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FACTORS INFLUENCING THE CLIMATE POLICY IN THE EUROPEAN UNION: THE
CASE OF ESTONIA

Master's thesis

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Table of contents

Introduction	9
1. Theoretical framework and methodology	12
1.1 Theoretical framework	12
1.1.1 Definitions	12
1.1.2 An Applied Equilibrium model as analytical tool.....	13
1.1.3 Factors influencing the climate policy in the European Union	14
Structure of the gross inland consumption in the EU.....	14
1.2 Analytical model	19
1.3 Methodology	20
2. Energy policy in Estonia	21
2.1 Estonian National policy and legislative documents.....	21
2.2 Political framework in Estonia	23
2.3 European commitment and distribution of the efforts	24
2.4 Summary	26
3. Assumption that climate policy is independent.....	28
3.1 The PRIMES model	28
3.2 Methodology of PRIMES - example of the GHG emission reductions	29
3.3 Utility of the PRIMES for the present thesis.....	31
3.4 PRIMES results overview for Estonia	31
4. Import dependence and foreign policy	33
4.1 Present natural gas imports in Estonia	33
4.2 National strategy for the natural gas sector	34
4.3 Present imports of liquid oil fuels in Estonia	35
4.4 National strategy for the future liquid fuels sector in Estonia.....	35
4.5 Rational forecasts of the PRIMES on gas and oil imports.....	36
4.6 Discussion on the differences between the national policy and the rational forecasts on import dependency	37
5. Security of the energy supply	39
5.1 Electricity generation in Estonia	39
5.2 Strategy for the development of the sector.....	42
5.2.1 European-Emission Trading System	42
5.2.2 National actions	45
5.3 Rational forecasts of the PRIMES on electricity generation.....	47
5.4 Discussion on the differences between the national policy and the rational forecasts on electricity generation	48
6. Price formation.....	51
6.1 Current mechanisms regulating the energy prices in Estonia	51
6.2 Influence of the PRIMES forecasts on the energy price	55
6.3 Discussion on the Estonian Strategy and its influence on energy prices	55
Conclusion.....	57
References	58

Figures

Figure 1: Illustration of different carbon footprints by fuels for power generation

Figure 2: Gross inland consumption in the EU in 2006 by type of fuel

Figure 3: Relations between future and prepared development plans directing the energy sector

Figure 4: Breakdown of the GHG emission targets by 2020 with the EU-ETS system

Figure 5: PRIMES modular structure

Figure 6: Current gas network in Estonia

Figure 7: Gross inland consumption in Estonia in 2005 by type of fuel

Figure 8: Gross inland consumption in Estonia PRIMES forecasts for 2020 by type of fuel

Figure 9: sources of energy used for electricity production in Estonia in 2008

Figure 10: Map of power system of Baltic countries and north-western Russia

Figure 11: CO₂ emissions of coal and oil shale combustion for power generation

Figure 12: Carbon footprints of different power generation methods

Figure 13: GHG emissions per sector in the EU (2006)

Figure 14: GHG emissions per sector in Estonia (2006)

Figure 15: Excise duty rate on unleaded petrol by Member State (July 2009)

Figure 16: The revenue from environmental fees and charges 1994–2008, in thousands of Estonian kroons

Tables

Table 1: Non-ETS GHG emission and RES targets to reach for 2020 compared to 2005 levels by EU Member State

Table 2: Theoretical and practical implementation of the community policy package

Table 3: GHG targets and responsible entities in Estonia

Table 4: Consumption in power plants for energy generation

Table 5: National excise duty rates applicable to petrol and gas oil used as propellant and the EU minimum excise levels

Table 6: National excise duty rates applicable to heating fuels and electricity and the EU minimum excise levels (1.01.2010)

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Abbreviations

GHG: Greenhouse Gases

UNFCCC: United Nations Framework Convention on Climate Change

RES: Renewable Energy Sources

EU: European Union

OECD: Organisation for Economic Co-operation and Development

EU-ETS: European Union Emission Trading system

Glossary

Biofuel: Liquid, solid, or gaseous fuel produced by conversion of biomass. Examples include bioethanol from sugar cane or corn, charcoal or woodchips, and biogas from anaerobic decomposition of wastes¹

Carbon footprint: is the total amount of greenhouse gases produced to directly and indirectly support human activities, usually expressed in equivalent tons of carbon dioxide (CO₂)²

Computable equilibrium model: is a model of the economy so specified that all equations in it can be solved numerically, by use of a computer³

Ecological tax reform: The idea is to put taxes on fossil fuels and nuclear energy, on water consumption, on raw materials (especially those which are likely to end up as toxic pollutants or hazardous waste), and also possibly on emissions and waste and to reduce other taxes instead⁴

Greenhouse gases: Greenhouse gases refer to carbon dioxide, nitrous oxide, methane, ozone and chloro—fluorocarbons occurring naturally and resulting from human (production and consumption) activities, and contributing to the greenhouse effect (global warming)⁵

Kyoto protocol: The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change. The major feature of the Kyoto Protocol is that it sets binding targets for 37 industrialized countries and the European community for reducing greenhouse gas (GHG) emissions. These amount to an average of five per cent against 1990 levels over the five-year period 2008-2012⁶.

¹ Organisation for Economic Co-operation and Development, 'Glossary of statistical terms', <<http://stats.oecd.org/glossary/search.asp>>, [accessed 17 January 2010]

² Time for Change, <<http://timeforchange.org>> [accessed 12 January 2010]

³ Black, 'A dictionary of economics', Oxford University press

⁴ Weitzsasher & Jesinghaus, 'Ecological tax reform, a policy proposal for sustainable development', 1992

⁵ Organisation for Economic Co-operation and Development, 'Glossary of statistical terms', <<http://stats.oecd.org/glossary/search.asp>>, [accessed 17 January 2010]

⁶ Organisation for Economic Co-operation and Development, 'Kyoto protocol', <http://unfccc.int/kyoto_protocol/items/2830.php> [accessed 22 January 2010]

Introduction

Since the society realized the limits of fossil resources and the dangerous effect of air pollution on the atmosphere, climate policy became a necessity. Indeed, diminutions of oil and natural gas stocks already hurt global economy and the accumulation of Greenhouse Gases (GHG) creates a warming of the planet. Most of these threatening phenomenons are consequences of an excessive and inappropriate use of energy resources.

These phenomenons lead to the creation of a new concept; the climate policy. A climate policy tries to reduce the GHG emissions by implementing actions on the different sectors causing the emissions. Due to the global size of the matter, climate policies are present on several levels. It may be national or international. The tendency appears to be international negotiations for global agreements

International summits and conferences have gathered representatives of all countries in order to tackle the problem through an internal recognition of the gravity of the situation and common actions for a more sustainable use of energy. The recent failure of the Copenhagen summit proved recently that the challenge of uniting all nations for this ecological cause is complicated, even though the United Nations Framework Convention on Climate Change (UNFCCC) brought together 187 States that ratified the Kyoto protocol⁷. The European Community signed the protocol in 1998, ratified it in 2002 and it entered in force on 16 February 2005⁸. Thereby, it committed itself to achieve an 8% lower GHG emissions level in 2012 compared with its level of 1990. In 2008, the European Parliament approved a new policy package going further and setting new targets to reach by 2020. The community's new goal is to lower its GHG emissions by 20% in 2020, still compared with the 1990 level. In addition, 20% of the energy supply should come from Renewable Energy Sources (RES), the transport fuel mix should contain a 10% share of biofuels and the energy efficiency should be improved in all sectors.

The finality of the European climate policy is to fight against global warming. Global warming occurs because the concentration of certain gases in the atmosphere increases, creating a greenhouse effect. Human activities and especially energy related activities caused the recent global warming by excessive emissions of GHG. In order to slow down or stop the

⁷ United Nation Framework Convention on Climate Change, 'Kyoto protocol, status of ratification', January 2009

⁸ European commission, '2002/358/EC, council decision of 25 April 2002 concerning the approval, on behalf of the European community, of the Kyoto protocol to the United Nations Framework convention on climate change', April 2005

greenhouse effect, the GHG emissions have to decrease. Energy-related emissions account for about 80% of the total greenhouse gas emissions in the EU-27⁹. As a large part of the GHG emissions are energy-related, actions should target the energy system in order to decrease its GHG level. There are three ways to do so.

- Lowering the final energy demand results in a smaller production. The whole energy sector is diminished and therefore less emitting.

- Shifting from GHG intensive energy sources to GHG free or less intensive energy sources is another strategy. Energy sources have different environmental footprints. The combustion of fossil fuels releases large quantities of GHG while power generation by windmill or nuclear unit does not. The gross inland consumption mix influences the GHG intensity of an economy.

- The improvement of the efficiency in energy production, distribution and consumption decreases the gross energy demand.

- Underground carbon storage. (The geological situation in Estonia is unfavourable to CO₂ storage¹⁰. Therefore, this way of lowering the GHG emissions will not be subject to further comments in this work.)

In order to reach objectives to tackle the present greenhouse effect, policy makers have to create a change in the energy sector through one or several of the ways above mentioned. If efficient and calibrated, the actions will give a new structure to the energy market with a new distribution of the supply and demand integrating the objectives set to fight against climate change.

This thesis will demonstrate that in practice, climate policies are influenced by other factors that are not directly related to community targets and that push policy makers towards choices that are not in accordance with a pursue of a more ecological energy system. These factors are the importance of energy security, the political impact of import dependency and the costs of the modification of an energy system.

⁹ European Environment Agency, 'Greenhouse gas emission trends and projections in Europe 2009 – tracking progress towards Kyoto targets', report 2009

¹⁰ Shogenova, 'Possibilities for geological storage and mineral trapping of industrial CO₂ emissions in the Baltic region', Energy Procedia; February 2009, Vol. 1 Issue: Number 1 p2753-2760

The case of Estonia will be analyzed and will show that even though the country is an EU Member State and that it has to participate to the effort of the community, its government has to consider additional factors to organize the future of its energy. Therefore, Estonian policy makers are forced to implement actions that are not acceptable from a strict ecological point of view.

The purpose of this study is to show that the factors presented here have to be taken into consideration in forecast models and that climate policy can not be limited to the obvious reduction of GHG emissions. It is also a warning against the only use of economic equilibrium models to forecast the evolution of an energy market. Indeed, these models are based on a rationality assumption that does not necessarily reflects the actual behaviours of economic agents.

The theoretical background and methodology are explained in chapter 1. It will give some background information about the factors that will be tested and will introduce the equilibrium models that will be used all along this work. Then, the hypothesis will be formulated as well as the research method. It will consist in a comparison between the analyzed national action plans and priorities in Estonia with the forecasts of an equilibrium model that assumes rational thinking and that climate policy can be considered independently. Chapter 2 reviews the different climate policy documents in force in Estonia. In chapter 3, the forecasts of a specific computable equilibrium model assuming a policy package limited to the ecological targets will be presented. This model is the PRIMES. It represents the European energy market and can forecasts the theoretical evolution of its demand and supply under various constrains. These forecasts will be criticised in the chapters 4, 5 and 6. Chapter 4 will show that increased imports would weaken the Estonian leverage in a context of foreign policy with Russia. Chapter 5 will debate the reduction of the use of oil shale from a security of supply point of view and eventually, chapter 6 will criticize the impact of ecology-concentrated climate policy on price formation. The conclusion will summarize the factors influencing the climate policy in the European Union a the consequences of these factors on the use of economic models as forecast and policy evaluation instruments.

1. Theoretical framework and methodology

1.1 *Theoretical framework*

1.1.1 Definitions

As a start, it is important to define the two major terms that will be used in this thesis.

Climate policy: In this work, climate policy is understood as the policy implemented by a government towards the modern global warming phenomenon that took place over the last few decades. It includes the preparation and enforcement of actions aiming at a reduction of the Greenhouse gas emissions released in the atmosphere by human activities.

Energy policy: The energy policy is the policy implemented by a government to manage the production, distribution and consumption of the energy resources.

Climate policy was introduced since it was proven that the emission of greenhouse gases was directly responsible for the temperature increases observed during the twentieth century¹¹ and that this increase was harmful for the planet and its inhabitants¹². These greenhouse gases are mainly caused by the intensive human activity¹³, and more precisely by the energy production and consumption¹⁴. This fact binds the two policies and the emergency of the situation gives them a main role in the modern politics.

Climate policy can not be considered as a part of energy policy, even though it is mostly included in it. Some specific sectors, like farming, are the cause of some GHG emissions but these are not related to energy production or consumption. The confusion is easily made because both policies are dealing with the same environmental and economic concerns.

Lately these two politics gained a great importance with the recent climate changes. The alarming ecological reports and visible consequences of the global warming such as the

¹¹ Houghton, 'Scientific assessment of climate change', Intergovernmental Panel on Climate Change, Cambridge University Press, 1990

¹² Folland & Karl, 'Observed climate variability and change', Climate change, 1992

¹³ Baliounas, 'Are human activities causing global warming?', Marshal Institute, January 1995

¹⁴ European Parliament, 'An overview of global greenhouse gas emissions and emissions reduction scenarios for the future', 2007, p2

melting glaciers raised an important public interest and demanded political reactions. It increased the importance of climate policy. Immediately, the link between these ecological issues and the modern energy intensive lifestyle brought the focus also on the energetic situation and its management, so energy policy.

