Assignment No ENE1321

Analysis of the options for implementing Energy Efficiency Directive 2012/27/EU

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Meie oskused on Teie edu ! ™

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Foreword

Autumn 2012 saw the adoption of Directive 2012/27/EU of the European Parliament and of the Council on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC (hereinafter referred to as the ‘Directive 2012/27/EU’). It is the task of the Ministry of Economic Affairs and Communications (MoEAC) to ensure the harmonisation of Estonian legislation with the Directive and prepare materials for the European Commission where necessary for compliance with the requirements of Directive 2012/27/EU. This study titled ‘Analysis of the options for implementing Energy Efficiency Directive 2012/27/EU’ has been commissioned by the MoEAC following the relevant public procurement procedure.

The aim of the assignment was to analyse the impact of different options for implementing Directive 2012/27/EU in Estonia and prepare draft documents for notifying the European Commission. The study identified the sectors to which energy efficiency obligations should apply and the extent of such obligations, and/or whether and to what extent alternative measures should be implemented instead of the energy efficiency obligation of companies.

The study was conducted in accordance with the Commission’s guidance document on the implementation of Directive 2012/27/EU, taking into account the comments and information of the MoEAC set out in the terms of reference of the assignment.

This report has been prepared by ÅF-Consulting AS in close cooperation with the MoEAC.

1. Calculation of the total amount of required energy savings

1.1. Gross final energy consumption

According to Directive 2012/27/EU, each Member State must calculate the total energy sales, following the instructions set out in the guidance document on Article 7. The total energy sales were calculated using the datasets from Eurostat's energy statistics. The calculation was based on Eurostat's statistical data for 2010 and 2011. In addition, Statistics Estonia's unofficial energy balance data for 2012 are indicated.

The Energy Efficiency Directive prescribes that all final energy sold to natural and legal persons (with the exception of energy used in the transport sector) must be included in the calculation. However, any amounts of energy transformed on site and used for own-use, and those that are used for the production of other energy forms (for non-energy use), are excluded.

In 2010 and 2011 the average gross energy consumption was 33 463 GWh in Estonia, of which the transport sector accounted for 9126 GWh. According to Section 8 of the guidance document on Article 7 of Directive 2012/27/EU, energy sales for the transport sector may be excluded from the calculation of the total amount of energy sales, as may energy volumes transformed by auto-producers. Data on final energy consumption in Estonia from 2010 to 2012 by sector are presented in Table 1.

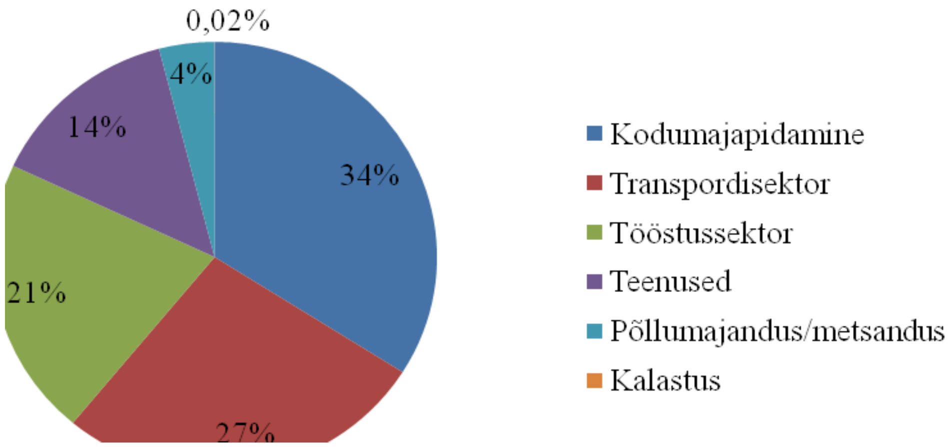
Table 1. Final energy consumption by sector

Estonia	**2010**	**2011**	**2012***	**Average (2010/2011)**
Gross final energy consumption [GWh] *(Eurostat – Code B_101700)*	33 859	33 068	34 346	33 463
Industry [GWh] *(Eurostat – Code B_101800)*	6 687	7 065	7 273	6 876
Transport [GWh] *(Eurostat – Code B_101900)*	9 138	9 114	6 085	9 126
Other sectors (households, services, agriculture/forestry, fisheries) [GWh] *(Eurostat – Code B_102000)*	18 034	16 888	20 988	17 461
– households [GWh] *(Eurostat – Code B_102010)*	11 953	10 890	14 408	11 421
– services [GWh] *(Eurostat – Code B_102035)*	4 970	4 725	5 275	4 847
– agriculture/forestry [GWh] *(Eurostat – Code B_102030)*	1 108	1 265	1 295	1 186
– fisheries [GWh] *(Eurostat – Code B_102040)*	4	9	10	6
Energy procured by consumers [GWh] *(Statistics Estonia)*	1 842	1 515	1 745	1 678
Total energy sales [GWh]	**22 880**	**22 439**	**26 516**	**22 659**

* Unofficial energy balance data for 2012 from Statistics Estonia. These data were not used in the calculation of the last column ‘Average’.

According to Statistics Estonia’s survey of household energy consumption, 35% of firewood and 49% of wood waste have been procured by households themselves. Based on the data of Statistics Estonia for 2010 and 2011, energy procured by consumers themselves amounts to 1842 GWh and 1515 GWh, respectively.

Therefore, the calculated average total energy sales in 2010 and 2011 in Estonia amounts to 22 659 GWh. The percentage breakdown of final consumption by sector is presented in Figure 1.



Households
Transport
Industry
Services
Agriculture/forestry
Fisheries

Figure 1. Percentage breakdown of final energy consumption by sector

1.2. Total amount of required energy savings

The energy savings to be achieved during the seven-year obligation period (1 January 2014 to 31 December 2020) are calculated in the same way regardless of the methods used to achieve the savings. The 1.5% energy savings required under the Energy Efficiency Directive are calculated on the basis of the average total energy sales of 2010 and 2011. In addition, under the concept of lifetimes in Annex V, part 3, point (e), each individual energy-saving measure is considered to deliver savings not only in the year of implementation, but also in future years up to 2020. For this reason, the required amount of savings has to be ‘cumulated’ year-on-year (if not, one year’s measures could be considered enough to fulfil the entire requirement). The overall amount of energy savings to be reached over the whole obligation period is therefore a sum of the following cumulative percentages: 2014 – 1.5%; 2015 – 3%; 2016 – 4.5%; 2017 – 6%; 2018 – 7.5%; 2019 – 9%; 2020 – 10.5%.

In Estonia, the 1.5% energy savings of the total energy sales amount to 340 GWh per year. The overall energy savings to be achieved during the seven-year obligation period (1 January 2014 to 31 December 2020) amount to 9520 GWh (Table 2).

Table 2. Calculation of energy savings in accordance with the instructions in paragraph 1

Year	**Energy savings [GWh]**							**Total**	**[%]**
2014	340							340	1.5
2015	340	340						680	3.0
2016	340	340	340					1 020	4.5
2017	340	340	340	340				1 360	6.0
2018	340	340	340	340	340			1 700	7.5
2019	340	340	340	340	340	340		2 040	9.0
2020	340	340	340	340	340	340	340	2 380	10.5
Total								9 520	42.0

1.3. Alternative energy savings

According to Article 7(2) of the Energy Efficiency Directive, a Member State may, subject to Article 7(3), use options (a) – (d) described below when calculating the energy savings. Article 7(3) states that the application of Article 7(2) may not lead to a reduction of more than 25% of the amount of energy savings referred to in Article 7(1). In Estonia, this means that the difference in energy savings may not be greater than 2380 GWh in the seven-year obligation period. Therefore, the total alternative energy savings for the seven-year obligation period amount to **7140 GWh**. Member States making use of Article 7(2) are required to notify that fact to the Commission by 5 June 2014, including the elements to be applied and a calculation showing their impact on the amount of energy savings referred to in Article 7(1).

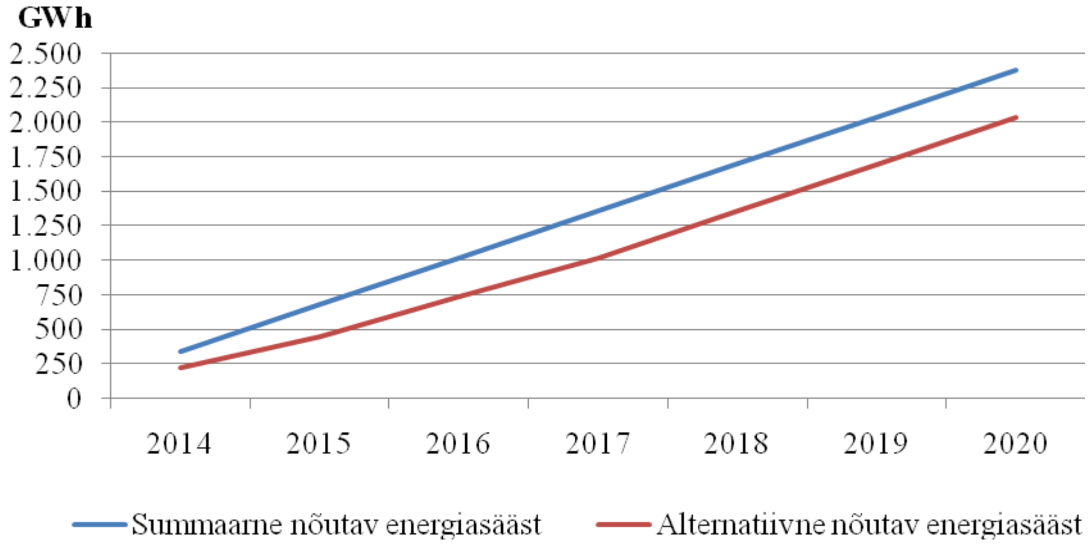
(a) A Member State may carry out the calculation required by the second subparagraph of Article 7(1) using values of 1% in 2014 and 2015; 1.25% in 2016 and 2017; and 1.5% in 2018, 2019 and 2020.

Using the alternative calculation of energy savings results in the amounts of annual increments in energy savings being different, because the percentage applied is different. The total alternative energy savings for the seven-year obligation period (from 1 January 2014 to 31 December 2020), calculated under Article 7(2)(a), amount to 7534 GWh (see Table 3). In Estonia the energy savings to be achieved using the alternative calculation would be 1986 GWh or 20.9% smaller compared to the calculation made in accordance with paragraph 1, and would thus meet the condition laid down in Article 7(3). The difference resulting from the method of calculating energy savings is shown in Figure 2.

Table 3. Calculation of energy savings in accordance with the instructions in paragraph 2

Year	**Energy savings [GWh]**							**Total**	**[%]**
2014	227							227	1.0
2015	227	227						454	2.0
2016	227	227	283					735	3.25
2017	227	227	283	283				1 020	4.5
2018	227	227	283	283	340			1 360	6.0

2019	227	227	283	283	340	340		1 700	7.5
2020	227	227	283	283	340	340	340	2 040	9.0
Total								7 534	33.25



Total amount of required energy savings Required alternative energy savings

Figure 2. Comparison of energy saving calculations

(b) A Member State may exclude from the calculation all or part of the sales, by volume, of energy used in industrial activities listed in Annex I to Directive 2003/87/EC:

- combustion installations with a rated thermal input exceeding 20 MW (except hazardous or municipal waste installations);
- mineral oil refineries;
- coke ovens.

According to the data of Statistics Estonia on the final energy consumption of traders in emissions for 2012, the gross final consumption of electricity and heat is 673 GWh in this sector, accounting for 7.1% of the result calculated in accordance with Article 7(1) and thus meeting the condition laid down in Article 7(3).

*Table 4. Emission traders' final energy consumption in 2012**

Data on emission traders' final energy consumption for 2012	**GWh**
Electricity	646
Heat	27
Total	673

* All activities listed in Annex I to Directive 2003/87/EC

(c) A Member State may allow energy savings achieved in the energy transformation, distribution and transmission sectors, including efficient district heating and cooling infrastructure, as a result of the implementation of the requirements set out in Article 14(4), Article 14(5)(b) and Article 15(1)–(6) and Article 52(9) to be counted towards the amount of energy savings required under paragraph 1.

The study of energy savings in district heating conducted by the Development Fund reveals that there are significant heat losses from pipelines in the current heating districts (average loss of 21%) and that most of the boiler equipment used is old. Therefore, there is a notable potential for energy savings in district energy networks. The study concludes that potential energy savings resulting from comprehensive renovation of heat pipelines could amount to 542 GWh. The modernisation of heat production could result in potential energy savings of 137 GWh. Considering the 'Efficient generation and transmission of heat' measure of energy efficiency-related financing schemes (see Section 3.1.2), the estimated energy savings to be achieved by using this alternative measure for district heating renovation amount to 225 GWh. Using the same measure for the generation of heat will result in energy savings of only 5 GWh. Overall, the energy savings to be achieved with the help of this measure account for 2.4% of the required energy savings calculated in accordance with Article 7(1) and thus meet the condition laid down in Article 7(3).

(d) A Member State may count energy savings resulting from individual actions newly implemented since 31 December 2008 that continues to have an impact in 2020 and that can be measured and verified, towards the amount of energy savings referred to in Article 7(1).

According to the data of the Environmental Investment Centre (EIC), 84 projects have received structural assistance and support granted under the green investment scheme in the total amount of EUR 40 million in the period 2009–2012. However, local governments estimate that the investment need of the district heating sector is around EUR 800 million.

The reconstruction of small boiler plants and heat pipelines and the construction of district heating systems continued to be supported under the green investment scheme in 2012. Several heat pipeline reconstruction projects have been completed, for example in Räpina, Sompa, Vaida and Lähte. A number of district heating networks i.e. thousands of metres of heat pipes have been reconstructed. The Environmental Investment Centre estimates that, as a result, more than 5 GWh/yr of heat can be saved.

The energy savings achieved with the help of individual actions in said period have not been summarised.

2. Determining the sectors to which the energy efficiency obligation applies

2.1. Overview of the Estonian energy market

2.1.1. Estonian electricity market[1]

The Estonian electricity system is made up of electricity producers, transmission networks, distribution networks and electricity consumers. The electricity system currently operates within the synchronised IPS/UPS system of the CIS countries and the Baltic States and is connected with Latvia and Russia via AC power lines and with Finland via a DC link. The capacities of the interstate AC links between Belarus, Russia, Estonia, Latvia and Lithuania are limited, requiring close cooperation between the TSOs in the planning and management of joint synchronised parallel work. In 2012 the aggregate consumption of electricity amounted to 7407 GWh in Estonia (data of Statistics Estonia).

In Estonia the single company that provides the transmission network service is Elering AS, which is also the system operator. In addition, there are 36 companies that provide distribution network services. The transmission system operator owns a total of 5223 km of transmission lines (110–330 kV), while the length of the low and medium voltage distribution networks totals nearly 68 060 km.

The market is highly concentrated as regards distribution networks. The largest company is Elektrilevi OÜ with the service volume of 6605 GWh and the number of customers of 496 012 in 2012. The company's market share was 87% based on sales volume. The next two distribution companies have roughly the same service volume: the annual service volume of Estonian private capital-based VKG Elektrivõrgud OÜ was 220 GWh (3%) and the number of its customers was 33 953, and the annual service volume of Imatra Elekter AS was 207 GWh (2.8%) and the number of its customers was 24 542. The total annual sales volume of the remaining 33 distribution networks is less than 500 GWh. The largest among those are TS Energia OÜ, AS Sillamäe SEJ and AS Loo Elekter. The annual sales volume of the smallest networks is less than 2 GWh.

Table 5. Data on electricity networks

Group of companies	Quantity of electricity supplied to customers (GWh/yr)	Share of consumption (%)
Less than 1 GWh/yr	0.7	0.01%
1–2 GWh/yr	12.3	0.17%
2–3 GWh/yr	12.2	0.16%
3–5 GWh/yr	18.9	0.25%
5–10 GWh/yr	37.7	0.51%

[1] Competition Authority and Elering AS

10–50 GWh/yr	123.8	1.67%
50–100 GWh/yr	191.0	2.58%
Over 100 GWh/yr	7013.5	94.65%
Total network operators	**7410.2**	**100.00%**

According to the exemption agreed with the European Union, Estonia had to open 35% of its electricity market in 2009 and open the market up for all customers in 2013. For a customer, the opening up of the market entails the opportunity to choose the most suitable seller of electricity regardless of the network operator with whom the customer has contracted for the provision of network services. All the electricity contracts expired at the end of 2012. A customer who did not sign a contract with any seller of electricity is supplied with electricity by the network operator that provides services in the area where the customer's consumption point is located (universal service). In May 2013, 73% of consumption points had a new electricity contract and 27% of consumption points were using the universal service (source: Elering AS). Thus, the opening up of the market is characterised by a very high level of activity of customers and a relatively small number of universal service consumers compared to other European countries. Today, these customers who do not use the universal service or the service of a seller of electricity who operates in the same group as the network operator receive two separate invoices: one for the network service and the other for electricity.

At the time of carrying out this assignment, there are 13 sellers of electricity who offer price packages on the open market. The largest share of electricity sales is held by Eesti Energia AS (69.8%), followed by Elektrum Eesti AS (13.0%) and 220 Energia OÜ (1.5%).

The Electricity Market Act and the Grid Code provide for detailed balance responsibility rules, according to which every market participant is responsible for its balance. The transmission system operator is responsible for the balance of the entire system, and several balance providers may operate in the market. To ensure balance, the transmission system operator buys or sells balancing electricity. Balance is settled by means of a remote reading device if the customer's electrical connection capacity exceeds 63 A. The balance of other customers is determined using standard load curves, i.e. for household customers the gradual transition to online metering is still underway. Eligible customers conclude with a seller an open supply contract, which designates the balance provider who is committed to keeping the balance of the eligible customer. The balance of non-eligible customers is the responsibility of distribution network operators. The biggest balance provider is Eesti Energia AS, and there are six more balance providers active on the market.

In connection with the opening up of the electricity market in 2013, a data exchange platform (Data Warehouse) was created in Estonia in 2012, which is an essential prerequisite for the Estonian electricity consumers to be able to choose and change electricity suppliers from 2013 onwards. Elering as the system operator developed the digital environment with the overall goal of ensuring effective data exchange processes that respect the principle of equal treatment of market participants and meet the requirements provided in the Electricity Market Act once the electricity market is fully opened. Through the Data Warehouse, data are exchanged for the purpose of changing open market suppliers, transmitting metering data, and performing and exercising the statutory obligations and rights of market participants (customers, network operators, sellers). The Data Warehouse contains all the contracts for sale of electricity and network services, as well as electricity consumption metering data.

The majority of Estonian households buy electricity directly from energy suppliers, with the exception of the general electricity of apartment buildings which is mostly purchased by apartment associations or communities of apartment owners. In business and public service sectors, electricity is mostly bought by building managers.

2.1.2. Natural gas market[2]

In 2011 the total consumption of natural gas amounted to 657 million m^3 in Estonia (data of AS Eesti Gaas). Natural gas is primarily used in district heating (39% of the gas consumed) and industry (33% of the gas consumed). Estonia has natural gas network connections with Russia and Latvia. The required pressure in the Estonian gas system is provided by the compressor stations of the Russian transmission system or by the Latvian Inčukalns underground gas storage. Estonia has no gas storages or liquefied gas terminals.

Gas is imported from Russia and there is currently only one wholesale trader active on the market – AS Eesti Gaas. Import licences have also been issued to AS Nitrofert that procures gas only for its own production needs and to Baltic Energy Partners OÜ that has not procured any gas so far. Similar to the wholesale market, AS Eesti Gaas also has the dominant position on the retail market. In 2012 the share of AS Eesti Gaas on the retail market was 86.5%; the remaining 13.5% of gas sold on the retail market is purchased by other network operators from AS Eesti Gaas for resale. There are currently 27 gas sellers active on the gas market.

