventional energy might express overconfidence regarding the risks of harms from the negative effects of conventional power to the environment.

- ***Differences between decision and experience utility***

Sunstein (1997) highlights another type of discrepancy that impedes the predictions of traditional economics – namely, the expected utility of the agent at the moment of taking a decision might sometimes not be equal to the actual utility brought forward as an outcome of the respective decision. Carter and McBride (2013) relate the concept of experience utility to the level of happiness a person experiences. They also find significant evidence that the respective reference point is influenced by the individual expectations as well as by the comparisons made in the social setting. These results appear as useful insights for policy making.

Relevance: In the context of my research, there might be users of conventional energy who are not willing to switch because according to the above-mentioned arguments they do not evaluate the experience utility in a way allowing them to see the benefits of such a decision. Therefore, they might be induced to switch to a more environmental scheme in which part of the energy is supplied by renewable energy by the implementation of an appropriate regulative and policy framework.

- ***Feeling of fairness***

Considering the fact that people usually live in social settings, it is very logical to think that some agents might ignore their own needs to some extent in the name of helping their fellows. An emblematic example in this respect is the standard Ultimatum game. It has been well documented that often players deviate from the equilibrium solution (which is accomplished when Player 1 suggests to give away the minimal possible unit and Player 2 agrees to take it) and settle for a situation in which Player 1 suggests to pay a much higher number of units basing this decision on the feeling of what is fair (Sunstein 1997). Pollitt and Shaorshadze (2011) also acknowledge that agents might undertake actions which are good for the environment based on fairness assumptions and against rational behavior.

Relevance: The research above points out the appearance of fairness issues in environmental regulation especially considering the fact that a group of people or a whole society is subjected to regulation. This is therefore a bias to take into account when analyzing the replies of energy users in the survey.

- ***Cooperation***

Here I need to refer once again to a game theoretic analysis in order to clarify the meaning of this behavioral bias. There are games in which non-cooperation is the rational choice of both players. The most pronounced example is of course the Prisoner's Dilemma (Sunstein 1997). However, in the corresponding real life situations it is evident that sometimes people do cooperate and find this the "right" decision according to their view even though it might not be the economically justified one. Furthermore, Sunstein (1997) points out that cooperation is often the preferred action when players are allowed to communicate and discuss strategies. This bias is actually an indication of the existing good nature of people and their willingness to help others in certain situations.

Relevance: The applicability of this bias to my case study is a bit abstract but I still find it worthwhile to discuss. Hypothetically, there is a small closed society, for example a residential building, in which due to infrastructural facilities and organization, the flat owners should make a unanimous decision on switching to a specific energy supply plan. The present bias infers that an owner who is reluctant to change her consumption model might anyways accept this, taking into consideration the high value such a change would have to other neighbors.

Agreeing to a payment scheme which promises reduction in prices for all users at a future point could also enhance the person's care about the comfort and well-being of others despite the own financial consequences in the beginning. Set in such a context, this behavior corresponds to the cooperation bias.

- ***Heuristics***

In their extensive work, Tversky and Kahneman (1974) analyze a few commonly seen heuristics – representativeness, availability and anchoring. They clarify that representativeness refers to respondents' perceptions of the probability that a certain event or subject is part of another one. Tor (2008) further makes the remark that one should be cautious about this bias because there might have situations when probability level is affected but the degree of similarity of the events is not. He also refers to the “character evidence” by explaining why it would be in principle unacceptable in courts. This is related to the assertion that previous wrongful actions of a person might not be representative for the currently prosecuted case. Nonetheless, the complexity of this situation stems from the still higher probability of such a person committing something wrong than a regular, well-behaved person (Tor 2008).

Availability, on the other hand, is described by Tversky and Kahneman (1974) as the possibility to assess events by taking into consideration other similar events available. Tor (2008) states that people tend to get affected to a greater extent in their decisions by types of events which are more frequently seen or that are more frequently communicated in the public space. A crucial point he makes is that this bias might actually lead to overestimation of specific types of risks making people request for more regulation, thus shifting demand upwards.

Third, Tversky and Kahneman (1974) define anchoring as the occurrence in which decisions are related to some predetermined value. Tor (2008) once again makes very relevant remarks on the topic by claiming that this bias might have a higher effect if the anchor is an event which is not closely connected or which is exaggerated, making it more distant or even inappropriate as a starting point of elaborating a conclusion on the event under consideration.

Further important points are made by Sunstein (1997) with respect to environmental issues. The author mentions “the pollutant of the month” as a factor which might significantly increase the concerns of society and therefore the demand for more regulation (Sunstein 1997, p.14). It is sometimes an intrinsic reaction of agents to exaggerate the risks related to events which have

recently occurred even though there is no significant evidence for such a high probability of it happening again in the near future. Another reason for agents to miscalculate the possible risks is if they have anchored their decision on a value which might not be sufficiently accurate (Sunstein 1997).

Relevance: All three types of biases being representativeness, availability and anchoring could be considered in the context of evaluating the risks or consequences stemming from harmful sources of energy. It is possible for a certain level of the “pollutant of the month” heuristic (Sunstein 1997) to be as well exhibited in the case of renewable energy consumption because agents’ decisions might be influenced by a recent environmental catastrophe which would make them prone to using clean energy.

- ***Taste based on probability***

Often human behavior is based on traits in the character that are difficult to explain by others. This is because every person is an individual and sometimes sticks to her own preferences irrespective of what the relevant economic theory says. There are a few matters that Sunstein (1997) considers under this category. First, the author ascertains that an individual is more satisfied by a totally rather than just partially reduced risk, even though the interval of reduction might be the same in both cases. This is due to the assertion of non-linear probability weighting (Sunstein 1997). It might be important for the regulator to bear in mind that providing agents with information on risks to be reduced to a certain level might have a weaker (or insignificant) effect than stating that the risk will disappear completely. Second, the researcher outlines a very typical taste being the agents’ preference to uncertainty rather than risk, just because they feel calmer when they know the probabilities of an event to occur.

Relevance: Referring to the case of renewable energy, this could be important for the regulator or policy maker who would seek (if possible) to present information and regulation with regard to the use of conventional and renewable energy based on probabilities and with minimized ambiguity in order to guarantee higher effectiveness (Sunstein, 2011).

- ***Mental accounting***

It is interesting that in the context of his analysis Sunstein (1997) rejects the fungibility property of money set out in conventional economic theories. Quite early, Thaler (1985, p.200) has

already made a very relevant remark in this regard: “Money is not supposed to have labels attached to it.” However, the same author provides examples where this principle does not hold because households’ decisions might depend on additional factors such as considering the origin of the money received or the purpose of spending it, i.e. the “label” is present (Thaler 1985). Individuals sometimes put labels on money and they do not have the same attitude to easily earned money compared to money earned with hard work. Human mind is a complex mechanism and as Sunstein (1997) asserts, it assigns different accounts to different purposes with different values so it is not that easy to reallocate these means. The author suggests that the strength of regulators in this respect would be to possibly establish a public account as part of the set of other accounts and thus induce higher compliance (Sunstein 1997).

Relevance: In my example of renewable energy regulation, this approach might prove efficient if, given that care for environment has been ascertained, the regulator can apply a policy where it is stipulated that a portion of the energy bill paid would go to an account dealing specifically with certain environmental issues, thus making the subjects comply.

- ***Norms reflected in monetary terms***

Another remark of Sunstein (1997) refers to the hardships in determining the monetary reflection of normative decisions. For instance, the author asserts that a group of individuals might give very different replies with regard to the amount they would be willing to pay in the name of environmental improvement.

Therefore, a part of the regulator’s tasks is to look for proper ways in which these assessments could be limited to some boundaries and to design the appropriate rules. A recommendation for coping with this issue in research is given by Kahneman and Frederick (2002) who state that an initial number which reflects a standard value could be set and used to determine subsequent relative values of other occurrences.

Relevance: In line with the observations of Kahneman and Frederick (2002), this bias stemming from the difficulty to express norms in consistent and comparable terms outlines the importance of performing an appropriate survey before undertaking a regulation in order to be able to at least approximately estimate the willingness of energy users to pay more for contributing to a better environment and using renewable energy.

As a reminder of the main focus of my present work, it can be argued that some of these discrepancies with rational behavior have the chance to appear in a situation of environmental regulation. In the recent essay elaborated by Sunstein (2011) the author refers the work of Laibson (1997) with remarks on one very interesting and important element of consumers' behavior which is also to be included in the group of biases, as follows:

- ***Hyperbolic discounting***

According to Laibson (1997, p.443), this is a situation in which there are “dynamically inconsistent preferences, implying a motive for consumers to constrain their own future choices.” This is an issue that could be also associated with the points made by Viscusi and Huber (2006) on public goods, as the researchers emphasize the important influence of analyzing this person-specific time preference in policy-making procedures and winning the consumers on their side.

Relevance: Consumers of electricity are possible subjects to the emergence of this bias. They might value the present benefit of keeping this additional amount of funds and using it for something else, rather than investing it into the prospects of gaining benefits from the reduced prices in the future. As conferred already, there are some discounting matters that could arise. A payment plan which aims at a future accomplishment of a renewable energy use goal leading to lower prices of the users of this plan investigates the way in which consumers see the perspectives for the future as well as how they value the present. Disagreeing with it would imply signs of hyperbolic discounting.

I consider two more effects found to be noteworthy by Sunstein (2011) as they might be present or even predispose some of the biases described above:

- ***Framing***

One more outstanding research of Tversky and Kahneman (1981) reveals that the very presentation of a problem may incur different reactions with regard to the preferences of respondents. In accordance with this assertion, Sunstein (2011) finds that depending on the way information is served, some biases mentioned above could arise. As an example of framing that incurs loss aversion to come out of one's actions, the author refers to the use of energy and claims that he would expect a more favorable feedback to a statement of winning from

undertaking an energy-efficient action than to a statement of losing from not undertaking it (Sunstein 2011).

Relevance: The possible availability of this bias is important for the design of the survey on renewable energy. Basically, the matter considered or the policy pursued might be the same, and still be perceived as different due to the particular choice of wording or phrasing.

- ***Influence exercised by the society***

The connotation of Sunstein (2011) here is that social opinion and norms may affect one's decisions. In legal terms they might be so convincing that they could even lead to the so-called "compliance without enforcement" (Sunstein 2011, p.1357). Tor (2008) profoundly adds that this is namely one example of behavior where people might not be led by self-interest. He points out that there is evidence revealing the personal desire to be involved in exchange settings which are driven by fair terms.

Therefore, this is another aspect of the fairness bias and the cooperation bias (Sunstein 2011) which might have implications appropriated to the behavior regarding consumption of renewable energy. For example, Sunstein (1997) states that taking a course of action in favor of fairness but against rationality might be further enhanced by making the decision known to others.

Relevance: In addition to the above, if users' decision on energy payment plan is made known to neighbors, the public, etc. then more of them might actually agree to a particular course of action and this has specific implications in the process of designing renewable energy policies.

- ***Herding***

Herding is an interesting occurrence that has been also widely examined. Baddeley (2010, p.282) describes it as being the "phenomenon of individuals deciding to follow others and imitating group behaviours rather than deciding independently and atomistically on the basis of their own, private information." The author quite logically points out that this is a bias affecting persons especially in social settings and in groups with common objectives. That is why it is tightly related to the social influence bias described above.

Relevance: In line with the strong effect society might exercise on a person, it might be explored whether people would ignore their own information and just follow the actions undertaken by the members of society with respect to whether they switch to a new electricity plan or not.

- ***Environmental care and friendliness***

This is a behavioral trait not typically included as a bias in the literature on behavioral economics. Nonetheless, taking into account the specifics of the topic and the claims of some authors that care for the environment induces people to deviate from rational behavior, it is relevant to include it in this list. As part of their analysis on the policies applied in the energy sector, Pollitt and Shaorshadze (2011, p.6) emphasize that people also exhibit “pro-environmental behaviour” despite the fact that this could involve costs and even contradict the rationality assumptions.

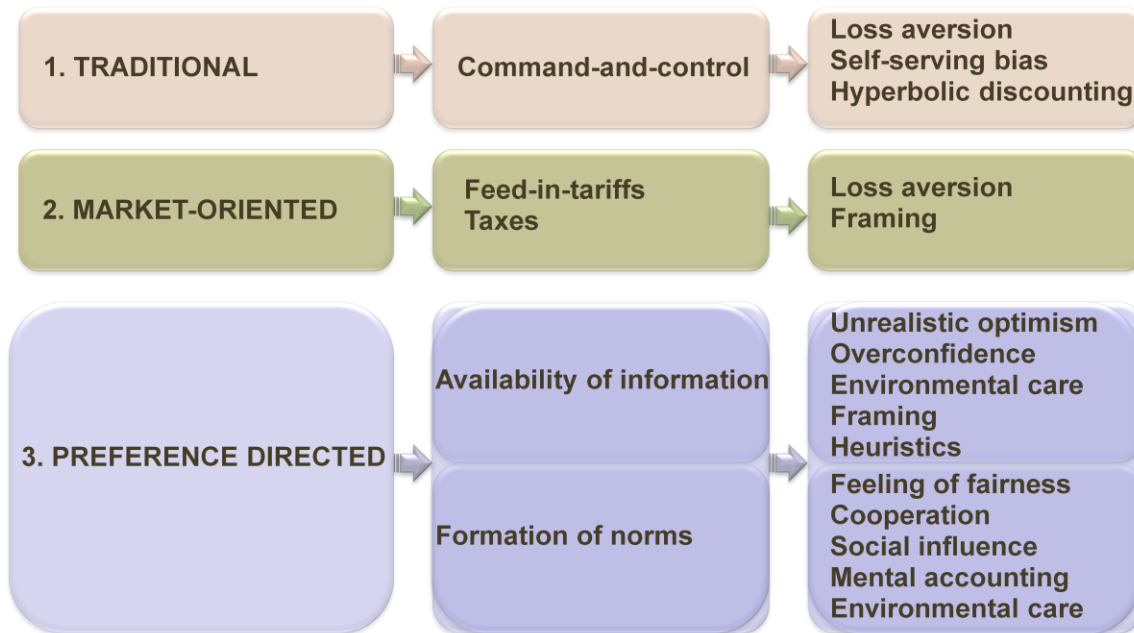
Relevance: Renewable energy is a clean source and therefore it might be preferred due to environmental considerations. It is studied in the following sections whether providing more information on the effects of such consumption would make people forego their rationality and support the idea of contributing to the welfare of the environment.

2.5. INTERCONNECTION BETWEEN RENEWABLE ENERGY REGULATIVE MEASURES AND BEHAVIORAL BIASES

2.5.1. Types of Relevant Regulative Frameworks

The functions of the regulative bodies are also important for this analysis because the decision on using a specific regulative instrument might prove to be more (or less) efficient depending on the behaviors of its subjects. Different approaches to setting regulation in the area of environmental issues are considered by Livermore (2007). According to the author, there are three broad categories and below is presented a concise summary of the main remarks which appear relevant to my further research:

Figure 3: Connecting the Behavioral Biases to Regulative Tools



Source: Compiled from Livermore (2007), Couture et al. (2010), and own elaboration

I consider the above instruments applicable to a certain extent to the renewable energy case. Below are described the selected instruments of interest as well as the specific ways in which they can provoke some behavioral biases discussed already in the previous section. The following paragraphs are related to regulative tools which have been extensively used together with a conventional economic analysis.