1.1.2 An Applied Equilibrium model as analytical tool

Presentation

The EU policy package on climate change and renewables sets up objectives that will modify the energy system of every Member State with the overall expected outcomes of a reduced GHG emission and higher share of RES. In practice each Member State can not come up with national plans that will orient the whole system towards these outcomes. National plans can only implement actions that will modify the behaviour of the actors in the system. Only the combined results of these actions can be grouped at national level for an overall evaluation. In theory however, outcomes can be set as constraints of a given energy system. Theories based on the neoclassical principles can forecast the behaviour of the actors put in a situation where reaching the objectives is mandatory. These are the Neoclassical Equilibrium theories. Neoclassical economics is defined by Weintraub¹⁵ as follow: “The neoclassical vision involves economic "agents," be they households or firms, optimizing (doing as well as they can), subject to all relevant constraints. Value is linked to unlimited desires and wants colliding with constraints or scarcity“. It supposes that in an economic system, producers and consumers make choices to maximize their satisfaction and that these choices are driven by costs constrained profits for producers and by income-constrained purchases for consumers. According to the equilibrium theory, economic systems have a point of equilibrium, an organisation of the offer and demand that maximises the utility for all economic actors. Applied Equilibrium models are computable tools that can generate economic systems and determine their point of equilibrium under external constraints. Very precise versions of these Applied Equilibrium models, also called Computable Equilibrium models can simulate the behaviour of the economic agents of sector markets or national systems. They are broadly used in energy and climate change forecasting, scenario construction and policy impact analysis (Babiker¹⁶, Schäfer & Jacoby¹⁷...). Bhattacharyya¹⁸ wrote a literature review of

¹⁵ Weintraub, ‘Neoclassical Economics’, The Concise Encyclopedia of Economics, 1993

¹⁶ Babiker, ‘Climate change policy, market structure, and carbon leakage’ Journal of international economics, 2005

publications that used Applied General Equilibrium studies in the field of energy and climate policy already in 1996.

Discussion about the equilibrium models

Is an equilibrium model suitable for this thesis? The PRIMES model that will be used in this work is based on the neoclassical vision that supposes rational thinking and maximisation of the utility. That rationality of individuals is discussable. One can say that individuals, in addition to the maximisation of their satisfaction through purchase, are also reacting to irrational emotions, beliefs, interests or concerns. In other words, equilibrium models represent utopia markets where economic agents act on the basis of a unique focus of the maximisation of their utility under an income constraint. Their forecasts offer therefore a vision of how the future of a market should be if all its agents were behaving rationally, but it does not show how a market will be.

It is on this observation that will be based the analysis in the following chapters. Considering an energy market and its supposed evolution according to an equilibrium model assuming rational thinking on the one hand, and the actual goals set by policy makers for the future of that same market: if the theoretical forecasts differ from the practical objectives, there must be external factors to be taken into account. In this work, the market that will be considered is the European energy market under the EU climate policy constraints by 2020. Three factors are presented and in the next section. They are assumed to create irrational distortions of this market. Further in the chapters 4, 5 and 6, the presence of these distortions will be tested on the Estonian market.

1.1.3 Factors influencing the climate policy in the European Union

Structure of the gross inland consumption in the EU

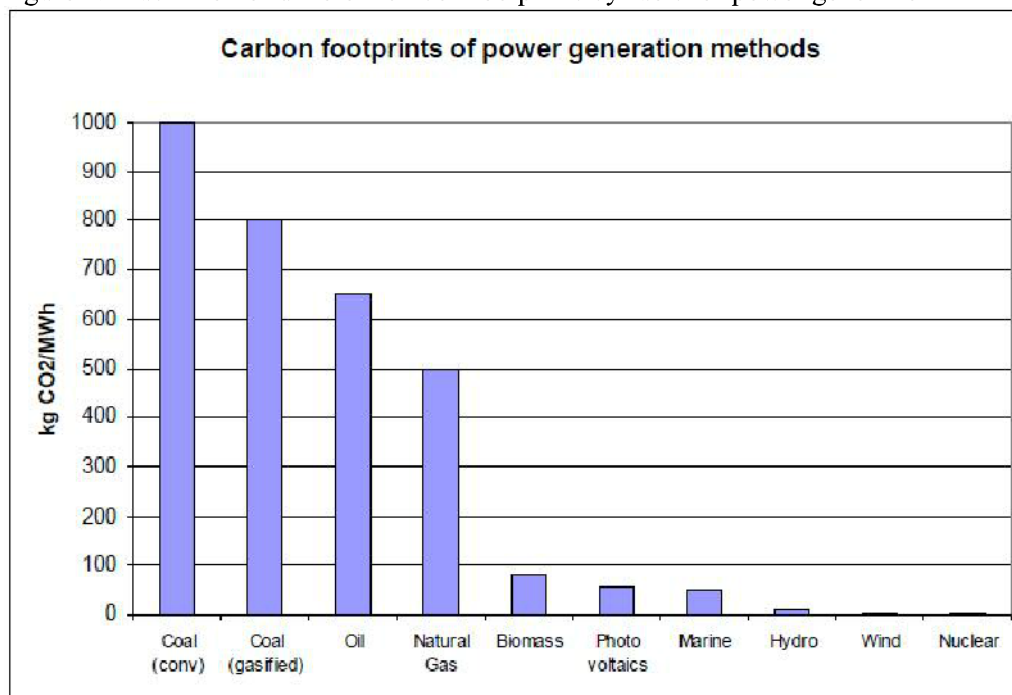
Carbon footprints depend on fuels and on energy generation methods. Although exact GHG intensity level depends on several factors like the technology employed, it is recognised that the solid fuels such as coal and oil shale produce the highest rate of GHG per energy unit

¹⁷ Schäfer & Jacoby, 'Technology detail in a multisector CGE model: transport under climate policy', energy economics volume 27, January 2005

¹⁸ Bhattacharyya, 'Applied general equilibrium models for energy studies: a survey', Energy economics volume 18, July 1996

compared with other fuels¹⁹. An illustration of different carbon footprints by method for power generation is presented in figure 1. Therefore, the use of solid fuels should in the context of GHG reduction scheme should decrease and turn towards less GHG intensive and more efficient fuels.

Figure 1: Illustration of different carbon footprints by fuels for power generation



Source: Parliamentary Office of Science and Technology

Solid fuels are mainly burned for power generation. They can be replaced by alternative technologies such as wind, geothermal or hydro power generation. They can also be replaced by other fuels in new or existing combustion facilities. A third alternative is the intensification of the use of nuclear power²⁰ that is GHG free. As alternative power generation methods are still lacking experience and infrastructure²¹, it can be assumed that a modification of the fuel mix for power generation and the use of nuclear power are the most feasible

¹⁹ Seppälä J, 'Introduction and implementation of life cycle assessment methodology in Estonia: Effects of oil shale electricity on the environmental performance of products (OSELCA)', April 2005

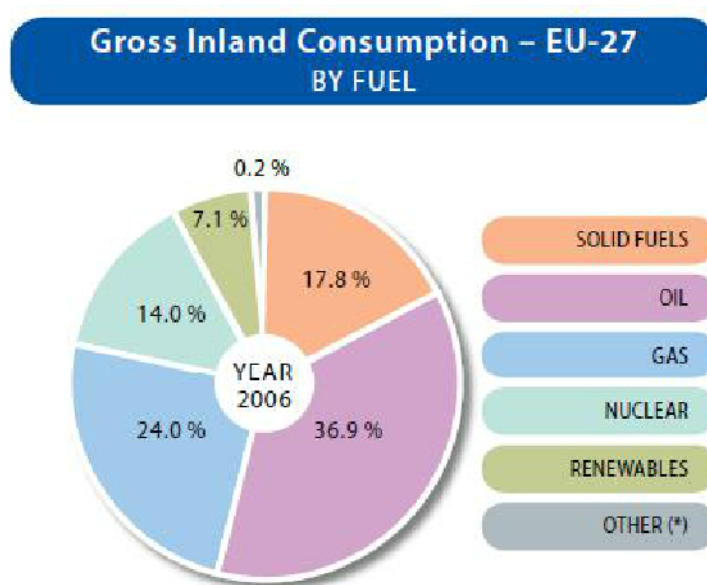
²⁰ 'Nuclear power and environment', Energy Information administration, <
<http://www.eia.doe.gov/cneaf/nuclear/page/nuclearenvissues.html>>, [accessed 16 January 2010]

²¹ Directorate General for Energy and transport, 'European infrastructure – Fighting congestion and building links', 2002

possibilities at least in the short term, even if the RES use is also supposed to grow as required by the community targets.

If such a switch takes place, it will have some repercussions on the EU energy balance. And more precisely on its fuel consumption and import sheet as it is where a change is expected to occur. The European Union already is a net fuel importer. Actually, not less than 53,8 % of its consumption was provided by third countries. It is an uncomfortable position because the supply of resources depends on good relations agreements with exporters. The situation is the most critical in natural gas and oil sectors for two reasons. Firstly, these fuels are very important in the present European energy gross inland consumption with respectively 36,9% for oil and 24% for natural gas (see figure 2).

Figure 2: Gross inland consumption in the EU in 2006 by type of fuel



Source: Directorate General for Energy and Transport

Secondly, the natural gas and oil is provided by a limited number of supplying countries. Russia, Norway, Libya and Saudi Arabia supply together 67,7% of the crude oil coming to the European Union and 84,4% of the Natural gas is imported only Russia, Norway and Algeria. A deterioration of the political relation with one of the above mentioned countries could result in an interruption of the supply. As it was just mentioned, such an interruption would have dramatic consequence on the European economy and on the wellbeing of its inhabitants. Such a scenario might be seen as extreme in the present situation but nevertheless, import dependency provides an excellent leverage to the fuel exporters in a context of foreign policy

between the European Union (EU) and its fuel suppliers. Controlling this leverage is a factor influencing the climate policy

Pressure on energy producers

In order to create a shift in the choice of energy choice, policy makers have to apply a pressure in the producers and suppliers. This pressure can materialize in different kinds of actions. It can be an incentive for an improvement of the energy efficiency. It can be an incentive for investment in renewable energy sources. It can also consist in charging the emissions of GHG through an adaptation of the legal or tax system. Some measures already took place in the EU aiming in that sense. The European Council, the European Environment Agency and the Organisation of Economic Co-operation and development (OCDE) claim that if the burden of taxation is shifted away from labour and other production costs towards the environmental costs of products and processes, this can reduce the distorting impact of taxation in the economy and benefit the environment²². On that principle, several EU member states (Germany²³, Estonia²⁴...) approved and implemented an Ecological Tax Reform. The European Union itself has approved the use of a legally binding EU-wide economic instrument that will regulate the CO2 emissions of certain energy intensive sectors by an emission allowance trading system (EU-ETS). The EU-ETS will be described in the next chapter. The higher the ecological fees and taxes are, the more they will force a change of behaviour.

The suppliers of GHG intensive energies have to consider additional costs related to their emissions. They can try to forward these costs on their customers or some could simply reduce or stop their activities that would not be profitable anymore. The limitation of the production and the price increase has to be expected as a short term effect of economic instruments targeting the energy sector. In a context of high import dependency, it raises questions on the security of the supply. Indeed, although policy makers of the EU member States are looking for solutions to reach their ecological commitments, they also need to ensure that the energy needs of their citizens are fulfilled. Therefore, security of the energy supply is another factor influencing the climate policy

²² Estonian Ministry of finances, 'Carrying out the ecological tax reform in Estonia', January 2020

²³ German ministry of finance, 'German stability programme', December 2002, pp 19-20

²⁴ Estonian Ministry of finances, 'Carrying out the ecological tax reform in Estonia', January 2020

Costs associated to a climate policy

As mentioned in the previous section, the development of alternative energy sources requires investments. Improvement of the efficiency in production and distribution also comes together with important costs to adapt the existing infrastructures. If the current energy system does not include a larger share of RES, it is mainly for economical reasons. RES are usually more expensive than conventional fuels²⁵-²⁶. To reach the European community target of a 20% share of renewables, the EU Members States will have to bear important investment costs associated with the production of RES.

Ecological fees and taxes as well as these costs necessary for the development would create a conflict with a will for affordable energy prices. Access to energy is fundamental for the wellbeing of the population, the well functioning of the economy and eventually the well being of the society. Policy makers have to consider this when preparing a climate policy. Energy price is a factor influencing climate policy.

