

Flex4RES

Flexible Nordic Energy Systems

Framework conditions for flexibility in the individual heatingelectricity interface



Flex4RES project summary

The Flex4RES project investigates how an intensified interaction between coupled energy markets, supported by coherent regulatory frameworks, can facilitate the integration of high shares of variable renewable energy (VRE), in turn ensuring stable, sustainable and cost-efficient Nordic energy systems.

Through a holistic system approach based on coupled energy markets, we identify potentials, costs and benefits of achieving flexibility in the Nordic electricity market created by the heat, gas and transport sectors as well as by electricity transmission and generation. Flex4RES develops and applies a multidisciplinary research strategy that combines technical analysis of flexibility needs and potentials, economic analysis of markets and regulatory frameworks, and energy system modelling that quantifies impacts.

Through the development of a coherent regulatory frameworks and market designs that facilitate market interactions, which are optimal for the Nordic conditions in an EU context, transition pathways to sustainable Nordic energy systems are identified. Flex4RES will comprehensively discuss and disseminate the recommended pathways and market designs for achieving a future Nordic sustainable energy solution with a variety of stakeholders from government, industry and civil society.

More information regarding the Flex4Res project can be found at <u>www.Flex4RES.org</u> or by contacting project manager Klaus Skytte at klsk@dtu.dk

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Framework conditions for flexibility in the individual heating-electricity interface

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Results at a glance

- This study reviews framework conditions for energy system flexibility within individual heating, defined as heating and hot water in households not connected to district heating,
- Except for Norway and Sweden, where deployment of power-to-heat is significant, inflexible fuelbased technologies are dominant in individual heating of the Nordic and Baltic countries. This means that there is a *large technical potential for conversion to flexible power-to-heat* technologies, in case flexibility from this part of the energy system is desired.
- Flexibility requires an incentive to invest in flexible technologies, and to operate these flexibly. I.e. the right incentives regarding fixed as well as variable costs. Norway and Denmark, as the only countries, have a potentially flexible heat technology – air-water heat pump – as the most economical alternative to invest in, while Sweden provides hourly based contracts for flexible operation. None of the countries reviewed offer ideal conditions for investment in flexible individual heating technologies, together with conditions for flexible operation of these.
- Biomass-based individual heating is generally the most economically attractive option to invest in, apart from Denmark and Norway.
- Flexible operation is dependent on hourly metering, and subsequently on contracts for this, and technologies and consumers, who will respond to price signals. Under current conditions, smart electricity consumption has a very limited effect towards improving the business-case for flexible heat production technologies
- Incentives for investment in power-to-heat can be increased along several paths, where these are the main: Decreasing the cost of operation of flexible technologies; increasing the cost of operation of inflexible technologies; or decreasing the investment cost for flexible technologies and vice versa for inflexible technologies. The first could be achieved by a reduction in levies on electricity; the second by increasing levies on use of particularly biomass; and the third could address high capital costs of flexible technologies by subsidising, or providing low or no interest loans.

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Executive summary

As part of the Flex4RES project, this study explores the current framework conditions for flexibility in the individual heating-electricity interface, in the Baltic and Nordic countries. Based on these findings, opportunities for increasing the flexibility are explored.

Flexible technologies are in this study considered to be heat pumps and electric resistance-based electric heating, i.e. power-to-heat technologies in the interface between heat and electricity. Conversely, *inflexible technologies* comprise of fuel-based heating, which does not contribute to integration of variable renewable energy. The study does not advocate a complete transition from inflexible to flexible technologies, but explores the framework conditions for increasing the flexibility.

The review of national statistics shows that individual heating, i.e. provision of heat and hot water in households not connected to district heating, consumes considerable amounts of energy in all countries. In Norway and Sweden, deployment of power-to-heat technologies is significant, while fuel-based technologies are dominant in the remaining countries. This leaves a considerable potential for increasing the share of power-to-heat in the Baltic and Nordic countries.

Reviews of national barriers and drivers reveals that support for flexible technologies can be in shape of subsidies or reduced levies, and can be provided for investment as well as operation. Regarding flexible operation, the review shows a more limited set of experiences. All countries have or are deploying smart meters, but the use of these for hourly pricing is limited to Sweden.

In addition to the review of drivers and barriers, an extensive review has been conducted on national regulation of levies, subsidies, fuel prices, and tariffs. These have provided input for analysis of the annual costs and heat production costs for selected flexible and inflexible technologies. Except for Denmark and Norway, where the air-water heat pump is the most economically attractive alternative, biomass-based heating is generally the most attractive solution in all countries.

If provision of flexibility from individual heating is desired, this situation needs to change.

Flexible operation is dependent on hourly metering, and subsequently on contracts for this, and technologies and consumers, who will respond to price signals.

Economic investment in flexible technologies can be improved along four paths:

- 1. Decreasing the variable costs of flexible technologies
- 2. Increasing the variable costs of inflexible technologies
- 3. Decreasing the fixed cost for flexible technologies
- 4. Increasing the fixed cost for inflexible technologies

The first could be achieved by reduction in levies on electricity; the second by increasing levies on use of particularly biomass; the third could address high capital costs of flexible technologies by subsidising, or providing low or no interest loans; the final could be addressed by adding levies on the investment cost of fuel-based technologies.

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CONTENT

1	Ir	ntroduction	3
	1.1	Research questions	3
	1.2	Report contents	3
2	N	lethodology	4
	2.1	Focus: Incentives for investment and flexible operation	4
	2.2	Flexibility: Definition and application	4
	2.3	Definition of individual heating	5
	2.4	A typical household	5
	2.5	Review of national regulation	5
3	Ir	ndividual heating technologies	6
	3.1	Technologies in review	6
	3.2	Flexible operation of individual heating technologies	7
	3.3	Technologies beyond the review	7
4	R	Review of common practice regarding the regulation of individual heating	9
5	R	Review of framework conditions for flexibility in individual heating	11
	5.1	Denmark	11
	5.2	Estonia	15
	5.3	Finland	17
	5.4	Latvia	20
	5.5	Lithuania	23
	5.6	Norway	26
	5.7	Sweden	30
6	D	Discussion and conclusion	33
	6.1	Potentials for power-to-heat	33
	6.2	Drivers and barriers for flexibility in individual heating	33
	6.3	Investment incentives	34
	6.4	Conclusion	36
	6.5	Further work	38
7	R	References	39
8	А	ppendices	42
	8.1	Data used in the analyses of annual heat cost	42
	8.2	Subsidies	43

nN		Introduction
8.3	Costs and characteristics for individual heating technologies	
8.4	Heat production costs between countries	
8.5	Liquid to water heat pump	
8.6	Air to water heat pump	
8.7	Resistance-based electric heating	50
8.8	Natural gas boiler	51
8.9	Firewood stove and electric water heater	52
8.10	Oil boiler	53
8.11	Wood pellet boiler	54
8.12	Technological assumptions	55

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1 Introduction

Residential heating is an important part of the energy demand in the Baltic and Nordic countries, and can be an important contributor to a flexible energy system. Conversely, residential heating can be a barrier, if not interacting with the rest of the energy system, or if operated inflexibly. Within the Flex4RES project, the subject of flexibility in district heating has been explored in *Framework conditions for flexibility in the district heating- electricity interface* [1], and the subject of electricity system flexibility in *Framework Conditions for Flexibility in the Electricity Sector* [2]. This report on residential heating focuses on individual heating, i.e. heating and hot water for households which are not connected to district heating systems. The geographical scope is the Baltic (Estonia, Latvia, Lithuania) and Nordic (Denmark, Finland, Norway, Sweden) countries.

1.1 Research questions

The study is based in the following questions:

- What are the current framework conditions for flexibility in the individual heating-electricity interface?
- If we want increased flexibility in the individual heating-electricity interface, how can this be achieved?

This study reveals tools for increased flexibility. Like any other tools, these should be reviewed in their concrete context (e.g. by energy system analysis and/or economic analysis), before being applied. Such analyses are conducted in the Work Package 3 of the Flex4RES project. Findings from these analyses will be a good starting point for implementation.

1.2 Report contents

The methodology is described in Section 2. Section 3 outlines the technological scope of the study, and relates the technologies to flexibility. Section 4 outlines good and historical practice in incentivising flexibility in individual heating. Section 5 presents the review of barriers and drivers for flexibility in individual heating in the Baltic and Nordic countries, including the annual cost of heat from selected technologies. In Section 6 the results from Section 5 are collected, discussed and concluded upon. References are found in Section 7. Appendices with the country-specific data are found in Section 8.

2 Methodology

2.1 Focus: Incentives for investment and flexible operation

The study reviews the conditions for investing in potentially flexible technologies, i.e. power-toheat (P2H) technologies, and operating such technologies flexibly. This provides an overview of important barriers for flexibility. The analyses of the annual cost of heat, and annual costs for each technology, shows which technologies are most economically attractive, when investing in a new technology for individual heating. The terms *fixed costs* and *variable costs* could equally well apply for the terms mainly used in this study, respectively *investment costs* and *operation costs*.

2.2 Flexibility: Definition and application

Flexibility has been defined in two other studies within the Flex4RES project [1,2], as the ability of shifting either production or consumption between hours (inter-hour shifting). Thematically, the flexible consumption takes the main share of this study, since prosumers are outside the scope. To operate flexibly, i.e. performing shifts in consumption, technologies must be physically present in the system; they must be invested in. These two key elements are illustrated in Figure 1, where the overlap is the ideal situation for flexibility.



Figure 1 Overlap: Ideal conditions for flexibility.

This study should not be interpreted as an advocacy for a full electrification of individual heating, but as an investigation of the drivers and barriers for increasing flexibility. The distinction is relevant, since it is likely that individual heating based on e.g. biomass would be a better option than P2H in some cases. For instance, when the marginal energy production comes from fossil sources, when the distribution grid is too limited to handle increased electrification, or when socio-economic analysis shows that P2H would not be preferable for other reasons.

2.3 Definition of individual heating

In this study, individual heating describes residential heating without connection to a common heat provider, i.e. district heating. We limit the study to household consumers, focusing on the regulatory frameworks related to this consumer group. Other types of regulation and heat demand, which applies to commercial and industrial heat consumers, are not considered. Although heat pumps (HP) are usually able to provide cooling as well as heating, cooling is not addressed in the study.

2.4 A typical household

For the review and analysis of levies on different heat sources in Section 5, the following assumptions were made for the analyses of annual cost of heat and annual cost of heating technology:

- The heat source is installed in an existing house with waterborne system, a chimney and no existing heat source installed. Payment for energy (electricity and other fuels) is based on annual average prices from 2016.
- Heat demand is based on the standard house, as defined by the Danish Energy Agency: "*An* existing one-family house is defined to have an annual heat demand of 16.8 MWh and a peak demand of 7 kW." [3]
- Investment period is 15 years with a 5% interest rate. No discounting is done. Technologies with a lifetime of more than 15 years are assumed decommissioned at a scrap value which is subtracted from the cost. Investment costs are based on the Danish Energy Agency [3].
- It is assumed that firewood is bought according to national prices. If gathered for free or in other ways obtaining wood materials at a lower cost, this will decrease the cost of firewood-based heating.

2.5 Review of national regulation

An extensive review of the subsidies, taxes, tariffs, and energy costs have been conducted for the Baltic and Nordic countries. This review is, to the best of the authors' knowledge, exhaustive as of 2016.

3 Individual heating technologies

3.1 Technologies in review

In Section 5, seven different technologies for individual heating are analysed regarding their annual costs and heat production costs. This section provides a brief description of these technologies regarding flexibility.

3.1.1 Heat pump air-water

HPs are the most energy efficient source of heating among the two P2H types, since heat pumps use electricity for extraction of heat from an external source. In the case of the air-water HP the efficiency used is 325% [3], and the heat source is ambient air.

3.1.2 Heat pump liquid-water

The same characteristics apply as for the air-water HP described in 3.1.1, with exception of the efficiency of 360% and a heat source based on liquid. Liquid-water based HPs utilises heat from a liquid, which in turn extracts heat from rock, ground or water.

3.1.3 Resistance-based electric heating

As the name indicates, resistance-based electric heating generates heat by utilising the resistance in the material that electricity is passed through. This happens in electric radiators and electric floor heating.

3.1.4 Natural gas boiler

Natural gas boilers generate heat by combustion of natural gas. Natural gas boilers are dependent on a natural gas grid, which is deployed at no or limited extent in Finland and Norway. Hence, natural gas boilers are not included in the review for these countries. In this configuration, they offer no flexible operation in regard of the energy system. They are hence not considered a flexible individual heating option in this study.

3.1.5 Oil boiler

Oil gas boilers generate heat by combustion of oil. The oil is usually stored in tanks, refuelled by lorries. In this configuration, they offer no flexible operation in regard of the energy system. They are hence not considered a flexible individual heating option in this study.

3.1.6 Wood pellet boiler

Wood pellet boilers generate heat by combustion of wood pellets. The pellets are stored in a local store and automatically (assumed in this study) or manually fed to the wood pellet boiler. In this

configuration, they offer no flexible operation in regard of the energy system. They are hence not considered a flexible individual heating option in this study.

3.1.7 Firewood and electric water heater

While firewood stoves might be the oldest and least efficient (65% efficiency [4]) among the technologies reviewed for individual heating, they persist in residential heating, often in combination with other technologies. For this study, the configuration is assumed to be firewood stove (79% of total heat demand) and electric water heater (21% of total heat demand).

3.2 Flexible operation of individual heating technologies

P2H can be operated as a flexible or inflexible part of the energy system. When it is inflexible, it operates according to pre-set operation cycles or solely according to heat demand. Conversely, flexible operation satisfies the heat demand while offering flexibility in the energy system. In this case, the ability to store heat is essential, either in the form of an actual heat storage (e.g. hot water tank), or as the inertia of the heat capacity of the building's physical mass. The benefit of a hot water storage tank, is that it maintains comfort for the user, regardless of operation of the flexible technology. The drawback is that a storage takes up space, which might not be available or prioritised for other needs.

Since P2H, and HPs in particular, is not flexible per se, making the technology flexible can have higher investment costs than e.g. inflexible HPs. Whether this additional flexibility adds value to the heat consumer, determines the incentive to choose between the flexible and inflexible alternatives.

3.3 Technologies beyond the review

As in the rest of the energy system, individual heating is subject to constant change and development. This section reflects on this, by addressing technologies of relevance, which are not addressed in the review in Section 5.

3.3.1 Air-air heat pumps

Since this study focus on individual heating technologies with the ability to cover the full heat demand for a household, air-air heat pumps are not included. This type of heat pump is very similar to the air-water heat pump in the study, with the exception that air-air heat pumps heats the air in the house, instead of water as part of a waterborne system. Air-air heat pumps have relatively low investment cost, and are assumed to have relatively high deployment already.

3.3.2 Blockchain and peer-to-peer energy trading

Whereas the blockchain and peer-to-peer trading presently appear to be centred on electricity mainly, they might equally well extend into individual heating, particularly P2H.

Among its many applications, the blockchain technology provides the opportunity of contracting energy consumption and production on the prosumer level. Among the potential consumer benefits,

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Individual heating technologies

are reduced transaction costs and more flexible switching among suppliers [5]. The latter would potentially mean that P2H consumers could contract directly with the source of electricity of choice, which inevitably adds an additional layer of complexity to obtaining a balanced energy system, all things being equal. The technology is in its infancy, and can take different paths, some of which might be disruptive to the traditional provision of energy and flexibility in the energy system.

Peer-to-peer energy trading can happen through blockchain as described above, but does not have to. There are already facilitators of regional markets, who provide contact between local providers and consumers. The difference to the blockchain approach is that peer-to-peer trading functions more like a virtual power plant, where utilities and facilitators can play a role in ensuring a balance between producers and consumers.

The pragmatic perspective on both blockchain and peer-to-peer trading is that the physical infrastructure sets natural limits on the use of the electricity grid, regardless of contracting. From this follows that the grid providers will maintain their need for financing for the infrastructure, which in turn means that the issue regarding tariff design for grid use persists.

3.3.3 Hybrid heat pumps

Existing boilers can be supplemented with a HP, allowing an interchange of production, and possibly simultaneous operation during cold periods. The hybrid HP can potentially be operated flexibly, adding flexibility to the energy system. E.g. by turning off and replacing with boiler production in periods with electricity scarcity and high electricity prices.

3.3.4 Prosumers

Prosumer is a collective term for the several different opportunities of consuming and producing residential energy. The considerable cost reductions in photovoltaic panels and batteries in the recent decade have made these a significant part of the prosumer category. However, dark and cold Baltic and Nordic winters will require very large capacities of batteries, if wanting to be truly independent of the grid, with or without P2H. Assuming such a setup, and a flexible operation of P2H, batteries might contribute to flexibility by *valley-filling and peak-shaving*, i.e. consuming when electricity prices are low, and producing when high.

Micro CHPs are another option, and can be based on e.g. natural gas or hydrogen fuel cells. If operated according the energy system needs, they have a similar flexibility potential as batteries, by valley-filling and peak shaving. Except for micro CHPs based on a regular gas engine, the technology is not yet commercial. Their relatively high costs mean that further technological development is needed, to make these a viable alternative [6].

Solar heating is presently relatively limited in individual heating. The use of solar heating in combination with a heat storage provides a potentially significant contribution to flexibility, in case it is combined with a P2H unit, which has access to this heat storage.

4 Review of common practice regarding the regulation of individual heating

With respect to an improvement of flexibility in the electricity system, the impact of the regulatory framework is primarily of importance in relation to two aspects: 1) the choice of technology; 2) the daily operation of it in order to achieve the intended effect. There are various kinds of instruments that may be used for affecting both the adoption of technologies and the operation of them. One may distinguish between direct load control measures and indirect attempts to control load by price or other informational feedback [7]. The latter type is mostly aimed at the operation of appliances, but attractive pricing schemes may also have an influence on the adoption of technologies. Moreover, utilities have been very active in promoting technologies that would have a positive impact on the load shape and thus on the utilisation of assets. Utility activities may include financing of appliances, cooperating with manufacturers in the design of new appliances and marketing such appliances themselves [8].

In the residential sector focus has long been on electric heating in the form of both storage and direct electric heating – this is particularly the case for European countries, such as France, Germany, UK and the Scandinavian countries. Individual electric heating has been promoted by utilities throughout Europe since the 1960s to fill the valleys in the load shape. They have been promoted with attractive tariffs linked to the condition of off-peak use. Traditionally two approaches have been used to ensure that heat customers are charged at favourable rates. The first is a time-of-use tariff granting a reduced price during off-peak periods during which hot water storage tanks are charged. As the remaining non-heat related consumption is billed under the same tariff, it would be possible to reduce costs for the use of other appliances as well by shifting the loads to the low-price periods. Another approach is to install a separate meter for consumption for electric heating. In this way it is possible to isolate the use for heating and offer specific rates. An advantage of the separate approach is that the utility can better control the amount of load that is shifted to off-peak periods. With increasing installations of electric heating in some countries it became important to avoid that new peaks are created causing capacity problems.

Besides the mere price, various approaches were implemented to control the use of devices. Most often the heating systems were installed with a simple form of automation. The operation could be based on a timer that could turn appliances on or off at a specific point in time. To avoid that all devices start at the same time, groups of appliances start at shifted points in time, resulting in a rolling connection of the additional load. In addition to this timer-based operation there are examples of remote control by radio signals or signals sent through the electric network itself. Such signals have been used since the 1930s for the control of large industrial loads. As well as with the timer-based model, it is possible to group the devices such that they respond to a specific signal, and the groups are controlled differently according to system needs.

It had been envisaged that similar price incentives could be applied to other kinds of loads. The French system of dynamic tariffs has been developed very early to cover for the full consumption of households. In many other countries pricing pilots have been initiated to test the responsiveness of household consumption. Electric heating, however, remained the most effective form of responsive

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Review of common practice regarding the regulation of individual heating

demand for household consumers -a major reason being that small thermal storage elements made it possible to control the loads without affecting the comfort of consumers.

Besides the rather static tariff systems based on time-of-use, the 1980s saw the discussion, testing and introduction of more dynamic rates to control loads [9]. These incorporate real-time aspects into the tariff structure to achieve a more cost-efficient demand management. A simple form of dynamic schemes are interruptible load contracts that include the option for the utility to curtail load at critical points in time, rather than implementing a regular control based on a static structure. The most complex schemes reflect real-time system conditions in the form of spot prices to the consumers. Although such pricing schemes have been implemented to some extent throughout the past, most dynamic pricing schemes contain only some real-time elements [10]. Critical peak day pricing could, for example, result in exceptionally high prices during a short period of the day at short notice. Also dynamic time-of-use structures have been implemented. In such schemes price levels and the overall number of hours per price level can be predetermined, however, the exact timing is only notified in real-time. A recent example for tariff design proposed by Skytte et al. [11] (yet to be published by primo 2017), focuses on an increased fixed charge and a relatively smaller variable charge, which can be dynamic.

5 Review of framework conditions for flexibility in individual heating

In this section, present deployment, barriers and drivers are described for flexible individual heating solutions in each country. Background data for the analyses of annual heat costs, and a detailed comparative overview of the shares of heat production costs are found in the appendix, Section 8.

Data on the distribution of energy for heating and consumption in households varies in format by country, since this is compiled in different ways. Moreover, the statistics does generally not distinguish between different types of heat pumps. Thus, air-air heat pumps are likely to be part of the number on heat pumps, where these numbers are provided.

5.1 Denmark

5.1.1 Current distribution of heating: Denmark

Table 1 2014 data on energy demand for individual heating in Denmark

ТҮРЕ	ENERGY [GWh]
Natural gas	6 513
Oil boilers	2 282
Biomass	10 230
Resistance-based electric heating	570
Heat pumps	411

Sales of HPs have been almost constant for a decade, and the current number of HPs is estimated to 70 000. The Danish TSO Energinet.dk has in a projection estimated the need for HPs to be 350 000 by 2035, in order to reach a fully renewables-based heating sector. [12]



Figure 2 Sales of heat pumps in Denmark. Figure from Nyhedsbladet Dansk Energi [12].

5.1.2 Barriers and drivers for flexibility in individual heating: Denmark

Investment

The drivers for investment in P2H identified in Denmark:

- Scrap your oil boiler (Skrot dit oliefyr, discontinued). Subsidies for exchanging oil boilers with e.g. district heating or HPs. An evaluation showed that approximately 1/3 of those who invested, would not otherwise have done so [13]
- Reduced electricity tax (0.12 EUR/kWh to 0.05 EUR/kWh) for electricity consumption more than 4 MWh. Consumption beyond this level is assumed to derive from electric heating
- Heat pump list, maintained by the Danish Energy Agency. Provides information on efficiencies, capacities etc. on the HPs on the market
- Public subsidy for companies who develop business models for leasing or renting of HPs [14]
- Preparing new building plots for HPs, by drilling wells for ground-source HPs [15]. A similar service is seen for district heating
- *Craftsman deduction* (håndværkerfradrag), where expenses for craftsman salaries can be deducted from the tax payment of the household [16]. This subsidy is included in the analyses in Section 5
- Energy companies are obliged to perform energy savings, which they among other sources can ensure but subsidising or buying energy savings in households. For heating in individual households, the savings are realised by changing heat supply from a less efficient or older heat source. Since the analyses in Section 5 assume no existing heat source, this subsidy is not included. [17]

A recent analysis calculates the annual socio-economic cost of damages by emissions from wood stoves to 800 MDKK (107 MEUR) [18]. While this could provide incentive for taxation on biomass or wood stoves, this has per primo 2017 not attracted a political majority.

Operation

There are technical solutions for varying production in existing heat pumps according to electricity price, but Danish research shows that presently the costs for installing such solutions, are higher than the economic benefits. [19]

Generating benefits from the flexible operation of P2H depends on the implementation of hourly settlement procedures (so called flex-afregning). Preconditions in terms of regulation and infrastructure (metering, communication, data management etc.) is already in place for many residential consumers. At present, however, further implementation is hampered by outstanding issues regarding the handling of consumers with solar PV installations that are guaranteed annual net-metering arrangements. Therefore, dynamic retail pricing in Denmark is limited to products following spot prices on an aggregated basis. That is, customers are billed according to the monthly spot market procurement costs of their suppliers [20]. Besides the pure energy price, Denmark has opened for distribution grid companies charging time-of-use tariffs to residential consumers. The design is not dynamic, though, and the differences between base load and peak load tariffs are moderate.

5.1.3 Annual individual heat production costs – 2016: Denmark

The impact of investment costs, taxes, tariffs, energy costs and subsidies on heat cost for individual heating in Denmark is illustrated in Figure 3 and Figure 4. It is seen that the air-water HP and the wood pellets-based biomass boiler are the least cost solutions. The liquid-water HP is less competitive, explained by the relatively higher investment costs. For resistance-based electric heating, taxes and tariffs on electricity use is the determining factor for its lack of competitiveness. Whereas subsidies (embedded in the capital costs) improve the competitiveness of the natural gas boiler and the heat pumps, the wood pellet boiler remains among the most economical solutions, due to the absence of levies, and its relatively low investment costs.



Figure 3 Total annual costs and heat price per kWh for individual heating in Denmark. Left axis shows total annual heat price in the lifetime of the investment, including levies, fuel, maintenance, and capital costs, but excluding scrap value. Right axis shows the cost per kWh of heat, including levies, fuel, maintenance, capital costs, and scrap value.



Figure 4 Annual costs divided on levies, subsidies, energy costs and scrap value of individual heating in Denmark.

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Review of framework conditions for flexibility in individual heating

It should be noted that the figure is shown without the Danish PSO tariff, since this is to be phased out towards 2022. Whereas the absence of PSO increases the competitiveness of the electricity-based heat sources, the overall picture remains the same.

5.2 Estonia

5.2.1 Current distribution of heating: Estonia

Exact statistics on heat demand in different individual heat sources are not available. Instead, Table 2 shows fuel consumption in private households. Because private households use most of the fuel for heat production, it can be assumed that the fuel consumption corresponds to the type of technology it is most typically used in. The exception here being electricity. It is generally not known how much residential electricity is consumed for heating. However, the largest and dominant distribution grid operator, Elektrilevi has analysed electricity consumption change according to the ambient temperature, and estimated that in the distribution grid, about 20%, or 800 GWh of electricity is used for electric heating (HPs and heaters combined). Thus, the number in the table for electric heaters and HPs is (Electricity use in residential buildings) x 0.2. This is an extremely rough measure, but no better one has been found.

Table 2 2015 data on energy demand for residential heating in Estonia

ТҮРЕ	ENERGY [GWh]
Natural gas	577
Oil boilers	956
Wood pellet boilers	48
Firewood stoves	4 144
Biomass total	4 192
Resistance-based electric heating and HP	346

5.2.2 Barriers and drivers for flexibility in individual heating: Estonia

Investment

Using firewood in wood stoves is considered more cost effective than electric heating devices in rural areas.

Operation

A barrier for flexible operation is the relatively high grid tariffs. Consumers rarely see a significant change in end-consumer prices because the energy price in the overall cost of electricity is quite low.

Among the drivers is that the installation of smart meters in all residential consumers is near completion.

5.2.3 Annual individual heat production costs - 2016: Estonia

Generally, the regulation of individual heating is quite liberal in Estonia, with very few restrictions or specific taxes. Investment costs, taxes, tariffs, energy costs and subsidies for individual heating in

Review of framework conditions for flexibility in individual heating

Estonia are illustrated in Figure 5 and Figure 6. It is seen that the flexible technologies are generally more expensive than inflexible technologies, where natural gas, wood pellets and firewood can provide heat for 0.07 EUR/kWh. Of particular relevance for this difference is the relatively high investment costs of HPs, and the distribution grid tariff. The sole exception is oil boilers, where the energy tax drives a significant increase in cost.



Figure 5 Total annual costs and heat price per kWh for individual heating in Estonia. Left axis shows total annual heat price in the lifetime of the investment, including levies, fuel, maintenance, and capital costs, but excluding scrap value. Right axis shows the cost per kWh of heat, including levies, fuel, maintenance, capital costs, and scrap value.



Figure 6 Annual costs divided on levies, subsidies, energy costs and scrap value of individual heating in Estonia.

As an additional fact regarding heat prices, district heating has lower prices than the combined cost of grid tariffs, electrical energy price and other taxes for most of the individual heating options. For example, in the largest distribution grid operator's area, the grid tariff for regular residential consumers is presently around 0.054 €/kWh. The price for district heat can be as low as 0.052 €/kWh in Tallinn without VAT. [21]

5.3 Finland

5.3.1 Current distribution of heating: Finland

Exact data on fuel consumption on different types of individual heating technologies in Finland has not been identified. Instead, Table 3 and Figure 7 indicate the amount and distribution of energy used in households, and the energy sources used for satisfying this demand.

Corrected on 8 December 2016. The corrections are indicated in red.								
	2010	2011	2012	2013	2014	2015		
Heating of spaces	48 765	41 419	45 928	4 2 739	42 831	40 804		
Residential buildings proper, total	46 365	39 339	43 663	40 643	40 690	38 760		
- Detached houses	29 101	25 091	27 641	25 595	25 967	24 507		
- Terraced houses	4 462	3 767	4 215	3 972	3 925	3 816		
- Blocks of flats	12 802	10 481	11 807	<mark>11 076</mark>	10 798	10 437		
Free-time residential buildings	2 399	2 080	2 265	2 097	2 140	2 044		
Household appliances ¹⁾	9 092	8 320	8 856	8 395	8 099	7 886		
- Lighting	2 702	<mark>2 48</mark> 2	2 349	2 115	1 919	1 876		
- Cooking	826	799	714	697	689	680		
- Other electrical equipment	5 564	5 039	5 793	5 583	5 491	5 330		
Heating of saunas	2 880	2 871	2 894	2 902	2 924	2 920		
Heating of domestic water	9 522	9 584	9 658	9 727	9 789	9 850		
Housing, total	70 259	62 194	67 336	63 763	63 643	61 460		

Table 3 Data on energy demand for residential heating in Finland. Table from [22]

1) Apart from electricity consumption, consumption of household appliances includes use of natural gas and liquid gas in cooking. Electricity consumption also covers solar power produced by households.



Used energy sources 61 TWh. The group Others contains the following energy sources: natural gas and liquid gas 0.7 %, peat 0.1 %, heavy fuel oil 0.1 % and coal 0.005 % of energy consumption in households.

Figure 7 Data on energy demand for residential heating in Finland. Figure from [22]

5.3.2 Barriers and drivers for flexibility in individual heating: Finland

Investment

Biomass-based heating is generally applied in rural areas, often preferred by house owners who have access to biomass from forests. Additionally, local/individual heat producers or *heat entrepreneurships* are progressing in rural areas. Heat entrepreneurship is mainly based on bioenergy use, supplying heat to smaller rural consumer groups, e.g. municipal buildings; the scheme is forestry bioenergy-driven, and incentives for P2H may not yet be there.

Heat pumps gain popularity, both in new buildings but also in retrofitting old oil boilers. Heat pumps are particularly applied in urban areas. Heat pumps also start to penetrate to larger buildings and high rise buildings, also in district heating areas, although the amounts in the latter are still small.

Moreover, in 2010, the government of Finland introduced a supportive package for deployment of renewable energy with emphasis, among others, on the wood-based bioenergy through feed-in tariffs and financial support for investments in biorefineries. Individuals do not directly get subsidies for their heating system investment. However, they receive a so-called household tax deduction on the installing work; the deduction per person is 45% of work costs up to 5,000 euro. If two persons are in the household, then the subsidy doubles.

Finally, the goal is to increase the current share of wood-based bioenergy as a source of total energy consumption to 30% by 2020. Currently, 85 TWh (about 20%) of Finnish energy consumption is based on wood-based bioenergy and it is aimed to extend that to 99 TWh (about 30%) of the total energy consumption.

Operation

Smart meters are being deployed throughout Finland, but has not reached all households as of primo 2017. Time of use-payment is possible, split on day/night, which has incentivised P2H in combination with heat storage. In practice a water storage has been charged with cheaper night-electricity. As the tariff difference between day and night was significant, many consumers had an incentive to invest in a water tank with electric resistance. These schemes have typically been driven by municipal utilities.

5.3.3 Annual individual heat production costs - 2016: Finland

Investment costs, taxes, tariffs, energy costs and subsidies for individual heating in Finland are illustrated in Figure 8 and Figure 9. It is seen that air-water HP is rather competitive against all technologies, while liquid-water HP and resistance-based electric heating are the most expensive options, together with the oil boiler. Wood pellets are by a small margin the least cost option. Of particular relevance for the higher costs of flexible technologies are the investment costs.



Figure 8 Total annual costs and heat price per kWh for individual heating in Finland. Left axis shows total annual heat price in the lifetime of the investment, including levies, fuel, maintenance, and capital costs, but excluding scrap value. Right axis shows the cost per kWh of heat, including levies, fuel, maintenance, capital costs, and scrap value.



Figure 9 Annual costs divided on levies, subsidies, energy costs and scrap value of individual heating in Finland.

5.4 Latvia

5.4.1 Current distribution of heating: Latvia

Exact data on fuel consumption on different types of individual heating technologies in Latvia has not been identified. Instead, Table 4 indicates the amount of energy used.