- **Traditional: Command-and-control tools**

The Guidelines of the Environmental Protection Agency of the U.S. (2010, Ch.4, p.3) specify that the command-and-control measures fall within the scope of prescriptive regulation which is “a policy that prescribes how much pollution an individual source or plant is allowed to emit and/or what types of control equipment it must use to meet such requirements.” It can be assumed that behavioral biases are less probable to occur because the range of personal choice is quite minimized when people are directly compelled to comply with a certain regulation that is controlled for. Yet, considering the demand side of regulation, there are numerous disadvantages of the command-and-control mechanism, mainly related to the assertion that it “relies on a remote centralized bureaucratic apparatus that lacks adequate democratic accountability” (Stewart 2001, quoted in Livermore 2007, p.7) and this might logically lead to unwillingness to

comply. The command-and-control method seems closest to the model described in Figure 1.1. above and considered with some reservations.

My conjecture is that the following biases could logically occur as a result of applying this approach: loss aversion, self-serving bias or hyperbolic discounting (Figure 3).

- ***Market-oriented tools***

Concerning the renewable energy situation, the influence of a market-based regulative tool can be exercised by also setting higher taxes for competitive but less clean sources of energy. It might be assumed that consumers are affected by the higher costs related to their current electricity supply plan and switch to the cleaner due to economic reasons. However, I consider it appropriate to also pay attention to the possibility of consumers exerting loss aversion in their attempt to avoid additional charges in the form of taxes. The mechanisms of feed-in tariffs and options for tax credits are namely elements of the market-oriented tools which are tackled by Couture et al. (2010). Another point to make here is that by indicating some sources as harmful to environment, the regulator could be trying to set norms (considered in the next category) and signal the consumer with the higher taxes.

According to my conjectures, the biases that could logically be present as a result of this type of tools are loss aversion and the framing effect (Figure 3).

- ***Preference-based tools***

Information announcement

Livermore (2007) argues that disclosing additional information to the attention of consumers, irrespective whether by own means or by compelling the supplier to give it out, the regulator is able to change the status-quo of preferences. Furthermore, the research of Livermore (2007) emphasizes the presumption that in the case of two identical products (P1 and P2), where:

→ Price of P1 = Price of P2;

→ Quality of P1 = Quality of P2;

→ Adverse effect on environment of P1 and no adverse effect on environment of P2, BUT this is not made known to the consumers;

→ Assumption that the effects on environment are important to consumers;

=> the expected outcome would be OVERconsumption of P1 and UNDERconsumption of P2.

Of course, this is a simplified case but it clearly reveals that the attempts of narrowing down the gap caused by asymmetric information can increase efficiency (Livermore 2007).

In order to overcome information asymmetries and set the information in a regulative context, Livermore (2007) discusses the influence of reflexive law on demand. Reflexive law is helpful in the sense that a consumer is able to see the externality and then perform an informed decision on whether to ignore it and buy the environmentally unsafe product or take the possibility of the emergence of an externality into consideration and refuse to buy the product. This case involves more comprehensive information given to consumers rather than just differing individual prices (Livermore 2007).

The implementation of such measures could result in biases, such as unrealistic optimism and overconfidence, heuristics, framing or care for the environment according to the conjectures made in this research (Figure 3).

Norms

The norms in a given society are also an important issue for regulators to consider if they genuinely strive for the success of a certain policy. That is why regulators often consider, parallel to the legislative tool implemented, the ways in which they could set or enhance the effect of these norms and accomplish the tasks of the legislation by relying on the “auto-enforcing” norms (Livermore 2007, p.18). This means that a regulation should be designed in such a way that it invokes personal norms to come out and be expressed in the form of compliance. Of course, as Livermore (2007) suggests, it would be much easier and less costly to implement a regulation which is in harmony with the norms (and consequently preferences) instilled in the person subject to it. Another appropriate point made by Livermore (2007) is that compliance would be better achieved with alignment of the norms of society to the norms set by regulation, irrespective if there are fines or not in case of non-compliance. Therefore, an environmental policy designed to set as a rule the requirement of a higher level of renewable energy sources to be used could appeal in a similar way to the norms of consumers and it is worthwhile to explore the extent to which they would comply with this.

I conjecture that the biases which could be associated to this category are the feeling of fairness, cooperation, social influence, mental accounting, and environmental care (the latter being mentioned as part of the previous sub-group related to information as well) in Figure 3.

2.5.2. Applicability of Regulative Tools to Environmental and Renewable Energy Regulation

De Civita, MacDonald, and Downs (2011) confirm the applicability of behavioral economic principles into the realm of regulation, especially with regard to environment. They assert that such instruments allow regulators to make a detour from traditional methodologies and analyze in advance the possible effects a policy might have on consumer behavior.

There are authors who show how previously applied regulative measures could be revised by taking account of the behavioral effects and thus be readjusted in the context of energy regulation. Houde and Todd (2011) provide quite a few illustrations and recommendations on policy measures based on specific biases displayed. With regard to loss aversion and policies for energy saving, for example, they advise that the regulator formulates a given policy in a way to convince consumers that it avoids a potential loss instead of taking the different approach of emphasizing the gains from it. This might seem counter-intuitive, but Houde and Todd (2011) mention results according to which such a “framing” approach has proven successful in making 26% of the people change their decisions.

Houde and Todd (2011) make another very relevant point regarding mental accounting and the ways in which it can be turned in favor of policies. The researchers suggest the option of providing consumers with information on how the energy saved is utilized by mentioning as an example the “British Columbia Climate Credit” (Houde and Todd 2011). Such a framework gives confidence to the consumers that their expenses are allocated to a proper account. This point is relevant to my research because it highlights the positive effects which could arise from informing consumers that their additional costs spent on renewable energy accumulate in a larger account used for environmental purposes.

Aversion to extreme cases is also something considered by Houde and Todd (2011) in the sense that people might be prone to put up with an option which could be best among others. For example, they suggest that the regulator introduces an additional, less favorable option, thus attracting the attention to the one that is actually aimed at. This is so because by comparing them the consumer might decide that the initial option is more acceptable.

Social matters are considered by the researchers in the sense that policies might prove successful if people are aware of the level to which their peers are also joining them. Furthermore, it has

been ascertained that in the energy saving area this approach might attract more consumers compared to a campaign outlining the negative effects on environment (Houde and Todd 2011).

As already mentioned above, discrepancies in how people discount are also a matter to analyze in the policy-making process. Korobkin and Ulen (2000) outline the importance of two factors that might affect personal discount rates – time span considered and the amount of remuneration to be enjoyed. Houde and Todd (2011) assert that it is possible to cope with this unwillingness to pay more now and obtain the gains in a future point by introducing a policy where people become part of a larger-scale commitment plan in which more people are involved and put efforts into achieving it.

2.6. TOOLS USED IN BEHAVIORAL ECONOMIC RESEARCH

De Civita, MacDonald, and Downs (2011) suggest that the consideration of bounded rationality, bounded willpower and bounded self-interest could account for behavioral aspects which are necessary to explain and link the differences between the theoretical assertions of economics and the behavior of actors in reality. Due to these specifics of human mind and actions, researchers in the sphere of behavioral economics often use behavior as the basis to establish the analysis through experiments (Ariely 2010) which then leads them to the relevant conclusions about choices made. Camerer and Loewenstein (2002) point out that namely the experimental approach gained popularity at the rise of behavioral economics but afterwards other tools also appeared relevant. For example, in addition to experiments in a laboratory setting, Berg (2003) mentions the obtaining of data on the field, surveys and interviews as other possible tools for research.

Sometimes in experimental or empirical studies steps are undertaken to avoid or isolate the biases (e.g. Druckman 2001; Sunstein 2011) in order to analyze the rational behavior of subjects. However, my current research is concerned about these biases in the sense that their presence in certain situations might lead to the establishment of new policy considerations in the renewable energy sector.

III. BASELINE CASE STUDY

ILLUSTRATING RENEWABLE ENERGY REGULATION

I investigate a case study consisting of two countries, Bulgaria and Austria, in order to look for signs of the adoption of behavioral analysis in recently applied regulations and policies.

3.1. BULGARIA

3.1.1. Outline of the Regulative Tools Used

A very comprehensive analysis on the policies which Bulgaria has implemented since the introduction to the renewable energy use is presented by Mineva, Karaboev, and Stefanov (2011). It tracks the steps undertaken with regard to legislation and financial incentives by setting forth the following milestones on a national level:

- *Energy Act 2003*. This was command-and-control legislation which set specific targets to be met by Bulgaria and which would appear as ultimatums to the prompt development of renewable energy supply. It is interesting to find out that in 2006 the initial 10-year target was decreased to a 5-year time limit (Stefanov et al. 2011).
- *Renewable and Alternative Energy Sources and Biofuels Act 2008*. The approach resembles command-and-control measures in the sense that under this Act there were obligations for the supply of renewable energy. The main aims accomplished refer to introduction and faster pace of application of renewable sources but also to the tendency for increase of payment bills (Mineva, Karaboev, and Stefanov 2011);
- *Energy from Renewable Sources Act 2011* (instead of the Renewable and Alternative Energy Sources and Biofuels Act). Here the legislative rules favored conditions for biomass sources and lowered the price for photovoltaic energy (Mineva, Karaboev, and Stefanov 2011) which is at least one element contributing to the tendency for lower renewable energy prices;
- Among the incentive mechanisms that enhance the popularity of renewable energy are the *feed-in tariffs* (Mineva, Karaboev, and Stefanov 2011).
- *Credit lines* are another way to motivate the use of renewable energy (Stefanov et al. 2011).

This is a matter of international significance so it is quite logical that Bulgaria, especially after the admission to the EU in 2007, is both facilitated and controlled by the EU. Without going into details, it is worthwhile to just indicate the type of incentive and regulative measures that are provided in this regard:

- *Grants* from the European Regional Development Fund via the Operational Programme Competitiveness and Operational Programme Regional Development (Mineva, Karaboev, and Stefanov 2011). The specialists state that EU funding is of essential importance and even the tools used on the national level are determined in such a way to comply with the EU Directives (Mineva, Karaboev, and Stefanov 2011).

Information is also part of the overall regulative approach of Bulgaria. The following tools are an attempt to increase the quantity of information that electricity consumers receive:

- *Green energy line*. According to the green energy line, consumers retrieve information from their bills regarding the preferential prices of electricity coming from renewable energy sources (Stefanov et al. 2011);
- Improvement of the *information* exchange process – described in the National Renewable Energy Action Plan by the Ministry of Economy, Energy and Tourism (2010).

The analysis in this section is useful for my research because it outlines the importance of Bulgaria acting in accordance not only with the domestic rules and policies but also with the pressure coming from the EU standards and regulations (Mineva, Karaboev, and Stefanov 2011). Therefore, in the attempt to achieve the targets set, regulators might be pushed to be more decisive and strict in the approach of introducing renewable energy to electricity producers and consumers, respectively.

If the recently applied regulation in Bulgaria has to be categorized by the types mentioned in Section 2.5., then the following summary proves useful:

- Command-and-control tools – legislative acts, EU targets set within time limits (as indicated above, e.g. Stefanov et al. 2011; Mineva, Karaboev, and Stefanov 2011);
- Market tools – price changes, feed-in tariffs (as indicated above, e.g. Mineva, Karaboev, and Stefanov 2011);
- Preference-based (information) tools – green energy line (as indicated above, e.g. Stefanov et al. 2011).

3.1.2. Was the Overall Policy Successful in the Eyes of Consumers? Why?

There are recent political events that highlight the consumers' disapproval of energy costs. National protests were started and the leading reason for them was the high prices for electricity which are seen as unjustified (Krasimirov 2013). This outlines the importance of transparency and active communication between regulators and the public.

For the purposes of this research, it is necessary to look back and analyze the measures taken specifically with regard to renewable energy. The first and foremost visible effect to consumers is the increase of electricity prices. The question is what approach was undertaken in order to induce them to accept this initial change in the best way while working parallel on the measures to bring the prices down. The evaluation of the respective legislation in Bulgaria indicates that the initial purpose has been to make these measures “very liberal” so that at the starting point they become easier to implement by providing extensive financing for renewable energy, while later they are gradually transformed into measures containing lower level of financial incentives (Stefanov et al. 2011). The idea seemed very appropriate for the introduction of such a novelty but the problem was its realization. As Stefanov et al. (2011) criticize, the legislation was not drafted in a way to specify the precise functions of the participants in the renewable energy market. This led to huge attention on behalf of investors who saw favorable opportunities. By 2007, the number of investors exceeded by far the amount of necessary capacity and the technical possibilities to install renewable energy facilities. The large contradiction was that, on the one hand, the legislative framework obliged the distribution companies to include additional renewable energy to the network and, on the other, this was not technically viable then.

Along with the implementation difficulties, there was another issue – no unified system for provision of up-to-date information that could orientate suppliers and consumers on the extent to which the introduction of renewable energy sources was progressing. Stefanov et al. (2011) point out that the development of such a system was within the tasks and scope of the legislation but it actually did not become functional. The lack of information is something that could risk the public's trust in the reliability of these policies as well as in the effectiveness of these new sources of energy.

Stefanov et al. (2011) do acknowledge the efforts exerted in the Energy from Renewable Sources Act to cope with the discrepancies between those numerous investments and the lack of

readiness for them but they also admit the importance of this being done “post factum.” The confusion that broke off has to a certain extent led to renewable energy being negatively perceived by the society in Bulgaria (Stefanov et al. 2011).

There is one more practical aspect in the regulation of electricity supplied from renewable sources and it refers to the puzzlement over the green energy line (Stefanov et al. 2011). Basically, the electricity bills reveal information on the price contribution of renewable energy and thus could give the impression that it is among the main reasons for consumers having to pay higher bills. The comparisons between renewable and nuclear energy resulting from this and favoring nuclear energy were also inappropriate as they were based on different measurement indicators (Stefanov et al. 2011). As a consequence, consumers could probably hardly follow-up and the clearest indicator for them was just the higher amount of money they had to pay to the electricity company.

All these considerations can be summed up by asserting that there are flaws in the actual implementation of renewable energy regulation, mainly due to the following drawbacks:

- Monopolistic price setting for renewable energy sources (Stefanov et al. 2011);
- No standardized system for transparent and up-to-date information (Stefanov et al. 2011);
- Confusion around the green energy line as it might have conveyed an inaccurate message by giving the impression of advantageous position of the nuclear power with regard to pricing (Stefanov et al. 2011);
- Improvement of information and education was planned within the Bulgarian Energy Strategy of the Republic of Bulgaria till 2020 (2011). Still, it does not contain detailed or more elaborate information on consumers’ behavioral biases and how it can be incorporated in specific policies.
- Promising improvements in the quality of information provision were planned within the National Renewable Energy Action Plan (2010) especially regarding the establishment of a “national public information system” and “geographical information system.”
- Furthermore, an information campaign is a projected measure as of 2012, again part of the National Renewable Energy Action Plan (2010). It is intended to incur “behavioral change” by emphasizing the positive environmental impact and other possibly favorable consequences from using renewable sources.

Intermediate conclusion: There are no significant signs of explicit behavioral approach in the policy-making approach implemented so far. Nationally and internationally set targets seem to be of primary importance to regulators, thus leaving narrow space for the analysis of the behavior of consumers. Nonetheless, there are recently developed plans with important behavioral considerations and instruments within the overall strategy of the country which are on the way of coming into effect.

In order to investigate the actual attitude and behavior of customers that could be significantly affected by all regulative changes and events, I turn to an empirical study described below.