Table 6. Data on gas networks

Group of companies	Quantity of gas supplied to customers (GWh/yr)	Share of consumption (%)
Less than 1 GWh/yr	0.4	0.00%
1–2 GWh/yr	3.9	0.05%
2–3 GWh/yr	2.6	0.03%
3–5 GWh/yr	3.5	0.05%
5–10 GWh/yr	24.2	0.31%
10–50 GWh/yr	308.2	3.95%
50–100 GWh/yr	96.2	1.23%
Over 100 GWh/yr	7372.2	94.38%
Total	**7811.1**	**100.00%**

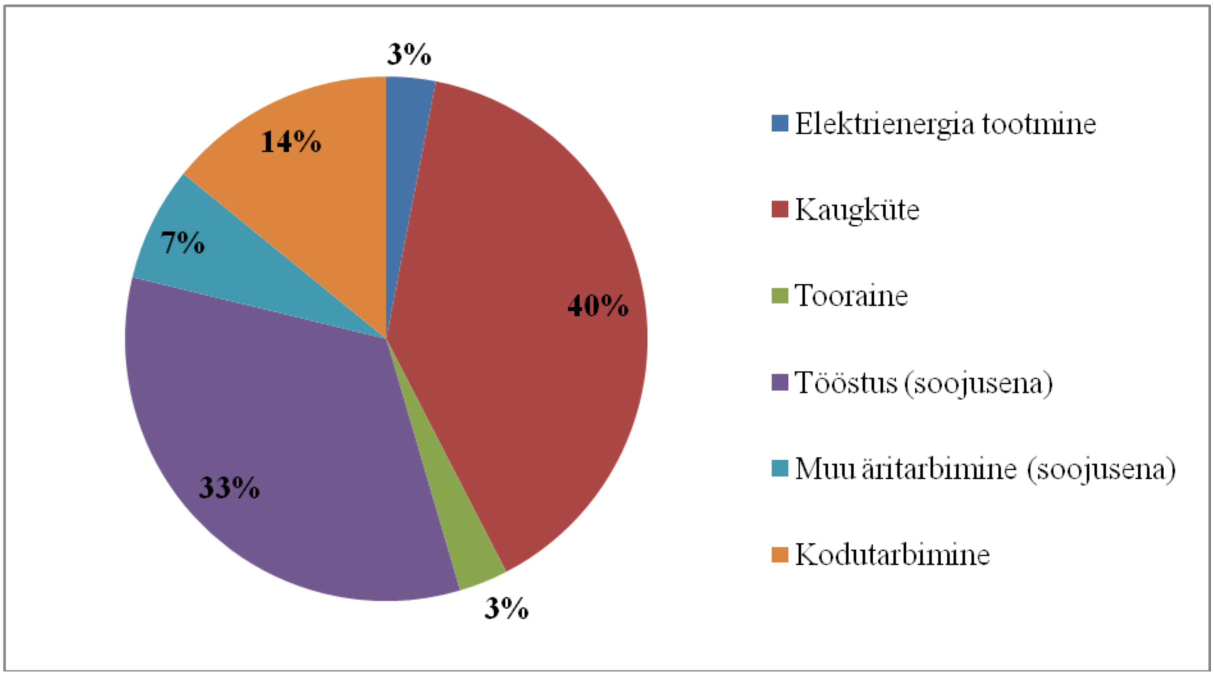
The combined gas system operator in Estonia is AS EG Võrguteenus, which provides both transmission and distribution services. In addition to AS EG Võrguteenus there are 25 natural gas distribution companies in Estonia which possess a total of 650 km of natural gas distribution pipelines (22% of the total length of distribution networks). 14% of the distribution services are provided through these networks. The largest distribution companies are Adven Eesti AS, Gasum Eesti AS, Tehnovõrkude Ehitus OÜ and AS Sillamäe SEJ.

The whole Estonian gas transmission network of 878 km is in the possession of AS EG Võrguteenus, including 36 gas distribution stations, 3 gas metering stations and 69% of the

[2] Competition Authority

gas distribution network – 1447 km, altogether 2325 km. AS EG Võrguteenus has taken the gas network assets on lease from AS Eesti Gaas.

The retail market is divided between the fields of use of natural gas as indicated in Figure 3. The produced biogas is used locally for the production of electricity and heat.



Electricity production
District heating
Raw material
Industry (heating)
Other commercial use (heating)
Households

Figure 3. Use of natural gas in 2012[3]

Since 2012, natural gas is being used again as a raw material for the chemical industry (AS Nitrofert). The share of gas as a raw material is expected to increase to 22% of the total consumption in 2013.

The number of customers on the retail market for gas is approximately 42 000, including nearly 41 000 household customers. Gas purchase contracts have predominantly been concluded by apartment associations or communities of apartment owners, who can be regarded as final customers for gas.

2.1.3. Estonian district heating market

District heating is the prevalent way of supplying heat in Estonia. Heat is produced for an entire city, town or group of buildings in a boiler plant or CHP plant and distributed through a heat network or pipeline to customers. Typically, heat is produced and distributed by the same company. Of the 226 local governments of Estonia, district heating is used in 151; it is

[3] Competition Authority

estimated that 60% of the country's population consumes heat produced in this way. The rest of the population uses local heating equipment for producing heat, e.g. stoves, boilers, heat pumps, electric heating, or other options[4].

The district heating market is not as concentrated as the markets for electricity and gas. There are a total of 239 different heating districts. According to Eurostat, the annual consumption of heat amounts to 5852 GWh (average for 2010 and 2011[5]). The annual sales volume of the district heating networks subject to the price regulation of the Competition Authority amounts to 4202 GWh (based on price regulation forecast data).

Table 7. Data on district heating networks falling under the regulation of the Competition Authority

Group of companies	Quantity of heat supplied to customers (GWh/yr)	Share
Less than 1 GWh/yr	2	0.05%
1–2 GWh/yr	11	0.26%
2–3 GWh/yr	17	0.40%
3–5 GWh/yr	34	0.81%
5–10 GWh/yr	47	1.12%
10–50 GWh/yr	399	9.50%
50–100 GWh/yr	208	4.95%
Over 100 GWh/yr	3484	82.91%
Total GWh/yr	**4202**	**100.00%**

The following is an overview of Estonia's largest district heating networks and customers[6]:

1. The largest heat distribution network (422 km) of Estonia is operated by AS Tallinna Küte. In 2012 the annual sales amounted to 1707 GWh. The district heating network of AS Tallinna Küte is connected to:

- 3644 buildings (housing – 71%, commercial institutions – 18%, municipal agencies – 11%);
- 2939 large customers;
- 2771 contractual final customers;
- 4065 boiler rooms, 91% of which are fully automated;
- 3873 heat meters, 97% of which belong to the company;
- 401 remote heat meters.

2. AS Fortum Tartu has 1222 contractual customers. Heating networks with a total length of 153 kilometres supply the districts of Tartu, except Tamme and Veeriku districts. In 2012 the annual sales amounted to 475 GWh.

[4] National Audit Office's report
[5] Statistics Estonia
[6] Information from companies' websites

Customers can be divided into three groups:

- the housing sector, which includes apartment associations, housing associations and private houses, accounts for 66% of the customers;
- state or municipal budget-funded agencies account for 11%;
- other agencies and companies account for 23%.

3. At the beginning of 2011, over 600 customers were connected to the district heating network of Fortum Eesti AS. The company operates approximately 60 km of district heating networks in the city of Pärnu. In 2012 the annual sales amounted to 174 GWh. Based on the sales volume, the district heating network customers of Fortum Eesti AS in Pärnu can be divided into four main groups:

- the housing sector (apartment buildings and single-family homes) accounts for 70% of the customers;
- state or municipal budget-funded agencies account for 10% of the customers;
- industrial enterprises account for 10% of the customers;
- business customers engaged in manufacturing or provision of services account for 10% of the customers. Medical rehabilitation centres form one of the largest buyer groups.

4. AS Eraküte supplies heat to consumers in several cities in Estonia:

- Haapsalu division has 197 customers. Residents (mainly apartment buildings) account for 80%, and businesses, offices, hotels, childcare institutions and a hospital account for 20% of the customers in the heating district. The total length of the heat network is approximately 19 km;
- Jõgeva district heating network supplies heat to a total of 90 customers: 53 residential buildings (~ 2000 apartments) and 37 administrative and service buildings. The total length of the heat network in Jõgeva is 8.6 km;
- Keila division supplies heat to 25 buildings. The majority of customers are apartment buildings, but heat is also supplied to schools, a hospital, a health centre, childcare institutions and private residences. The total length of district heating networks is 12.4 km;
- The city of Valga has a total of 16.4 km of heat networks and the main customers for district heating are apartment buildings. Heat is also supplied to schools, childcare institutions, shops, a hospital, a sewing factory, and some private residences. Most of the private residences located farther away from the city centre, as well as smaller apartment buildings, are stove-heated. The largest industrial enterprises of the city produce heat in their own boiler plants. District heat is supplied to 173 buildings, including 111 residential buildings, 21 commercial and dining establishments, 22 office buildings, 10 schools and childcare institutions, 4 healthcare and social service institutions, 4 sports and cultural facilities, and one industrial building;
- The total length of the heat network of Rapla is 10.9 km. AS Rapla Küte sells heat to 110 buildings in the city of Rapla. Approximately half of the heat is sold to residents and the other half to various companies and state and local government agencies;
- In Kärdla, heat is mostly supplied to apartment associations, followed (based on the share in sales) by municipal agencies, companies and the buildings of Kärdla Upper Secondary School. The total length of the district heating network of Kärdla is 5.9 km, including 5.2 km of modern pre-insulated pipelines.

In addition to these six cities, the local boiler plants of AS Eraküte supply heat to a number of companies and residential districts in Tallinn.

5. Adven Eesti AS supplies heat to several towns and villages in Estonia. The company produces heat in 101 boiler plants with a total capacity of 295 MW and operates 86 km of heat networks.

6. VKG Soojus AS owns 140 km of heat networks. The company supplies heat to the Ahtme district of Kohtla-Järve, and to Jõhvi rural municipality. In 2012 the annual sales amounted to 294 GWh. District heating is supplied to 1300 properties and a total of over 30 000 people.

7. The district heating network of Danpower (Võru Soojus AS) supplies heat to 201 customers. Danpower Eesti AS owns a total of 24.8 km district heat pipes. In 2012 the annual sales amounted to 55 GWh.

8. In Kuressaare, AS Kuressaare Soojus owns 34.1 km of heat pipes. The company has 211 contractual customers in Kuressaare; 308 buildings are connected to the heat network.

9. In Rakvere, the total length of the district heating network is around 19 km. AS Rakvere Soojus supplies heat to approximately 187 buildings, including 106 apartment buildings.

In addition to these large heat network operators there are a number of smaller network operators and local boiler plants that supply heat to settlements.

Table 8. Aggregate data on major heat network operators

Company	**Location**	**Production capacity**	**Annual sales of heat**	**Heat sales**	**Heat networks**
		MW	MWh	%	km
AS Tallinna Küte	Tallinn	1030	1 707 000	29.2%	422
AS Fortum Tartu	Tartu	272	475 000	8.1%	153
AS Fortum Eesti	Pärnu	150	173 800	3.0%	64
VKG Soojus AS	Kohtla-Järve, Jõhvi, Ahtme	435	294 000	5.0%	140
AS Narva Soojusvõrk	Narva	200	380 000	6.5%	70
AS Sillamäe SEJ	Sillamäe	94	167 000	2.9%	
AS Eraküte		111.6	197 100	3.4%	64.6
including	Haapsalu	37	57 400	1.0%	19
	Valga	20	50 000	0.9%	16.4
	Keila	23.5	34 800	0.6%	12.4
	Jõgeva	13.1	25 000	0.4%	8.6
	Rapla	15	23 000	0.4%	10.9
	Kärdla	3	6 900	0.1%	5.9
Adven Eesti AS		295	405 000	6.9%	86
including	Rakvere	28	45 000	0.8%	19
	100 small boiler plants	267	360 000	6.2%	67
Danpower Eesti AS	Võru	59	55 000	0.9%	24.8

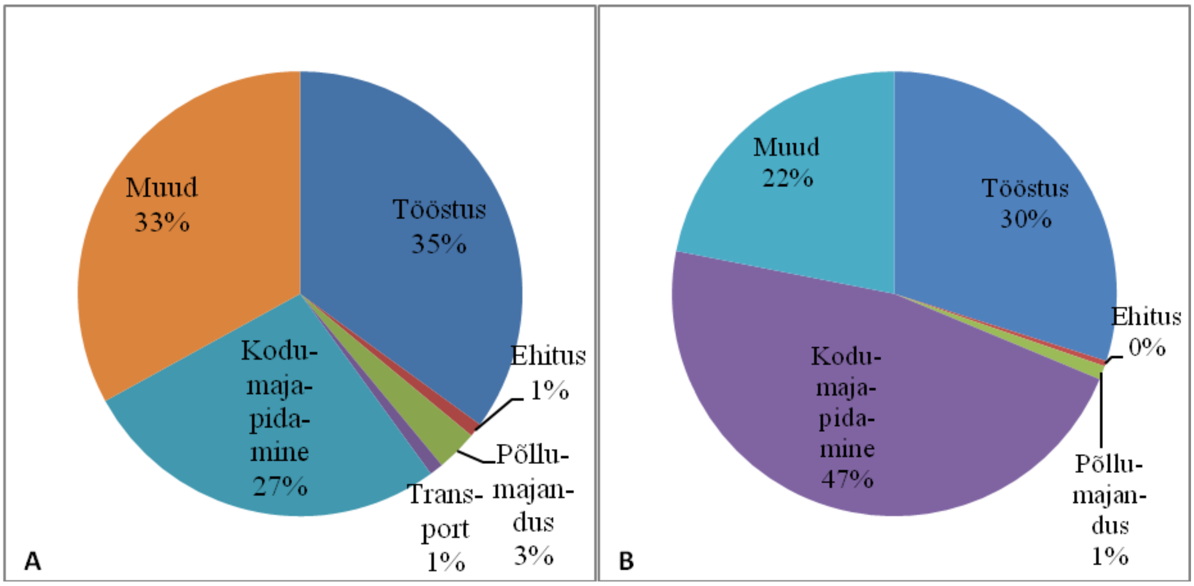
Total large producers			**3 853 900**	65.9%	
Total heat			5 852 000		

The rest of the heat for district heating is produced and distributed by more than 200 medium-sized and small local heat network operators. In the sector of households, the final customers for heat mostly include apartment associations and communities of apartment owners, while in business and public service sectors heat is primarily purchased by management companies.

According to Statistics Estonia, in the period 2010–2012 the average consumption of electricity amounted to 7228 GWh per year and the average consumption of heat was 8506 GWh per year, including 6751 GWh in district heating.

Table 9. Consumption of electricity and heat in Estonia

Consumption	**Electricity**		**Heat**	
	GWh	%	GWh	%
Industry	2 526	34.9	2527	29.7
Construction	72	1.0	40	0.5
Agriculture	200	2.8	117	1.4
Transport	55	0.8		0.0
Households	1 971	27.3	3994	47.0
Other	2 404	33.3	1829	21.5
Total consumption	**7 228**	**100.0**	**8 506**	**100.0**



35% Industry
33% Other
27% Households
3% Agriculture
1% Construction
1% Transport

47% Households
30% Industry
22% Other
1% Agriculture
0% Construction

Figure 4. Consumption of electricity (A) and heat (B) in Estonia (average for years 2010–2012)

2.2. Aspects to be considered in establishing energy efficiency obligations

According to Article 7(1) of Directive 2012/27/EU of the European Parliament and of the Council, Estonia is required to set up an energy efficiency obligation scheme, which ensures that energy distributors and/or retail energy sales companies operating within its territory achieve a cumulative end-use energy savings target (at least 1.5% of the annual energy sales to final customers) by 2021. For this purpose, the obligated parties must be designated amongst the energy distributors and/or retail energy sales companies operating in the territory of Estonia on the basis of objective and non-discriminatory criteria.

To find out about energy utilities' opinions on, and readiness for, the implementation of the energy efficiency obligation, a group discussion was organised in conjunction with the Ministry of Economic Affairs and Communications which took place on 10 October 2013 in the Ministry. Representatives of 11 energy utilities and professional associations participated in the discussion. In addition to the group discussion a survey was conducted in which energy utilities responded to questions relating to their administrative burden, past energy efficiency-related activities, and the proposed energy efficiency obligation. The questionnaire (see Appendix 1) was sent out on 17 October 2013 and energy utilities had one (1) week to give their responses. Representatives of seven (7) energy utilities responded to the questionnaire.

Based on the results of the group discussion and the survey, this section analyses the aspects that, in the opinion of both energy utilities and the authors of this study, should be taken into account when imposing the energy efficiency obligations on energy utilities.

During the group discussion held in the Ministry of Economic Affairs and Communications, the representatives of energy utilities highlighted a problem that is related to the instability of the electricity market. The instability of the electricity market is primarily due to the fact that the Estonian electricity market was only fully opened up at the beginning of 2013. The heat and gas markets, on the other hand, have functioned for a long time without any major changes, and are therefore characterised by a higher degree of development. Since the customer base of companies operating on the electricity market is changing constantly, the end-use energy savings to be achieved and declared by the companies will depend on the developments in the customer base, and this will complicate the calculation and reporting of energy savings. In addition, account should be taken of the requirement to avoid double counting of energy savings, which in turn leads to the need to decide whether the energy efficiency obligation would apply only to the sellers or only to the distributors of energy.

Owing to the foregoing, the suggestion to apply the energy efficiency obligation only to the network operators active on the electricity market was made during the group discussion. The authors of the study feel, however, that this would not meet the objectivity and non-discrimination requirement laid down in the Directive and, therefore, it is recommended to apply the energy efficiency obligation to companies active on the electricity, heat and gas markets. It is also important to solve the problem associated with the collection of data and the avoidance of double counting.

Given that final customers move actively between different sellers of energy, but the energy distributors' market can be considered stable, the preferred option is to apply the energy efficiency obligation to energy distributors. The obligation would apply to distributors of natural gas, electricity and heat. The application of the energy efficiency obligation only to energy distributors would cover all final customers and all the energy markets. This will avoid double counting and ensure energy efficiency-related activities in all sectors and for all forms of energy.

Pursuant to Directive 2012/27/EU, an energy saving achieved must be determined in a transparent manner and may be declared by only one obligated party (to avoid double counting). Also, the state must set up measurement and control systems under which at least a statistically significant proportion and representative sample of the energy efficiency improvement measures put in place by the obligated parties is verified independently of the obligated parties. Since this will increase the administrative burden of both companies and authorities, it is important to set a threshold on the size of the energy utilities' market share starting from which the energy efficiency obligation would have to be met. Otherwise the administrative burden of smaller companies would increase significantly, leading to a deterioration in competitiveness and, ultimately, market distortions.

According to the Energy Efficiency Directive 2012/27/EU, Member States are required to submit detailed reports on the impact of measures taken under the energy efficiency policy, including the energy utilities' progress in compliance with the energy efficiency obligation. The methodologies necessary to that end are difficult to use, as the data supplied by energy utilities and included in Estonian energy statistics provide limited opportunities for assessing the impact of energy-saving measures. To obtain more detailed information, it is essential to develop both the energy statistics of Statistics Estonia and the customer management programs of energy utilities which serve as the basis for the collection and processing of statistical data. The lack of statistical data needed for the calculation of energy savings has previously been referred to in the study that discussed the development of an energy efficiency policy monitoring mechanism[7]. It is therefore important to ensure that the energy efficiency obligation is applied to the companies that are able to collect, analyse and report the relevant data and whose final customers constitute a representative portion of the total energy market of Estonia. Thus, the application of the energy efficiency obligation is directly linked to the size of a company's market share, assuming that larger energy utilities have acquired customer management programs, which enable the necessary data to be processed without administrative costs substantially increasing.

The survey revealed that some energy utilities have carried out energy-related campaigns and awareness-raising work among customers in the past. For example, they have issued textbooks and conducted seminars and delivered lectures to students, adults and apartment associations on the conservation of energy. However, the impact of these measures has not been evaluated so far, and the companies estimate that it will be difficult to collect the relevant data in the future. All this boils down to a lack of the need to submit data, as well as to shortcomings in the companies' data analysis systems. Nevertheless, it is possible to obtain data on energy savings through various surveys. For example, a survey commissioned by a heat company revealed that over the 10-year period from 2003 to 2012 the customers' real heat consumption has decreased by about 13%, new customers have increased final consumption by approximately 9%, and the total consumption of old customers has dropped by about 22%.

