EUFORIE
European Futures for Energy Efficiency

Consumers and energy efficiency

(Workpackage 5)

Country Report for Finland

An inventory of policies, business and civil society initiatives focusing on heating & hot water and the use of electricity

December, 2015

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Methodological notes:

This report has been compiled as a result of desktop search and semi-structured interviews into:

i) data on energy consumption in the household sector in Finland, and

ii) policies, business and civil society initiatives mainly at the national level to promote energy efficiency in the household sector in Finland.

The report focuses on the use of energy in the household sector for the purposes of heating and the use of hot water, as well as on the use of electricity. Transport-related use of energy is excluded.

The data analysis on energy consumption is based on the ODYSSEE database on energy efficiency indicators and data (http://www.odyssee-mure.eu), using the most recent data available.

The scope of information presented in the report in the case of policies at the national level is mainly on governmental measures in effect. In the case of business and civil society initiatives the main objective of the report is to illustrate diversity and not to provide a complete overview or an exhaustive list of all existing initiatives. An attempt was made to introduce the better-known campaigns and programmes as well as to indicate the variety of the actions.

The collection of information was concluded by end of December 2015.

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Content

Abbreviations

CANEMU	Carbon Neutral Municipalities
ESD	Energy Saving Directive
EPBD	Energy Performance of Buildings Directive
GHG	Green House Gases
HINKU	Hiilineutraalia Kuntaa (Fin. for 'Carbon Neutral Municipalities')
KULTU	Kestävän kulutuksen ja tuotannon (Programme to Promote Sustainable Consumption and Production)
NEEAP	National Energy Efficiency Action Plan
SCP	Sustainable Consumption and Production
SITRA	Finnish National Fund for Research and Development/Finnish Innovation Fund
SULPU	Finnish Heat Pump Association
TEKES	Finnish Funding Agency for Innovation
VTT	Technical Research Center of Finland

List of tables

List of figures

List of relevant official documents

Energy and Climate Strategy (currently 4th from 2013. 5th under development since fall 2015)
ERA17 – For an Energy-Smart Built Environment 2017
Energy Efficiency Act 2015
Act on Energy Efficiency Services 2009
Electricity Market Act 2013
Government Decision on Energy Efficiency Measures (2010)
Ecodesign Act 2008

1. Introduction

Energy efficiency refers to measures that utilise energy in an efficient way, thus using less energy than before. Energy saving, in turn, refers to entirely giving up an activity that requires energy or settling for less, which reduces the need for energy. Energy efficiency measures are typically divided in two areas. Most of the measures are related to technology and technical solutions, such as the consumption of a car, the efficiency of electric devices and the insulation of a building. The other area involves the consumer's own actions and choices. (Finnish Ministry of Employment and the Economy, 2013b).

Energy efficiency and energy savings, technical solutions and behavioural change, these are the main information and lines of arguments collected in the country report. It first provides a general picture of socio-economic and energy related data for household respectively residential energy use. It then reflects on the main policies for energy efficiency which focuses or at least touch the household sector and finally emphasis selected examples of private business, municipality and NGO engagement in the field of energy efficiency. The findings presented are based on official documents, scientific studies and interviews carried out with 12 experts on household energy consumption in Finland.

1.1. General socio- economic and energy data

Table 1 General socio-economic data

SOCIO-ECONOMIC				
Item	**Unit**	**1995**	**2005**	**2012**
GDP at exchange rate	M€2005	112.917,44	164.387,00	173.104,97
GDP at 2005 PPP	M€2005p	96.675,89	140.742,29	148.206,31
Population	k	5.116,83	5.255,58	5.426,67
Number of households	k	2.180,93	2.435,00	2.579,78
Private consumption of household at exchange rate	M€2005	59.190,34	78.881,00	90.309,09
Private consumption of household at 2005 PPP	M€2005p	50.676,66	67.535,10	77.319,43
Value added of agriculture at exchange rate	M€2005	3837,53	3752	4418,2
Value added of agriculture at 2005 PPP	M€2005p	3285,56	3212,33	3782,7
Value added of industry at exchange rate	M€2005	27870,42	47789	44135,7
Value added of industry at 2005 PPP	M€2005p	23861,66	40915,24	37787,42
Value added of tertiary at exchange rate	M€2005	68560,58	91699	99455,61
Value added of tertiary at 2005 PPP	M€2005p	58699,13	78509,42	85150,35

Source: Odyssee database

Finland economy grew by 53.30% in the period 1995-2012; GDP and private consumption at 2005 PPP increased with annual average rate of 2.96% and 2.92%, respectively.

1.2. Residential sector

According to data from Statistics Finland from 2014 44% of Finnish households live in flats, 40% in detached houses, and 14% in attached houses, and the rest (approximately 2%) in other types of housing[1]. The share of housing stock built before 1990 is 73% for detached houses and 77% for blocks of flats. Consequently, measures to tackle the energy consumption of existing housing stock are important in order to achieve reductions in the carbon footprint of the Finnish housing sector.

[1] http://tilastokeskus.fi/til/asu_en.html

Energy consumption

The household sector accounted for 21.1% of Finland's total energy end-use in 2012. The residential final energy consumption per capita was the highest level among the European Member States (1.03 Toe per inhabitant). Table 2 provides a list of data relevant for household energy consumption.

Table 2 Data related residential energy consumption

ENERGY				
Item	**Unit**	**1995**	**2005**	**2012**
Final consumption of residential (with climate correction)	Mtoe	4,36	5,19	5,68
Final consumption of residential	Mtoe	4,29	4,96	5,62
➢ Coal	Mtoe	0,01	0,01	0,01
➢ Oil	Mtoe	0,79	0,70	0,44
➢ Gas	Mtoe	0,02	0,03	0,03
➢ Heat	Mtoe	1,23	1,43	1,66
➢ Wood	Mtoe	0,84	1,02	1,56
➢ Electricity	Mtoe	1,40	1,78	1,92
Space heating	Mtoe	2,80	3,17	4,00
Water heating	Mtoe	0,64	0,72	0,79
Cooking	Mtoe	n.a.	n.a.	0,06
Air cooling	Mtoe	n.a.	n.a.	0,01
Electrical appliances and lighting	Mtoe	0,85	1,06	0,76
Electricity consumption of captive electricity	TWh	9,84	12,34	8,86
Total stock of dwellings	k	2.570,81	2.666,73	2.865,57
Stock of dwellings permanently occupied	k	2.180,93	2.435,00	2.579,78
Total construction of dwellings	k	24,43	33,75	30,76
Floor area of dwellings (average)	m2	83,41	95,87	98,44
Stock of refrigerators	k	2.222,56	n.a.	n.a.
➢ Unit consumption	kWh/year	528,59	n.a.	n.a.
➢ Rate of equipment ownership	%	n.a.	n.a.	n.a.
Stock of freezers	k	1.901,78	n.a.	n.a.
➢ Unit consumption	kWh/year	n.a	n.a.	n.a.
➢ Rate of equipment ownership	%	83,00	n.a.	n.a.
Stock of washing machines	k	1.901,78	n.a.	n.a.
➢ Unit consumption	kWh/year	n.a	n.a.	n.a.
➢ Rate of equipment ownership	%	83,00	n.a.	n.a.
Stock of dishwashers	k	939,43	n.a.	n.a.
➢ Unit consumption	kWh/year	n.a	n.a.	n.a.
➢ Rate of equipment ownership	%	41,00	n.a.	n.a.
Stock of TV	k	2.199,65	n.a.	n.a.
➢ Unit consumption	kWh/year	n.a	n.a	n.a
➢ Rate of equipment ownership	%	96,00	92,80	91,00