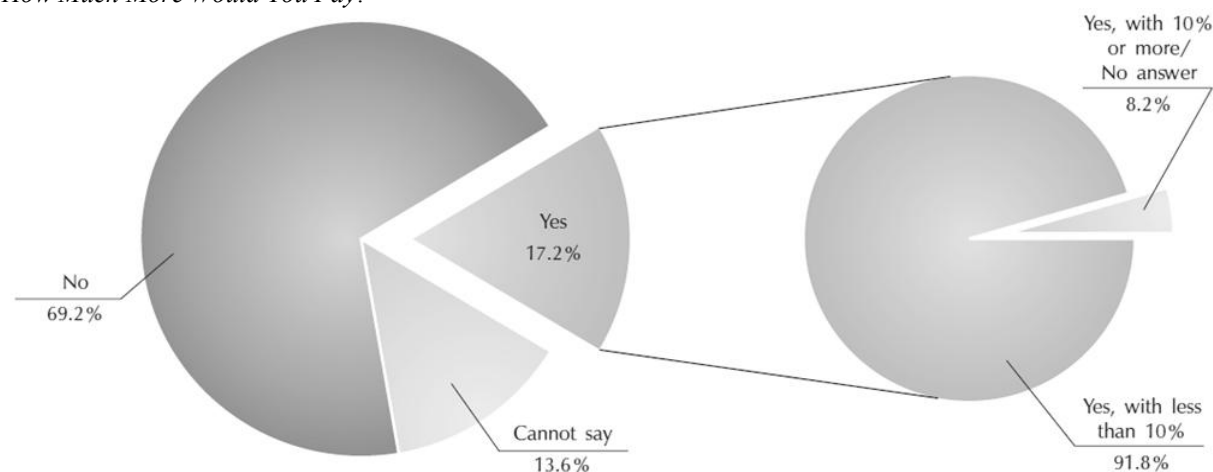
3.1.3. Previous Empirical Results

As a foreword, it is important to note that there were recently a lot of discussions in Bulgaria regarding the plans for building a second nuclear power plant. During a national referendum in January, slightly more than 60% of the people who participated replied positively for nuclear power even though the referendum was not approved as valid due to the low overall voting activity of 21% turnout (Enerdata 2013). Such results, however, could be considered in order to indirectly analyze the Bulgarians' attitude towards the more expensive renewable energy.

Based on the outline in the preceding section, it is now worthwhile to have a look at what the reaction of household consumers was with regard to the regulative changes. Stefanov et al. (2011) present the following summary of answers provided by electricity consumers when asked about their promptness to pay for electricity produced from renewable energy:

Figure 4: Bulgarians' Willingness to Pay for Renewable Energy

*"Would You Pay a Higher Price for Electricity if it Were Produced through Renewable Energy Sources?
How Much More Would You Pay?"*



Source: Center for the Study of Democracy Energy Survey (2010), quoted in Stefanov et al. (2011)

These results do not look very promising for the development of the renewable energy source network in Bulgaria up to that point of time. Figure 4 reveals even further the discrepancy between enthusiastic investors and sceptical consumers. More than two thirds of the Bulgarian households (69.2%) replied that they do not wish to pay more for having renewable energy in return. Also, the majority of the 17.2% that actually do not object (91.8% out of the 17.2%) agree to a bill which is higher but not by more than 10%. The remaining 8.2% are assigned to the people who would pay more than 10% or did not give an answer. This generalization makes it difficult to obtain a precise figure for the most positive replies, no matter how small in percentage they might be. Therefore, Bulgarian society is mainly concerned about the price, given the current regulative, social and financial environment, and being provided only with the information contained in the question.

3.2. AUSTRIA

3.2.1. Outline of the Regulative Tools Used

As a starting step, it is important to note one event that marks the consecutive active development of renewable energy sources in Austria. A national referendum was organized in 1978 in order to refer to the public opinion on nuclear power even though a new power plant in Zwentendorf had already been built. It was a big breakthrough that the Austrian population discarded the use of nuclear power and it was eventually banned by law² (Stockinger 1998).

Furthermore, below are listed the legislative measures that have contributed to the advance of renewable energy use especially in the electricity markets:

- *Green Electricity Act 2002.* Austria was also not ensured against the establishment of “waiting lists” (Winkel et al. 2011) formed after popularizing the highly supportive legislation. As the authors indicate, there were similar problems related to the quite abundant financial support because it drew the attention of an excessive number of potential investors. The regulators were fast in the reaction to these events and there were measures undertaken in the opposite direction towards shrinking the effect of these supportive tools. They were successful in achieving a significant decrease of the number of renewable electricity projects (Winkel et al. 2011).

² There have been consequent studies which analyze the results from the referendum and show that another reason is given to be the attempt to vote down the Chancellor by rejecting the use of nuclear power (Böck 2012).

- *Renewable Electricity Act 2006*. This was another significant step towards the popularization of renewable sources of electricity (PwC 2009).
- *Amended Green Electricity Act 2009*. The efforts towards balancing the market for renewable energy in electricity continued through the years and led to the approval of tools which had to motivate the investors once again. This Act contributes to the reconsideration of the amounts and periods of tariffs as well as to increased financial incentives (Winkel et al. 2011).
- *Amended Green Electricity Act 2012*. The analysis of Winkel et al. (2011) points out that a significant step ahead is the attempt to reduce the costs on technology because this way Austria could cope with the problems of inefficient capacity. This is an effect that complements the amendments in legislation, such as cutting off waiting lists by requiring a second application procedure, again aiming at a successful and balanced market for electricity from renewable energy sources (Winkel et al. 2011; European Renewable Energy Council 2009).

The Austrian approach to renewable energy regulation refers to:

- *Feed-in tariffs* – Austria relies on feed-in tariffs as the most widely used instrument to make renewable energy an attractive source to utilize (Winkel et al. 2011). This is, however, an instrument which actively operates on the supply and price side of regulation (Van Dijk et al. 2003).
- *Quota obligations* – This is a regulative approach which concentrates on the demand and quantitative side. Thus it can be directed to electricity consumers (Van Dijk et al. 2003).

The financing of the renewable energy sector in Austria is supplemented by the following:

- *Subsidies* – There are also various subsidies implemented in the attempt of enhancing the renewable energy use. An example would be the subsidy provided for the development of “medium scale hydro power plants” (European Renewable Energy Council 2009). Furthermore, an assessment of the Green Electricity Act 2012 indicates increases in the subsidies provided for renewable energy (Benn-Ibler 2011).

The ways in which information is made available and those in which the public could become involved are described in details in the National Renewable Energy Action Plan for Austria by Karner et al. (2010):

- *Austrian Climate Protection Initiative* – providing information which could motivate users to prefer renewable sources to conventional ones;
- *Solar Campaigns* performed in 2003, 2004 – 2009, 2010 – aiming to promote solar energy among the Austrian population.

Again, I refer to the main categories of regulation (Figure 3) and allocate them to the mechanisms applied in Austria in order to obtain the following summary:

- Command-and-control tools – legislative acts, EU targets (as indicated above, e.g. Winkel et al. 2011; PwC 2009; European Renewable Energy Council 2009);
- Market tools – price changes, feed-in tariffs, subsidies (as indicated above, e.g. Winkel et al. 2011; Van Dijk et al. 2003; Benn-Ibler 2011);
- Preference-based tools – the referendum regarding the use of nuclear power (as indicated above by mentioning the remarks of Stockinger 1998); extensive programs focused on the involvement of the public in environmental matters (Karner et al. 2010).

3.2.2. Was the Overall Policy Successful in the Eyes of Consumers? Why?

The advancement observed in the regulation efforts of Austria might have versatile signals to society. On the one hand, people might perceive these consecutive fluctuations in the implementation of expansion and then contraction measures as a lack of thorough long-term strategy. On the other hand, the very same approach might give the impression of regulation which is flexible and responsive to the market dynamics.

With regard to the level of considering the electricity consumers into the design of policies, Karner et al. (2010) provide a very comprehensive list of the information tools used as well as the target groups approached with each specific tool. This makes it convenient to analyze and ascertain that there are many policy instruments which are designed for the purposes of informing and meeting the needs of electricity consumers.

If the question is whether the overall strategy was successful in the eyes of consumers, the answer is relatively positive. One reason for this, however, is the fact that the task was easier for Austrian policy makers because they had good insights already for the attitude of consumers towards renewable energy by knowing the results from the referendum and the actual voting out

of nuclear power. This could partially account for the smoother implementation of the initial regulative tools.

Based on the analysis above, the following brief summary can be made regarding the situation in Austria:

- Users' negative opinion regarding nuclear power became evident through the outcome of the referendum (Stockinger 1998) so the positive attitudes towards renewable energy sources could be assumed known;
- Flexible and responsive regulation is applied. An indication for this is the amendment of legislative acts to meet the current developments in the market (Winkel et al. 2011; PwC 2009; European Renewable Energy Council 2009);
- Broad access to information, campaigns for promotion of renewable energy as an environmentally friendly source (Karner et al. 2010).

Intermediate conclusion: There was a good head start for renewable energy with the referendum in Austria. The majority of regulations and legislative reforms afterwards are mostly related to the objectives of balancing and ensuring the proper functioning of the renewable energy market. Consumer behavior is also important to policy makers but the main focus in this regard is towards environmental care and the other biases are not analyzed in specific, at least to the best of my knowledge obtained through the research made.

3.2.3. Previous Empirical Results

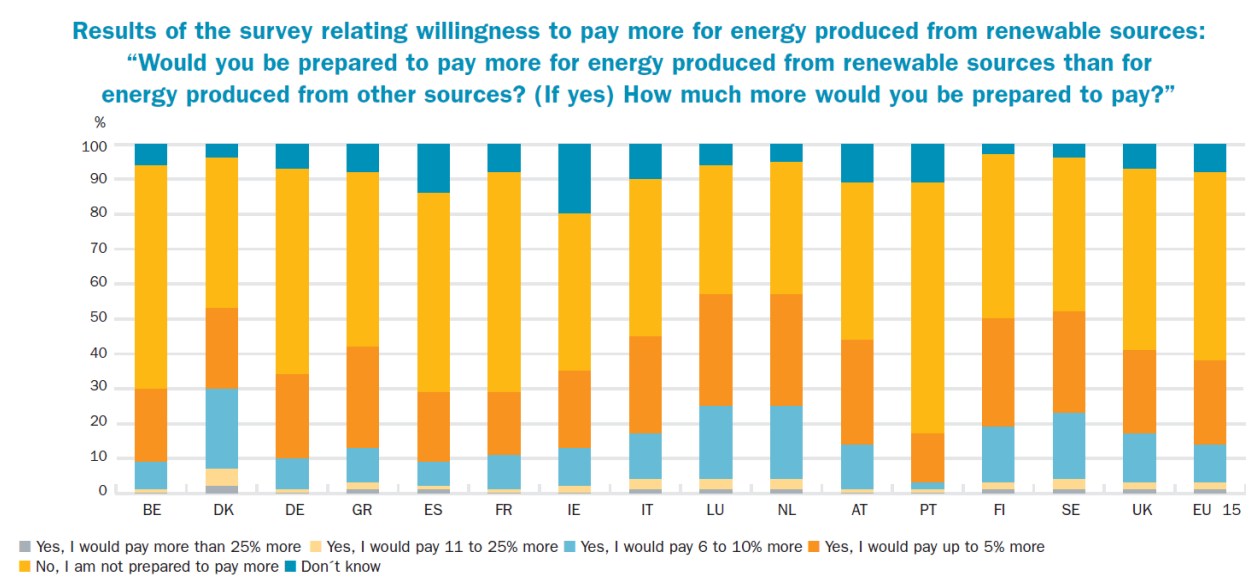
It is essential now to have a look at the information and opinions in the public space because they inevitably form certain positions in the Austrian society.

In order to achieve this task, it also appears useful to obtain a comprehensive idea of Austrian energy consumers compared to other European countries and the EU 15 aggregate results. This is accomplished through the data of the European Opinion Research Group (2003), quoted in Morthorst et al. (2005) as illustrated on Figure 5 below.

There are two main issues regarding this data that I need to emphasize beforehand. First of all, this research dates back to 2003. There are, of course, some changes that have occurred since then but, given the earlier start of Austria's development of renewable energy (in comparison with Bulgaria), it is worthwhile to explore the attitude of respondents at this time. Second, the

question is formulated more broadly to comprise energy sources and not electricity in particular. Nonetheless, for the purposes of my study, this is still a very valuable data set which reveals personal attitude in favor or against renewable energy.

Figure 5: Austrians' and Other EU Member States' Willingness to Pay for Renewable Energy



Source: Morthorst et al. (2005), quoting the European Opinion Research Group (2003)

The European Opinion Research Group (2003) recognized 44% of the Austrians who replied that they would pay in addition for renewable energy. If we look at this portion separately, the number of people that would be ready to pay decreases as the percentage of the additional amount goes up. Therefore, the portion of all people that would pay above 25% is practically invisible on the chart because it is none. An increase between 11% and 25% is also not a very viable option as the people giving this reply are 1%. On the other hand, the persons who would pay an increase between 6% and 10% are 13%. The results also show that 30% of the whole Austrian sample would not object to pay maximum 5% and thus make use of renewable energy.

Interestingly, according to the European Opinion Research Group (2003) the Austrians who gave negative replies are nearly the same number (45%) as those who confirmed for some specific percentage increase (44% in total). This means that the society was quite controversial and had preferences leading to both options. Finally, there was a 10% portion of the people who could not give a definite answer. Overall, the responses of the Austrian population are quite similar to the results for EU 15 in Figure 5 above.

3.3. AUSTRIA AND BULGARIA – MAIN FIGURES AND COMPARISON

3.3.1. Quantities Accomplished Already and to be Accomplished by 2020

Winkel et al. (2011) present the relevant results for different countries so the summaries on Austria and Bulgaria are illustrated on the following table:

Table 1: Targets on the Use of Renewable Energy of Austria and Bulgaria

EU Member State	RES 2005	RES 2009 (provisional)	2020 RES target	% ↑ required (from 2009 to 2020)
Austria	23,3%	29,2%	34%	5%
Bulgaria	9,4%	11,5%	16%	5%

Note: RES stands for renewable energy sources.

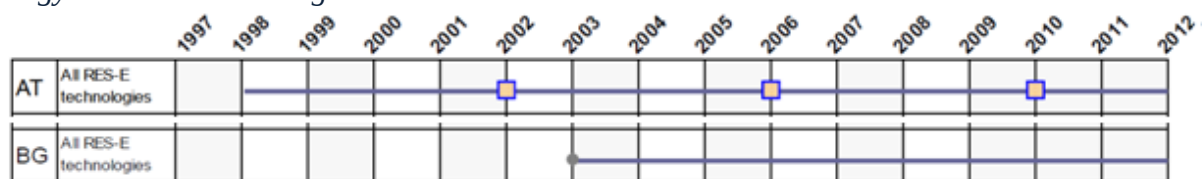
Source: Winkel et al. (2011)

If we consider 2005 as a starting point, then it is evident that Austria and Bulgaria are far from each other with respect to percentage of renewable energy used. Furthermore, between 2005 and 2009 the rate of growth of these percentages is again in favor of Austria (5,9%) compared to Bulgaria (2,1%). All in all, it is interesting to find out that the growth rate for 2020 coincides for both countries (5%). A reason for these differences could be sought in the regulative tools implemented and that is why the next point reveals further details on Austria and Bulgaria in this respect.

3.3.2. Timelines in the Development of Incentive Tools for Electricity Production from Renewable Sources

The data on both countries as presented in Figure 6 below is again part of the research carried out by Winkel et al. (2011):

Figure 6: Development of the Incentive Mechanisms for Electricity Production from Renewable Energy in Austria and Bulgaria



Legend:

- Feed-in tariff/premium
- Quota / TGC
- Tender
- Tax incentives / Investment grants
- Change of the system
- Adaptation of the system

Note: RES-E stands for renewable energy sources – electricity.

Source: Winkel et al. (2011)

Figure 6 sheds more light on the reasons for Bulgaria's lag behind, at least in the electricity sector. It shows that Austria has gained more experience as there were incentive instruments towards the increase of renewable energy use in 1998, whereas in Bulgaria the system was modified later in 2003 to introduce the feed-in tariffs. Furthermore, according to the data available on Figure 6, Bulgaria did not have the time for adaptation, or did not implement such adaptive approach which is inherent in the Austrian system indicating adaptation every four years.