Heat companies are of the view that measures to be taken in connection with the energy efficiency obligation and information campaigns will contribute to achieving real energy

[7] Uuring energiasäästupoliitika seiremehhanismi arendamiseks (Study on the development of the energy efficiency policy monitoring mechanism), ÅF-Estivo AS, 2010

savings, as customers will be better informed and interested in saving energy. Energy utilities view various information campaigns, materials and events as the key measures to be taken in connection with the energy efficiency obligation. In addition, consumption analyses and customer surveys could be conducted, and informational materials could be targeted at specific customer groups on the basis of the results of the analyses and surveys. Companies estimate the annual costs of various information campaigns and seminars to be in the order of EUR 20 000 to EUR 25 000. For smaller companies, such amounts are a significant expense that affects their business.

Summing up all the above, it is recommended to take into account in particular the following two aspects when designating the obligated parties (if the energy efficiency obligation is to be applied to energy utilities):

- the company's business or sector in which the company operates – the energy efficiency obligation should be applied to companies engaged in the distribution of electricity, heat, gas and/or various fuels (network operators), observing the Directive's principles of objectivity, non-discrimination and avoidance of double counting;
- the company's size – the application of the energy efficiency obligation should be based on a threshold of the size of the company's market share in order to ensure the availability of representative statistical data and avoid a significant increase in administrative burden and a damage to competitiveness. The authors of this study recommend setting this threshold (the quantity of energy distributed/sold by a company) at the level of 100 GWh/yr for distributors of electricity and natural gas and for heat network operators.

2.3. Administrative burden resulting from the introduction of the energy efficiency obligation

To obtain an overview of the current administrative burden of companies and the contribution of the introduction of the energy efficiency obligation to the administrative burden, a group discussion with energy utilities was organised in conjunction with the Ministry of Economic Affairs and Communications. In addition, a survey was conducted among energy utilities.

The group discussion took place on 10 October 2013 in the Ministry of Economic Affairs and Communications. Eleven persons representing eight energy utilities and professional associations attended the discussion. Producers and network operators active on the markets for heat, gas and electricity were represented.

The questionnaire (see Appendix 1) was sent out on 17 October 2013 and companies had one (1) week to give their responses. Representatives of seven (7) energy utilities responded to the questionnaire.

Information on the administrative burden is summed up below, based on the energy utilities' responses to the survey and the concerns raised during the group discussion.

The companies are of the view that changes/increases in customer groups will not have a significant impact on their administrative burden. It is currently possible for larger energy utilities to distinguish the energy consumption data of the relevant customer groups (i.e. resellers of energy, businesses and institutions, individual household customers and associations of household customers). Changes can be introduced to the existing customer management programs at low labour costs.

Resellers of energy usually lack a consumption point, and energy is typically sold to customers in a portfolio in which the consumption points change constantly. Energy utilities generally have two main types of databases – accounting software and customer management software. Commercial accounting programs are only used for handling invoices. An invoice usually indicates the person who has to pay the invoice, and the street address where the invoice is to be sent. For example, a management company that manages several consumption points receives monthly invoices that indicate the address of the management company rather than the addresses of the consumption points. Thus, ordinary accounting programs do not enable information on consumption points to be collected.

In addition to accounting programs energy utilities also use customer management software, which enables them to collect the consumption history of individual consumption points in specific geographic locations. The functionality/flexibility offered by such software is varied and it largely depends on the size of the given company. Smaller companies cannot afford complex applications offered on the market and often use applications that have been developed locally. Locally developed applications have weaker support, which in turn means that changes to the structure of data cannot be introduced at reasonable costs. Therefore, a modification of the system for collection of statistical data will be the most burdensome for smaller energy utilities whose administrative burden will increase significantly, while larger companies already have the necessary programs and capability.

Another significant administrative cost for companies will result from the installation and introduction of remote and smart meters for statistical processing of data. Most of the companies are already working on the introduction of remote meters, the relevant plans are in place and funds have been planned/allocated for the coming years. However, the remote reading method currently applied does not enable data to be read at any given time. Data are generally read only once a month.

According to companies, the cost of collecting meter readings in the current manner is low – approximately EUR 100 per 450 meters per month (data are read twice a month). Heat companies estimate that the administrative cost of replacing one meter with a remote meter amounts to around EUR 300. No estimates were provided in respect of electricity and gas meters. The adjustment of all remote meters so that data can be read on a continuous basis would require a one-off investment in the order of EUR 10 000 in the modification of software. The amount of the investment differs by company and depends primarily on the existing software, the number of different customer groups and the consumption volume. It is therefore essential to consider that the increase in administrative costs will be greater for, and have a more significant impact on, smaller companies.

The companies' plans do not foresee a considerable increase of investments in tangible fixed assets or real estate in the coming years. Nor do the companies expect a significant increase in the number of persons employed or in the amount of labour costs – despite the active work on the replacement of meters and the improvement and upgrading of software systems. The companies estimate that investments in machinery, equipment and other tools will grow the most.

2.4. Advantages and disadvantages of an energy efficiency fund in Estonia

Article 20 of Directive 2012/27/EU introduces the concept of an Energy Efficiency National Fund. Paragraph 4 of the same Article provides that the purpose of this fund is to support national energy efficiency initiatives. Article 20(6) provides for the opportunity of meeting the energy efficiency obligation by way of companies' contributions to the Energy Efficiency National Fund. This provision also states that an annual contribution to the Energy Efficiency National Fund must be equal to the investments required for the given company to meet the energy efficiency obligation. The Directive does not provide for any restrictions on the operation of the Energy Efficiency Fund.

2.4.1 Could an existing fund perform the functions of the Energy Efficiency Fund?

The European Energy Efficiency Fund has been set up in Europe to support energy conservation and the deployment of renewable energy[8]. The fund is engaged in the technical preparation of, and provides consultancy services and financing for, energy-saving projects with the help of the European Investment Bank, Deutsche Bank as well as local banks. The fund does not provide investment grants, and the projects funded must prove to be viable under the market conditions. The fund has a total volume of approximately EUR 265 million, including EU funding of EUR 125 million. The fund has been in operation since July 2011 and has so far decided to participate in six projects.

Estonian banks have not opened a private initiative-based financing channel dedicated to energy efficiency. The Environmental Investment Centre has launched the provision of so-called environmental loans, but this loan product has so far been used only for financing water sector measures and as bridge financing for non-profit associations and foundations participating in development projects. Thus, there is no national fund in Estonia that can be regarded as an Energy Efficiency Fund.

This section analyses whether it would be expedient to establish a separate Energy Efficiency Fund in Estonia and implement energy-saving measures with the support of such a fund in order to achieve the required savings. Directive 2012/27/EU does not require Member States to set up an Energy Efficiency Fund, i.e. an energy efficiency obligation can be imposed on companies instead. In this case, the companies themselves would have to find the technical solutions and resources for introducing saving initiatives. In so doing, they can rely on the support of the European Energy Efficiency Fund, local banks and on their own resources.

2.4.2 Nature of the Energy Efficiency National Fund

In order to explain the nature of the Energy Efficiency Fund, we look at its financing and the way its activities are organised.

The only source of financing for the Energy Efficiency Fund is the contributions of the companies that do not take their own measures to meet the energy efficiency obligation. Contributions to the Energy Efficiency Fund should be determined on the basis of the nature of potential energy saving measures (scope, implementation costs, possible distribution of

[8] European Energy Efficiency Fund EEEF; www.eeef.eu

costs between parties in the implementation of activities) and the manner of financing of the measures.

The Energy Efficiency National Fund can operate in the following essentially different ways:

1) Financial resources will be concentrated in the Energy Efficiency National Fund, which will organise the implementation of measures. In the case of this option, the state would have to set up units that will implement centralised energy saving measures in various foundations and companies of the state. Currently there are no overwhelmingly good reasons for the consolidation of national energy policy measures in a single institution. The state's companies and foundations are doing good work in their respective fields of activity (e.g. KredEx in the field of reconstruction of housing to increase its energy efficiency, the EIC in the modernisation of public infrastructure, the Enterprise Estonia Foundation in the implementation of entrepreneurship and regional policy measures, and Riigi Kinnisvara AS (State Real Estate Ltd.) in the management of public buildings), and consolidation would not entail better results. The existing network of implementing agencies can be regarded as adequate; no new implementing agencies are needed for additional national energy-saving initiatives.
2) Financial resources will be concentrated in the Energy Efficiency National Fund, but the system of implementing the measures will not be reformed and the Energy Efficiency Fund will just select the potential energy saving measures and the promoters based on the principles laid down in the legislation, rather than implement these measures itself. This role can be fulfilled, for example, by:
    a. the Government of the Republic. If the financing of the measures will be decided by the Government of the Republic, there will be a more comprehensive overview of the implementation of the sectoral policy and better links with the budget process. However, it should be considered that in addition to the funding of the measures the funding entity must also ensure the consolidation of the reports of individual implementing agencies. These reports are an input to the national reports to be submitted under the Directive. Thus, the reporting burden would fall entirely on the Ministry of Economic Affairs and Communications. The principle according to which the funding of the implementation of sectoral policy measures is decided by the Government is also applied to the use of revenues from the EU ETS;[9]
    b. the Development Fund, which is not substantively involved in the implementation of any energy policy measures and is independent of any entities implementing such measures. Since the second half of 2011, the Development Fund has consistently contributed to activities aiming to identify growth opportunities in the field of green economy. The Development Fund has a leading role in developing the new Energy Sector Development Plan 2030. In this case, the Development Fund will consolidate the reports on the national measures whose funding will be organised by the Energy Efficiency Fund operating within the Development Fund, and forward the reports to the Ministry of Economic Affairs and Communications.

[9] See also the Government of the Republic Regulation No 138 of 19 September 2013, 'General terms and conditions of using auction revenues during the greenhouse gas emission allowance trading period 2013-2020, and reporting'; https://www.riigiteataja.ee/akt/120092013015

2.4.3 SWOT analysis of setting up the Energy Efficiency National Fund

In order to analyse what are the advantages and disadvantages of financing energy efficiency-related actions with the help of the Energy Efficiency Fund compared to the direct application of the energy efficiency obligation to companies, a **SWOT** analysis is carried out.

A **SWOT** analysis is a very well-known, simple and widely used analytical model, which enables the internal strengths, weaknesses and external opportunities and threats of a planned action to be mapped. The acronym '**SWOT'** is formed of the first letters of the words **s**trengths, **w**eaknesses, **o**pportunities and **t**hreats.

The following are the strengths of setting up the Energy Efficiency Fund:

- energy-saving initiatives can be implemented in a shorter term, enabling energy savings to be achieved faster;
- energy saving measures will be implemented by agencies that have long-term experience in implementing national energy efficiency policy measures;
- Estonian energy utilities' readiness to meet the energy efficiency obligation and implement energy saving measures in respect of customers is low and they prefer the state's leadership in the implementation of energy-saving measures;
- the financial burden of companies that are obligated parties and that implement energy-saving measures will be distributed over a longer period;
- concentration of the measures and projects of different sectors, and better opportunities to use leverage to finance them;
- independence from the other goals of energy utilities' activities, absence of conflicts of interests in the business pursued (for example, a decrease in energy consumption can be harmful for energy utilities, and revenues from energy services might not be enough to compensate for the harm);
- the Energy Efficiency Fund will be able make the necessary technical and economic calculations;
- the state will have better control of energy saving measures; smaller negative consequences arising from insufficient regulation;
- concentration of the energy saving-related competencies available in the state.

The following are the weaknesses of setting up the Energy Efficiency Fund:

- the implementation of energy saving measures by obligated parties will have a greater effect due to Article 7(7)(c) of Directive 2012/27/EU;
- some sectors lack energy saving measures; in the case of centralised funding, preference might be given to the implementation of the energy-saving measures that have proved to be effective, rather than to the development of new measures;
- society would not support the creation of new national institutions;
- the contributions of energy utilities to the Energy Efficiency Fund would be rather similar to excise duties imposed on energy; therefore, increasing the excise duties might be preferred over the creation of a new scheme;
- financing of the Energy Efficiency Fund will be decided at the political level; the temptation to keep energy prices low will not be conducive to the adequate financing of the Energy Efficiency Fund.

The following external opportunities are associated with the creation of the Energy Efficiency Fund:

- better integration of the national system of subsistence allowances and energy saving measures; development of energy saving measures targeted at certain social groups;

- the opportunity to use the Energy Efficiency Fund as an instrument of the economic policy.

The following external threats are associated with the creation of the Energy Efficiency Fund:
- low stimulating impact on cooperation between companies that could have the potential for developing more cost-effective energy-saving solutions;
- changes in financing conditions in the course of work;
- the Energy Efficiency Fund will (initially) not be staffed with highly skilled professionals;
- beneficiaries would have to take into account the Energy Efficiency Fund's requirements for technical solutions and due dates.

The SWOT analysis shows that setting up the Energy Efficiency Fund is rational in Estonia and that the strengths and external opportunities outweigh the weaknesses and external threats identified. The weaknesses and external threats of the Energy Efficiency Fund are not such that cannot be prevented or avoided. Also, some energy utilities expressed the opinion that the energy saving measures so far taken through public foundations have worked well, and setting up energy utilities' similar systems for implementing energy-saving measures among energy customers would amount to unreasonable duplication.

The financial resources of the Energy Efficiency Fund would primarily be obtained from the contributions of companies designated as obligated parties. The main task of the Energy Efficiency Fund will be to finance energy efficiency-related actions. The Energy Efficiency Fund should engage experts to evaluate the technical level of the energy efficiency-related actions and approve financing.

2.5. Opportunities for achieving additional energy savings

2.5.1. Ecodesign and energy labelling requirements for products

According to the general principles of Article 7 of the Directive and Sections 25–27 of the guidance document on Article 7, only the savings achieved through energy saving measures that are more stringent than the minimum requirements set out in EU law may be counted towards the achievement of additional energy savings. These are important in individual actions, which may contribute to the energy efficiency obligation scheme, alternative measures and the Energy Efficiency Fund and are linked to the EU legislation such as the following:

- the Ecodesign Directive 2009/125/EC[10] and the minimum energy efficiency requirements for energy-using products established by implementing acts adopted under that Directive. By September 2013, implementing acts have taken effect with regard to the following product groups (20):
    - space heaters and combination heaters;
    - water heaters and hot water storage tanks;
    - vacuum cleaners;
    - computers and computer servers;
    - household tumble driers;

[10] Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products

- heating circulators;
- water pumps;
- household air conditioners and comfort fans;
- fans (electric input power between 125 W and 500 kW);
- household dishwashers;
- household washing machines;
- households' and the third sector's lighting equipment (including directional lamps, light emitting diode lamps and related equipment; fluorescent lamps, high intensity discharge lamps and integrated ballasts; and non-directional household lamps);
- household refrigeration appliances (refrigerators and freezers);
- televisions;
- electric motors;
- external power sources (requirements for their energy consumption in standby mode and normal mode);
- simple set-top boxes;
- complex set-top boxes (tuners, with additional functions; a voluntary measure agreed between manufacturers);
- imaging equipment (copiers, fax machines, printers, scanners, multifunctional devices; a voluntary measure agreed between manufacturers whose scope is equivalent to the U.S. Energy Star);
- standby and off-mode electric power consumption of electrical and electronic household and office equipment.

In future, it is intended to increasingly cover also the products that use energy indirectly (such as windows and insulation materials) by implementing acts and to evaluate other environmental impacts;

- the Energy Labelling Directive 2010/30/EU[11], which aims to assist customers in choosing the products that help save energy and thus reduce financial costs (taking into account the entire life cycle of a product), and to encourage the industry to invest in and develop more sustainable product design. By September 2013, implementing acts have taken effect with regard to the following product groups (10):
  - space heaters, combination heaters and packages of these with solar devices;
  - water heaters, hot water storage tanks and packages of water heater and solar devices;
  - vacuum cleaners;
  - electrical lamps and luminaires;
  - household tumble driers;
  - air conditioners;
  - televisions;
  - household washing machines;
  - household refrigerating appliances;
  - household dishwashers;

[11] Directive 2010/30/EU of the European Parliament and of the Council of 19 May 2010 on the indication by labelling and standard product information of the consumption of energy and other resources by energy-related products

- EU Regulations No 443/2009 and 510/2011 laying down emission performance standards for new passenger cars and new light commercial vehicles;

- Directive 2003/96/EC laying down the minimum levels of taxation for fuel in the taxation of energy products and electricity, and Directive 2006/112/EC on the common system of value added tax.

In addition to these restrictions, the Directive also excludes standards and norms that aim to improve the energy efficiency of products, services, buildings and vehicles, where such standards and norms are mandatory and applicable in Member States under EU law. The same principle applies to energy labelling schemes, which are mandatory in Member States by virtue of EU law. In summary, where the specific minimum energy efficiency levels or energy labelling schemes have been set as a result of the automatic transposition of EU legislation, they cannot be regarded as alternative measures. Any measures can only be taken into account if the nationally set levels of requirements are more ambitious than those set on the EU level (e.g. even more efficient products, buildings, vehicles or services).

The general requirements for the energy consumption of products and the labelling of the energy consumption have been laid down in Directive 2010/30/EU of the European Parliament and of the Council. Under that Directive, product groups are assigned to energy consumption classes G to A (and even classes from A to A+++ for many modern appliance groups). Each group of appliances and energy consumption class corresponds to an energy efficiency index EEI, which characterises the appliance's energy consumption. However, the EU regulations prescribe the maximum permissible energy consumption index for each new product in a group of appliances. Energy savings can only be counted if we introduce appliances that consume less energy than the EEI prescribed by regulations.

In this section we look at the requirements established for products by the Ecodesign Directive and its implementing acts, and **analyse the situation where the state implements a measure supporting the purchase of products that are more energy-efficient compared to the minimum requirements laid down under the Ecodesign Directive**. The Ecodesign Directive (2009/125/EC) and the Energy Labelling Directive (2010/30/EU) have been developed and are to be applied in conjunction with each other, which means that the Ecodesign Directive establishes the minimum requirements for product groups to which products must conform if they are to be marketed on the EU market and which correspond to the lowest energy label class level under the Energy Labelling Directive (from G to A, depending on the product group). The label is intended to inform consumers that it is possible to acquire even more efficient appliances than just those that meet the minimum requirements, guiding consumers with the help of different energy label classes, where energy efficiency is increasing from class G to class A and for some product groups to class A+ or even A+++, which currently designates the highest energy efficiency (in addition, the labels typically specify the annual energy consumption of the given product in normal use). Thus, by acquiring a better product than that conforming to the minimum requirements for the energy label class, one contributes to energy savings resulting from an alternative measure, which may be counted as additional savings, as they are voluntary and more than the EU legislation (the Ecodesign Directive) prescribes. For example, according to the market agreement, the minimum energy efficiency requirement for refrigerators established under the Ecodesign Directive will be so much tighter from 1 July 2014 that it will be equivalent to class A+ under the relevant implementing act (product group) of the Energy Labelling

Directive. Thus, for additional savings to be achieved (counted), one should purchase a product with a class A++ or A+++ energy label, because an A+ product is the most energy inefficient product available on the EU market and this energy efficiency requirement is mandatorily met on the market under law.

When implementing the measure in practice, it should be considered that the legislation can be amended or new implementing acts can be adopted that result in the minimum requirements becoming more stringent over time (which means that additional savings cannot be counted, as energy would be saved anyway). Essentially, this would mean that the potential measure described above will lose the additional energy-saving effect and become unusable if the minimum requirements are made more stringent, i.e. raised to the target level of the measure.