Source: Odyssee database

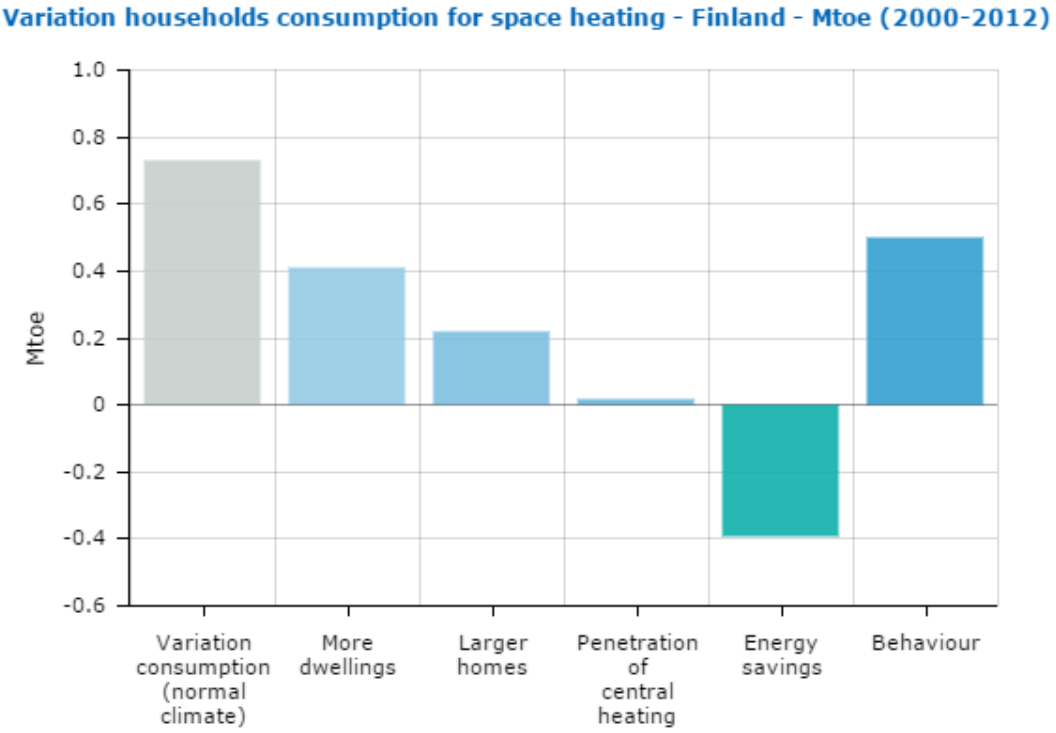
In 2012, Finland's final residential energy consumption amounted to 5.62 Mtoe – a 31% increase compared to 1995 – reaching its peak in 2010, with 5.85 Mtoe.

Nevertheless, the beginning decrease can not necessarily be seen as a serious change. The Technical Research Center of Finland (VTT) does not draw a too rosy picture of the developments of energy consumption in households. The main reason for the decrease trend, they argue, is the change in how the statistics are made 2007/2008, and they warn therefore to draw too far reaching

conclusions for the future of the turning point (Koreneff, Grandell, Lehtilä, Koljonen, & Nylund, 2014).

The main factors behind the growth of the energy use in households are unchallenged: an increase in the number of households, on more spacious than before and also the population is increasing. Energy intensity of households has also increased, although there may also be statistically based explanations behind that. The growth in electricity use as well as intensity appears to have stopped in the mid 2000's, but because of the change in the statistical method it is difficult to assess the state and trend at the moment.

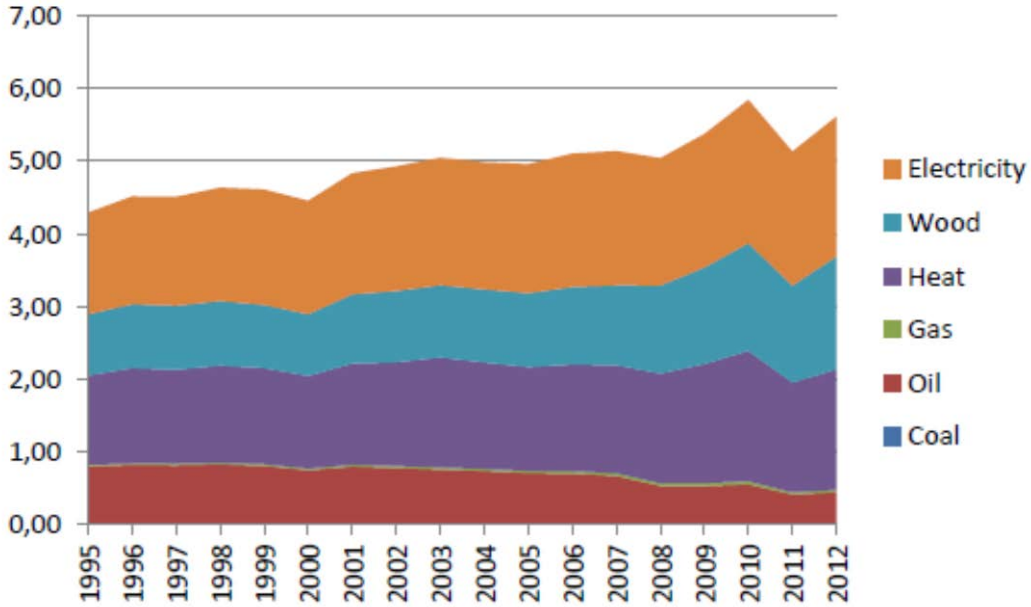
Figure 1 Influencing factors for the energy demand in space heating



Source: ODYSSEE database

The penetration of electricity in the residential sector has always been significant. From 1995 to 2012, it increased of 37% and represented 34% of the total residential energy consumption, followed by heat (29.5%) and wood (27.6%). Fossil fuels such as oil, gas and coal all together accounted for only the 8.4% of the total energy used. Figure 2 shows the progress of energy consumption by source from 1995 to 2012.