The following table is a summary of the points made on both countries with regard to a few key indicators. This makes it possible to look at the broad picture and facilitate the nomination of measures to apply in the attempt to improve performance.

Table 2: Comparison between Austria and Bulgaria by Different Indicators

Comparative analysis of Austria and Bulgaria	
Indicator	Comparison
Beginning of implementation	<i>Austria > Bulgaria</i> ; considered in the baseline case study (Chapter III)
Popularity of renewable sources	<i>Austria > Bulgaria</i> ; considered in the baseline case study (Chapter III)
Policy tools paying attention to environment friendliness biases	<i>Austria > Bulgaria</i> ; considered in the baseline case study (Chapter III)
Policy tools paying attention to other factors for behavioral biases	<i>Austria ≈ Bulgaria</i> ; considered in the baseline case study (Chapter III)
Public support of renewable energy <u>in research performed already</u>	<i>Austria > Bulgaria</i> ; considered in the baseline case study (Chapter III)
Public support of renewable energy <u>given certain regulative measures</u>	<i>Austria ≈ Bulgaria</i> ; more details given in the empirical analysis (Chapter IV)

Source: Compiled from the research and analysis in Chapter III and Chapter IV

3.4. CHALLENGES TO OVERCOME ON THE EUROPEAN SCENE

As mentioned above, both Austria and Bulgaria faced the issues of large demand and technology capacities with difficulties to accommodate it. Yet, the analysis on legislation in these countries reveals that Austria has gradually found the way towards increasing this capacity (Winkel et al. 2011).

The EU has published comprehensive reports on the stage to which national and EU regulations have achieved the ultimate 2020 target. Of course, the assessment also includes the challenges that have arisen along the process and a lot can be learned from the analysis made by the EC Road Map (2007) with regard to the failure to meet the previous 2010 target related to renewable energy.

The EU analysis of the problems is very well systemized in the Road Map (2007) where it is stated that one potential hindrance to success is the relatively high cost of renewable energy together with the ignored cost of externalities - the latter being partially referred to the lack of proper attention on the externalities caused by the rest of the energy sources to the environment (Road Map 2007).

Another issue that the Road Map (2007) listed as problematic can be included in the group of regulative tools as it concerns the insufficient administrative coordination in the actual development of renewable energy facilities. Moreover, there has been indication of “inadequate information” being disclosed to the different actors in the process, including consumers (Road Map 2007). These findings serve as a lesson to regulators who could consider them in order to improve the communication practice and thus send a positive signal to the public.

IV. EMPIRICAL ANALYSIS

4.1. METHODOLOGY

4.1.1. Survey

The public's willingness to pay for renewable energy is a topic of interest in the academic world and it is often approached through survey tools. Kriström (2009), for example, is thus able to analyze the behavioral aspects that refer to environmental and economic matters as part of his research.

The present empirical work builds upon the reliable findings of Stefanov et al. (2011). Yet, it comprises mainly two countries – Austria and Bulgaria, as well as various aspects of behavioral attitudes in addition to the presence of the renewable energy source option. This is an issue that well deserves attention especially now when the technologies and competition speed up, bringing prices of renewable energy down and gradually melting the differences with the costs of other sources of energy. Such a convergence could slightly diminish the importance of price gaps between sources and leave space for other factors from the personality of consumers to step in and appear as important which is to be explored through the empirical study.

I elaborate the analysis by means of opinion poll with more insights and empirical contributions to the assertions made in the hypotheses. I focus on a few of the aforementioned biases because I aim at obtaining additional empirical data on them specifically and later supplementing its results to the already available broader theoretical and empirical research. The results could be the basis for the development of a more extensive experimental research if further empirical data is needed on behavior.

My main concern is not related to redistributional issues because it has already been shown by Stefanov et al. (2011) that the people with lower income are more reluctant to pay for renewable energy. The variables which I take into account are connected to behavioral traits rather than monetary dimensions.

The solution to the issue of obeying and approving the rules might be namely associated with the individual's clear understanding of why and how the regulation is enacted and applied (NCC 2008). As I emphasize in the main hypothesis, in order to accomplish a balanced situation the regulator ought to study thoroughly this very same understanding of the person as a starting point

and in accordance with NCC (2008). This implies the conduct of research which is directly related to people's actions.

The active discussion of behaviors and bounded rationality makes it apparent that some of the most appropriate sources of primary data in support of my research appear to be the survey or the experiment (Berg 2003). I decided to seek distinction in behaviors by asking the participants explicit questions about their preferences and course of action in an online survey. The reasons behind choosing the particular method of a Likert scale (Bertram 2007) refer to the research on extremity aversion in Section 2.4. above. I prefer to include 5 points of selection, namely: strongly agree (1), agree (2), neutral (3), disagree (4), strongly disagree (5), in line with the examples given by Bertram (2007). My motivation for designing an odd number of selection options is that this way there is "symmetry" and I avoid inducing the respondents to be compelled towards one extremity more than the other, known as "forced choice" (Bertram 2007).

The survey is presented bilingually in English and Bulgarian. It is structured in two main parts. The first part concerns a few environmental matters in principle and it seeks to provide me with data on the level to which respondents care about environment and the regulation in this respect. Then two control questions follow. They are both displayed on a separate screen in order to guarantee that respondents are not influenced by the next questions. The second main part is the core element of the research. People are provided with a basic situation and then only one condition in the form of additional information gets modified in each paragraph in order to "measure" the behavioral bias they might exhibit. Details on the specific design of the survey are provided in the Appendix.

The beginning of the questions in the second part is analogical (e.g. the sentences start with "I am willing to pay..." instead of some being formulated as "I am not willing to pay...") because this is important for the positive reaction on behalf of respondents. The purpose is for them to be presented with clear, detailed and logically structured information. Also, there are indications explicitly stated in the introductory text of the survey concerning approximate duration and confidentiality. This is again for the purpose of gaining respondents' confidence in the reliability of the study and their willingness to fill in the survey as precisely as possible.

With regard to the formulation of the parameters in the questions, I chose the 10% increase in price because it seems appropriate to use as a threshold a percentage which has appeared

important in the results of the Energy Survey (2010), quoted in Stefanov et al. (2011) and discussed in Section 3.1. above. Furthermore, I found it interesting that both Bulgaria and Austria need to increase the portion of renewable sources by 5% as shown in the research of Winkel et al. (2011) so I use this specific amount in the questions as well.

The same sample is considered for all parts of the survey. After obtaining the data, it was imperative to exclude those observations that have missing responses for one or more questions³. This makes it possible to follow the changes in the behavior of all participants along questions when being provided with modifying conditions and different pieces of information.

4.1.2. Testing

The methodology of statistical testing is based on the specifics of the data obtained from the survey. As already mentioned above in this section, the design chosen is a Likert scale and this suggests the implementation of non-parametric tests according to procedures similar to those of Grosse (2006), Moore and McCabe (2005), and Schlag (2012). Moore and McCabe (2005) emphasize that it is possible to use non-parametric tests irrespective of the nature of the population distribution, i.e. there is no prerequisite to assume that the responses are normally distributed. Among all types, I chose the following tests that prove to be most appropriate for the purposes of this research:

- ***Exact Wilcoxon signed-rank test***

Moore and McCabe (2005) point out that the Wilcoxon signed-rank test is specifically used for the cases of matched pairs in one and the same sample. They further define the test statistic being “the sum of the ranks of the positive (or negative) differences when we rank the absolute values of the differences” (Moore and McCabe 2005, Ch.15, p.24). Another suggestion is to consider the exact distribution of the test statistic especially in the case of samples that are not large (Moore and McCabe 2005). That is why the exact versions of the tests are implemented.

In the context of this analysis, the Wilcoxon signed-rank test is applied to compare the distribution of the responses of one question to the distribution of another question. The selection of comparisons is according to pre-specified criteria which depend on the characteristics of the information provided in both questions and the bias which could invoke differences between

³ An exception is the last question from the survey illustrated on Figure 22 because it is not included in the testing procedures and there is no necessity for it to comprise the whole sample.

them. The various situations are explained further in Section 4.3. As indicated already, the test is based on matched pairs and thus facilitates the possibility to ascertain the changes in responses of the same persons from one question to the other. Given that the two-sided test is applied, it could provide insights merely on the presence of significant differences without specifying their nature and whether subjects switched in the direction of “strongly agree” or the opposite, i.e. it is an indication of a “systematic change” (Moore and McCabe 2005, Ch.15, p.24). This makes it necessary to continue the analysis by implementing the next type of test.

- ***Exact Binomial test***

Schlag (2012) systemizes the situations in which the binomial test appears useful and one of them refers to comparing the probability of success in a sample where all paired data observations are independent. By converting the Likert-scaled data into binomial data, it is possible to test for differences in the number of successes according to the hypothesis to be tested. This way I would be able to ascertain the direction into which responses change.

- ***Exact Mann-Whitney-Wilcoxon test***

The Mann-Whitney-Wilcoxon test is relevant when considering two samples with independent observations (Moore and McCabe 2005). The test statistic can be defined as “the sum of the ranks of one of the samples” (Moore and McCabe 2005, Ch.15, p.14). This test enables the comparison of the samples consisting of Austrian and Bulgarian residents respectively. It can provide important insights on the differences in the answers given to the same question by both groups of respondents.

The tests are performed by using the statistical software R. More details on the actual testing procedures are given in Section 4.4.

4.2. SUMMARY STATISTICS

The first step would be to get a grasp of the type of data obtained. Missing observations are taken out in order to enable the further testing procedure which is based on matched pairs. That is how I have a total sample size of 101 observations available for further research. The table below provides a data summary with respect to three groups – age, gender and country of residence.

Table 3: Summary Statistics by Main Groups

Age Groups			Gender		Country of Residence		
20 – 30	31 – 45	46 – 60	Female	Male	Austria	Bulgaria	Other
84	13	4	56	45	20	64	17
83,17%	12,87%	3,96%	55,45%	44,55%	19,80%	63,37%	16,83%
Total number of observations: 101							

One characteristic of the sample is that it mostly comprises relatively young people – 83,17% of the people are in the age group of 20 – 30 years, 12,87% are in the age group of 31 – 45 years, and 3,96% are in the age group of 46 – 60 years.

Regarding gender classification, the data shows a slightly higher portion of female responses compared to male responses. Approximately 55,45% of all participants are women which is not a large difference compared to the remaining 44,55% of men.

The third group on Table 3 refers to the relevant country of residence. The reason for being interested namely in the residence place instead of choosing the nationality as a criterion is that people living in the given country are subjects to the electricity supply regulations of this country irrespective of their nationality. Most of the subjects are residents of Austria and Bulgaria who account for 19,80% and 63,37% respectively. There are people who live in other countries as well. They are summarized under the sub-group called “Other” which accounts for 16,83% of total responses.

Pursuant to the above summary statistics, it is important to make a remark that the data bears certain deficiencies. First, the age structure consists of a larger portion of observations of relatively young ages. The strength of conclusions would be reduced by concentrating on the age groups of 20 – 30 and 31 – 45, whereas at this stage it would not be possible to draw conclusions on other age groups like retired persons, for example. Second, when analyzing the samples with regard to the country of residence, dropping all the observations residing in areas different from Austria and Bulgaria would narrow down the number of observations that can be used. Therefore, the following analysis is performed under the restrictions of the available data and one should be aware that the use of another, more comprehensive sample might lead to different or more comprehensive results.

4.3. FINDINGS

The following bar charts illustrate the participants' responses to those questions in the online survey that provide data eligible for further analysis⁴. Percentages are rounded to the second decimal place.

4.3.1. Regarding the Attitude towards Environment (Part I)

Figure 7: News about the Environment

I regularly follow the news and the current information concerning environmental issues.

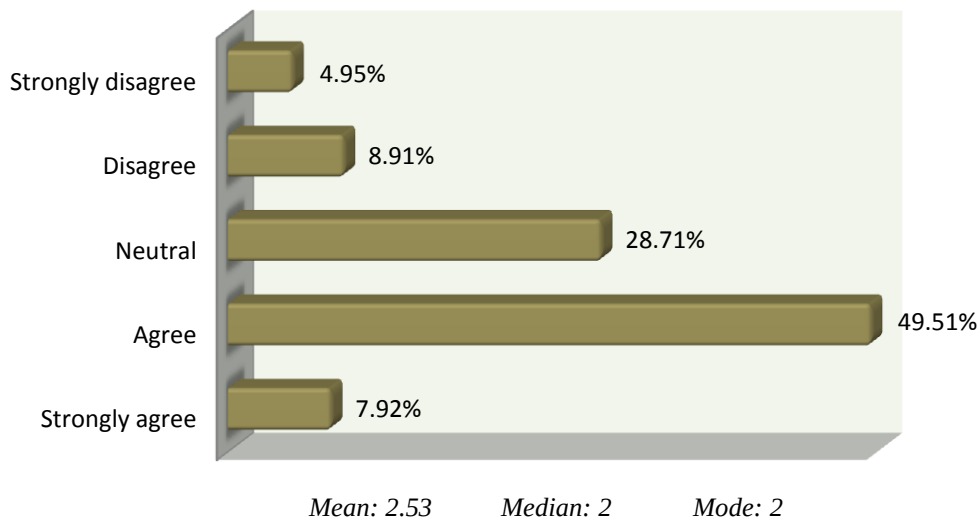
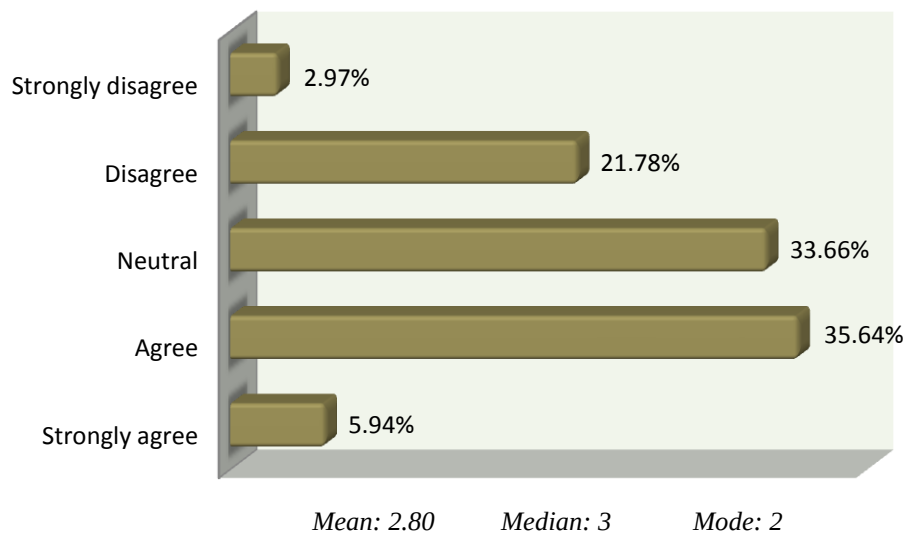


Figure 8: Awareness of the Rules on Environmental Matters

I am familiar with the rules, laws and regulation on environmental protection.



⁴ Two of the questions are excluded from the analysis due to technical issues in their text formulation. Still, they are included in the Appendix for reference.

Figure 9: Environmental Protection without Explicit Requirement

I am willing to undertake actions to protect the environment even when I am not explicitly required to do so by the government or other institutions.