2.5.2. Additional savings from using appliances that consume less energy – a potential measure

Based on the product groups covered by the Energy Labelling Directive and the minimum energy efficiency requirements established for products under the Ecodesign Directive, the following analysis is conducted to examine three of the most electricity-consuming household appliances and identify the potential impact of a measure under which support would be given to households for acquiring products of a higher energy efficiency label class than that prescribed by the minimum requirements. This means creating a measure that supports the purchase of products, which meet higher energy efficiency requirements than the minimum requirements established under the EU legislation (ecodesign) i.e. fall into a higher energy label category, and which, therefore, can be included in alternative energy saving measures and counted towards energy savings under Article 7. The analysis is based on the following principles:

- No requirements have been established in Estonia for products which the Ecodesign Directive does not address or which are more ambitious than those laid down in the Ecodesign Directive. It is also hard to see a process or market demand for the introduction of requirements that are more stringent than the minimum ecodesign requirements for products, considering also that these will become tighter over time anyway and that the current EU-level process takes into account all the market participants on the EU market.
- For the purposes of achieving considerable additional energy savings compared to the EU-level minimum requirements established by EU legislation, first the product groups that Estonian consumers use the most are ascertained, i.e. the main cause of energy consumption. To this end, the survey of households' energy consumption in 2012 is used.
- The population of the energy consumption survey comprised all households whose main dwelling is located in Estonia. The address list compiled for the population and housing census was used as the survey frame. It contained all the addresses of dwellings located in Estonia, a total of 740 952. The address list did not contain information on whether a given address was the address of the main dwelling or not. Thus, the frame was overcovered, containing addresses that were not suitable for the survey. The overcoverage rate was 23.5% and thus 566 828 households must be taken into account.
- In addition, the survey aimed to ascertain which electrical appliances are used by households the most. Although the number of electrical appliances is high, the electricity consumption of most of them is relatively low (thus, it would probably unreasonable to

include, e.g. vacuum cleaners in the calculation of energy savings). The results are presented in Table 10.

Table 10. Number of household appliances[12]

Type of appliance	Relative share (%)	In how many households in the population of 566 828
Refrigerator	99%	561 160
Vacuum cleaner	93%	527 150
Television	97%	549 823
Washing machine	89%	504 477
Music centre	73%	413 784
Electric cooker	72%	408 116
Computer	68%	385 443
Microwave oven	61%	345 765
TV set-top box/satellite tuner	50%	283 414

As previously stated, the relative share of various appliances in households may not give an overview of the annual power consumption of the product groups used in Estonia. This is because of the very different usage frequency or time (over a year). Thus the energy saving potential of the appliances is also very different. For the purpose of choosing the product groups on which the measure could be based, in addition to the relative share of use it is also necessary to identify the annual energy consumption of the most common product in each product group, assuming normal use. To identify the most common products, it is necessary to conduct a market analysis among end sellers (essentially to find out the most common or the most required parameters of products). Also, in the implementing acts of the Ecodesign Directive, the Commission has developed a methodology for calculating the annual energy consumption of some product groups based on the most common model and its normal operation.

The following table (Table 11) provides an overview of the appliances specified in the household survey and included in the scope of the Ecodesign and Energy Labelling Directives, indicating the most prevalent (sought after) models of product groups on the market and their annual energy consumption values together with the energy consumption of the entire product group (based on the number of households used), assuming that all the appliances that are currently used meet the minimum requirements. The latter assumption is indeed very general, but serves its purpose to make the annual energy consumption values of different product groups (sectors) comparable, it being supposed that the larger the energy consumption of a group the greater will be the energy savings, for which reason the above measure should be based on the product group characterised by the highest energy consumption. As we had to choose three product groups to be analysed, these groups are (as indicated in Table 11) refrigerators, televisions and washing machines.

[12] Survey on energy consumption of households. Statistics Estonia, 2012

Table 11. Annual energy consumption of groups of household appliances meeting the minimum requirements (under the Ecodesign Directive 2009/125/EC)

Type of appliance	Label category (2010/30/EU) corresponding to the minimum requirement set under 2009/125/EC	Most common model on the Estonian market (general parameters)	Estimated annual energy consumption of the model that meets the minimum requirements, kWh/yr	Annual energy consumption of the entire product group in Estonian households, if all the appliances meet the minimum requirements, kWh/yr
Refrigerator	A (EEI <55) from 1.7.2010; **A+ (EEI <44) from 1.7.2012;** A+ (EEI <42) from 1.7.2014	Combined refrigerator (refrigerator + freezer), capacity 250–340 l	220 - 310	123 - 174
Vacuum cleaner	**G (<62 kWh/yr) from 1.9.2014**; D (<43 kWh/yr) from 1.9.2017	Analysis related to the maximum allowable energy consumption	62	33
Television	G (EEI <1) from 20.8.2010; **D (EEI < 0.8) from 20.8.2012**	32" screen, Full HD, 100 Hz (maximum permissible wattage: 129 W; operated 4 hours a day)	188	103
Washing machine	A (EEI <68) from 1.12.2010; **A+ (EEI <59) from 1.12.2013**	6 kg load, front-loading, 220 washing times a year (according to the Commission's guidance)	179	90
Music centre	No measures exist or are planned	-	-	-
Electric cooker	**C (EEI <146) from 1.7.2014;** B (EEI <121) from 1.7.2016; A (EEI <96) from 1.7.2018	Insufficient overviews, as the relevant legislation has not taken effect; resellers do not provide the data on annual energy consumption	-	-
Computer	**<158 kWh/yr for category B computers from 1.7.2014**; <112 kWh/yr for category B computers from 1.1.2016; labelling for screens only	Category B computer with at least a two-core processor and 2 GB of RAM	158	61
Microwave oven	No measures exist or are planned	-	-	-
TV set-top box/satellite tuner	Only minimum energy efficiency requirements; no labels	-	-	-

Bearing in mind the effective implementation of the potential support measure in practice, we assume that in addition to the minimum ecodesign requirements deriving from the relevant implementing act there should also be an implementing act for the energy labelling of a product group – the support measure could rely on the label classes laid down therein (otherwise we should establish a more effective level ourselves). We will now assess the impact of the potential measure based on the selected product groups – refrigerators, televisions and washing machines.

1. How much more expensive is a product of the next energy label class compared to one that meets the minimum requirements?
2. How much (electrical) energy will a product of the next energy label class save per year compared to one that meets the minimum requirements?
3. What is the cost-effectiveness of achieving energy savings in the given product group with the help of the potential measure?
4. A realistic assessment of the potential for energy savings.

Refrigerators

Under EU standards, 99% of the refrigerators used in Estonian households have been assigned an energy efficiency index in accordance with the appliance's energy class from G to A+++[13].

Class A+++	EEI < 22
Class A++	22 ≤ EEI < 33
Class A+	33 ≤ EEI < 44
Class A	44 ≤ EEI < 55
Class B	55 ≤ EEI < 75
Class C	75 ≤ EEI < 95
Class D	95 ≤ EEI < 110
Class E	110 ≤ EEI < 125
Class F	125 ≤ EEI < 150
Class G	EEI ≥ 150

The EU standards specify the minimum energy efficiency requirements for household refrigerators as follows:

from 1 July 2012	EEI ≤ 44
from 1 July 2014	EEI ≤ 42

This means that all new refrigerators must correspond to at least class A+ in terms of energy consumption. Additional energy savings can be counted only if we start using refrigerators that are better than those required by EU standards, i.e. class A++ or A+++ refrigerators instead of class A+ refrigerators.

To compare products of different energy label classes in the above manner (cost, energy savings, etc.), it is the most reasonable to study the products that are actually offered on the market, trying to compare products with as similar parameters as possible (the same model, dimensions, functionality, etc.). In the table below (Table 12) we compare models from different manufacturers which are of different energy classes, yet as similar as possible in terms of capacity, design and functionality, so as to make it possible to accurately assess a

[13] Regulations No 643/2009 and No 1060/2010 on household refrigerators and freezers

further need for investment in the acquisition products of a higher energy efficiency class (source: kodumasinad.ee), taking the real situation as the basis.

Table 12. Comparison of refrigerator models from different manufacturers which are of different energy classes, yet as similar as possible

Manufacturer	**Class A+ model**	**Class A++ model**	**Price difference**	**Energy savings (kWh/yr)**	**Energy saving cost, compensation for price difference €/kWh**
Atlant	XM 4008-022; 244 l; 223 kWh/yr; 250 €	XM 4109-031; 251 l; 186 kWh/yr; 269 €	19 €	37	0.51
Beko	CS 232020; 270 l; 272 kWh/yr; 280 €	CS 232030; 303 l; 225 kWh/yr; 300 €	20 €	47	0.43
Bosch	KGN 34X44; 280 l; 295 kWh/yr; 550 €	KGN 36VW32; 319 l; 239 kWh/yr; 639 €	89 €	56	1.59
Whirlpool	WBE 3112X; 318 l; 285 kWh/yr; 350 €	WBE 31122; 311 l; 230 kWh/yr; 390 €	40 €	55	0.73
Whirlpool	WBE 3414 TS; 338 l; 310 kWh/yr; 339 €	WBE 34142 TS; 338 l; 231 kWh/yr; 349 €	10 €	79	0.13
Average:			€ 30	55	0.54
				Payoff period (years)	5.4

The table indicates that the average investment needed is 30 EUR to procure a more energy efficient product (class A++) than that required by the minimum energy efficiency requirements (class A+), and that the average annual additional energy savings amount to 55 kWh. At today’s electricity prices (10c€/kWh), the payoff period of such additional investment would be at least five years. In essence, the measure could only take the form of additional support to encourage consumers to buy an even more efficient product (A++) instead of one meeting the minimum requirements (A+). In this case, the investment needed for supporting the purchase of e.g. 10 000 products would be EUR 300 000, while additional energy savings are expected to amount to 0.55 GWh per year. Replacement of all the products in this product group is unthinkable in Estonia, since the consumers who already have a modern refrigerator would have no motivation to replace it without full compensation. The payoff period of full compensation, however, will be very long. Thus, it is conceivable to design a support measure that basically means 10% support to consumers for the acquisition of a more energy efficient product than the one that the consumers themselves would buy. In this case the energy saving cost would amount to around 0.54 €/kWh.

To give an assessment, it can be assumed that all the refrigerators currently used in Estonia (561 160) are of class A+ and replacing them with A++ refrigerators will result in potential energy savings of 31 GWh. The impact of a possible information campaign concerning the product group should not be underestimated either. If we assume that 10% of refrigerators will be replaced with class A++ refrigerators per year and consumers will find at least a 5-year payoff period and a 30 EUR additional investment attractive, the replacement of refrigerators can result in annual energy savings of 3 GWh, which can be taken into account as additional savings attributable to the impact of the campaign.

Televisions

The minimum requirements for televisions are logically related to the screen size (in inches) and, depending to the screen resolution, two formulas are used to find the maximum permissible wattage weighted by the energy efficiency index (EEI).

Energy class	Energy efficiency index EEI	Maximum wattage W	
		32"	42"
A+++	EEI < 0.10	14.40	26.70
A++	EEI < 0.16	23.04	42.72
A+	EEI < 0.23	33.12	61.41
A	EEI < 0.30	43.20	80.10
B	EEI < 0.42	60.48	112.14
C	EEI < 0.60	86.40	160.20
D	EEI < 0.80	115.20	213.60
E	EEI < 0.90	129.60	240.30
F	EEI < 1.00	144.00	267.00
G	1.00 ≤ EEI		

Televisions in classes E, F and G may not be manufactured or marketed in the EU from 20 August 2012.

This analysis is based on the most popular televisions with the screen diagonals of 32 and 42 inches. From 20 August 2012, the maximum permissible wattage of these televisions in on-mode is 115 W and 214 W, respectively, which corresponds to energy label class D under the minimum requirements.

For the purpose of the analysis, similar models from different manufacturers are compared which have the most widespread configuration and whose common parameters are: the same screen diagonal (32" or 42"), full HD resolution of 1920 x 1080, 100 Hz, non–3D, and just a few additional features that increase the price or energy consumption (e.g. smart TV). The results of the comparison are set out in Table 13 (data from elion.ee).

Table 13. Comparison of television models from different manufacturers which are of different energy classes, yet as similar as possible (with the most popular screen diagonals of 32" and 42")

Manufacturer	Class B model	Class A model	Price difference	Energy savings (kWh/yr)	Energy saving cost, compensation for price difference €/kWh
32''	F6200	F5300			
Samsung	32" LED screen, Full HD 1920 x 1080 pixels, 100 Hz; 63 kWh/yr; 479 €	32" LED screen, Full HD 1920 x 1080 pixels, 100 Hz; 58 kWh/yr; 379 €	–100 €	5	None, will pay off (information campaign is needed)
42''	**Class A model**	**Class A+ model**			
	LG LN5400; LED screen, resolution 1920 x 1080 pixels, 100 Hz; 83 kWh/yr; 499 €	LED screen, resolution 1920 x 1080 pixels, 100 Hz; 76 kWh/yr; 459 €	–40 €	7	None, will pay off (information campaign is needed)

Although the above table provides just a brief overview of the situation on the market, an additional analysis confirms a market anomaly – products of a higher energy label class are not more expensive, but rather in the same price range or even cheaper than other products. This is despite the fact that investments in product development, including energy efficiency, should generally entail additional costs, which should be reflected in the price. Apparently, the keen competition between manufacturers results in significant pressure on prices, which is why, instead of a support measure, it would be very wise to conduct an information campaign regarding this product group and measure its impact on energy savings. Given that the minimum requirement for this product corresponds to class D, while there are also class A+ televisions available on the market, an information campaign could have a significant impact. The maximum permissible wattage of a 42-inch television in on-mode is 214 W (class D) which means that the annual maximum permissible energy consumption is 312 kWh; for a class A+ television, however, the maximum permissible wattage is up to 62 W and the annual maximum permissible energy consumption is 90 kWh, which implies the energy saving potential of more than 220 kWh per year compared to the minimum requirement (assuming on-mode for 4 hours a day). The replacement of the existing televisions with class A+ products in just 5% of households a year would provide annual energy savings of 6 GWh, given that this can be achieved with the help of an information campaign (the price difference between products of different energy label classes is not clear).

For computers, the EU standards define the annual energy consumption of class A, B, C and D computers as E_{TEC} kWh/yr. The annual energy consumption takes into account the wattage and the average daily use of a computer for 10 hours. From 1 July 2014, the E_{TEC} standards are as follows:

Category A computers	$E_{TEC} \leq 133$ kWh/yr
Category B computers	$E_{TEC} \leq 158$ kWh/yr
Category C computers	$E_{TEC} \leq 188$ kWh/yr

Category D computers $E_{TEC} \leq 211$ kWh/yr

Looking at the measured electricity consumption of the computers currently used, it appears that the electricity consumption of a computer in isolation is low, and our computers are of class A. The picture is different, however, when considering a computer and a monitor as a single workstation – this workstation is of class D. The ultimate targets set for the electricity consumption of computers are 2.5–4 times higher compared to the current standards. Computer manufacturers still have much to do to achieve these targets.

Reducing the electricity consumption of computers by 10 kWh compared to the EU standards will entail 4 GWh of electricity savings. On the assumption of 25% of computers being replaced each year, potential annual electricity savings amount to 1 GWh.

Refrigerators, televisions and computers are the most intensely used household appliances. The use of other household appliances is significantly lower in intensity. Calculations show, however, that the introduction of household appliances that consume less energy than required by EU standards will make it possible to achieve additional electricity savings of 3–5 GWh/yr from other household appliances.

If all household appliances were replaced with ones that are more efficient than prescribed by EU standards, annual electricity savings would amount to 10–12 GWh, which account for 0.12–0.16% of the total electricity consumption.

2.5.3. Electricity savings in standby mode of appliances

In order to assess the actual energy consumption of the appliances used, the authors of this study measured the electricity consumption of some commonly used office and household electrical appliances in standby mode. The results are presented in Table 14 below.

Table 14. Measured electricity consumption of office and household appliances

Appliance	**Mode**	**Measured wattage (W)**
Laptop	On-mode	26 – 35
	Standby mode	4
Computer monitor	On-mode	37
	Standby mode	4
Networked Philips 42" LCD television	On-mode	44 – 59
	Standby mode	8 – 10
Sony music centre	On-mode	25
	Standby mode	6
Sony CRT television	On-mode	100
	Standby mode	0
Kyocera TasKalfa 250cl copier	On-mode	500
	Standby mode	49
Jura coffee machine	On-mode	up to 1300
	Standby mode	8 – 10

Drinking water dispenser	Heating mode	100 – 500
	Standby mode	0

The EU's current ecodesign requirements prescribe that the electricity consumption of electronic equipment in standby mode may not exceed 1 W[14]. By way of an exception, the electricity consumption of networked televisions may be up to 8 W in standby mode[15]. The ultimate target is no more than 0.4–0.5 W standby electricity consumption of household electronic equipment.

As the measurements show, the electricity consumption of office and household appliances is very different. The standby electricity consumption of a computer (Dell) and monitor and a music centre is significantly higher than permitted by ecodesign standards. The electricity consumption of the television observed is near the limit prescribed by the Ecodesign Regulation. To completely turn off an appliance, its power supply must be disconnected. Older appliances (such as CRT televisions) consume more electricity, but they have a button to turn the appliance off. The newer electronic equipment observed do not enable additional savings to be achieved in standby mode. As these appliances are not manufactured in Estonia, we cannot influence the savings through a technical solution.

Copiers and coffee machines consume a lot of electricity in standby mode. The electricity consumption can be reduced by disconnecting the appliance's power supply. Unfortunately, these appliances lack a button to turn the appliance off. This can only be done by pulling out the plug or disconnecting the circuit.

Consequently, additional energy savings can be achieved in relation to the use of office and household appliances, if the appliances are disconnected from the power supply, rather than left in standby mode when not used.

Next we calculated the potential electricity savings that could be achieved if all household customers unplugged their televisions, music centres and computers as the most commonly used household appliances that can be turned off when not used. The results are presented in Table 15 below.

Table 15. Electricity consumption of household appliances in standby mode

	Number of appliances	**Operating hours per day**	**Standby hours per year**	**Power consumption in standby mode**	**Electricity consumed by one appliance**	**Electricity consumption of all appliances in standby mode**
		hour	hour	W	kWh/yr	GWh/yr
Television	549823	4	7300	8	58.4	32
Music centre	413784	8	5840	6	35.0	14
Computer	385443	8	5840	4	23.4	9
Total						56

[14] Commission Regulation of October 2009
[15] Commission Regulation No 801/2013, 22 August 2013

The calculation shows that unplugging household appliances for the time that they are not used will enable 56 GWh, or 0.8% of the electricity consumed in Estonia, to be saved.

No electrical appliances are manufactured in Estonia. The electricity consumption of office and household appliances sold on the market is relatively high compared to EU Directives and recommendations, especially in standby mode. Some additional savings can be achieved by replacing the existing household appliances with ones that are even more efficient than required by the EU (classes A++ and A+++).

We can achieve significant additional savings, if electrical household and office appliances are unplugged when not used. To this end, consumers' awareness needs to be raised and the energy-saving opportunities must be explained to them. In addition, manufacturers should bring the electricity consumption of their appliances in both on-mode and standby mode into conformity with the levels set by EU Directives.

3. Analysis of the impact of alternative measures and proposal of a package of energy efficiency obligations and alternative measures

3.1. Analysis of the impact of alternative measures

As an alternative to setting up an energy efficiency obligation scheme, Estonia may opt to take other policy measures to achieve energy savings among final customers under Article 7(9). These measures may include the following policy measures or combinations thereof:

- energy and CO_2 taxes;
- financing schemes and instruments or fiscal incentives;
- regulations or voluntary agreements;
- standards and norms;
- energy labelling schemes;
- training and education.

When selecting the alternative measures, the criteria set out in paragraphs 10 and 11 of Article 7 must be observed. Among other things, the energy savings achieved with the help of the measures must be determined in a transparent manner and any double counting must be avoided. The policy measures to be taken must provide for at least two intermediate periods before 31 December 2020, and the energy savings must be calculated in accordance with the provisions of Annex V. According to Article 7(10), a control system must be put in place that also includes independent verification of a statistically significant proportion of the energy efficiency improvement measures, and data on the annual trend of energy savings must be published annually.

In this study, we analyse the impact of alternative measures on the energy saving target. Owing to the terms of reference of the assignment, only the following alternative measures are analysed: (1) energy and CO_2 taxes (Section 3.1.1), and (2) financing schemes and instruments or fiscal incentives (Section 3.1.2). It must be noted that when determining energy savings from energy and CO_2 taxes, credit may only be given for energy savings from taxation measures exceeding the minimum levels of taxation applicable to fuels as required in Directive 2003/96/EC or Directive 2006/112/EC. In addition, there is a requirement to use only recent and representative official data on price elasticities.