²⁵ Energy Information Administration, 'How much renewable energy do we use?', <
http://tonto.eia.doe.gov/energy_in_brief/renewable_energy.cfm>, [accessed 16 January 2010]

²⁶ American department of energy, 'Wind energy myths', May 2005

1.2 Analytical model

The above elaborated theoretical framework has showed that there are deemed to be three important factors that influence the climate policy in the EU member states: the foreign policy towards fuel importers, the relationship with the security of the supply and the necessity of affordable energy costs. In order to assess the influence of those factors regarding national climate policy, the following hypotheses have been produced for validation:

- a) Climate policy is included in a context of foreign policy and is committed not to increase the dependency on the import of foreign fuels
- b) Climate policy does not put the security of the energy supply at risk
- c) Climate policy is concerned by the energy price and guarantees an energy access at affordable costs

The task of this work is to prove that in political decisions are not only based in the most rational way to reach the community targets. Instead, the above mentioned hypotheses create a distortion of the priorities and result in a different repartition of the efforts. In order to show this distortion, a comparison will be made between the expected results of political actions presently activated or planned in Estonia and the forecasts of an applied equilibrium model that assumes rationality and the achievement of the national and community targets. One specific sector will be analysed for each hypothesis. The foreign policy concern will be tested by the analysis of the fuel importation and fuel input for power generation. The security concern will be tested by the comparison between the political actions in the sector of power generation and the rational forecasted evolution of that sector. Eventually, the impact of the theoretical model on the cost of energy will be assessed by discussing the applicability of the forecasts on the present price formation system in Estonia.

1.3 Methodology

The research method in this thesis is a comparison between a theoretical model and the evaluation of a national policy. The main advantage of this kind of research is that it allows pointing out the difference between rational goals only oriented towards the ecological targets with an actual policy that is involved in the system. Thanks to these two different approaches, it is possible to determinate and to evaluate the variables that play a role in climate policy. This would not have been so a comparison of case studies. The precision of the applied equilibrium model (PRIMES) allows an access to detailed data forecasting the future of the Energy sector and these data are easily linked to the political actions lead by the Estonian government. Also, considering the fact that the different national action plans sometimes include quantified targets, the study is not limited to qualitative approach.

There are still a few drawbacks of the chosen methodology. Firstly, the approach relies on one specific forecast model. Even though the chosen one has been recognised and used in major researches, the relevance of applied equilibrium in climate change forecasts is universally acknowledge. In addition, the precision of the results rely on the quality of the chosen model. This quality ha not been verified in this work.

The validity of the study is short. Indeed, National and European regulations are regularly updated and modified and so is the data on the energy markets. For example, the problem should have been reconsidered in case of different outcomes from the Copenhagen summit.

2. Energy policy in Estonia

This section explores the current political documents and plans related to the energy sector in Estonia. The purpose of this review is to identify the national guidelines, the reasoning and motivation behind the actual actions.

2.1 Estonian National policy and legislative documents

Sustainable development act²⁷: Adopted by the Estonian parliament in 1995 threw the basis of a national strategy based on the principles established in the decisions of the United Nations (UN) Conference on Environment and Development of Rio de Janeiro in 1992.

Sustainable Estonia 21²⁸: is an integral conception which is clearly focused on sustainability of long-term development of the Estonian state and society until the year 2030²⁹.

Estonian Environmental Strategy 2030³⁰: is a long term strategy plan developed by the Estonian Ministry of Environment (MOE) based on the Sustainable Estonia 21 conception and demanded by the Sustainable Development Act³¹. It was approved by the Estonian parliament in 2005. Its scope is still very broad and covers all environmental concerns, including but not limited to Energy and climate change issues.

National Environmental Action Plan 2007-2013³²: It is the first concrete action plan from the Estonian Environmental Strategy 2030. It includes the preparation, financing and implementation of actions directly related to energy and climate change with sections on energy production, energy consumption and the transport sector³³. Other development plans are also related to the Estonian Environmental strategy 2030, some of them having direct or indirect impacts on the energy sectors. The main documents are the Estonian Enterprise Policy 2007-2013, the Estonian Forestry Development Plan until 2020, the Long-term Public Fuel and Energy Sector Development Plan until 2015, the Estonian Development Plan for the

²⁷ Estonian Parliament, 'Act on sustainable development', 1995

²⁸ Estonian Ministry of Environment, 'Sustainable Estonia 21', 2005

²⁹ Estonian Ministry of Environment, <<http://www.envir.ee/166310>>, [accessed 5 December 2010]

³⁰ Estonian Ministry of Environment, 'Estonian Environmental Strategy 2030', 2005

³¹ Estonian parliament, 'Act on sustainable development', 1995, Article 12, (6)

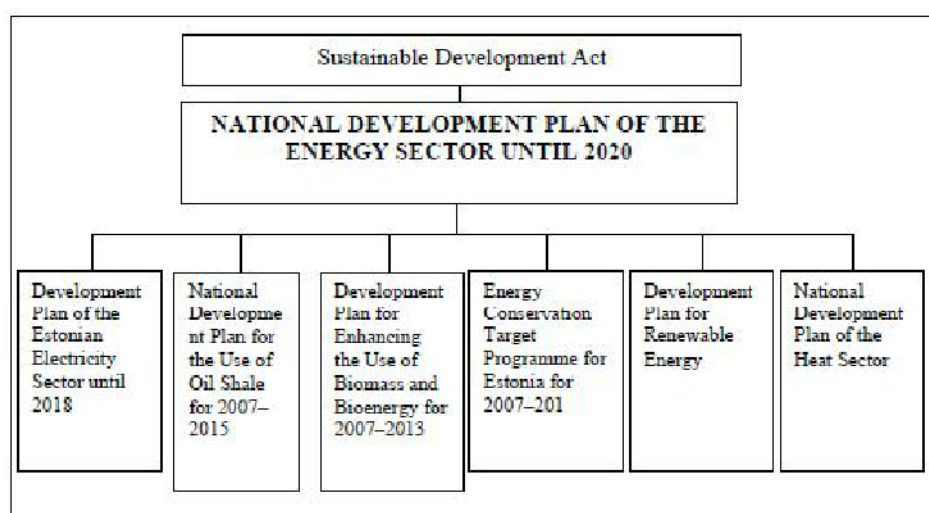
³² Estonian Ministry of Environment, National Environmental Action plan 2007-2013, February 2007

³³ Estonian Ministry of Environment, National Environmental Action plan 2007-2013, February 2007, pp27-31

Electricity Sector 2005-2015, the national development plan of the rural sector, the National Programme for Reduction of Greenhouse Gases 2003-2012, the Estonian Housing Development Plan 2007-2013 and the ecological tax reform.

The Development Plan of the Energy Sector until 2020³⁴: This plan is also a consequence of the act on sustainable development subsection 12 (6). It plans activities aiming to three objectives: a continuous energy supply, a sustainable energy supply and consumption by 2020 and an ensured energy supply at justified price. It also is the basis for the development plans of the electricity, oil shale, biomass and bioenergy sectors and the energy conservation target programme concerning energy conservation issues (see figure 3) Other related plans on renewable energy and on heat sector are still being developed. The national development plan of the energy sector until 2020 replaces the long term public fuel and energy sector development plan until 2015 since its approval by the Estonian Parliament in March 2009. Legislative main documents directly related to it are the sustainable development act, the electricity market act, the natural gas act, the district heating act, the liquid fuel act, the liquid fuel stocks act and the efficiency of equipment act.

Figure 3: Relations between future and prepared development plans directing the energy sector



Source: National development plan of the energy sector until 2020

³⁴ Estonian Parliament, 'national development plan of the energy sector until 2020', March 2009

2.2 Political framework in Estonia

On the basis of the background information provided by the reading of the documents mentioned in section 3.1, the priorities for the energy sector in Estonia can be highlighted and the key principle of the policy is clearly defined: sustainability of the development. The essence of the policy is to ensure successful functioning of the Estonian society and state in the longer term. This success depends on the achievement of four goals³⁵.

- Viability of the Estonian cultural space
- Growth of the welfare
- Ecological balance
- Coherence of the society

It is in that framework that is included the climate policy. It will participate to the achievement of the growth of welfare and to an ecological balance.

The strategic actions are planned by the National development plan of the energy sector until 2020 and other documents related to that plan. Its vision is “to ensure continuous, efficient, sustainable energy supply at a justified price and sustainable energy consumption”. The vision is supposed to be achieved through the realisation of three objectives:

a) A continuous energy supply is ensured in Estonia. This will be effective thanks to the realisation of several measures.

- The diversification of the energy supply by through a more even distribution of the energy sources and the construction of new connections.
- Supplementing the legislation in the field of the security of the energy supply
- Coordination of the energy policy of local governments
- Cooperation with other Member States of the European Union for the purpose of the development of common foreign policy in the energy sector.
- Establishment and maintenance of fuel stocks.

The most important activities will consist in an increased support of renewable energies, the construction of network infrastructures for electricity (such as the Estlink 2 project³⁶) and gas

³⁵ Estonian Ministry of Environment, ‘Sustainable Estonia 21’, 2005, pp13-31

³⁶ Elering, ‘Estlink 2’, < <http://www.elering.ee/index.php?id=586&L=1> >, [accessed 17 January 2010]

exchanges with the other EU Members and the creation of storage infrastructure for liquid fuels.

b) Insuring a sustainable energy supply and consumption. The measures that will be implemented to achieve that objective are numerous and detailed in several plans specific to some sectors. The main guidelines are;

- Information to the population about the possibilities of energy savings and encourage energy efficiency decisions and investments in business, state and private sectors.
- Improvement of the distribution of heat and electricity to reduce the energy losses.
- Improvement of the domestic energy production by an increased efficiency in oil shale extraction and production
- Support to the production of domestic biomass and bioenergy.
- Development of alternative energy technology including the exploration of the possibility of introducing the nuclear power.

c) Ensuring justified energy price for customers. This objective will be achieved by the following measure:

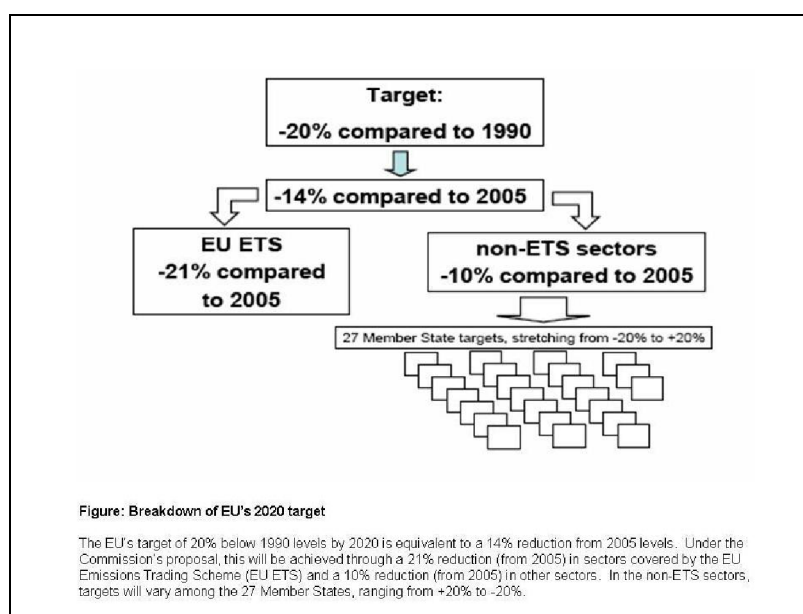
- Constant analysis of the functioning market by the Estonian Competition Authority to eliminate the possible competitions deviations and market distortions.
- Optimal distribution of the investment support
- Optimal implementation of the emission allowance auctions and distribution of the revenues
- Adaptation of the tax system

2.3 European commitment and distribution of the efforts

- EU policy package on climate change: as described in the introduction, this package approved in December 2008 set the objectives pursued by the community and distributes the efforts among the Member States. It also prepares the implementation of the EU-ETS. The EU-ETS is the system that will allow the reduction of CO₂ emission by the energy intensive sectors. ETS sector gathers the European power stations and other combustion installations, oil refineries, coke ovens, iron and steel, cement, glass, lime, bricks, ceramics, and pulp, paper and board. Aviation will be added in 2013. ETS sector's CO₂ emission will be regulated by the introduction of tradable emission allowances. It is an EU-wide mechanism that will be

implemented in 2012 as decided by the EP and EC in the 2009/29/EC³⁷. As the ETS sector is under an EU-cap responsibility, Member State share the task of reducing the non-ETS GHG by 10% compared to 2005 (See figure 4). The effort is distributed among Member State taking into account their per capita GDP (See table 1). The policy package also includes the distribution of the RES targets per Member State as decided in the decision 406/2009/EC (See figure 4). The RES target attributed to Estonia is a 25% share of renewables in its final energy demand.