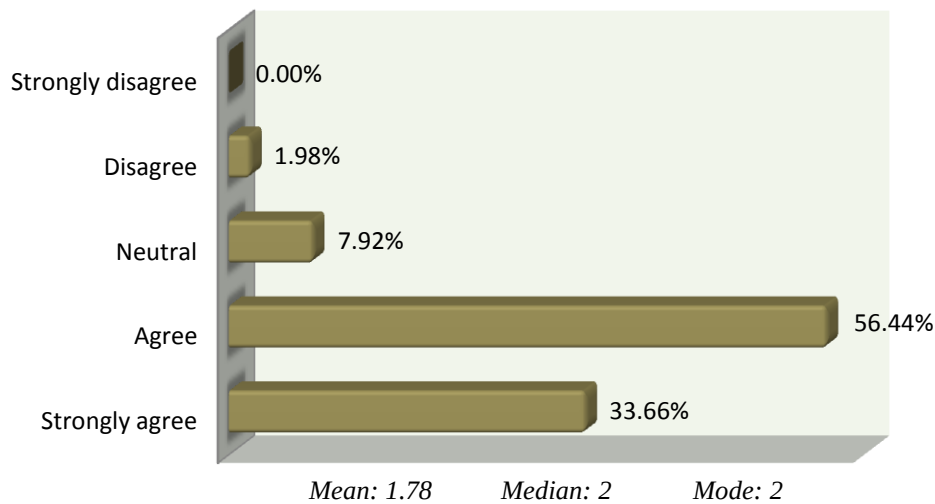


Figure 10: Environmental Protection with Explicit Requirement

I am willing to undertake actions to protect the environment only when I am explicitly required to do so by the government or other institutions.

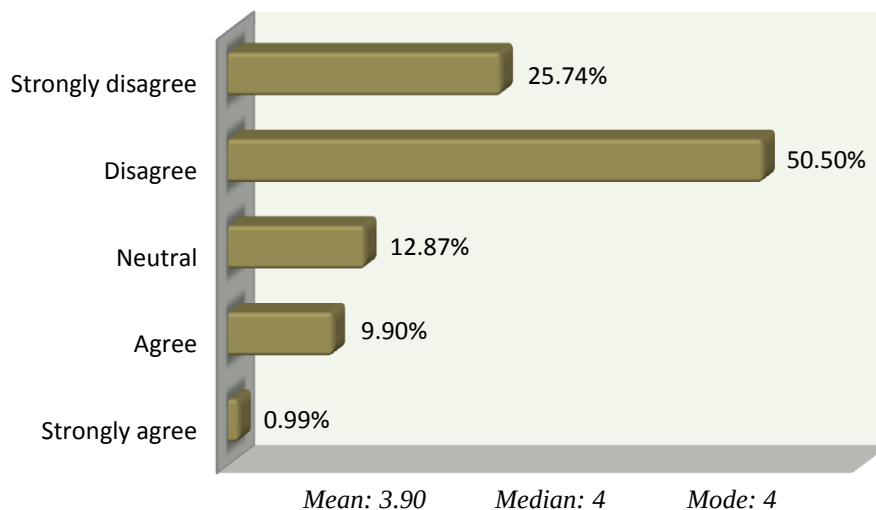
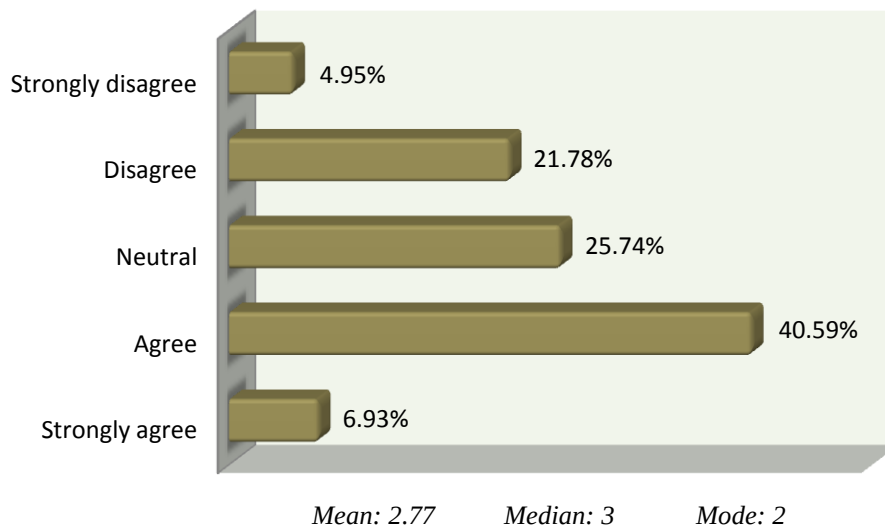


Figure 11: Environmental Protection with Budget Constraint

I am willing to protect the environment as long as this does not significantly harm my budget.



The queries in this part seek to determine the overall disposition of respondents to environment and the matters of its protection in their daily life. Some of the questions tackle the concept of rationality (i.e. those depicted in Figure 10 and Figure 11), in the sense that they concern subjects' welfare as well. The rest (i.e. those in Figure 7, Figure 8 and Figure 9) may be supplementary to the explanation for the arousal of a few biases discussed already in Section 2.4.

Figure 7 is an indication that more than half of the people being analyzed responded positively (49,51% agree and 7,92% strongly agree) and they show interest in the developments regarding environmental protection. The positive replies illustrated on Figure 8 are a relatively smaller portion (35,64% agree and 5,94% strongly agree), revealing that these people consider themselves informed about the legislative frameworks on environmental matters. It is important to note, however, that 33,66% are neutral, giving signs that there might have points for communication improvements between them and the regulative institutions. Figure 9 displays some very impressive results. Slightly over 90% of the respondents (56,44% agree and 33,66% strongly agree) are voluntarily going to engage in activities related to environmental protection without being compelled to do so. None of the respondents strongly disagreed with this statement. The next question in Figure 10 is quite similar and it examines again the attitude

towards rules being imposed in contrast to the voluntary action. Logically, more than 75% (50,50% disagree and 25,74% strongly disagree) responded that they would not protect the environment only when they are required and when they are facing legislative consequences for non-compliance but also upon their own discretion. Only 0,99% would agree to such a statement.

The ultimate preference of consumers in favor of environment is studied in the question with responses summarized in Figure 11 because a “strongly disagree” answer would imply that the consumer is willing to act in the direction of keeping the environment unharmed no matter the magnitude of the costs incurred to income. The results show that there is a considerable number of people (40,59% agree and 6,93% strongly agree) who are concerned about the effect of such actions on their income. Yet, it is surprising to ascertain that more than 26% in total (21,78% disagree and 4,95% strongly disagree) tend to disprove this statement.

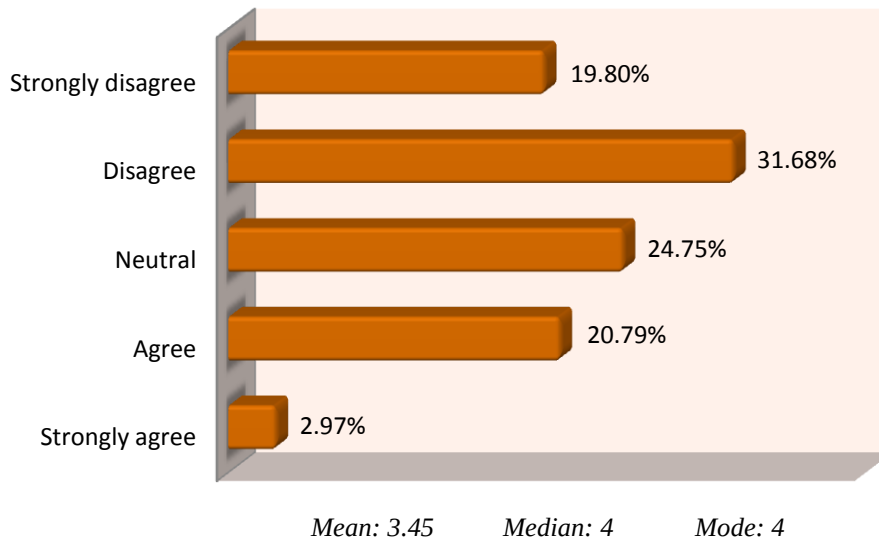
This stage of the research provides a few important insights on respondents’ expected behavior. First, it becomes evident that people do care about environmental matters and therefore it is worthwhile to examine and test for the *environmental care and friendliness bias*. Second, it should be kept in mind that such a bias would often not be exhibited unconditionally, i.e. we could expect that respondents are willing to act in favor of environment but still they might have certain considerations about budget limitations.

The next step is to present the statistical analysis of the control questions, the second part of the survey, and the comparisons of the replies in order to draw conclusions on the existence of behavioral biases.

4.3.2. Regarding the Control Questions

Figure 12: Willingness to Pay for Electricity (Control Question 1)

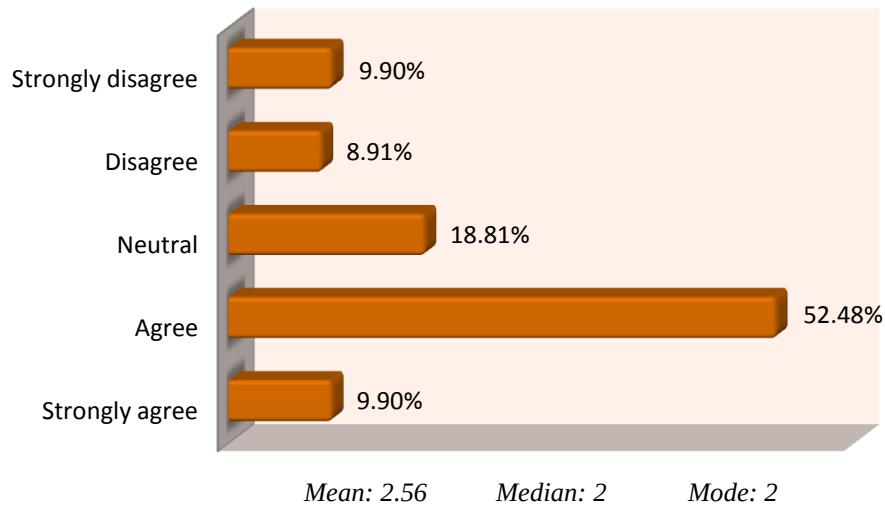
I am willing to pay additional 10% per kilowatt hour (kWh) to my current electricity bill for the same level of consumption.



The above is a control question which examines the consumers' attitude towards the option of paying more without being provided with any further information that could evoke a behavioral bias. Such a setting implying rational behavior is necessary in order to be able to compare these answers to the situations where there is additional information. Logically, the responses lean more to the negative answers, with the highest portion of 31,68% being for those who disagree followed by the neutral responses accounting for 24,75%. Even though in general this question is met with scepticism, it is important to point out that there is no strict threshold between willing and unwilling people, since more than 20% of the people (20,79% agree and 2,97% strongly agree) would accept to pay additionally. Therefore, the comparisons across questions will be made based on statistical tests verifying the significance of the differences and the development of personal decisions with the provision of different pieces of information.

Figure 13: Willingness to Pay for Electricity from Renewable Energy (Control Question 2)

I am willing to pay additional 10% per kilowatt hour (kWh) to my current electricity bill for the same level of consumption in order to have a 5% larger portion produced by renewable sources.



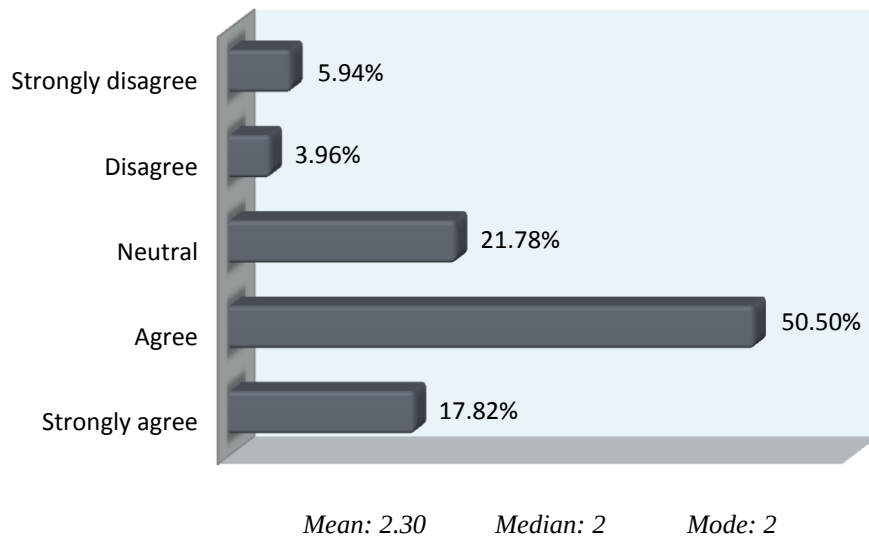
This is another control question providing a bit more information to respondents by introducing the renewable energy sources. The inclusion of this condition already leads to quite a lot positive responses, i.e. 52,48% agree and 9,90% strongly agree. Nonetheless, it is still unable to provide evidence on the specific reasons and incentives that guide the consumers towards such a decision. We can see the final result but it is not clear what specifically drives this choice. The effect should be decomposed and namely that is attempted hereinafter.

Each of the following set of questions contains an additional piece of information which might change the behavior of consumers and make them more inclined to pay a higher price for electricity. The next sub-section presents the responses and how they are reallocated as a result of the different settings of the questions. The extent to which these differences are statistically significant is a matter of hypothesis testing which is established later on.

4.3.3. Regarding the Additional Questions (Part II)

Figure 14: Tax Relief

I am willing to pay additional 10% per kilowatt hour (kWh) to my current electricity bill for the same level of consumption and thus have a 5% larger portion produced by renewable sources, as long as I am provided with a tax relief (Note: Assume that the amount of this tax relief is lower than the 10% increase mentioned above).

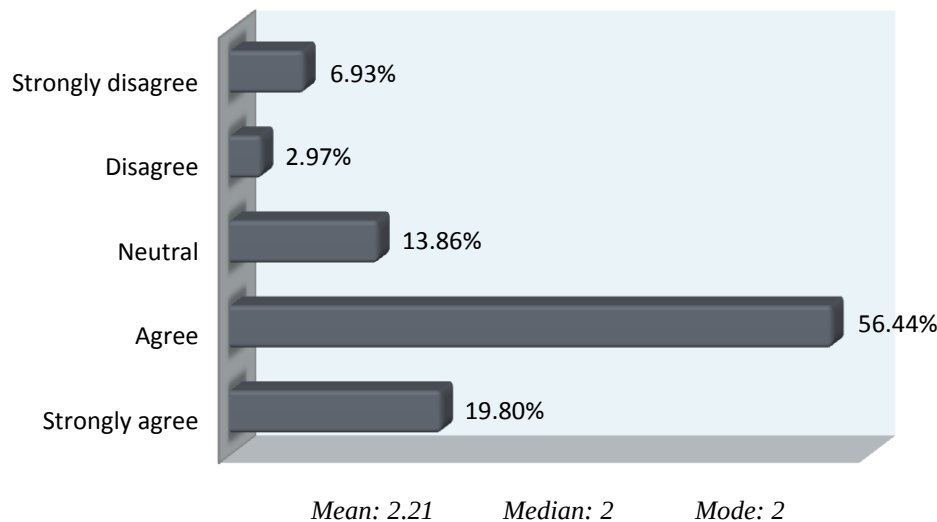


The current question examines a mechanism which can be qualified as a market-based method similar to the examples in Figure 3 since it is related to the terms of preferential tax rates as an incentive to conform to a specific policy. The question itself might be considered as a bit more difficult to comprehend. Still, there is no tendency for participants to skip answering it when compared to the number of other responses from this part of the survey.