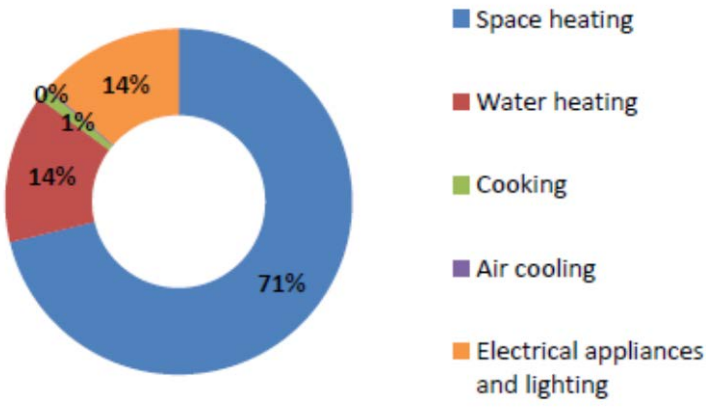
Figure 2 Finland's final residential energy consumption by source 1995 – 2012 (Mtoe)



Source: Author's elaboration based on Odyssee database

Cold winters explain to a large extent how energy has been employed. In 2012 approximately 71% of energy in the residential sector was used for space heating, roughly 14% for water heating, about 13.5% for electricity for appliances and lighting, and a small part for air cooling and cooking (1.2%). Figure 3 illustrates the composition of the energy end-use in the residential sector in 2012.

Figure 3 Finland's final residential energy consumption by end-use 2012 (%)



Source: Author's elaboration based on Odyssee database

Total use of energy for space heating amounted to 4 Mtoe in 2012. Of this, wood was 1.51 Mtoe (37.7%), heat 1.23 Mtoe, electricity 0.88 Mtoe, oil 0.35 Mtoe, gas 0.03 Mtoe. Wood and heat increased of 23% and 118,84% respectively in the period 1995-2012.

Heat was the main source of energy used for water heating in 2012; it represented the 54.4% of the total energy share of water heating in 2012, followed by electricity (29.1%), oil (10.1%), wood (5%), gas (1.2%). While coal has never been used for both space heating and water heating, gas was the only energy source consumed for cooking in 2012.

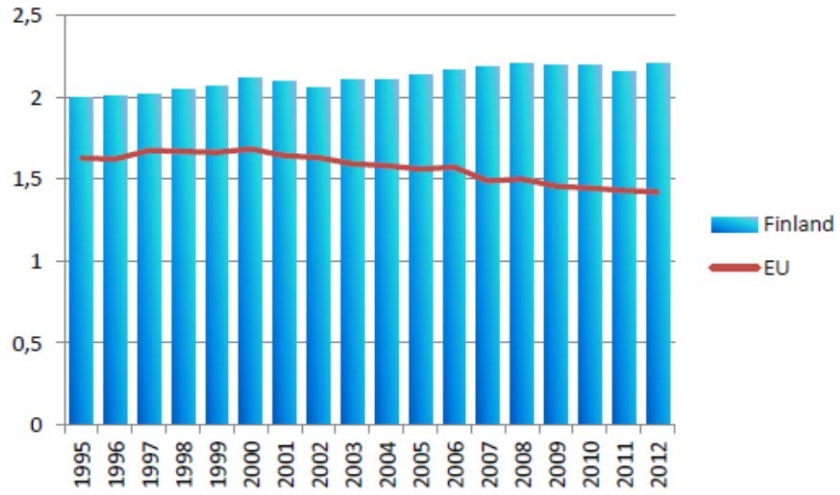
If excluding electricity for heating the electricity consumption originates with by 73.7% from

electrical appliances the remaining 26.3% was used for lighting in 2012 (together 14% of energy consumption).

In 2012, the average floor area of dwellings was about 98.44m² and thus bigger than the average of the European Member States (87.81). Energy consumption of households per permanently occupied dwellings (calculated at normal climate), was 2.2 toe/dw, the second highest value of the European Member States.

Figure 4 shows the household consumption per dwelling of Finland compared to the average of the European Member States over the period 1995-2012.

Figure 4 Finland's final energy consumption per dwelling 1995-2012 (toe/dwelling)



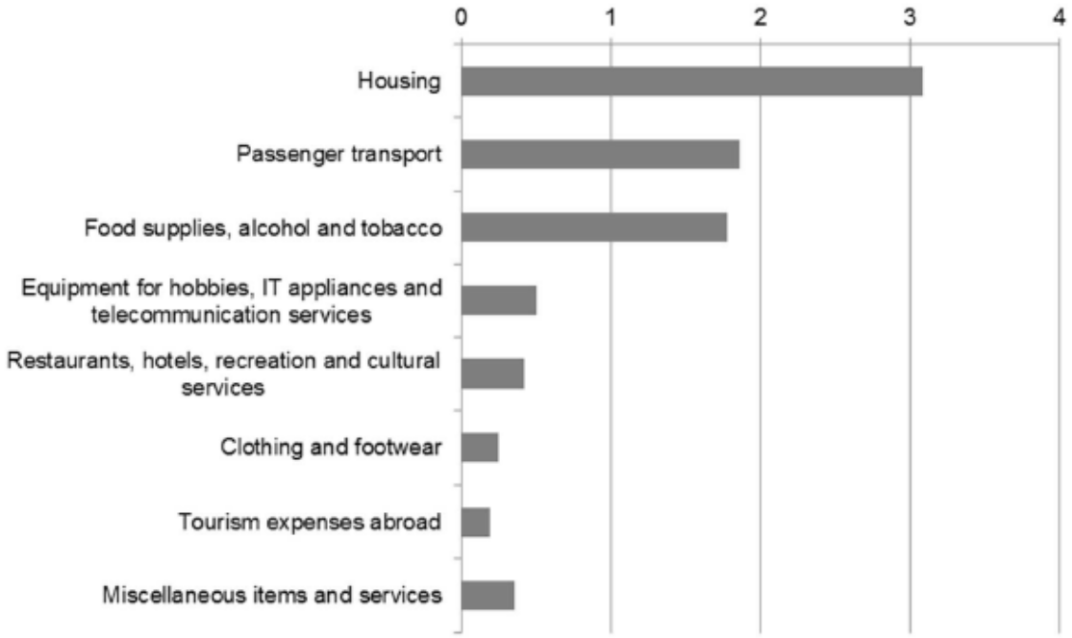
Source: Author's elaboration based on Odyssee database

In 2013 energy consumption in households fell by 5.7 % compared to the previous year. This reflects a good decoupling as the population increased by 0.5 % and the number of households by 0.8 %. Total final energy consumption fell as well but only 1.3 %. Nevertheless, primary energy consumption increased by 0.1 % in 2013.

Greenhouse gas emissions

Housing typically accounts for roughly one-third of all greenhouse gas emissions from Finnish households (Seppälä et al., 2011). Therefore, housing and energy consumption, and especially heating, typically offers the highest potential for reduction. In addition to regulations related to energy and material efficiency, behavioral aspects and the energy efficiency of appliances play a role as well (Salo et al., 2014). This also impacts greenhouse gas emissions.

Figure 5 Greenhouse gas emissions from private consumption (tonnes CO_2 equivalent/capita)



Source: (Salo et al., 2014)

Measures for saving energy and enhancing the efficiency of energy consumption contribute towards meeting reduced GHG emissions and so do the increased use of renewable energies. The residential sector's share of total emissions (6.23 Mt) decreased by 25.12% from 1995 to 2012 and thus was far better than the average of the European Union which decreased by 11.89% in the same period. In addition, Finland is ranked in the eighteenth position for the emissions of the residential sector per capita among the European Member States in 2012 (where Estonia is in the first position being the least efficient).