Figure 4: Breakdown of the GHG emission targets by 2020 with the EU-ETS system



Source: Pew centre on climate change

³⁷ European parliament and council, 'Directive 2009/29/EC amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community', Official Journal of the European Union, April 2009

Table 1: Non-ETS GHG emission and RES targets to reach for 2020 compared to 2005 levels
by EU Member State

Member State	Member State greenhouse gas emission limits in 2020 compared to 2005 greenhouse gas emissions levels	RES target in final energy demand by 2020
Austria	– 16 %	34%
Belgium	– 15 %	13%
Bulgaria	20%	16%
Cyprus	– 5 %	13%
Czech Republic	9%	13%
Denmark	– 20 %	30%
Estonia	11%	25%
Finland	– 16 %	38%
France	– 14 %	23%
Germany	– 14 %	18%
Greece	– 4 %	18%
Hungary	10%	13%
Ireland	– 20 %	16%
Italy	– 13 %	17%
Latvia	17%	42%
Lithuania	15%	23%
Luxembourg	– 20 %	11%
Malta	5%	10%
Netherlands	– 16 %	14%
Poland	14%	15%
Portugal	1%	31%
Romania	19%	24%
Slovakia	13%	14%
Slovenia	4%	25%
Spain	– 10 %	20%
Sweden	– 17 %	29%
United Kingdom	– 16 %	15%

Source: Decision 406/2009/EC, directive 2009/28/EC

2.4 Summary

After reviewing the different policy documents, it appears that the guidelines are given by the objectives of the National Development Plan of the Energy sector until 2020. This plan follows a principle of sustainable development. A target of fight against climate change is not a proper goal but is incorporated into the general concept of sustainability. Therefore, some measures directly aim towards that direction and are spread among the different sector-specific action plans.

The European Union on the other hand has a policy package especially dedicated to ensure a sharp limitation of the GHG emissions but only offers a mechanism, the EU-ETS, to regulate the emissions of some specific sectors. Thereby, the EU delegates the fulfilment of the additional requirements to the governments of the Member States to. As a Member State of the EU, Estonia will also have to deal with the targets imposed by the European parliament in order to participate to the effort of the community. There are two layers of policy.

3. Assumption that climate policy is independent

3.1 *The PRIMES model*

PRIMES is an applied equilibrium model developed and maintained by the Energy – Economics - Environment Modelling Laboratory (E3M-lab) of the national and technical university of Athens that is specialised in the field of energy systems analysis and economics, macroeconomics and environmental economics by using and developing large-scale mathematical models based on advanced techniques of Applied Econometrics, Operations Research and Computer-based Information Systems³⁸.

The PRIMES is a modelling system that simulates a market equilibrium solution for energy supply and demand in the European Union Member States. The model determines the equilibrium by finding the prices of each energy form such that the quantity producers find best to supply match the quantity consumers wish to use. The equilibrium is static (within each time period) but repeated in a time-forward path, under dynamic relationships³⁹. It is organized in Modules.

For each member state the PRIMES covers (See figure 1):

12 sectors: subdivided in 26 sub-sectors using 12 generic processes

4 transport modes, 9 transport means and 10 vehicles technologies

5 Dwelling types (residential sector)

12 types of energy durable goods

3 service sectors using 6 generic processes

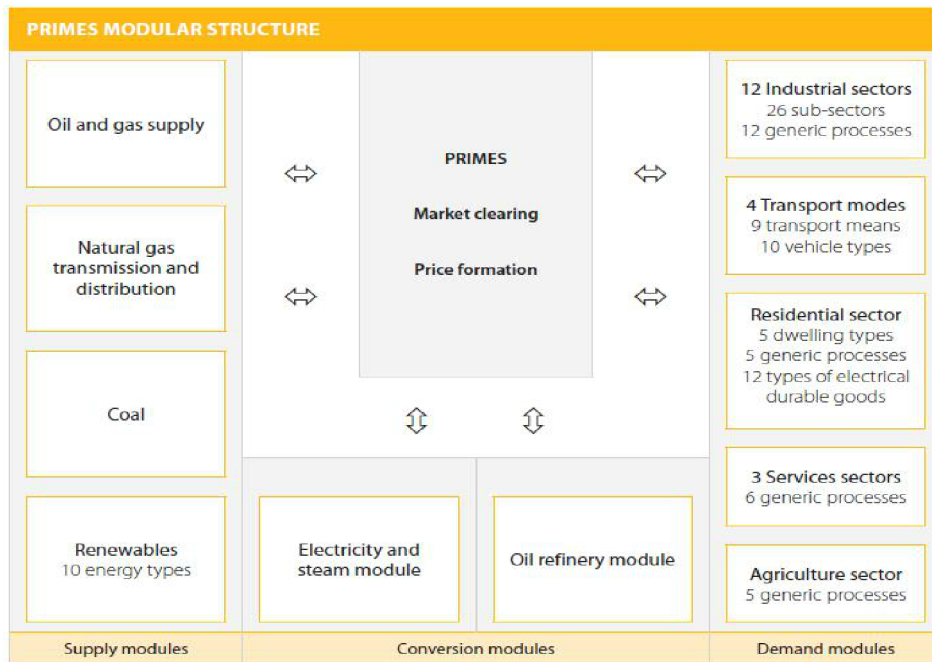
Agriculture sector using 5 generic processes

14 types of fossil fuels, 10 types of renewable energy and energy carriers.

³⁸ E3M Lab; 'About the laboratory', <<http://www.e3mlab.ntua.gr/>> [accessed 28 November 2009]

³⁹ National technical university of Athens, 'PRIMES Energy system model, summary description', 2005

Figure 5: PRIMES modular structure



Source: Market observatory for energy

The model is behavioural and reflects considerations about market economics, industry structure, energy/environmental policy and regulation. These considerations are conceived so as to influence market behaviour of energy system agents⁴⁰.

The modular structure of the PRIMES is crucial for this thesis. Thanks to its breakdown in sectors, it is possible to compare the theoretical forecasts for every sector separately with the actions of national plans that target it in particular. This close relation will help evaluating the relevance of the political decisions or the possible lack of it.

3.2 Methodology of PRIMES - example of the GHG emission reductions

This section explains how PRIMES can determinate the behaviour of specific sectors under an external forced constraint, here a GHG emission reduction.

Overall emission reduction target can be considered as an economic constraint. Every energy form can be associated with a cost factor depending on the carbon-intensity of the energy

⁴⁰ Market observatory for Energy, Europe's position, present and future, report 2008

form. According to neoclassical economics, demand and supply are aiming to reduce their costs and maximize the utility to reach an optimum repartition, or equilibrium. If pressed by a GHG emission reduction constraint, demand and supply will logically shift to less GHG intensive energy form in order to minimize the associated cost. PRIMES can simulate how the system will react and anticipate the behaviours of the actors who are supposed to act rationally. This rational thinking is a principle of neoclassical economics. Demanders try to maximise the utility under income constraints while producers try to minimize production costs. The model considers that this choice is made over time in a dynamic way, involving not only the choice of commodities that are consumed but also the choice of technology and investment in end-use devices, processes and appliances, including investment favouring energy efficiency and energy saving.

The interest of this essay is to analyse the estimated future breakdown of energy sectors according to the PRIMES results with and without GHG and RES constraints and then question if the current political framework is aiming to the same direction (See table 2).

Table 2: Theoretical and practical implementation of the community policy package

	Constraint of environmental policy	Adaptation of the behaviours of the actors	Effect
Theory (equilibrium model)	External constraint	Maximisation of the utility and minimization of the costs under the new constraints	New equilibrium of the market, respecting the constraints
Practice	Implementation of EU policy package and national policy package	Application of the policy packages the policy packages	New equilibrium of the market including the constraints if the policy is successful

Source: own elaboration

Neoclassical theory says that the equilibrium of market exists, can be calculated and that it maximises the satisfaction of the economic agents. Policy packages should therefore aim to reach the same equilibrium.

3.3 Utility of the PRIMES for the present thesis

A model like the PRIMES is the only way to consider the climate policy as an independent variable. Thanks to the PRIMES forecasts, it is possible to have a representation of the structure of the future Estonian energy market if the climate targets could be taken independently from any other political concern. Especially, it would show the results of a scenario free from any distortions coming from foreign policy, security of energy price regulations that are the variables that will be analyzed in the following chapters. This essay will consider a scenario where the PRIMES includes the particular set of constraints applicable to Estonia:

- Estonia participates to the EU-ETS that will ensure a reduction of 21 % of the CO₂ emissions by 2020 compared with the 2005 level in the EU in these particular sectors.
- Estonia participates to the community commitment to reach a minimum share of 10% of biofuel in its road transportation mix.
- Estonia ensures a 25% share of renewable energy in its domestic final energy demand.
- Estonia ensures a maximum increase of 11% of its non EU-ETS GHG emissions compared to its 2005 level.

The last run of the PRIMES model that was performed at the end of 2007 presents such a scenario. The raw data of the run for the European Union and for Estonia are available in appendix 1.

3.4 PRIMES results overview for Estonia

In this section, the some information obtained by the PRIMES are extracted and presented. Only the most relevant facts in the context of this thesis will be taken in consideration. Taking into account the set of constraints mentioned in section 4.5, the PRIMES model forecasts the following evolution of the Estonian energy sector between 2005 and 2020:

- An important diminution of the domestic production of primary energies. This evolution is a consequence of an approximate 50% cut in the production of solid fuels
- An increased level of importation, more precisely of fossil fuels. Oil products and natural gas are more demanded.

From the two forecasts above would result an increased dependency on foreign suppliers

- An increased electricity generation.
- A modification in the electricity generation sources. Natural gas combustion and renewable energy sources, especially Biomass and wind power emerge and replace a large share of the solid fuels in the electricity generation mix. The introduction of wind energy is especially remarkable as it is expected to grow from a production of 54 gigawatt-hour to 1070 gigawatt-hour.
- No nuclear power will be generated domestically, and Estonia would remain net electricity exporter

From the three forecasts above mentioned would result a deep change in the electricity generation technologies.

- The energy-related costs, excluding the payment of emission allowances if applicable, would progress to 3,5 billion EUR in 2020 against 1,9 billion in 2005.

4. Import dependence and foreign policy

In this chapter, the first hypothesis presented by the theoretical framework will be tested. This hypothesis suggests that an increase of the dependency on foreign supplies unwanted. Policy makers would avoid implementing measures leading to such an increase, although it might be a recommended evolution from a rational point of view. After an overview of the natural gas and oil product import situation in Estonia, this chapter will compare the actions and the expected outcomes of the Estonian policy on these sectors and the rational forecasts of the PRIMES. On the basis of these observations, the factor validation will be argued.

4.1 Present natural gas imports in Estonia

The country does not have any natural gas resources domestically. In addition, the geographical situation and the present network (see figure 6) isolates the country from potential natural gas sources and connections. At the moment, all imported natural gas is brought from Russia⁴¹ either directly from Russia from the East and South-East or through Latvia but still from a Russian source. There are no storage infrastructures for liquefied gas so all the supply depends on the well functioning procurement from the incoming pipelines. The total import in 2008 was 962 M m³. Considering the fact that Russia is owns the world's largest natural gas reserves⁴², the risk of shortage is not a pressing worry.

⁴¹ Kasekamp, 'Energy security in Estonia in the context of the energy policy of the European Union', Estonian Foreign Policy Institute, September 2006, p18

⁴² Energy Information Administration, 'Russia', < <http://www.eia.doe.gov/emeu/cabs/Russia/Background.html> > [accessed 19 January 2010]

Figure 6: Current gas network in Estonia



Source: Eesti Gaas

Natural gas is an important part of the Estonian fuels mix. It accounts for 13% of the gross Inland consumption (see annex 1), which makes it the second most important fuel after oil shale. It is mostly converted into heat and electricity but still accounts for 7% of the final energy demand (see annex 2).

4.2 National strategy for the natural gas sector

Import, transmission, distribution and sale of natural gas are already subject to the Natural gas act. The act aims at the coordination of the above mentioned activities and at their conformity to the principles of objectivity, equal treatment and transparency in order to ensure a secure, reliable and effective gas supply at a justified price. The organism in charge with the regulation of the natural gas market in Estonia is the Estonian Competition authority. Its main purpose is to ensure a price regulation of the natural gas supply as a market regulation is lacking. Natural gas is also targeted by the national development plan for the energy sector until 2020. The plan sets a maximum share of 20% in the national energy balance (measure 1.1) and a diminution to a maximum 30% share in the heat generation fuel mix against 43% at the moment (measure 2.5).

The plan also prepares the implementation of a diversification of the natural gas supply. The government will by 2018 establish new connections with other EU Member States and build infrastructure allowing the storage of liquid gas and/or liquefied gas.

The will of the current policy makers is, to summarize, to limit the consumption of natural gas and to open the market to other suppliers by developing the necessary infrastructures. As mentioned in section 5.1, Russian gas is for the moment the only alternative and this situation needs to be changed.