Table 4 Data on energy consumption in households in Latvia. Note that this includes "consumption in agricultural holdings and for other economic activities". [23]

ТҮРЕ	ENERGY
Electricity (GWh)	1 758
Natural gas, (GWh)	1 298
Liquefied petroleum gas (LPG) (t)	16 617
Fuel oil for heating and hot water (t)	2 093
Hard coal (t)	20 900
Fire wood (thousand m3 solid)	2 441
Wood briquettes (t)	23 337
Wood pellets (t)	115 012
Wood wastes (t)	36 254
Charcoal (t)	1 517
Heat (heating and hot water) (GWh)	3 917

5.4.2 Barriers and drivers for flexibility in individual heating: Latvia

No recent data has been identified regarding the deployment of smart meters in Latvia. A report from the European Commission from 2014 found a negative result from a cost-benefit analysis of a large-scale roll-out of smart meters by 2020 for Latvia. Furthermore, the study pointed towards an

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absence of legislation for deployment of smart meters in Latvia. [24] Both characteristics are considered to be barriers. Since the study is from 2014, conditions might have changed since then.

Operation

As Investment.

5.4.3 Annual individual heat production costs - 2016: Latvia

Investment costs, taxes, tariffs, energy costs and subsidies for individual heating in Latvia are illustrated in Figure 10 and Figure 11. It is seen that the flexible technologies are generally not competitive with inflexible technologies. Of relevance for this difference are the significant electricity tariffs, in particular the distribution grid tariff of 5.6 EURc/kWh. Air-water HP and oil boiler are on par under current levels of levies.



Figure 10 Total annual costs and heat price per kWh for individual heating in Latvia. Left axis shows total annual heat price in the lifetime of the investment, including levies, fuel, maintenance, and capital costs, but excluding scrap value. Right axis shows the cost per kWh of heat, including levies, fuel, maintenance, capital costs, and scrap value.



Figure 11 Annual costs divided on levies, subsidies, energy costs and scrap value of individual heating in Latvia.

5.5 Lithuania

5.5.1 Current distribution of heating: Lithuania

Table 5 indicates the amount and distribution of energy used in households. The distribution allows insight in the types of energy that satisfies the demand, but not in the types of technologies in which the energy is converted.

ТҮРЕ	SUBTYPE	Fuel and energy consumption in households by type of end use [natural units]
Hard coal, thous. tonnes	Total by end use	58.1
	Space heating	53.7
	Water heating	4
	Cooking	0.4
Peat and peat briquettes, thous. tonnes	Total by end use	37
	Space heating	34
	Water heating	2.3
	Cooking	0.7
Firewood, wood and agricultural waste,	, in the second s	
thous. cubic metres	Total by end use	2505.1
	Space heating	2324.7
	Water heating	132.8
	Cooking	47.6
Liquefied petroleum gases, thous. tonnes	Total by end use	28.5
	Space heating	0.8
	Water heating	0.1
	Cooking	27.6
Heating gasoil, thous. tonnes	Total by end use	9.5
	Space heating	7
	Water heating	2.5
	Cooking	
Natural gas, GWh	Total by end use	1585.4
	Space heating	995.6
	Water heating	187.1
	Cooking	402.7
Electricity, GWh	Total by end use	2660
	Space heating	141
	Water heating	151.6
	Cooking	175.6
Heat, GWh	Total by end use	4997.9
	Space heating	4173.2
	Water heating	824.7
	Cooking	

Table 5 Data on energy consumption in households in Lithuania 2015. [25]

Review of framework conditions for flexibility in individual heating 5.5.2 Barriers and drivers for flexibility in individual heating: Lithuania

Investment

No recent data has been identified regarding the deployment of smart meters in Lithuania. A report from the European Commission from 2014 found a negative result from a cost-benefit analysis of a large-scale roll-out of smart meters by 2020 for Lithuania. Furthermore, the study pointed towards an absence of legislation for deployment of smart meters in Lithuania. [24] Both characteristics are considered to be barriers. Since the study is from 2014, conditions might have changed since then.

Operation

As Investment.

5.5.3 Annual individual heat production costs - 2016: Lithuania

Investment costs, taxes, tariffs, energy costs and subsidies for individual heating in Lithuania are illustrated in Figure 12 and Figure 13. It is seen that the flexible technologies are generally not competitive with the inflexible technologies. Of relevance for this difference are the investment costs and electricity tariffs.



Figure 12 Total annual costs and heat price per kWh for individual heating in Lithuania.



Figure 13 Annual costs divided on levies, subsidies, energy costs and scrap value of individual heating in Lithuania.

5.6.1 Current distribution of heating: Norway

Electrical energy in Norway is broadly used for space and domestic water heating, which explains typically high electricity shares in total consumption especially in households and service sector. In recent years, the use of HPs for space heating purposes has increased significantly. While in 2004 HPs were installed in only 4% of dwellings, the share was 27% in 2012 and even 44% in single family houses. Table 6 shows the distribution of energy consumption in households, while Table 7 shows the distribution of heat sources.

Table 6 Energy consumption in households in Norway 2015. [26]

ТҮРЕ	ENERGY [GWh]
Coal, coke and petrol coke	4
Biofuel and waste	6 139
Crude oil	0
Natural gas/LNG	39
Other gases and LPG	101
Petrol and kerosene	9 108
Middle distillates, heavy fuel etc.	8 915
Electricity and district heating	38 419

 Table 7 Share of heating sources in Norwegian households. Numbers can exceed 100%, since a household can have more heating sources. [27]

TYPE	Row house, linked house and house with 3 or 4 dwellings	Multi- dwelling building	Detached	Farmhouse
		bullaring	nouse	Turrinouse
Electric space heaters or electric floor heating	97%	89%	96%	94%
Gas stove	3%	4%	3%	4%
Stove for oil or kerosene	2%	2%	7%	3%
Stove for oil or kerosene and/or combined stove for fuel wood and oil	6%	3%	15%	11%
	070	570	1370	11/0
Stove for solid fuels and/or open fire place	65%	22%	86%	98%
Stove for solid fuel or open fire place and/ or combined stove for fuel wood and oil	65%	23%	89%	99%
Open fire place	9%	2370 4%	17%	19%
Fireplace and similar	6%	3%	7%	1%
Closed stove for fuel wood	58%	19%	80%	98%
Stove for pellets	0%	0%	1%	0%
Combined stove for fuel wood and oil	4%	1%	10%	9%
Common or individual central heating, excl.				
district heating	5%	18%	8%	8%
Common central heating, excl. district heating	2%	18%	0%	0%
Individual central heating	3%	0%	8%	8%
District heating	2%	13%	1%	0%
Heat pump	16%	6%	44%	30%
Ambient-air heat pump	15%	2%	39%	27%
Geothermal or ground-source heat nump	1%	/10/	6%	1%
Heat recovery	8%		10%	

A few studies regarding the share of energy consumption for heating have been conducted, but they all provide different conclusions depending on the method used. Estimates of the share of the electricity consumption used for heating purposes ranges from 20-30% [28] over 41% [29] to approximately 50% [30]. The method used in the latter study is temperature corrected, and dependent on the energy source per building. However, in that study the efficiencies of different fuels are not considered. Factors as building types and isolation also matter, and leads to differences between the estimates.

5.6.2 Barriers and drivers for flexibility in individual heating: Norway

Investment

- Energy requirements for new buildings [31]
- Prohibited to install heating systems for fossil fuels

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- From 2016, resistance-based electric heating has been allowed in all buildings
- Investment subsidies are provided for air-water and liquid-water heat pumps, and for biomass boilers. The subsidy is 25% of the investment cost, subject to a cap which varies between the technologies [32]

Operation

Although hourly metering is not yet fully rolled out to all residential consumers, the majority of consumers already buys electricity on the basis of spot prices [20]. While at present consumers are billed based on average spot prices (typically monthly) or a mix of short-term forward products, this is expected to change, as hourly metering is deployed. While individual consumers in theory have had the opportunity for hourly-based contracts, the absence of smart metering has limited this option. Grid tariffs can already hold a capacity component. It is being discussed, whether to increase the capacity component and reduce the energy component, thus establishing an increased incentive for peak shaving.

5.6.3 Annual individual heat production costs - 2016: Norway

Investment costs, taxes, tariffs, energy costs and subsidies for individual heating in Norway are illustrated in Figure 14 and Figure 15. It is seen that air-water HP has the lowest heat cost (0.08 EUR/kWh), followed by the wood pellet boiler and resistance-based electric heating. Worth noticing is that the CO₂- and energy tax on oil makes this the costliest alternative. Subsidies are applied on HPs and the wood pellet boiler, resulting in the air-water HP becoming more competitive than resistance-based electric heating and wood pellet boiler. A removal of subsidies for the wood pellet boiler would make the liquid-water HP a competitive alternative.



Figure 14 Total annual costs and heat price per kWh for individual heating in Norway. Left axis shows total annual heat price in the lifetime of the investment, including levies, fuel, maintenance, and capital costs, but excluding scrap value. Right axis shows the cost per kWh of heat, including levies, fuel, maintenance, capital costs, and scrap value.



Figure 15 Annual costs divided on levies, subsidies, energy costs and scrap value of individual heating in Norway.

The use of wood pellets in households is presently marginal, as indicated in Section 5.6.1. It will be relevant to follow the development of wood pellet boilers, since these appear to be competitive with the alternatives within P2H.

5.7.1 Current distribution of heating: Sweden

Table 8 shows the amount of energy used in households, and the distribution of technologies in which the energy is converted.

Table 8 Data on energy consumption in households in Sweden 2015. "Total use of energy for heating and hot water in one- and
two-dwelling buildings in 2015, by use of fuels and type of heating system used, GWh". [33]

Type of individual heating	0	il	Di: he	strict ating	Electrici non-hea purpose	ty (incl. ting s)	Electricity (ex non-heating purposes)	xcl.	Natural gas	Local heating systems	Biomass
TOTAL		751		5 587		22 486	13 8	852	245	146	10 351
Electric heating											
(direct heating)	-		-			4 456	2 7	769	-	-	18
Electric heating											
(water-based)	-		-			5 474	3 !	570	-	-	23
Only oil		377	-		-		-		-	-	-
Oil and electricity		123	-			120		74	-	_	-
Biomass and											
electricity	-		-			5 270	3 (051	-	-	3 950
Only biomass	-		-		-		-		-	-	4 944
Heat pump with heat source rock/ground/water											
and electricity	_		_			1 003	(676	-	_	3
Heat pump with heat source rock/ground/water											
and biomass	-		-			936	I.	599	-	-	495
Heat pump with heat source											
rock/ground/water	-		-			3 835	2 4	419	-	-	12
District heating	_			4 514	-		-		_	_	4
Other types of											
individual heating		251		1 073		1 392	(693	245	146	900

5.7.2 Barriers and drivers for flexibility in individual heating: Sweden

Investment

Up to 30% of the installation cost for all types of heating analysed in this study can be deducted from the tax payment of the household [34]. This subsidy is included in the analyses in Section 5

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Operation

DSO-monitored smart meters have been mandatory in Sweden for several years. Contracts based on electricity spot prices are possible for individual households. Taxes and grid tariffs are mainly based on energy (i.e. kWh), independent of time. This provides no incentive for flexibility. Possibility for customer monitoring of spot prices are provided in multiple ways.

5.7.3 Annual individual heat production costs – 2016: Sweden

Investment costs, taxes, tariffs, energy costs and subsidies for individual heating in Sweden are illustrated in Figure 16 and Figure 17. It is seen that the flexible technologies are generally in the mid-range regarding cost, compared to inflexible technologies, where biomass-based heating is the least cost option. The significant CO₂ tax means that natural gas and oil becomes the costliest options. The relatively limited subsidies, in form of a deductible share of 30% of installation cost for all technologies, does not affect the outcome regarding the relative costs among the technologies.



Figure 16 Total annual costs and heat price per kWh for individual heating in Sweden. Left axis shows total annual heat price in the lifetime of the investment, including levies, fuel, maintenance, and capital costs, but excluding scrap value. Right axis shows the cost per kWh of heat, including levies, fuel, maintenance, capital costs, and scrap value.



Figure 17 Annual costs divided on levies, subsidies, energy costs and scrap value of individual heating in Sweden.

6 Discussion and conclusion

The review of regulatory framework conditions for individual heating in Section 5 provides the background for a discussion and conclusion on the results in this section.

6.1 Potentials for power-to-heat

Except from Norway and to some degree Sweden, there is a limited deployment of power-to-heat in the reviewed countries.

- Denmark: HP sales are constant. 2.3 TWh of oil boilers are to be phased out. Significant shares of biomass and natural gas as well.
- Estonia: Biomass is dominant. Oil boilers of approximately 1 TWh.
- Finland: Use of natural gas and fuel oil is less than 1/10 of household energy use. Around ¼ of household energy consumption is covered by biomass, whereof heating is assumed to be dominant.
- Latvia: Coal, biomass and natural gas all holds significant shares of household energy use.
- Lithuania: Biomass, natural gas and coal use are significant.
- Norway: Oil and biomass both takes up considerable shares.
- Sweden: Biomass is the only heat source with considerable potential for conversion.

In summary, all countries have considerable technical potential for power-to-heat, since they all show a large deployment of inflexible fuel-based technologies. For concrete estimates of numbers and amounts of energy, more detailed data is needed for some of the countries.

6.2 Drivers and barriers for flexibility in individual heating

Investment

- No direct investment- or operation subsidies have been identified for heat storage-options for individual heating.
- Denmark: A now discontinued subsidy scheme has incentivised switching from oil boilers. Reduced tax for electric heating. Business models for leasing and renting are under development. Preparing building plots for HP, like what is done for DH.
- Norway: Prohibition of oil boilers. Resistance-based electric heating allowed in all buildings. Investment subsidy for heat pumps and biomass boilers.
- Finland, Denmark and Sweden: Expenses for investment in heating technologies can be deducted from the taxable income.

Both carrot (subsidies) and stick (prohibition of oil boilers) have thus been, or are applied. The study shows that oil boilers are commonly among the most expensive options, but since not all investments are based on an economic incentive, a ban on certain technologies might be necessary as well.



Flexible operation is here reduced to the technical issue of smart meters allowing for hourly settlement, combined with contracting models for providing price signals to the electricity consumer. The deployment of these elements is illustrated in Table 9.

COUNTRY	SMART METERS	CONTRACTS FOR FLEXIBLE DEMAND
DENMARK	Presently being deployed	Implementation of regulation hampers actual hourly electricity prices for individual consumers
ESTONIA	Almost fully deployed	Unknown
FINLAND	Presently being deployed	Day/night time of use tariffs
LATVIA	No legislation for smart meters. No status on deployment	Unknown
LITHUANIA	No legislation for smart meters. No status on deployment	Unknown
NORWAY	Presently being deployed	Absence of smart meters has halted spot-price contracts, but these are expected to come. Capacity component in grid tariffs incentivises peak shaving.
SWEDEN	Smart meters are mandatory and deployed	Spot market-based contracts are available

While the deployment of smart meters seems to be increasing, the opportunity for contracting for flexible demand appears more limited. The study has not enquired into the reasons for this, but causes might be lack of economic incentive due to relatively small gains from offering flexibility, lack of technological know-how, and regulatory bottlenecks. An additional challenge not addressed in this study, is the potentially minor share that the variable payment makes up of the total electricity bill. Variable pricing might thus be hampered by the dampening effect provided by the fixed charges that consumers face in their invoicing. The latter aspects of low private economic benefit are indicated in the following section on investment incentives.

6.3 Investment incentives

Table 10 displays the heat prices for each of the technologies analysed. Biomass-based heating stands out as the generally most economical option. This can be explained by low investment costs, absence of levies, and relatively low fuel costs. Resistance-based electric heating, oil boilers and liquid to water HP are seen in the other end of the spectrum. This is for the HP caused by high investment cost and levies on the electricity consumption, while for oil boilers, this is caused by the fuel cost and levies. Generally, power-to-heat is not the most economical option. All things being equal, this means that the economic incentive drives individual heating towards inflexible, biomass-based heat production technologies.

Table 10 Annual heat production costs per kWh, utilising average electricity prices. Green indicates lowest; red highest. Colour scale applies horizontally per country.

	Heat pump air-	Heat pump liquid-	Resistance- based electric	Natural		Wood	
	water	water	heating	gas	Oil boiler	pellets	Firewood
Denmark	0.10	0.12	0.15	0.11	0.15	0.10	0.16
Estonia	0.10	0.12	0.13	0.07	0.14	0.07	0.07
Finland	0.10	0.12	0.12		0.11	0.09	0.10
Latvia	0.11	0.13	0.15	0.08	0.10	0.07	0.07
Lithuania	0.10	0.12	0.12	0.08	0.09	0.07	0.07
Norway	0.08	0.10	0.09		0.13	0.09	0.10
Sweden	0.10	0.12	0.12	0.14	0.13	0.08	0.08

In a simple analysis of the impact of smart use of electricity, it is assumed that the electricity consumption is based only on the average of the lowest 25% of 2016-electricity prices, where the analysis so far has assumed average 2016-electricity prices. This analysis is optimistic in assuming that these low prices are distributed evenly, allowing for utilisation over the full year. As seen in Table 11, the consumer benefit of smart electricity consumption is limited, when comparing to the average prices seen in Table 10. As could be expected, due to the relatively large electricity consumption, the difference is largest in resistance-based electric heating. It can be concluded that smart electricity use alone under current conditions is insufficient to shift incentives from inflexible to flexible individual heating.

	Heat pump air- water	Heat pump liquid- water	Resistance- based electric beating	Natural	Oil boiler	Wood	Firewood
Denmark	0.10	0.12	0.15	0.11	0.15	0.10	0.16
Estonia	0.10	0.12	0.12	0.07	0.14	0.07	0.07
Finland	0.09	0.12	0.11		0.11	0.09	0.10
Latvia	0.10	0.12	0.14	0.08	0.10	0.07	0.07
Lithuania	0.09	0.11	0.10	0.08	0.09	0.07	0.07
Norway	0.08	0.10	0.08		0.13	0.09	0.10
Sweden	0.09	0.11	0.11	0.14	0.13	0.08	0.08

 Table 11 Annual heat production costs per kWh, utilising the average of the lowest 25% of electricity prices. Green indicates lowest; red highest. Colour scale applies horizontally per country.

The effect of subsidies in making power-to-heat competitive has been shown by especially the Danish and Norwegian schemes. While there are several alternatives to shift the investment incentives, two are briefly discussed in the following.

• A tax on biomass, by metering the use of wood stoves and biomass boilers, has been proposed by The Danish Ecological Council among others [35]. This would, in a similar fashion as reducing electricity levies, increase the competitiveness of power-to-heat.

• Providing loans with 0 or very low interest (5% is used in this study) for preferred technologies, here exemplified with liquid-water heat pumps, would improve the investment incentive for preferred technologies. Liquid-water heat pumps, which are otherwise challenged by their high investment costs, would with 0% interest be significantly more attractive, as seen in Table 12.

	Heat	Heat	Resistance-				
	pump air-	liquid-	electric	Natural		Wood	
	water	water	heating	gas	Oil boiler	pellets	Firewood
Denmark	0.10	0.09	0.15	0.11	0.15	0.10	0.16
Estonia	0.10	0.09	0.13	0.07	0.14	0.07	0.07
Finland	0.10	0.09	0.12		0.11	0.09	0.10
Latvia	0.11	0.10	0.15	0.08	0.10	0.07	0.07
Lithuania	0.10	0.09	0.12	0.08	0.09	0.07	0.07
Norway	0.08	0.07	0.09		0.13	0.09	0.10
Sweden	0.10	0.09	0.12	0.14	0.13	0.08	0.08

6.4 Conclusion

As presented in the introduction, this study has addressed two research questions. The answers provided by the study, are summarised in this section.

• What are the current framework conditions for flexibility in the individual heating-electricity interface?

The study shows that Norway and Sweden presently have the largest deployment of power-to-heat. The technical potential for increasing the share of power-to-heat, is significant in all countries, since fuel-based heating serves large shares of the heating demand.

Furthermore, flexibility within individual heating in the Baltic and Nordic countries, is currently limited by two things. First is that, except from Denmark and Norway, the deployment of potentially flexible heating options based on power-to-heat, is limited by lack of economic incentives for investing in these for the household. Second is that the flexible operation of power-to-heat is hampered by the absence of contracting for flexibility, e.g. by electricity prices that reflect the spot market in real time – except for Sweden. As shown in Figure 18, the ideal situation is the overlap between the two circles. None of the countries satisfies this condition, and only three qualifies in either of the two categories.



Figure 18 The ideal conditions for offering flexibility are in the overlap.

• If we want increased flexibility in the individual heating-electricity interface, how can this be achieved?

Full electrification of all individual heating might not necessarily be the most beneficial solution for society, or for the energy system. With this caveat in mind, increased shares of power-to-heat can, simply put, be achieved by either decreasing heat production costs of power-to-heat or increasing those in non-flexible technologies. Expanding on this, economic investment incentive for flexible technologies can be improved along four paths:

- 1. Decreasing the variable costs of flexible technologies
- 2. Increasing the variable costs of inflexible technologies
- 3. Decreasing the fixed cost for flexible technologies
- 4. Increasing the fixed cost for inflexible technologies

The first could be achieved by reduction in levies on electricity; the second by increasing levies on use of particularly biomass; the third could address high capital costs of flexible technologies by subsidising, or providing low or no interest loans; the final could be addressed by adding levies on the investment cost of fuel-based technologies.

The analysis shows that competitiveness of power-to-heat can be improved by subsidies, or by extending levies on particularly biomass. Along this path, 0 interest loans have been analysed. They proved to be efficient for making the annual cost of heat competitive of the otherwise uncompetitive liquid-water heat pump. Under current conditions, the benefit from flexible electricity demand is in itself insufficient to shift the incentive for investment in power-to-heat.

The above approaches have not been weighed or analysed regarding socio-economy or energy system, which is why recommendations of one over the other are not provided.

While the study has not addressed the specific capabilities for flexibility of each technology, perhaps electric resistance-based electric heating is presently the most well-suited technology for provision of flexibility, since it without significant challenges can be turned on and off. The challenge here is to provide a solution which is economically attractive, and which does not impede comfort for the



consumers. Regardless of technology, the flexible operation is highly dependent on the ability to store heat. While the study has not identified special incentives for individual heat storage, such ability to store should be an important part of the deployment of power-to-heat.

6.5 Further work

This section contains an array of options which will be relevant to address and include, if analysing this subject further.

Further studies would benefit from more detail on the time of life of individual heating installations. This would provide a better estimate of the real potential of a shift from inflexible to flexible individual heating. This due to the unlikeliness of people decommissioning e.g. a well-functioning biomass boiler, before it is at the end of its lifetime.

Spot prices have been used to represent the cost of electricity. Consumers are under current conditions likely to pay a premium on the variable part of this price, which is not reflected in the study. A more detailed study could include this, which would further reduce the investment incentive of power-to-heat.

Same investment costs are used for all technologies. More context specific costs, e.g. including labour costs, might show different results, particularly for the liquid-water heat pump, since this is impeded by its large capital costs.

Regarding subsidies, the Danish subsidy on exchanging existing heat sources is not included in the study, due to the assumption of having no existing heat source in the analysis. Since the subsidy is not insignificant, it would in most Danish cases provide a better business case for heat pumps, gas boilers and biomass-based boilers.

Analysing technologies described in Section 3.3, in a similar way as done in the present study, would provide an indication of how these would be impacted by present regulation. And, perhaps equally important, what degree of technological maturity and cost reductions would be necessary, before they would have significant impacts on competitiveness with existing technologies. Air-air heat pumps are technologically mature, and further studies would benefit from determining flexibility-potentials from this type of heat source.

Additionally, a separate analysis would shed light on the impacts of peer-to-peer trading, blockchain and similar new business models, which can impact flexibility.

The question of time and frequency is also important to address: Will the flexibility be activated few or many times/year, and for how long? The common denominator is that comfort should be maintained for the consumer.

District heating has been addressed separately in the Flex4RES project. Bringing this together with present and future results from individual heating, would provide estimates for the competitiveness between the technologies, and ultimately, an estimate of the costs and benefits of applying either technology to increase flexibility in the energy system.

7 References

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8 Appendices

8.1 Data used in the analyses of annual heat cost

 Table 13 Costs (EUR/kWh) related to the use of electricity. References are national statistics on tariffs, spot market prices, and taxes. Colours indicate level, and are read vertically: red is high; green is low.

Country	Electric grid tariff	Electric trans- mission tariff	Electricity price	Energy tax	Energy tax - electric heating	PSO (or similar elec. tariff)
DK	0.032	0.011	0.027	0.119	0.051	-
FI	0.019	0.003	0.033	0.022	-	0.013
NO	0.017	-	0.026	0.017	-	0.001
SE	0.036	-	0.029	0.031	-	-

Table 14 Costs (EUR/kWh) related to the use of firewood. References are national statistics on fuels. Colours indicate level, and are read vertically: red is high; green is low.

Country	Fuel price
DK	0.073
FI	0.047
NO	0.050
SE	0.029

 Table 15 Costs (EUR/kWh) related to the use of natural gas. References are national statistics on tariffs, gas prices, and taxes.

 Colours indicate level, and are read vertically: red is high; green is low.

Country	CO₂ tax	Energy tax	Fuel price	Gas distribution tariff
DK	0.005	0.027	0.020	0.013
FI	-	0.015	0.027	0.010
NO	0.009	-	0.022	0.002
SE	0.023	0.009	0.033	0.028

Table 16 Costs (EUR/kWh) related to the use of oil. References are national statistics on oil prices, and taxes. Colours indicate level, and are read vertically: red is high; green is low.

		Energy	
Country	CO_2 tax	tax	Fuel price
DK	0.006	0.027	0.063
FI	0.007	0.007	0.042
NO	0.013	0.017	0.048
SE	0.034	0.009	0.039

Table 17 Costs (EUR/kWh) related to the use of wood pellets. References are national statistics on fuels. Colours indicate level, and are read vertically: red is high; green is low.

Country	Fuel price
DK	0.050
FI	0.046
NO	0.053
SE	0.043

8.2 Subsidies

Subsidies are applied in Denmark, Norway and Sweden. In Denmark, the subsidy for conversion from older heat sources to e.g. heat pumps. In Norway, the subsidy is provided for heat pumps and biomass boilers, whereas subsidy for all technologies is provided in Sweden. The Norwegian subsidy provides a 25% cost-refund of the total investment, while the Swedish subsidy comes as a deductible amount equivalent to the labour cost of the investment. Both subsidies are subject to a price cap.

8.3 Costs and characteristics for individual heating technologies

Table 18 Technological data based on [3,36,37]. Assumed to be the same for all countries.

Auxiliary electricity is electricity used for operation of the unit. In the case of the firewood stove and electric heater, this category also covers electricity used for water-heating.

Annual efficiency describes the average efficiency. Heat pumps have >100%, due to the utilization of ambient heat. The natural gas boiler utilizes condensation, whereby the higher heating value is >100%.

									Investment –	
Technology	Annual efficiency	Auxiliary electricity [kWh/year]	Technical lifetime [years]	Heat demand [kWh/year]	Heat capacity [kW]	Variable maintenance [EUR/kWh]	Fixed maintenance [EUR/year]	Investment – Hardware cost [EUR]	Connection costs and other hardware costs [EUR]	Investment – Installation costs [EUR]
Heat pump air-water	325%	100	15	16 800	7	-	200	7 000	-	3 000
Heat pump liquid- water	360%	100	20	16 800	7	-	200	10 400	-	5 600
Resistance- based electric heating	100%	-	30	16 800	7	-	70	3 920	-	1 680
Natural gas boiler	102%	176	22	16 800	7	-	235	1 800	2 000	2 200
Oil boiler	100%	406	20	16 800	7	-	270	4 620	-	1 980
Wood pellet boiler	80%	526	20	16 800	7	-	201	2 571	-	536
Firewood stove and electric water heater	65%	3 500	24	16 800	7	-	212	2 540	-	762

Appendices



8.4 Heat production costs between countries





Figure 20 Annual consumer costs, and heat cost for air to water heat pump.



Figure 21 Annual consumer costs, and heat cost for resistance-based electric heating.



Figure 22 Annual consumer costs, and heat cost for natural gas boiler.



Figure 23 Annual consumer costs, and heat cost for wood stove and electric water heater.



Figure 24 Annual consumer costs, and heat cost for oil boiler.

nl



Figure 25 Annual consumer costs, and heat cost for wood pellet boiler.