Based on the results of the impact analysis, a proposal is made for a package of energy efficiency obligations and alternative measures to ensure that the obligation laid down in Article 7(1) is met (see Section 3.2).

3.1.1. Tax system

In this section, we analyse value added tax and excise duty on fuel and electricity, changes in which could potentially affect the final energy consumption. The analysis addresses the energy efficiency-related effect of these taxes, taking also into account the price elasticity of electricity, natural gas and heat from district heating. Energy savings achieved as a result of tax effects is calculated using the following formula[16]:

dD(%) * Eanv = dEanv,

where dD(%) = dPSM * EPE,

where dPSM = (P + S_{EE} + M_{EE}) – (P + S_M + M_M) / (P + S_M + M_M), where

P – price of final consumption of the form of energy,

S_{EE} – current rate of excise duty in Estonia,

S_M – minimum rate of excise duty under EU Directive 2003/96/EC,

M_{EE} – current rate of value added tax in Estonia, i.e. 20%,

M_M – minimum rate of value added tax under EU Directive 2006/112/EC,

EPE – price elasticity coefficient,

Eanv – final energy consumption,

dEanv – calculated energy savings.

This formula is used to find the estimated annual energy savings in the final consumption of electricity, natural gas, transport fuels and heat from district heating. Making a number of assumptions about the price of energy, final consumption quantities, tax rates and the temporal constancy of the price elasticity coefficient, the potential energy savings in the final consumption of energy are calculated for the period 2014–2020. The calculation results are given in Table 16.

[16] ER 2013:04 Implementering av artikel 7 i energieffektiviseringsdirektivet – Energimyndighetens beräkningar och förslag (in Swedish)

Table 16. Estimated final energy consumption savings from the taxation of electricity, heat, transport fuels and natural gas. Electricity and natural gas prices are given as the average business and household customer prices for the period 1 January 2013 – 30 June 2013. The prices of transport fuels and heat are given as at 1 December 2013 in Estonia. The data were obtained from Statistics Estonia (http://www.stat.ee/), as were the annual final energy consumption data. The values specified in several studies[17,18,19] have been used as the price elasticity coefficients.

Form of energy	Price	Consumption volume (TJ)	Price elasticity coefficient	Estimated annual energy savings from taxation	Total savings in the period 2014–2020
Natural gas	11.90 €/GJ	5 113	-0.26	73.20 GWh	512.41 GWh
Electricity	0.11 €/kWh	25 202	-0.18	226.49 GWh	1585.41 GWh
District heating	57.09 €/MWh	16 560	-0.20	134.25 GWh	939.74 GWh
Petrol	1.29 €/l	11 067	-0.26	78.13 GWh	546.88 GWh
Light fuel oil, diesel	1.35 €/l	24 581	-0.26	167.75 GWh	1174.23 GWh
				TOTAL	**4.8 TWh**

As the potential energy savings indicated in the table are merely estimated results, in the calculation of which rather general assumptions were made, we will analyse the current situation of energy taxes and the possibility of tax increases in more detail in Annex 2.

3.1.2. Financing schemes and instruments

This section discusses energy efficiency-related measures of financing schemes. The most important of them are being planned under the 'Energy efficiency' priority axis (measures1–3) and the 'Growth-capable entrepreneurship and the RD&I supporting it' priority axis (measure 4) of the Operational Programme for Cohesion Policy funding 2014–2020:

1. energy efficiency in housing;
2. efficient generation and transmission of heat**;**
3. improving energy efficiency and increasing the share of renewable energy;
4. energy and resource efficiency of companies.

The authors of the study also analysed the possible impact of other activities described in the Operational Programme for Cohesion Policy funding 2014–2020. Unfortunately, the expected impact of those other activities could not be described with sufficient reliability during the preparation of this study.

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[17] World Energy Model 2011. IEA
http://www.iea.org/media/weowebsite/energymodel/WEM_Methodology_WEO2011-1.pdf

[18] Frankhauser, S., Tepic, S. 2005. Can poor consumers pay for energy and water? An affordability analysis for transition countries. European Bank
http://www.ebrd.com/downloads/research/economics/workingpapers/wp0092.pdf

[19] Balmorel - Data and Calibration v 2.05
http://www.eabalmorel.dk/files/download/Balmorel%20Data%20and%20Calibration%20Version%202.05.pdf

The following is a more detailed analysis of the above measures. In addition, the energy savings to be achieved by using these alternative measures will be calculated.

1. **Energy efficiency in housing**
   Given that 97% of Estonia's housing stock is privately owned and the low incomes of the bulk of the population will not permit the development of new housing for a long time to come, the main focus should continue to be on maintaining and modernising the existing housing stock by supporting the owners of dwellings in making the necessary investments. About 45% of energy resources are spent in the household sector in Estonia. KredEx estimates that the area potentially in need of renovation accounts for 70% of the area of apartment buildings in the target group, i.e. 14.5 million m^2.

   Since 2009, 1.1 million m^2 (approximately 5% of the target market) have been renovated with the assistance of the renovation loan and reconstruction support of KredEx. To achieve the 20/20/20 objectives (specifically the objective of Directive 2012/27/EU), 700 000–1 000 000 m^2 should be renovated annually. This renovation volume would reduce CO_2 emissions by an average of 30 000–40 000 tonnes per year.

   The aim of the state's investment support for the reconstruction of existing housing is to achieve a better indoor climate and energy performance and reduce the energy consumption of residential buildings among final customers in order to foster the reduction of energy dependency and greenhouse gas emissions (planned amount – ca. EUR 110 million). The reconstruction of the housing stock will contribute to increased energy savings, improve the living environment and have a positive impact on the environment and the economy.

   a. <u>Supporting the reconstruction of apartment buildings:</u> the target group comprises apartment associations and communities of apartment owners that are active in apartment buildings constructed before 1993. Funds will be allocated from the Cohesion Fund to support the comprehensive reconstruction of residential buildings with a view to reducing their energy bills. The financing scheme is 15–35% (declining over time) of the cost of the reconstruction work aimed at improving the energy performance of a residential building, and 50% of the cost of preparation of the building design documentation and of the project management and owner's supervision services. The support is intended to cover the applicants' self-financing portions of bank loans raised for investing in the renovation of apartment buildings and will depend on the rate of energy savings to be achieved. The aim of implementing the measure is to achieve energy savings in reconstructed buildings at the average estimated rate of 45% of the consumption under the building design documentation by 2020.

      Complete insulation of buildings together with the renovation of boiler rooms and heating equipment within buildings and the construction of ventilation systems with heat recovery can result in the reduction of heat consumption by 30%. Estimated savings can amount to 45%[20].

      The energy consumption of a building is characterised by its energy performance indicator (EP). The ranges based on the new energy performance certificate

[20] Study 'Kaugkütte energiasääst' (Energy savings in district heating), Development Fund 2013

system are set out in the table below[21]. Estonian buildings are mostly in classes D and E. Class A buildings are nearly zero-energy buildings.

Table 17. Energy performance indicators (EP) of apartment buildings and corresponding energy performance classes

EP, kWh/(m²·a)	**Class**
EP ≤ 100	A
101 ≤ EP ≤ 120	B
121 ≤ EP ≤ 150	C
151 ≤ EP ≤ 180	D
181 ≤ EP ≤ 220	B
221 ≤ EP ≤ 280	F
281 ≤ EP ≤ 340	G
EP ≥ 341	H

As regards the reconstruction of the housing stock, the target is to renovate 2.9 million m^2 of residential space by 2022. The vast majority of the residential buildings to be renovated are apartment buildings of classes D and E, and their average energy consumption is 185 kWh/m^2. It follows that the average energy consumption of 2.9 million m^2 is in the order of 536.5 GWh. Given that, realistically, the energy savings that can be achieved in a renovated building are in the range of 30–45%, this work is based on the average achievable energy savings of 37%. Consequently, it can be concluded that the potential average energy savings from the renovation of 2.9 million m^2 amounts to **198.5 GWh**.

b. <u>Supporting the preparation of standard building design documentation for the construction of nearly zero-energy buildings (nZEB).</u> KredEx will organise a public procurement procedure to contract the preparation of standard building design documentation of residential buildings (4–5 different buildings, including small houses and apartment buildings), which the private sector can use for construction of dwellings and thus save on design costs. In view of the obligation assumed by Estonia under the EU Energy Performance of Buildings Directive to ensure that from 2019 all public buildings and from 2021 all new buildings will be constructed as nearly zero-energy buildings (nZEB), it is necessary to encourage residential owners to order low-energy houses (at least in the period 2015–2018, to ensure a smooth transition and stimulate the market demand).

[21] 'Methodology for calculating the energy performance of buildings', Regulation No 63; 08.10.2012, entered into force on 09.01.2013; 'Minimum requirements for energy performance', Regulation No 68; 30.08.2012, entered into force on 09.01.2013, 'Format and procedure for issue of energy performance certificates', Regulation No 30, 23.04.2013, entered into force on 03.05.2013

Table 18. Output indicators and target levels of activities planned under the 'Energy efficiency in housing' measure

Activity	Output indicator	Unit	Target level 2016	Target level 2018	Target level 2020	Target level 2022	Target level 2023	Source (basis of indicator level; who will measure and how; frequency of measurement; description of indicator)
1.	Number of households with improved energy consumption classification	number	40000	50000	55000	60000	60000	The indicator level is based on the reconstruction volume and investment capacity; measured by KredEx once a year
2.	Share of reconstructed housing stock	m^2	2 400 000	2 600 000	2 800 000	2 900 000	2 900 000	The indicator level is based on the reconstruction volume and investment capacity; measured by KredEx once a year
3.	Number of residential buildings supported	number	1200	1500	1550	1600	1600	The indicator level is based on the reconstruction volume and investment capacity; measured by KredEx once a year
4.	Number of different standard building designs for construction of nZEB	number	0	5	5	5	5	The indicator level is based on the evaluation of the market demand and capacity; the number of standard building designs as the indicator will not change over time. KredEx is the source of the indicator.

2. Efficient generation and transmission of heat

The measure is intended to provide investment aid to heat companies (both private and local government-owned companies) for improving the reliability and efficiency of district heating systems in order to reduce final energy consumption through more efficient generation and transmission of heat, introduce cheaper sources of heat and thereby achieve a reduction of heat costs for customers (planned amount – ca. EUR 80 million). Under the measure, non-repayable investment aid can be obtained for the reconstruction of boiler plants or the replacement of boiler plants with new ones, the reconstruction of heat pipes or the replacement of unviable district heating systems with local heating. To ascertain unviable systems, local governments can apply for support for financing audits.

a. Renovation of district heating boilers and replacement of fuels: support will be offered for investment in the acquisition of new or the renovation of old boiler equipment, which will enable the provision of competitive district heating services to be continued in the regions where these services are viable (long-term existence of customers).

b. Renovation of dilapidated and inefficient heat pipelines: support will be offered for replacement of heat pipelines with more efficient pipelines or for partial renovation of pipelines (e.g. only the replacement of the insulation). Modern construction materials (pre-insulated pipes) and optimal planning of pipelines can help save an estimated average of 10–15% of the heat produced, if the majority of the pipelines are replaced (possible in smaller areas). The exact need for the support and its share in the investment will be specified on the basis of calculations made under the energy sector development plans drawn up by local governments in advance (mandatory) and verified by the EIC.

   Heat losses in district heating networks amount to 966 GWh (the average loss is 21%). The total length of heat networks is 1427.6 km. The reduction of the diameter of pipes and the installation of pre-insulated pipes will theoretically enable losses to be reduced by 56% on average (savings in the case of pipes with different diameters range between 52% and 57%), considering also the 2% effect resulting from the reduction of diameters. Today, the average heat loss per 100 m of a heating network is 966 000 / 14 276 = 67.6 MWh. After the renovation: 67.6 x 0.44 = 29.7 MWh per 100 m. After the replacement of pipelines, theoretical losses will amount to 425 GWh. The saving potential of the renovation of district heating networks is 966 – 425 = 542 GWh per year.[22] Consequently, the **average energy saving potential of renovating 137.5 km of pipelines** under the measure (renovation of dilapidated and inefficient heat pipelines) **is 52.1 GWh**.

Table 19. Cumulative energy savings from the renovation of district heating pipes

Measure	**Cumulative annual energy savings (GWh)**							**Total* (GWh)**
	2014	2015	2016	2017	2018	2019	2020	

[22] Study ‘Kaugkütte energiasääst’ (Energy savings in district heating), Development Fund 2013

Renovation of district heating pipes	8	19	27	33	40	46	52	225

Since the potential energy savings from the renovation of district heating pipelines have already been taken into account in the calculation of alternative energy savings in Section 1.3, the energy savings from this measure will not be considered under the financing schemes and instruments, keeping in mind the requirement of avoiding double counting.

c. Economic and technical audits of heating districts: support will be offered to local governments for drawing up energy sector development plans (conducting energy audits), which define the course of development of the heat sector and compare a variety of technical and economic options.

d. Replacement of district heating with local heating solutions: support will be offered for the elimination of the heating districts where the continuation of district heating is economically unreasonable and local solutions should be preferred.

Table 20. Output indicators and target levels of activities planned under the 'Efficient generation and transmission of heat' measure

Activity	**Output indicator**	**Unit**	**Target level 2016**	**Target level 2018**	**Target level 2020**	**Source** (basis of indicator level; who will measure and how; frequency of measurement; description of indicator)
1. Renovation of district heating boilers and replacement of fuels	Renovated or new heat generation capacity, including renewable energy production	MW	40	60	86	The EIC will collect feedback from applicants. Technical calculations of indicators are set out in applications.
2. Renovation of dilapidated and inefficient heat pipelines	The length of renovated and new pipelines	km	70	105	137.5	The EIC will collect feedback from applicants. Technical calculations of indicators are set out in applications.
3. Economic and technical audits of heating districts	Number of audits	Number	100	150	200	The EIC will keep records of the audits conducted.
4. Replacement of district heating with local heating solutions	Total capacity of new local heating solutions	MW	4	8	10	The EIC will collect feedback from applicants. Technical calculations of indicators are set out in applications.

3. **Improving energy efficiency and increasing the share of renewable energy**

The overall objective of the measure is to completely renovate the outdated networks of street lighting infrastructure in Estonia (planned amount – ca. EUR 57 million). Considering the amount of resources to be allocated, the measure aims to reduce (by 2022) the wattage of the street lighting infrastructure by at least 1985 MW compared to the current level, thus **saving approximately 7.94 GWh of electricity per year**. This is equivalent to the complete renovation of 22 000 lighting points, which, given the assessment of 40% of the street lighting systems in Estonian cities and towns being outdated and the fact that the measure should focus only on that part of the systems (40%), means that support can be given to up to 28 medium-sized cities and towns (based on the target group comparable to that of the 'Project of seven cities': cities and towns with 8000–15 000 inhabitants).

Table 21. Output indicators and target levels of activities planned under the 'Improving energy efficiency and increasing the share of renewable energy' measure

Activity	**Output indicator**	**Unit**	**Tar–get level 2022**	**Source** (basis of indicator level; who will measure and how; frequency of measurement; description of indicator)
1. Renovation of street lighting infrastructure	Reduction of the wattage of street lighting systems	MW	1985	The indicator is based on the renovation volume; measured by the EIC once a year

The following measure is being planned under the 'Growth-capable entrepreneurship and the RD&I supporting it' priority axis of the Operational Programme for Cohesion Policy funding 2014–2020:

4. **Energy and resource efficiency of companies**

The measure is intended to increase energy and resource efficiency in companies and industry, which can be achieved primarily through the introduction of innovative solutions (planned amount – ca. EUR 130 million).

The first sub-objective of the measure is to achieve greater energy and resource savings in industry mainly through the introduction of innovative solutions. Using the best available equipment, including technology, will enable resource productivity to be increased in all areas of production.

The description of the impact of the 'Energy and resource efficiency of companies' measure suggests that 30 companies will have benefited by 2018, 150 companies by 2020 and 300 companies by 2022 from the measure. Assuming that the target group will consist of companies characterised by significant energy consumption, the expected impact of the measure can be summarised as follows:

- the total amount of initial investments will be EUR 90–100 million during the period of implementation of the measure, i.e. years 2014–2022. The private sector can be engaged in the funding of the measure; the need for structural funds is much more modest;
- the average energy savings will amount to 75 GWh/yr in the period 2014–2022;

- **total energy savings in the companies covered by the measure will amount to 223 GWh in the period 2014–2020 and 527 GWh in the period 2014–2022.**

Table 22. Output indicators and target levels of activities planned under the 'Energy and resource efficiency of companies' measure

Activity	**Output indicator**	**Measurement unit**	**Target level 2018**	**Target level 2020**	**Target level 2022**	**Source** (basis of indicator level; who will measure and how; frequency of measurement; description of indicator)
1.	Number of companies supported with a view to increasing their resource and energy savings	Company	30	150	300	Projects implemented

Based on the above analysis and calculations, the average energy savings from the most significant financing schemes and instruments can be identified (see Table 20). The greatest savings can be achieved under the 'Energy and resource efficiency of companies' measure, but no less important are the savings achieved through the implementation of the 'Reconstruction of apartment buildings' measure.

Table 23. Average potential energy savings from the most significant energy efficiency-related measures by 2020

Measure	**Potential energy savings**
Renovation of street lighting	55.6 GWh
Energy and resource efficiency of companies	223.0 GWh
Reconstruction of apartment buildings	191.5 GWh
Total	**470.1 GWh**

The following table shows potential energy savings that can be achieved in the period 2014-2020. The table indicates the annual energy savings from different measures and the total cumulative energy savings. The cumulative energy savings from the measures have been calculated on the basis of the target levels of the measures which are divided proportionally between all years. The calculations are also based on the assumption that the lifetime of the measures is longer than seven years, and thus the energy savings to be achieved from the measures implemented in 2014 will be the same in 2015, 2016 as well as in 2019.

Table 24. Cumulative average potential energy savings from the most important energy efficiency-related measures in the years 2014–2020

Measure	**Annual energy savings**							**Total* (GWh)**
	2014	2015	2016	2017	2018	2019	2020	
Renovation of street lighting (GWh)	7	15	22	30	37	44	56	211

Energy and resource efficiency of companies (GWh)	-	6	19	32	45	134	223	459
Reconstruction of apartment buildings (GWh)	54	110	164	170	177	184	192	1051
TOTAL (GWh)	61	131	205	232	259	362	467	**1721**

* Total cumulative energy savings

3.2. Proposal of a package of energy efficiency obligations and alternative measures

According to Article 7(1) of the Energy Efficiency Directive 2012/27/EU, each Member State is required to set up an energy efficiency obligation scheme. In Sections 1.2 and 1.3 of this report, both the total amount of required energy savings and the alternative energy savings were calculated on the basis of the guidance document on the Directive. Total calculated alternative energy savings for the seven-year obligation period (01.01.2014 – 31.12.2020) amount to 7140 GWh (see Section 1.3).

The state is required to implement Article 7 of the Directive and meet the energy efficiency obligations. This can be done in two ways: imposing energy efficiency obligations on companies operating in the energy sector and/or taking alternative measures. As alternative measures, Estonia can introduce various policy measures to achieve energy savings among final customers. Based on the terms of reference of the assignment, potential energy savings from the following two alternative measures have been analysed and calculated in this study: (1) energy and CO_2 taxes (see Section 3.1.1), and (2) financing schemes and instruments or fiscal incentives (see Section 3.1.2).

As the potential cumulative energy savings that can be achieved by 2020 with the help of the alternative measures amounts to approximately 6.5 TWh, it is necessary to also impose energy efficiency obligations on energy utilities, specifically the distributors of energy (see Section 2.2), to achieve the saving objective under Article 7.

Although this study has not addressed the impact of energy efficiency obligations on the general objective of the national energy efficiency policy, it can be stated that achieving the general objective will require additional measures, and one of the possible measures is the establishment of energy efficiency obligations on energy utilities (in addition to the alternative policy measures that the state will implement to meet the obligations arising from Article 7 of the Directive). Thus, considering Article 7, the following combination can be used:

- energy efficiency obligations of network operators (including contributions to the Energy Efficiency Fund);
- alternative measures to be implemented by state authorities, the state's foundations and companies.