4.3 Present imports of liquid oil fuels in Estonia

Despite a very little share of synthetic oil produced from oil shale domestically, oil products are imported. The main supplier is again Russia but there are also other actors. The market is said to be well functioning⁴³. Most of the imported oil products are light fuel, diesel and gasoline. The liquid fuel stock act provides the bases for the establishment, maintenance and holding of compulsory liquid fuel stocks i.e. the quantities of petroleum products to be kept at the disposal or under the control of the state. These stocks are established in order to ensure national security and the survival of the population of the state, to perform obligations assumed under international agreements relating to the supply of energy and fuel, and to prevent an adverse effect on economic activities or to mitigate the effect of disturbances in the event of disturbances in the supply of petroleum products⁴⁴.

Stability of the liquid fuel supply is important for Estonia because this kind of fuel represents one third of the final demand (see annex 2). The need is already important at the moment and is expected to grow with the development of the country, especially through an increased demand for transport⁴⁵.

4.4 National strategy for the future liquid fuels sector in Estonia

First of all, the stocks mentioned in section 5.2 will be renewed and increased to guarantee a sufficient volume of fuel to supply the national demand for 90 days⁴⁶. The State organism in charge with these stocks is the Estonian Stockpiling agency to guarantee available fuel in case of shortage of the supply.

⁴³ Estonian Ministry of Economic Affairs and Communication, 'national development plan of the energy sector until 2020', March 2009, p 19

⁴⁴ Estonian Parliament, 'Liquid Fuel Stock act', February 2005, article 1

⁴⁵ Directorate for Energy and Transport, 'European energy and transport, trend to 2030 – update 2007', 2007

⁴⁶ Estonian Stockpiling agency, < <http://www.ospa.ee> >, [accessed 19 January 2010]

Other measures and actions will aim at the limitation of the consumption or the development of alternative liquid fuels. The general objective is not to exceed a share of 20% in the energy balance for petroleum products. To achieve this, several plans are or will be implemented.

In accordance with the community target of 10% of biofuels in the road transport mix, bioethanol and biodiesel are promoted and their competitiveness is increased by excises exemptions. The use of biofuels is very limited so far with only 0.06% of the liquid fuel mix in 2007⁴⁷. It has to reach 10% by 2020. The fuel filling stations will be required to sell diesel and petrol containing 5% of biodiesel and bio ethanol respectively. These concentrations will be mandatory already after 2010.

There will be more connections between the bigger cities and former train lines will be rehabilitated. Bike stands will be available in bigger cities and parking in city centre will be restricted to encourage the use of public transports. These measures are still in development and their application should be effective by 2013. In addition, awareness campaigns will be lead to increase the public awareness on the benefits of public transport and soft traffic.

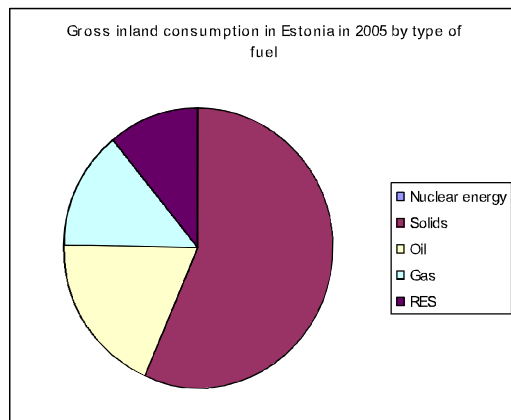
The above mentioned actions will ensure a more sustainable final consumption of petroleum products. Although imported petroleum imported products are mainly directly consumed, some are used for power production.

4.5 Rational forecasts of the PRIMES on gas and oil imports

If the climate policy was the only concern, the consumption of natural gas and oil product would increase significantly. According the PRIMES forecasts, the demand for these fuel will increase under the climate policy constrains and will replace an important share of solid fuels in the gross inland consumption fuel mix. By 2020, the gross inland consumption fuel mix will have 50% of its fuels imported, natural gas accounting for 20% and oil products for 30% (see figure 7 and 8).

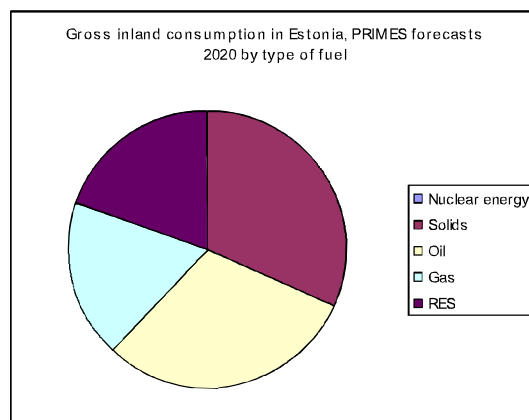
⁴⁷ Estonian Ministry of Finance, 'Monitoring Report Concerning State Aid for Biofuels', 2008

Figure 7: Gross inland consumption in Estonia in 2005 by type of fuel



Source: Eurostat

Figure 8: Gross inland consumption in Estonia PRIMES forecasts for 2020 by type of fuel



Source: PRIMES

In volumes, the demand for both fuels is supposed to increase. As Estonia has no natural gas or oil resources as primary energy resources, these fuels will be imported, bringing the import dependency to almost 50%. This switch is easily understandable considering the better efficiency and lower carbon footprint of oil products and natural gas compared to solid fossil fuel.

4.6 Discussion on the differences between the national policy and the rational forecasts on import dependency

When considering the national strategy for the development of liquid fuels and natural gas on the one hand and the forecasts given by the PRIMES under the assumption of rationality and achievement of the community targets on the other hand, differences are obvious. The Estonian government is not willing to let its dependency on foreign supply go up although it is the best rational choice. This is why it plans to contain the natural gas and oil products shares to a maximum 20% each of the gross inland consumption. This thesis claims that this unwillingness to follow a rational evolution is caused by a foreign policy concern.

The connections between Estonia and other States for natural gas and oil products are weak. As mentioned in sections 5.1 and 5.3, the main connections are made with Russia. Even though the national development plan for the energy sector until 2020 will implement the creation of additional connections with EU Member States and of the creation of liquefied gas storage infrastructures, the expansion of the network to the West will not be effective before 2018. In the meantime, the supply will mostly remain on the Russian capacity and agreement.

This is where an irrational choice is taken by the Estonian government. Russia already has an important influence on the Estonian energy supply and this control gives a political power that Russia can use as leverage. History already showed that Russia is capable of using such a method. In 1993, the Estonian Parliament adopted a new law on citizenship that did not appeal to Russia. As reaction, Russia cut off the gas supply in sign of both contestation and punishment⁴⁸.

If the import dependency increases to 50% as suggested by the PRIMES, Estonia will give up an even more important leverage to Russia that could use it in a dispute between the two countries. As long as Estonia will be highly depending on Russia, foreign policy will interfere with the energy and climate policy of the country and it will proscribe an increase of fuel imports from that country.

⁴⁸ Larson, 'Russia's Energy Policy: Security Dimensions and Russia's Reliability as an Energy Supplier', Swedish Defense Research Agency, March 2006, pp189-190

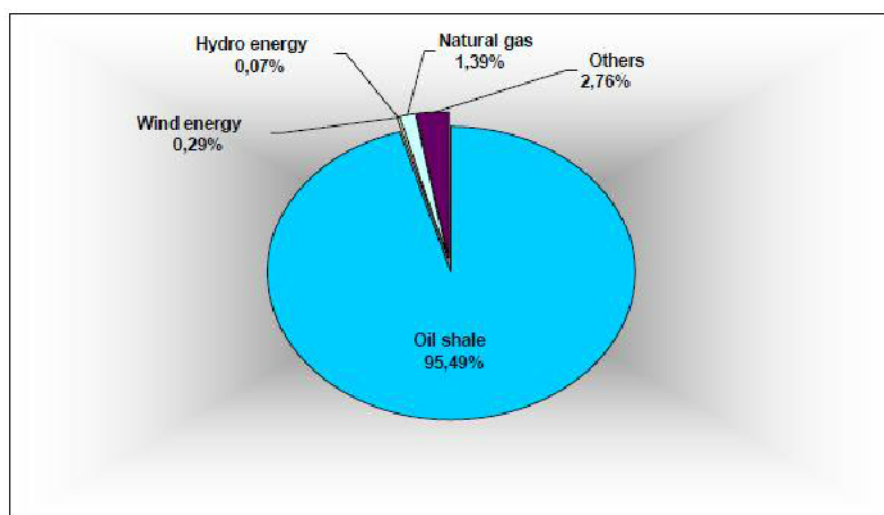
5. Security of the energy supply

In this chapter, the focus will be put on the security of the energy supply and its possible interference with the climate policy. More precisely, the electricity generation sector will be considered in order to test the second hypothesis defined in section .12, i.e. climate policy does not put the security of the supply at risk. The power generation mix and additional background information will be provided as well as the current plans for the sector. Then the PRIMES forecasts for the sector will be presented and eventually a comparison with the actions and the theoretical forecasts will be compared and analysed to identify a possible influence of a concern on the security of the supply.

5.1 Electricity generation in Estonia

The electricity sector is controlled by the state owned company Eesti Energia and 95%⁴⁹ if the national energy generation is provided by its power plants in Narva. The electricity production units are mostly based on oil shale combustion (see figure). The share of electricity generated from renewable energy sources was is slowly increasing since 2000 and reached 2,1%⁵⁰ in 2008.

Figure 9: Sources of energy used for electricity production in Estonia in 2008



Source: Estonian Competition Authority

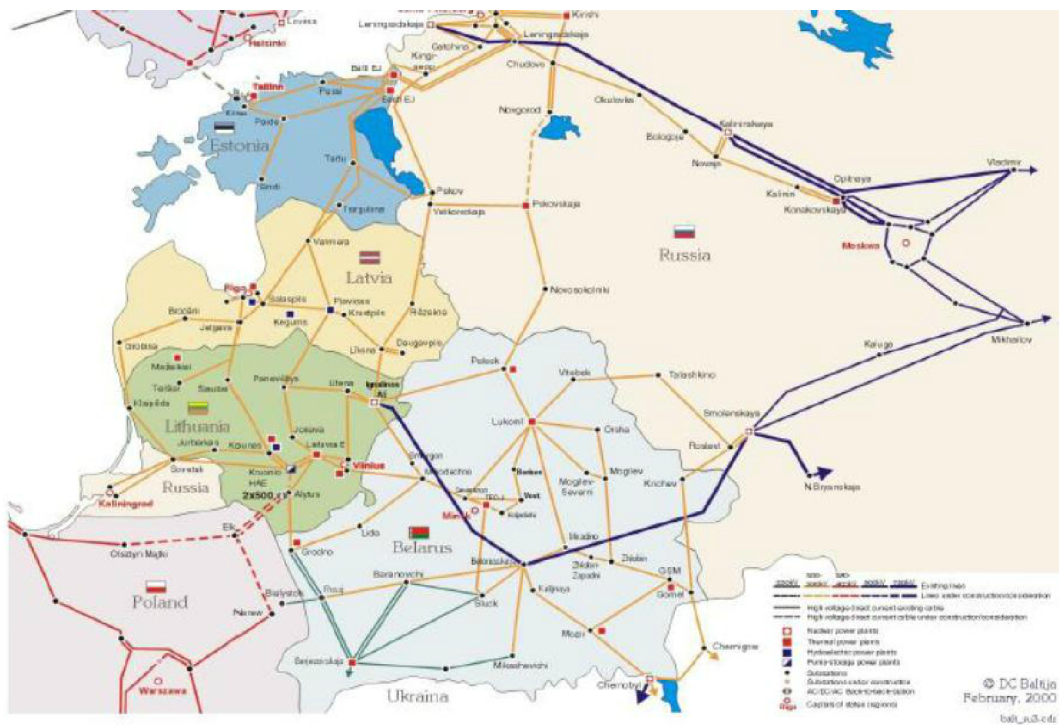
⁴⁹ Narva Power Plants, products <<http://www.powerplant.ee>>, [accessed 9 January 2010]

⁵⁰ Statistics Estonia, energy efficiency indicators, [accessed 9 January 2010]

EE also owns oil shale mines and also distributes its production directly to end users or through daughter companies. Thanks to this vertical integration, Eesti Energia has a firm dominant position on the market and prices that make the entrance of competitors very complicated. Price level is roughly 43% under the EU average⁵¹. Only Lithuania in the EU has a lower electricity prices for households. The opening of the market was already discussed and agreed during the EU integration and the unbundling of the system was effective after 2004 and the administrative division of Eesti Energia. However, no competitor has entered the competition yet.

Most of the electricity network was built under the Soviet Union. The Baltic grid mostly connects Estonia to Russia and Latvia (see figure10). The biggest development for the network was the finalization of the Estlink that connects the Estonian network to Finland thanks to an underwater cable.