Appendices

8.5 Liquid to water heat pump

Levies, subsidies and energy	Category								
		Unit	Denmark	Estonia	Finiand	Latvia	Lithuania	Norway	Sweden
Subsidies:	None		-	-	-	-	-	-	-
	Electric heating fee	EUR/kWh	0,05	-	-	-	-	-	-
Taxes and fees:	Energy tax	EUR/kWh	0,12	0,00	0,02	0,00	0,00	0,02	0,03
	CO2 tax	EUR/kWh	-	-	-	-	-	-	-
	NOxtax	EUR/kWh	-	-	-	-	-	-	-
	electricity production	EUR/kWh	0,03	0,01	0,01	0,03	0,02	0,00	
Tariffs:	Electricity local grid tariff	EUR/kWh	0,03	0,05	0,02	0,06	0,04	0,02	0,04
	Electricity system/transmission tariff	FLIR/kW/h	0.01		0.00		_	_	
	Electricity price	ELIR/kW/b	0.03	0.02	0.02	0.03	0.03	0.02	0.02
Energy price, excl. tax etc.:	Electricity price	EUR/k/M/b	0.03	0.02	0.02	0,00	0.03	0.02	0.02
		Loiviti	0,00	0,02	0,02	0,00	0,00	0,02	0,02
Technology costs	Catagory		D						A
recimology costs	Variable maintenance costs - heat pump	Unit	Denmark	Estonia	Finland	Latvia	Lithuania	Norway	Sweden
Maintenance costs:	liquid-water	EUR/kWh	0	-	-	-	-	-	-
	water	EUR/unit/year	200	200	200	200	200	200	200
	Hardware costs - heat pump liquid-water	EUR/unit	10400	10.400	10.400	10.400	10.400	10.400	10.400
	Connection costs and other hardware costs - heat pump liquid-water	ELIR/upit	0	_	_	_	_	_	-
Capital costs:	Installation costs - heat pump liquid-water	EUR/unit	5600	5 600	5 600	5 600	5 600	5 600	-
	Total cost	EUR/unit	10000	10,000	10,000	5.000	5.000	10,000	5.000
		EUR/Unit	10000	16.000	16.000	16.000	10.000	16.000	16.000
Loan:		years	15	15	15	15	15	15	15
		EUR/year	1.541	1.541	1.541	1.541	1.541	1.541	1.541
Remaining technical lifetime	Remaining technical lifetime	years	5	5	5	5	5	5	5
Scrap value:	Revenue	EUR	-2.600	-2.600	-2.600	-2.600	-2.600	-2.600	-2.600
Technical characteristics	Category	Data	Denmark	Estonia	Finland	Latvia	Lithuania	Norway	Sweden
Technical characteristics	Category Annual efficiency - heat pump liquid-water	Data	Denmark 360%	Estonia 360%	Finland 360%	Latvia 360%	Lithuania 360%	Norway 360%	Sweden 360%
Technical characteristics	Category Annual efficiency - heat pump liquid-water Auxillary electricity consumption - heat pump liquid-water	Data kWh/year	Denmark 360% 100	Estonia 360% 100	Finland 360% 100	Latvia 360% 100	Lithuania 360% 100	Norway 360% 100	Sweden 360% 100
Technical characteristics	Category Annual efficiency - heat pump liquid-water Auxillary electricity consumption - heat pump liquid-water Technical lifetime (years) - heat pump liquid- water	Data kWh/year	Denmark 360% 100	Estonia 360% 100	Finland 360% 100	Latvia 360% 100	Lithuania 360% 100	Norway 360% 100	Sweden 360% 100
Technical characteristics Technical characteristics	Category Annual efficiency - heat pump liquid-water Auxillary electricity consumption - heat pump liquid-water Technical lifetime (years) - heat pump liquid- water Annual heat demand - individual house	Data kWh/year years	Denmark 360% 100 20	Estonia 360% 100 20	Finland 360% 100 20	Latvia 360% 100 20	Lithuania 360% 100 20	Norway 360% 100 20	Sweden 360% 100 20
Technical characteristics Technical characteristics	Category Annual efficiency - heat pump liquid- water Auxillary electricity consumption - heat pump liquid- water Technical lifetime (years) - heat pump liquid- water Annual heat demand - individual house Effect need	Data kWh/year years kWh/year	Denmark 360% 100 20 16800	Estonia 360% 100 20 16.800	Finland 360% 100 20 16.800	Latvia 360% 100 20 16.800	Lithuania 360% 100 20 16.800	Norway 360% 100 20 16.800	Sweden 360% 100 20 16.800
Technical characteristics Technical characteristics	Category Annual efficiency - heat pump liquid-water Auxillary electricity consumption - heat pump liquid-water Technical lifetime (years) - heat pump liquid- water Annual heat demand - individual house Effect need Effect need	Data kWh/year years kWh/year kW	Denmark 360% 100 20 16800 7	Estonia 360% 100 20 16.800 7	Finland 360% 100 20 16.800 7	Latvia 360% 100 20 16.800 7	Lithuania 360% 100 20 16.800 7	Norway 360% 100 20 16.800 7	Sweden 360% 100 20 16.800 7
Technical characteristics Technical characteristics	Category Annual efficiency - heat pump liquid- water Auxillary electricity consumption - heat pump liquid- water Technical lifetime (years) - heat pump liquid- water Annual heat demand - individual house Effect need Electricity consumption for heat	Data kWh/year years kWh/year kW kWh/year	Denmark 360% 100 20 16800 7 4666,666667	Estonia 360% 100 20 16.800 7 4.667	Finland 360% 100 20 16.800 7 4.667	Latvia 360% 100 20 16.800 7 4.667	Lithuania 360% 100 20 16.800 7 4.667	Norway 360% 100 20 16.800 7 4.667	Sweden 360% 100 20 16.800 7 4.667
Technical characteristics Technical characteristics Ground source HP - annual	Category Annual efficiency - heat pump liquid- water Auxillary electricity consumption - heat pump liquid- water Technical lifetime (years) - heat pump liquid- water Annual heat demand - individual house Effect need Electricity consumption for heat	Data kWh/year years kWh/year kW kWh/year	Denmark 360% 100 20 16800 7 4666,666667	Estonia 360% 100 20 16.800 7 4.667	Finland 360% 100 20 16.800 7 4.667	Latvia 360% 100 20 16.800 7 4.667	Lithuania 360% 100 20 16.800 7 4.667	Norway 360% 100 20 16.800 7 4.667	Sweden 360% 100 20 16.800 7 4.667
Technical characteristics Technical characteristics Ground source HP - annual consumer cost 2016	Category Annual efficiency - heat pump liquid- water Auxiliary electricity consumption - heat pump liquid- water Technical lifetime (years) - heat pump liquid- water Annual heat demand - individual house Effect need Electricity consumption for heat Cost category	Data kWh/year years kWh/year kW kWh/year Denmark	Denmark 360% 100 20 16800 7 4666,666667 Estonia	Estonia 360% 100 20 16.800 7 4.667 Finland	Finland 360% 100 20 16.800 7 4.667 Latvia	Latvia 360% 100 20 16.800 7 4.667 Lithuania	Lithuania 360% 100 20 16.800 7 4.667 Norway	Norway 360% 100 20 16.800 7 4.667 Sweden	Sweden 360% 100 20 16.800 7 4.667 Unit
Technical characteristics Technical characteristics Ground source HP - annual consumer cost 2016 Capital costs:	Category Annual efficiency - heat pump liquid-water Auxillary electricity consumption - heat pump liquid-water Technical lifetime (years) - heat pump liquid- water Annual heat demand - individual house Effect need Electricity consumption for heat Cost category Annual loan costs	Data kWh/year years kWh/year kW kWh/year Denmark 1.541	Denmark 360% 100 20 16800 7 4666,666667 Estonia 1.541	Estonia 360% 100 20 16.800 7 4.667 Finland 1.541	Finland 360% 100 20 16.800 7 4.667 Latvia 1.541	Latvia 360% 100 20 16.800 7 4.667 Lithuania 1.541	Lithuania 360% 100 20 16.800 7 4.667 Norway 1.541	Norway 360% 100 20 16.800 7 4.667 Sweden 1.541	Sweden 360% 100 20 16.800 7 4.667 Unit EUR/year
Technical characteristics Technical characteristics Ground source HP - annual consumer cost 2016 Capital costs:	Category Annual efficiency - heat pump liquid- water Auxillary electricity consumption - heat pump liquid- water Technical lifetime (years) - heat pump liquid- water Annual heat demand - individual house Effect need Electricity consumption for heat Cost category Annual loan costs Variable maintenance costs - heat pump liquid- water	Data kWh/year years kWh/year kW kWh/year Denmark 1.541	Denmark 360% 100 20 16800 7 4666,666667 Estonia Estonia 0	Estonia 360% 100 20 16.800 7 4.667 Finland 1.541 0	Finland 360% 100 20 16.800 7 4.667 Latvia 1.541 0	Latvia 360% 100 20 16.800 7 4.667 Lithuania 1.541 0	Lithuania 360% 100 20 16.800 7 4.667 Norway 1.541 0	Norway 360% 100 20 16.800 7 4.667 Sweden 1.541 0	Sweden 360% 100 20 16.800 7 4.667 Unit EUR/year EUR/year
Technical characteristics Technical characteristics Technical characteristics Ground source HP - annual consumer cost 2016 Capital costs: Maintenance costs:	Category Annual efficiency - heat pump liquid- water Auxillary electricity consumption - heat pump liquid- water Technical lifetime (years) - heat pump liquid- water Annual heat demand - individual house Effect need Electricity consumption for heat Cost category Annual loan costs Vanable maintenance costs - heat pump liquid- water Fixed maintenance costs - heat pump liquid- water	Data kWh/year years kWh/year kW kWh/year Denmark Denmark 1.541	Denmark 360% 100 20 16800 7 4666,666667 Estonia 1.541 0	Estonia 360% 100 20 16.800 7 4.667 Finland 1.541 0	Finland 360% 100 20 16.800 7 4.667 4.667 Latvia 1.541 0	Latvia 360% 100 20 16.800 7 4.667 Lithuania 1.541 0 200	Lithuania 360% 100 20 16.800 7 4.667 Norway 1.541 0 200	Nonway 360% 100 20 16.800 7 4.667 Sweden 1.541 0	Sweden 360% 100 20 16.800 7 4.667 Unit EUR/year EUR/year EUR/year
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Technical characteristics Technical characteristics Technical characteristics Ground source HP - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs:	Category Annual efficiency - heat pump liquid- water Auxillary electricity consumption - heat pump liquid- water Technical lifetime (years) - heat pump liquid- water Annual heat demand - individual house Effect need Electricity consumption for heat Cost category Annual loan costs Variable maintenance costs - heat pump liquid- water Electricity price Auxillary electricity price All electricity tariffs	Data kWh/year years kWh/year kW kWh/year Denmark Denmark 0 200 126 3	Denmark 360% 100 200 16800 7 4666,666667 2 Estonia 1.541 0 200 100 200	Estonia 360% 100 20 16.800 7 4.667 Finland 1.541 0 200 94 22	Finland 360% 100 20 16.800 7 4.667 4.667 Latvia 1.541 0 200 121 3 3	Latvia 360% 100 20 16.800 7 4.667 Lithuania 1.541 0 200 121 3 245	Lithuania 360% 100 16.800 7 4.667 Norway 1.541 0 200 85 2	Norway 360% 100 20 16.800 7 4.667 8 Sweden 1.541 0 200 85 2 2	Sweden 360% 100 20 16.800 7 4.667 Unit EUR/year EUR/year EUR/uear EUR/year EUR/year
Technical characteristics Technical characteristics Technical characteristics Ground source HP - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs: Sinheidiae:	Category Annual efficiency - heat pump liquid-water Auxillary electricity consumption - heat pump liquid-water Technical lifetime (years) - heat pump liquid- water Annual heat demand - individual house Effect need Electricity consumption for heat Cost category Annual loan costs Variable maintenance costs - heat pump liquid-water Electricity price Auxillary electricity price All electricity tariffs Subsidies	Data kWh/year years kWh/year kW kWh/year Denmark Denmark 1.541 0 0 2000 126 3 3 63	Denmark 360% 100 20 16800 7 4666,666667 Estonia Estonia 0 0 0 0 0 0 0 0 0 0 0 0 0	Estonia 360% 100 20 16.800 7 4.667 4.667 5 5 1.541 0 200 94 22 166	Finland 360% 100 20 16.800 7 4.667 4.667 1.541 0 200 121 3 397	Latvia 360% 100 20 16.800 7 4.667 Lithuania 1.541 0 200 121 3 245	Lithuania 360% 100 16.800 7 4.667 4.667 1.541 0 200 85 22 87	Norway 360% 100 20 16.800 7 4.667 5 8 8 8 0 2 0 8 5 2 2 172	Sweden 360% 100 20 16.800 7 4.667 Unit EUR/year EUR/year EUR/unit/year EUR/year EUR/year
Technical characteristics Technical characteristics Technical characteristics Ground source HP - annual Consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs: Subsidies:	Category Annual efficiency - heat pump liquid-water Auxillary electricity consumption - heat pump liquid-water Technical lifetime (years) - heat pump liquid- water Annual heat demand - individual house Effect need Electricity consumption for heat Cost category Annual loan costs Variable maintenance costs - heat pump liquid- water Fixed maintenance costs - heat pump liquid- water Electricity price Auxillary electricity price All electricity tariffs Subsidies Electric to target for the for t	Data kWh/year years kWh/year kW kWh/year Denmark Denmark 1.541 0 0 2000 126 3 363 0	Denmark 360% 100 20 16800 7 4666,666667 Estonia Estonia 0 200 100 200 100 20 100 100 1	Estonia 360% 100 20 16.800 7 4.667 4.667 1.541 1.541 0 200 94 22 166 0	Finland 360% 100 20 16.800 7 4.667 4.667 1.541 0.0 200 121 3 397 0.0	Latvia 360% 100 20 16.800 7 4.667 4.667 1.541 1.541 00 200 121 3 245 0	Lithuania 360% 100 20 16.800 7 4.667 4.667 1.541 0 200 85 22 87 0	Norway 360% 100 20 16.800 7 4.667 5 8 8 8 0 2 0 200 85 2 2 172 0 0	Sweden 360% 100 20 16.800 7 4.667 Unit EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year
Technical characteristics Technical characteristics Technical characteristics Ground source HP - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs: Subsidies:	Category Annual efficiency - heat pump liquid-water Auxiliary electricity consumption - heat pump liquid-water Technical lifetime (years) - heat pump liquid- water Annual heat demand - individual house Effect need Electricity consumption for heat Cost category Annual loan costs Variable maintenance costs - heat pump liquid- water Fixed maintenance costs - heat pump liquid- water Electricity price Auxillary electricity price All electricity tariffs Subsidies Electricity tax/electric heating fee	Data kWh/year years kWh/year kW kWh/year Denmark Denmark 0 2000 126 3 363 0 240	Denmark 360% 100 20 16800 7 4666,666667 8 5 5 5 1.541 0 200 100 20 100 20 100 20 100 20 100 10	Estonia 360% 100 20 16.800 7 4.667 4.667 1.541 0.0 200 94 20 94 2 166 0 0 0	Finland 360% 100 20 16.800 7 4.667 4.667 1.541 0.0 200 121 3 397 0.0	Latvia 360% 100 20 16.800 7 4.667 2 Lithuania 1.541 0 200 121 3 245 0 0 5	Lithuania 360% 100 20 16.800 7 4.667 4.667 1.541 0 200 85 22 85 22 87 0 0 80	Norway 360% 100 20 16.800 7 4.667 5 8 8 4.667 1.541 0 200 85 2 2 172 0 0 144	Sweden 360% 100 20 16.800 7 4.667 Unit EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year
Technical characteristics Technical characteristics Technical characteristics Ground source HP - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs: Subsidies:	Category Annual efficiency - heat pump liquid-water Auxillary electricity consumption - heat pump liquid-water Technical lifetime (years) - heat pump liquid- water Annual heat demand - individual house Effect need Electricity consumption for heat Cost category Annual loan costs Variable maintenance costs - heat pump liquid- water Eixed maintenance costs - heat pump liquid- water Electricity price Auxillary electricity price All electricity tax/electric heating fee CO2 tax Variable	Data Wh/year years kWh/year kW kWh/year Denmark Denmark 1.541 0 200 126 3 363 0 240 -	Denmark 360% 100 20 16800 7 4666,666667 5 5 5 5 1.541 0 200 100 200 100 200 100 200 100 200 100 1	Estonia 360% 100 20 16.800 7 4.667 Finland 1.541 0 0 200 94 20 200 94 22 166 0 0 105	Finland 360% 100 20 16.800 7 4.667 4.667 1.541 0 1.541 0 200 121 3 397 0 5 -	Latvia 360% 100 20 16.800 7 4.667 4.667 2 4.667 2 4.667 2 0 200 121 3 245 0 0 5 5	Lithuania 360% 100 20 16.800 7 4.667 7	Norway 360% 100 20 16.800 7 4.667 5 8 8 8 1.541 0 200 85 2 2 172 0 0 144	Sweden 360% 100 20 16.800 7 4.667 Unit EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year
Technical characteristics Technical characteristics Technical characteristics Ground source HP - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs: Subsidies: Taxes and fees:	Category Annual efficiency - heat pump liquid- water Auxillary electricity consumption - heat pump liquid- water Technical lifetime (years) - heat pump liquid- water Annual heat demand - individual house Effect need Electricity consumption for heat Cost category Annual loan costs Variable maintenance costs - heat pump liquid- water Electricity price Auxillary electricity price All electricity tax/electric heating fee CO2 tax NOx tax	Data Data kWh/year years kWh/year kW kWh/year Denmark Denmark 200 200 200 200 200 200 200 200 200 20	Denmark 360% 100 20 16800 7 4666,666667 5 5 5 5 1.541 0 200 1.00 200 100 200 100 200 100 200 100 200 100 1	Estonia 360% 100 20 16.800 7 4.667 Finland 1.541 0 200 94 20 200 94 20 166 0 0 105 -	Finland 360% 100 20 16.800 7 4.667 4.667 4.667 4.667 4.627 4.637 4.637 5 5 - -	Latvia 360% 100 20 16.800 7 4.667 20 200 2121 3 245 0 5 - -	Lithuania 360% 100 20 16.800 7 4.667 4.667 8 0 1.541 0 200 200 200 85 2 2 8 7 0 80 80 - -	Norway 360% 100 20 16.800 7 4.667 8 5 8 6 1.541 0 200 85 2 2 172 0 144 - -	Sweden 360% 100 20 16.800 7 4.667 Unit EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year
Technical characteristics Technical characteristics Technical characteristics Ground source HP - annual Consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs: Subsidies: Taxes and fees:	Category Annual efficiency - heat pump liquid- water Auxillary electricity consumption - heat pump liquid- water Technical lifetime (years) - heat pump liquid- water Annual heat demand - individual house Effect need Electricity consumption for heat Cost category Annual loan costs Variable maintenance costs - heat pump liquid- water Electricity price Auxillary electricity price All electricity tax/electric heating fee CO2 tax NOx tax Electricity tax on auxillary electricity	Data Data KWh/year years KWh/year KW KWh/year Denmark Denmark 0 200 126 3 3 363 0 0 240 - 1 12	Denmark 360% 100 200 16800 7 4666,666667 5 5 5 5 1.541 0 200 200 200 200 200 200 200	Estonia 360% 100 20 16.800 7 4.667 4.667 5 1.541 0 200 94 200 94 20 200 94 200 94 1.541 0 1.541 0 1.541 0 200 1.541 2.00 1.541 0 1.541 0 2.00 1.541 1.541 1.541.541 1.55	Finland 360% 100 20 16.800 7 4.667 4.667 4.667 4.627 4.637 5 - - - - - - - - - - - - - 0	Latvia 360% 100 20 16.800 7 4.667 4.667 1.541 0 200 121 3 245 0 245 0 5 - - 0	Lithuania 360% 100 20 16.800 7 4.667 4.667 0 1.541 0 200 200 85 2 2 87 0 0 80 80 - - 2 2	Norway 360% 100 20 16.800 7 4.667 8 5 weden 1.541 0 200 85 20 85 20 172 0 144 - - 3	Sweden 360% 100 20 16.800 7 4.667 Unit EUR/year EUR/year
Technical characteristics Technical characteristics Technical characteristics Ground source HP - annual Consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs: Subsidies: Taxes and fees: Capital costs:	Category Annual efficiency - heat pump liquid- water Auxillary electricity consumption - heat pump liquid- water Technical lifetime (years) - heat pump liquid- water Annual heat demand - individual house Effect need Electricity consumption for heat Cost category Annual loan costs Vanable maintenance costs - heat pump liquid- water Electricity price Auxillary electricity price All electricity tar/fls Subsidies Electricity tax/electric heating fee CO2 tax NOx tax Electricity tax on auxillary electricity Revenue	Data kWh/year years kWh/year kW kWh/year Denmark Denmark 1.541 0 200 200 126 3 3 6 3 6 3 3 6 3 0 0 240 240 - 12 12 - 12	Denmark 360% 100 102 16800 7 4666,666667 1.541 0 1.541 0 200 1.00 200 1.00 200 1.00 200 1.00 200 1.00 200 1.00 200 1.00 200 1.00 200 1.00 1	Estonia 360% 100 20 16.800 7 4.667 4.667 5 7 4.667 0 1.541 0 200 94 200 94 20 200 94 200 94 166 0 0 105 - 175	Finland 360% 100 20 16.800 7 4.667 4.667 1.541 0 200 121 3397 0 0 121 3397 0 0 5 - - - 0 0 5 - 0 0 - 173	Latvia 360% 100 20 16.800 7 4.667 20 1541 0 200 121 3 245 0 200 121 3 245 0 5 0 5 0 121 3 245 0 0 121 133 145 120 120 120 120 120 120 120 120	Lithuania 360% 100 16.800 7 4.667 4.667 0 1.541 0 200 85 200 85 20 200 85 20 0 85 20 0 85 20 0 85 20 20 1.541 0 200 1.541 1.54	Norway 360% 100 20 16.800 7 4.667 8 5 8 9 1.541 0 200 85 20 85 22 172 0 0 144 - 1.5 3 3 -173	Sweden 360% 100 120 16.800 7 4.667 Unit EUR/year EUR/year
Technical characteristics Technical characteristics Technical characteristics Ground source HP - annual Capital costs: Capital costs: Capital costs: Energy price, excl. tax etc.: Electricity tariffs: Subsidies: Taxes and fees: Capital cost	Category Annual efficiency - heat pump liquid-water Auxillary electricity consumption - heat pump liquid-water Technical lifetime (years) - heat pump liquid- water Annual heat demand - individual house Effect need Electricity consumption for heat Cost category Annual loan costs Vanable maintenance costs - heat pump liquid- water Electricity price Auxillary electricity price All electricity tax/electric heating fee CO2 tax NOx tax Electricity tax on auxillary electricity Revenue	Data kWh/year years kWh/year kW kWh/year Denmark Denmark 0 200 126 3 3 3 6 3 0 240 - 12 - 12 - 173 2.311	Denmark 360% 100 102 16800 7 4666,666667 8 5 5 5 6 1.541 0 0 200 1.541 0 0 200 1.541 0 0 1.541 0 0 1.541 0 0 0 1.541 0 0 0 0 0 0 0 0 0 0 0 0 0	Estonia 360% 100 20 16.800 7 4.667 4.667 1.541 0 200 94 200 94 200 94 200 94 200 94 166 0 0 105 - - - 2 163 1937	Finland 360% 1000 200 16.800 7 4.667 4.667 1.541 0 2000 121 3397 0 0 55 - - - - 0 0 55 - - 0 0 53 - - 173 2.093	Latvia 360% 100 200 16.800 7 4.667 200 1.541 0 200 121 3 245 0 245 0 121 3 245 0 121 3 245 0 121 3 245 0 121 3 245 0 121 3 245 0 121 121 121 121 121 121 121	Lithuania 360% 100 16.800 7 4.667 4.667 1.541 0 200 85 200 85 22 87 0 0 80 85 20 200 85 200 200 200 200 200 200 200 200 200 20	Norway 360% 1000 200 16.800 7 4.667 8 5 200 85 200 85 200 85 200 85 200 1124 00 1444 - - - 3 3 -173	Sweden 360% 100 20 16.800 7 4.667 Unit EUR/year EUR/year

8.6 Air to water heat pump

Levies, subsidies and energy price 2016	Category	Unit	Denmark	Estonia	Finland	Latvia	Lithuania	Norway	Sweden
Subsidies:	None		_	-	-	_	-	-	<u>.</u>
	Electric heating fee	FUR/kW/b	0.05						
	Energy tax	EUR/kWb	0,00	0.00	0.02	0.00	0.00	0.02	0.03
Taxes and fees:	CO2 tax	EUR/kWb		-	0,02	-	0,00	0,02	-
	NOxtax								
	PSO (or similar tariff) for subsidy of other	LOIVKWII		-					_
Tariffe	electricity production	EUR/kWh	0,03	0,01	0,01	0,03	0,02	0,00	-
railits.	Electricity local grid tariff	EUR/kWh	0,03	0,05	0,02	0,06	0,04	0,02	0,04
	Electricity system/transmission tariff	EUR/kWh	0,01	-	0,00	-	-	-	-
Energy price, excl. tax etc.:	Electricity price	EUR/kWh	0,03	0,02	0,02	0,03	0,03	0,02	0,02
	Auxillary electricity price	EUR/kWh	0,03	0,02	0,02	0,03	0,03	0,02	0,02
Technology costs	Category Variable maintenance costs - heat pump air-	Unit	Denmark	Estonia	Finland	Latvia	Lithuania	Norway	Sweden
Maintenance coste:	water	EUR/kWh	0	-	-	-	-	-	-
Maintenance costs.	Fixed maintenance costs - heat pump air- water	EUR/unit/year	200	200	200	200	200	200	200
	Hardware costs - heat pump air- water	EUR/unit	7000	7.000	7.000	7.000	7.000	7.000	7.000
	Connection costs and other hardware costs								
Capital costs:	heat pump air water	EUR/unit	0	-	-	-	-	-	-
	Total aast	EUR/unit	3000	3.000	3.000	3.000	3.000	3.000	3.000
		EUR/unit	10000	10.000	10.000	10.000	10.000	10.000	10.000
		years	15	15	15	15	15	15	15
De secla in standard a di Utationa	Annuarioan costs	EUR/year	963	963	963	963	963	963	963
Remaining technical lifetime	Remaining technical lifetime	years	-	-	-	-	-	-	-
Scrap value:	Revenue	EUR	-	-	-	-	-	-	-
To the local shares are dealers.	0-1	ł	ł						l
Technical characteristics	Category	Data	Denmark	Estonia	Finland	Latvia	Lithuania	Norway	Sweden
Technical characteristics	Category Annual efficiency - heat pump air-water Auxillary electricity consumption - heat	Data	Denmark 325%	Estonia 325%	Finland 325%	Latvia 325%	Lithuania 325%	Norway 325%	Sweden 325%
Technical characteristics	Category Annual efficiency - heat pump air-water Auxillary electricity consumption - heat pump air-water	Data kWh/year	Denmark 325% 100	Estonia 325% 100	Finland 325% 100	Latvia 325% 100	Lithuania 325% 100	Norway 325% 100	Sweden 325% 100
Technical characteristics	Category Annual efficiency - heat pump air-water Auxillary electricity consumption - heat pump air-water Technical lifetime (years) - heat pump air- water	Data kWh/year years	Denmark 325% 100	Estonia 325% 100 15	Finland 325% 100 15	Latvia 325% 100 15	Lithuania 325% 100 15	Norway 325% 100 15	Sweden 325% 100 15
Technical characteristics Technical characteristics	Category Annual efficiency - heat pump air-water Auxillary electricity consumption - heat pump air-water Technical lifetime (years) - heat pump air- water Annual heat demand - individual house	Data kWh/year years kWh/year	Denmark 325% 100 15 16800	Estonia 325% 100 15 16.800	Finland 325% 100 15 16.800	Latvia 325% 100 15 16.800	Lithuania 325% 100 15 16.800	Norway 325% 100 15 16.800	Sweden 325% 100 15 16.800
Technical characteristics Technical characteristics	Category Annual efficiency - heat pump air-water Auxillary electricity consumption - heat pump air-water Technical lifetime (years) - heat pump air- water Annual heat demand - individual house Effect need	Data kWh/year years kWh/year kW	Denmark 325% 100 15 16800 7	Estonia 325% 100 15 16.800 7	Finland 325% 100 15 16.800 7	Latvia 325% 100 15 16.800 7	Lithuania 325% 100 15 16.800 7	Norway 325% 100 15 16.800 7	Sweden 325% 100 15 16.800 7
Technical characteristics Technical characteristics	Category Annual efficiency - heat pump air-water Auxillary electricity consumption - heat pump air-water Technical lifetime (years) - heat pump air- water Annual heat demand - individual house Effect need Electricity consumption for heat	Data kWh/year years kWh/year kW kWh/year	Denmark 325% 100 15 16800 7 5169,230769	Estonia 325% 1000 155 16.800 7 5.169	Finland 325% 100 15 16.800 7 5.169	Latvia 325% 100 15 16.800 7 5.169	Lithuania 325% 100 15 16.800 7 5.169	Norway 325% 100 15 16.800 7 5.169	Sweden 325% 100 15 16.800 7 5.169
Technical characteristics Technical characteristics	Category Annual efficiency - heat pump air- water Auxillary electricity consumption - heat pump air- water Technical lifetime (years) - heat pump air- water Annual heat demand - individual house Effect need Electricity consumption for heat	Data kWh/year years kWh/year kW kWh/year	Denmark 325% 100 15 16800 7 5169,230769	Estonia 325% 100 15 16.800 7 5.169	Finland 325% 100 15 16.800 7 5.169	Latvia 325% 100 15 16.800 7 5.169	Lithuania 325% 100 15 16.800 7 5.169	Norway 325% 100 15 16.800 7 5.169	Sweden 325% 100 15 16.800 7 5.169
Technical characteristics Technical characteristics Air to water HP - annual consumer cost 2016	Category Annual efficiency - heat pump air-water Auxillary electricity consumption - heat pump air-water Technical lifetime (years) - heat pump air- water Annual heat demand - individual house Effect need Electricity consumption for heat	Data kWh/year years kWh/year kW kWh/year	Denmark 325% 100 15 16800 7 5169,230769	Estonia 325% 100 15 16.800 7 5.169	Finland 325% 100 15 16.800 7 5.169	Latvia 325% 100 15 16.800 7 5.169	Lithuania 325% 100 15 16.800 7 5.169	Norway 325% 100 15 16.800 7 5.169	Sweden 325% 100 15 16.800 7 5.169
Technical characteristics Technical characteristics Air to water HP - annual consumer cost 2016 Capital costs:	Category Annual efficiency - heat pump air-water Auxillary electricity consumption - heat pump air-water Technical lifetime (years) - heat pump air- water Annual heat demand - individual house Effect need Electricity consumption for heat Cost category Annual loan costs	Data kWh/year years kWh/year kW kWh/year Denmark	Denmark 325% 100 15 16800 7 5169,230769 Estonia	Estonia 325% 100 15 16.800 7 5.169 Finland	Finland 325% 100 15 16.800 7 5.169 Latvia	Latvia 325% 100 15 16.800 7 5.169 Lithuania	Lithuania 325% 100 15 16.800 7 5.169 Norway	Norway 325% 100 15 16.800 7 5.169 Sweden	Sweden 325% 100 15 16.800 7 5.169 Unit
Technical characteristics Technical characteristics Air to water HP - annual consumer cost 2016 Capital costs:	Category Annual efficiency - heat pump air-water Auxillary electricity consumption - heat pump air-water Technical lifetime (years) - heat pump air- water Annual heat demand - individual house Effect need Electricity consumption for heat Cost category Annual loan costs Variable maintenance costs - heat pump air-	Data kWh/year years kWh/year kW kWh/year Denmark 963	Denmark 325% 100 15 16800 7 5169,230769 Estonia 963	Estonia 325% 1000 15 16.800 77 5.169 Finland 963	Finland 325% 100 15 16.800 7 5.169 Latvia 963	Latvia 325% 100 15 16.800 7 5.169 Lithuania 963	Lithuania 325% 100 15 16.800 7 5.169 Norway 963	Norway 325% 100 15 16.800 7 5.169 Sweden 963	Sweden 325% 100 15 16.800 7 5.169 Unit EUR/year
Technical characteristics Technical characteristics Air to water HP - annual consumer cost 2016 Capital costs: Maintenance costs:	Category Annual efficiency - heat pump air-water Auxillary electricity consumption - heat pump air-water Technical lifetime (years) - heat pump air- water Annual heat demand - individual house Effect need Electricity consumption for heat Cost category Annual loan costs Variable maintenance costs - heat pump air- water Fixed maintenance costs - heat pump air-	Data kWh/year years kWh/year kW kWh/year Denmark 963 0	Denmark 325% 100 15 16800 7 5169,230769 Estonia 963 0	Estonia 325% 1000 15 16.800 7 5.169 Finland 963 0	Finland 325% 100 15 16.800 7 5.169 Latvia 963 0	Latvia 325% 100 15 16.800 7 5.169 Lithuania 963 0	Lithuania 325% 100 15 16.800 7 5.169 Norway 963 0	Norway 325% 100 15 16.800 7 5.169 Sweden 963 0	Sweden 325% 100 15 16.800 7 5.169 Unit EUR/year EUR/year
Technical characteristics Technical characteristics Air to water HP - annual consumer cost 2016 Capital costs: Maintenance costs:	Category Annual efficiency - heat pump air-water Auxillary electricity consumption - heat pump air-water Technical lifetime (years) - heat pump air- water Annual heat demand - individual house Effect need Electricity consumption for heat Electricity consumption for heat Cost category Annual loan costs Variable maintenance costs - heat pump air- water	Data kWh/year years kWh/year kW kWh/year Denmark 963 0 200	Denmark 325% 100 15 16800 7 5169,230769 Estonia 963 0 200	Estonia 325% 100 15 16.800 7 5.169 Finland 963 0 0	Finland 325% 100 15 16.800 7 5.169 Latvia 963 0 200	Latvia 325% 100 15 16.800 7 5.169 Lithuania 963 0 200	Lithuania 325% 100 15 16.800 7 5.169 Norway 963 0 200	Norway 325% 100 15 16.800 7 5.169 Sweden 963 0 200	Sweden 325% 100 15 16.800 7 5.169 Unit EUR/year EUR/year EUR/unit/year
Technical characteristics Technical characteristics Air to water HP - annual consumer cost 2016 Capital costs: Maintenance costs:	Category Annual efficiency - heat pump air-water Auxillary electricity consumption - heat pump air-water Technical lifetime (years) - heat pump air- water Annual heat demand - individual house Effect need Electricity consumption for heat Cost category Annual loan costs Variable maintenance costs - heat pump air- water Fixed maintenance costs - heat pump air- water	Data kWh/year years kWh/year kW kWh/year Denmark 963 0 200	Denmark 325% 100 15 16800 7 5169,230769 Estonia 963 0 200	Estonia 325% 100 15 16.800 77 5.169 Finland 963 0 0	Finland 325% 100 15 16.800 7 5.169 Latvia 963 0 200	Latvia 325% 100 15 16.800 7 5.169 Lithuania 963 0 200	Lithuania 325% 100 15 16.800 7 5.169 Norway 963 0 200	Norway 325% 100 15 16.800 7 5.169 Sweden 963 0 200	Sweden 325% 100 15 16.800 7 5.169 Unit EUR/year EUR/year EUR/year
Technical characteristics Technical characteristics Air to water HP - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.:	Category Annual efficiency - heat pump air-water Auxiliary electricity consumption - heat pump air-water Technical lifetime (years) - heat pump air- water Annual heat demand - individual house Effect need Electricity consumption for heat Cost category Annual loan costs Variable maintenance costs - heat pump air- water Electricity price	Data kWh/year years kWh/year kW kWh/year Denmark 963 0 200 139	Denmark 325% 100 15 16800 7 5169,230769 Estonia 963 0 200	Estonia 325% 100 15 16.800 7 5.169 963 963 0 200	Finland 325% 100 15 16.800 7 5.169 4 5.169 4 963 0 200 200	Latvia 325% 100 15 16.800 7 5.169 Lithuania 963 0 200 134	Lithuania 325% 100 15 16.800 7 5.169 Norway 963 0 2000 94	Norway 325% 100 15 16.800 7 5.169 Sweden 963 0 2000 2000	Sweden 325% 100 15 16.800 7 5.169 Unit EUR/year EUR/year EUR/year
Technical characteristics Technical characteristics Air to water HP - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.:	Category Annual efficiency - heat pump air-water Auxillary electricity consumption - heat pump air-water Technical lifetime (years) - heat pump air- water Annual heat demand - individual house Effect need Electricity consumption for heat Cost category Annual loan costs Variable maintenance costs - heat pump air- water Fixed maintenance costs - heat pump air- water Electricity price Auxillary electricity price	Data kWh/year years kWh/year kW kWh/year Denmark 963 0 200 139 3	Denmark 325% 100 15 16800 7 5169,230769 Estonia 963 0 200 111 2	Estonia 325% 100 15 16.800 7 5.169 963 963 0 0 200 104 20	Finland 325% 100 15 16.800 7 5.169 25.169 4 5.169 963 0 200 134 3	Latvia 325% 100 15 16.800 7 5.169 Lithuania 963 0 200 134 3	Lithuania 325% 100 15 16.800 7 5.169 Norway 963 0 200 200 94 2	Norway 325% 100 15 16.800 7 5.169 Sweden 963 0 200 200	Sweden 325% 100 15 16.800 7 5.169 Unit EUR/year EUR/year EUR/unit/year EUR/year
Technical characteristics Technical characteristics Air to water HP - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs:	Category Annual efficiency - heat pump air-water Auxiliary electricity consumption - heat pump air-water Technical lifetime (years) - heat pump air- water Annual heat demand - individual house Effect need Electricity consumption for heat Cost category Annual loan costs Variable maintenance costs - heat pump air- water Electricity price Auxiliary electricity price All electricity tariffs	Data kWh/year years kWh/year kW kWh/year Denmark 963 0 200 200 139 3 401	Denmark 325% 100 15 16800 7 5169,230769 Estonia 963 0 200 1111 2 335	Estonia 325% 100 16.800 7 5.169 5.169 963 963 0 200 200 104 202 104	Finland 325% 100 15 16.800 7 5.169 5.169 433 00 200 134 3 438	Latvia 325% 100 15 16.800 7 5.169 Lithuania 963 0 200 200 134 3 271	Lithuania 325% 100 15 16.800 7 5.169 Norway 963 0 200 200 94 22 96	Norway 325% 100 15 16.800 7 5.169 963 0 200 963 0 200 94 200 94	Sweden 325% 100 15 16.800 7 5.169 Unit EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year
Technical characteristics Technical characteristics Air to water HP - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs: Subsidies:	Category Annual efficiency - heat pump air-water Auxillary electricity consumption - heat pump air-water Technical lifetime (years) - heat pump air- water Annual heat demand - individual house Effect need Electricity consumption for heat Cost category Annual loan costs Variable maintenance costs - heat pump air- water Electricity price Auxillary electricity price All electricity tariffs Subsidies	Data kWh/year years kWh/year kW kWh/year Denmark 963 0 200 139 3 401	Denmark 325% 100 15 16800 7 5169,230769 Estonia 963 0 200 111 2 335 0	Estonia 325% 100 15 16.800 7 5.169 5.169 963 0 200 200 104 200 104 201 201 200	Finland 325% 100 15 16.800 7 5.169 45.169 963 0 200 200 134 3 438 0	Latvia 325% 100 15 16.800 7 5.169 200 200 134 3 200 134 3 2271 0	Lithuania 325% 100 15 16.800 7 5.169 Norway 963 0 200 94 20 94 2 96 0	Norway 325% 100 15 16.800 7 5.169 Sweden 963 0 200 94 200 94 22 190	Sweden 325% 100 15 16.800 7 5.169 Unit EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year
Technical characteristics Technical characteristics Air to water HP - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs: Subsidies:	Category Annual efficiency - heat pump air-water Auxiliary electricity consumption - heat pump air-water Technical lifetime (years) - heat pump air- water Annual heat demand - individual house Effect need Electricity consumption for heat Cost category Annual loan costs Variable maintenance costs - heat pump air- water Electricity price Auxiliary electricity price All electricity tariffs Electricity tax/electric heating fee	Data kWh/year years kWh/year kW kWh/year Denmark Denmark 0 200 139 3 401 0 266	Denmark 325% 100 15 16800 7 5169,230769 5169,230769 200 200 200 1111 2 2 335 0 0 23	Estonia 325% 100 15 16.800 7 5.169 963 963 00 2000 2000 104 200 104 200 104 104	Finland 325% 100 15 16.800 7 5.169 45.169 200 200 200 134 3 438 0 438 0 5	Latvia 325% 100 15 16.800 7 5.169 963 0 200 200 134 3 2200 134 3 2271 0 0 5	Lithuania 325% 100 15 16.800 7 5.169 9 8 8 8 9 6 3 0 0 200 9 4 2 2 9 6 0 9 4 2 9 6 3 9 9 4 8 9	Norway 325% 100 15 16.800 7 5.169 963 0 200 200 94 200 94 22 190 0 159	Sweden 325% 100 15 16.800 7 5.169 Unit EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year
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Technical characteristics Technical characteristics Air to water HP - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs: Subsidies: Taxes and fees:	Category Annual efficiency - heat pump air-water Auxillary electricity consumption - heat pump air-water Technical lifetime (years) - heat pump air- water Annual heat demand - individual house Effect need Electricity consumption for heat Cost category Annual loan costs Variable maintenance costs - heat pump air- water Fixed maintenance costs - heat pump air- water Electricity price Auxillary electricity price All electricity tariffs Subsidies Electricity tax/electric heating fee CO2 tax NOx tax	Data kWh/year years kWh/year kW kWh/year Denmark 963 0 200 139 3 401 0 266 - -	Denmark 325% 100 15 16800 7 5169,230769 Estonia 963 0 200 111 2 335 0 23 - -	Estonia 325% 100 15 16.800 7 5.169 963 963 0 963 0 0 200 200 104 200 104 200 104 200 104 200 104 200	Finland 325% 100 15 16.800 7 5.169 963 0 200 134 3 438 438 0 5 5 -	Latvia 325% 100 15 16.800 7 5.169 963 0 200 200 134 3 270 1 3 271 0 0 5 -	Lithuania 325% 100 15 16.800 7 5.169 963 0 200 94 200 94 200 94 200 94 200 94 200 94 200 94	Norway 325% 100 15 16.800 7 5.169 963 0 963 0 200 94 200 94 200 94 200 94 200 94 200 94 200	Sweden 325% 100 15 16.800 7 5.169 Unit EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year
Technical characteristics Technical characteristics Air to water HP - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs: Subsidies: Taxes and fees:	Category Annual efficiency - heat pump air-water Auxillary electricity consumption - heat pump air-water Technical lifetime (years) - heat pump air- water Annual heat demand - individual house Effect need Electricity consumption for heat Cost category Annual loan costs Variable maintenance costs - heat pump air- water Electricity price Auxillary electricity price All electricity tax/electric heating fee CO2 tax NOX tax Electricity tax on auxillary electricity	Data Data kWh/year kWh/year kW kWh/year Denmark 963 0 200 139 3 401 0 266 - - 12	Denmark 325% 100 15 16800 7 5169,230769 Estonia 963 0 200 1111 2 335 0 23 - - 0 0	Estonia 325% 100 15 6.800 7 7 5.169 963 0 963 0 0 200 200 200 104 200 104 200 104 104 200 104 104 200 104 104 200 104 104 200 104 104 105 105 105 105 105 105 105 105 105 105	Finland 325% 100 15 16.800 7 5.169 963 0 200 134 3 438 0 438 0 5 5 - - 0	Latvia 325% 100 15 16.800 7 5.169 2.169 2.169 2.169 2.00 2.00 134 3.00 2.00 134 3.271 0.0 5 5.0 9 6.3 0.0 2.00 1.5 4.00 0.0 5.00 0.00 5.00 0.00 0.00 0.0	Lithuania 325% 100 15 16.800 7 5.169 963 0 200 94 200 94 200 94 200 94 200 94 200 94 200 94 200 94 200 94	Norway 325% 100 15 16.800 7 5.169 963 0 200 94 200 94 200 94 200 94 200 94 200 94 200 94 200 94 200 94 200 94 200 94 200 94 200 95 300 200 300 200 300 300 300 300 300 300	Sweden 325% 100 15 16.800 7 5.169 Unit EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year
Technical characteristics Technical characteristics Technical characteristics Air to water HP - annual consumer cost 2016 Capital costs: Capital costs: Maintenance costs: Electricity tariffs: Subsidies: Taxes and fees: Scrap value:	Category Annual efficiency - heat pump air-water Auxillary electricity consumption - heat pump air-water Technical lifetime (years) - heat pump air- water Annual heat demand - individual house Effect need Electricity consumption for heat Electricity consumption for heat Cost category Annual loan costs Variable maintenance costs - heat pump air- water Electricity price Auxillary electricity price All electricity tax/electric heating fee CO2 tax NOx tax Electricity tax on auxillary electricity Revenue	Data Data kWh/year kWh/year kWh/year Denmark 963 0 200 139 3 401 0 266 - 12 12 -	Denmark 325% 100 15 16800 7 5169,230769 Estonia 963 0 200 200 201 111 2 335 0 23 - - 0 - 0 - 0	Estonia 325% 100 16.800 7 5.169 5.169 963 963 963 00 200 200 104 200 104 104 104 104 104 104 104 104 20 104 104 20 104 104 20 104 104 104 104 104 104 104 104 104 10	Finland 325% 100 15 16.800 7 5.169 5.169 963 963 0 200 200 134 3 438 0 438 0 5 5 - - - 0 5 -	Latvia 325% 100 15 16.800 7 5.169 2.00 2.00 2.00 2.00 2.00 134 3.201 2.00 2.00 5.5 5 - 0 5 - 0 0	Lithuania 325% 100 15 16.800 7 5.169 0 5.169 0 5.169 0 0 200 200 200 200 200 200 200 94 22 96 0 0 89 6 3 2 0 2 2	Norway 325% 100 15 16.800 7 5.169 5.169 963 0 200 200 200 94 200 94 200 94 200 159 - - 3 3	Sweden 325% 100 15 16.800 7 5.169 Unit EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year
Technical characteristics Technical characteristics Technical characteristics Air to water HP - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs: Subsidies: Taxes and fees: Scrap value: Total cost	Category Annual efficiency - heat pump air-water Auxillary electricity consumption - heat pump air-water Technical lifetime (years) - heat pump air- water Annual heat demand - individual house Effect need Electricity consumption for heat Electricity consumption for heat Cost category Annual loan costs Variable maintenance costs - heat pump air- water Electricity price Auxillary electricity price All electricity tax/electric heating fee CO2 tax NOx tax Electricity tax on auxillary electricity Revenue	Data kWh/year years kWh/year kW kWh/year Denmark Denmark 0 2000 139 3 401 0 266 - - 12 - 1984	Denmark 325% 100 15 16800 7 5169,230769 Estonia 963 0 200 2111 2 335 0 233 0 23 - - 0 23 - - 0 1.635	Estonia 325% 100 15 16.800 7 5.169 963 963 963 0 0 200 0 200 0 200 0 200 0 200 0 104 2 200 0 104 2 0 0 104 2 0 0 116 10 9 5.169 9 10 10 10 10 10 10 10 10 10 10 10 10 10	Finland 325% 100 15 16.800 7 5.169 40 5.169 963 0 200 200 134 3 438 0 438 0 5 - - 0 5 - 1.744	Latvia 325% 100 15 16.800 7 5.169	Lithuania 325% 100 15 16.800 7 5.169 963 0 963 0 2000 94 200 94 22 96 0 0 2000 94 200 94 2 96 0 0 89 94 2 2 96	Norway 325% 100 15 16.800 7 5.169 963 0 2000 2000 94 200 94 200 94 200 0 159 - - - 3 - - 1.611	Sweden 325% 100 15 16.800 7 5.169 Unit EUR/year EUR/year