Based on the general objective of the national energy efficiency policy and the expected contribution of alternative measures, the total energy efficiency obligation will be defined, which will then be divided between companies. The companies to which energy efficiency obligations should be applied are suggested in Section 2.2 of the report. The energy efficiency obligations should be applied to companies engaged in the supply of electricity, heat and gas (network operators), observing the Directive's principles of objectivity, non-discrimination and avoidance of double counting. In addition, the size of companies and the impact of the energy efficiency obligations on the administrative burden and competitiveness of companies must be considered. Therefore, we recommend using the following threshold for the size of companies (annual consumption volume supplied by a company to its customers): the threshold of 100 GWh/yr should be applied to both electricity and gas distributors and heat network operators.

The energy savings to be achieved need to be divided between the obligated parties on the basis of the information submitted to the Competition Authority (sales volumes, planned and approved activities of companies). For example, if the target of annual savings is set at the level of 1%, the energy savings to be achieved in the final consumption by the customers of electricity, gas and heat network operators would be 70.13 GWh/yr, 73.72 GWh/yr and 34.84 GWh/yr, respectively.

Companies can meet the energy efficiency obligation through various methods: (1) carrying out various energy saving measures among final customers; (2) carrying out efficiency improvement activities regarding their production equipment and networks; (3) carrying out activities in conjunction with energy service providers and others; (4) making contributions to the Energy Efficiency Fund. The amounts of contributions need to be established on the state level. Contributions will be directly dependent on the energy efficiency obligation of a given company.

4. Description of the methods of calculating the energy savings to be achieved as a result of activities carried out under the measures included in the package of energy efficiency obligations and alternative measures

This section describes the methods of calculating the energy savings to be achieved as a result of activities carried out under the measures included in the package of energy efficiency obligations and alternative measures. This is done largely on the basis of the draft methodology for determining the energy efficiency indicators referred to in Directive 2006/32/EC of the European Parliament and of the Council, which consists of three main documents: Recommendation note – Harmonised top-down calculation model, Harmonised bottom-up calculation model (Annex I to the draft methodology), and Preliminary list of harmonised average lifetimes of energy efficiency improvement measures and programmes for bottom-up calculations (Annex II to the draft methodology). The draft methodology describes top-down and bottom-up indicators in detail and contains the necessary explanations and formulas. These formulas serve as the basis for calculating energy savings and progress towards compliance with the national energy efficiency obligation.

The top-down and bottom-up indicators are described in more detail in Tables 1 and 2 in Annex 3 which sets out all the top-down and bottom-up indicators for different sectors. More information about the indicators and their calculation methods is available in the report on the 'Study on the development of the energy efficiency policy monitoring mechanism'[23]. The report also contains more detailed explanations about the designations of input data in the formulas used in Tables 1 and 2 of Annex 3.

The above-mentioned indicators are the basis for calculating energy savings, but according to the terms of reference of this study the formulas need to be adapted so that the energy savings from the measures to be taken can be calculated both for different sectors where energy is consumed and for different forms of energy. Therefore, the top-down and bottom-up indicators need to be combined and modified to cover all the sectors and forms of energy (see Table 25). It should also be borne in mind that data on the implementation of specific measures will be collected by various state authorities, the state's foundations and companies (e.g. KredEx and EIC). In order to simplify the preparation of consolidated reports, the entity gathering the data (MoEAC) should establish basic units and forms for the annual submission of data. For example, the result of implementing energy-saving measures in apartment buildings and the service sector can be measured both as the absolute result (GWh/yr) and as the result per renovated area (GWh/m^2). The results of renovating lighting systems can be measured in both GWh/yr and GWh per device.

[23] Uuring energiasäästupoliitika seiremehhanismi arendamiseks (Study on the development of the energy efficiency policy monitoring mechanism), ÅF-Estivo AS, 2010

Table 25. Initial top-down and bottom-up indicators suggested by the authors of the study for the calculation of annual energy savings for different energy forms and sectors

	Electricity	**Heat**	**Natural gas**	**Other fuels**
House-holds	Top-down indicator M2	Top-down indicator M1	Top-down indicator M1 adjusted to the consumption of natural gas	Top-down indicator M1 adjusted to the consumption of fuels
	A bottom-up indicator of the consumption of electricity, district heat, natural gas and various other fuels in households based on the data collected about the 'Energy efficiency in housing' measure implemented by KredEx Unit – GWh/m^2 or GWh/yr			
Service sector	Top-down indicator M4	Top-down indicator M3	Top-down indicator M3 adjusted to the consumption of natural gas	Top-down indicator M3 adjusted to the consumption of fuels
	There is currently no suitable measure to which various bottom-up indicators of the service sector can be applied.			
Public sector	Top-down indicator M4 applied to public buildings	Top-down indicator M3 applied to public buildings	Based on the same formula as M3, but applied only to public buildings	Based on the same formula as M3, but applied only to public buildings
	Bottom-up indicator of electricity consumption in public buildings (kWh/m^2)	Bottom-up indicator of district heat consumption in public buildings (kWh/m^2)	Bottom-up indicator of natural gas consumption in public buildings (GJ/m^2)	Bottom-up indicator of consumption of other fuels in public buildings (GJ/m^2)
Industry	Top-down indicator P14 or M8 adjusted to the consumption of electricity	Top-down indicator P14 or M8 adjusted to the consumption of heat (district heating)	Top-down indicator P14 or M8 of natural gas consumption	Top-down indicator P14 or M8 adjusted to the consumption of various fuels
	Indicator P14 or M8 of the consumption of electricity, heat and various fuels (GWh or GJ per unit of production can be used as the unit) in the industrial sector based on the data collected about the 'Energy and resource efficiency of companies' and 'Efficient generation and transmission of heat' measures implemented by the EIC			
Agri-culture	There is currently no suitable top-down or bottom-up indicator that could be used for the calculation of energy savings to be achieved in agriculture.			
Transport	Whether or not energy savings achieved in the transport sector will be reported needs to be considered. Possible options include top-down indicators M5, M6 and M7 depending on the availability of data from the Road Administration, Statistics Estonia and the Environmental Information Centre.			
Appliance s	To avoid double counting, energy savings from appliances should not be calculated, as they are contained in the energy savings calculated for the sectors listed above. It is possible to calculate bottom-up indicators of companies' compliance with the energy efficiency obligations through the implementation of specific energy saving measures (e.g. renovation of street lighting infrastructure).			

5. Proposal for designing a system to evaluate and verify the impact of energy saving measures in Estonia

According to paragraphs 6 and 10 of Article 7 of the Energy Efficiency Directive 2012/27/EU, Estonia must set up measurement, control and verification systems under which at least a statistically significant proportion and representative sample of the energy efficiency improvement measures put in place by the obligated parties is verified. That measurement, control and verification must be conducted independently of the obligated parties and the monitoring of results must be ensured.

To ensure the operation of a system to evaluate and verify the impact of energy saving measures in Estonia, it is necessary to distribute specific duties and responsibilities between the various parties involved (entities submitting and collecting data; calculation and evaluation of the savings achieved).

Since the obligations laid down in Article 7 of the Directive will largely be met through alternative policy measures, the state must ensure that reports on the impact of these measures are submitted. Data for evaluating the impact will be collected by authorities engaged in implementing the alternative policy measures (Tax and Customs Board, KredEx, the Environmental Investment Centre), who will ascertain the impact of the measures using their chosen evaluation methodologies, and forward the information to the Ministry of Economic Affairs and Communications as the authority responsible for implementing the Directive. The Ministry of Economic Affairs and Communications will do the following:

- analyse the reports of the authorities engaged in the implementation of policy measures and the veracity of the evaluation of impact;
- compile national consolidated data on the impact of the alternative policy measures implemented;
- advise the authorities engaged in the implementation of the policy measures on the development and improvement of impact evaluation methodologies;
- develop the impact evaluation methodologies;
- provide Statistics Estonia with data, where necessary.

Supervision over energy utilities' compliance with their energy efficiency obligations (if established) should be exercised by the Competition Authority as the energy market regulator. If energy efficiency obligations are imposed on companies, the Competition Authority should perform the following tasks:

- analyse the reports of the obligated companies and the veracity of the evaluation of their activities' impact, submitted by the companies. It probably would not be reasonable to commission audits from independent companies, as the volume of auditing would be relatively small and interest in the provision of audit services will most likely be modest, given the high demands placed on auditors operating under private law;
- compile national consolidated data on the application of energy efficiency obligations in Estonia and submit these to the Ministry of Economic Affairs and Communications;
- advise obligated companies on the preparation of reports and contribute to the improvement of the evaluation of impact.

6. Summary

Based on the Energy Efficiency Directive 2012/27/EU and the guidance document on the Directive, both the overall amount of required energy savings and the alternative energy savings have been calculated in this report for Estonia. Since Member States are free to decide how the calculated quantity of new savings referred to in Article 7(1) are to be phased over the period, they may use the alternative calculation method set out in paragraph 2. Using the alternative calculation method, the total energy savings would amount to **7140 GWh** in the period 2014-2020. Member States making use of paragraph 2 are required to notify that fact to the Commission by 5 June 2014, including the elements listed under paragraph 2 to be applied and a calculation showing their impact on the amount of energy savings referred to in paragraph 1. In Estonia the energy savings to be achieved using the alternative calculation method would be 1986 GWh or 20.9% smaller compared to calculation made in accordance with paragraph 1, and would thus meet the condition laid down in paragraph 3.

To comply with Article 7 of the Energy Efficiency Directive and achieve the required energy savings by 2020, the following combination is suggested:

1. Energy efficiency obligations of network operators (distributors of electricity, heat and gas). Recommended threshold values for the size of energy utilities (annual consumption volume of a company's customers): the thresholds of 100 GWh/yr for electricity distributors, 100 GWh/yr for gas distributors and 100 GWh/yr for heat network operators. The energy savings to be achieved would be divided between the obligated parties on the basis of the information submitted to the Competition Authority (sales volumes, planned and approved activities of companies). Companies can meet the energy efficiency obligation through various methods: (1) carrying out various energy saving measures among final customers; (2) carrying out efficiency improvement activities regarding their production equipment and networks; (3) carrying out activities in conjunction with energy service providers and others; (4) making contributions to the Energy Efficiency Fund. The amounts of contributions need to be established on the state level and will be directly dependent on the energy efficiency obligation of a given company.
2. Alternative measures (policy measures to be implemented by state authorities, the state's foundations and companies), including energy and CO_2 taxes and the priority measures to be taken under the Operational Programme for Cohesion Policy funding 2014–2020.

The following table sets out total potential cumulative energy savings that can be achieved in the period 2014–2020 through the establishment of the chosen obligations. The savings resulting from the energy efficiency obligations of energy utilities were calculated on the basis of the 1% saving target for the companies that exceed the threshold set (100 GWh/yr).

Table 26. Total potential cumulative energy savings according to the alternative calculation method

Policy measure	**Total cumulative savings in the period 2014–2020**
1. Companies' energy efficiency obligations	1.2 TWh

2. Alternative measures	
2.1 Energy and CO_2 taxes	4.8 TWh
2.2 Financing schemes and instruments	1.7 TWh
TOTAL	**7.7 TWh**

Pursuant to Article 7(10) of the Directive, there will be at least two intermediate periods during the seven-year obligation period ending on 31 December 2020, which will lead to the achievement of the level of ambition set. The following intermediate periods are suggested: from 1 January 2014 to 31 December 2016, 1 January 2017 to 31 December 2018, and 1 January 2019 to 31 December 2020. Thus, one of the intermediate periods will last three years, and the next two intermediate periods will last two years.

The following table shows the energy saving targets and expected energy savings for the whole period and for intermediate periods.

Table 27. Expected energy savings to be achieved over the obligation period and intermediate periods

Measure	2016 (TWh)	2018 (TWh)	2020 (TWh)
1. Companies' energy efficiency obligations	0.53	0.88	1.2
2. Alternative measures			
2.1 Energy and CO_2 taxes	2.06	3.42	4.8
2.2 Financing schemes and instruments	0.40	0.49	1.7
TOTAL	**2.99**	**4.79**	**7.7**

As the potential energy savings from energy and CO_2 taxes will amount to a total of 4.8 TWh by 2020, energy efficiency obligations of energy utilities will be applied, as well. Based on the total alternative energy savings calculated in Section 1.3 (7.1 TWh) and the final consumption data of electricity, gas and heat network operators set out in Section 2.1, the energy efficiency obligation to be applied to energy utilities could amount to 1.2 TWh, which is equivalent to the obligation of each energy utility to achieve a saving of 1% in the annual final energy consumption of its customers. The amount of contributions to the Energy Efficiency Fund should be proportional to the obligation (and final customers' consumption volume) of each energy utility.

The energy savings to be achieved as a result of the activities carried out under the measures included in the package of energy efficiency obligations and alternative measures are calculated using the efficiency indicators referred to in Directive 2006/32/EC of the European Parliament and of the Council (described in the draft methodology). The draft methodology describes the top-down and bottom-up indicators in detail and contains the necessary explanations and formulas. These formulas serve as the basis for calculating energy savings and progress towards compliance with the national energy efficiency obligation. The energy efficiency indicators for different sectors and forms of energy are described in Table 22 (see Section 4). The reporting entity should develop more detailed calculation formulas and also draw up a common set of protocols/forms for the collection of input data and calculation of the energy savings. This obligation also derives from Annex V to the Directive.

The main source of input data for the calculation of top-down indicators is Statistics Estonia. For top-down calculations the data would be submitted by energy distributors, distribution system operators, retail sales companies and other companies. For the indicators calculated using the bottom-up method, it is necessary that the entities implementing various energy efficiency programmes and measures (e.g. EIC, KredEx, Riigi Kinnisvara AS, obligated companies) collect data continuously, and also analyse and report these data. The Ministry of Economic Affairs and Communications will gather all the data needed to evaluate the impact of energy saving measures into a consolidated report and disclose the results. The duty to control and verify the results could be performed by an entity in the area of administration of the Ministry of Economic Affairs and Communications or by impartial experts.

Appendix 1. Questions to energy sellers and network operators concerning the energy efficiency obligation arising from the Energy Efficiency Directive

COMPANY:…………………..………..

1. What kind and how large additional expenses (human resources, IT solutions, calculation methods, training courses and notifications) will be entailed by the company's obligation to supply data on the production, purchase and sales of energy (electricity, heat) for the following customer groups: (1) resellers of energy, (2) companies and agencies, (3) individual household customers, (4) associations of household customers (apartment associations and management companies)?

2. Please fill in Table 1 below, which is based on report form 102013 of Statistics Estonia. Please indicate the actual data for the years 2011 and 2012, and forecast data for the years 2013–2017. Please also specify the following:
   2.1 What the company has planned for the introduction and installation of remote/smart meters in order to provide all customers with such meters?
   2.2 What manner and scale of expenses will be entailed by the processing and use of the data obtained from these meters for the purpose of calculating energy savings?
   2.3 How manner and quantities of resources are being planned for customer education and information with a view to promoting the use of remote/smart meters?

Table 1. Investments in tangible fixed assets and investment properties (including finance leases). Based on report form 102013 of Statistics Estonia 102013 (http://www.stat.ee/15197). Please provide data for each year.

	2011	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Labour costs							
Number of persons employed							
Hours worked by employees							
Investments (including finance leases)							
…acquisition of buildings							
…construction and reconstruction of buildings							
…means of transport							
…computers and computer systems							
…other machinery and equipment, fixtures, fittings and tools							
…land							

3. Have you carried out energy efficiency-related awareness-raising work or campaigns or taken other measures to promote energy efficiency among customers in the past? Did you evaluate the impact of these measures and how?

3.1 What measures (customer information campaigns, exemplary energy-saving projects, introduction of smart meters together with information campaigns, preferential tariffs according to energy performance certificates, etc.) would the company take if it had the obligation to achieve an annual saving of 1% in the final energy consumption of its customers, and what would be the cost of such measures?

4. Next, please answer the following questions based on the company's core activities (4.1 sales or distribution of electricity; 4.2 sales and/or distribution of gas; or 4.3 sales and/or distribution of heat).

4.1 Sales or distribution of electricity: if your company had to encourage customers to replace their old refrigerators with new ones for the company to meet the energy efficiency obligation that will lead to total savings of 10 GWh of electricity in the period 2015–2020:

- how would you organise the implementation of the measure and what would be its expected costs?
- how would you ensure that the impact of this measure is demonstrated in the evaluation of the energy savings achieved in a statistically significant sample, and what would be the expected costs of evaluating the impact of the measure? (see Article 7(6) of the Directive).
- In the absence of better data, the energy consumption of an average old refrigerator can be considered to be equal to 400 kWh/yr, the energy consumption of a refrigerator meeting the minimum ecodesign requirements can be considered to be equal to 300 kWh/yr, and the energy consumption of a refrigerator offered on the market and characterised by average efficiency can be considered to be equal to 250 kWh/yr. NB: due to the restrictions established by Directive 2012/27/EU, only the difference between the consumption meeting minimum ecodesign requirements and the actual consumption of a new product may be counted as an energy saving [see point (2)(a)(ii) of Annex V to the Directive].

4.2 Sales or distribution of gas: if your company had to encourage customers to replace their old gas water boilers with new ones for the company to meet the energy efficiency obligation that will lead to total savings of 10 GWh of gas in the period 2015–2020:

- how would you organise the implementation of the measure and what would be its expected costs?
- how would you ensure that the impact of this measure is demonstrated in the evaluation of the energy savings achieved in a statistically significant sample, and what would be the expected costs of evaluating the impact of the measure? (see Article 7(6) of the Directive)
- The replacement of gas water boilers is subject to the requirements of Regulation No 78 of the Ministry of Economic Affairs and Communications and the requirements of Council Directive 92/42/EEC on efficiency requirements for hot-water boilers.

4.3 Sales or distribution of heat: if your company had to organise an information campaign on various energy saving options among customers for the company to meet its energy efficiency obligation:

- how would you organise the conduct of the information campaign and what would be its expected costs?
- how would you ensure the evaluation of the impact of the measure and what would be the expected costs of evaluating the impact of the measure?

If you have any questions or clarifications regarding the questionnaire, please write to the e-mail address janika.laht@afconsult.com or call 55 620 654.

Thank you for your cooperation!

Ministry of Economic Affairs and Communications and ÅF-Consulting AS

Appendix 2. Estonian tax system

This Appendix discusses the impact of various taxes on energy consumption. The value added tax, excise duty on electricity and fuel, and various environmental charges are analysed in more detail. Owing to the urgency of this study and the short timespan given for carrying out the study, the analysis of the impact of the taxes is based on various previous studies, such as the 'Analysis of environmental expenditure'[24] made by the Praxis Centre for Policy Studies in 2012, the 'Environmental charges impact analysis'[25] made by SEI Tallinn and the Centre for Applied Social Sciences in the University of Tartu in 2013, the draft Operational Programme for Cohesion Policy funding 2014–2020[26], measure sheets of the Operational Programme[27], etc.

Value added tax

Value added tax (VAT) is a universal consumption tax, which is applied to all goods and services consumed. It differs from other consumption taxes in that it includes all sales levels and the object of the tax is the value of a product or service. Value added tax is an objective tax. The amount of tax depends on the type and value of the goods or service, not the taxpayer. The tax is normally charged regardless of the identity of the seller or buyer (although there are some exemptions in relation to imports). In Estonia, the VAT period lasts for one month; in the European Union, tax periods of up to a year in length are allowed.

Value added tax is an indirect tax. The tax burden is borne by the consumer who buys a product or service and pays the tax, which is included in the price of the product. For the sake of better administration of value added tax, it is sellers which have to keep records of and pay the tax. Consumption is taxed through the taxation of turnover. To exempt companies from the obligation to pay the tax on turnover, the tax is built on the principle of taxing the value added. The value added tax has been applicable in all the European Union Member States since 1968. A value added tax payable on turnover is neutral in relation to the consumer. Value added tax is a multiphase tax – the tax amount is divided between several companies. Goods or services pass through a long sales chain before reaching the consumer. Each link in the chain pays the tax on the value added by it, and the amounts so paid result in the total tax amount payable on the sales price of the product.