The behavioral effect would be *loss aversion* since the reduction in taxes might be perceived as a gain and leave a favorable impression in consumers despite the higher price to be paid for electricity. It has already been asserted in Section 2.4. that people are expected to favor an option where they see the gain instead of the threat of a sanction. The answers above show possible signs of this, as approximately 68% of the persons (50,50% agree and 17,82% strongly agree) would pay higher bills for an increased portion of renewable energy.

Figure 15: Subsidy for Energy Efficiency Improvement

I am willing to pay additional 10% per kilowatt hour (kWh) to my current electricity bill for the same level of consumption and thus have a 5% larger portion produced by renewable sources, as long as I am provided with a subsidy for improvement of my household's energy efficiency.

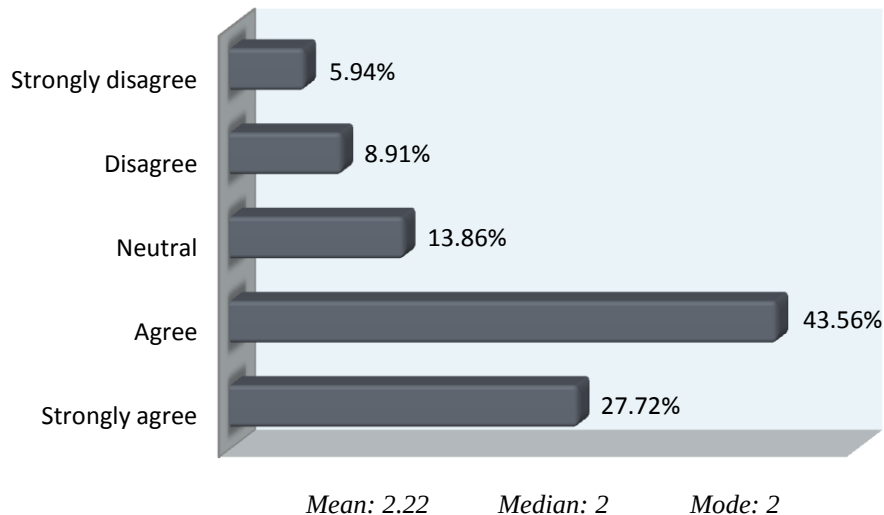


This point once again refers to the concept of *loss aversion* and seeks to analyze if in reality people are more prone to comply when presented with such a scheme (with a perceived gain) compared to the other alternative of paying tax (with a perceived loss). More than 76% of the people answered that they agree (56,44%) or strongly agree (19,80%) to pay additionally, in contrast to 2,97% who disagree, 6,93% who strongly disagree, and 13,86% who remain neutral in this case.

The effect from such a regulative tool might be seen as matching to the one illustrated in Figure 14 but even so the incentives behind choosing an answer might differ in nature – saving money and saving energy, respectively. Another aspect that is worth mentioning here is the probable consideration of energy saving matters and therefore indirectly of care about the environment. Still, since this is a complex and indirect effect, it is assumed of secondary importance in this point.

Figure 16: Information on the Positive Effect of Renewable Energy

I am willing to pay additional 10% per kilowatt hour (kWh) to my current electricity bill for the same level of consumption and thus have a 5% larger portion produced by renewable sources, as long as I am provided with regular and accurate information on the positive contribution of these used renewable energy sources on environment in my area.

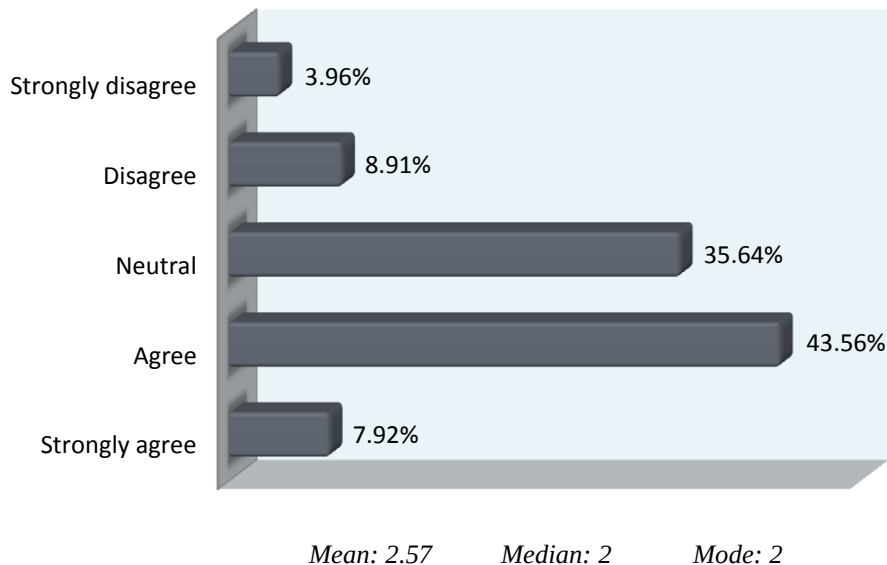


The question considered above may be associated with the preference-based information and norm establishment tool considered earlier in Figure 3. It is directly related to respondents' level of *environmental care and friendliness*. Answering positively would, on the one hand, be perceived as non-conformity to the rationality concept and, on the other hand, as evidence of their strong affiliation with the well-being of the environment. The replies show a relatively strong willingness (43,56% agree and 27,72% strongly agree) to pay more under the condition that people are made familiar with the positive impact that their action entails.

It can be even noticed that the extreme answer of “strongly agree” is preferred by quite a large portion of respondents which is usually not typical for the responses of other questions in this survey and to some extent overcomes the extremity aversion assumption.

Figure 17: Legislation without Fines

I am willing to pay additional 10% per kilowatt hour (kWh) to my current electricity bill for the same level of consumption and thus have a 5% larger portion produced by renewable sources, as long as this is set out by law or by certain standards (Note: Assume that there are no fines if you refuse to do so).

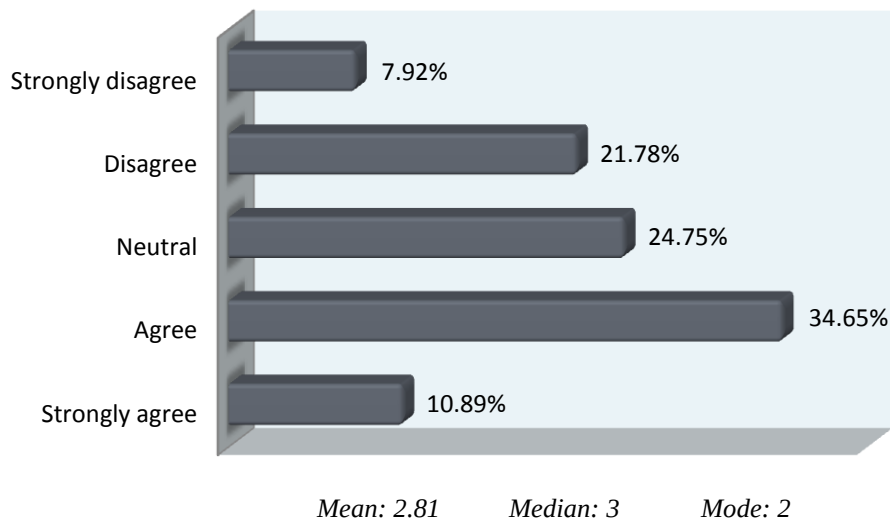


Such a statement can be appropriated to the regulation which sets norms as described in Figure 3. It explores the ability of regulations to tune up with the norms of society and induce people to act in favor of them as suggested by Livermore (2007). The data shows that 43,56% agree and 7,92% strongly agree to comply with such requirements even though they do not get penalized otherwise. Agreeing to this option may be an indication that people do approve such a policy and would like to become integrated in the goals of achieving a higher level of renewable energy use and improving the condition of environment. This is an attempt to ascertain the extent to which people would voluntarily comply with the rules due to *environmental care and friendliness*.

More than 35% are neutral which is a sign that special attention should be placed on the approach of presenting these regulations to society in order to be well understood, communicated and eventually lead to optimal effectiveness.

Figure 18: Legislation with Fines

I am willing to pay additional 10% per kilowatt hour (kWh) to my current electricity bill for the same level of consumption and thus have a 5% larger portion produced by renewable sources, as long as this is set out by the law or by certain standards and I get fined if I refuse to do so (Note: Assume that the fine is higher than the amount equivalent to the 10% mentioned above).

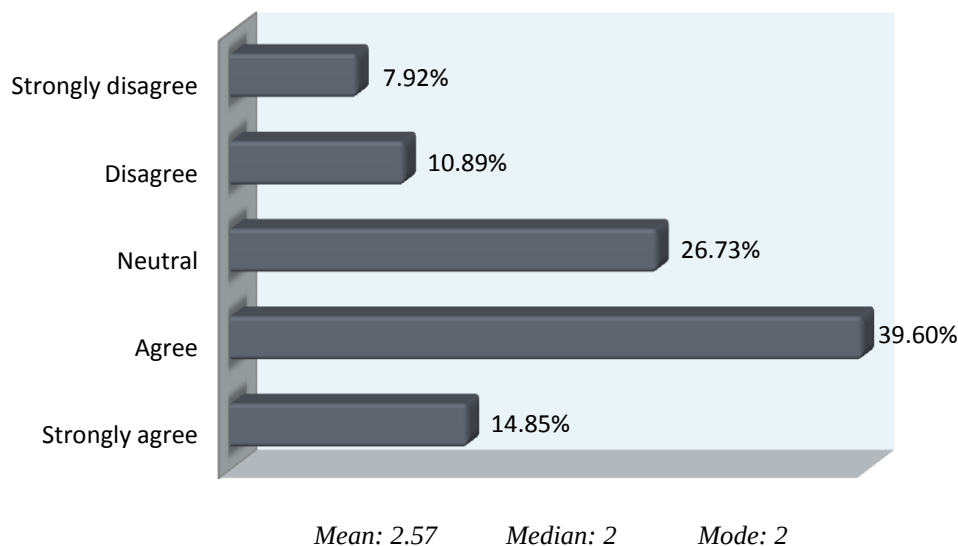


This is a direct reference to the command-and-control type in Figure 3. It would be the rational choice to comply with the rules set out by the regulative body. Nearly half of the respondents would agree or strongly agree (34,65% and 10,89% respectively). Once again, a considerably large portion is neutral (24,75%), whereas 21,78% disagree and 7,92% strongly disagree. However, a key issue here is that subjects might answer that they are willing to pay just because they are *compelled* and not because they are actually *willing*. This is a question that appears relevant for the cases where there is no convenient or possible alternative to switch to a different provider and consumers must comply with the rules of the one they are already subscribed with. The fine or the sanction can be perceived in the form of interest on delayed monthly payments or litigation costs, for example.

Still, it would be interesting to make a comparison with the situations of a tax relief (Figure 14) or a subsidy (Figure 15) in order to explore the possibility for *loss aversion* to arise. On the other hand, comparing this Figure 18 to the identical situation but without a fine (Figure 17) could lead to conclusions on the level of *environmental care and friendliness*. These differences are tested later on and the results are illustrated in Table 5 and Table 8 from Section 4.4.

Figure 19: Information on Recent Pollution

I am willing to pay additional 10% per kilowatt hour (kWh) to my current electricity bill for the same level of consumption and thus have a 5% larger portion produced by renewable sources, as a result of becoming acquainted with recent regional or global statistics available on pollution levels.



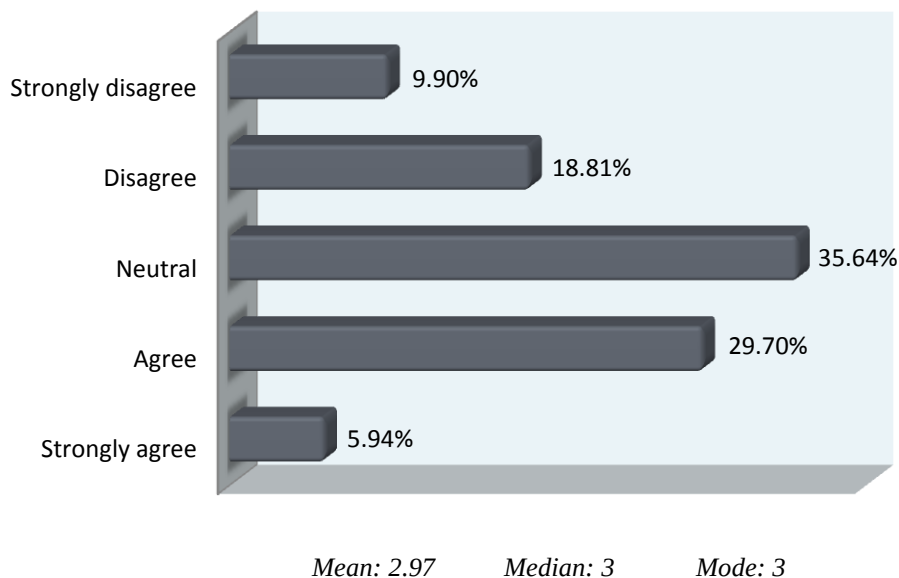
This could be appropriated to the information tools from the class of preference-based regulation as described in Figure 3. Changing actions based on such information alone could be considered as going astray from rational behavior due to arising concerns for environment.

Even though sometimes it would not prove rational, personal consumer behavior might be substantially affected by a recent event. In this case, the relevant bias to consider is the “*pollutant of the month*” heuristics (Sunstein 1997) already discussed in Section 2.4. On the other hand, strong disagreement might be an implication for the bias related to *unrealistic optimism* and *overconfidence*. The actual results indicate that 39,60% agree and 14,85% strongly agree to the statement when people are made aware of data on recent pollution. Therefore, these indicators seem to lean more towards the “pollutant of the month” (Sunstein 1997).

Framing is a bias that can also be tested by comparing the responses of the current question to those of the situation where information on the positive impact is provided (Figure 16). The relevant results are again presented in Table 5 and Table 8 from Section 4.4.

Figure 20: Behavior of Other Consumers

I am willing to pay additional 10% per kilowatt hour (kWh) to my current electricity bill for the same level of consumption and thus have a 5% larger portion produced by renewable sources, because I notice that other people around me switch to such type of electricity supply scheme as well.

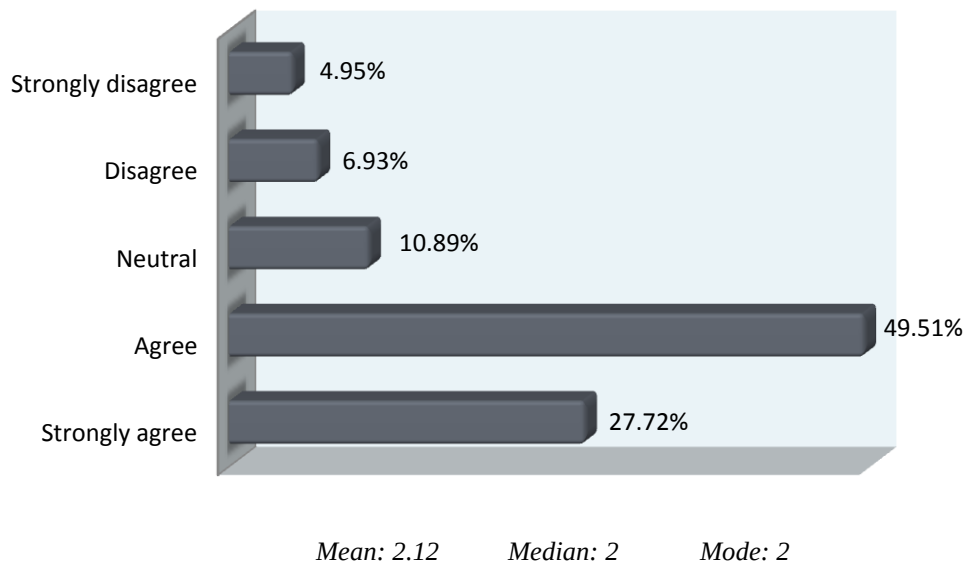


This point examines the level to which the behavior of friends, neighbors or people met in daily life matters for the determination of own actions. Of course, the effect of this bias could be owing to the significance of *social norms* mentioned in Section 2.4. or *herding* in the sense of “everyone doing what everyone else is doing, even when their private information suggests doing something quite different” (Banerjee 1992, p.798). Nonetheless, the responses do not strongly suggest such type of behavior, at least when considering the figure above. Indeed, according to the data, a sum of 35,64% agree or strongly agree (29,70% and 5,94% respectively) but interestingly it is the same portion as those who give neutral responses. Out of all responses considered, 18,81% disagree and 9,90% strongly disagree.