Appendices

8.7 Resistance-based electric heating

price 2016	Category	Unit	Denmark	Estonia	Finland	Latvia	Lithuania	Norway	Sweden
Subsidies:	None		-	-		-	-	-	-
	Electric heating fee	EUR/kWh	0.05			-		-	-
	Energy tax	EUR/kWh	0,12	0.00	0,02	0,00	0,00	0.02	0,03
Taxes and fees:	CO2 tax	EUR/kWh	-			-	_		-
	NOx tax	EUR/kWh	-			-			-
	PSO (or similar tariff) for subsidy of other	20101111							
Tariffe	electricity production	EUR/kWh	0,03	0,01	0,01	0,03	0,02	0,00	-
rains.	Electricity local grid tariff	EUR/kWh	0,03	0,05	0,02	0,06	0,04	0,02	0,04
	Electricity system/transmission tariff	EUR/kWh	0,01	-	0,00	-	-	-	-
Energy price, excl. tax etc.:	Electricity price	EUR/kWh	0,03	0,02	0,02	0,03	0,03	0,02	0,02
	Auxillary electricity price	EUR/kWh	0,03	0,02	0,02	0,03	0,03	0,02	0,02
Technology costs	Category Variable maintenance and the residuese	Unit	Denmark	Estonia	Finland	Latvia	Lithuania	Norway	Sweden
	electricity	EUR/kWh	0	-		-	-	-	-
Maintenance costs:	Fixed maintenance costs - resistance electricity	ELIP/upit/voor	70	70	70	70	70	70	70
	Hardware costs - resistance electricity	EUR/unit	2020	2 0 2 0	2 0 2 0	3 020	2 0 2 0	2 020	2 0 2 0
	Connection costs and other hardware costs -	EURVUIIIL	3920	3.920	3.920	3.920	3.920	3.920	3.920
Capital costs:	resistance electricity	EUR/unit	0	-	-	-	-	-	-
	Installation costs - resistance electricity	EUR/unit	1680	1.680	1.680	1.680	1.680	1.680	1.680
	Total cost	EUR/unit	5600	5.600	5.600	5.600	5.600	5.600	5.600
	Loan period	years	15	15	15	15	15	15	15
	Annual loan costs	EUR/year	540	540	540	540	540	540	540
Remaining technical lifetime	Remaining technical lifetime	years	15	15	15	15	15	15	15
Scrap value:	Revenue	EUR	- 1.960	- 1.960	- 1.960	- 1.960	- 1.960	- 1.960	- 1.960
			1				1		
Technical characteristics	Category	Data	Denmark	Estonia	Finland	Latvia	Lithuania	Norway	Sweden
Technical characteristics	Category Annual efficiency - resistance electricity	Data	Denmark 100%	Estonia 100%	Finland 100%	Latvia 100%	Lithuania 100%	Norway 100%	Sweden 100%
Technical characteristics	Category Annual efficiency - resistance electricity Auxillary electricity consumption - resistance electricity	Data kWh/year	Denmark 100% 0	Estonia 100%	Finland 100%	Latvia 100% -	Lithuania 100% -	Norway 100% -	Sweden 100% -
Technical characteristics	Category Annual efficiency - resistance electricity Auxillary electricity consumption - resistance electricity Technical lifetime (years) - resistance electricity	Data kWh/year	Denmark 100% 0	Estonia 100% -	Finland 100% -	Latvia 100% -	Lithuania 100% -	Norway 100% -	Sweden 100% -
Technical characteristics Technical characteristics	Category Annual efficiency - resistance electricity Auxillary electricity consumption - resistance electricity Technical lifetime (years) - resistance electricity Annual heat demand - individual house	Data kWh/year years	Denmark 100% 0 30	Estonia 100% - 30	Finland 100% - 30	Latvia 100% - 30	Lithuania 100% - 30	Norway 100% - 30	Sweden 100% - 30
Technical characteristics Technical characteristics	Category Annual efficiency - resistance electricity Auxillary electricity consumption - resistance electricity Technical lifetime (years) - resistance electricity Annual heat demand - individual house Effect need	Data kWh/year years kWh/year	Denmark 100% 0 30 16800	Estonia 100% - 30 16.800	Finland 100% - 30 16.800	Latvia 100% - 30 16.800	Lithuania 100% - 30 16.800	Norway 100% - 30 16.800	Sweden 100% - 30 16.800
Technical characteristics Technical characteristics	Category Annual efficiency - resistance electricity Auxillary electricity consumption - resistance electricity Technical lifetime (years) - resistance electricity Annual heat demand - individual house Effect need Electricity consumption for heat	Data kWh/year years kWh/year kW	Denmark 100% 0 30 16800 7	Estonia 100% - 30 16.800 7	Finland 100% - 30 16.800 7	Latvia 100% - 30 16.800 7	Lithuania 100% - 30 16.800 7	Norway 100% - 30 16.800 7	Sweden 100% - 30 16.800 7
Technical characteristics Technical characteristics	Category Annual efficiency - resistance electricity Auxillary electricity consumption - resistance electricity Technical lifetime (years) - resistance electricity Annual heat demand - individual house Effect need Electricity consumption for heat	Data kWh/year years kWh/year kW	Denmark 100% 0 30 16800 7 16800	Estonia 100% - 30 16.800 7 16.800	Finland 100% - 30 16.800 7 16.800	Latvia 100% - 30 16.800 7 16.800	Lithuania 100% - 30 16.800 7 16.800	Norway 100% - 30 16.800 7 16.800	Sweden 100% - 30 16.800 7 16.800
Technical characteristics Technical characteristics Resistance electricity -	Category Annual efficiency - resistance electricity Auxillary electricity consumption - resistance electricity Technical lifetime (years) - resistance electricity Annual heat demand - individual house Effect need Electricity consumption for heat	Data kWh/year years kWh/year kW kWh/year	Denmark 100% 0 30 16800 7 16800	Estonia 100% - 30 16.800 7 16.800	Finland 100% - 30 16.800 7 16.800	Latvia 100% - 30 16.800 7 16.800	Lithuania 100% - 30 16.800 7 16.800	Norway 100% - 30 16.800 7 16.800	Sweden 100% - 30 16.800 7 16.800
Technical characteristics Technical characteristics Resistance electricity - annual consumer cost 2016	Category Annual efficiency - resistance electricity Auxillary electricity consumption - resistance electricity Technical lifetime (years) - resistance electricity Annual heat demand - individual house Effect need Electricity consumption for heat Cost category	Data kWh/year years kWh/year kW kWh/year Denmark	Denmark 100% 0 30 16800 7 16800 Estonia	Estonia 100% - 30 16.800 7 16.800 Finland	Finland 100% - 30 16.800 7 16.800 Latvia	Latvia 100% - 30 16.800 7 16.800 7 16.800	Lithuania 100% - 30 16.800 7 16.800 Norway	Norway 100% - 30 16.800 7 16.800 Sweden	Sweden 100% - 30 16.800 7 16.800 Unit
Technical characteristics Technical characteristics Resistance electricity - annual consumer cost 2016 Capital costs:	Category Annual efficiency - resistance electricity Auxillary electricity consumption - resistance electricity Technical lifetime (years) - resistance electricity Annual heat demand - individual house Effect need Effect need Electricity consumption for heat Cost category Annual loan costs Variable maintenance costs - resistance	Data kWh/year years kWh/year kW kWh/year Denmark 540	Denmark 100% 0 30 16800 7 16800 540	Estonia 100% - 30 16.800 7 16.800 Finland 540	Finland 100% - 30 16.800 7 16.800 Latvia 540	Latvia 100% - 30 16.800 7 16.800 Lithuania 540	Lithuania 100% - 16.800 7 16.800 Norway 540	Norway 100% - 30 16.800 7 16.800 Sweden 540	Sweden 100% - 30 16.800 7 16.800 Unit EUR/year
Technical characteristics Technical characteristics Technical characteristics Resistance electricity - annual consumer cost 2016 Capital costs:	Category Annual efficiency - resistance electricity Auxillary electricity consumption - resistance electricity Technical lifetime (years) - resistance electricity Annual heat demand - individual house Effect need Effect need Electricity consumption for heat Cost category Annual loan costs Variable maintenance costs - resistance electricity	Data kWh/year years kWh/year kW kWh/year Denmark 540 0	Denmark 100% 0 30 16800 7 16800 Estonia 540	Estonia 100% - 30 16.800 7 16.800 Finland 540 0	Finland 100% - 30 16.800 7 16.800 Latvia 540 0	Latvia 100% - 300 16.800 7 16.800 2 16.800 2 Lithuania 540 0	Lithuania 100% - 300 16.800 7 16.800 Norway 540 0	Norway 100% - 30 16.800 7 16.800 540 0	Sweden 100% - 30 16.800 7 16.800 Unit EUR/year EUR/year
Technical characteristics Technical characteristics Resistance electricity - annual consumer cost 2016 Capital costs: Maintenance costs:	Category Annual efficiency - resistance electricity Auxillary electricity consumption - resistance electricity Technical lifetime (years) - resistance electricity Annual heat demand - individual house Effect need Electricity consumption for heat Cost category Annual loan costs Variable maintenance costs - resistance electricity Fixed maintenance costs - resistance electricity	Data kWh/year years kWh/year kW kWh/year Denmark 540 0	Denmark 100% 0 30 16800 7 16800 540 540 0	Estonia 100% - 30 16.800 7 16.800 7 16.800 Finland 540 0	Finland 100% - 30 16.800 7 16.800 16.800 2 16.800 2 16.800 0 2 540 0 70	Latvia 100% - 30 16.800 7 16.800 2 16.800 2 Lithuania 540 0	Lithuania 100% - 30 16.800 7 16.800 800 800 800 800 800 800 800 800 800	Norway 100% - 300 16.800 7 16.800 7 16.800 Sweden 540 0	Sweden 100% - 30 16.800 7 16.800 Unit EUR/year EUR/year EUR/year
Technical characteristics Technical characteristics Resistance electricity - annual consumer cost 2016 Capital costs: Maintenance costs:	Category Annual efficiency - resistance electricity Auxillary electricity consumption - resistance electricity Technical lifetime (years) - resistance electricity Annual heat demand - individual house Effect need Electricity consumption for heat Cost category Annual loan costs Variable maintenance costs - resistance electricity Fixed maintenance costs - resistance electricity	Data kWh/year years kWh/year kW kWh/year Denmark 0 0 70	Denmark 100% 0 30 16800 7 16800 2 540 0 70	Estonia 100% - 16.800 7 16.800 7 16.800 7 16.800 540 0 70	Finland 100% - 30 16.800 7 16.800 16.800 16.800 20 20 20 20 20 20 20 20 20 20 20 20 2	Latvia 100% - 30 16.800 7 16.800 7 16.800 2 Lithuania 540 0 70	Lithuania 100% - 16.800 7 16.800 7 16.800 8 0 8 0 0 70	Norway 100% - 30 16.800 7 16.800 7 16.800 540 0 70	Sweden 100% - 30 16.800 7 16.800 Unit EUR/year EUR/year EUR/unit/year
Technical characteristics Technical characteristics Resistance electricity - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.;	Category Annual efficiency - resistance electricity Auxiliary electricity consumption - resistance electricity Technical lifetime (years) - resistance electricity Annual heat demand - individual house Effect need Electricity consumption for heat Cost category Annual loan costs Variable maintenance costs - resistance electricity Electricity Electricity price	Data kWh/year years kWh/year kW kWh/year Denmark 0 70 453	Denmark 100% 0 30 16800 7 16800 Estonia 540 0 70	Estonia 100% - 30 16.800 7 16.800 7 16.800 Finland 540 0 70	Finland 100% - 30 16.800 7 16.800 16.800 16.800 10 16.800 0 10 540 0 70	Latvia 100% - 30 16.800 7 16.800 7 16.800 2 Lithuania 540 0 70	Lithuania 100% - 16.800 7 16.800 7 16.800 0 70 70 70	Norway 100% - 300 16.800 7 16.800 70 540 0 70 70	Sweden 100% - 30 16.800 7 16.800 Unit EUR/year EUR/year EUR/uear
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Technical characteristics Technical characteristics Technical characteristics Resistance electricity - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs:	Category Annual efficiency - resistance electricity Auxillary electricity consumption - resistance electricity Technical lifetime (years) - resistance electricity Annual heat demand - individual house Effect need Electricity consumption for heat Electricity consumption for heat Cost category Annual loan costs Variable maintenance costs - resistance electricity Fixed maintenance costs - resistance electricity Electricity price Auxillary electricity price All electricity tariffs	Data kWh/year years kWh/year kW kWh/year Denmark 540 0 70 453 -	Denmark 100% 0 30 16800 7 16800 7 16800 7 16800 0 540 0 70 360 - 1062	Estonia 100% - 30 16.800 7 16.800 Finland 540 0 0 70 338 -	Finland 100% - 30 16.800 7 16.800 2 16.800 2 16.800 0 0 70 436 - 1208	Latvia 100% - 30 16.800 7 16.800 16.800 20 16.800 0 20 20 20 20 20 20 20 20 20 20 20 20	Lithuania 100% - 300 16.800 7 16.800 70 16.800 70 540 0 70 305 - 207	Norway 100% - 300 16.800 7 16.800 540 540 0 0 70 305 - 505	Sweden 100% - 30 16.800 7 16.800 Unit EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year
Technical characteristics Technical characteristics Technical characteristics Resistance electricity - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs: Subsidies:	Category Annual efficiency - resistance electricity Auxillary electricity consumption - resistance electricity Technical lifetime (years) - resistance electricity Annual heat demand - individual house Effect need Electricity consumption for heat Cost category Annual loan costs Variable maintenance costs - resistance electricity Fixed maintenance costs - resistance electricity Electricity price Auxillary electricity price All electricity tariffs Subsidies	Data kWh/year years kWh/year kW kWh/year Denmark Denmark 540 0 70 453 - 1.279	Denmark 100% 0 30 16800 7 16800 2 540 0 540 0 70 360 - 1068	Estonia 100%	Finland 100% - 30 16.800 7 16.800 7 16.800 0 10 540 0 70 436 - 1.398	Latvia 100% - 30 16.800 7 16.800 7 16.800 2 1 16.800 0 2 0 70 436 - 864	Lithuania 100% - 300 16.800 7 16.800 7 16.800 70 8 540 0 70 70 305 - 307	Norway 100% - 30 16.800 7 16.800 540 540 0 70 305 - 605	Sweden 100% - 30 16.800 7 16.800 Unit EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year
Technical characteristics Technical characteristics Resistance electricity - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs: Subsidies:	Category Annual efficiency - resistance electricity Auxillary electricity consumption - resistance electricity Technical lifetime (years) - resistance electricity Annual heat demand - individual house Effect need Electricity consumption for heat Cost category Annual loan costs Variable maintenance costs - resistance electricity Fixed maintenance costs - resistance electricity Electricity price Auxillary electricity price All electricity tax/electric heating fee	Data kWh/year years kWh/year kW kWh/year Denmark Denmark 0 0 70 453 - 1.279 0 0	Denmark 100% 0 30 16800 7 16800 Estonia Estonia 0 70 360 - 1.068 0	Estonia 100%	Finland 100% - 30 16.800 7 16.800 70 Latvia 540 0 70 436 - 1.398 00	Latvia 100% - 300 16.800 7 16.800 7 16.800 2 Lithuania 540 0 70 436 - 864 0 7 7 7 7 7 7 7 7 7 7 7 7 7	Lithuania 100% - 300 16.800 7 16.800 70 16.800 0 70 70 305 - 305 - 307 0	Norway 100% - 30 16.800 7 16.800 540 0 540 0 70 305 - 605 0	Sweden 100% . 30 16.800 7 16.800 Unit EUR/year EUR/year
Technical characteristics Technical characteristics Resistance electricity - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs: Subsidies:	Category Annual efficiency - resistance electricity Auxillary electricity consumption - resistance electricity Technical lifetime (years) - resistance electricity Annual heat demand - individual house Effect need Electricity consumption for heat Cost category Annual loan costs Variable maintenance costs - resistance electricity Fixed maintenance costs - resistance electricity Electricity price Auxillary electricity price All electricity tar/ffs Subsidies Electricity tax/electric heating fee CO21 ax	Data kWh/year years kWh/year kW kWh/year Denmark Denmark 0 0 70 453 - 1.279 0 864	Denmark 100% 0 30 16800 7 16800 Estonia Estonia 0 360 - 1.068 0 75	Estonia 100%	Finland 100% - 30 16.800 7 16.800 2 16.800 16.800 2 16.800 10 16.800 10 16.800 10 16.800 10 16.800 10 16.800 10 16.800 10 16.800 10 16.800 10 10 16.800 10 16.800 10 16.800 10 16.800 10 10 16.8000 10 16.8000 10 16.8000 10 16.8000 10 16.8000 10 16.8000 10 16.8000 10 10 10 10 10 10 10 10 10 10 10 10	Latvia 100% - 300 16.800 7 16.800 2 Lithuania 540 0 70 436 - 864 0 17	Lithuania 100% - 30 16.800 7 16.800 70 16.800 800 70 305 - 305 - 307 0 0 289	Norway 100% - 300 16.800 7 16.800 Sweden 540 0 700 305 - 605 0 518	Sweden 100% - 30 16.800 7 16.800 Unit EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year
Technical characteristics Technical characteristics Technical characteristics Resistance electricity - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs: Subsidies: Taxes and fees:	Category Annual efficiency - resistance electricity Auxillary electricity consumption - resistance electricity Technical lifetime (years) - resistance electricity Annual heat demand - individual house Effect need Electricity consumption for heat Cost category Annual loan costs Variable maintenance costs - resistance electricity Fixed maintenance costs - resistance electricity Electricity price Auxillary electricity price All electricity tar/fls Subsidies Electricity tax/electric heating fee CO2 tax	Data kWh/year years kWh/year kW kWh/year Denmark Denmark 540 0 1279 0 864 -	Denmark 100% 0 30 16800 7 16800 540 540 0 70 360 - 1.068 0 75 -	Estonia 100%	Finland 100% - 30 16.800 7 16.800 2 16.800 16.800 2 16.800 10 16.800 10 16.800 10 16.800 10 16.800 10 16.800 10 16.800 10 16.800 10 16.800 10 10 16.8000 10 16.8000 10 16.8000 10 16.8000 10 16.8000 10 16.8000 10 16.8000 10 16.8000 10 16.8000 10 16.8000 10 16.8000 10 16.8000 10 10 10 10 10 10 10 10 10 10 10 10	Latvia 100% - 30 16.800 7 16.800 2 16.800 2 16.800 0 16.800 0 16.800 10.8000 10.8000 10.800 10.8000 10.8000 10.8000 10.8000 10.8	Lithuania 100% - 30 16.800 7 16.800 7 16.800 70 540 0 70 305 - 305 - 307 0 0 289 -	Norway 100% - 30 16.800 7 16.800 5 40 5 40 0 70 305 - 605 0 5 18 0 5 18	Sweden 100% - 30 16.800 7 16.800 Unit EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year
Technical characteristics Technical characteristics Resistance electricity - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs: Subsidies: Taxes and fees:	Category Annual efficiency - resistance electricity Auxillary electricity consumption - resistance electricity Technical lifetime (years) - resistance electricity Annual heat demand - individual house Effect need Electricity consumption for heat Cost category Annual loan costs Variable maintenance costs - resistance electricity Fixed maintenance costs - resistance electricity Electricity price Auxillary electricity price All electricity tax/electric heating fee CO2 tax NOx tax	Data Attemportant Content of Co	Denmark 100% 0 30 16800 7 10 10 10 10 10 10 10 10 10 10	Estonia 100% - 30 16.800 7 16.800 70 540 0 70 338 - 586 0 0 376 - -	Finland 100% - 30 16.800 7 16.800 2 436 - 1.398 0 1.398 0 17 - -	Latvia 100% - 30 16.800 7 16.800 7 16.800 70 16.800 0 70 436 - 864 0 17 -	Lithuania 100% - 300 16.800 7 16.800 70 16.800 70 540 0 70 305 - 305 - 307 0 289 - -	Norway 100% - 300 16.800 7 16.800 540 540 0 70 305 - 605 0 518 - 0 518 -	Sweden 100% - 30 16.800 7 16.800 Unit EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year
Technical characteristics Technical characteristics Resistance electricity - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs: Subsidies: Taxes and fees:	Category Annual efficiency - resistance electricity Auxillary electricity consumption - resistance electricity Technical lifetime (years) - resistance electricity Annual heat demand - individual house Effect need Electricity consumption for heat Cost category Annual loan costs Variable maintenance costs - resistance electricity Fixed maintenance costs - resistance electricity Electricity price Auxillary electricity price All electricity tariffs Subsidies Electricity tax/electric heating fee CO2 tax NOx tax Electricity tax on auxillary electricity	Data Data kWh/year years kWh/year kW kWh/year Denmark Denmark 540 0 1.279 0 864	Denmark 100% 0 30 16800 7 16800 7 16800 7 16800 0 540 0 100 100 100 100 100 100 100 100 100	Estonia 100% - 30 16.800 7 16.800 7 16.800 70 540 0 0 338 - 586 0 376 - - - -	Finland 100% - 30 16.800 7 16.800 2 16.800 2 540 0 540 0 70 436 - 1.398 0 0 177 - -	Latvia 100% - 30 16.800 70 10.800 70 70 70 70 70 70 70 70 70	Lithuania 100% - 300 16.800 7 16.800 70 16.800 70 540 0 70 305 - 305 - 307 0 289 - - 307	Norway 100% - 300 16.800 7 16.800 540 540 0 540 0 70 305 - 605 0 518 - - 605	Sweden 100% 100% 30 16.800 7 16.800 Unit EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year
Technical characteristics Technical characteristics Technical characteristics Resistance electricity - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs: Subsidies: Taxes and fees: Scrap value:	Category Annual efficiency - resistance electricity Auxiliary electricity consumption - resistance electricity Technical lifetime (years) - resistance electricity Annual heat demand - individual house Effect need Electricity consumption for heat Electricity consumption for heat Cost category Annual loan costs Variable maintenance costs - resistance electricity Fixed maintenance costs - resistance electricity Electricity price Auxillary electricity price All electricity tariffs Subsidies Electricity tax/electric heating fee CO2 tax NOx tax Electricity tax on auxillary electricity Revenue	Data Data kWh/year years kWh/year kW kWh/year Denmark Denmark Control C	Denmark 100% 0 30 16800 7 16800 7 16800 7 16800 0 540 0 0 70 360 0 - 1.068 0 0 75 131	Estonia 100% - 30 16.800 7 16.800 7 16.800 70 70 338 - 586 0 376 - - 131	Finland 100% - 30 16.800 7 16.800 2 16.800 2 540 0 0 70 436 - 1.398 0 1.398 0 1.398 0 1.398	Latvia 100% - 30 16.800 7 16.800 7 16.800 7 16.800 7 16.800 7 16.800 7 16.800 7 16.800 7 16.800 10.800 10.800 16.800 10.800 1	Lithuania 100% - 300 16.800 7 16.800 70 16.800 70 540 0 70 305 - 305 - 307 0 289 - - 307 - 1289 - - 131	Norway 100% - 300 16.800 7 16.800 540 540 0 540 0 70 305 - 605 0 518 - 0 518 - - 131	Sweden 100% 100% 30 16.800 7 16.800 Unit EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year
Technical characteristics Technical characteristics Technical characteristics Resistance electricity - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs: Subsidies: Taxes and fees: Carap value: Total cost	Category Annual efficiency - resistance electricity Auxillary electricity consumption - resistance electricity Technical lifetime (years) - resistance electricity Annual heat demand - individual house Effect need Electricity consumption for heat Cost category Annual loan costs Variable maintenance costs - resistance electricity Exed maintenance costs - resistance electricity Electricity price Auxillary electricity price All electricity tariffs Subsidies Electricity tax/electric heating fee CO2 tax NOx tax Electricity tax on auxillary electricity	Data Data kWh/year years kWh/year kW kWh/year Denmark Denmark Denmark Control Contro Control Control C	Denmark 100% 0 30 16800 7 16800 Estonia Estonia 0 7 360 0 70 360 0 70 360 0 75	Estonia 100% - 30 16.800 70 16.800 70 70 3388 - 5866 0 3766 - 1.771 1.779 1.779	Finland 100% - 30 16.800 77 16.800 70 14.800 0 70 436 - 1.398 0 1.398 0 1.398 0 1.398 0 1.398 0 1.398	Latvia 100% - 30 16.800 7 16.800 7 16.800 70 16.800 70 436 - 864 0 0 177 - 864 0 177 - 17 - 171	Lithuania 100% - 300 16.800 7 16.800 7 16.800 70 540 0 70 70 305 - 307 0 289 - - 307 0 289 - - 1380	Norway 100% - 300 16.800 7 16.800 Sweden 540 0 0 0 0 0 10 0 0 10 0 10 0 0 10 1	Sweden 100% 100% 30 16.800 7 16.800 Unit EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year