In the European Union, the VAT system is regulated by Directive 2006/112/EC. Nevertheless, the tax rates are very different in the Member States (see Table 1). The average basic rate of the tax of the countries listed in the table is 20.8%. Most countries (except Denmark) also use a reduced rate of value added tax (minimum 5%).

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[24] Kralik, S., Kaarna, R. Rell, M. Keskkonnakulutuste analüüs (Analysis of environmental expenditure). Praxis Centre for Policy Studies, 2013

[25] Lahtvee, V., Nõmmann, T., Runnel, A., Sammul, M., Espenberg, S., Karlõseva, A., Urbel-Piirsalu, E., Jüssi, M., Poltimäe, H., Moora, H. Keskkonnatasude mõjuanalüüs (Environmental charges impact analysis). SEI Tallinn and the Centre for Applied Social Sciences in the University of Tartu, 2013

[26] Ministry of Finance. Operational Programme for Cohesion Policy funding 2014–2020, 2013

[27] Ministry of Finance. Measure sheets of the Operational Programme for Cohesion Policy funding 2014–2020, 2013

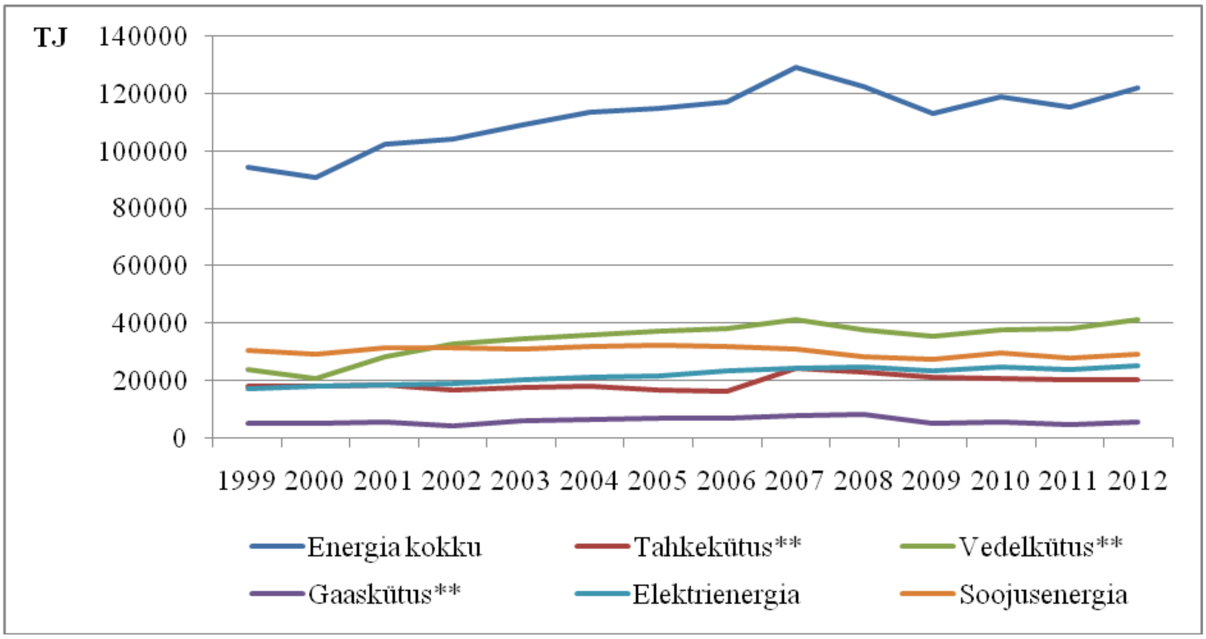
Table 1. Basic and reduced VAT rates in Europe on 1 July 2013

Country	**Reduced rate**	**Basic VAT rate**	**Country**	**Reduced rate**	**Basic VAT rate**
Austria	10	20	Italy	10	21
Belgium	6 / 12	21	Latvia	12	21
Bulgaria	9	20	Lithuania	5 / 9	21
Croatia	5 / 10	25	Luxembourg	6 / 12	15
Cyprus	5 / 8	18	Malta	5 / 7	18
Czech Republic	15	21	Netherlands	6	21
Denmark	-	25	Poland	5 / 8	23
Estonia	9	20	Portugal	6 / 13	23
Finland	10 / 14	24	Romania	5 / 9	24
France	5.5 / 7	19.6	Slovakia	10	20
Germany	7	19	Slovenia	9.5	22
Greece	6.5 / 13	23	Spain	10	21
Hungary	5 / 18	27	Sweden	6 / 12	25
Ireland	9 / 13.5	23	United Kingdom	5	20

The impact of differences in VAT rates are clearly reflected in the prices of fuels in EU Member States (see Table 2). Compared to Estonia, where VAT accounts for an average of 16.7% of the final price of fuel, a significantly higher rate is applied, for example, in Denmark, where VAT accounts for 20.0% of the retail price, and in Hungary, where it accounts for 21.2% of the retail price of fuel.

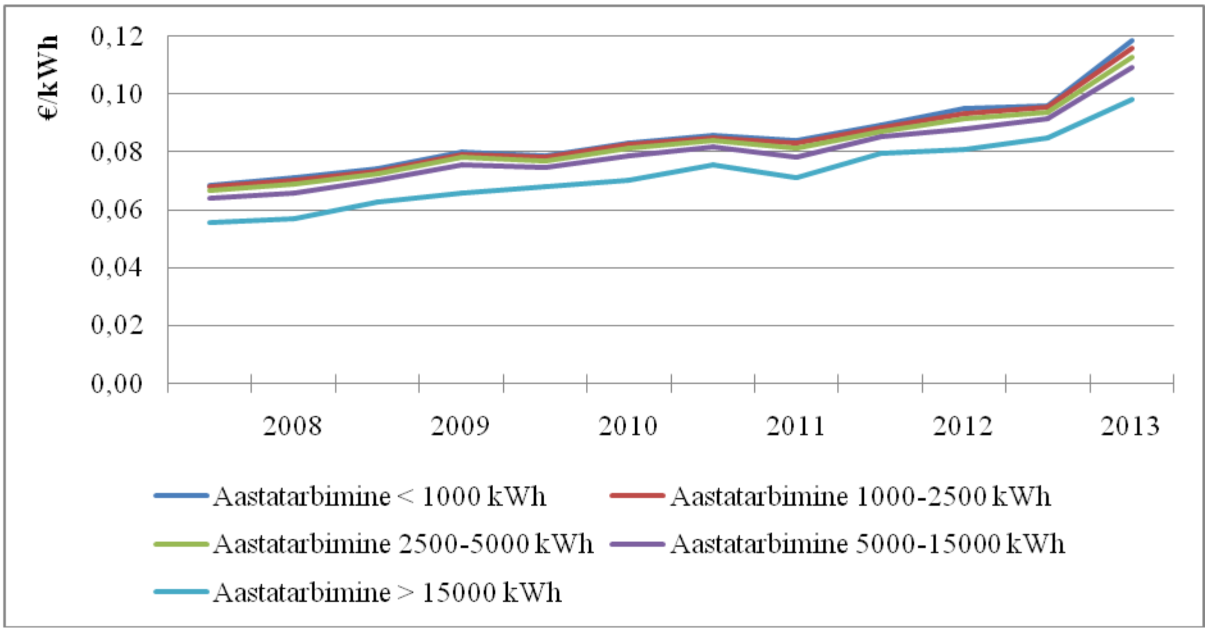
Every year, over 150 million VAT returns are submitted to tax authorities in the European Union, but differences in national legislation make this particularly difficult for companies that try to operate in more than one Member State. On 23 October 2013 the European Commission presented a proposal for standardising VAT returns, which should simplify operation on the Single Market, especially for smaller companies. The proposal is part of the Commission's broader VAT programme, which aims to simplify the EU's VAT system, since tax issues are one of the ten biggest difficulties faced by small and medium-sized enterprises.

Given the intention of the Commission to harmonise VAT rates in EU Member States, it is not reasonable to change VAT rates in Estonia with a view to inducing a decrease in final energy consumption. Although VAT is a consumption tax which has a significant impact also on the final price of a product/service to the consumer, an analysis of the data of Statistics Estonia on energy consumption and prices shows that changing VAT does not have a significant impact on people's consumption behaviour. For example, the rise in the VAT rate in 2009 has not affected the final consumption of heat or electricity. The consumption of all energy forms and fuels has increased (see Figure 1), despite the fact that in the meantime there have been a number of extensive price increases (e.g. increase in VAT in 2009, and the opening up of the electricity market at the beginning of 2013) (see Figure 2). While the figure shows the trend of the price of electricity for household customers, similar price movements have also been observed for heat, natural gas and other fuels.



Total energy Solid fuels** Liquid fuels**
Gaseous fuels** Electricity Heat

Figure 1. Final energy consumption in Estonia in the period 1999–2012.
*** Solid fuels include coal, coke, oil shale, peat, firewood, wood chips and wood waste. Liquid fuels are fuel oils and motor fuels. Gaseous fuels include natural gas, liquefied gas and shale gas. Source: Statistics Estonia www.stat.ee*



Annual consumption <1000 kWh Annual consumption 1000–2500 kWh
Annual consumption 2500–5000 kWh Annual consumption 5000–15 000 kWh
Annual consumption >15 000 kWh

Figure 2. Price of final consumption of electricity for household customers from the second half of 2007 until the first half of 2013. VAT is not included. Source: Statistics Estonia www.stat.ee

Table 2. Prices of liquefied petroleum gas (LPG) and fuel oil in Europe on 2 November 2013. Prices are calculated for 1 l of fuel. The margin includes refining, transportation, storage, distribution and sales to consumers. Source: www.energy.eu

	LPG					**FUEL OIL**				
Country	Crude oil	Margin	Excise duty	VAT	Retail price	Crude oil	Margin	Excise duty	VAT	Retail price
Austria					-	0.493	0.227	0.098	0.164	0.981
Belgium	0.193	0.361	0.000	0.116	0.671	0.493	0.224	0.017	0.154	0.889
Bulgaria	0.193	0.269	0.093	0.111	0.666	0.493	0.238	0.026	0.151	0.907
Croatia	0.193	0.263	0.087	0.125	0.668	0.493	0.199	0.026	0.165	0.883
Cyprus					-	0.493	0.266	0.125	0.159	1.042
Czech Republic	0.193	0.271	0.084	0.115	0.663	0.493	0.260	0.027	0.164	0.944
Denmark	0.193	0.507	0.267	0.242	1.208	0.493	0.431	0.347	0.318	1.589
Estonia	**0.193**	**0.340**	**0.067**	**0.120**	**0.720**	**0.493**	**0.240**	**0.111**	**0.169**	**1.013**
Finland					-	0.493	0.258	0.163	0.219	1.133
France	0.193	0.409	0.058	0.129	0.789	0.493	0.231	0.057	0.153	0.934
Germany	0.193	0.335	0.097	0.119	0.743	0.493	0.200	0.076	0.146	0.915
Greece					-	0.493	0.245	0.330	0.246	1.314
Hungary	0.193	0.357	0.135	0.185	0.870	0.493	0.264	0.386	0.308	1.451
Ireland	0.193				-	0.493	0.382	0.102	0.132	1.109
Italy	0.193	0.289	0.144	0.131	0.757	0.493	0.288	0.403	0.249	1.433
Latvia	0.193	0.174	0.069	0.092	0.528	0.493	0.250	0.021	0.161	0.925
Lithuania	0.193	0.231	0.163	0.123	0.710	0.493	0.182	0.021	0.146	0.843
Luxembourg	0.193	0.327	0.055	0.034	0.609	0.493	0.195	0.010	0.084	0.782
Malta					-	0.493	0.229	0.142	0.156	1.020
Netherlands	0.193	0.391	0.097	0.143	0.823	0.493	0.258	0.126	0.184	1.061
Poland	0.193	0.183	0.108	0.111	0.596	0.493	0.211	0.053	0.174	0.931
Portugal	0.193	0.416	0.069	0.156	0.833	0.493	0.278	0.292	0.245	1.308
Romania	0.193	0.286	0.069	0.131	0.679	0.493	0.126	0.330	0.228	1.177
Slovakia	0.193	0.305	0.098	0.119	0.715	0.493	0.109	0.386	0.198	1.186
Slovenia	0.193	0.387	0.067	0.130	0.777	0.493	0.210	0.138	0.168	1.009
Spain	0.193	0.487	0.031	0.149	0.860	0.493	0.192	0.085	0.162	0.932
Sweden					-	0.493	0.175	0.461	0.282	1.411
United Kingdom	0.193	0.296	0.197	0.137	0.823	0.493	0.200	0.130	0.041	0.863

Energy taxes

An excise duty is a consumption tax levied on a certain commodity group. An excise duty complements VAT, rather than replacing it. Excise goods are subject to VAT pursuant to the general procedure, and the excise duty increases the taxable value. Excise duties are generally levied on consumable goods. Excise duties are single-level taxes and, generally, the tax base is linked to the amount rather than the value of goods.

Excise duties are indirect taxes. In this respect, excise duties are similar to VAT. The tax burden is borne by the final customer, who uses excise goods outside business, but the excise duties are collected and paid by companies that manufacture or import the goods. Consumption is taxed through an increase in the price of the product. Excise duties are not so visible for the customer as VAT, because sellers do not show the excise duties included in the price of goods on invoices.

The imposition of excise duties is based on the principle of solvency – excisable goods usually do not fall within the usual range of basic commodities, even though they are consumed a lot. The consumption of excise goods indicates a person's solvency, excise duties are generally accepted in society and correspond to people's perception of fair taxation.

Taxation with excise duties is subject to all the general principles of consumption taxes, such as the principle of neutrality (the taxation of goods does not depend on the identity of the seller or producer) and the destination principle (goods are taxed at the place of consumption). In addition to the traditional fiscal objective, excise duties also have a function of considerably restricting consumption and regulating the market. The regulatory function of excise duties may be regarded as even more important than the fiscal function, but no excise duty can be claimed to completely lack a fiscal element. Excise duties often restrict the consumption of goods that are harmful to health or the environment. It is sought to influence consumer preferences through excises duties, for example, induce a preference for weaker alcoholic beverages or fuels that are safer for the environment. Therefore, excise duties are also a possible solution to reducing final energy consumption.

However, when selecting excise goods, one has to consider both the amount of tax revenues to be received and the complexity of tax administration. Today, excise duties are applied to widely consumed goods whose taxation entails significant tax revenues. Goods whose consumption is not so widespread are not taxed as the costs of administrating the excise duty may exceed the tax receipts. A common feature of excise goods is that they are goods whose production and sale would be to some extent controlled by the state anyway, regardless of their taxation.

Although the European Union has recently set the goal to achieve a greater control over the budgetary and tax policies of the Member States, the introduction of uniform environmental taxes seems to be possible only in the context of energy taxes (excise duties). In the EU the taxation of energy products is as of 1 January 2004 governed by the Energy Taxation Directive 2003/96/EC laying down minimum rates of excise duty on mineral oils and other energy products, including coal and lignite, natural gas and electricity. The Directive aims to reduce the distortions of competition and to achieve the proper functioning of the internal market; increasing energy efficiency and reducing CO_2 emissions are also highlighted.

In Estonia, energy taxes (excise duty on electricity and fuel) have been laid down in the Alcohol, Tobacco, Fuel and Electricity Excise Duty Act[28]. The excise duty on fuel is applied to motor fuels and fuel oils (unleaded petrol, leaded petrol, aviation spirit, kerosene, diesel fuel, diesel fuel for specific purposes, light fuel oil, heavy fuel oil, shale oil, liquefied gas), solid fuels (coal, lignite and coke), fuel-like products and biofuels. In 2008, Estonia established excise duties on petrol and diesel fuel at the rates equal to the minimum rates applicable in the EU, but increased the rates in the subsequent years, so that as of 1 January 2011 the rates are higher than those prescribed by the EU Directive. For petrol, the rate of the excise duty is 422.77 EUR per 1000 litres (see Table 3), while the EU minimum rate is 359 EUR per 1000 litres. Similarly, the excise duty on natural gas is higher in Estonia than the minimum level in the EU (0.15–0.3 EUR/GJ in the EU, 0.7 EUR/GJ in Estonia).

Despite the relatively high rates of the excise duty in Estonia, the excise duty represents an average of 10% of the retail price of fuel (9.31% in the case of LPG and 10.96% in the case of fuel oil). The excise duty on fuel accounts for the largest share of the retail price of LPG in the United Kingdom (23.9%), Lithuania (22.9%) and Denmark (22.1%). In the case of fuel oil, the share of excise duty is even bigger, e.g. over 32% of the retail price in Slovakia and Sweden, over 28% in Romania and Italy, and 26.6% in Hungary.

In the comparison of the Baltic States, fuel prices are the lowest in Estonia. This is a clear sign of a very stiff competition on the local market for motor fuels, which is very positive for customers. At the beginning of 2013, the excise duty amounted to 0.423 EUR in the per litre price of petrol in Estonia, 0.410 EUR in Latvia and 0.434 EUR in Lithuania. In the per litre price of diesel fuel, the excise duty amounted to 0.393 EUR in Estonia, 0.330 EUR in Latvia and 0.330 in Lithuania.

Table 3. Rates of excise duty on fuels and electricity in Estonia on 1 November 2013, and the lowest level of taxation of motor fuels in the EU from 1 January 2010 under Directive 2003/96/EC

Energy product	**Rate of excise duty in Estonia**	**Taxation level in the EU**	**Unit**
Unleaded petrol (with a lead content not exceeding 0.013 g/l (inclusive), CN codes 2710.11.41, 2710.11.45, 2710.11.49)	422.77 €	359.00 €	1000 l
Leaded petrol (CN codes 2710.11.51, 2710.11.59)	422.77 €	421.00 €	1000 l
Aviation spirit (CN codes 2710.11.31, 2710.11.70)	422.77 €		1000 l
Kerosene (CN codes 2710.19.21, 2710.19.25)	330.10 €		1000 l
Diesel fuel (CN codes 2710.19.29, 2710.19.41)	392.92 €	330.00 €	1000 l
Diesel fuel for specific purposes (CN codes 2710.19.29, 2710.19.41)	110.95 €		1000 l
Light fuel oil (marked with a fiscal marker, CN codes 2710.19.45, 2710.19.49)	110.95 €		1000 l
Heavy fuel oil (CN codes 2710.19.61–2710.19.69)	15.01 €	15.00 €	1000 kg
Shale-derived fuel oil (CN codes 2710.19.61, 2710.19.63)	15.01 €	15.00 €	1000 kg
Liquefied petroleum gas (CN codes 2711.19.00, used as	125.26 €	0.00 € –	1000 kg

[28] Alkoholi-, tubaka-, kütuse- ja elektriaktsiisi seadus (Alcohol, Tobacco, Fuel and Electricity Excise Duty Act). RT I, 01.06.2013, 2

motor fuel, including in stationary engines)		125.00 €	
Liquid combustible substances and biofuels (including when added to another fuel) used for the same purpose as petrol	422.77 €		1000 l
Liquid combustible substances and biofuels (including when added to another fuel) used for the same purpose as diesel fuel	392.92 €		1000 l
Liquid combustible substances and biofuels (including when added to another fuel) used for the same purpose as light fuel oil	110.95 €		1000 l
Liquid combustible substances and biofuels (including when added to another fuel) used for the same purpose as heavy fuel oil	15.01 €		1000 kg
Diesel fuel and light heating oil for specific purposes released for consumption from which the fiscal marker has been removed	392.92 €		1000 l
Fuel-like products (CN codes 2707.10, 2707.20, 2707.30, 2707.50, 2710.11.11–2710.11.25, 2710.11.90, ex 2901 (substances which are not gaseous at atmospheric pressure and a temperature of 15°C), 2902.20.00, 2902.30.00, 2902.41.00, 2902.42.00, 2902.43.00 or 2902.44.00)	422.77 €		1000 l
Fuel-like products (CN codes 2710.19.11 or 2710.19.15)	330.10 €		1000 l
Fuel-like products (CN codes 2710.19.31 or 2710.19.35)	392.92 €		1000 l
Fuel-like products (CN codes 2710.19.51 or 2710.19.55)	15.01 €		1000 kg
Fuel-like products (CN codes 2711.12– 2711.14, used as motor fuel, including in stationary engines)	125.26 €		1000 kg
Fuel-like products (CN heading 3811, except CN codes 3811 21 00 or 3811 29 00)	The rate of excise duty depends on the purpose of use		
Solid fuels (coal, lignite, coke and shale used for heating whose CN codes are 2701, 2702, 2704, 2714.10.00)	0.30 €	0.30 €	GJ of the upper calorific value
Natural gas (CN codes 2711.19.00 and used for heating)	23.45 €		1000 m^3 [29]
Electricity (CN codes 2716.00.00)	4.47 €	1.0 €	MWh

As of 1 January 2008, the excise duty must also be paid on electricity in Estonia. The rate of the excise duty is 4.47 EUR per MWh, while the EU average is 0.5–1 per MWh. The excise duty on electricity is paid in Estonia by (1) network operators who use electricity or distribute it to customers, (2) consumers of self-generated electricity, and (3) consumers of electricity transmitted through a direct line.