Figure 10: Map of power system of Baltic countries and north-western Russia

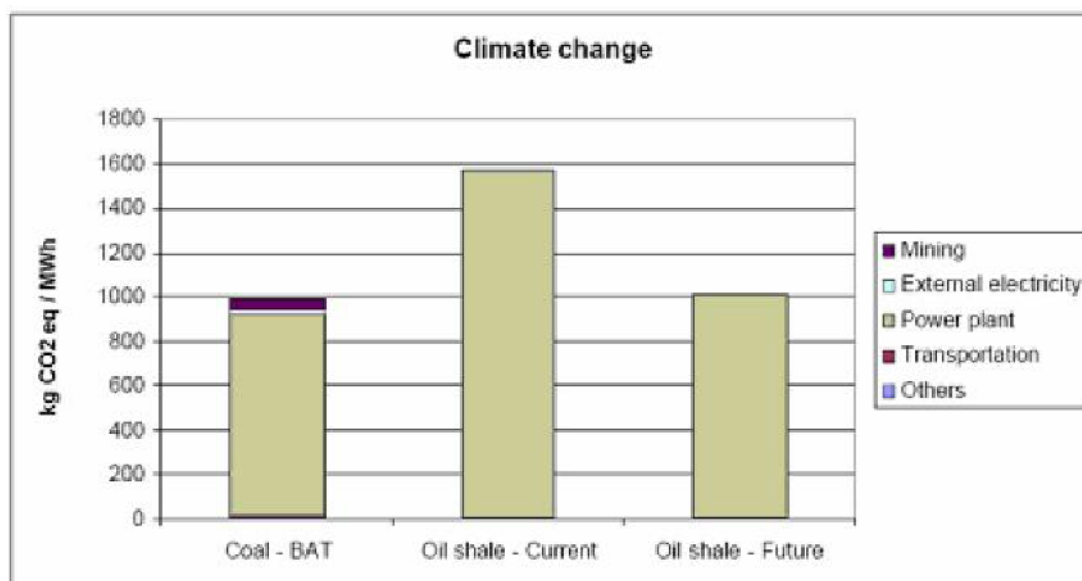


Source: Estonian Competition Authority

⁵¹ European Commission, 'Estonia – Internal market fact sheet', January 2007, p2

The security of supply of energy is good in Estonia. A legislative framework is in force. The electricity market act Act regulates the generation, transmission, sale, export, import and transit of electricity and the economic and technical management of the power system⁵² and the grid code regulates the requirements applied to the security of supply of electrical power systems and the technical requirements for electrical installations arising from security of supply⁵³. Thank to the above mentioned documents, the electricity supply has been continuous over the past last years without any important shortage in the supply. The opportunity to extract the resources locally also ensures a regular primary energy procurement. The counter side of this system is the very important CO₂ and S₂O emissions inherent to the oil shale combustion. Oil shale is the most heavily affecting the environment. Even if electricity is generated with the best available technologies and with the best quality oil shale, the environmental footprint is higher than any other fuel. If the combustion is taking place in modern efficient installations, its combustion creates approximately 1 tonne of CO₂ per MWh, which is similar to the footprint of coal combustion (see figures 11 and 12).

Figure 11: CO₂ emissions of coal and oil shale combustion for power generation



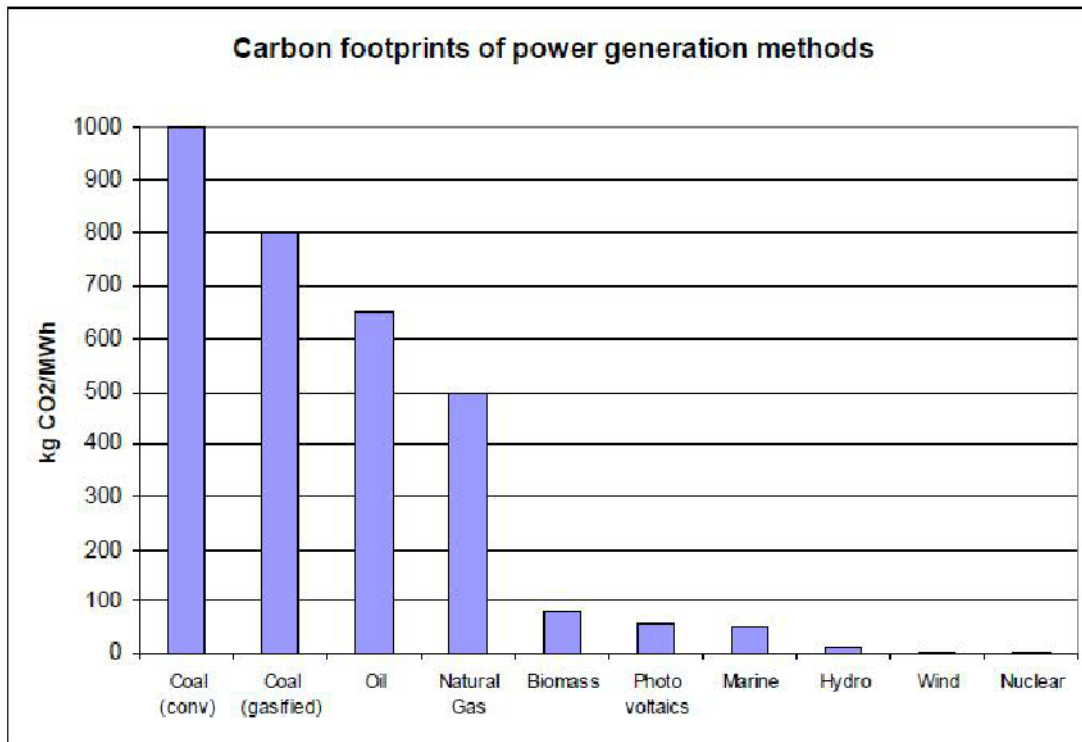
Source: Seppälä 2005⁵⁴

⁵² Estonian Parliament, 'Electricity Market Act', February 2003

⁵³ Estonian Parliament, 'the Grid Code', May 2007

⁵⁴ Seppälä J, 'Introduction and implementation of life cycle assessment methodology in Estonia: Effects of oil shale electricity on the environmental performance of products (OSELCA)', April 2005

Figure 12: Carbon footprints of different power generation methods



Source: Parliamentary Office of Science and Technology

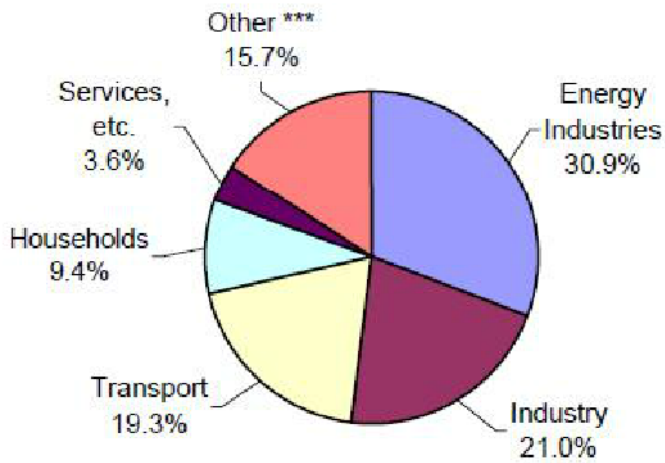
5.2 Strategy for the development of the sector

5.2.1 European-Emission Trading System

Power generation is in the centre of both European and Estonian strategies towards climate change. The sector is the main cause of GHG. It produces 30.9% of the EU emissions and 64,2% of the Estonian ones (see figures 13 and 14). For this sector and other energy intensive industries, the EU created a specific instrument.

Figure 13: GHG emissions per sector in the EU (2006)

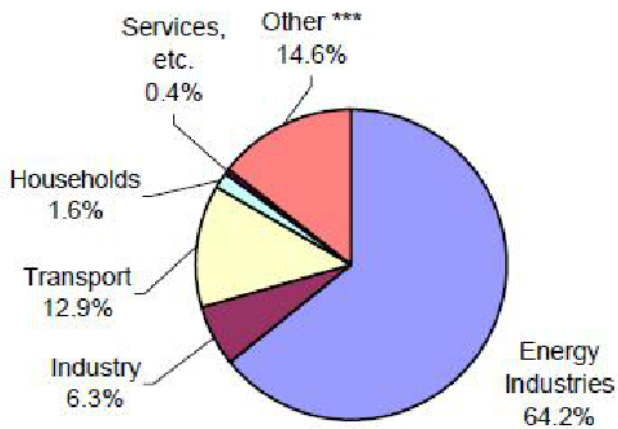
**Greenhouse Gas Emissions (GHG)* by Sector,
EU-27 (2006)**



Source: DG TREN, EU energy in figures 2009

Figure 14: GHG emissions per sector in Estonia (2006)

**Greenhouse Gas Emissions (GHG)* by Sector,
Estonia (2006)**



Source: DG TREN, EU energy in figures 2009

The EU Emissions Trading System (EU ETS) is based on a recognition that creating a price for carbon through the establishment of a market for emission allowances offers the most cost effective way for countries to move towards the low-carbon economy of the future and achieve the deep reductions in global greenhouse gas emissions that are needed to prevent climate change from reaching dangerous levels⁵⁵. The system requires the purchase of emission permits by the energy intensive industries. Allowances will be limited and delivered by auctioning. Their number will decrease yearly until 2020 to reach the community objective. The scheme is based on the Directive 2003/87/EC, which entered in force on 25 October 2003. The scope of the EU-ETS is limited. A difference must be made between CO₂ emissions and other GHGs and between the ETS sectors and the non ETS as different goals are set and different organisms are in charge. The EU cap only covers the emissions of CO₂ of the ETS sectors. The industries included in the ETS sectors are the European power stations and other combustion installations, oil refineries, coke ovens, iron and steel, cement, glass, lime, bricks, ceramics, and pulp, paper and board. Aviation will be added in 2013. All other GHG emissions and the CO₂ emissions of the non ETS sectors are under the responsibility of the Estonian State. It has to limit them to a maximum increase of 11% in 2020 compared with the 2005. It does not include the possible limitations of the CO₂ emissions in the EU-ETS sectors (see table 3).

Table 3: GHG targets and responsible entities in Estonia

<i>Sectors</i>	ETS sectors	Non ETS sectors
<i>Emission type</i>		
CO ₂ emissions	<ul style="list-style-type: none"> - EU-ETS trading system - responsibility of the European Union - EU wide 20% lower emission compared to the 1990 level 	
Other GHGs		<ul style="list-style-type: none"> - National plans of action - responsibility of the Estonian State - maximum 11% increase compared to the 2005 level

Source: Own elaboration in the basis of the EU-ETS information

⁵⁵ European Commission, 'EU action against climate change – EU emissions trading: an open system promoting innovation', November 2007

Under the EU-ETS, limited amounts of emission allowance will be delivered to energy intensive sectors. In Estonia, it targets mainly targets the power plants and other combustion installations. Although the EU is in charge with the CO₂ emissions of the ETS sector, the Estonian State will be the actual entity dealing with the targets. The Estonian State is the owner of the company Eesti Energia that manages the Estonian thermal power stations included in the EU-ETS sectors. In addition, these thermal central are oil shale combustion based, which means that they are also responsible for the emission of non CO₂ that are principally nitrous oxide and methane⁵⁶. The management and limitation of the emission level of these pollutants are the responsibility of the Estonian state. Presently, the Estonian government issues allowances until 2013 when the community will carry on with the distribution. The current annual quota until 2012 is 12,7 million tons and the group Eesti Energia will receive a constant 9,2 million tons in allowances per year. This amount is sufficient for the group to answer the current demand. Starting 2013, the allowances will decrease every year.

5.2.2 National actions

Although the EU-ETS mechanism will help regulation the sector and stimulate its pursue of efficiency and CO₂ emission reduction, extra national measures are to be undertaken. In 2005, the ETS sector in Estonia released 12,6 million tons of CO₂⁵⁷, which was two thirds of the total domestic GHG emissions in CO₂ equivalent (18,9 million tons). The sources of these emissions were coming almost exclusively from combustion installations producing heat and power. Well aware of that, the ministry of environment established the National Environmental Action plan to 2013. For the period between 2007 and 2013, it plans almost 45 billion EEK⁵⁸, most of it in investments for a more environmental friendly energy production. Different actors are contributing to these investments: The main agents involved are the Ministry of agriculture, Ministry of environment, Ministry of economic affairs and communications, Environment information centre, Tallinn University of technology, University of Tartu, companies and principally Eesti Energia, Local governments, and the

⁵⁶ UNFCCC, 'GHG data', < http://unfccc.int/ghg_data/ghg_data_unfccc/items/4146.php > [accessed 10 January 2010]

⁵⁷ European Environment Agency, 'EU-ETS data', 2005

⁵⁸ Ministry of Environment, 'Estonian Environmental action plan 2007-2013', February 2007, pp27-28

Narva power plants. Actions are separated in several sections. Firstly, there is the creation and update of regulative tools such as several national plans. For example, the long term national fuel and energy sector development plan that already is finalized was one of them. A second part set of actions prepares the legal enforcement and monitoring of regulations regarding air protection. The third and main part consists in the modernization of the energy production and conversion plants. As mentioned earlier, electricity generation is based on oil shale. Table 4 shows the different fuel inputs in the different local power plants in 2008. It clearly appears that oil shale is the principal and almost exclusive primary energy source.