8.8 Natural gas boiler

price 2016	Category	Unit	Denmark	Estonia	Finland	Latvia	Lithuania	Norway	Sweden
Subsidies:	None		-	-	-	-	-	-	-
	Energy tax	EUR/kWh	0,027	0,004	-	0,00	-	-	0,009
	CO2 tax	EUR/kWh	0,005	-		0,00	-	-	0,023
laxes and fees:	NOxtax	EUR/kWh	0,000	-	-	0,00	-	-	-
	Electricity tax	EUR/kWh	0,119	0,004	0,022	0,00	0,001	-	0,031
	PSO (or similar tariff) for subsidy of other electricity production		0.033	0.010	0.013	0.03	0.016		
	Electricity local grid tariff	EUD/W/b	0,033	0,010	0,010	0,05	0,010		0.026
Tariffs:	Electricity system/transmission tariff		0,032	0,034	0,019	0,00	0,035	-	0,030
	Gas distribution tariff		0,012	-	0,003	-	-	-	-
	Natural gas price		0,013	0,004	-	0,00	0,014	-	0,020
Energy price, excl. tax etc.:	Electricity price		0,020	0,018	-	0,03	0,020	-	0,033
		EUR/KWN	0,027	0,021	0,020	0,026	0,026	-	0,018
Technology costs	Category	Unit	Donmark	Estania	Finland	Lotvio	Lithuania	Nonvov	Sweden
	Variable maintenance costs - natural gas	CUDINA	Denmark	Estonia	Finiano	Latvia	Liinuania	Norway	Sweden
Maintenance costs:	Fixed maintenance costs - natural das	EUR/KWN	-	-	-	-	-	-	-
	Hardware costs - natural das	EUR/unit/year	235	235	235	235	235	235	235
	Connection costs and other hardware costs	EUK/Unit	1.800	1.800	1.800	1.800	1.800	1.800	1.800
Capital costs:	- natural gas	EUR/unit	2.000	2.000	2.000	2.000	2.000	2.000	2.000
	Installation costs - natural gas	EUR/unit	2.200	2.200	2.200	2.200	2.200	2.200	2.200
	Total cost	EUR/unit	6.000	6.000	6.000	6.000	6.000	6.000	6.000
Loan:	Loan period	years	15	15	15	15	15	15	15
	Annual loan costs	EUR/year	578	578	578	578	578	578	578
Remaining technical lifetime	Remaining technical lifetime	years	7	7	7	7	7	7	7
Scrap value:	Revenue	EUR	- 573	- 573	- 573	- 573	- 573	- 573	- 573
Technical characteristics	Category	Data	Denmark	Estonia	Finland	Latvia	Lithuania	Norway	Sweden
Technical characteristics	Category Annual efficiency - natural gas Auxillary electricity consumption - natural	Data	Denmark 102%	Estonia 102%	Finland 102%	Latvia 102%	Lithuania 102%	Norway 102%	Sweden 102%
Technical characteristics	Category Annual efficiency - natural gas Auxillary electricity consumption - natural gas	Data kWh/year	Denmark 102% 176	Estonia 102% 176	Finland 102% 176	Latvia 102% 176	Lithuania 102% 176	Norway 102% 176	Sweden 102% 176
Technical characteristics Technical characteristics	Category Annual efficiency - natural gas Auxillary electricity consumption - natural gas Technical lifetime (years) - natural gas	Data kWh/year years	Denmark 102% 176 22	Estonia 102% 176 22	Finland 102% 176 22	Latvia 102% 176 22	Lithuania 102% 176 22	Norway 102% 176 22	Sweden 102% 176 22
Technical characteristics Technical characteristics	Category Annual efficiency - natural gas Auxillary electricity consumption - natural gas Technical lifetime (years) - natural gas Annual heat demand - individual house	Data kWh/year years kWh/year	Denmark 102% 176 22 16.800	Estonia 102% 176 22 16.800	Finland 102% 176 22 16.800	Latvia 102% 176 22 16.800	Lithuania 102% 176 22 16.800	Norway 102% 176 22 16.800	Sweden 102% 176 22 16.800
Technical characteristics Technical characteristics	Category Annual efficiency - natural gas Auxillary electricity consumption - natural gas Technical lifetime (years) - natural gas Annual heat demand - individual house Effect need	Data kWh/year years kWh/year kW	Denmark 102% 176 22 16.800 7	Estonia 102% 176 22 16.800 7	Finland 102% 176 22 16.800 7	Latvia 102% 176 22 16.800 7	Lithuania 102% 176 22 16.800 7	Norway 102% 176 22 16.800 7	Sweden 102% 176 22 16.800 7
Technical characteristics Technical characteristics	Category Annual efficiency - natural gas Auxillary electricity consumption - natural gas Technical lifetime (years) - natural gas Annual heat demand - individual house Effect need Natural gas consumption	Data kWh/year years kWh/year kW kWh/year	Denmark 102% 176 22 16.800 7 16.471	Estonia 102% 176 22 16.800 7 16.471	Finland 102% 176 22 16.800 7 16.471	Latvia 102% 176 22 16.800 7 16.471	Lithuania 102% 176 22 16.800 7 16.471	Norway 102% 176 22 16.800 7 16.471	Sweden 102% 176 22 16.800 7 16.471
Technical characteristics Technical characteristics	Category Annual efficiency - natural gas Auxillary electricity consumption - natural gas Technical lifetime (years) - natural gas Annual heat demand - individual house Effect need Natural gas consumption	Data kWh/year years kWh/year kW kWh/year	Denmark 102% 176 22 16.800 7 16.471	Estonia 102% 176 22 16.800 7 16.471	Finland 102% 176 22 16.800 7 16.471	Latvia 102% 176 22 16.800 7 16.471	Lithuania 102% 176 22 16.800 7 16.471	Norway 102% 176 22 16.800 7 16.471	Sweden 102% 176 22 16.800 7 16.471
Technical characteristics Technical characteristics Natural gas boiler - annual consumer cost 2016	Category Annual efficiency - natural gas Auxillary electricity consumption - natural gas Technical lifetime (years) - natural gas Annual heat demand - individual house Effect need Natural gas consumption Cost category	Data kWh/year years kWh/year kW kWh/year Denmark	Denmark 102% 176 22 16.800 7 16.471 Estonia	Estonia 102% 176 22 16.800 7 16.471 Finland	Finland 102% 176 22 16.800 7 16.471 Latvia	Latvia 102% 176 22 16.800 7 16.471 Lithuania	Lithuania 102% 176 22 16.800 7 16.471 Norway	Norway 102% 176 22 16.800 7 16.471 Sweden	Sweden 102% 176 22 16.800 7 16.471 Unit
Technical characteristics Technical characteristics Technical characteristics Natural gas boiler - annual consumer cost 2016 Capital costs:	Category Annual efficiency - natural gas Auxillary electricity consumption - natural gas Technical lifetime (years) - natural gas Annual heat demand - individual house Effect need Natural gas consumption Cost category Annual loan costs	Data kWh/year years kWh/year kW kWh/year Denmark	Denmark 102% 176 22 16.800 7 16.471 Estonia	Estonia 102% 176 22 16.800 7 16.471 Finland	Finland 102% 176 22 16.800 7 16.471 16.471	Latvia 102% 176 22 16.800 7 16.471 Lithuania	Lithuania 102% 176 22 16.800 7 16.471 Norway	Norway 102% 176 22 16.800 7 16.471 Sweden 578	Sweden 102% 176 22 16.800 7 16.471 Unit EUR/year
Technical characteristics Technical characteristics Natural gas boiler - annual consumer cost 2016 Capital costs:	Category Annual efficiency - natural gas Auxiliary electricity consumption - natural gas Technical lifetime (years) - natural gas Annual heat demand - individual house Effect need Natural gas consumption Cost category Annual loan costs Variable maintenance costs - natural gas	Data kWh/year years kWh/year kW kWh/year Denmark 578	Denmark 102% 176 22 16.800 7 16.471 16.471 Estonia	Estonia 102% 176 22 16.800 7 16.471 Finland	Finland 102% 176 22 16.800 7 16.471 16.471 Latvia 578	Latvia 102% 176 22 16.800 7 16.471 16.471 Lithuania 578	Lithuania 102% 176 22 16.800 7 16.471 Norway	Norway 102% 176 22 16.800 7 16.471 Sweden 578 -	Sweden 102% 176 22 16.800 7 16.471 10.471 Unit EUR/year EUR/year
Technical characteristics Technical characteristics Technical characteristics Natural gas boiler - annual consumer cost 2016 Capital costs: Maintenance costs:	Category Annual efficiency - natural gas Auxillary electricity consumption - natural gas Technical lifetime (years) - natural gas Annual heat demand - individual house Effect need Natural gas consumption Cost category Annual loan costs Variable maintenance costs - natural gas Fixed maintenance costs - natural gas	Data kWh/year years kWh/year kW kWh/year Denmark 578 - 235	Denmark 102% 176 22 16.800 7 16.471 16.471 Estonia 578 - 235	Estonia 102% 176 22 16.800 7 16.471 Finland	Finland 102% 176 22 16.800 7 16.471 16.471 Latvia 578 - 235	Latvia 102% 176 22 16.800 7 16.471 16.471 Lithuania 578 - 235	Lithuania 102% 176 22 16.800 7 16.471 Norway	Norway 102% 176 22 16.800 7 16.471 578 578 - 235	Sweden 102% 176 22 16.800 7 16.471 16.471 Unit EUR/year EUR/year EUR/year
Technical characteristics Technical characteristics Technical characteristics Natural gas boiler - annual consumer cost 2016 Capital costs: Maintenance costs:	Category Annual efficiency - natural gas Auxillary electricity consumption - natural gas Technical lifetime (years) - natural gas Annual heat demand - individual house Effect need Natural gas consumption Cost category Annual loan costs Variable maintenance costs - natural gas Fixed maintenance costs - natural gas Natural gas price	Data kWh/year years kWh/year kW kWh/year Denmark 578 578 235	Denmark 102% 176 22 16.800 7 16.471 16.471 578 578 - 235 290	Estonia 102% 176 22 16.800 7 16.471 Finland	Finland 102% 176 22 16.800 7 16.471 16.471 16.471 Latvia 578 - 235 544	Latvia 102% 176 22 16.800 7 16.471 16.471 16.471 16.471 16.471 235 235 329	Lithuania 102% 176 22 16.800 7 16.471 Norway	Norway 102% 176 22 16.800 7 16.471 578 578 - 235 544	Sweden 102% 176 22 16.800 7 16.471 Unit EUR/year EUR/uear EUR/year EUR/year EUR/year
Technical characteristics Technical characteristics Technical characteristics Natural gas boiler - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.:	Category Annual efficiency - natural gas Auxillary electricity consumption - natural gas Technical lifetime (years) - natural gas Annual heat demand - individual house Effect need Natural gas consumption Cost category Annual loan costs Variable maintenance costs - natural gas Fixed maintenance costs - natural gas Natural gas price Auxillary electricity cost	Data kWh/year years kWh/year kW kWh/year Denmark Denmark 578 - 235 332	Denmark 102% 176 22 16.800 7 16.471 16.471 578 578 - 235 290 4	Estonia 102% 176 22 16.800 7 16.471 16.471	Finland 102% 176 22 16.800 7 16.471 16.471 16.471 578 - 235 544 554	Latvia 102% 176 22 16.800 7 16.471 16.471 16.471 16.471 2.35 329 5 5	Lithuania 102% 176 22 16.800 7 16.471 16.471 Norway	Norway 102% 176 22 16.800 7 16.471 578 - 235 544 3	Sweden 102% 176 22 16.800 7 16.471 Unit EUR/year EUR/year EUR/unit/year EUR/year
Technical characteristics Technical characteristics Technical characteristics Natural gas boiler - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.:	Category Annual efficiency - natural gas Auxillary electricity consumption - natural gas Technical lifetime (years) - natural gas Annual heat demand - individual house Effect need Natural gas consumption Cost category Annual loan costs Variable maintenance costs - natural gas Fixed maintenance costs - natural gas Natural gas price Auxillary electricity cost All electricity tariffs	Data kWh/year years kWh/year kW kWh/year c c c c c c c c c c c c c c c c c c c	Denmark 102% 176 22 16.800 7 16.471 16.471 255 290 4 11	Estonia 102% 176 22 16.800 7 16.471 Finland	Finland 102% 176 22 16.800 7 16.471 16.471 16.471 16.471 235 578 - 235 578 578 578 578 578 578 578 578 578 57	Latvia 102% 176 22 16.800 7 16.471 16.471 1	Lithuania 102% 176 22 16.800 7 16.471 Norway	Norway 102% 176 22 16.800 7 16.471 3 578 - 235 544 3 6	Sweden 102% 176 22 16.800 7 16.471 Unit EUR/year
Technical characteristics Technical characteristics Technical characteristics Natural gas boiler - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Tariffs	Category Annual efficiency - natural gas Auxillary electricity consumption - natural gas Technical lifetime (years) - natural gas Annual heat demand - individual house Effect need Natural gas consumption Cost category Annual loan costs Variable maintenance costs - natural gas Natural gas price Auxillary electricity cost All electricity tariffs #REF!	Data kWh/year years kWh/year kW kWh/year c c c c c c c c c c c c c c c c c c c	Denmark 102% 176 22 16.800 7 16.471 16.471 205 290 4 11 64	Estonia 102% 176 22 16.800 7 16.471 Finland	Finland 102% 176 22 16.800 7 16.471 16.471 16.471 16.471 235 578 578 235 544 5 5 15 24	Latvia 102% 176 22 16.800 7 16.471 16.471 1 Lithuania 235 329 5 9 9	Lithuania 102% 176 22 16.800 7 16.471 Norway	Norway 102% 176 22 16.800 7 16.471 3 578 - 235 544 3 6 459	Sweden 102% 176 22 16.800 7 16.471 Unit EUR/year
Technical characteristics Technical characteristics Technical characteristics Natural gas boiler - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Tariffs Subsidies:	Category Annual efficiency - natural gas Auxillary electricity consumption - natural gas Technical lifetime (years) - natural gas Annual heat demand - individual house Effect need Natural gas consumption Cost category Annual loan costs Variable maintenance costs - natural gas Fixed maintenance costs - natural gas Ratural gas price Auxillary electricity cost All electricity tariffs #REF! Subsidies	Data Data kWh/year years kWh/year kW kWh/year Denmark Denmark 578 - 235 332 5 13 209 -	Denmark 102% 176 22 16.800 7 16.471 16.471 16.471 235 290 4 111 64	Estonia 102% 176 22 16.800 7 16.471 Finland	Finland 102% 176 22 16.800 7 16.471 16.471 16.471 235 578 - 235 544 5 4 5 544 5 -	Latvia 102% 176 22 16.800 7 16.471 16.471 1 Lithuania 578 - 235 329 5 329 5 9 9 225	Lithuania 102% 176 22 16.800 7 16.471 Norway	Norway 102% 176 22 16.800 7 16.471 578 - 578 - 235 544 3 6 459 -	Sweden 102% 176 22 16.800 7 16.471 Unit EUR/year EUR/year <t< td=""></t<>
Technical characteristics Technical characteristics Technical characteristics Natural gas boiler - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Tariffs Subsidies:	Category Annual efficiency - natural gas Auxillary electricity consumption - natural gas Technical lifetime (years) - natural gas Annual heat demand - individual house Effect need Natural gas consumption Cost category Annual loan costs Variable maintenance costs - natural gas Fixed maintenance costs - natural gas Natural gas price Auxillary electricity cost All electricity tariffs #REF! Subsidies Energy tax	Data KWh/year years kWh/year kWh/year Commark Denmark Denmark Cass Cass Cass Cass Cass Cass Cass Ca	Denmark 102% 176 22 16.800 7 16.471 16.471 578 - 235 290 4 11 64 - 11 64	Estonia 102% 176 22 16.800 7 16.471 Finland	Finland 102% 176 22 16.800 7 16.471 16.471 16.471 235 578 - 235 578 - 235 544 5 4 5 4 5 4 2 5 24 - 24 -	Latvia 102% 176 22 16.800 7 16.471 17.471 16.471 17	Lithuania 102% 176 22 16.800 7 16.471 Norway	Norway 102% 176 22 16.800 7 16.471 578 - 235 544 3 6 459 - 459 - 148	Sweden 102% 176 22 16.800 7 16.471 16.471 EUR/year
Technical characteristics Technical characteristics Technical characteristics Natural gas boiler - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Tariffs Subsidies:	Category Annual efficiency - natural gas Auxillary electricity consumption - natural gas Technical lifetime (years) - natural gas Annual heat demand - individual house Effect need Natural gas consumption Cost category Annual loan costs Variable maintenance costs - natural gas Fixed maintenance costs - natural gas Natural gas price Auxillary electricity cost All electricity tariffs #REF! Subsidies Energy tax CO2 tax	Data KWh/year years KWh/year kWh/year CDenmark Denmark Cash Cash Cash Cash Cash Cash Cash Cas	Denmark 102% 176 22 16.800 7 16.471 16.471 578 - 235 290 4 11 64 - 164 -	Estonia 102% 176 22 16.800 7 16.471 16.471 1 5 10 10 10 10 10 10 10 10 10 10 10 10 10	Finland 102% 176 22 16.800 7 16.471 16.471 578 578 - 235 544 5578 554 554 554 554 554 554 554 524 5 24 24 25 515 24 24 26	Latvia 102% 176 22 16.800 7 16.471 17.6 16.471 17.6 16.471 17.6 17.6 17.6 17.6 17.6 17.6 17.6 17	Lithuania 102% 176 22 16.800 7 16.471 16.471 10 10 10 10 10 10 10 10 10 10 10 10 10	Norway 102% 176 22 16.800 7 16.471 578 - 235 544 3 6 459 - 459 - 148 379	Sweden 102% 176 22 16.800 7 16.471 Unit EUR/year
Technical characteristics Technical characteristics Technical characteristics Natural gas boiler - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Tariffs Subsidies: Taxes and fees:	Category Annual efficiency - natural gas Auxillary electricity consumption - natural gas Technical lifetime (years) - natural gas Annual heat demand - individual house Effect need Natural gas consumption Cost category Annual loan costs Variable maintenance costs - natural gas Fixed maintenance costs - natural gas Natural gas price Auxillary electricity cost All electricity tariffs #REF! Subsidies Energy tax CO2 tax NOx tax	Data kWh/year years kWh/year kW kWh/year Denmark Denmark 578 - 235 332 5 332 5 332 13 209 - 14 - 15	Denmark 102% 176 22 16.800 7 16.471 16.471 235 290 4 11 64 11 64 - 61 -	Estonia 102% 176 22 16.800 7 16.470 16.471 16.471 10 10 10 10 10 10 10 10 10 10 10 10 10	Finland 102% 176 22 16.800 7 16.471 16.471 16.471 235 578 - 235 544 55 8 4 5 544 5 5 15 24 - 26 12 0 0	Latvia 102% 176 22 16.800 7 16.471 16.471 16.471 2.25 329 5 329 5 329 5 9 225 329 5 9 225 9 9 225	Lithuania 102% 176 22 16.800 7 16.471 16.471 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Norway 102% 176 22 16.800 7 16.471 578 - 235 544 3 6 459 - 148 379 -	Sweden 102% 176 22 16.800 7 16.471 Unit EUR/year
Technical characteristics Technical characteristics Technical characteristics Natural gas boiler - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Tariffs Subsidies: Taxes and fees:	Category Annual efficiency - natural gas Auxillary electricity consumption - natural gas Technical lifetime (years) - natural gas Annual heat demand - individual house Effect need Natural gas consumption Cost category Annual loan costs Variable maintenance costs - natural gas Fixed maintenance costs - natural gas Ratural gas price Auxillary electricity cost All electricity tax fits Energy tax CO2 tax NOX tax Electricity tax on auxillary electricity	Data KWh/year years kWh/year kW kWh/year Commark C	Denmark 102% 176 22 16.800 7 16.471 16.471 235 290 4 111 64 11 64 - - 61 - - 1	Estonia Estonia 102% 176 22 16.800 7 16.471 Finland Finland 1 1 1 1 1 1 1 1 1 1 1 1 1	Finland 102% 176 22 16.800 7 16.471 16.471 235 578 - 235 578 - 235 574 578 - 235 574 578 - 235 574 578 - 24 - 26 12 20 00 00	Latvia 102% 176 22 16.800 7 16.471 1	Lithuania 102% 102 102% 176 22 16.800 7 16.471 10 10 10 10 10 10 10 10 10 10 10 10 10	Norway 102% 176 22 16.800 7 16.471 578 - 235 544 3 6 459 - 148 379 - 148 379 -	Sweden 102% 176 22 16.800 7 16.471 Unit EUR/year
Technical characteristics Technical characteristics Technical characteristics Natural gas boiler - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Tariffs Subsidies: Taxes and fees: Scrap value:	Category Annual efficiency - natural gas Auxillary electricity consumption - natural gas Technical lifetime (years) - natural gas Annual heat demand - individual house Effect need Natural gas consumption Cost category Annual loan costs Variable maintenance costs - natural gas Fixed maintenance costs - natural gas Natural gas price Auxillary electricity cost All electricity tax on auxillary electricity Revenue	Data KWh/year years kWh/year kW KWh/year CONTRACT KW DONTRACT CONTRACT CONTR	Denmark 102% 176 22 16.800 7 16.471 16.471 235 290 4 111 64 211 64 - - - 61 - - - 1 - - 38	Estonia 102% 1176 22 16.800 7 16.471 16.471 10 10 10 10 10 10 10 10 10 10 10 10 10	Finland 102% 176 22 16.800 7 16.471 16.471 16.471 2.578 5.78 5.78 5.74 5.75 5.544 5.57 5.544 5.524 1.5 5.244 0.26 6.12 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0	Latvia 102% 176 22 16.800 7 16.471 1. 1. 1. 1. 1. 235 329 5 329 5 329 5 9 225	Lithuania 102% 102 102% 102 102% 102%	Norway 102% 176 22 16.800 7 16.471 3 578 - 235 544 3 6 459 - 148 379 - 148 379 - 5 5 4 54	Sweden 102% 176 22 16.800 7 16.471 Unit EUR/year
Technical characteristics Technical characteristics Technical characteristics Natural gas boiler - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Tariffs Subsidies: Taxes and fees: Scrap value: Total cost	Category Annual efficiency - natural gas Auxillary electricity consumption - natural gas Technical lifetime (years) - natural gas Annual heat demand - individual house Effect need Natural gas consumption Cost category Annual loan costs Variable maintenance costs - natural gas Fixed maintenance costs - natural gas Natural gas price Auxillary electricity cost All electricity tariffs #REF! Subsidies Energy tax CO2 tax NOx tax Electricity tax on auxillary electricity Revenue	Data KWh/year years KWh/year kWh/year KW CDenmark Denmark Cass Cass Cass Cass Cass Cass Cass Ca	Denmark 102% 176 22 16.800 7 16.471 16.471 578 - - 235 290 4 11 64 - - 1 64 - - 1 61 - - - 1 - 38 1.206	Estonia Estonia 102% 176 22 16.800 7 16.471 Finland 1 1 1 1 1 1 1 1 1 1 1 1 1	Finland 102% 176 22 16.800 7 16.471 7 16.471 7 7 235 578 - 235 578 - 235 578 - 235 544 54 4 5 4 24 - 26 15 24 - 26 15 24 - 26 - 235 544 54 24 57 8 10 8 10 8 10 8 10 8 10 8 10 8 10 8 1	Latvia 102% 176 22 16.800 7 16.471 17.6 17.6 17.7 17.7 17.7 17.7 17.7 17	Lithuania 102% 176 22 16.800 7 16.471 Norway	Norway 102% 176 22 16.800 7 16.471 578 - 235 544 33 6 459 - 148 379 - 148 379 - 5 5 44 3379 -	Sweden 102% 1028 122 16.800 7 16.471 16.471 Unit EUR/year