Table 3 Climate aspects of residential energy consumption

ENVIRONMENT				
Item	**Unit**	**1995**	**2005**	**2012**
CO_2 emissions of households (excluded electricity)	$MtCO_2$	2,53	2,12	1,43
Total CO_2 emissions of households (included electricity)	$MtCO_2$	8,32	7,60	6,23
CO_2 emissions per dwelling	tCO_2/dw	1,16	0,87	0,55
CO_2 emissions per dwelling (with climatic corrections)	tCO_2/dw	1,18	0,91	0,56
CO_2 emissions per dwelling with climatic corrections (included electricity)	tCO_2/dw	3,83	3,16	2,42
CO_2 emissions of space heating per dwelling	tCO_2/dw	0,93	0,7	0,44
CO_2 emissions of space heating (with climatic corrections)	tCO_2/dw	0,96	0,8	0,45
CO_2 emissions of space heating with climatic corrections (included electricity)	tCO_2/dw	1,99	1,73	1,39
Degree-days	degree	4.392,52	4.165,00	4.423,00

Source: Odyssee database

2. Politics effecting energy consumption in households

In Finland, several policy instruments have been introduced over the years, which have influenced energy efficiency of household consumption. Regulations have been used, for example, to set requirements on the specific energy consumption of new buildings and energy using products. Economic instruments such as energy and carbon taxes have been deployed in order to raise the price of electricity, district heating and fuels. Informative instruments aim to inform the public of the energy and environmental performance of products and thus enhance the transparency of markets. A rather comprehensive overview was recently provided by Nissinen and colleagues (Nissinen et al., 2015).

2.1. Policy framework

Overall situation[2]

Steering mechanisms for energy efficiency in households are induced by standards (e.g., building codes, emission limits on new cars), voluntary agreements, economic steering and communication and education. Finland employs all of these methods. In particular, voluntary energy efficiency agreements and audits have a long history and have produced good experiences. Finland's energy efficiency activities have been praised in international assessments by the EU and IEA for their diversity and market orientation (Finnish Ministry of Employment and the Economy, 2013b).

Energy matters in Finland are handled under the umbrella of the Ministry of Employment and Economy. Accordingly the primary objective of energy efficiency is the cost effective reduction of greenhouse gas emissions, with securing of energy supply, decreased the need for imported energy, reduced energy costs, environmental protection and air pollution control as secondary goals. With beginning of 2014 the practical implementation of measures to improve energy efficiency were transferred to the Energy Authority (Finish Ministry of Employment and the Economy, 2015).

2.1.1. Relevant policy documents

Energy and Climate Strategy

National Energy and Climate Strategies (NECS) are applied since 2001. The latest (forth) strategy was approved by the Government in 2013. It recognizes that a significant proportion of emissions in sectors not covered by the emissions trading system are generated through consumption, travel, building-specific heating and choices of food. In the case of many other consumer sector activities, such as electricity consumed and district heating, such emissions are released in the sector covered by the emissions trading system. While different households vary with regard to their situations and opportunities to have an influence the strategy postulates that the average consumer can make a significant reduction in his or her carbon footprint through personal choices. For this reason, consumer advice on the efficient use of energy and energy saving, as well as advice on promoting the use of renewable energy, is seen as an important topic which and must be increased. There is a need to develop tools, online services and other services for comparing the impacts of one's own choices and for finding solutions tailored to one's own situation and household. The strategy's recommendations 76 and 77 point out that

- Advisory services, tools and best practices will be compiled to improve the energy and material efficiency of consumption and encourage the adoption of new solutions.

[2] Where not mentioned explicitly this section is based on information gained in the expert interviews.

- Public steering regarding housing, nutrition and transport will be developed, with the aim of encouraging consumers to make choices that reduce greenhouse gas emissions.

(Finish Govermnent, 2013)p.44

Already in an earlier process, on 4 February 2010, the Finnish Government passed a resolution on energy saving and energy efficiency measures for implementation during the current decade. This government decision is based on a June 2009 report by a broad-based Energy Efficiency Committee, appointed by the Ministry of Employment and the Economy. The energy efficiency measures implement the objectives of the long-term Climate and Energy Strategy (Finnish Government, 2010). Regarding household and residential energy efficiency it introduced the following plannings for the decade to 2020. Bold items were set priority, brackets indicate the responsible ministries.

- **Stricter energy regulations for new building projects will be implemented in phases. (Ministry of the Environment)**
- **Renovation construction and, as part of this, the improvement of energy efficiency will be supported and encouraged through targeted economic steering and support measures. (Ministry of the Environment)**
- **Statutes will be used to steer the installation of apartment-specific water meters in new buildings. (Ministry of the Environment)**
- Requirements will extended to renovation construction on the basis of the directive under renewal on the energy performance of buildings. (Ministry of the Environment)
- Adoption of life-cycle based tools for building planning, use and maintenance will be promoted. (Ministry of the Environment)
- The development and implementation of operating models for the planning and customer-oriented realisation of renovation construction will be promoted, in cooperation with actors in the construction and real estate sector. (Ministry of the Environment)
- **Regulations concerning energy-efficiency standards for equipment will be implemented. Efficient implementation will be ensured by sufficient communication. (Ministry of Employment and the Economy)**
- Ensuring that households have access to reliable, up-to-date, unbiased information on energy conservation measures which are genuinely advisable and cost effective in the context of our overall energy system. (Ministry of Employment and the Economy)
- Developing and introducing methods for metering and monitoring apartment specific energy consumption. Consumers will be provided with comparable data on their energy consumption and on measures for improving its efficiency. (Ministry of Employment and the Economy)

Further tasks were delegated to the Ministry of the Environment regarding community structure supportive for energy efficiency.

Ecodesign Act

The Ecodesign Directive and the Energy Labelling Directive have been enforced nationally through the Ecodesign Act which entered into force in early 2009. The requirements of the Ecodesign Act apply to the product groups for which the European Union has defined product-group specific requirements.

Energy Efficiency Services Act

The Finnish Act on energy efficiency services of companies operating in the energy market and the Government Decree on electricity and supply statements and metering issued under the Finnish Electricity Market Act both entered into force 2009 and cover most of the requirements concerning the provision of meters to final customers for electricity, natural gas, district heating and district cooling and the requirements concerning the implementation of intelligent metering systems (Finnish Ministry of Employment and the Economy, 2014).

ERA17 – For an Energy-Smart Built Environment 2017

This program was started in 2010 by the Minister of Housing encourages Finland to regain its position as the leader in energy-efficient built environments. Efficient land use, distributed methods of energy production, a roadmap for the development of building regulations, an environmental classification system for regions and buildings, and advanced education for energy efficiency build the main elements of the program (Finnish Ministry of the Environment, 2010).

Electricity Market Act

A renewed Finnish Electricity Market Act entered into force in September 2013. In addition to better supply security and improve the transmission capacity consumers shall also benefit from guarantees of origin for electricity so consumers can decide on specifically produced energy, e.g. electricity from renewable energy, in a proved way (Fingrid, 2013).

Energy Efficiency Act (2015)

Finally the Energy Efficiency Act that entered into force 2015 provides for compulsory energy audits among others for metering and billing (Finnish Government, 2015). It sets the basis for the work of about 2000 energy certifiers which mainly work in the private sector and therefore are discussed in section 3. An energy audit model for detached houses is still not established in the housing sector by end of 2015.