In Estonia the final price of electricity consists of the production cost, the network service charge, the renewable energy charge, the excise duty on electricity, and VAT. Therefore, the price of electricity for final customers is affected by changes in both VAT and the excise duty on electricity, which, however, does not mean that electricity is a product characterised by a high price elasticity. Based on the data of Statistics Estonia on the prices and final consumption of electricity and heat it can be argued that neither the above-mentioned changes in the rates of excise duty nor the increase in the price of electricity resulting from the opening up of the electricity market have had a significant impact on customer behaviour.

[29] Calculated at a temperature of 20 °C and pressure of 1.01325 bar

On an open market, the power exchange is a place that brings together purchase and sale offers and where the ultimate electricity price equally reflects the interests of all the parties concerned. The producers whose variable costs are the lowest are the first that can access the power exchange to sell their electricity. These are generally producers who use hydro and wind power and who do not have to pay fuel costs or pollution charges or buy CO_2 quotas. If hydro and wind power is not enough to cover the demand, the next best offer in terms of price will be accepted – until the demand is covered. Electricity producers whose variable costs, as indicated in the sales offers, are higher than the power exchange price at the equilibrium point cannot access the power exchange during the given trading hour.

Variable costs are those costs that change when the production volume changes. Variable costs increase as the product volume grows, and decrease as the production volume declines. In electricity generation, the main variable cost components are fuel, the CO_2 quota and environmental charges (including the excise duty).

Owing to the foregoing and a previous study,[30] it can be argued that environmental charges or changes in them do not have a significant impact on the price of electricity. A significant increase in the excise duty or CO_2 emission charge for combustion of fossil fuels means that electricity produced from oil shale will not be competitive on the market and that oil shale power plants are not likely to produce electricity for the market in the current volume. Yet that does not mean that the price of electricity will increase, but rather that electricity producers that produce less CO_2 emissions (regional hydro power plants, nuclear power stations and wind power producers) will have an advantage on the market. Since there is plenty of low-carbon fuels and hydro-electric power capacities in the region, the price of electricity will not change in the Nord Pool price area of Estonia as a result of an increase in environmental charges.

In their study, SEI and the Centre for Applied Social Sciences analysed the actual production figures and environmental charges paid, using the example of a particular company. According to the analysis, environmental charges account for an average of 0.21% in the price of electricity. Hence, an increase in various environmental charges and in the excise duty will have just a marginal impact on the retail price of electricity and thus on customer behaviour. It is especially important to get the consumption of electricity under control, as the data of Statistics Estonia suggest that electricity consumption has increased the most, while stability or a small decline can be observed in the final consumption of fuels and heat (see Figure 1). This finding is also supported by the studies of KredEx which confirm an increase in the share of consumption of electricity in renovated apartment buildings.

While no considerable energy savings can be achieved through the excise duty on electricity, an increase in the excise duty on fuel can affect the final consumption of heat and fuels. Savings can be achieved, in particular, from the measures implemented under the 'Energy efficiency' priority axis (see Section 3.1.1), combined with the renovation of housing with people's own funds and the introduction of renewable fuels. The target of the 'Energy efficiency in housing' measure is to renovate 2.9 million m^2 of residential area by 2020. If combined with approximately 10% of that area renovated with people's own funds, the additional energy savings could amount to around 19.9 GWh.

[30] Lahtvee, V., Nõmmann, T., Runnel, A., Sammul, M., Espenberg, S., Karlõseva, A., Urbel-Piirsalu, E., Jüssi, M., Poltimäe, H., Moora, H. Keskkonnatasude mõjuanalüüs (Environmental charges impact analysis). SEI Tallinn and the Centre for Applied Social Sciences in the University of Tartu, 2013

Environmental charges

Environmental charges have consistently been applied in Estonia since 1991 with the aim of preventing or reducing possible damage related to the use of natural resources, emission of pollutants into the environment and waste disposal. According to Eurostat's definition, an environmental tax is a tax whose base is a physical unit (or a proxy of it) of something that has a proven, specific negative impact on the environment. Thus, the basis for the imposition of the tax and its impact on the environment are equally decisive factors in the definition of an environmental tax. Environmental charges should guide the environment protection-related activities of companies and agencies in such a manner as to reduce any pollution and waste resulting from economic activities and increase the efficiency and sustainability of the use of natural resources.

In Estonia, environmental charges are regulated by the Environmental Charges Act,[31] the Taxation Act,[32] the Earth's Crust Act,[33] the Ambient Air Protection Act,[34] the Waste Act[35] and legislation adopted under these Acts. According to the Environmental Charges Act, environmental charges are divided into natural resource charges (hereinafter: resource charges) and pollution charges. Resource charges include the forest stand cutting charge, the mineral resource extraction charge, the water abstraction charge, the fishing charge and the hunting charge. Pollution charges are imposed in the event of emission of pollutants into the ambient air, groundwater or soil, and for waste disposal.

On an open electricity market and power exchange the main factor influencing the price of electricity for customers is the existence of adequate production capacities and connections to ensure the distribution of electricity both within the given country and between neighbouring countries. Consequently, the most important factors affecting the formation of the price of electricity are the existence of transmission and production capacities in the market region and the availability of the cheapest energy resources (wind and water) as the factors that reduce the price, and the cost of fuels and the CO_2 quota price on the EU emissions trading market (which directly affects the price of electricity produced from fossil fuels) as the factors that increase the price. Environmental charges influence the price of electricity insofar as they affect the price of fuels through increases in natural resource charges and pollution charges imposed in connection with the production of fuels, and increases in emission charges imposed in connection with the use of fuels.

Resource and pollution charges imposed in connection with fuels have a direct impact on energy prices and thus also an indirect impact on the reduction of the final consumption of energy. This impact is manifested through fuel price increases and thereby through both electricity and heat price increases, and thus should force final customers to save energy. The impact is especially pronounced for lower income customer groups, whose final consumption, however, accounts for quite a small part of the total final energy consumption. Therefore, a comprehensive socio-economic impact study needs to be conducted before a substantial increase in the charges.

[31] Keskkonnatasude seadus (Environmental Charges Act). RT I, 16.05.2013, 13
[32] Maksukorralduse seadus (Taxation Act). RT I, 07.06.2013, 3
[33] Maapõueseadus (Earth's Crust Act). RT I, 15.03.2013, 35
[34] Välisõhu kaitse seadus (Ambient Air Protection Act). RT I, 12.07.2013, 13
[35] Jäätmeseadus (Waste Act). RT I, 14.06.2013, 6

Appendix 3. Energy efficiency indicators

Top-down indicators

A top-down calculation method means that the amount of energy savings is calculated using the national or larger-scale aggregated sectoral levels of energy savings as the starting point. Adjustments of the annual data are then made for extraneous factors such as degree days (weather conditions), structural changes, product mix, etc. to derive a measure that gives a fair indication of total energy efficiency improvement, as described in point 1.2 of Annex IV to Directive 2006/32/EC. The factors mentioned in this point include weather conditions, such as degree days; occupancy levels; opening hours for non-domestic buildings; installed equipment intensity; plant throughput, level of production, volume or added value; schedules for installation and vehicles; and relationship with other units.

This method does not provide exact measurements at a detailed level nor does it show cause and effect relationships between measures and their resulting energy savings. However, it is simpler and less costly and it is considered to be more appropriate for evaluating energy efficiency at the national level, as it gives an indication of developments.

Based on the draft methodology, energy savings are calculated in the final consumption in household, service, transport and industrial sectors, using top-down indicators. The indicators are divided into three categories: preferred indicators (P1-P14), alternative indicators (A1, A2) and minimum indicators (M1-M8).

Table 1. Top-down indicators for different sectors. The top-down indicators are denoted as follows: P – preferred indicators, A – alternative indicators, M – minimum indicators. Green colour denotes the indicators for the calculation of which the necessary data are available. The indicators on white background are those for the calculation of which the necessary data are not yet available at the present moment.

Indicator		**Calculation formula**	**Unit**
Household sector:			
P1	Energy consumption for space heating per total floor area, adjusted for climatic conditions	$(E^{Hsh}/F^{H})*(MDD_{25}^{heating}/ADD_{t}^{heating})$	toe/m^2
P2	Energy consumption of households for space cooling per total floor area, adjusted for climatic conditions	$(E^{Hsc}/F^{H})*(MDD_{25}^{cooling}/ADD^{cooling})$	toe/m^2
P3	Energy consumption for water heating per inhabitant	(E^{Hwh}/P)	toe/inhabitant
P4	Electricity consumption per appliance type	UEC^{X}	kWh/yr
P5	Electricity consumption for lighting per dwelling	E^{Hli}/D	kWh/yr per dwelling
M1	Non-electricity energy consumption per dwelling, adjusted for climatic	$(E^{Hnon\text{-}el}/D)*(MDD_{25}^{heating}/ADD^{heating})$	toe/yr per dwelling

	conditions		
M2	Electricity consumption per dwelling, adjusted for climatic conditions	E^{Hel}/D	kWh/yr per dwelling
Service sector:			
P6	Non-electricity energy consumption in sub-sector X per indicator of activity, adjusted for climatic conditions	$(E^{Snon\text{-}el}/IA^{Sx})*(MDD_{25}{}^{heating}/ADD^{heating})$	toe/IA^{x}
P7	Electricity consumption in subsector X per indicator of activity	E^{SXel} / IA^{x}	kWh/IA^{x}
M3	Non-electricity energy consumption per employee in full time equivalent, adjusted for climatic conditions	$(E^{Snon\text{-}el}/em^{S})*(MDD_{25}{}^{heating}/ADD^{heating})$	toe/employee
M4	Electricity consumption per employee in full time equivalent	E^{Sel}/em^{S}	kWh/employe e
Transport sector:			
P8	Energy consumption of cars per passenger-km	E^{CA}/T^{CA}	goe/passenger-km
A1	Energy consumption of cars in l per 100 km driven	E^{CAspec}	l/100 km
P9	Energy consumption of trucks and light vehicles per tonne-km	E^{TLV}/T^{TLV}	goe/tonne-km
A2	Energy consumption of trucks and light vehicles per vehicle	E^{TLV}/S^{TLV}	toe/vehicle
P10	Energy consumption of passenger rail transport per passenger-km	E^{RPa}/T^{RPa}	goe/passenger-km
P11	Energy consumption of freight rail transport per tonne-km	E^{RFr}/T^{RRr}	goe/tonne-km
P12	Share of public transport (bus, train, metro, tram) in total land passenger transport	$P^{t}=T^{Pa}{}_{Pub}/T^{Pa}$	%
P13	Share of rail and inland waterways freight transport in total freight transport	$RW=T^{Fr}{}_{RW}/T^{Fr}$	%
M5	Energy consumption of road vehicles	$E^{RV}/S^{RVcareq}$	toe/ vehicle equivalent
M6	Energy consumption of rail transport per tonne-km	E^{R}/T^{R}	goe/tonne-km
M7	Energy consumption of inland waterways transport per tonne-km	E^{W}/T^{W}	koe/tonne-km
Industry sector:			
P14	Energy consumption of industrial subsectors	E^{Ix}/IPI^{Ix}	toe/unit of production
M8	Energy consumption of industrial subsectors	E^{Ix}/VA^{Ix}	toe/EUR

In the household sector, energy savings in final consumption are calculated for space heating and cooling, water heating, lighting, and large household appliances. Final energy consumption is split into electricity and non-electricity energy consumption. Results are presented per square metre or dwelling. When using the indicators for calculating the energy savings for the entire country, square metres (m^2) should be used as the unit. However, energy utilities cannot use this unit when calculating energy savings arising from the energy efficiency obligation, since the necessary data are not available to them in sufficient detail. To calculate energy savings, energy utilities should therefore distinguish the final energy consumption of long-term customers and new/leaving customers in different years.

In the service sector, the final energy consumption covers electricity and non-electricity energy consumption in sub-sectors of the service sector. These sub-sectors are, for example, hotels and restaurants, retail and wholesale trade, public administration, and education, social and health care services. Energy savings are calculated per person employed in the service sector. These data, however, are not available to energy utilities. Therefore, energy utilities should make energy saving calculations based on the final energy consumption data of long-term customers and new/leaving customers. In addition, commercial buildings must be distinguished from public buildings in energy saving calculations.

Energy savings in final energy consumption in the transport sector cover passenger and freight transport by road, rail and waterways. Energy savings are calculated for vehicle types or transport modes, and the savings achieved by different categories are then summed up. Diesel fuel and petrol consumption figures are summed up to find the final energy consumption in the transport sector. Calculations can also be performed separately for each fuel type. The obligation to make energy saving calculations will not be applied to energy utilities – all calculations will have to be made at the national level, based on the data of the Road Administration, Statistics Estonia and the Environment Information Centre.

Energy savings achieved in the industrial sector are determined for sub-sectors. Agriculture may be included as one sub-sector or excluded from energy saving calculations. Companies participating in international emissions trading must be excluded from the calculation of energy efficiency indicators. The relevant adjustments must also be made for the number of employees, value added and other input data.

Bottom-up indicators

A bottom-up calculation method means that energy savings obtained through the implementation of a specific energy efficiency improvement measure are measured in kilowatt-hours (kWh), in Joules (J) or in kilogram oil equivalent (kgoe) and added to energy savings results from other specific energy efficiency improvement measures. For the bottom-up calculation method, the data and methods referred to in Annex IV to Directive 2006/32/EC are used:

- data and methods based on measurements, such as invoices from distribution companies and retailers, energy sales data, equipment and appliance sales data and end-use load data;
- data and methods based on estimates, such as simple engineering estimated data with and without inspection.

Under the bottom-up method, the energy savings from a building, its parts and utility systems are ascertained. Therefore, the indicators are calculated for two main sectors: household and service sectors. Just like in the case of the top-down indicators, the service sector is taken to include service establishments, education, social and health care services, and public administration under the bottom-up methodology. The household sector includes both small houses and apartment buildings. For the purposes of application of the energy efficiency obligation, these buildings must be distinguished in accordance with the requirements of Directive 2012/27/EU.

Table 2. Bottom-up indicators for household and service sectors (UFES – unitary final energy savings)

No.	**Indicator**	**Calculation formula**	**Unit**
Household sector:			
1	Energy-saving refurbishment measures	$UFES=SHD_{init}/\eta_{init}-SHD_{new}/\eta_{new}$	kWh/m^2 of useful area per year
2	Insulation refurbishment measures applied to building components in existing buildings	$UFES=[(Uvalue_{init}-Uvalue_{new})*HDD*24h*a*b*c]/1000$	kWh/m^2 of renovated area
3	Introduction of more stringent energy efficiency requirements for buildings	$UFES=SHD_{Unicode}/\eta_{inicode}-SHD_{newcode}/\eta_{new}$	kWh/m^2 per year
4	Replacement of heating supply equipment	$UFES=(1/\eta_{ini}–1/\eta_{new})*SHD*A$	kWh/unit per year
5	Water heating	$UFES=(1/\eta_{ini}–1/\eta_{new})*SWD$ where: $SWD=(C_{hot\_water}*365*n_{persons/hhds}*(t_{hot\_water}-t_{cold\_water})*C_{water}*c_f)/1000$	kWh/unit per year
6	Air conditioning systems (<12 kW)	$UFES=(1/EER_{average}–1/EER_{best\_prf\_on\_market})*P_{fn}*\eta_h$ where: $\eta_h=\eta_{sh}*f_u$	kWh/unit per year
7	Solar water heating	$UFES=USAVE/\eta_{stock\_average\_heating\_system}$	kWh/m^2 per year
8	Replacement/acquisition of household appliances	$UFES=AEC_{reference\ year}-AEC_{reference\ market\ promoted\ energyclass}$	kWh/unit per year
9	Replacement/acquisition of lamp bulbs	$UFES=[(P_{stock\_average}-P_{best\ market\ promoted})*\eta_h*F_{rep}]/1000$	kWh/unit per year
Service sector:			
1	Energy-saving refurbishment measures	$UFES=SHD_{init}/\eta_{init}-SHD_{new}/\eta_{new}$	kWh/m^2 of useful area per year
2	Insulation refurbishment measures applied to building components in existing buildings	$UFES=[(Uvalue_{init}-Uvalue_{new})*HDD*24h*a*b*c]/1000$	kWh/m^2 of renovated area
3	Introduction of more stringent energy efficiency requirements for buildings	$UFES=SHD_{Unicode}/\eta_{inicode}-SHD_{newcode}/\eta_{new}$	kWh/m^2 per year
4	Replacement of heating supply equipment	$UFES=(1/\eta_{ini}–1/\eta_{new})*SHD*A$	kWh/unit per year
5	Water heating	$UFES=(1/\eta_{ini}–1/\eta_{new})*SWD$ where: $SWD=(C_{hot\_water}*365*n_{persons/hhds}*(t_{hot\_water}-t_{cold\_water})*C_{water}*c_f)/1000$	kWh/unit per year
6	Air conditioning systems (<12 kW)	$UFES=(1/EER_{average}–1/EER_{best\_prf\_on\_market})*P_{fn}*\eta_h$	kWh/unit per year

		where: $\eta_h = \eta_{sh} * f_u$	
7	Solar water heating	UFES = USAVE / $\eta_{stock\_average\_heating\_system}$	kWh/m^2 per year
8	Replacement/acquisition of household appliances	UFES = $AEC_{reference\ year}$ - $AEC_{reference\ market\ promoted\ energyclass}$	kWh/unit per year
9	Replacement/acquisition of lamp bulbs	UFES=[($P_{stock\_average}$-$P_{best\ market\ promoted}$)* η_h*F_{rep}]/1000	kWh/unit per year
10a	Replacement/acquisition of lighting systems or components thereof	[H_{st}*Σ($N_{l,st}$*$P_{l,s}$+$N_{b,st}$*$P_{b,st}$-H_{ef}*Σ($N_{l,ef}$*$P_{l,ef}$+$N_{b,ef}$+$N_{b,ef}$*$P_{b,ef}$)$_i$*(1-F_d)$_i$]/1000 where: H_{ef}=H_{st}*(1-F_c)	kWh/unit per year
10b	Replacement/acquisition of lighting systems or components thereof	UFES=(P_{ini}*η_{h_ini}-P_{new}*η_{h_new})/1000	kWh/unit per year
10c	Replacement/acquisition of lighting systems or components thereof	UFES=(P_{ini}*η_{h_ini}-P_{new}*η_{h_new})/1000	kWh/unit per year
11	Replacement/acquisition of office equipment in existing and new office buildings	UFES=[($PA_{referenceyearstockaverage}$-$PA_{reference\ yearbestperfmarket}$)*$h_{active}$]/1000 UFES=[($PS_{referenceyearstockaverage}$-$PS_{reference\ yearbestperfmarket}$)*$hs_{standby}$]/1000	kWh/unit per year

National energy savings compared to the base year can be calculated for different sectors using the indicators set out in the tables. The bottom-up indicators that indicate the energy savings achieved with the help of a particular measure provide an additional contribution, which is essential in terms of meeting the energy efficiency obligation.