Table 4: Consumption in power plants for energy generation

CONSUMPTION OF FUELS IN POWER PLANTS FOR ENERGY GENERATION by Year, Type of power plant, Type of fuel and Indicator			
	Total consumption	Consumption for electricity generation	Consumption for heat generation
2008			
All power plants			
Oil shale, thousand t	12 075	11 451	624
Peat, thousand t	39	7	32
Wood waste, thousand m ³	30	22	8
Heavy fuel oil, thousand t	0	0	0
Shale oil, thousand t	13	9	4
Diesel, thousand t	0.0	0.0	0.0
Natural gas, million m ³	212	54	158
Renewables, thousand tce	49	8	41
Shale oil gas, thousand tce	165	77	88

Source: Statistics Estonia

Unfortunately, oil shale combustion has a very high carbon indicator (see section 5.1). The state-owned company Eesti Energia controls most of the production, distribution and sale of electricity in Estonia. It also owns the Narva power plants that generate most of the domestic electricity and even the oil shale mines that provides the fuels for these power plants. Logically, the company is strongly solicited to contribute to the efforts. The company will build two new units in the Narva power plants⁵⁹ in conformity with the EU environmental requirements. It will also upgrade its power station in Iru, the waste gas purification facilities of the current energy units of Narva Power Plants as well as the units themselves. These measures will improve the efficiency of the production system.

⁵⁹ Estonian Ministry of Environment, 'Estonian Environmental Action Plan 2007-2013', February 2007, measure 3.1.4.1

One more part of the strategy is the development alternative electricity generation methods. It includes the construction of additional wind farms and an adaptation of the transmission network to these wind farms⁶⁰. It also includes developments of the management of the forestry resources and the promotion of energy use of waste.

The main targets of the climate policy regarding electricity generation are presented on the objective Nr2⁶¹ of the Estonian Development plan for the electricity sector until 2018. It sets a 15% share of electricity generated from renewable energy sources (objective 2 indicator 1) and a maximum 70% share of oil shale produced electricity (objective 2 indicator 6). Eventually, some campaigns and audits will be conducted to stabilize the final electricity demand to the 2007 level (objective 2 measure 2.4).

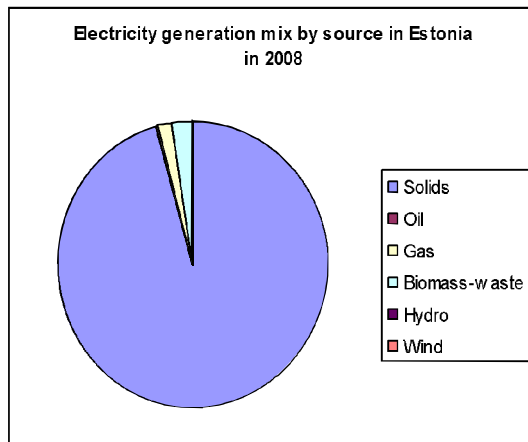
5.3 Rational forecasts of the PRIMES on electricity generation

According to the PRIMES, the electricity generation mix should radically change by 2020. The share of oil shale should decrease significantly to be replaced by gas, biomass and wind power. The main energy source, oil shale, should have its share cut from 95% in 2008 to 55% in 2020. The alternative electricity generation methods all have a very limited role so far but that situation should change according to the PRIMES. Gas should become the second source with 23%, Biomass and waste combustion 11% and wind power for a little bit less than 9% (see the comparison on figures 15 and 16).

⁶⁰ Estonian Ministry of Environment, National Environmental Action plan 2007-2013, February 2007, measure 3.1.5.4 and 3.1.5.6

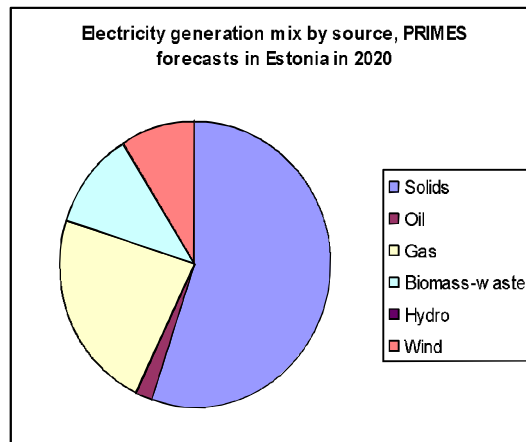
⁶¹ Estonian Ministry of Economic Affairs and Communication, 'Development plan for the Estonian electricity sector until 2018', 2008, pp 41-52

Figure 15: Electricity generation mix by Source in Estonia in 2008



Source: Statistics Estonia

Figure 16: Electricity generation mix by source, PRIMES forecasts for Estonia in 2020



Source: PRIMES

It is important to mention that according to the PRIMES that follows the general trends of the European Commission estimations, the final domestic demand will slightly increase by 2020. This information will be used later in this work.

5.4 Discussion on the differences between the national policy and the rational forecasts on electricity generation

The biggest difference between the Estonian strategy and the PRIMES results is the future use of oil shale. On the one hand, the PRIMES advises to reduce its use down to 55% of the electricity generation mix by 2020. On the other hand, the Estonian government set a maximum 70% share target by 2018. There are two reasons that can explain this difference.

Firstly, the PRIMES suggests to replace a large share of oil shale by gas and to some weaker level by oil. As considered already in chapter 4, Estonia is not willing to increase its imports as it exposes the country to economic pressure by Russia. Therefore, it is unlikely that the 23% share of gas proposed by the PRIMES actually becomes reality by 2020.

Secondly, the Estonian climate policy is promoting the development of alternative electricity generation methods, especially of wind power. Unfortunately, these methods lack infrastructure and/or experience. The wind power is still at its earliest stage of development. The first wind park was built in 2002. In 2008, wind power only accounted for 0,29% of the total domestic generation.

The use of biomass is also a possible alternative to oil shale combustion. Unfortunately, the stocks of the available biomass are almost exhausted⁶² and the prices of wood products are rising⁶³. In March 2009, the Estonian parliament took the decision to prepare a national forestry development plan and appointed the Estonian Ministry of Environment for its preparation. The plan should be ready soon and will organize a sustainable development of the sector for 2011-2020⁶⁴. It will organise a better management and planning of its biomass resources much needed if the consumption is to be increased.

Considering the unwillingness to increase the consumption of imported fuels and the increasing but still limited availability of RES sources, the conservation of oil shale as the main component of the electricity generation mix seems to be a necessity for security reasons. Indeed, the availability of oil shale on the national territory and its important reserves allow a secured access to a fuel for electricity generation.

Electricity generation sector is, as mentioned in section 5.1, a key sector for climate policy because of its high GHG emissions. The PRIMES suggests a deep change in the electricity generation mix to lower the emissions and would allow the energy demand to increase. The savings would be done thanks to the difference of carbon intensity between the oil shale combustion dominating the present power generation method for other means:

- gas combustion
- biomass combustion
- waste combustion / energy use
- wind power

According to the analysis of the different development plans, the Estonian government chooses another option. It does not want such a radical shift and prefers to keep the dominant status of oil shale in the electricity generation mix. Instead, it plans on keeping oil as the main electricity source while continuing the promotion of wind power and biomass. In addition, a pressure on the final energy demand should help allowing additional savings necessary to meet the national targets. This shows that for the few years to come, Estonia sees in oil shale the safest choice and will guarantee a continuous supply before the generation by biomass and wind power becomes mature enough to share a greater role in the Estonian energy production.

⁶² Heinsoo & Koppel, 'Renewable energy from Biomass in Estonia: current status and outlook', Estonian Agricultural University, October 2005

⁶³ Heinsoo & Koppel, 'Renewable energy from Biomass in Estonia: current status and outlook', Estonian Agricultural University, October 2005

⁶⁴ Ministry of Environment - State forest management centre, < <http://www.sagadi.ee>>, [accessed 17 January 2010]

It thereby validates the second hypothesis and confirms that a security concern influences the climate policy.

6. Price formation

This section will take a closer look at the present price formation mechanisms in the energy market in Estonia. Then, the possible impact of the PRIMES forecasts on the prices will be discussed to identify where the rational choices would not be followed in order to guarantee an accessible energy price.

6.1 *Current mechanisms regulating the energy prices in Estonia*

The influence on prices will vary with the fuels and the national policy.

Oil products and natural gas are imported. Their future oil price depends on two main variables. The retail price demanded the oil supplier and the level of excises. Oil price is difficult to determine as it depends on the global demand and on the fluctuation of the world's market places. Excises are set by the ministry of finance. It follows the recommendations of the OCDE, of the European Commission and of the European Environment Agency that suggests that if the burden of taxation is shifted away from labour and other production costs towards the environmental costs of products and processes, this can reduce the distorting impact of taxation in the economy and benefit the environment⁶⁵. The excises adopted for 2010 are presented on tables 5 and 6. They are significantly higher than the minimum rates imposed by the EU. The national environmental tax reform was approved by the government in July 2005

Table 5: National excise duty rates applicable to petrol and gas oil used as propellant and the EU minimum excise levels

Energy product	Excise rates in Estonia from 2010	The EU minimum levels of taxation
Unleaded petrol	423 EUR 1000 l	359 EUR 1000 l
Diesel	393 EUR 1000 l	330 EUR 1000 l

Source: Lelumees 2010

⁶⁵ Lelumees, 'Carrying out the ecological tax reform in Estonia', Ministry of finance, January 2010

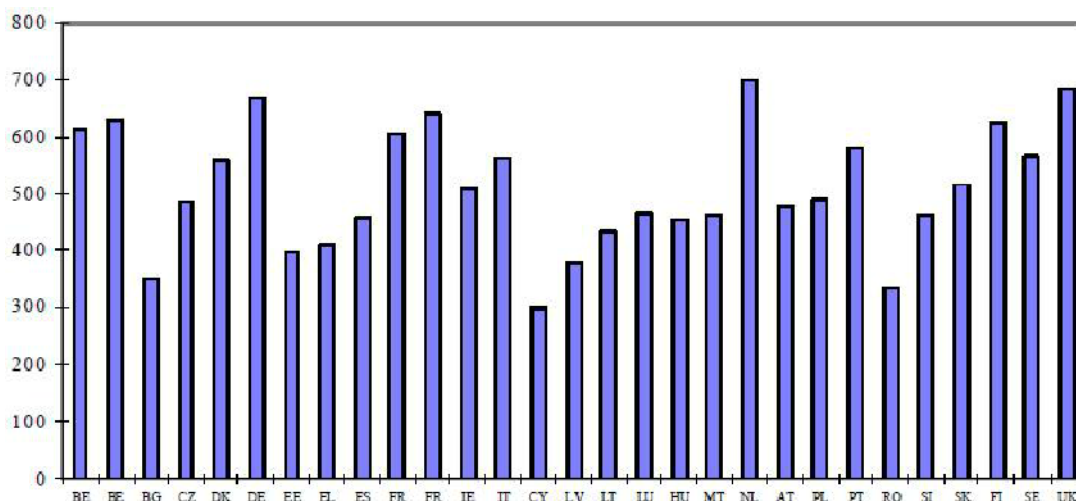
Table 6: National excise duty rates applicable to heating fuels and electricity and the EU minimum excise levels (1.01.2010)

Energy product	Excise rates in Estonia from 2010	EU minimum levels of taxation	
		Business use	Non-business
Light heating oil	111 EUR/1000 l	21 EUR/1000 l.	21 EUR/1000 l.
Heavy Fuel Oil	15 EUR/1000 kg	15 EUR/1000 kg	15 EUR/1000 kg
Kerosene	330 EUR/1000 l	0	0
Natural Gas	0,7 EUR GJ	0,15 EUR GJ	0,3 EUR GJ
Coal and coke	0,3 EUR GJ	0,15 EUR GJ	0,3 EUR GJ
Electricity	3,2 EUR/ MWh	0,5 EUR/ MWh	1 EUR/ MWh

Source: Lelumees 2010

On an EU level, the excise rate is rather low compared to the other Member States (see figure 15).