Climate Change Act

The Climate Change Act, which entered into force in June 2015, establishes a framework for the planning of climate change policy in Finland and the monitoring of its implementation to enhance and coordinate the activities of state authorities in planning measures that are aimed at mitigation of climate change and adaptation to it, and at the monitoring of the implementation of these measures. Its goals are to ensure the fulfilment of obligations under the treaties binding on Finland and under the legislation of the European Union to reduce and monitor greenhouse gases and thus to reduce anthropogenic emissions of greenhouse gases through national actions by at least 80 per cent by 2050 compared to 1990 levels, and to adapt to climate change. The Government is called to approve the national adaptation plan for climate change at least once every ten years and a medium term plan once per electoral term. The public must be given an opportunity to review the draft plan and submit opinions on it. An annual climate change report shall provide information about progress.

Act in accordance to the EPBD

Finnish legislation is following the targets set by the EPBD to achieve nearly zero energy buildings from beginning of 2019. The respective act is just under preparation in the ministry of the Environment. It should go for public hearing in about spring 2016 and can be expected to pass the parliament by end of 2016 or early 2017.

2.1.2. Expert reflections

Whether energy efficiency is a sufficiently relevant topic in policy making receives a mixed echo among experts. The term does not appear as such in the governmental program in 2015. However, it is clearly embedded in the new concepts e.g. of the circular economy or bio economy. In addition, the target on renewable energy is rather ambition in Finland (39% in 2020 and 50% in 2050) and this influences the force for energy efficiency and energy saving measures because otherwise the target will be difficult to reach.

The actual 4th energy and climate strategy provides some very good policies for energy efficiency respectably the reduction of greenhouse gas emission. Of specific importance is the change in the production of energy. Regulations for the renovation of buildings are considered as important as

well. The regulations are getting stronger all the time so new houses are heading towards zero energy. But there is no indication that they go beyond the EU requirements.

Households seem to be a kind of missing factor in Finnish energy strategies so far. This is because industry is so energy intensive and thus takes a lot of attention. In late fall 2015 a group was set up to develop the next energy and climate strategy which should be launched end of 2016 and replace the one from 2013. Here energy savings will be considered in a more elaborate way because it will also consider the sectors not involved in the emission trading system. Also the Finish Climate Change Act is expected to increase perception of household contributions to emission reductions as it puts emphasis as well on none emission trading sectors.

Actually due to the quite good achievements of energy reductions in industry there are production over capacities now. This also includes overcapacities in electricity provision. This results in the problem that energy is offered at a very cheap rate. This is a common position among all experts. It concerns electricity even if the electricity price for private use is more expensive than for industry. This holds especially true for heating energy. District heating holds a high share in apartment blocks and it is argued, that the heat is available anyway as a co-product from electricity production. Actual political debates are between the interest for cheap and the demand for wise energy provision. But all in all the share of households on the Finish energy consumption is relatively small (about 25%).

2.2. Energy Efficiency Targets

Table 4 EU and Finnish climate targets for 2020

Targets for 2020	**The EU**	**Finland**
Reduction of greenhouse gas emissions[1]	-20%	EU-level target
- ETS emissions[2]	-21%	EU-level target
- non ETS emissions[2]	-10%	-16%
Share of renewable energy sources in final energy consumption	20%	38%
- Share of biofuel in transport fuels	10%	20%
Improving energy efficiency[3]	+20%	EU-level target

[1]Base year 1990, [1]base year 2005, [1]in comparison to development as estimated in 2007

Source: (Finish Govermnent, 2013)

In accordance with the Energy Services Directive Finland's energy saving target for 2016 is 17.8 TWh. The combined energy saving effect of the measures discussed in the NEEAP-3 are estimated to reach 25.4 TWh by 2016. This would indicate, if working out as planned, Finland would exceed its energy saving target for 2016 by 43%. For 2020 the energy saving effect has been estimated to rise to 37.3 TWh which equates to an energy saving of just over 19%. As the NEEAP-3 report does not include an estimate of all energy efficiency measures by the volume of energy, reaching the 20% energy saving target in the sectors governed by the ESD looks very likely.

Calculated savings through energy efficiency measures

Finland has only set sector-specific energy efficiency targets with regard to transport. The share of household related savings remains unclear in this context as national statistics do not differentiate precise enough. Table 3 below, however, can indicate the relative size of saving contributions from households.

Table 5 Summary of impacts on energy consumption

Sector	**2010 GWh/a**	**2016 GWh/a**	**2020 GWh/a**
Total Energy Savings - all	21313	37417	51844
Total Energy Savings according to ESD	**11858**	**25388**	**37577**
- therefrom buildings	6614	15081	21009
= share of total	*31,03%*	*40,31%*	*40,52%*
- therefrom services and private	189	433	506
= share of total	*0.87%*	*1,16%*	*0,97%*

Source: (Finnish Ministry of Employment and the Economy, 2014), own selection and calculation

This indicates that in fact energy efficiency measures directly related to households play a rather marginal role.

NEEAP-3 incorporates eight energy efficiency measures. At least some of them are partly relevant for households as well:

- Energy efficiency agreements
- Transport fuel taxes / road transport
- Energy audits
- Energy efficiency agreements / Energy Services Action Plan and Höylä III with regard to
- customers
- Heat pumps for detached and terraced houses
- Investments in heating plants
- Energy efficiency regulations for renovations and subsidies to incentivize renovations
- Energy efficiency regulations for new development

The annual energy saving effect of 6 614 GWh calculated for the year 2010 equates to a 5% energy saving across the total energy consumption attributable to buildings. The following measures are expected to raise the annual energy saving to a level of 12% by the year 2016 and to a level of 16% by 2020.

Table 6 Estimated savings in energy consumption in buildings based on specific measures (GWh/a)

Measures	2010	2016	2020
Energy efficiency regulation for new development in 2003, 2008, 2010 and 2012	1923	4925	7085
Energy efficiency regulation for renovation	0	750	1750
Energy subsidies for residential buildings	282	1323	1321
Heat pumps for detached and terraced houses	2326	5347	7726
Mandatory installations of unit-specific water meters	0	74	128
Energy labeling of windows	52	66	93
Höylö III energy efficiency agreement – oil heated detached houses	1988	2297	2476
Energy efficiency agreements for the property sector	44	299	430
Total energy savings - ESD	**6614**	**15081**	**21009**

Source: (Finnish Ministry of Employment and the Economy, 2014) p.20

Later in this report, we further elaborate on the energy efficiency agreements (see 3.3), heat pumps (see 3.7.3), the energy efficiency regulations for renovations (see 2.3.1) and subsidies to incentivize renovations and energy efficiency regulations for new development[3] (see 2.3.2).

[3] The Finnish original of the NEEAP suggests that 'new development' means new buildings erected according to EPBD regulations.