A probable reason for such an outcome could be the topic of the question. There might have a campaign revealing summarized results on how many people have started using a new electricity plan similar to the implications of Houde and Todd (2011) but, on the individual level, this information need not be announced to the public and personal choices may be kept confidential.

Figure 21: Transfer to an Environmental Account

I am willing to pay additional 10% per kilowatt hour (kWh) to my current electricity bill for the same level of consumption and thus have a 5% larger portion produced by renewable sources, if I know that this specific amount of 10% is transferred to a special account used by the regulator for environmental matters.

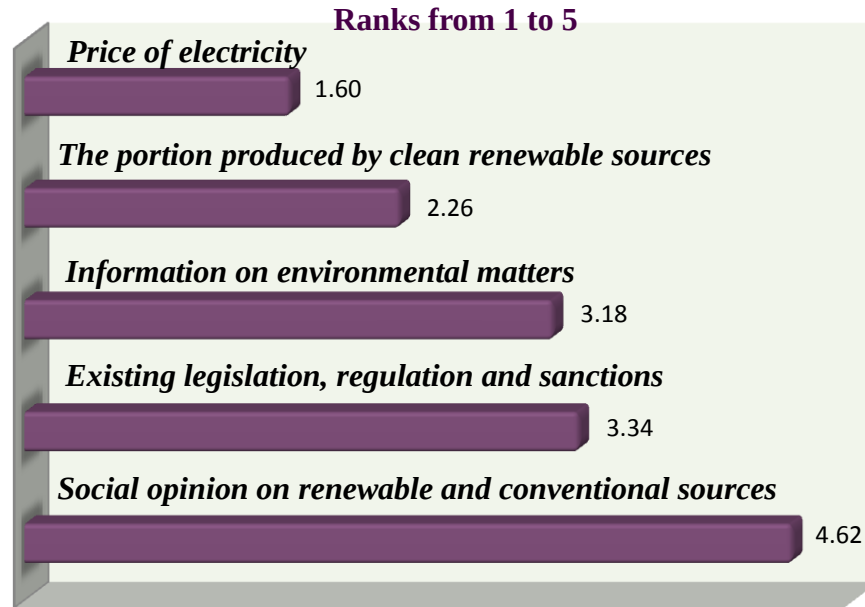


This is a question explicitly exploring the existence of *mental accounting* as an explanation for the possible lack of purely rational behavior. It also exhibits the trust that respondents would be placing in the regulative body performing this type of policy.

It is an important approach to further consider as the majority of the respondents agree (49,51%) or strongly agree (27,72%) to the proposed payment plan under the condition that they know these funds are utilized for environmental purposes and this activity can be certified by the existing account. Considering the sample, a smaller portion of 6,93% disagree and 4,95% strongly disagree, whereas 10,89% are neutral. Such a policy would be an indication of the relevant institution's readiness to engage in these activities and be accountable in front of consumers.

The following figure refers to the final request in the survey and it shows how people rank the main elements to be considered in a policy:

Figure 22: Ranking of Policy Elements by Importance



As described in the Survey (shown in the Appendix), placing a row to be on the first position stands for the “most important”, whereas placing a row to be on the last fifth position stands for the “least important.” Figure 22 is based on the mean value of the replies which are given for each category. Therefore, the closer the mean value is to 1, the more respondents ranked this element as being the most important. It should be noted that fewer people from the sample assigned ranks – 77 out of 101 participants. Also, possible technical difficulties in performing the ranking might have arisen so this data can be used just to obtain an indicative idea of the ranking. According to the replies available, it is not a surprise that price is still a very crucial element and stands on the top of the ranking, followed by the portion of renewable energy, information on environment, very closely followed by legislation, and then social opinion. It appears interesting that the availability of information is considered almost as important as legislation which sometimes also involves monetary considerations in the form of sanctions or penalties. This confirms the assertion that providing more comprehensive information might influence consumer behavior as well. Another noteworthy observation is that personal choice is not so much affected by the other members of society when it comes to electricity payment schemes.

It is obvious that the price does matter to consumers and still, considering the previous responses, it can be conjectured that a slight portion of price increase might be justified and actually approved given that the proper policy is applied and the information is provided transparently. Furthermore, based on the biases exhibited in the settings presented in the survey, agreeing to the new electricity plan could be appropriated to behavioral aspects.

4.4. HYPOTHESIS TESTING OF THE BEHAVIORAL BIASES

4.4.1. Testing the Difference in the Distributions of Responses

Hypothesis testing is necessary in order to confirm the above-mentioned considerations, i.e. to attempt to reject the null hypotheses of identical distributions. The Wilcoxon signed-rank test is used to compare the distributions of matched pairs between two Likert responses and to check if there is a significant difference between the distributions (e.g. Grosse 2006; Moore and McCabe 2005). I formulate null hypotheses which have the following general form $H_0: P(\text{Response1}) \equiv P(\text{Response2})^5$ similar to the examples indicated by Schlag (2012). This is a two-sided test for matched pairs of dependent samples so rejecting the null would only imply that there is a difference in the distributions to be considered (Schlag 2012). Below are presented the relevant outputs from the hypothesis testing procedure by indicating some of the biases and the types of regulation already discussed in Figure 3:

Table 4: Control Question 1 Compared to Questions with Additional Information
(Exact Wilcoxon Signed-Rank Test)

Responses tested	Expected bias or bounded rationality	Relevant regulative tool	Test statistic	P-value	Sign.
$H_0: P(R12) \equiv P(R13)$	Ambiguous (composite effect)	Ambiguous	$V = 1682$	$8.237 \cdot 10^{-10}$ ($< .001$)	***
$H_0: P(R12) \equiv P(R14)$	Bounded rationality	Market-based	$V = 2989$	$2.190 \cdot 10^{-11}$ ($< .001$)	***
$H_0: P(R12) \equiv P(R15)$	Bounded rationality	Market-based	$V = 3120$	$2.734 \cdot 10^{-11}$ ($< .001$)	***
$H_0: P(R12) \equiv P(R16)$	Environmental friendliness	Preference-based (Information)	$V = 2851$	$2.987 \cdot 10^{-12}$ ($< .001$)	***
$H_0: P(R12) \equiv P(R17)$	Environmental friendliness	Preference-based (Norms)	$V = 2258.5$	$1.050 \cdot 10^{-9}$ ($< .001$)	***
$H_0: P(R12) \equiv P(R18)$	Bounded Rationality	Command-and-control	$V = 2006.5$	$7.296 \cdot 10^{-5}$ ($< .001$)	***
$H_0: P(R12) \equiv P(R19)$	Pollutant of the month vs. Overconfidence	Preference-based (Information)	$V = 2367$	$1.071 \cdot 10^{-8}$ ($< .001$)	***
$H_0: P(R12) \equiv P(R20)$	Social norms bias	Preference-based (Norms)	$V = 1660$	$6.627 \cdot 10^{-5}$ ($< .001$)	***
$H_0: P(R12) \equiv P(R21)$	Mental accounting	Preference-based (Norms)	$V = 3138$	$1.633 \cdot 10^{-12}$ ($< .001$)	***

⁵Abbreviations analogous to $P(R1) \equiv P(R2)$ will be used where “P” stands for “Probability”, “R” stands for “Response,” and the numbers correspond to the figure on which the relevant response is illustrated.

More supporting evidence on existing biases can be obtained by performing the same test for other pairs of responses. The criteria used for selecting these particular pairs are related to the logical expectation of changes in behavior depending on different regulative tools put in place. Further details on the rationale behind choosing the pairs are also presented in Section 4.3.

*Table 5: Comparisons across Questions with Additional Information
(Exact Wilcoxon Signed-Rank Test)*

Responses tested	Expected bias or bounded rationality	Relevant regulative tool	Test statistic	P-value	Sign.
$H_0: P(R14) \equiv P(R18)$	Loss aversion	Market-based vs. Command-and-control	$V = 236$	$7.525 \cdot 10^{-5}$ ($< .001$)	***
$H_0: P(R15) \equiv P(R18)$	Loss aversion	Market-based vs. Command-and-control	$V = 220.5$	$2.457 \cdot 10^{-5}$ ($< .001$)	***
$H_0: P(R17) \equiv P(R18)$	Bounded rationality / Environmental friendliness	Preference-based (Norms) vs. Command-and-control	$V = 597$	$6.140 \cdot 10^{-2}$ ($< .1$)	*
$H_0: P(R16) \equiv P(R19)$	Framing effect	Preference-based (Information)	$V = 224$	$1.447 \cdot 10^{-4}$ ($< .001$)	***

Table 4 and Table 5 indicate a strong significance in all of the instances listed except for the comparison between R17 and R18. Hence, there is sufficient statistical evidence to state that the respective distributions are significantly different at the 5% level (and even on the 1% level). The difference in the distributions of R17 and R18 is significant only at the 10% level.

Nonetheless, this test does not tell more about the specifics of these differences and it is necessary to continue the analysis in order to draw conclusions on the direction. For this purpose, the data is processed in a way to enable the performance of binomial tests.

The first step in this regard is to consider each subject's pair of responses for two questions. All the answers are denoted from 1 (strongly agree) to 5 (strongly disagree). The following transformations follow a procedure suggested by Schlag (2012) in order to facilitate the implementation of the exact binomial test. An indicative example clarifying the procedure is given below:

Table 6: Example of the Transformation into Binomial Data

	R12	R13	1 if success for R13, 0 if no success for R13
Subject 1	2	3	0
Subject 2	4	3	1
Subject 3	5	5	Deleted
$H_0: P(\text{success for R13}) \leq P(\text{success for R12})^6$			

Successful and unsuccessful responses are coded with 1 and 0. Then they are counted separately in order to be able to formulate the null hypothesis. The rejection of the null hypothesis means that the probability of success in favor of R13 is strictly higher than the probability of success for R12. Interpreted in the context of the questions where numbers closer to 1 stand for agreement to pay, it could be stated that there is significant evidence of exhibiting the behavioral bias expressed in a higher willingness to pay in R13 than in R12. When the observations are transformed into binary data according to the steps provided by Schlag (2012) it is possible to proceed to testing. The results from the matched-pair testing procedure are presented in the table:

Table 7: Control Question 1 Compared to Questions with Additional Information
(Exact Binomial Test)

Responses tested	No. of successes	No. of trials	P-value	Sign.	P(success) "greater"
$H_0: P(\text{success R13}) \leq P(\text{success R12})$	56	59	$5.947 \cdot 10^{-14}$ ($< .001$)	***	0.95
$H_0: P(\text{success R14}) \leq P(\text{success R12})$	72	80	$2.688 \cdot 10^{-14}$ ($< .001$)	***	0.90
$H_0: P(\text{success R15}) \leq P(\text{success R12})$	75	82	$8.646 \cdot 10^{-16}$ ($< .001$)	***	0.91
$H_0: P(\text{success R16}) \leq P(\text{success R12})$	72	77	$< 2.2 \cdot 10^{-16}$ ($< .001$)	***	0.94
$H_0: P(\text{success R17}) \leq P(\text{success R12})$	60	70	$4.002 \cdot 10^{-10}$ ($< .001$)	***	0.86
$H_0: P(\text{success R18}) \leq P(\text{success R12})$	54	72	$1.284 \cdot 10^{-5}$ ($< .001$)	***	0.75
$H_0: P(\text{success R19}) \leq P(\text{success R12})$	63	73	$7.768 \cdot 10^{-11}$ ($< .001$)	***	0.86
$H_0: P(\text{success R20}) \leq P(\text{success R12})$	53	65	$1.393 \cdot 10^{-7}$ ($< .001$)	***	0.82
$H_0: P(\text{success R21}) \leq P(\text{success R12})$	76	81	$< 2.2 \cdot 10^{-16}$ ($< .001$)	***	0.94

⁶ $P(\text{success for R12})$ is logically equivalent to $P(\text{no success for R13})$. Therefore, in terms of coding, the same null hypothesis can be presented as $H_0: P(1) \leq P(0)$.

The significance of the results in Table 7 confirms the presence of the biases listed in the second column of Table 4 because the number of successes, i.e. the number of answers leaning towards a higher willingness to pay, is larger for the questions where some additional information evoking biases is provided. Therefore, the data supports the hypotheses of existing behavioral biases which are as follows: *environmental care and friendliness bias*, “*pollutant of the month*” bias (Sunstein 1997), *social norms bias* and *mental accounting bias*. This means that people are willing to pay more for renewable energy when being subjects to the policies appealing namely to the above-mentioned behavioral considerations. Furthermore, it is confirmed that people might act under the assumptions of bounded rationality.

Turning back to the additional pairs of responses, it is once again imperative that exact binomial tests be performed between these responses analogical to the previous paragraphs:

Table 8: Comparisons across Questions with Additional Information (Exact Binomial Test)

Responses tested	No. of successes	No. of trials	P-value	Sign.	P(success) “greater”
$H_0: P(\text{success R14}) \leq P(\text{success R18})$	40	49	$4.632 \cdot 10^{-6}$ ($< .001$)	***	0.82
$H_0: P(\text{success R15}) \leq P(\text{success R18})$	44	51	$6.058 \cdot 10^{-8}$ ($< .001$)	***	0.86
$H_0: P(\text{success R17}) \leq P(\text{success R18})$	34	57	$9.243 \cdot 10^{-2}$ ($< .1$)	*	0.60
$H_0: P(\text{success R16}) \leq P(\text{success R19})$	37	46	$2.028 \cdot 10^{-5}$ ($< .001$)	***	0.80

The results in Table 8 indicate significant evidence at the 1% level of people being influenced by the *loss aversion* in two situations and *framing effect* in one situation as listed in the second column of Table 5. The evidence on loss aversion implies that people are willing to pay more when being presented the options of a tax relief (R14) or a subsidy (R15), rather than the threat of fines or penalties (R18). Presenting additional information in the context of a positive impact of renewable energy (R16) evokes to a higher extent willingness to pay compared to the negative statistical data on pollution (R19). The evidence on environmental friendliness bias, however, is quite weak (significant only at the 10% level) when analyzing the legislation with and without fines. Such a result is relatively expected because it would be very difficult to ascertain significant differences in the behavior of consumers in favor of legislation without fines compared to legislation with fines. Environmental matters are an important driver during the process of decision taking on whether to pay more but so is the warning of being imposed fines.