Appendices

8.9 Firewood stove and electric water heater

price 2016	Category	Unit	Denmark	Estonia	Finland	Latvia	Lithuania	Norway	Sweden
Subsidies:	None		-			-		-	
	Energy tax	EUR/kWh	-			-	-	-	-
	CO2 tax	EUR/kWh	-		-	-	-	-	-
Taxes and fees:	NOxtax	EUR/kWh	-			-	-	-	-
	Electricity tax	EUR/kWh	0,12	0,00	0,02	0,00	0,00	0,02	0,03
	PSO (or similar tariff) for subsidy of other electricity production	EUR/kWb	0.03	0.01	0.01	0.03	0.02	0.00	
Tariffs:	Electricity local grid tariff	EUR/kWb	0.03	0.05	0.02	0,00	0.04	0.02	0.04
	Electricity system/transmission tariff	EUR/kWh	0,00	-	0.00	-	-	-	-
	Firewood price	EUR/kWh	0.07	0.02	0.05	0.02	0.02	0.07	0.03
Energy price, excl. tax etc.:	Electricity price	EUR/kWh	0.03	0.02	0.02	0.03	0.03	0.02	0.02
				-,	-,	-,		-,	
Technology costs	Category	Unit	Denmark	Estonia	Finland	Latvia	Lithuania	Norway	Sweden
	Variable maintenance costs - firewood	EUR/kWh	0			-		-	
Maintenance costs:	Fixed maintenance costs - firewood	EUR/unit/year	212,1422819	212	212	212	212	212	212
	Hardware costs - firewood	EUR/unit	2540	2.540	2.540	2.540	2.540	2.540	2.540
	Connection costs and other hardware costs - firewood	ELIR/up#							
Capital costs:	Installation costs - firewood	EUR/unit	762	-	-	-	-	-	-
	Total cost	EUR/unit	2202	2 202	2 202	2 202	2 202	2 202	2 202
	Loan period	Veare	15	3.302	3.302	3.302	3.302	3.302	3.302
Loan:	Annual loan costs	FURMear	319	3.19	3.19	318	3.19	319	318
Remaining technical lifetime	Remaining technical lifetime	LONVyear	3 10	3 10	310	310	310	3 10	3 10
Scrap value:	Revenue	FUR	-953	- 953	- 953	- 953	- 953	- 953	- 953
·		Lon	500	555	555	300	500	555	500
Technical characteristics	Category	Data	Denmark	Estonia	Finland	Latvia	Lithuania	Norway	Sweden
Technical characteristics	Category Annual efficiency - firewood	Data	Denmark 65%	Estonia 65%	Finland 65%	Latvia 65%	Lithuania 65%	Norway 65%	Sweden 65%
Technical characteristics	Category Annual efficiency - firewood Auxillary electricity consumption - firewood	Data kWh/year	Denmark 65% 3500	Estonia 65% 3.500	Finland 65% 3.500	Latvia 65% 3.500	Lithuania 65% 3.500	Norway 65% 3.500	Sweden 65% 3.500
Technical characteristics	Category Annual efficiency - firewood Auxillary electricity consumption - firewood Technical lifetime (years) - firewood	Data kWh/year years	Denmark 65% 3500 24	Estonia 65% 3.500 24	Finland 65% 3.500 24	Latvia 65% 3.500 24	Lithuania 65% 3.500 24	Norway 65% 3.500 24	Sweden 65% 3.500 24
Technical characteristics Technical characteristics	Category Annual efficiency - firewood Auxillary electricity consumption - firewood Technical lifetime (years) - firewood Annual heat demand - individual house	Data kWh/year years kWh/year	Denmark 65% 3500 24 13300	Estonia 65% 3.500 24 13.300	Finland 65% 3.500 24 13.300	Latvia 65% 3.500 24 13.300	Lithuania 65% 3.500 24 13.300	Norway 65% 3.500 24 13.300	Sweden 65% 3.500 24 13.300
Technical characteristics Technical characteristics	Category Annual efficiency - firewood Auxillary electricity consumption - firewood Technical lifetime (years) - firewood Annual heat demand - individual house Effect need	Data kWh/year years kWh/year kW	Denmark 65% 3500 24 13300 7	Estonia 65% 3.500 24 13.300 7	Finland 65% 3.500 24 13.300 7	Latvia 65% 3.500 24 13.300 7	Lithuania 65% 3.500 24 13.300 7	Norway 65% 3.500 24 13.300 7	Sweden 65% 3.500 24 13.300 7
Technical characteristics Technical characteristics	Category Annual efficiency - firewood Auxillary electricity consumption - firewood Technical lifetime (years) - firewood Annual heat demand - individual house Effect need Firewood consumption	Data kWh/year years kWh/year kW kWh/year	Denmark 65% 3500 24 13300 7 20461,53846	Estonia 65% 3.500 24 13.300 7 20.462	Finland 65% 3.500 24 13.300 7 20.462	Latvia 65% 3.500 24 13.300 7 20.462	Lithuania 65% 3.500 24 13.300 7 20.462	Norway 65% 3.500 24 13.300 7 20.462	Sweden 65% 3.500 24 13.300 7 20.462
Technical characteristics Technical characteristics	Category Annual efficiency - firewood Auxillary electricity consumption - firewood Technical lifetime (years) - firewood Annual heat demand - individual house Effect need Firewood consumption	Data kWh/year years kWh/year kW kWh/year	Denmark 65% 3500 24 13300 7 20461,53846	Estonia 65% 3.500 24 13.300 7 20.462	Finland 65% 3.500 24 13.300 7 20.462	Latvia 655% 3.500 24 13.300 7 20.462	Lithuania 65% 3.500 24 13.300 7 20.462	Norway 65% 3.500 24 13.300 7 20.462	Sweden 65% 3.500 24 13.300 7 20.462
Technical characteristics Technical characteristics Wood stove and electric water heater - annual	Category Annual efficiency - firewood Auxillary electricity consumption - firewood Technical lifetime (years) - firewood Annual heat demand - individual house Effect need Firewood consumption	Data kWh/year years kWh/year kW kWh/year	Denmark 655% 3500 24 13300 7 20461,53846	Estonia 65% 3.500 24 13.300 7 20.462	Finland 65% 3.500 24 13.300 7 20.462	Latvia 65% 3.500 24 13.300 7 20.462	Lithuania 65% 3.500 24 13.300 7 20.462	Norway 65% 3.500 24 13.300 7 20.462	Sweden 65% 3.500 24 13.300 7 20.462
Technical characteristics Technical characteristics Wood stove and electric water heater - annual consumer cost 2016	Category Annual efficiency - firewood Auxillary electricity consumption - firewood Technical lifetime (years) - firewood Annual heat demand - individual house Effect need Firewood consumption Cost category	Data kWh/year years kWh/year kW kWh/year Denmark	Denmark 655% 3500 24 13300 7 20461,53846 Estonia	Estonia 655% 3.500 24 13.300 7 20.462 Finland	Finland 65% 3.500 24 13.300 7 20.462 Latvia	Latvia 655% 3.500 24 13.300 7 20.462 Lithuania	Lithuania 65% 3.500 24 13.300 7 20.462 Norway	Norway 65% 3.500 24 13.300 7 20.462 Sweden	Sweden 65% 3.500 24 13.300 7 20.462 Unit
Technical characteristics Technical characteristics Technical characteristics Wood stove and electric water heater - annual consumer cost 2016 Capital costs:	Category Annual efficiency - firewood Auxillary electricity consumption - firewood Technical lifetime (years) - firewood Annual heat demand - individual house Effect need Firewood consumption Cost category Annual loan costs	Data kWh/year years kWh/year kW kWh/year Denmark 318	Denmark 65% 3500 24 13300 7 20461,53846 Estonia 318	Estonia 655% 3.500 24 13.300 7 20.462 Finland 318	Finland 655% 3.500 24 13.300 7 20.462 Latvia 318	Latvia 655% 3.500 24 13.300 7 20.462 Lithuania 318	Lithuania 655% 3.500 24 13.300 7 20.462 Norway 318	Norway 65% 3.500 24 13.300 7 20.462 Sweden 318	Sweden 65% 3.500 24 13.300 7 20.462 Unit EUR/year
Technical characteristics Technical characteristics Technical characteristics Wood stove and electric water heater - annual consumer cost 2016 Capital costs: Maintenance costs:	Category Annual efficiency - firewood Auxillary electricity consumption - firewood Technical lifetime (years) - firewood Annual heat demand - individual house Effect need Firewood consumption Cost category Annual loan costs Variable maintenance costs - firewood	Data kWh/year years kWh/year kW kWh/year Denmark 318 0	Denmark 65% 3500 24 13300 7 20461,53846 Stonia 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	Estonia 65% 3.500 24 13.300 7 20.462 Finland 318 0	Finland 655% 3.500 24 13.300 7 20.462 Latvia 318 0	Latvia 655% 3.500 24 13.300 7 20.462 Lithuania 318 0	Lithuania 65% 3.500 24 13.300 7 20.462 0 Norway 3.18 0	Norway 655% 3.500 24 13.300 7 20.462 Sweden 318 0	Sweden 65% 3.500 24 13.300 77 20.462 Unit EUR/year EUR/year
Technical characteristics Technical characteristics Wood stove and electric water heater - annual consumer cost 2016 Capital costs: Maintenance costs:	Category Annual efficiency - firewood Auxillary electricity consumption - firewood Technical lifetime (years) - firewood Annual heat demand - individual house Effect need Firewood consumption Cost category Annual loan costs Variable maintenance costs - firewood Fixed maintenance costs - firewood	Data kWh/year years kWh/year kW kWh/year Denmark 212,1422819	Denmark 655% 33500 24 13300 7 20461,53846 20461,53846 Estonia 318 0 212,1422819	Estonia 65% 3.500 24 13.300 7 20.462 Finland 318 0 212,14	Finland 655% 3.500 24 13.300 7 20.462 20.462 Latvia 318 0 212,14	Latvia 65% 3.500 24 13.300 7 20.462 Lithuania 318 0 212,1423	Lithuania 65% 3.500 24 13.300 7 20.462 Norway 318 0 212,142	Norway 65% 3.500 24 13.300 7 20.462 Sweden 318 0 212,14	Sweden 665% 3.500 24 13.300 7 20.462 20.462 Unit EUR/year EUR/year EUR/year
Technical characteristics Technical characteristics Wood stove and electric water heater - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.:	Category Annual efficiency - firewood Auxillary electricity consumption - firewood Technical lifetime (years) - firewood Annual heat demand - individual house Effect need Firewood consumption Cost category Annual loan costs Variable maintenance costs - firewood Fixed maintenance costs - firewood Fixed maintenance costs - firewood	Data kWh/year years kWh/year kW kWh/year Denmark 318 0 212,1422819 1.500	Denmark 655% 3500 24 13300 7 20461,53846 Estonia 8 8 8 0 212,1422819 395	Estonia 65% 3.500 24 13.300 7 20.462 Finland 318 0 212,14 962	Finland 65% 3.500 24 13.300 7 20.462 20.462 4 20.462 318 0 212,14 320	Latvia 655% 3.500 24 13.300 7 20.462 Lithuania 318 0 212,1423 373	Lithuania 655% 3.500 24 13.300 7 20.462 Norway 318 0 212,142 1.355	Norway 65% 3.500 24 13.300 7 20.462 Sweden 318 0 212,14 595	Sweden 65% 3.500 24 13.300 7 20.462 Vuit EUR/year EUR/year EUR/unit/year EUR/year
Technical characteristics Technical characteristics Technical characteristics Wood stove and electric water heater - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.:	Category Annual efficiency - firewood Auxillary electricity consumption - firewood Technical lifetime (years) - firewood Annual heat demand - individual house Effect need Firewood consumption Cost category Annual loan costs Variable maintenance costs - firewood Fixed maintenance costs - firewood Firewood price Electricity price	Data kWh/year years kWh/year kW kWh/year Denmark 318 0 212,1422819 1.500 94	Denmark 655% 3500 24 13300 7 20461,53846 20461,53846 8 5 5 5 5 318 0 212,1422819 395 75	Estonia 65% 3.500 24 13.300 7 20.462 6 20.462 7 8 7 8 8 0 212,14 962 70	Finland 65% 3.500 24 13.300 7 20.462 20.462 Latvia 318 0 212,14 320 91	Latvia 655% 3.500 24 13.300 7 20.462 20.462 Lithuania 318 0 212,1423 373 91	Lithuania 65% 3.500 24 13.300 7 20.462 20.462 8 Norway 318 0 212,142 1.355 64	Norway 65% 3.500 24 13.300 7 20.462 Sweden 318 0 212,14 595 64	Sweden 65% 3.500 24 13.300 7 20.462 20.462 Unit EUR/year EUR/year EUR/year EUR/year
Technical characteristics Technical characteristics Technical characteristics Wood stove and electric water heater - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs:	Category Annual efficiency - firewood Auxillary electricity consumption - firewood Technical lifetime (years) - firewood Annual heat demand - individual house Effect need Firewood consumption Cost category Annual loan costs Variable maintenance costs - firewood Fixed maintenance costs - firewood Fixed maintenance costs - firewood Firewood price Electricity price All electricity tariffs	Data bata kWh/year years kWh/year kW kWh/year Denmark 2012,1422819 1.500 94 226,66	Denmark 65% 3500 24 13300 7 20461,53846 20461,538665 20461,538666 20461,538666 20461,538666 20461,538666 20461,	Estonia 65% 3.500 24 13.300 7 20.462 70 318 00 212,14 962 70 122	Finland 655% 3.500 24 13.300 7 20.462 20.462 318 00 212,14 320 91 291	Latvia 655% 3.500 24 13.300 7 20.462 20.462 2 Lithuania 318 0 212,1423 373 91 180	Lithuania 65% 3.500 24 13.300 7 20.462 20.462 20.462 20.462 1.355 64 64 64	Norway 65% 3.500 24 13.300 7 20.462 Sweden 318 0 212,14 595 64 126	Sweden 65% 3.500 24 13.300 20.462 20.462 Unit EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year
Technical characteristics Technical characteristics Technical characteristics Wood stove and electric water heater - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs: Subsidies:	Category Annual efficiency - firewood Auxillary electricity consumption - firewood Technical lifetime (years) - firewood Annual heat demand - individual house Effect need Firewood consumption Cost category Annual loan costs Variable maintenance costs - firewood Fixed maintenance costs - firewood Fixed maintenance costs - firewood Firewood price Electricity price All electricity tariffs Subsidies	Data Data kWh/year years kWh/year kW kWh/year Denmark Denmark 0 212,1422819 1.500 94 266 0	Denmark 65% 3500 24 13300 7 20461,53846 2 5 5 5 1212,1422819 395 212,1422819 395 75 223 0	Estonia 65% 3.500 24 13.300 77 20.462 70 318 0 212,14 962 70 122 70 122	Finland 65% 3.500 24 13.300 7 20.462 20.462 2 2 2.12,14 320 91 291 291 0	Latvia 655% 3.500 24 13.300 7 20.462 20.462 2 Lithuania 318 0 212,1423 373 91 180 0	Lithuania 65% 3.500 24 13.300 7 20.462 0 20.462 0 212,142 1.355 64 64	Norway 65% 3.500 24 13.300 7 20.462 Sweden 318 0 212,14 595 64 126 0	Sweden 65% 3.500 24 13.300 77 20.462 20.462 Unit EUR/year EUR/year EUR/unit/year EUR/year EUR/year EUR/year
Technical characteristics Technical characteristics Wood stove and electric water heater - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs: Subsidies:	Category Annual efficiency - firewood Auxillary electricity consumption - firewood Technical lifetime (years) - firewood Annual heat demand - individual house Effect need Firewood consumption Cost category Annual loan costs Variable maintenance costs - firewood Fixed maintenance costs - firewood Fixed maintenance costs - firewood Firewood price Electricity price All electricity tariffs Subsidies Energy tax	Data kWh/year years kWh/year kW kWh/year Denmark 0 212,1422819 1.500 94 266 0 0	Denmark 655% 3500 24 13300 7 20461,53846 Estonia 318 0 212,1422819 395 75 2223 0 0	Estonia 65% 3.500 24 13.300 7 20.462 20.462 70 212,14 962 70 2122 00 1222 00	Finland 65% 3.500 24 13.300 7 20.462 20.462 318 0 212,14 320 91 291 0 0 212,14	Latvia 655% 3.500 24 13.300 7 20.462 Lithuania 318 0 212,1423 373 91 180 0 0	Lithuania 655% 3.500 24 13.300 7 20.462 20.462 Norway 318 0 212,142 1.355 64 64 64 0	Norway 65% 3.500 24 13.300 7 20.462 Sweden 318 0 212,14 595 64 126 0 0	Sweden 65% 3.500 24 13.300 7 20.462 0 0 0 0 0 0 0 0 0 0 0 0 0
Technical characteristics Technical characteristics Technical characteristics Wood stove and electric water heater - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs: Subsidies: Taxes and fees;	Category Annual efficiency - firewood Auxillary electricity consumption - firewood Technical lifetime (years) - firewood Annual heat demand - individual house Effect need Firewood consumption Cost category Annual loan costs Variable maintenance costs - firewood Fixed maintenance costs - firewood Fixed maintenance costs - firewood Fixed maintenance costs - firewood Firewood price Electricity tariffs Subsidies Energy tax CO2 tax	Data kWh/year years kWh/year kW kWh/year Denmark 0 212,1422819 1.500 94 2266 0 0	Denmark 655% 3500 24 13300 7 20461,53846 20461,53846 8 8 8 0 212,1422819 395 75 223 0 0 - -	Estonia 65% 3.500 24 13.300 7 20.462 20.462 70 212,14 962 70 212,14 962 70 122 00	Finland 65% 3.500 24 13.300 7 20.462 20.462 20.462 212,14 320 91 2212,14 320 91 291 00 -	Latvia 655% 3.500 24 13.300 7 20.462 Lithuania 318 0 212,1423 373 91 180 0 0 -	Lithuania 65% 3.500 24 13.300 7 20.462 20.462 8 Norway 318 0 212,142 1.355 64 64 64 0 0	Norway 65% 3.500 24 13.300 7 20.462 Sweden 318 0 212,14 595 64 126 0 0 -	Sweden 65% 3.500 24 13.300 7 20.462 20.462 Unit EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year
Technical characteristics Technical characteristics Wood stove and electric water heater - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs: Subsidies: Taxes and fees:	Category Annual efficiency - firewood Auxillary electricity consumption - firewood Technical lifetime (years) - firewood Annual heat demand - individual house Effect need Firewood consumption Cost category Annual loan costs Variable maintenance costs - firewood Fixed maintenance costs - firewood Fixed maintenance costs - firewood Fixed maintenance costs - firewood Firewood price Electricity price All electricity tariffs Subsidies Energy tax CO2 tax NOx tax	Data Data kWh/year kWh/year kW kWh/year Denmark Denmark 0 212,1422819 1.500 94 266 0 0 - - - -	Denmark 655% 3500 24 13300 7 20461,53846 20461,54844 20461,54844 20461,54844 20461,54844 20461,54844 20461,54844 20461,54844 20461,54844 20461,54844 20461,54844 20461,54844 20461,54844 20461,54844 20461,54844 20461,5484420061,54844 20461,54844 20461,5484420461,54844 20461,548444420454 20461,54844200000000000000000	Estonia 65% 3.500 24 13.300 7 20.462 20.462 70 212,14 962 70 212,14 962 70 122 0 0	Finland 655% 3.500 24 13.300 7 20.462 20.462 20.462 212,14 320 212,14 320 91 2212,14 320 91 291 00 -	Latvia 655% 3.500 24 13.300 7 20.462 20.462 Lithuania 318 0 212,1423 373 91 180 0 0 - - -	Lithuania 655% 3.500 24 13.300 7 20.462 20.462 20.462 20.462 20.462 1.355 64 64 64 64 0 - -	Norway 65% 3.500 24 13.300 7 20.462 20.462 Sweden 318 0 212,14 595 64 126 0 0 -	Sweden 5% 3.500 24 13.300 7 20.462 20.4
Technical characteristics Technical characteristics Wood stove and electric water heater - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs: Subsidies: Taxes and fees:	Category Annual efficiency - firewood Auxillary electricity consumption - firewood Technical lifetime (years) - firewood Annual heat demand - individual house Effect need Firewood consumption Cost category Annual loan costs Variable maintenance costs - firewood Fixed maintenance costs - firewood Fixed maintenance costs - firewood Firewood price Electricity price All electricity tariffs Subsidies Energy tax CO2 tax NOx tax Electricity tax on auxillary electricity	Data Data Comparison Data KWh/year years KWh/year KW kWh/year Denmark Denmark 200 212,1422819 1.500 212,1422819 1.500 2412,1422819 1.500 2412,1422819 241 241 241 241 241 241 241 241 241 241	Denmark 655% 3500 24 13300 7 20461,53846 2 20461,53846 318 0 212,1422819 395 75 223 0 0 212,1422819 395 75 223	Estonia 65% 3.500 24 13.300 77 20.462 70 318 00 212,14 962 700 212,14 962 700 1222 00 - -	Finland 655% 3.500 24 13.300 7 20.462 2 2 4 2 4 2 9 1 2 9 1 2 9 1 2 9 1 2 9 1 0 0 - - - 4	Latvia 655% 3.500 24 13.300 7 20.462 2 2 2 4 2 13.300 7 20.462 2 2 13.300 7 2 2.0.462 2 2 13.300 7 1 2.0.462 2 2 10.00 7 10.00 7 10.00 7 10.00 7 10.00 7 10.00 7 10.00 7 10.00 7 10.00 7 10.00 7 10.00 7 10.00 7 10.00 7 10.00 7 10.00 7 10.00 7 10.00 7 10.00 7 10.00 7 10.00 10.00 7 10.00 10.00 7 10.00 1	Lithuania 655% 3.500 24 13.300 7 20.462 2 20.462 2 20.462 2 2 2.0,462 2 2 1.355 64 64 64 64 0 0 - - - -	Norway 65% 3.500 24 13.300 7 20.462 318 00 212,14 595 64 126 00 - - - - 108	Sweden 65% 3.500 24 13.300 20.462 20.462 Unit EUR/year
Technical characteristics Technical characteristics Wood stove and electric water heater - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs: Subsidies: Taxes and fees: Capital costs:	Category Annual efficiency - firewood Auxillary electricity consumption - firewood Technical lifetime (years) - firewood Annual heat demand - individual house Effect need Firewood consumption Cost category Annual loan costs Variable maintenance costs - firewood Fixed maintenance costs - firewood Fixed maintenance costs - firewood Firewood price Electricity price All electricity tariffs Subsidies Energy tax CO2 tax NOx tax Electricity tax on auxillary electricity Revenue	Data Data Comparison Data KWh/year years KWh/year KW kWh/year C Denmark C Denmark C Denmark C C C C C C C C C C C C C C C C C C C	Denmark 65% 3500 24 13300 7 20461,53846 7 5 20461,53846 2 2 12,1422819 395 212,1422819 395 223 0 0 212,1422819 395 223 0 0 212,1422819 395 223 0 0 212,1422819 395 223 0 0 212,1422819 395 223 0 0 212,1422819 395 223 0 0 212,1422819 395 223 0 0 212,1422819 395 223 0 0 212,1422819 395 223 223 224 224 224 224 224 224 224 224	Estonia 65% 3.500 24 13.300 77 20.462 70 318 0 212,14 962 70 122 70 122 0 0 122 70 122 70 122	Finland 65% 3.500 24 13.300 7 20.462 2 2 4 2 4 318 0 2 12,14 320 91 2 91 2 91 0 0 1 2 91 0 0 1 2 91 2 9	Latvia 655% 3.500 24 13.300 7 20.462 2 20.462 2 2 13.300 7 2 212,1423 373 91 180 0 2 212,1423 373 91 180 0 2 12,1423 373 91 180 0 2 12,1423 373 91 180 0 2 12,1423 373 91 180 0 2 4 4 4 4 4 4 4 4 4 4 5 5 6 5 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	Lithuania 65% 3.500 24 13.300 7 20.462 0 20.462 0 212,142 1.355 64 64 64 0 0 - - 60 -64	Norway 65% 3.500 24 13.300 7 7 20.462 318 0 212,14 595 64 126 0 0 212,14 595 64 126 0 0 - - 108 -64	Sweden 5% 3.500 24 3.300 24 24 3.00 20 20.402
Technical characteristics Technical characteristics Wood stove and electric water heater - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs: Subsidies: Taxes and fees: Carap value: Total cost	Category Annual efficiency - firewood Auxillary electricity consumption - firewood Technical lifetime (years) - firewood Annual heat demand - individual house Effect need Firewood consumption Cost category Annual loan costs Variable maintenance costs - firewood Fixed maintenance costs - firewood Fixed maintenance costs - firewood Firewood price Electricity price All electricity tariffs Subsidies Energy tax CO2 tax NOx tax Electricity tax on auxillary electricity Revenue	Data Wh/year years kWh/year kW kWh/year Denmark Denmark 318 0 212,1422819 1.500 94 266 0 94 266 0 0 1.500 94 266 0 0 1.500 94 266 0 0 1.500 94 266 0 0 1.500 94 266 0 0 1.500 94 2.742819 1.500 94 2.66 0 0 1.500 94 2.66 0 0 0 0 0 0 0 0 0 0 0 0 0	Denmark 655% 3500 24 13300 7 20461,53846 20461,53846 20461,53846 20461,53846 212,1422819 395 75 2223 0 0 212,1422819 395 75 223 0 0 212,1422819 395 75 223 0 0 1 6 1 6 1 6 1 6 4 1,175	Estonia 65% 3.500 24 13.300 7 20.462 20.462 70 212,14 962 70 212,14 962 70 212,14 962 70 212,14 962 70 212,14 962 70 212,14 962 70 212,14 962 70 212,14 962 70 70 212,14 962 70 21,15 962 70 70 21,15 962 70 70 21,15 962 70 70 21,15 962 70 70 21,15 962 70 70 21,15 962 70 70 21,15 962 70 70 21,15 70 70 70 70 70 70 70 70 70 70 70 70 70	Finland 65% 3.500 24 13.300 7 20.462 20.462 20.462 318 0 212,14 320 91 291 0 0 212,14 320 91 291 0 0 - - - 4 - 64 1.172	Latvia 655% 3.500 24 13.300 7 20.462 Lithuania 318 0 212,1423 373 91 180 0 212,1423 373 91 180 0 0 212,1423 373 91 180 0 0 212,1423 373 91 180 0 0 2 12,1423 373 91 180 0 0 2 12,1423 373 91 180 0 0 2 12,1423 373 91 180 0 0 2 12,1423 373 91 180 0 0 2 12,1423 373 91 11,1300 2 12,1423 11,1300 11,1423 11,14333 11,14333 11,14333 11,14333 11,14333 11,1433	Lithuania 65% 3.500 24 13.300 7 20.462 20.462 8 0 212,142 1.355 64 64 64 0 0 - - - - - 60 - 64 2.010	Norway 65% 3.500 24 13.300 7 20.462 8 weden 318 0 212,14 595 64 126 0 0 - - - - 108 -64 1.359	Sweden 65% 3.500 24 13.300 7 20.462 Unit EUR/year

8.10Oil boiler

Drice 2016	Category								
	···	Unit	Denmark	Estonia	Finland	Latvia	Lithuania	Norway	Sweden
Subsidies:	None		-	-	-	-	-	-	-
	Energy tax	EUR/kWh	0,03	0,04	0,01	0,01	0,00	0,02	0,01
Taxes and fees:	CO2 tax	EUR/kWh	0,01	-	0,01	0,00	-	0,01	0,03
	NOxtax	EUR/kWh	0,00	-	-	0,00	-	-	-
	Electricity tax	EUR/kWh	0,12	0,00	0,02	0,00	0,00	0,02	0,03
	PSO (or similar tariff) for subsidy of other electricity production	FUR/kWh	0.03	0.01	0.01	0.03	0.02	0.00	_
Tariffs:	Electricity local grid tariff	EUR/kW/b	0.03	0.05	0.02	0.06	0.04	0.02	0.04
	Electricity system/transmission tariff	EUD/W/b	0,00	0,00	0,02	0,00	0,04	0,02	0,04
		EURANA	0,01	-	0,00	-	-	-	-
Energy price, excl. tax etc.:		EUR/KVVN	0,06	0,04	0,04	0,04	0,04	0,05	0,04
	Electricity price	EUR/kWh	0,03	0,02	0,02	0,03	0,03	0,02	0,02
Technology costs	Category	Unit	Denmark	Estonia	Finland	Latvia	Lithuania	Norway	Sweden
Maintenance costs:	Variable maintenance costs - oil boiler	EUR/kWh	0	-	-	-	-	-	-
	Fixed maintenance costs - oil boiler	EUR/unit/year	270	270	270	270	270	270	270
	Hardware costs - oil boiler	EUR/unit	4620	4.620	4.620	4.620	4.620	4.620	4.620
	Connection costs and other hardware costs - oil boiler	EUR/unit	0	-	-		-		-
Capital costs:	Installation costs - oil boiler	EUR/unit	1980	1980	1980	1980	1980	1980	1980
		Lorvania	1000	1.000	1.000	1.500	1.500	1.500	1.000
	Total cost	EUR/unit	6600	6.600	6.600	6.600	6.600	6.600	6.600
1	Loan period	years	15	15	15	15	15	15	15
Loan:	Annual loan costs	EUR/year	636	636	636	636	636	636	636
Remaining technical lifetime	Remaining technical lifetime	vears	5	5	5	5	5	5	5
Scrap value:	Revenue	EUR	- 1.155	- 1.155	- 1.155	- 1, 155	- 1,155	- 1, 155	- 1, 155
Technical characteristics	Category	Data	Deserved	Fatania	Fishered	L - tuite	1. Maria and a	Manual	Ourselaur
Technical characteristics	Category	Data	Denmark	Estonia	Finland	Latvia	Lithuania	Norway	Sweden
Technical characteristics	Category Annual efficiency - oil boiler	Data	Denmark 100%	Estonia 100%	Finland 100%	Latvia 100%	Lithuania 100%	Norway 100%	Sweden 100%
Technical characteristics	Category Annual efficiency - oil boiler Auxillary electricity consumption - oil boiler	Data kWh/year	Denmark 100% 406,4	Estonia 100% 406	Finland 100% 406	Latvia 100% 406	Lithuania 100% 406	Norway 100% 406	Sweden 100% 406
Technical characteristics Technical characteristics	Category Annual efficiency - oil boiler Auxillary electricity consumption - oil boiler Technical lifetime (years) - oil boiler	Data kWh/year years	Denmark 100% 406,4 20	Estonia 100% 406 20	Finland 100% 406 20	Latvia 100% 406 20	Lithuania 100% 406 20	Norway 100% 406 20	Sweden 100% 406 20
Technical characteristics Technical characteristics	Category Annual efficiency - oil boiler Auxillary electricity consumption - oil boiler Technical lifetime (years) - oil boiler Annual heat demand - individual house	Data kWh/year years kWh/year	Denmark 100% 406,4 20 16800	Estonia 100% 406 20 16.800	Finland 100% 406 20 16.800	Latvia 100% 406 20 16.800	Lithuania 100% 406 20 16.800	Norway 100% 406 20 16.800	Sweden 100% 406 20 16.800
Technical characteristics Technical characteristics	Category Annual efficiency - oil boiler Auxillary electricity consumption - oil boiler Technical lifetime (years) - oil boiler Annual heat demand - individual house Effect need	Data kWh/year years kWh/year kW	Denmark 100% 406,4 20 16800 7	Estonia 100% 406 20 16.800 7	Finland 100% 406 20 16.800 7	Latvia 100% 406 20 16.800 7	Lithuania 100% 406 20 16.800 7	Norway 100% 406 20 16.800 7	Sweden 100% 406 20 16.800 7
Technical characteristics Technical characteristics	Category Annual efficiency - oil boiler Auxillary electricity consumption - oil boiler Technical lifetime (years) - oil boiler Annual heat demand - individual house Effect need Oil consumption	Data kWh/year years kWh/year kW kWh/year	Denmark 100% 406,4 20 16800 7 16800	Estonia 100% 406 20 16.800 7 16.800	Finland 100% 406 20 16.800 7 16.800	Latvia 100% 406 20 16.800 7 16.800	Lithuania 100% 406 20 16.800 7 16.800	Norway 100% 406 20 16.800 7 16.800	Sweden 100% 406 20 16.800 7 16.800
Technical characteristics Technical characteristics	Category Annual efficiency - oil boiler Auxillary electricity consumption - oil boiler Technical lifetime (years) - oil boiler Annual heat demand - individual house Effect need Oil consumption	Data kWh/year years kWh/year kW kWh/year	Denmark 100% 406,4 20 16800 7 16800	Estonia 100% 406 20 16.800 7 16.800	Finland 100% 406 20 16.800 7 16.800	Latvia 100% 406 20 16.800 7 16.800	Lithuania 100% 406 20 16.800 7 16.800	Norway 100% 406 20 16.800 7 16.800	Sweden 100% 406 20 16.800 7 16.800
Technical characteristics Technical characteristics Oil boiler - annual consumer cost 2016	Category Annual efficiency - oil boiler Auxillary electricity consumption - oil boiler Technical lifetime (years) - oil boiler Annual heat demand - individual house Effect need Oil consumption	Data kWh/year years kWh/year kW kWh/year	Denmark 100% 406,4 20 16800 7 16800	Estonia 100% 406 20 16.800 70 16.800	Finland 100% 406 20 16.800 7 16.800	Latvia 100% 406 20 16.800 7 16.800	Lithuania 100% 406 20 16.800 7 16.800	Norway 100% 406 20 16.800 7 16.800	Sweden 100% 406 20 16.800 7 16.800
Technical characteristics Technical characteristics Oil boiler - annual consumer cost 2016 Capital costs:	Category Annual efficiency - oil boiler Auxillary electricity consumption - oil boiler Technical lifetime (years) - oil boiler Annual heat demand - individual house Effect need Oil consumption Cost category Annual loan costs	Data kWh/year years kWh/year kW kWh/year Denmark	Denmark 100% 406,4 20 16800 7 16800 25 5 5 5 6 36	Estonia 100% 406 20 16.800 7 16.800 Finland 636	Finland 100% 406 20 16.800 7 16.800 Latvia	Latvia 100% 406 20 16.800 7 16.800 Lithuania	Lithuania 100% 406 20 16.800 7 16.800 Norway	Norway 100% 406 20 16.800 7 16.800 Sweden 636	Sweden 100% 406 20 16.800 7 16.800 Unit EUR/vear
Technical characteristics Technical characteristics Oil boiler - annual consumer cost 2016 Capital costs:	Category Annual efficiency - oil boiler Auxillary electricity consumption - oil boiler Technical lifetime (years) - oil boiler Annual heat demand - individual house Effect need Oil consumption Cost category Annual loan costs Variable maintenance costs - oil boiler	Data kWh/year years kWh/year kW kWh/year Denmark 636	Denmark 100% 406,4 20 16800 7 16800 5 5 5 5 6 3 6 3 6 3 6 3 6 3 6 3 6 3 6 3	Estonia 100% 406 20 16.800 77 16.800 Finland 636	Finland 100% 406 20 16.800 77 16.800 Latvia	Latvia 100% 406 20 16.800 7 16.800 16.800 Lithuania	Lithuania 100% 406 20 16.800 7 16.800 Norway 636	Norway 100% 406 20 16.800 7 16.800 Sweden 636	Sweden 100% 406 20 16.800 7 16.800 Unit EUR/year EUR/year
Technical characteristics Technical characteristics Technical characteristics Oll boiler - annual consumer cost 2016 Capital costs: Maintenance costs:	Category Annual efficiency - oil boiler Auxillary electricity consumption - oil boiler Technical lifetime (years) - oil boiler Annual heat demand - individual house Effect need Oil consumption Cost category Annual loan costs Variable maintenance costs - oil boiler Eixed maintenance costs - oil boiler	Data kWh/year years kWh/year kW kWh/year Denmark 636 0	Denmark 100% 406,4 20 16800 7 16800 5 5 5 5 6 36 6 36 6 36 0	Estonia 100% 406 20 16.800 7 16.800 Finland 636 0 0	Finland 100% 406 20 16.800 7 16.800 Latvia 636 0 0	Latvia 100% 406 20 16.800 7 16.800 Lithuania 636 0	Lithuania 100% 406 20 16.800 7 16.800 Nonway 636 0	Norway 100% 406 20 16.800 7 16.800 Sweden 636 0	Sweden 100% 406 20 16.800 7 16.800 Unit EUR/year EUR/year
Technical characteristics Technical characteristics Oil boiler - annual consumer cost 2016 Capital costs: Maintenance costs:	Category Annual efficiency - oil boiler Auxillary electricity consumption - oil boiler Technical lifetime (years) - oil boiler Annual heat demand - individual house Effect need Oil consumption Cost category Annual loan costs Variable maintenance costs - oil boiler Fixed maintenance costs - oil boiler	Data kWh/year years kWh/year kW kWh/year Denmark 636 0 270	Denmark 100% 406,4 20 16800 7 16800 5 5 5 5 6 36 6 36 6 36 0 0 270	Estonia 100% 406 20 16.800 7 16.800 Finland 636 0 0 270	Finland 100% 406 20 16.800 7 16.800 4 636 636 0 0 270	Latvia 100% 406 20 16.800 7 16.800 20 Ltthuania 636 0 0 270	Lithuania 100% 406 20 16.800 7 16.800 800 800 800 800 800 800 800 800 800	Norway 100% 406 20 16.800 7 16.800 5 8 weden 636 0 0 270	Sweden 100% 406 20 16.800 7 16.800 Unit EUR/year EUR/year EUR/year
Technical characteristics Technical characteristics Oil boiler - annual consumer cost 2016 Capital costs: Maintenance costs:	Category Annual efficiency - oil boiler Auxillary electricity consumption - oil boiler Technical lifetime (years) - oil boiler Annual heat demand - individual house Effect need Oil consumption Cost category Annual loan costs Variable maintenance costs - oil boiler Fixed maintenance costs - oil boiler	Data kWh/year years kWh/year kW kWh/year Denmark 636 0 270	Denmark 100% 406,4 20 16800 7 16800 Estonia 636 0 0 270	Estonia 100% 406 20 16.800 7 16.800 Finland 636 0 0 270	Finland 100% 406 20 16.800 7 16.800 4 636 636 0 270	Latvia 100% 406 20 16.800 7 16.800 16.800 20 Lithuania 636 0 0 270	Lithuania 100% 406 20 16.800 7 16.800 800 800 800 800 800 800 800 800 800	Norway 100% 406 20 16.800 7 16.800 8 Sweden 636 0 0 270	Sweden 100% 406 20 16.800 7 16.800 Unit EUR/year EUR/year EUR/unit/year
Technical characteristics Technical characteristics Technical characteristics Oli boiler - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.:	Category Annual efficiency - oil boiler Auxillary electricity consumption - oil boiler Technical lifetime (years) - oil boiler Annual heat demand - individual house Effect need Oil consumption Cost category Annual loan costs Variable maintenance costs - oil boiler Fixed maintenance costs - oil boiler Oil price	Data kWh/year years kWh/year kW kWh/year Denmark 636 0 270 1.059	Denmark 100% 406,4 20 16800 7 16800 5 5 5 5 6 36 6 36 6 36 6 36 6 36 6 36	Estonia 100% 406 20 16.800 7 16.800 636 636 0 0 270	Finland 100% 406 20 16.800 7 16.800 4 636 636 0 270	Latvia 100% 406 20 16.800 7 16.800 16.800 Lithuania 636 0 270 610	Lithuania 100% 406 20 16.800 7 16.800 16.800 808	Norway 100% 406 20 16.800 7 16.800 8 Sweden 636 0 0 270	Sweden 100% 406 20 16.800 7 16.800 Unit EUR/year EUR/unit/year EUR/year
Technical characteristics Technical characteristics Technical characteristics Oil boiler - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.:	Category Annual efficiency - oil boiler Auxillary electricity consumption - oil boiler Technical lifetime (years) - oil boiler Annual heat demand - individual house Effect need Oil consumption Cost category Annual loan costs Variable maintenance costs - oil boiler Fixed maintenance costs - oil boiler Oil price Electricity price	Data kWh/year years kWh/year kW kWh/year Denmark 636 0 270 1.059 11	Denmark 100% 406,4 20 16800 7 16800 5 5 5 6 36 6 36 6 36 6 36 6 36 6 36 7 13 7 13	Estonia 100% 406 20 16.800 7 16.800 6 36 6 36 6 36 6 36 6 36 6 36 6 36 6	Finland 100% 406 20 16.800 7 16.800 4 6.360 636 636 0 0 270 734	Latvia 100% 406 20 16.800 7 16.800 7 16.800 8 16.800 6 16.800 2 70 6 10 270 6 10	Lithuania 100% 406 20 16.800 7 16.800 16.800 0 808 808	Norway 100% 406 20 16.800 7 16.800 8 5weden 636 0 0 270 6558	Sweden 100% 406 20 16.800 7 16.800 Unit EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year
Technical characteristics Technical characteristics Technical characteristics Oli boiler - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs:	Category Annual efficiency - oil boiler Auxillary electricity consumption - oil boiler Technical lifetime (years) - oil boiler Technical lifetime (years) - oil boiler Annual heat demand - individual house Effect need Oil consumption Cost category Annual loan costs Variable maintenance costs - oil boiler Fixed maintenance costs - oil boiler Oil price Electricity price All electricity tariffs	Data kWh/year years kWh/year kW kWh/year Denmark 0 270 1.059 11 31	Denmark 100% 406,4 20 16800 7 16800 5 5 5 636 6 3 6 3 6 3 6 3 6 3 6 3 6 3 6	Estonia 100% 406 20 16.800 77 16.800 500 500 500 500 500 500 500 500 500	Finland 100% 406 20 16.800 7 16.800 4 636 636 0 270 270 734 11	Latvia 100% 406 20 16.800 7 16.800 Lithuania 636 0 270 610 610 11	Lithuania 100% 406 20 16.800 7 16.800 8 808 270 808 8 7 7	Norway 100% 406 20 16.800 7 16.800 8 8 8 0 0 270 658 658 7 7 15	Sweden 100% 406 20 16.800 7 16.800 Unit EUR/year EUR/year EUR/year EUR/year EUR/year
Technical characteristics Technical characteristics Technical characteristics Oil boiler - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs: Subsidies:	Category Annual efficiency - oil boiler Auxillary electricity consumption - oil boiler Technical lifetime (years) - oil boiler Annual heat demand - individual house Effect need Oil consumption Cost category Annual loan costs Variable maintenance costs - oil boiler Fixed maintenance costs - oil boiler Oil price Electricity price All electricity tariffs Subsidies	Data kWh/year years kWh/year kW kWh/year benmark 636 00 2700 1.059 11 1.059 11	Denmark 100% 406,4 20 16800 7 16800 8 5 5 636 0 270 270 7 13 9 26 20 9	Estonia 100% 406 20 16.800 70 16.800 636 636 0 2700 2708 8 8 8 8 14	Finland 100% 406 20 16.800 77 16.800 636 636 0 270 2734 734 11 34	Latvia 100% 406 20 16.800 7 16.800 16.800 270 610 610 11 11 21	Lithuania 100% 406 20 16.800 7 16.800 800 800 270 8008 7 7 7 8008	Norway 100% 406 20 16.800 7 16.800 8 8 8 6 36 6 36 6 36 6 36 7 7 15 6 0	Sweden 100% 406 20 16.800 7 16.800 Unit EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year
Technical characteristics Technical characteristics Technical characteristics Oil boiler - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs: Subsidies:	Category Annual efficiency - oil boiler Auxillary electricity consumption - oil boiler Technical lifetime (years) - oil boiler Annual heat demand - individual house Effect need Oil consumption Cost category Annual loan costs Variable maintenance costs - oil boiler Fixed maintenance costs - oil boiler Oil price Electricity price All electricity tariffs Subsidies Energy tax	Data kWh/year years kWh/year kW kWh/year Denmark 636 0 270 1.059 11 31 0 446	Denmark 100% 406,4 20 16800 7 16800 8 5 636 0 270 1 270 1 270 1 270 1 270 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 2 1 2 2 2 2 2 2 2 2 2 2 2 2 2	Estonia 100% 406 20 16.800 70 Finland 636 0 2700 2700 2700 8 8 8 8 8 14 0 0	Finland 100% 406 20 16.800 73 636 636 0 270 270 734 11 34 0 0 96	Latvia 100% 406 20 16.800 7 16.800 4	Lithuania 100% 406 20 16.800 7 16.800 800 636 0 270 636 7 808 7 7 7 0 0	Norway 100% 406 20 16.800 7 16.800 636 636 0 270 658 7 658 7 7 15	Sweden 100% 406 20 16.800 7 16.800 Unit EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year
Technical characteristics Technical characteristics Technical characteristics Oil boiler - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs: Subsidies:	Category Annual efficiency - oil boiler Auxillary electricity consumption - oil boiler Technical lifetime (years) - oil boiler Annual heat demand - individual house Effect need Oil consumption Cost category Annual loan costs Variable maintenance costs - oil boiler Fixed maintenance costs - oil boiler Electricity price All electricity tariffs Subsidies Energy tax CO2 tax	Data kWh/year years kWh/year kW kWh/year Denmark 6336 0 270 1.059 1.1 3.1 0 4.46 103,02	Denmark 100% 406,4 20 16800 7 16800 Estonia 636 0 270 270 1713 9 26 26 0 0 275 1	Estonia 100% 406 20 16.800 70 636 636 00 270 708 8 708 8 8 14 00 118 112,17	Finland 100% 406 20 16.800 73 636 636 0 270 270 734 734 11 34 0 96 15,66	Latvia 100% 406 20 16.800 7 16.800 270 16.800 0 270 610 270 11 1221 0 0 36	Lithuania 100% 406 20 16.800 7 16.800 800 800 270 808 7 7 7 0 0 291 217,64	Norway 100% 406 20 16.800 7 16.800 636 636 0 270 658 7 658 7 15 0 0 151	Sweden 100% 406 20 16.800 7 16.800 16.800 20 16.800 20 20 20 20 20 20 20 20 20 20 20 20 2
Technical characteristics Technical characteristics Technical characteristics Oil boiler - annual consumer Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs: Subsidies: Taxes and fees:	Category Annual efficiency - oil boiler Auxillary electricity consumption - oil boiler Technical lifetime (years) - oil boiler Annual heat demand - individual house Effect need Oil consumption Cost category Annual loan costs Variable maintenance costs - oil boiler Fixed maintenance costs - oil boiler Electricity price All electricity tariffs Subsidies Energy tax CO2 tax NOX tax	Data kWh/year years kWh/year kW kWh/year Denmark 636 0 270 1.059 1.059 1.1 3.1 0 446 103,02 2,04	Denmark 100% 406,4 20 16800 7 16800 Estonia 636 0 0 270 713 9 26 0 0 755 0 - 0	Estonia 100% 406 20 16.800 70 636 636 0 270 708 8 3 8 14 14 0 0 118, 12,17 -	Finland 100% 406 20 16.800 7 16.800 636 636 0 270 734 734 11 34 0 0 96 15,66 0,15	Latvia 100% 406 20 16.800 7 16.800 6 16 6 10 270 6 10 270 6 10 270 6 10 11 1 21 0 0 36 -	Lithuania 100% 406 20 16.800 7 16.800 4 0 0 0 2 0 2 0 0 2 70 7 7 7 7 0 0 2 91 2 17,64 0	Norway 100% 406 20 16.800 7 16.800 636 636 0 270 658 7 658 7 15 0 0 151 570,75	Sweden 100% 406 20 16.800 7 16.800 4 16.800 10 16.800 10 16.800 10 16.800 10 16.800 10 16.800 10 16.800 10 16.800 10 16.800 10 16.800 10 16.800 10 16.800 10 16.800 10 16.800 10 16.800 10 16.800 10 10 10 10 10 10 10 10 10 10 10 10 1
Technical characteristics Technical characteristics Technical characteristics Oil boiler - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs: Subsidies: Taxes and fees:	Category Annual efficiency - oil boiler Auxillary electricity consumption - oil boiler Technical lifetime (years) - oil boiler Annual heat demand - individual house Effect need Oil consumption Cost category Annual loan costs Variable maintenance costs - oil boiler Fixed maintenance costs - oil boiler Fixed maintenance costs - oil boiler Oil price Electricity price All electricity tariffs Subsidies Energy tax CO2 tax NOx tax Electricity tax on auxillary electricity	Data kWh/year years kWh/year kW kWh/year Denmark 0 0 270 1.059 1.11 311 0 446 103,02 2,04 48	Denmark 100% 406,4 20 16800 7 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	Estonia 100% 406 20 16.800 70 16.800 0 708 636 0 0 270 708 8 14 0 112,17 - 9	Finland 100% 406 20 16.800 7 16.800 6 36 6 36 6 36 7 34 7 34 7 34 7 34 10 7 34 6 36 6 36 0 7 34 7 34 7 34 7 34 7 34 7 34 7 34 7	Latvia 100% 406 20 16.800 7 16.800 6 16.800 0 270 6 10 270 6 10 270 6 10 270 6 10 270 0 21 10 21 0 0 36 2.0 0	Lithuania 100% 406 20 16.800 7 16.800 8 0 0 2 7 7 7 7 7 7 7 7 0 0 2217,64 - 7	Norway 100% 406 20 16.800 7 16.800 8 8 8 6 3 6 3 6 3 6 3 6 3 7 7 15 0 0 151 5 70,75 5 70,75 - 13	Sweden 100% 406 20 16.800 7 16.800 4 16.800 10 10 10 10 10 10 10 10 10 10 10 10 1
Technical characteristics Technical characteristics Technical characteristics Oil boiler - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs: Subsidies: Taxes and fees: Scrap value:	Category Annual efficiency - oil boiler Auxillary electricity consumption - oil boiler Technical lifetime (years) - oil boiler Technical lifetime (years) - oil boiler Annual heat demand - individual house Effect need Oil consumption Cost category Annual loan costs Variable maintenance costs - oil boiler Fixed maintenance costs - oil boiler Oil price Electricity price All electricity tariffs Subsidies Energy tax CO2 tax NOx tax Electricity tax on auxillary electricity Revenue	Data kWh/year years kWh/year kW kWh/year Denmark 636 0 0 2700 1.059 1.059 1.059 1.059 1.059 1.059 2.004 446 103,02 2,04 48	Denmark 100% 406,4 406,4 16800 1680	Estonia 100% 406 20 16.800 77 6.636 636 636 636 636 636 636 708 8 8 10 12,70 708 8 112,17 10 118 112,17 - - 77	Finland 100% 406 20 16.800 7 16.800 6 3 6 3 6 3 6 3 6 3 6 3 6 3 6 3 6 3 6	Latvia 100% 406 20 16.800 7 16.800 270 610 636 0 270 610 111 21 0 0 36 36 - - - 0 77	Lithuania 100% 406 20 16.800 7 16.800 0 7 636 0 0 270 270 270 20 20 1 217,64 217,64 217,64 2,77	Norway 100% 406 20 16.800 7 16.800 8 8 8 6 3 6 3 6 3 6 3 6 5 7 7 15 6 5 7 7 15 6 7 7 15 7 7 5 70,75 5 7,77	Sweden 100% 406 20 16.800 7 16.800 Unit EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year
Technical characteristics Technical characteristics Technical characteristics Oil boiler - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs: Subsidies: Taxes and fees: Scrap value: Total cost	Category Annual efficiency - oil boiler Auxillary electricity consumption - oil boiler Technical lifetime (years) - oil boiler Annual heat demand - individual house Effect need Oil consumption Cost category Annual loan costs Variable maintenance costs - oil boiler Fixed maintenance costs - oil boiler Oil price Electricity price All electricity tariffs Subsidies Energy tax CO2 tax NOx tax Electricity tax on auxillary electricity Revenue	Data kWh/year years kWh/year kW kWh/year COMPACTION kWh/year COMPACTION kWh/year kW kWh/year kW kWh/year kW kWh/year kW kWh/year kW kWh/year kW kWh/year kW kWh/year kW kWh/year kW kWh/year kW kWh/year kW kWh/year kW kWh/year kW kWh/year kW kWh/year kW kW kWh/year kW kW kWh/year kW kW kW kW kW kW kW kW kW kW	Denmark 100% 406,4 20 16800 7 16800 8 6 3 6 3 6 3 6 3 6 3 6 3 6 3 6 3 6 3 6 3 6 3 6 3 6 3 6 3 6 3 6 3 6 3 6 6 3 6 6 6 6 6 6 6 6 6 6 6 6 6	Estonia 100% 406 20 16.800 70 16.800 70 636 0 2700 708 8 102 102 102 102 102 102 102 102	Finland 100% 406 20 16.800 77 16.800 636 636 0 270 2734 734 734 11 34 9 0 15,66 0,15 6 0,15 0 0 15,66	Latvia 100% 406 20 16.800 7 16.800 0 270 610 0 270 610 111 0 0 36 - 0 0 36 - 0 0 - 7 1506	Lithuania 100% 406 20 16.800 7 16.800 800 20 636 0 270 200 200 200 217,64 - 7 217,64	Norway 100% 406 20 16.800 7 16.800 8 8 8 636 0 270 270 6 58 6 570,75 5 7,75 5 7,75 5 7,75 5 7,75 5 7,75 5 7,75 5 7,75 5 7,75 5 7,75 5 7,77 5 7,77 10,800 10,77 10,800 10,9000 10,9000 10,9000 10,9000 10,9000 10,9000 10,90	Sweden 100% 406 20 16.800 7 16.800 Unit EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year