Target on energy use

The ***Government Decision on Energy Efficiency Measures*** (2010) declared the stated objective of halting and reversing growth in energy end use. According to it energy saving measures have to be seen compared to a projected position that would arise if no new measures to improve energy efficiency were taken. Nevertheless, they prompted to enhance final energy consumption by approximately 37 TWh, i.e. around 11%, by 2020. Final energy consumption would then amount to 310 TWh in 2020 and primary energy consumption 417 TWh (35.86 Mtoe). Only the longer-term vision entails a de-facto decrease in final energy consumption by 2050 of at least one third of the 2020 level (Finish Govermnent, 2013). This was confirmed again in the first annual report required by the EED in April 2013 (Finnish Ministry of Employment and the Economy, 2013a).

Compared to the most recent data from 2013 listed in Table 2 this indicates a relative decoupling of GDP and energy use but still suggest that general growth effects will over-compensate the efficiency measures. The estimated gross domestic product for 2020 used in the scenarios was EUR 159 billion (EUR 134.7 billion in 2010 at 2000 prices).

Table 7 National energy target

	2013	Target for 2020
Primary energy consumption	382 TWh (32.85 Mtoe)	417 TWh (35.86 Mtoe)
Final energy consumption	304 TWh (26.13 Mtoe)	310 TWh (26.66 Mtoe)

Source: (Finnish Ministry of Employment and the Economy, 2014)

The argument behind this was that through recession lots of small inefficient industry units closed down. In 2013 there was big hope economy would start growing again soon. The still increasing overall figure for energy use is reflecting this growth scenario. An important share of this increasing energy consumption relates to one very large bio-refinery and some major data center which are planned to be built in Finland by Google and others because of the cold climate.

Reflections

These date show quite well the difference between energy savings based on (calculation for) energy efficiency and actual energy consumption. Reaching the target of 20% efficiency gains compared to a 'business as usual' scenario does not mean energy consumption in absolute terms is going down.

Beside political targets the Technical Research Center of Finland expects heating energy for buildings to decrease 21% to 25% by 2050 and the main drop in the energy usage to come from the decrease in old housing units. According to modelling results, specific heating consumption will decrease with 28% to 47% by 2050 depending on the type of the building (Koreneff et al., 2014).

2.3. Explicit policies

2.3.1. Administrative

1. Legislative/Normative

Following the Energy Performance of Buildings Directive (EPBD), Finland introduced cost-optimal levels of minimum energy performance requirements for renovations that require planning permission, which entered into force in 2013. The Finnish Ministry of the Environment also promotes the objectives of the Renewable Energy Sources Directive with regard to buildings undergoing thorough renovation (NEEAP-3).

The standard setting in Finland regarding mandatory standards for buildings; regulation for heating systems and hot water systems; mandatory standards for electrical appliances is in line with the

requirements of the EPBD but no especially ambiguous above this.

NEEAP-3 reports that comprehensive requirements have been set for renovating the building stock with regard to energy performance. Article 4 of the EED is designed, instead of setting requirements, for finding ways to mobilize investment in the energy efficiency of public and private residential and commercial buildings and to implement these in a systematic and timely manner in connection with renovation.

Expert opinion here is that regulation has proved to have the best impact on efficiency measures. In fact, the regulations are getting stronger all the time so new houses are heading towards zero energy. Compared what would be necessary from an environmental perspective efficiency standards are still rather weak.

To proceed better towards more efficiency a solution suggested by the experts was to reduce the tradable CO2 permits accordingly (Lorek, 2015).

2. *Legislative/Informative*

All mandatory informational instruments required for energy efficiency are taken up in Finish national legislation, however not necessarily in an optimal way from the perspective of energy savings.

Labeling of electrical appliances is mandatory in accordance with EU regulation and so is the energy labeling for new and to-be-sold houses and apartments. The mandatory requirements to display energy efficiency classes for products as well as for buildings have proven to be a quite helpful tool to provide orientation for households (Lorek, 2015).

More than 95% of all electricity usage points have an hourly electricity meter that can be read remotely. Remote reading is also already in use for more than 80% of district heating customers. There is very little retail-level supply of natural gas to consumers, and current regulations do not require hourly meters that can be read remotely. Especially for heating and water heating in older apartment blocks connected to district heating individual metering remains to be difficult. Regulation here points to cost effectiveness which weakens the general obligation for efficiency. Problems and potential solutions on this issue are further discussed in 2.3.3.

2.3.2. Economic

Energy efficiency in Finland is promoted by means of subsidies, energy tax well as tax credits for households4. About 2/3 of the Ministry of Employment and Economy subsidies for energy is still going into energy efficiency actions – with one third for EE investments, one third for EE audits and 1/3 for renewable energy investments. The development of energy services in Finland is promoted by means of programmes coordinated by the Finnish Funding Agency for Innovation (Tekes). The most important programmes, which also incorporate business relating to energy services, include Green Growth – Road to sustainable economy (2011–2015, EUR 80 million) and Built Environment (2009–2014, EUR 75 million).

Different from many other countries Finland has no national energy efficiency fund and plans to establish one. As the Parliament of Finland has no control over state funds that are not part of the state budget, a restriction on founding extra-budgetary funds is provided in the Constitution of Finland. An extra-budgetary fund could only be created if the performance of a permanent duty of the State requires this in an essential manner. However, the decision of the Parliament to adopt a

[4] The effects of taxes have not been evaluated separately as ESD savings in the NEEAP-3, as the saving effects would overlap with the effects of other measures discussed in this report. The energy saving effect of the tax credit available to households also overlaps with the effects of energy subsidies.

legislative proposal for the creation of an extra budgetary fund must be supported by at least two thirds of the votes cast. So no new funds are set up in practice.

1. Economic incentives in the investment phase

Unfortunately the financial support for regional energy advisors was cut for budget reasons. In general energy is too cheap in Finland, also the one for private consumption.

Subsidies

The role of small-scale investment, in particular by households or small businesses, has not been particularly prominent in Finnish energy policy (Snäkin et al. 2010). Unlike many other European countries, Finland has not introduced a FIT for solar power or other small-scale renewable energy units. The combined share of solar heat and power is only about 0.01 % of inland energy consumption (Motiva 2013) and there is no national target or universal policy subsidy for increasing this share (Hirvonen et al. 2015). Also passive or zero energy houses get nearly no support.

Some interest in households' investment is visible in the National Renewable Energy Action Plan NREAP (Finnish Ministry of Employment and the Economy, 2010) through its expectations of a sharp increase in ambient energy produced by heat pumps. This is mainly left to the market, because the small government grant (15% of investment cost of ground source heat pumps, bioenergy boilers and solar heat) was only available for homeowners during 2010-2012.

Tax reduction for house(hold) related labour

Finland applies a general tax reduction for any household service. It can be used e.g. for the service component of the installation, and totals 2000 €/taxpayer. The positive aspect is it can be used for drilling the ground source heat well. With two taxpayers in a family, it pays a large part of that investment (about 18 000 € for a medium-size house in total) about half of that is the drilling (Jalas, forthcoming; Lorek, 2015)
Household service tax deductions are regarded as a significant incentive for energy efficiency improvements in detached houses. Taxpayers can currently deduct from their taxes 45% of the value of household service or maintenance work conducted at the taxpayer's or his/her parent's home, up to a maximum value of €2,000 per year (€4,000 for a couple). Vendors of energy technology have utilised this incentive by pricing their work high and equipment low.