Figure 15: Excise duty rate on unleaded petrol by Member State (July 2009)

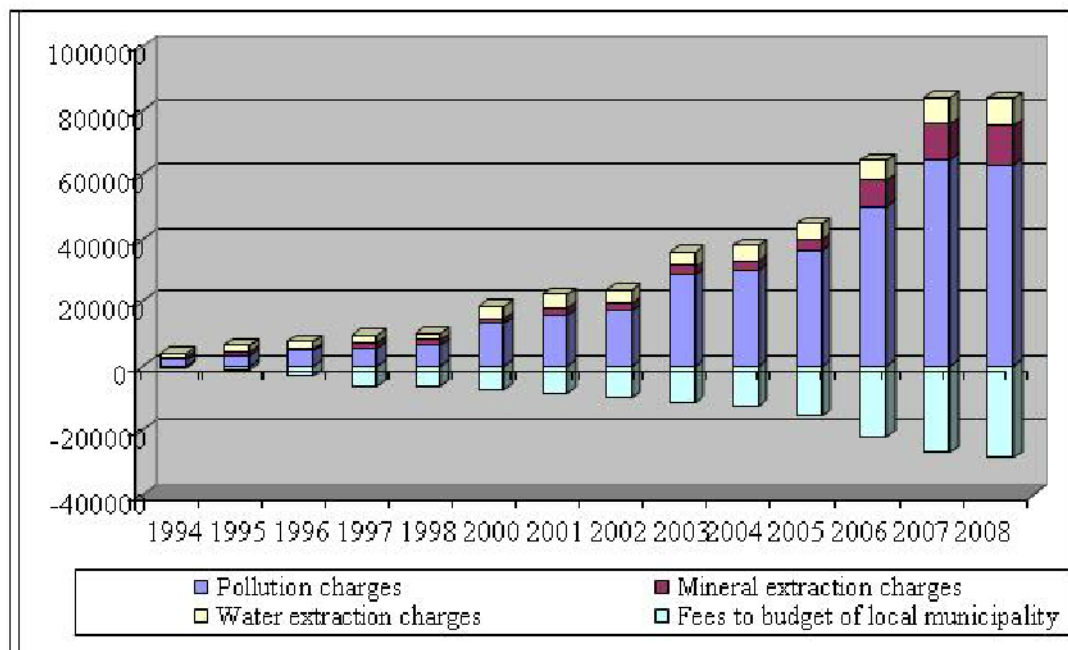


Source: European commission, Directorate General Taxation and customs Union Tax Policy⁶⁶

⁶⁶ Directorate General Taxation and Customs Union Tax Policy, 'Excise Duty table' July 2009, part II Energy products and electricity

The principle of the ecological tax reform is to lower the income tax and increase or create excises and fees on polluting fuels. It charges more specifically on the basis of the environmental impact. The income tax decreased from 26% in 2004 to 21% since 2008 as environmental fees increased (see figure 16). The purpose of doing so is to apply the “polluter pays principle”.

Figure 16: The revenue from environmental fees and charges 1994–2008, in thousands of Estonian kroons



Source: Ministry of Environment, The Conception of Environmental Fees and Charges

The supply of natural gas is influenced by three determinant variables. The price level of the natural gas, based on the Russian suppliers and on the fluctuation of the global demand, the excises (see table 6) set by the ministry of finances and by the Principles for Approval of Natural Gas Prices prepared in 2003 by the Energy Market Inspectorate with the collaboration

of Eesti Gaas⁶⁷ on the basis of the natural gas act⁶⁸. As for oil, prices of natural gas will follow the global trend is to a price increase as the resources diminish⁶⁹.

Biomass is produced domestically and mainly consists in firewood and wood products. Its price level is influenced by the national demand. According to the statistical data, the consumption between 2002 and 2008 increased by 10⁷⁰ % as the average cost of firewood consumed by an enterprise increased by 260%⁷¹. It shows that the price of this resource is very much influenced by the available stock. As it was mentioned in section 5.4, the stocks of biomass are weakening and this phenomenon will only increase the price of the resource. To keep competitive prices, the supply should also increase. This depends on the success of the government strategy promoting the production of biomass.

Electricity prices are set by the Estonian Competition Authority and by Eesti Energia⁷² and determine a cost oriented price determination⁷³. It also includes excises (see table 20) and a renewable energy charge that is used to fund the cost of electricity produced from renewable sources of energy using production equipment operating in a mode of efficient combined production. The amount of the charge is calculated and published by Elering OÜ, further to Section 592 of the Electricity Market Act⁷⁴. Due to this cost oriented price determination, there are three variables that will increase the electricity in the context of climate policy: the nature of the input fuel mix, the investments of the sector and the possible purchase of emission permits. Also, an important change in the structure of the market and the entrance of new players could also have important consequences on the prices.

Heat price formation is also under the Estonian Competition Authority supervision based on the document "Principles for Approval of the Price Limit of Heat Sale Price"⁷⁵. The legal source of this document is the district heating act⁷⁶. The cost oriented price determination makes the electricity and heat prices directly influenced by the input fuels. If Estonian power plants keep relying on oil shale combustion, secondary energies will remain very competitive if the heat producers have sufficient emission quotas and if there are not too many investments made.

⁶⁷ Energy Market Inspectorate, 'Principles for Approval of Natural Gas Prices', 2003

⁶⁸ Estonian Parliament, 'Natural gas act', July 2003

⁶⁹ Energy Information Administration, 'International energy outlook 2009', May 2009, chapter 3, pp 35-37

⁷⁰ Statistics Estonia, 'Energy balance sheet', < <http://pub.stat.ee> >, [accessed 11 January 2010]

⁷¹ Statistics Estonia, 'average costs of fuels and energy by enterprises', < <http://pub.stat.ee> >, [accessed 11 January 2010]

⁷² Estonian Competition Authority, 'report 2007', 2008

⁷³ Estonian Competition Authority, 'Standard Methodology for Calculating Electricity Network Charges', 2003

⁷⁴ Eesti Energia, 'Price package from 1 March 2010', < www.energia.ee >, [accessed 11 January 2010]

⁷⁵ Estonian Competition Authority, 'Principles for Approval of the Price Limit of Heat Sale Price', 2003

⁷⁶ Estonian Parliament, 'District heating act', 2003

6.2 Influence of the PRIMES forecasts on the energy price

The PRIMES forecasts important cuts in the electricity and heat production from oil shale. It also forecasts an important increase of the consumption of biomass and of imported gas and petroleum products. Eventually, the wind power becomes an important component of electricity generation.

Thanks to the drop of oil shale combustion, the power producers should manage not to exceed their allowances and there would not be any extra costs for the consumer because of this factor. However, wind power needs extensive investments and if the consumption of biomass goes on increasing, so will its price. As a consequence, the evolution of the energy demand as suggested by the PRIMES would have a strong impact on the electricity price and would increase it.

The PRIMES does not influence the price of imported resources. As mentioned in the previous section, the price of imported natural gas and liquid fuels is not depending on the domestic consumption volume but on the fiscal policy and the global market trends.

6.3 Discussion on the Estonian Strategy and its influence on energy prices

The Estonian government wishes to maintain its oil shale consumption. Thanks to that method, the country manages to meet the national emission requirements and to have the second lowest electricity price in the EU. It should not face any problem until 2013 as long as the emission allowances are sufficient to answer the domestic demand and the exports⁷⁷. According to the calculations of the Tallinn Technical University, the quotas from 2013 should also be sufficient as long as the consumption does not increase⁷⁸.

The Estonian government takes the challenge to limit its consumption and to improve the efficiency of its current energy system in order to limit the impact on the energy costs. The ecological tax reform and the renewable energy charge will bring credits to help developing alternative power generation methods such as wind power. Such a process ensures a minimum impact on the energy final prices. It also shows that the climate policy is influenced by the climate policy is influenced by the possible costs it would create for the population.

⁷⁷ Estonian Competition Authority, 'Electricity and Gas Market in Estonia', Report 2009, 2009

⁷⁸ Estonian Competition Authority, 'Electricity and Gas Market in Estonia', Report 2009, 2009, p51

Keeping an important production of oil shale also has another consequence on the Estonian economy. The oil shale industry is very important for the North-Eastern region of Estonia. The sector occupies 7500 persons mainly in that area⁷⁹. An important reduction of the activity would have important social costs in a region already struggling with high unemployment. However, this situation is particular to Estonia and can not be extended to all EU Members. This is therefore not considered as a factor influencing the climate policy.

For the above mentioned reasons, Estonia made the choice to keep oil shale as the main component of its gross inland consumption mix. Still, there is a risk in that strategy. If the government fails to keep the final demand at its current level, the national targets might not be met and the energy producers would be forced to purchase additional emission allowances that would increase the energy price.

⁷⁹ European Academies – Science Advisory council, ‘A Study on the EU Oil Shale Industry, Viewed in the Light of the Estonian Experience’, May 2007

Conclusion

The analysis of the Estonian case shows that climate policy in the European Union can not be considered independently. The test of three hypotheses has shown interconnections with other related issues that must be taken into account.

Firstly, the high dependency on imported fuels is a weakness that could serve supplying countries in a context of foreign policy. It is not in the interest of the Union to reach ecological goals by increasing its exposure to a foreign control of the energy supply.

Secondly, a climate policy could weaken the stability of the energy supply. A weak energy supply could lead to energy shortages that are harmful for the economy and society. Therefore, a special consideration on the maintenance of an acceptable level of security has to regulate the climate policy measures.

Thirdly, a climate policy can have an important impact on the energy price. When planning the implementation of such a policy, one has to evaluate the consequences of the measures on the prices that will have to be paid by the end-users.

The above mentioned considerations are not computable and therefore, equilibrium models that are often used for forecasting do not take them into account. The assumption of rationality of these models is necessary to allow the representation of the evolution of an economic system but because of it, the effect of important factors such as mentioned in the present thesis can not be represented.

Equilibrium models are often used in the field of climate policy forecasting and policy impact analysis (see section 1.1.2). It is therefore important to be aware of the limits of these models and to consider more information than only their results.

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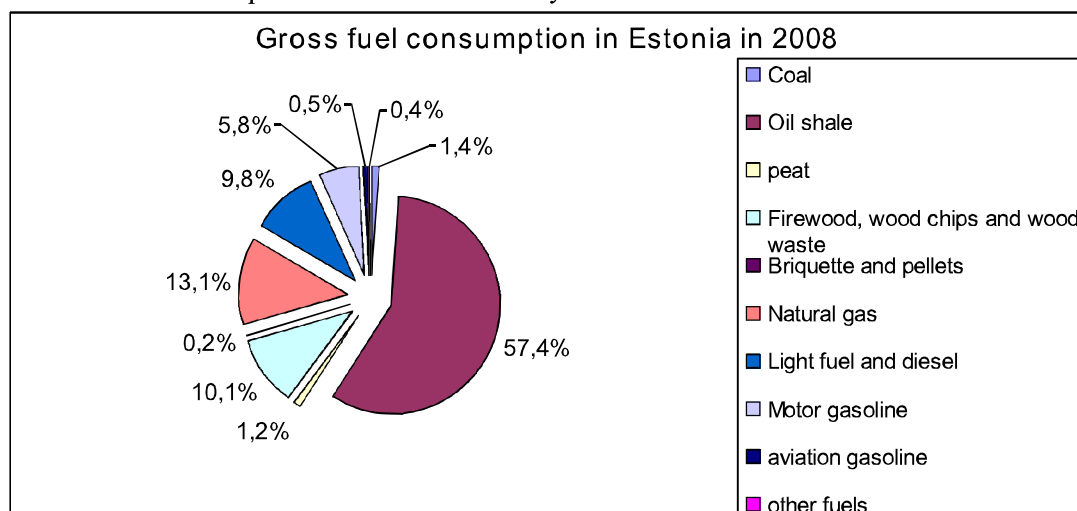
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Annexes

Annex 1

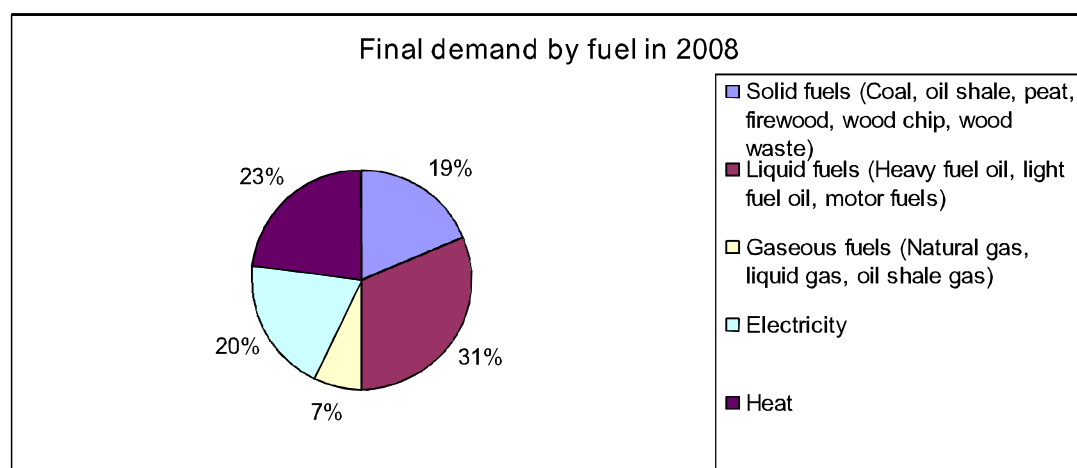
Gross Inland consumption in Estonia in 2008 by fuel



Source: Own elaboration, calculations made on the basis of the data from Statistics Estonia

Annex 2:

Final energy demand by fuel/energy type



Source: Own elaboration, calculations made on the basis of the data from Statistics Estonia

Appendix:

PRIMES raw data for Estonia