8.11 Wood pellet boiler

Levies, subsidies and energy price 2016	Category	Unit	Denmark	Estonia	Finland	Latvia	Lithuania	Norway	Sweden
Subsidies:	None		-	-	-		-	-	-
	Energy tax	EUR/kWh	-	-	-	-	-	-	-
	CO2 tax	EUR/kWh	-	-	-	-	-	-	-
Taxes and rees:	NOx tax	EUR/kWh	-	-	-	-	-	-	-
	Electricity tax	EUR/kWh	0,12	0,00	0,02	0,00	0,00	0,02	0,03
	PSO (or similar tariff) for subsidy of other electricity production		0.02	0.01	0.01	0.02	0.02	0.00	
Tariffs:	Electricity local grid tariff		0,03	0.05	0,01	0,05	0,02	0,00	0.04
	Electricity system/transmission tariff		0,03	0,05	0,02	0,00	0,04	0,02	0,04
	Pellet price		0,01	-	0,00	-	-	-	-
Energy price, excl. tax etc.:	Electricity price		0,05	0,03	0,05	0,03	0,03	0,05	0,04
		EUR/KWII	0,03	0,02	0,02	0,03	0,03	0,02	0,02
Technology costs	Category								
rechnology coata		Unit	Denmark	Estonia	Finland	Latvia	Lithuania	Norway	Sweden
Maintenance costs:		EUR/kWh	0	-	-	-	-	-	-
	Hardware easter wood a start	EUR/unit/year	201,3422819	201	201	201	201	201	201
	Connection costs and other hardware costs -	EUR/unit	2571,428571	2.571	2.571	2.571	2.571	2.571	2.571
Capital costs	wood pellets	EUR/unit	0	-	-		-	-	-
Capital Costs.	Installation costs - wood pellets	EUR/unit	535,7142857	536	536	536	536	536	536
	Total cost	FUD/unit	2407 442957	2 407	2 407	2 407	2 407	2 407	2 407
		EUR/unit	3107,142057	3.107	3.107	3.107	3.107	3.107	3.107
Loan:		years	61	15	15	15	ci	CI	61
Remaining technical lifetime	Remaining technical lifetime	EUR/year	299	299	299	299	299	299	299
Soran volue:		years	5	5	5	5	5	5	5
		EUR	- 643	-643	-643	-643	- 643	- 643	- 643
Technical characteristics	Category	Data	Donmark	Ectonia	Finland	Lotvio	Lithuania	Nonvoy	Sweden
Technical characteristics	Category Annual efficiency - wood pellets	Data	Denmark	Estonia	Finland	Latvia	Lithuania	Norway	Sweden
Technical characteristics	Category Annual efficiency - wood pellets Auxillary electricity consumption - wood	Data	Denmark 80%	Estonia 80%	Finland 80%	Latvia 80%	Lithuania 80%	Norway 80%	Sweden 80%
Technical characteristics	Category Annual efficiency - wood pellets Auxillary electricity consumption - wood pellets	Data kWh/year	Denmark 80% 526	Estonia 80% 526	Finland 80% 526	Latvia 80% 526	Lithuania 80% 526	Norway 80% 526	Sweden 80% 526
Technical characteristics Technical characterístics	Category Annual efficiency - wood pellets Auxillary electricity consumption - wood pellets Technical lifetime (years) - wood pellets	Data kWh/year years	Denmark 80% 526 20	Estonia 80% 526 20	Finland 80% 526 20	Latvia 80% 526 20	Lithuania 80% 526 20	Norway 80% 526 20	Sweden 80% 526 20
Technical characteristics Technical characteristics	Category Annual efficiency - wood pellets Auxillary electricity consumption - wood pellets Technical lifetime (years) - wood pellets Annual heat demand - individual house	Data kWh/year years kWh/year	Denmark 80% 526 20 16800	Estonia 80% 526 20 16.800	Finland 80% 526 20 16.800	Latvia 80% 526 20 16.800	Lithuania 80% 526 20 16.800	Norway 80% 526 20 16.800	Sweden 80% 526 20 16.800
Technical characteristics Technical characteristics	Category Annual efficiency - wood pellets Auxillary electricity consumption - wood pellets Technical lifetime (years) - wood pellets Annual heat demand - individual house Effect need	Data kWh/year years kWh/year kW	Denmark 80% 526 20 16800 7	Estonia 80% 526 20 16.800 7	Finland 80% 526 20 16.800 7	Latvia 80% 526 20 16.800 7	Lithuania 80% 526 20 16.800 7	Norway 80% 526 20 16.800 7	Sweden 80% 526 20 16.800 7
Technical characteristics Technical characteristics	Category Annual efficiency - wood pellets Auxillary electricity consumption - wood pellets Technical lifetime (years) - wood pellets Annual heat demand - individual house Effect need Pellet consumption	Data kWh/year years kWh/year kW	Denmark 80% 526 20 16800 7 21000	Estonia 80% 526 20 16.800 7 21.000	Finland 80% 526 20 16.800 7 21.000	Latvia 80% 526 20 16.800 7 21.000	Lithuania 80% 526 20 16.800 7 21.000	Norway 80% 526 20 16.800 7 21.000	Sweden 80% 526 20 16.800 7 21.000
Technical characteristics Technical characteristics Wood pell <u>et boiler - annual</u>	Category Annual efficiency - wood pellets Auxillary electricity consumption - wood pellets Technical lifetime (years) - wood pellets Annual heat demand - individual house Effect need Pellet consumption	Data kWh/year years kWh/year kW kWh/year	Denmark 80% 526 20 16800 7 21000	Estonia 80% 526 20 16.800 7 21.000	Finland 80% 526 20 16.800 7 21.000	Latvia 80% 526 20 16.800 7 21.000	Lithuania 80% 526 20 16.800 7 21.000	Norway 80% 526 20 16.800 7 21.000	Sweden 80% 526 20 16.800 7 21.000
Technical characteristics Technical characteristics Wood pellet boiler - annual consumer cost 2016	Category Annual efficiency - wood pellets Auxillary electricity consumption - wood pellets Technical lifetime (years) - wood pellets Annual heat demand - individual house Effect need Pellet consumption Cost category	Data kWh/year years kWh/year kW kWh/year Denmark	Denmark 80% 526 20 16800 7 21000 Estonia	Estonia 80% 526 20 16.800 7 21.000 Finland	Finland 80% 526 20 16.800 7 21.000	Latvia 80% 526 20 16.800 7 21.000 Lithuania	Lithuania 80% 526 20 16.800 7 21.000 Nonway	Norway 80% 526 20 16.800 7 21.000 Sweden	Sweden 80% 526 20 16.800 7 21.000 Unit
Technical characteristics Technical characteristics Technical characteristics Wood pellet boiler - annual consumer cost 2016 Capital costs:	Category Annual efficiency - wood pellets Auxillary electricity consumption - wood pellets Technical lifetime (years) - wood pellets Annual heat demand - individual house Effect need Pellet consumption Cost category Annual loan costs	Data KWh/year years kWh/year kW kWh/year Denmark 299	Denmark 80% 526 20 16800 7 21000 Estonia 299	Estonia 80% 526 20 16.800 7 21.000 Finland 299	Finland 80% 526 20 16.800 7 21.000 Latvia 299	Latvia 80% 526 20 16.800 7 21.000 Lithuania 299	Lithuania 80% 526 20 16.800 7 21.000 Norway 299	Norway 80% 526 20 16.800 7 21.000 Sweden 299	Sweden 80% 526 20 16.800 7 21.000 Unit EUR/year
Technical characteristics Technical characteristics Technical characteristics Wood pellet boiler - annual consumer cost 2016 Capital costs: Maintenance costs:	Category Annual efficiency - wood pellets Auxillary electricity consumption - wood pellets Technical lifetime (years) - wood pellets Annual heat demand - individual house Effect need Pellet consumption Cost category Annual loan costs Variable maintenance costs - wood pellets	Data kWh/year years kWh/year kW kWh/year Denmark 299 0	Denmark 80% 526 20 16800 7 21000 Estonia 299 0	Estonia 80% 526 20 16.800 7 21.000 Finland 299 0	Finland 80% 526 20 16.800 7 21.000 Latvia 299 0	Latvia 80% 526 20 16.800 7 21.000 Lithuania 299 0	Lithuania 80% 526 20 16.800 7 21.000 Norway 299 0	Norway 80% 526 20 16.800 7 21.000 Sweden 299 0	Sweden 80% 526 20 16.800 7 21.000 Unit EUR/year EUR/year
Technical characteristics Technical characteristics Technical characteristics Wood pellet boiler - annual consumer cost 2016 Capital costs: Maintenance costs:	Category Annual efficiency - wood pellets Auxillary electricity consumption - wood pellets Technical lifetime (years) - wood pellets Annual heat demand - individual house Effect need Pellet consumption Cost category Annual loan costs Variable maintenance costs - wood pellets Fixed maintenance costs - wood pellets	Data KWh/year years kWh/year kW kWh/year Denmark 299 0 201,3422819	Denmark 80% 526 20 16800 7 21000 5 21000 5 5 5 5 5 10 2 299 0 201,3422819	Estonia 80% 526 20 16.800 7 21.000 Finland 299 0 201,34	Finland 80% 526 20 16.800 7 21.000 Latvia 299 0 201,34	Latvia 80% 526 20 16.800 7 21.000 21.000 Lithuania 299 0 201,3423	Lithuania 80% 526 200 16.800 7 21.000 8 0 0 299 0 0 201,342	Norway 80% 526 20 16.800 7 21.000 Sweden 299 0 201,34	Sweden 80% 526 20 16.800 7 21.000 Unit EUR/year EUR/year EUR/unit/year
Technical characteristics Technical characteristics Wood pellet boiler - annual consumer cost 2016 Capital costs: Maintenance costs:	Category Annual efficiency - wood pellets Auxillary electricity consumption - wood pellets Technical lifetime (years) - wood pellets Annual heat demand - individual house Effect need Pellet consumption Cost category Annual loan costs Variable maintenance costs - wood pellets Fixed maintenance costs - wood pellets	Data KWh/year years kWh/year kW kWh/year Denmark 299 0 201,3422819	Denmark 80% 526 20 16800 7 21000 Estonia 299 0 201,3422819	Estonia 80% 526 20 16.800 7 21.000 Finland 299 0 201,34	Finland 80% 526 20 16.800 7 21.000 21.000 Latvia 299 0 201,34	Latvia 80% 526 20 16.800 7 21.000 Lithuania 299 0 201,3423	Lithuania 80% 526 20 16.800 7 21.000 Norway 299 0 201,342	Norway 80% 526 20 16.800 7 21.000 Sweden 299 0 201,34	Sweden 80% 526 20 16.800 7 21.000 Unit EUR/year EUR/year EUR/year
Technical characteristics Technical characteristics Technical characteristics Wood pellet boiler - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.:	Category Annual efficiency - wood pellets Auxillary electricity consumption - wood pellets Technical lifetime (years) - wood pellets Annual heat demand - individual house Effect need Pellet consumption Cost category Annual loan costs Variable maintenance costs - wood pellets Fixed maintenance costs - wood pellets Pellet price	Data KWh/year years KWh/year kW kWh/year Denmark 299 0 201,3422819 1.056	Denmark 80% 526 20 16800 7 21000 Estonia 299 0 201,3422819 646	Estonia 80% 526 20 16.800 7 21.000 Finland 299 0 201,34	Finland 80% 526 20 16.800 7 21.000 21.000 Latvia 299 0 201,34	Latvia 80% 526 20 16.800 7 21.000 21.000 Lithuania 299 0 201,3423 668	Lithuania 80% 526 20 16.800 7 21.000 Norway 299 0 201,342 1.120	Norway 80% 526 20 16.800 7 21.000 Sweden 299 0 201,34	Sweden 80% 526 20 16.800 21.000 Unit EUR/year EUR/year EUR/year EUR/year
Technical characteristics Technical characteristics Technical characteristics Wood pellet boiler - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.:	Category Annual efficiency - wood pellets Auxillary electricity consumption - wood pellets Technical lifetime (years) - wood pellets Annual heat demand - individual house Effect need Pellet consumption Cost category Annual loan costs Variable maintenance costs - wood pellets Fixed maintenance costs - wood pellets Fixed maintenance costs - wood pellets Pellet price Electricity price	Data kWh/year years kWh/year kW kWh/year Denmark 299 0 201,3422819 1.056 14	Denmark 80% 526 20 16800 7 21000 Estonia 299 0 201,3422819 646 11	Estonia 80% 526 20 16.800 7 21.000 Finland 299 0 201,34 965 11	Finland 80% 526 20 16.800 7 21.000 21.000 Latvia 299 0 201,34 6663 14	Latvia 80% 526 20 16.800 7 21.000 21.000 Lithuania 299 0 201,3423 6668 668	Lithuania 80% 526 20 16.800 7 21.000 Norway 299 0 201,342 1.120 10	Norway 80% 526 20 16.800 7 21.000 Sweden 299 0 201,34 910 10	Sweden 80% 526 20 16.800 7 21.000 Unit EUR/year EUR/unit/year EUR/year EUR/year EUR/year EUR/year EUR/year EUR/year
Technical characteristics Technical characteristics Technical characteristics Wood pellet boiler - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs:	Category Annual efficiency - wood pellets Auxillary electricity consumption - wood pellets Technical lifetime (years) - wood pellets Annual heat demand - individual house Effect need Pellet consumption Cost category Annual loan costs Variable maintenance costs - wood pellets Fixed maintenance costs - wood pellets Fixed maintenance costs - wood pellets Electricity price All electricity tariffs	Data KWh/year years KWh/year KW KWh/year Denmark 299 0 201,3422819 1.056 1.056	Denmark 80% 526 20 16800 7 21000 Estonia 2013422819 0 2013422819 646 11 1	Estonia 80% 526 20 16.800 7 21.000 7 21.000 7 21.000 201,34 965 11 18	Finland 80% 526 20 16.800 7 21.000 21.000 221,34 663 663 14 4	Latvia 80% 526 20 16.800 7 21.000 21.000 201,3423 6668 6468 14 27	Lithuania 80% 526 200 16.800 7 21.000 8 Norway 299 0 201,342 201,342 1.120 10	Norway 80% 526 20 16.800 7 21.000 5 8 8 9 0 201,34 910 10 19	Sweden Sweden Sweden Sveden Sveden Sveden Sveden Sveden Sveden Sveden Sveden Sveden Sveden Sveden Sveden Sveden Sveden Sveden Sveden Sveden Sveden Sveden Sveden Sveden Sv
Technical characteristics Technical characteristics Technical characteristics Wood pellet boiler - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs: Subsidies:	Category Annual efficiency - wood pellets Auxillary electricity consumption - wood pellets Technical lifetime (years) - wood pellets Annual heat demand - individual house Effect need Pellet consumption Cost category Annual loan costs Variable maintenance costs - wood pellets Fixed maintenance costs - wood pellets Fixed maintenance costs - wood pellets Effect price Electricity price All electricity tariffs Subsidies	Data kWh/year years kWh/year kW kWh/year Denmark 299 0 201,3422819 1.056 14 40 0 0	Denmark 80% 526 20 16800 7 21000 21000 201,3422819 646 11 33 33	Estonia 80% 526 20 16.800 7 21.000 21.000 201,34 965 11 18 00	Finland 80% 526 20 16.800 7 21.000 21.000 201,34 663 14 44 0	Latvia 80% 526 20 16.800 7 21.000 21.000 201,3423 668 648 14 27 0	Lithuania 80% 526 200 16.800 7 21.000 8 0 21.000 201,342 1.120 10 10 0 0	Norway 80% 526 20 16.800 7 21.000 5 8 8 9 0 201,34 910 10 19 0 0	Sweden 80% 226 200 16.800 7 21.000 Unit EUR/year
Technical characteristics Technical characteristics Wood pellet boiler - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs: Subsidies:	Category Annual efficiency - wood pellets Auxillary electricity consumption - wood pellets Technical lifetime (years) - wood pellets Annual heat demand - individual house Effect need Pellet consumption Cost category Annual loan costs Variable maintenance costs - wood pellets Fixed maintenance costs - wood pellets Fixed maintenance costs - wood pellets Electricity price All electricity tariffs Subsidies Energy tax	Data KWh/year years KWh/year KW KWh/year Denmark 299 0 201,3422819 1.056 1.1056 1.4 4.0 0	Denmark 80% 526 20 16800 7 21000 Estonia 299 0 201,3422819 646 11 33 0	Estonia 80% 526 20 16.800 7 21.000 7 21.000 7 21.000 201,34 965 11 18 0 0 -	Finland 80% 526 20 16.800 7 21.000 21.000 201,34 663 14 44 44 00 -	Latvia 80% 526 20 16.800 7 21.000 21.000 201,3423 6668 14 229 0 201,3423	Lithuania 80% 526 20 16.800 7 21.000 21.000 201,342 1.120 10 10 0 0	Norway 80% 526 20 16.800 7 21.000 Sweden 299 0 201,34 910 201,34	Sweden 80% 526 20 16.800 7 21.000 Unit EUR/year
Technical characteristics Technical characteristics Technical characteristics Wood pellet boiler - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs: Subsidies:	Category Annual efficiency - wood pellets Auxillary electricity consumption - wood pellets Technical lifetime (years) - wood pellets Annual heat demand - individual house Effect need Pellet consumption Cost category Annual loan costs Variable maintenance costs - wood pellets Fixed maintenance costs - wood pellets Fixed maintenance costs - wood pellets Electricity price All electricity tariffs Subsidies Energy tax CO2 tax	Data Data KWh/year years kWh/year kW CDenmark Denmark 299 0 201,3422819 1.056 1.056 1.4 4.0 0 0	Denmark 80% 526 20 16800 7 21000 Estonia 299 0 201,3422819 646 11 33 3 0 0	Estonia 80% 526 20 16.800 7 21.000 Finland 299 0 201,34 965 11 18 0 0 -	Finland 80% 526 20 16.800 7 21.000 21.000 201,34 6663 14 6663 14 44 0 -	Latvia 80% 526 20 16.800 7 21.000 21.000 201,3423 6668 14 299 0 201,3423 6668 14 227 0 0 -	Lithuania 80% 526 20 16.800 7 21.000 Norway 299 0 201,342 1.120 10 10 0 - -	Norway 80% 526 20 16.800 7 21.000 Sweden 299 0 201,34 910 10 19 0 0 201,34	Sweden 80% 526 20 16.800 7 21.000 Unit EUR/year
Technical characteristics Technical characteristics Technical characteristics Wood pellet boiler - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs: Subsidies: Taxes and fees:	Category Annual efficiency - wood pellets Auxillary electricity consumption - wood pellets Technical lifetime (years) - wood pellets Annual heat demand - individual house Effect need Pellet consumption Cost category Annual loan costs Variable maintenance costs - wood pellets Fixed maintenance costs - wood pellets Fixed maintenance costs - wood pellets Electricity price All electricity tariffs Subsidies Energy tax CO2 tax NOx tax	Data Data KWh/year years KWh/year KW CDenmark Denmark 299 0 201,3422819 1.056 1.1056 1.1056 1.105 0 0 0 0 0 0 0 0 0 0 0 0	Denmark 80% 526 20 16800 7 21000 Estonia 299 0 201,3422819 646 111 33 0 0 -	Estonia 80% 526 20 16.800 7 21.000 7 21.000 201,34 965 11 18 00 - -	Finland 80% 526 20 16.800 7 21.000 21.000 201,34 6663 14 6663 14 44 44 00 -	Latvia 80% 526 20 16.800 7 21.000 21.000 201.3423 6668 6468 14 299 0 0 201.3423 6668 14 27 0 0 201.3423	Lithuania 80% 526 20 16.800 7 21.000 Norway 299 0 201,342 1.120 10 10 10 0 0 0 201,342	Norway 80% 526 20 16.800 7 21.000 Sweden 299 0 201,34 910 201,34 910 10 19 0 0 19	Sweden 80% 526 20 16.800 7 21.000 Unit EUR/year
Technical characteristics Technical characteristics Technical characteristics Wood pellet boiler - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs: Subsidies: Taxes and fees:	Category Annual efficiency - wood pellets Auxillary electricity consumption - wood pellets Technical lifetime (years) - wood pellets Annual heat demand - individual house Effect need Pellet consumption Cost category Annual loan costs Variable maintenance costs - wood pellets Fixed maintenance costs - wood pellets Ekectricity price All electricity tariffs Subsidies Energy tax CO2 tax NOx tax Electricity tax on auxillary electricity	Data Data KWh/year years KWh/year KW KWh/year Denmark 299 0 201,3422819 1.056 1.056 1.056 1.056 1.056 1.05 1.056 1.05 1.05 1.05 1.05 1.05 1.05 1.05 1.05	Denmark 80% 526 200 16800 7 21000 21000 2013422819 0 2013422819 0 2013422819 0 2013422819 0 2013422819 0 2013422819 0 2013422819 0 2013422819 2 2	Estonia 80% 526 20 16.800 7 21.000 7 7 21.000 7 7 21.000 201,34 965 11 1 18 0 0 - - - 12	Finland 80% 526 20 16.800 7 21.000 21.000 201,34 663 663 44 44 00 - - - 1	Latvia 80% 526 20 16.800 7 21.000 21.000 201,3423 6668 14 299 00 201,3423 6668 14 27 00 - - - 1	Lithuania 80% 526 200 16.800 7 21.000 21.000 201,342 00 201,342 1.120 0 201,342 1.120 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Norway 80% 526 20 16.800 7 21.000 5 8 8 9 0 201,34 299 0 201,34 910 201,34 910 0 10 19 0 0 10 19	Sweden 80% 526 20 16.800 7 21.000 Unit EUR/year
Technical characteristics Technical characteristics Technical characteristics Wood pellet boiler - annual consumer cost 2016 Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs: Subsidies: Taxes and fees: Scrap value:	Category Annual efficiency - wood pellets Auxillary electricity consumption - wood pellets Technical lifetime (years) - wood pellets Annual heat demand - individual house Effect need Pellet consumption Cost category Annual loan costs Variable maintenance costs - wood pellets Fixed maintenance costs - wood pellets Fixed maintenance costs - wood pellets Electricity price All electricity tariffs Subsidies Energy tax CO2 tax NOx tax Electricity tax on auxillary electricity Revenue	Data Wh/year years Wh/year W W Wh/year 0 299 0 201,3422819 1.056 1.056 1.4 4 0 0 0 0 0 0 1.056 1.4 0 0 0 0 0 0 0 0 0 0 0 0 0	Denmark 80% 526 200 16800 7 21000 21000 2013422819 0 2013422819 0 2013422819 0 2013422819 0 2013422819 0 2013422819 0 2013422819 0 2013422819 0 2013422819 0 2013422819 201421000 2014210 20140000000000	Estonia 80% 526 20 16.800 7 21.000 21.000 201,34 965 11 18 0 965 11 18 0 0 - - - - 12 - 43	Finland 80% 526 20 16.800 7 21.000 21.000 201,34 663 14 44 0 - - - - - - - 1 - 43	Latvia 80% 526 20 16.800 7 21.000 21.000 201,3423 6668 14 2299 0 201,3423 6668 14 227 0 0 201,3423 668 14 27 0 0	Lithuania 80% 526 200 16.800 7 21.000 210,00 201,342 0,00 201,342 1.120 0,0 201,342 1.120 0,0 1,00 1,00 1,00 1,00 1,00 1,00 1,	Norway 80% 526 20 16.800 7 21.000 8 8 9 00 201,34 9 10 201,34 9 10 10 10 9 10 0 0 201,34 10 9 10 10 9 10 10 9 10 10 9 10 10 9 10 10 10 10 10 10 10 10 10 10 10 10 10	Sweden 80% 226 200 16.800 7 21.000 Unit EUR/year
Technical characteristics Technical characteristics Technical characteristics Wood pellet boiler - annual consumer cost 2016 Capital costs: Capital costs: Maintenance costs: Energy price, excl. tax etc.: Electricity tariffs: Subsidies: Taxes and fees: Capital cost	Category Annual efficiency - wood pellets Auxillary electricity consumption - wood pellets Technical lifetime (years) - wood pellets Annual heat demand - individual house Effect need Pellet consumption Cost category Annual loan costs Variable maintenance costs - wood pellets Fixed maintenance costs - wood pellets Fixed maintenance costs - wood pellets Electricity price All electricity tariffs Subsidies Energy tax CO2 tax NOx tax Electricity tax on auxillary electricity Revenue	Data Wh/year years KWh/year KW KWh/year Denmark 299 0 201,3422819 1.05666 1.05666 1.05666 1.05666 1.05666 1.05666 1.05	Denmark 80% 526 20 16800 7 21000 210 2010 2010 30 2010 30 2010 30 2010 30 2010 30 2010 30 2010 30 2010 30 2010 30 2010 30 20 20 30 20 20 20 20 20 20 20 20 20 20 20 20 20	Estonia 80% 526 20 16.800 7 21.000 21.000 201.34 965 111 18 00 - - - - 12 - 12 - 43 1.464	Finland 80% 526 20 16.800 7 21.000 21.000 201,34 299 0 201,34 4 4 4 4 4 4 0 - - - 1 - 1 - 4 3 1.179	Latvia 80% 526 20 16.800 7 21.000 21.000 201,3423 6668 14 229 0 201,3423 6668 14 227 0 0 201,3423 667 14 27 0 0 1-0 1 0	Lithuania 80% 526 20 16.800 7 21.000 21.000 201,342 0,00 201,342 1.120 0,0 201,342 1.120 0,0 1,0 0 0,0 1,0 0 0,0 1,0 0 0,0 0,0	Norway 80% 526 20 16.800 7 21.000 8 Sweden 299 0 201,34 910 201,34 910 10 10 10 10 10 10 10 10 10 10 10 10 1	Sweden 80% 220 16.800 7 21.000 Unit EUR/year