2. Economic incentives in the use phase

Regulation for energy pricing

Of crucial importance for the efficiency of the energy system is to avoid peaks in energy consumption. This is where the high CO2 emitting power plants are still needed for. Demand Response is a key word in this context. Consumers have to be re-minded that they should use energy while plenty of it is available – and thus cheap. This was habit in Finland for decades, mainly with regard to electricity based heating systems. They were charged during night time. Real time energy pricing and the IT equipment to observe it can help both: consumers to save money and the energy system to level demand as good as possible.

To support demand response measures Finland has implemented at least a) time-of-use tariffs and b) real-time pricing. The current legislation on the terms and conditions and pricing of system services as well as the terms and conditions and pricing (tariffs) of electricity system services does not prevent demand response or the development of tariffs that support dynamic pricing nor include restrictions on the structure of tariffs. However, considerations of progressive tariffs are not an issue in Finland. The legislation governing the terms and conditions and pricing of system services does not prevent consumer participation in system efficiency, including demand response. Moreover system operators have an obligation to provide their system services to all electricity market

participants in an equitable and non-discriminatory manner (Finnish Ministry of Employment and the Economy, 2014).

The grid service fee of Fingrid Oy was raised with start of 2016 by an average of 14 per cent. Despite the increase, the price level is still reasonable compared to other European countries, and there will be no significant changes in electricity prices for regular consumers. The grid service fee currently accounts for only two per cent of a consumer's electricity bill. For people who live in a block of flats, their electricity bill will increase by an estimated two euros per year as a result, and for owners of detached homes that are electrically heated, the increase will be roughly six euros per year .

2.3.3. Informational

Finland has a long history of investing in the dissemination of information, advice and training relating to energy efficiency. One of the most important organisations in this respect is Motiva Ltd, a state owned company operating as an affiliated Government agency. It covers all sectors from consumers to industry.

In addition, the Finnish Ministry of the Environment hosts an online portal called Korjaustieto.fi, which contains information about property renovations for consumers and property owners, and coordinates a renovation consultancy network.

A further instrument - underutilizes according to the expert interviews (Lorek, 2015) - is to provide better facilitation for apartment blocks which need renovation. Normally public authorities know quite well which houses require renovation in the next future. A timely proactive exchange with the house owners (whether private ones or companies) could help to pave the floor, raise awareness, and increase willingness to go through the 'suffering' which come with major renovations. Neutral experts have been proven to achieve more and trustful attention from tenants which lead to better solutions regarding energy efficiency.

BOX: Metering

An important measure to raise information and thus induce activity by households is an adequate and timely metering system. Her the Finnish situation shows some weaknesses. Therefore elaborated considerations are presented in a box, see next page.

Metering

A decree of the Finnish Ministry of the Environment on the energy performance of new buildings stipulates that all buildings must be equipped with energy consumption meters or have readiness for metering in order to be able to easily verify the consumption of different forms of energy. This metering is one of the aspects which frequently appeared as a problematic issue during the interviews.

Individual billing

Services of companies operating in the energy market and energy suppliers at retail level have an obligation to provide final customers for district heating and district cooling with meters that can be used to verify energy consumption as well as to provide information about the temporal distribution of consumption whenever a new supply is installed and whenever it is technically and economically reasonable to provide metering otherwise. This economically reasonable, however, appears to be problematic when heating, cooling or hot water are supplied to a building from a district heating network or from a central source servicing multiple buildings the picture becomes more difficult. Due to the way pipes are installed in such houses there is no unique measuring point for an apartment which is the requirement for precise measuring. To install such cost allocators would only pay for themselves once consumers would be able to use them to save more than 45% of their energy in apartment blocks. These thresholds have been calculated without factoring in any discount rates in profitability calculations. If discount rates are factored in, the required energy savings are even greater. Therefore, in 99% of existing buildings with multiple residential units, energy metering and indirect determination of heating consumption would generate costs beyond what can be covered by energy savings resulting from changes in consumer behaviour. At least in older buildings a heat or hot water meter only must be installed at the heating exchanger or point of delivery.

Here households get their bills based on the size of their apartment's independent from real energy consumption. Actually there is quite some resistance to individual metering. Typical counter-arguments are: it is too expensive to establish such metering and it would be unjust because central flats as a matter of fact have a lower energy demand than flats on the top level of a house. This is an unfortunate situation in so far as studies have shown that in detached houses of the same size of m² less energy is used. This is remarkable considered that detached houses have more outer walls and thus less advantaged starting conditions for energy efficiency. However, their residents indeed act according to the energy bills based on measured energy consumption.

So, the (regulation on) shift towards individual metering still face a lot of resistance but would help a lot to make people aware of their own energy consumption. At least regarding hot water use some more pragmatic ways of measuring could bring individual billing a step further. More flexibility towards electronic meters calculating the results from various measuring points would allow for at least approximate data for individual consumption and thus billing.

Demand Response

Taking into account various services and electronic systems relating to the management of energy consumption and energy supply, Finnish service providers are versatile and knowledgeable. There are numerous service providers on the market who have their own products and efficient channels and resources for marketing these. Projections for the future are encouraging.

Of crucial importance is to avoid peaks in energy consumption. This is where the high CO2 emitting power plants are still needed for. Demand Response is a key word in this context. Consumers have to be re-minded that they should use energy while plenty of it is available – and thus cheap. This was habit in Finland for decades, mainly with regard to electricity based heating systems. They were charged during night time. Real time energy pricing and the IT equipment to observe it can help both: consumers to save money and the energy system to level demand as good as possible.

2.3.4. Cross cutting

Following the UN 'Plan of Implementation' which was adopted at the World Summit for Sustainable Development in Johannisburg 2002 (WSSD, 2002) the Finnish government as one of the first worldwide set up a national strategy for sustainable consumption and production (SCP). Their programme 'Getting more from less' was developed in a participatory process and launched in 2005 (KULTU Committee, 2005). Beside a strong focus on material efficiency it also targeted energy efficiency. Some illustrative tools were developed in various research projects on this matter as a basis for assessing the environmental impacts of individual decisions (for examples see 4.3). While the process of developing the programme went quite well, a real implementation was missing (Berg, 2007, 2011). In 2013 a second national programme 'More from less – wisely' updated the old program bases on the outcomes of the Rio+20 Sustainable Development Summit and the EU Sustainable Consumption and Production Action Plan (European Commission, 2008; United Nations, 2012). In it key goals for housing and other buildings especially endeavor to reduce energy consumption and encourage the use of renewable and hybrid energy solutions through 'reshaping energy policy in the nation's living rooms' (Finnish Ministry of the Environment, 2013). The programmes brochure, targeting average consumers, emphasis the collaboration with Motiva (see 3.1), Demos/Peleton Club (see 3.7.2), and the HINKU Forum (see 4.1.1).