4.4.2. Testing the Difference in the Distributions of the Answers to One Question by Using Two Independent Samples (Austria and Bulgaria as a Country of Residence)

A distinction between two samples is made – respondents whose country of residence is Austria and Bulgaria respectively. Then the exact Mann-Whitney-Wilcoxon test is performed in order to compare the distributions within each particular response by using the independent samples of Bulgarian and Austrian residents similar to the suggestions of Schlag (2012). An example of a null hypothesis would then be: $H_0: P(AT1) \equiv P(BG1)$ ⁷. The summarized results indicate no sufficient evidence to state that there are differences in the distributions of the responses given by people residing in Austria and Bulgaria according to the available data:

Table 9: Comparison of Austrian and Bulgarian Samples within One Likert Response (Exact Mann-Whitney-Wilcoxon Test)

Responses tested	Test statistic	P-value	Sign.
$H_0: P(AT12) \equiv P(BG12)$	W = 758.5	0.1995	Cannot reject the H_0
$H_0: P(AT13) \equiv P(BG13)$	W = 529.5	0.2054	Cannot reject the H_0
$H_0: P(AT14) \equiv P(BG14)$	W = 533	0.2234	Cannot reject the H_0
$H_0: P(AT15) \equiv P(BG15)$	W = 521	0.1630	Cannot reject the H_0
$H_0: P(AT16) \equiv P(BG16)$	W = 570	0.4385	Cannot reject the H_0
$H_0: P(AT17) \equiv P(BG17)$	W = 494	0.1000	Cannot reject the H_0
$H_0: P(AT18) \equiv P(BG18)$	W = 589	0.5786	Cannot reject the H_0
$H_0: P(AT19) \equiv P(BG19)$	W = 668.5	0.7560	Cannot reject the H_0
$H_0: P(AT20) \equiv P(BG20)$	W = 551.5	0.3348	Cannot reject the H_0
$H_0: P(AT21) \equiv P(BG21)$	W = 482.5	0.0772	*

Therefore, considering these specifics of the data, it is not necessary to proceed with further tests and at this point it is safe to draw conclusions on the overall sample. If a future analysis is concentrated more on either of the samples, one should be cautious about the weakly significant evidence at the 10% level for the existence of differences between residents of Bulgaria and Austria in order to attempt to consider more detailed data exploring the Bulgarian residents' behavior in this respect.

More conclusive results on the country differences could be obtained upon a larger sample, as an extension to the present research work.

⁷ Abbreviations analogous to $P(AT1) \equiv P(BG1)$ will be used where “P” stands for “Probability”, “AT” stands for “Austrian resident,” “BG” stands for “Bulgarian resident,” and the numbers correspond to the figure on which the relevant response is illustrated.

V. CONCLUSIONS AND POLICY CONSIDERATIONS

This paper combines and explores the logical connections of behavioral economic propositions and various renewable energy policies. Throughout the research, it was possible to gain insights on answering the questions posed in the beginning. Below are provided the remarks as a summary of all sections in the attempt to draw conclusions on Hypotheses 2 and 3, then making a more comprehensive conclusion on the main Hypothesis 1.

The review of pronounced literature emphasizes the importance of behavioral economics in environmental regulation. By outlining the numerous behavioral biases, their effects and availability in policies it became clear that Hypothesis 2 does hold with regard to previous theoretical and empirical analyses. Therefore, according to the findings of the current paper, behavioral economics plays an important role and should be considered in policy preparation.

The power of Hypothesis 2 is further confirmed by the analysis of a case study in Chapter III. It shows some indications of considering behavior but mainly with regard to information provision on environment by the regulators in Austria. There is still a relatively low level of elaboration in Bulgaria with plans to improve. Moreover, previous empirical works on both countries are examined. What is observed as a common feature is that they are based on the willingness to pay but without many details on further behavioral characteristics to justify the choice. Also, a large portion of responses is negative, especially in the case of Bulgaria. This part of the paper once again supports the assertion made in Hypothesis 1.

After becoming acquainted with the academic work in existence, I perform an empirical analysis on the basis of an online survey which explores the consumers' willingness to pay for renewable energy mainly in Austria and Bulgaria, as well as the various behavioral aspects in this regard. Based on the data in the first part of the survey, it can be concluded that some respondents exhibit a marked care about environment even though they might not be completely indifferent about the costs which environmental protection could incur. The analysis of the data in the second part is further elaborated by including other types of information. The relevant hypothesis testing shows significant statistical evidence of behavioral biases, especially regarding the following: environmental friendliness, "pollutant of the month" (Sunstein 1997), social norms, mental accounting, framing effect, and loss aversion. These findings correspond to the assertions made in Hypothesis 3, namely that biases would be indeed expected. In addition, the outcomes from an empirical analysis of these biases might be useful for the design of renewable energy

policies. These outcomes can be set in accordance with some of the measures suggested by Houde and Todd (2011) as well as other researchers mentioned in the paper. In summary, the behavior exhibited by the participants directs policy makers towards the following tools to design in the attempt to enhance compliance:

- implementation of additional methodologies along with cost-benefit analysis in order to account for behavior and bounded rationality;
- even further emphasis on the environmental advantages of renewable energy sources and increase of the quantity of transparent information;
- consideration that choices might be affected by environmental effects from the near past;
- social opinion is important so provision of updates on the behavior of the members of society might influence choices;
- the assurance that the additional funds paid are used up for the purposes of a collective environmental purpose might increase trust and willingness to pay;
- the formulation of policies, e.g. framing of environmental information, is important for changing choices;
- aversion to losses should be considered as a possible tendency to react favorably to prospective benefits in the forms of subsidies, refunds or even non-monetary gains.

These are, of course, conclusions drawn from the data. Possible extensions can lead to improvements in the empirical analysis – a more numerous sample comprising a broader range of age groups, inclusion of variables accounting for size of budget, rented or own flats or houses, inclusion of more biases to be considered. As for the comparison between Austria and Bulgaria, it should be noted that the differences in the economic situations and the political changes in Bulgaria are also important.

The overall analysis supports the main hypothesis and indicates that effective regulation could be achieved in the context of this research given that behavioral economics is an integral part of the policy-making process. If applied appropriately and by taking into account supplementary, country-specific political, social, and economic factors, regulators could possibly increase the level of successful implementation. This empirical research, due to the limitations of the current data, cannot be taken as an unconditional policy guideline. The findings are rather an indication of the efforts to narrow down and specify the behavioral biases that mostly need attention so they could be used as an initial point for the further analysis of important policy considerations.

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ABSTRACT (ENGLISH)

The research in this paper is built pursuant to the propositions of behavioral economics in order to contribute to the identification of effective policy instruments in the sphere of renewable energy. After becoming acquainted with the academic work in existence, I perform an empirical analysis on the basis of an online survey which explores the consumers' willingness to pay for renewable energy mainly in Austria and Bulgaria, as well as the various behavioral aspects in this regard.

The relevant hypothesis testing shows significant statistical evidence of behavioral biases, especially regarding the following: environmental friendliness, “pollutant of the month” (Sunstein 1997), social norms, mental accounting, framing effect, and loss aversion. This empirical research, due to the limitations of the current data, cannot be taken as an unconditional policy guideline. The findings are rather an indication of the efforts to narrow down and specify the behavioral biases that mostly need attention so they could be used as an initial point for the further analysis of important policy considerations.

Keywords: behavioral economics, bounded rationality, behavioral biases, renewable energy, regulative tools

ABSTRACT (GERMAN)

Die in der vorliegenden Arbeit durchgeführte Untersuchung wird gemäß den Grundannahmen der Verhaltensökonomie aufgebaut, um zur Identifikation von effektiven Politikinstrumenten im Bereich der erneuerbaren Energie beizutragen. Nach der Durchsichtung vorhandener Forschungsarbeiten wird auf einer Online-Umfrage basierende empirische Analyse durchgeführt, die die Zahlungsbereitschaft für erneuerbare Energie der Verbraucher vor allem in Bulgarien und Österreich sowie verschiedene Verhaltensaspekte in diesem Zusammenhang untersucht.

Die relevanten Hypothesentests zeigen einen signifikanten statistischen Beweis von Verhaltensabweichungen, insbesondere in Bezug auf folgende Einheiten wie Umweltfreundlichkeit, “pollutant of the month” (Sunstein 1997), soziale Normen, mentale Buchführung, Framing-Effekt und Verlustaversion. Aufgrund von Einschränkungen der aktuellen Daten kann diese empirische Untersuchung nicht als uneingeschränkte politische Richtlinie angesehen werden. Die Studienergebnisse sind eher ein Hinweis auf die Bemühungen zur Einschränkung und Spezifizierung der zu berücksichtigenden Verhaltensabweichungen. Demzufolge könnte die vorliegende Untersuchung als Ausgangspunkt für weitere Analysen wichtiger politischer Erwägungen in Betracht genommen werden.

Schlüsselwörter: Verhaltensökonomie, eingeschränkte Rationalität, Verhaltensabweichungen, erneuerbare Energie, regulative Instrumente

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APPENDIX: SURVEY

Welcome to the page of this online survey that concerns a few substantial aspects of environmental regulation.

The survey consists of two main sections. You could obtain further information and instructions from the introductory text in the beginning of each section. After finishing the first section, you will be asked two preliminary questions before proceeding to the second section. Please answer all questions according to your individual views and preferences.

It would take just approximately 10 – 15 minutes for you to complete the survey.

Note: In the beginning you are asked about your name and a few subsidiary questions. Please be informed that your personal details are kept confidential and they will be used only for the exclusive purposes of this study.

Thank you for participating!

Personal details

First name:

Family name:

Age:

Gender: F / M

Nationality: Austria, Bulgaria, other (*please specify*)

Country of residence: Austria, Bulgaria, other (*please specify*)

I. Part – Environment (*new screen*)

In this part I would like to draw your attention to some broad environmental matters and possibly find out more about your attitude to environmental care and regulation, the information provided on pollution, etc.

I regularly follow the news and the current information concerning environmental issues.

Strongly agree

Agree

Neutral

Disagree

Strongly disagree

I am familiar with the rules, laws and regulation on environmental protection.

<i>Strongly agree</i>	<i>Agree</i>	<i>Neutral</i>	<i>Disagree</i>	<i>Strongly disagree</i>
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I am willing to undertake actions to protect the environment even when I am not explicitly required to do so by the government or other institutions.

<i>Strongly agree</i>	<i>Agree</i>	<i>Neutral</i>	<i>Disagree</i>	<i>Strongly disagree</i>
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I am willing to undertake actions to protect the environment only when I am explicitly required to do so by the government or other institutions.

<i>Strongly agree</i>	<i>Agree</i>	<i>Neutral</i>	<i>Disagree</i>	<i>Strongly disagree</i>
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I am willing to protect the environment as long as this does not significantly harm my budget.

<i>Strongly agree</i>	<i>Agree</i>	<i>Neutral</i>	<i>Disagree</i>	<i>Strongly disagree</i>
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Preliminary question 1 (*Control question displayed on a new screen*)

I am willing to pay additional 10% per kilowatt hour (kWh) to my current electricity bill for the same level of consumption.

<i>Strongly agree</i>	<i>Agree</i>	<i>Neutral</i>	<i>Disagree</i>	<i>Strongly disagree</i>
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Preliminary question 2 (*Control question displayed on a new screen*)

I am willing to pay additional 10% per kilowatt hour (kWh) to my current electricity bill for the same level of consumption in order to have a 5% larger portion produced by renewable sources.

<i>Strongly agree</i>	<i>Agree</i>	<i>Neutral</i>	<i>Disagree</i>	<i>Strongly disagree</i>
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II. Part - Renewable energy regulation (new screen)

In the second part I would be grateful if you could give me some insights on the payment decisions you would make when given a specific situation of an electricity scheme which includes supply from renewable sources.

I am willing to pay additional 10% per kilowatt hour (kWh) to my current electricity bill for the same level of consumption and thus have a 5% larger portion produced by renewable sources, as long as I am provided with a tax relief (Note: Assume that the amount of this tax relief is lower than the 10% increase mentioned above).

<i>Strongly agree</i>	<i>Agree</i>	<i>Neutral</i>	<i>Disagree</i>	<i>Strongly disagree</i>
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I am willing to pay additional 10% per kilowatt hour (kWh) to my current electricity bill for the same level of consumption and thus have a 5% larger portion produced by renewable sources, as long as I am provided with a subsidy for improvement of my household's energy efficiency.

<i>Strongly agree</i>	<i>Agree</i>	<i>Neutral</i>	<i>Disagree</i>	<i>Strongly disagree</i>
-----------------------	--------------	----------------	-----------------	--------------------------

I am willing to pay additional 10% per kilowatt hour (kWh) to my current electricity bill for the same level of consumption and thus have a 5% larger portion produced by renewable sources, as long as I am provided with regular and accurate information on the positive contribution of these used renewable energy sources on environment in my area.

<i>Strongly agree</i>	<i>Agree</i>	<i>Neutral</i>	<i>Disagree</i>	<i>Strongly disagree</i>
-----------------------	--------------	----------------	-----------------	--------------------------

I am willing to pay additional 10% per kilowatt hour (kWh) to my current electricity bill for the same level of consumption and thus have a 5% larger portion produced by renewable sources, as long as this is set out by law or by certain standards (Note: Assume that there are no fines if you refuse to do so).

<i>Strongly agree</i>	<i>Agree</i>	<i>Neutral</i>	<i>Disagree</i>	<i>Strongly disagree</i>
-----------------------	--------------	----------------	-----------------	--------------------------

I am willing to pay additional 10% per kilowatt hour (kWh) to my current electricity bill for the same level of consumption and thus have a 5% larger portion produced by renewable sources, as long as this is set out by the law or by certain standards and I get fined if I refuse to do so (Note: Assume that the fine is higher than the amount equivalent to the 10% mentioned above).

<i>Strongly agree</i>	<i>Agree</i>	<i>Neutral</i>	<i>Disagree</i>	<i>Strongly disagree</i>
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I am willing to pay additional 10% per kilowatt hour (kWh) to my current electricity bill for the same level of consumption and thus have a 5% larger portion produced by renewable sources, if the taxes on nuclear power, coal or other sources which are harmful to environment increase even more.

<i>Strongly agree</i>	<i>Agree</i>	<i>Neutral</i>	<i>Disagree</i>	<i>Strongly disagree</i>
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I am willing to pay additional 10% per kilowatt hour (kWh) to my current electricity bill for the same level of consumption and thus have a 5% larger portion produced by renewable sources, as a result of becoming acquainted with recent regional or global statistics available on pollution levels.

<i>Strongly agree</i>	<i>Agree</i>	<i>Neutral</i>	<i>Disagree</i>	<i>Strongly disagree</i>
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I am willing to pay additional 10% per kilowatt hour (kWh) to my current electricity bill for the same level of consumption and thus have a 5% larger portion produced by renewable sources, because I notice that other people around me switch to such type of electricity supply scheme as well.

<i>Strongly agree</i>	<i>Agree</i>	<i>Neutral</i>	<i>Disagree</i>	<i>Strongly disagree</i>
-----------------------	--------------	----------------	-----------------	--------------------------

I am willing to pay additional 10 % per kilowatt hour (kWh) to my current electricity bill for the same level of consumption and thus have a 5% larger portion produced by renewable sources, if I know that this specific amount of 10% is transferred to a special account used by the regulator for environmental matters.

<i>Strongly agree</i>	<i>Agree</i>	<i>Neutral</i>	<i>Disagree</i>	<i>Strongly disagree</i>
-----------------------	--------------	----------------	-----------------	--------------------------

I am willing to pay additional 10% per kilowatt hour (kWh) to my current electricity bill for the same level of consumption and thus have a 5% larger portion produced by renewable sources, if I know that in doing so I contribute to the goal that by the year 2020 the electricity price for all other consumers with this scheme in my country will be reduced below the present price (Note: Assume that this is the only source with a tendency for price reduction).

<i>Strongly agree</i>	<i>Agree</i>	<i>Neutral</i>	<i>Disagree</i>	<i>Strongly disagree</i>
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Please rank the following points according to their importance for your decision on choosing an electricity supply plan. You can move each row with the computer mouse in order to place the most important at the top and the least important at the bottom of the list.

- Price of electricity
- Existing legislation, regulation and sanctions
- The portion produced by clean renewable sources
- Information on environmental matters
- Social opinion on renewable and conventional sources