8.12Technological assumptions

	Category	Data	Unit	Reference	Note
					All heating hardware is assumed to be new; not
	Annual efficiency				existing
	A			P41 - https://ens.dk/sites/ens.dk/files/Analyser/update	
	water	325%	PCT	transport - aug 2016.pdf	radiators
				P45 - https://ens.dk/sites/ens.dk/files/Analyser/update	
	Annual efficiency - heat pump			_technology_data_catalogue_for_individual_heating_plants_and_energy	Assuming an existing one-family house with
	liquid-water	360%	PCT	_transportaug_2016.pdf	radiators
	Annual efficiency - resistance			P84 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi	Assuming one-family house new building 5 kW unit
	electricity	100%	РСТ	vidual_heating_plants_and_energy_transport_aug2016.pdf	scaled to 7 kW
				P32 -	
		1020/	DCT	https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi	
	Annual enriciency - natural gas	10276	rti	P21 -	Assuming one-ranny nouse, existing bunding
				https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi	Assuming an existing one-family house with
	Annual efficiency - oil boiler	100%	РСТ	vidual_heating_plants_and_energy_transport_aug2016.pdf	radiators, 15 kW oil boiler (smallest in catalogue)
				P46 - https://ans.dk/citas/ans.dk/files/Analyser/ald_tachnolomy_data_for_indi	Assuming automatic staking - one family house
	Annual efficiency - wood pellets	80%	РСТ	vidual heating plants and energy transport aug2016.pdf	existing building
					Assuming one-family house, existing and new
				P62 -	building, share of 100% of heat demand covered by
	Appual officiancy firmunad	650/	DCT	https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi	firewood, while tap water is covered by electric
	Annual enciency - firewood	65%	PCI	vidual_neating_plants_and_energy_transport_aug2016.pdf	water neater
					·
	Auxillary electricity				
	Auxillary electricity			P41 - https://ens.dk/sites/ens.dk/files/Analyser/undate -	
	consumption - heat pump air-			_technology_data_catalogue_for_individual_heating_plants_and_energy	Assuming an existing one-family house with
	water	100	kWh/year	_transportaug_2016.pdf	radiators
	Auxillary electricity			P45 - https://ens.dk/sites/ens.dk/files/Analyser/update	
	consumption - neat pump liquid- water	100	kWh/vear	_technology_data_catalogue_for_individual_neating_plants_and_energy transport - aug_2016.pdf	Assuming an existing one-tamily house with radiators
	Auxillary electricity	100	kwii/yeui		
	consumption - resistance				
	electricity	0	kWh/year		Not found. Assumed 0
	Auxillary electricity	176	kWh/vear	P3 - http://www.byggeriogenergi.dk/media/1710/udskiftning-af-	
	consumption - natural gas	170	Kwii/yeai	gaskeuei_ok.pui	Assuming an existing one-family house with
					radiators, 15 kW oil boiler (smallest in catalogue).
chnical	Auxillary electricity			P17 - http://www.byggeriogenergi.dk/media/1718/guide-valg-af-	Electricity demand assumed to be 20% less in new
acteristic	consumption - oil boiler	406,4	kWh/year	varmetorsyning.pdf P22 - http://www.byggeriogenergi.dk/media/1718/guide.valg.af.	oil boiler
	consumption - wood pellets	526	kWh/year	varmeforsyning.pdf	
					Assuming one-family house, existing and new building, share of 100% of heat demand covered by firewood, while tan water is covered by electric
					water heater. Tap water included here, and calculated based on P12
				P62 -	https://ens.dk/sites/ens.dk/files/Analyser/old_techn
	consumption - firewood	3500	kWh/vear	vidual heating plants and energy transport aug2016.pdf	rgy transport aug2016.pdf
	··· ·· .				
	Technical lifetime (years)				
				P41 - https://ens.dk/sites/ens.dk/files/Analyser/update	
	Technical lifetime (years) - heat			_technology_data_catalogue_for_individual_heating_plants_and_energy	Assuming an existing one-family house with
	pump air-water	15	years	_transportaug_2016.pdf P45 - https://eps.dk/sites/eps.dk/files/Apalyser/update	radiators
	Technical lifetime (years) - heat			_technology_data_catalogue_for_individual_heating_plants_and_energy	Assuming an existing one-family house with
	pump liquid-water	20	years	_transportaug_2016.pdf	radiators
	Technical lifetime (second			P84 -	Accuming one family house any building 5 bits
	resistance electricity	30	vears	https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_tor_indi vidual_beating_plants_and_energy_transport_aug2016.pdf	Assuming one-family nouse, new building. 5 kW unit scaled to 7 kW
		55	,	P32 -	
	Technical lifetime (years) -			https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi	
	natural gas	22	years	vidual_heating_plants_and_energy_transport_aug2016.pdf	Assuming one-family house, existing building
	Tochnical lifetime (vears) - oil			P21 - https://aps.dk/sitas/aps.dk/files/Applysor/ald_tashpalamy_data_for_indi	Assuming an existing one family house with
	boiler	20	years	vidual_heating_plants_and_energy_transport_aug2016.pdf	radiators, 15 kW oil boiler (smallest in catalogue)
				P46 -	
	Technical lifetime (years) - wood			https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi	Assuming automatic stoking - one-family house,
	pellets	20	years	vidual_heating_plants_and_energy_transport_aug2016.pdf	existing building
				P62 -	building, share of 100% of heat demand covered by
	Technical lifetime (years) -			https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi	firewood, while tap water is covered by electric
	firewood	24	years	vidual_heating_plants_and_energy_transport_aug2016.pdf	water heater
	Energy supply				
				P17 - https://ens.dk/sites/ens.dk/files/Analyser/update	"An existing one-family house is defined to have an
	Annual heat demand - individual			_technology_data_catalogue_for_individual_heating_plants_and_energy	annual heat demand of 16.8 MWh and a peak
	house	16800	kWh/year	_transportaug_2016.pdf	demand of 7 kW."
				technology data catalogue for individual heating plants and energy	annual heat demand of 16.8 MWh and a neak
	Effect need	7	kW	_transportaug_2016.pdf	demand of 7 kW."

Appendices

Maintena costs

Variable maintenance costs				
		ĺ.	P41 - https://ens.dk/sites/ens.dk/files/Analyser/update -	
Variable maintenance costs -			technology data catalogue for individual heating plants and energy	Assuming an existing one-family house with
heat numn air-water	0	FUR/kW/b	transport - aug 2016 pdf	radiators
near pump an-water	0	LOIVENU	DAE https://aca.dl/sites/aca.dl/files/Acaluses/usdate	
			P45 - https://ens.uk/sites/ens.uk/ines/Analyser/update	
Variable maintenance costs -			_technology_data_catalogue_for_individual_heating_plants_and_energy	Assuming an existing one-family house with
heat pump liquid-water	0	EUR/kWh	_transportaug_2016.pdf	radiators
			P84 -	
Variable maintenance costs -			https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi	Assuming one-family house, new building. 5 kW uni
resistance electricity	0	EUR/kWh	vidual heating plants and energy transport aug2016.pdf	scaled to 7 kW
			P32 -	Assuming one-family house, existing building, 100
Variable maintenance costs -			https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi	ELIR/year assumed to be a simplification. Added
natural gas		ELID /kW/b	vidual beating plants and energy transport aug2016 pdf	under fixed cost
inatural gas	0	EUR/KWII	vidual_heating_plants_and_energy_transport_aug2010.put	
			P21-	
Variable maintenance costs - oil			https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi	Assuming an existing one-family house with
boiler	0	EUR/kWh	vidual_heating_plants_and_energy_transport_aug2016.pdf	radiators, 15 kW oil boiler (smallest in catalogue)
			P46 -	
Variable maintenance costs -			https://ens.dk/sites/ens.dk/files/Analyser/old technology data for indi	Assuming automatic stoking - one-family house,
wood pellets	0	FUR/kWh	vidual heating plants and energy transport aug2016.pdf	existing building
				Assuming one-family house existing and new
			063	huilding share of 100% of heat demand sourced by
				burraing, share of 100% of heat demand covered by
Variable maintenance costs -			https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi	firewood, while tap water is covered by electric
firewood	0	EUR/kWh	vidual_heating_plants_and_energy_transport_aug2016.pdf	water heater
Fixed maintenance costs				
		ĺ	P41 - https://ens.dk/sites/ens.dk/files/Analyser/update	
Fixed maintenance costs - heat			P41 - https://ens.dk/sites/ens.dk/files/Analyser/update technology data catalogue for individual heating plants and energy	Assuming an existing one-family house with
Fixed maintenance costs - heat	200	EUR/unit/vear	P41 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy transport - aug_2016.pdf	Assuming an existing one-family house with radiators
Fixed maintenance costs - heat pump air-water	200	EUR/unit/year	P41 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy _transportaug_2016.pdf P45 - https://ens.dk/files/Analyser/undate	Assuming an existing one-family house with radiators
Fixed maintenance costs - heat pump air-water	200	EUR/unit/year	P41 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy _transportaug_2016.pdf P45 - https://ens.dk/sites/ens.dk/files/Analyser/update	Assuming an existing one-family house with radiators
Fixed maintenance costs - heat pump air-water Fixed maintenance costs - heat	200	EUR/unit/year	P41 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy _transportaug_2016.pdf P45 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy	Assuming an existing one-family house with radiators Assuming an existing one-family house with
Fixed maintenance costs - heat pump air-water Fixed maintenance costs - heat pump liquid-water	200	EUR/unit/year	P41 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy _transportaug_2016.pdf P45 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy _transportaug_2016.pdf	Assuming an existing one-family house with radiators Assuming an existing one-family house with radiators
Fixed maintenance costs - heat pump air-water Fixed maintenance costs - heat pump liquid-water	200	EUR/unit/year	P41 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy _transportaug_2016.pdf P45 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy _transportaug_2016.pdf P84 -	Assuming an existing one-family house with radiators Assuming an existing one-family house with radiators
Fixed maintenance costs - heat pump air-water Fixed maintenance costs - heat pump liquid-water Fixed maintenance costs -	200	EUR/unit/year	P41 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy _transportaug_2016.pdf P45 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy _transportaug_2016.pdf P84 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi	Assuming an existing one-family house with radiators Assuming an existing one-family house with radiators Assuming one-family house, new building. 5 kW uni
Fixed maintenance costs - heat pump air-water Fixed maintenance costs - heat pump liquid-water Fixed maintenance costs - resistance electricity	200 200 70	EUR/unit/year EUR/unit/year	P41 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy _transportaug_2016.pdf P45 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy _transportaug_2016.pdf P84 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf	Assuming an existing one-family house with radiators Assuming an existing one-family house with radiators Assuming one-family house, new building. 5 kW uni scaled to 7 kW
Fixed maintenance costs - heat pump air-water Fixed maintenance costs - heat pump liquid-water Fixed maintenance costs - resistance electricity	200 200 70	EUR/unit/year EUR/unit/year	P41 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy transport_agg_2016.pdf P45 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy _transportaug_2016.pdf P84 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P32 -	Assuming an existing one-family house with radiators Assuming an existing one-family house with radiators Assuming one-family house, new building. 5 kW uni scaled to 7 kW
Fixed maintenance costs - heat pump air-water Fixed maintenance costs - heat pump liquid-water Fixed maintenance costs - resistance electricity Fixed maintenance costs -	200 200 70	EUR/unit/year EUR/unit/year EUR/unit/year	P41 - https://ens.dk/sites/ens.dk/files/Analyser/update technology_data_catalogue_for_individual_heating_plants_and_energy _transportaug_2016.pdf P45 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy _transportaug_2016.pdf P84 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P32 -	Assuming an existing one-family house with radiators Assuming an existing one-family house with radiators Assuming one-family house, new building. 5 kW uni scaled to 7 kW Assuming one-family house, existing building. Fixed
Fixed maintenance costs - heat pump air-water Fixed maintenance costs - heat pump liquid-water Fixed maintenance costs - resistance electricity Fixed maintenance costs - natural eas	200 200 70	EUR/unit/year EUR/unit/year EUR/unit/year	P41 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy _transportaug_2016.pdf P45 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy _transportaug_2016.pdf P84 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P32 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf	Assuming an existing one-family house with radiators Assuming an existing one-family house with radiators Assuming one-family house, new building. 5 kW uni scaled to 7 kW Assuming one-family house, existing building. Fixed and (fixed annual) variable cost added together
Fixed maintenance costs - heat pump air-water Fixed maintenance costs - heat pump liquid-water Fixed maintenance costs - resistance electricity Fixed maintenance costs - natural gas	200 200 70 235	EUR/unit/year EUR/unit/year EUR/unit/year	P41 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy _transportaug_2016.pdf P45 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy _transportaug_2016.pdf P84 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P32 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P32 -	Assuming an existing one-family house with radiators Assuming an existing one-family house with radiators Assuming one-family house, new building. 5 kW uni scaled to 7 kW Assuming one-family house, existing building. Fixed and (fixed annual) variable cost added together.
Fixed maintenance costs - heat pump air-water Fixed maintenance costs - heat pump liquid-water Fixed maintenance costs - resistance electricity Fixed maintenance costs - natural gas	200 200 70 235	EUR/unit/year EUR/unit/year EUR/unit/year EUR/unit/year	P41 - https://ens.dk/sites/ens.dk/files/Analyser/update technology_data_catalogue_for_individual_heating_plants_and_energy _transportaug_2016.pdf P45 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy _transportaug_2016.pdf P84 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_individual_heating_plants_and_energy_transport_aug2016.pdf P32 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_individual_heating_plants_and_energy_transport_aug2016.pdf P32 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_individual_heating_plants_and_energy_transport_aug2016.pdf P32 -	Assuming an existing one-family house with radiators Assuming an existing one-family house with radiators Assuming one-family house, new building. 5 kW uni scaled to 7 kW Assuming one-family house, existing building. Fixed and (fixed annual) variable cost added together.
Fixed maintenance costs - heat pump air-water Fixed maintenance costs - heat pump liquid-water Fixed maintenance costs - resistance electricity Fixed maintenance costs - natural gas Fixed maintenance costs - oil	200 200 70 235	EUR/unit/year EUR/unit/year EUR/unit/year EUR/unit/year	P41 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy transport_aug_2016.pdf P45 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy _transportaug_2016.pdf P84 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P32 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P21 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi	Assuming an existing one-family house with radiators Assuming an existing one-family house with radiators Assuming one-family house, new building. 5 kW uni scaled to 7 kW Assuming one-family house, existing building. Fixed and (fixed annual) variable cost added together. Assuming an existing one-family house with
Fixed maintenance costs - heat pump air-water Fixed maintenance costs - heat pump liquid-water Fixed maintenance costs - resistance electricity Fixed maintenance costs - natural gas Fixed maintenance costs - oil boiler	200 200 70 235 270	EUR/unit/year EUR/unit/year EUR/unit/year EUR/unit/year	P41 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy _transportaug_2016.pdf P45 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy _transportaug_2016.pdf P84 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P32 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P21 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P21 -	Assuming an existing one-family house with radiators Assuming an existing one-family house with radiators Assuming one-family house, new building. 5 kW uni scaled to 7 kW Assuming one-family house, existing building. Fixed and (fixed annual) variable cost added together. Assuming an existing one-family house with radiators, 15 kW oil boiler (smallest in catalogue)
Fixed maintenance costs - heat pump air-water Fixed maintenance costs - heat pump liquid-water Fixed maintenance costs - resistance electricity Fixed maintenance costs - natural gas Fixed maintenance costs - oil boiler	200 200 70 235 270	EUR/unit/year EUR/unit/year EUR/unit/year EUR/unit/year	P41 - https://ens.dk/sites/ens.dk/files/Analyser/update technology_data_catalogue_for_individual_heating_plants_and_energy _transport aug_2016.pdf P45 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy _transportaug_2016.pdf P84 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P32 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P21 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf	Assuming an existing one-family house with radiators Assuming an existing one-family house with radiators Assuming one-family house, new building. 5 kW uni scaled to 7 kW Assuming one-family house, existing building. Fixed and (fixed annual) variable cost added together. Assuming an existing one-family house with radiators, 15 kW oil boiler (smallest in catalogue) Assuming automatic stoking -one-family house,
Fixed maintenance costs - heat pump air-water Fixed maintenance costs - heat pump liquid-water Fixed maintenance costs - resistance electricity Fixed maintenance costs - natural gas Fixed maintenance costs - oil boiler Fixed maintenance costs - wood	200 200 70 235 270	EUR/unit/year EUR/unit/year EUR/unit/year EUR/unit/year	P41 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy _transportaug_2016.pdf P45 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy _transportaug_2016.pdf P84 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P32 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P21 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P21 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P22 - http://www.byggeriogenergi.dk/media/1718/guide-valg-af-	Assuming an existing one-family house with radiators Assuming an existing one-family house with radiators Assuming one-family house, new building. 5 kW uni scaled to 7 kW Assuming one-family house, existing building. Fixed and (fixed annual) variable cost added together. Assuming an existing one-family house with radiators, 15 kW oil boiler (smallest in catalogue) Assuming automatic stoking - one-family house, existing building. This value used, since the one in
Fixed maintenance costs - heat pump air-water Fixed maintenance costs - heat pump liquid-water Fixed maintenance costs - resistance electricity Fixed maintenance costs - natural gas Fixed maintenance costs - oil boiler Fixed maintenance costs - wood pellets	200 200 70 235 270 201	EUR/unit/year EUR/unit/year EUR/unit/year EUR/unit/year EUR/unit/year	P41 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy _transport aug_2016.pdf P45 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy _transport aug_2016.pdf P84 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P32 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P21 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P21 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P22 - http://www.byggeriogenergi.dk/media/1718/guide-valg-af- varmeforsyning.pdf	Assuming an existing one-family house with radiators Assuming an existing one-family house with radiators Assuming one-family house, new building. 5 kW uni scaled to 7 kW Assuming one-family house, existing building. Fixed and (fixed annual) variable cost added together. Assuming an existing one-family house with radiators, 15 kW oil boiler (smallest in catalogue) Assuming automatic stoking - one-family house, existing building. This value used, since the one in the DEA's was considered unrealistic
Fixed maintenance costs - heat pump air-water Fixed maintenance costs - heat pump liquid-water Fixed maintenance costs - resistance electricity Fixed maintenance costs - natural gas Fixed maintenance costs - oil boiler Fixed maintenance costs - wood pellets	200 200 70 235 270 201	EUR/unit/year EUR/unit/year EUR/unit/year EUR/unit/year EUR/unit/year	P41 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy transport_aug_2016.pdf P45 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy _transport_aug_2016.pdf P44 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P32 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P21 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P22 - http://www.byggeriogenergi.dk/media/1718/guide-valg-af- varmeforsyning.pdf	Assuming an existing one-family house with radiators Assuming an existing one-family house with radiators Assuming one-family house, new building. 5 kW uni scaled to 7 kW Assuming one-family house, existing building. Fixed and (fixed annual) variable cost added together. Assuming an existing one-family house with radiators, 15 kW oil boiler (smallest in catalogue) Assuming automatic stoking -one-family house, existing building. This value used, since the one in the DEA's was considered unrealistic Assumine and fixed annuals of the one family house, existing and new
Fixed maintenance costs - heat pump air-water Fixed maintenance costs - heat pump liquid-water Fixed maintenance costs - resistance electricity Fixed maintenance costs - natural gas Fixed maintenance costs - oil boiler Fixed maintenance costs - wood pellets	200 200 70 235 270 201	EUR/unit/year EUR/unit/year EUR/unit/year EUR/unit/year EUR/unit/year	P41 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy _transportaug_2016.pdf P45 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy _transportaug_2016.pdf P84 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P32 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P21 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P21 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P22 - http://www.byggeriogenergi.dk/media/1718/guide-valg-af- varmeforsyning.pdf	Assuming an existing one-family house with radiators Assuming an existing one-family house with radiators Assuming one-family house, new building. 5 kW uni scaled to 7 kW Assuming one-family house, existing building. Fixed and (fixed annual) variable cost added together. Assuming an existing one-family house with radiators, 15 kW oil boiler (smallest in catalogue) Assuming automatic stoking - one-family house, existing building. This value used, since the one in the DEA's was considered unrealistic Assuming one-family house, existing and new building - share of 100% of heat demand covered building.
Fixed maintenance costs - heat pump air-water Fixed maintenance costs - heat pump liquid-water Fixed maintenance costs - resistance electricity Fixed maintenance costs - natural gas Fixed maintenance costs - oil boiler Fixed maintenance costs - wood pellets	200 200 70 235 270 201	EUR/unit/year EUR/unit/year EUR/unit/year EUR/unit/year EUR/unit/year	P41 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy _transportaug_2016.pdf P45 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy _transportaug_2016.pdf P84 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P32 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P31 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P21 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P22 - http://www.byggeriogenergi.dk/media/1718/guide-valg-af- varmeforsyning.pdf	Assuming an existing one-family house with radiators Assuming an existing one-family house with radiators Assuming one-family house, new building. 5 kW un scaled to 7 kW Assuming one-family house, existing building. Fixed and (fixed annual) variable cost added together. Assuming an existing one-family house with radiators, 15 kW oil boiler (smallest in catalogue) Assuming automatic stoking - one-family house, existing building. This value used, since the one in the DEA's was considered unrealistic Assuming one-family house, existing and new building, share of 100% of heat demand covered by Grauped while hen were is covered by Grauped weighter of the second
Fixed maintenance costs - heat pump air-water Fixed maintenance costs - heat pump liquid-water Fixed maintenance costs - resistance electricity Fixed maintenance costs - natural gas Fixed maintenance costs - oil boiler Fixed maintenance costs - wood pellets	200 200 70 235 270 201	EUR/unit/year EUR/unit/year EUR/unit/year EUR/unit/year	P41 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy _transportaug_2016.pdf P45 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy _transportaug_2016.pdf P84 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P32 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P21 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P22 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P22 - http://www.byggeriogenergi.dk/media/1718/guide-valg-af- varmeforsyning.pdf	Assuming an existing one-family house with radiators Assuming an existing one-family house with radiators Assuming one-family house, new building. 5 kW un scaled to 7 kW Assuming one-family house, new building. Fixed and (fixed annual) variable cost added together. Assuming an existing one-family house with radiators, 15 kW oil boiler (smallest in catalogue) Assuming automatic stoking - one-family house, existing building. This value used, since the one in the DEA's was considered unrealistic Assuming one-family house, existing and new building, share of 100% of heat demand covered by firewood, while tap water is covered by electric
Fixed maintenance costs - heat pump air-water Fixed maintenance costs - heat pump liquid-water Fixed maintenance costs - resistance electricity Fixed maintenance costs - natural gas Fixed maintenance costs - oil boiler Fixed maintenance costs - wood pellets	2000 2000 700 2355 2700 2011	EUR/unit/year EUR/unit/year EUR/unit/year EUR/unit/year EUR/unit/year	P41 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy _transport aug_2016.pdf P45 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy _transport aug_2016.pdf P84 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P32 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P21 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P21 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P22 - http://www.byggeriogenergi.dk/media/1718/guide-valg-af- varmeforsyning.pdf	Assuming an existing one-family house with radiators Assuming an existing one-family house with radiators Assuming one-family house, new building. 5 kW un scaled to 7 kW Assuming one-family house, existing building. Fixed and (fixed annual) variable cost added together. Assuming an existing one-family house with radiators, 15 kW oil boiler (smallest in catalogue) Assuming automatic stoking - one-family house, existing building. This value used, since the one in the DEA's was considered unrealistic Assuming one-family house, existing and new building, share of 100% of heat demand covered by firewood, while tap water is covered by electric water heater. Assumed the same as with wood
Fixed maintenance costs - heat pump air-water Fixed maintenance costs - heat pump liquid-water Fixed maintenance costs - resistance electricity Fixed maintenance costs - natural gas Fixed maintenance costs - oil boiler Fixed maintenance costs - wood pellets	200 200 70 235 270 201	EUR/unit/year EUR/unit/year EUR/unit/year EUR/unit/year EUR/unit/year	P41 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy _transportaug_2016.pdf P45 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy _transportaug_2016.pdf P84 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P32 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P21 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P22 - http://www.byggeriogenergi.dk/media/1718/guide-valg-af- varmeforsyning.pdf	Assuming an existing one-family house with radiators Assuming an existing one-family house with radiators Assuming one-family house, new building. 5 kW un scaled to 7 kW Assuming one-family house, existing building. Fixed and (fixed annual) variable cost added together. Assuming an existing one-family house with radiators, 15 kW oil boiler (smallest in catalogue) Assuming automatic stoking - one-family house, existing building. This value used, since the one in the DEA's was considered unrealistic Assuming one-family house, existing and new building, share of 100% of heat demand covered by firewood, while tap water is covered by electric water heater. Assumed the same as with wood pellets. This value used, since the one in the DEA's
Fixed maintenance costs - heat pump air-water Fixed maintenance costs - heat pump liquid-water Fixed maintenance costs - resistance electricity Fixed maintenance costs - autural gas Fixed maintenance costs - oil boiler Fixed maintenance costs - wood pellets	200 200 70 235 270 201	EUR/unit/year EUR/unit/year EUR/unit/year EUR/unit/year EUR/unit/year	P41 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy _transportaug_2016.pdf P45 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy _transportaug_2016.pdf P84 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P32 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P21 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P21 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P22 - http://www.byggeriogenergi.dk/media/1718/guide-valg-af- varmeforsyning.pdf	Assuming an existing one-family house with radiators Assuming an existing one-family house with radiators Assuming one-family house, new building. 5 kW uni scaled to 7 kW Assuming one-family house, new building. 5 kW uni scaled to 7 kW Assuming one-family house, existing building. Fixed and (fixed annual) variable cost added together. Assuming an existing one-family house with radiators, 15 kW oil boiler (smallest in catalogue) Assuming automatic stoking - one-family house, existing building. This value used, since the one in the DEA's was considered unrealistic Assuming one-family house, existing and new building, share of 100% of heat demand covered by firewood, while tap water is covered by electric water heater. Assumed the same as with wood pellets. This value used, since the one in the DEA's was considered unrealistic. Water heater costing

naruware costs				
Hardware costs - heat pump air- water	7000	EUR/unit	P41 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy _transportaug_2016.pdf	Assuming an existing one-family house with radiators. 70% of total costs are equipment
Hardware costs - heat pump liquid-water	10400	EUR/unit	P45 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy _transportaug_2016.pdf	Assuming an existing one-family house with radiators. 65% of total costs are equipment
Hardware costs - resistance electricity	3920	EUR/unit	P84 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf	Assuming one-family house, new building. 5 kW unit scaled to 7 kW. 70% of total costs are equipment
Hardware costs - natural gas	1800	EUR/unit	P32 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf	Assuming one-family house, existing building. 45% of total costs are equipment
Hardware costs - oil boiler	4620	EUR/unit	P21 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf	Assuming an existing one-family house with radiators, 15 kW oil boiler (smallest in catalogue). 70% of total costs are equipment
Hardware costs - wood pellets	2.571	EUR/unit	P22 - http://www.byggeriogenergi.dk/media/1718/guide-valg-af- varmeforsyning.pdf	Assuming automatic stoking - one-family house, existing building.
Hardware costs - firewood	2540	EUR/unit	P62 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf and https://www.billigvvs.dk/Varmesystemer-Varmtvandsbeholdere-El- VandvarmerMetro-El-vandvarmer-model-110-173057.html	Assuming one-family house, existing and new building, share of 100% of heat demand covered by firewood, while tap water is covered by electric water heater. This value used, since the one in the DEA's was considered unrealistic. Water heater costing 540 EUR assumed.
Connection costs and other				
hardware costs		1	DAA huma llass di later lass di l'Eles Ann huma las det	
Connection costs and other hardware costs - heat pump air- water	0	EUR/unit	P41 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy _transportaug_2016.pdf	Assuming an existing one-family house with radiators
Connection costs and other hardware costs - heat pump liquid-water	0	EUR/unit	P45 - https://ens.dk/sites/ens.dk/files/Analyser/update _technology_data_catalogue_for_individual_heating_plants_and_energy _transportaug_2016.pdf	Assuming an existing one-family house with radiators
Connection costs and other hardware costs - resistance electricity	0	EUR/unit	P84 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf	Assuming one-family house, new building. 5 kW unit scaled to 7 kW.
Connection costs and other hardware costs - natural gas	2000	EUR/unit	P32 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf P21 -	Assuming one-family house, existing building
Connection costs and other hardware costs - oil boiler	0	EUR/unit	https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf	Assuming an existing one-family house with radiators, 15 kW oil boiler (smallest in catalogue)
Connection costs and other hardware costs - wood pellets	0	EUR/unit	P22 - http://www.byggeriogenergi.dk/media/1718/guide-valg-af- varmeforsyning.pdf	existing building. Assumed that chimney and central heating system is already present
Connection costs and other hardware costs - firewood	0	EUR/unit	P62 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual heating plants and energy transport aug2016.pdf	Assuming one-family house, existing and new building, share of 100% of heat demand covered by firewood, while tap water is covered by electric water heater. Assumed that chimney is already present
Installation costs				
	1		P41 - https://ens.dk/sites/ens.dk/files/Analyser/update	
Installation costs - heat pump air-water	3000	EUR/unit	_technology_data_catalogue_for_individual_heating_plants_and_energy _transportaug_2016.pdf P45_https://ens.dk/sites/ens.dk/files/Analyser/update -	Assuming an existing one-family house with radiators. 30% of total costs are installation
Installation costs - heat pump liquid-water	5600	EUR/unit	_technology_data_catalogue_for_individual_heating_plants_and_energy _transportaug_2016.pdf	Assuming an existing one-family house with radiators. 35% of total costs are installation
Installation costs - resistance electricity	1680	EUR/unit	https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf	Assuming one-family house, new building. 5 kW unit scaled to 7 kW. 30% of total costs are installation
Installation costs - natural gas	2200	EUR/unit	https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf	Assuming one-family house, existing building. 45% of total costs are equipment
Installation costs - oil boiler	1980	EUR/unit	P21 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi vidual_heating_plants_and_energy_transport_aug2016.pdf	Assuming an existing one-family house with radiators, 15 kW oil boiler (smallest in catalogue). 30% of total costs are installation
Installation costs - wood pellets	536	EUR/unit	P22 - http://www.byggeriogenergi.dk/media/1718/guide-valg-af- varmeforsyning.pdf	Assuming automatic stoking - one-family house, existing building.
Installation costs - firewood	762	ELIR/unit	P62 - https://ens.dk/sites/ens.dk/files/Analyser/old_technology_data_for_indi	Assuming one-family house, existing and new building, share of 100% of heat demand covered by firewood, while tap water is covered by electric water heater. Installation for water heater assumed to be 30% of bardware cost



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