A recent study evaluated the saving potential and cross fertilization of mixes of policy instruments. Nissinen and colleagues integrated instrument into packages, to minimize potential negative interferences, while strengthening synergies and complementarities between these instruments (Nissinen et al., 2015). They compared on a first level whether instruments were directly (D) or indirectly (I) interacting and further distinguished if the relationship for direct interactions was prerequisite P/D, supportive S/D, replacing R/D or conflicting C/D respective for the indirect interactions if they increased the potential of the instruments I/P or deduced it I/R. On a second level the degree of the influence was estimated with + weak, ++ moderate, +++strong or 0 none(Nissinen et al., 2015).

Figure 6 Analying interactions for policy instruments for housing

Policy instrument matrix for housing	a) Building codes	b) Effects of eco-design directive on appliances at households	c) Taxes on energy	d) Subsidies for choice or renewal of heating system, blocks of flats	e) Subsidies for choice or renewal of heating system, houses (2006-2008)	f) Tax deduction for repair work	g) Energy experts in block of flats	h) National energy guidance	i) Energy certificate	j) Real-time metering of electricity consumption	k) EU energy label
A1 Building codes		A1-b 0	A1-c 0	A1-d 0	A1-e 0	A1-f 0	A1-g 0	A1-h 0	A1-i I/P +	A1-j 0	A1-k 0
A2 Effects of eco-design directive on appliances at households			A2-c D/S +	A2-d 0	A2-e 0	A2-f 0	A2-g D/S +	A2-h D/S +	A2-i D/S +	A2-j D/S +	A2-k D/S +++
A3 Taxes on energy				A3-d I/P ++	A3-e I/P ++	A3-f I/P ++	A3-g D/S+	A3-h D/S +	A3-i I/P +	A3-j D/S++	A3-k I/P ++
A4 Subsidies for choice or renewal of heating system, block of flats					A4-e D/P +++	A4-f 0	A4-g D/S+++	A4-h D/S++	A4-i D/S++	A4-j D/S++	A4-k D/S++
A5 Subsidies for choice or renewal of heating system, houses (2006-2008)						A5-f D/R	A5-g 0	A5-h D/P +++	A5-i D/S +++	A5-j D/S ++	A5-k D/S ++
A6 Tax deduction for repair work							A6-g D/S ++	A6-h D/S +	A6-i D/S +	A6-j D/S +	A6-k D/S +
A7 Energy experts in block of flats								A7-h D/S+++	A7-i D/S+++	A7-j D/S+++	A7-k D/S+++
A8 National energy guidance									A8-i D/S +++	A8-j D/S +++	A8-k D/S +++
A9 Energy certificate										A9-j D/S +	A9-k D/S +
A 10 Real-time metering of electricity consumption											A10-k D/S +
A11 EU energy label											

Source: (Nissinen et al., 2015) p. 460

According to their findings the following policy instruments combinations seemed to be especially promising (see Figure 7):

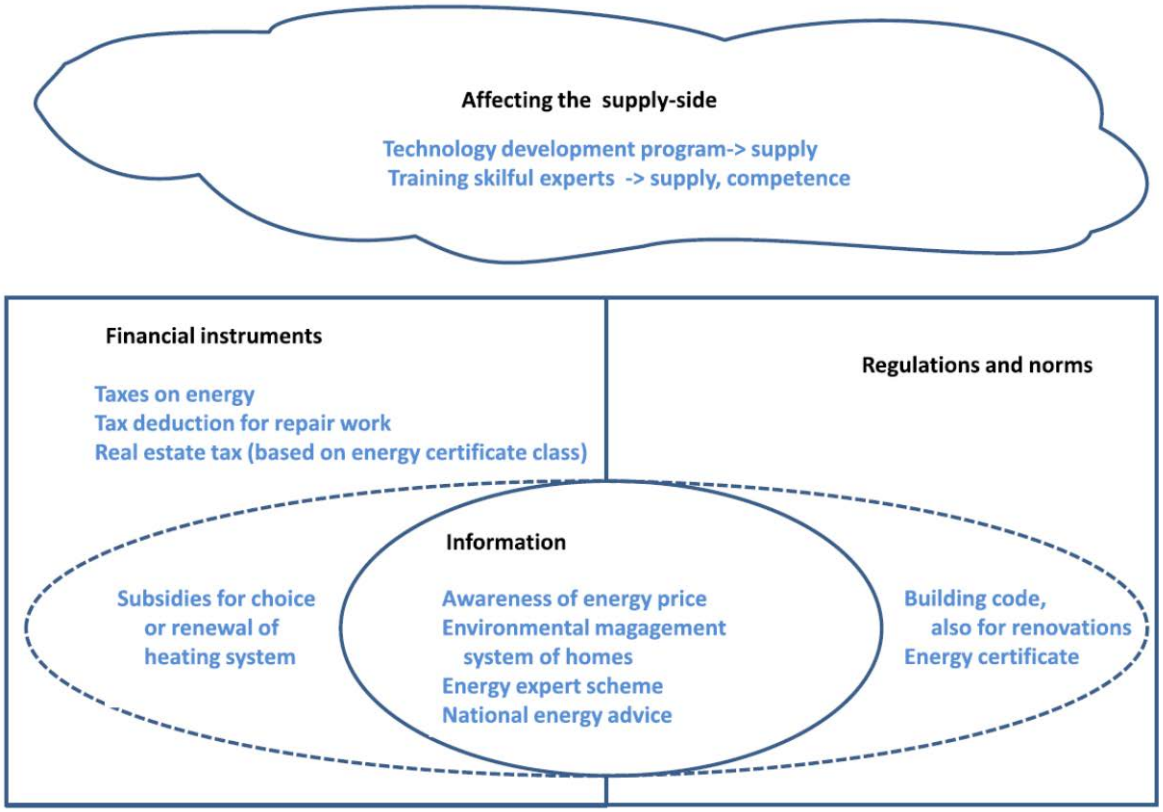
A) Extend the scope of regulatory instruments (energy efficiency requirements on renovation of existing buildings and stricter requirements concerning energy performance certification of buildings);

B) Create incentives for energy renovations, heating systems upgrades and climate-friendly user behavior (by influencing energy price expectations, and through energy taxes, a differentiated real estate tax, subsidies for energy efficiency investments and a tax deduction for energy renovations);

C) Offer guidance and advice for energy renovations and climate-friendly user behavior (national energy advice, mandatory advice connected to building permits and energy renovation subsidies, application of environmental management systems also for homes, as well as improvements in the so-called energy expert scheme, i.e., the use of voluntary residents trained to offer energy advice to their neighbors);

D) Enhance supply-side capacities to design and implement cost-effective energy renovations (technology programmes and training).

Figure 7 Packages of policy instruments for energy efficient housing



Source: (Nissinen et al., 2015)p. 461

When attempting to address the emissions from energy use in housing, focus shall be given to existing buildings, since the renewal rate of the building stock is rather slow (about 1.5% per year), and energy efficiency requirements on new buildings have become fairly stringent.

As the study was conducted to identify CO2 reductions the authors calculated the emission reductions to be gained from the policy instrument package targeted at housing. They identified a potential of 0.92 Mt reduction gained through heating systems replacements and improvements (replacement of half of the oil heating and all central electric heating systems with ground-source heat pumps and pellets and improvement of room based electric heating with air-to-air heat pumps and solar water heaters) and a 0.40 Mt reduction due to energy renovations of building envelopes and technical systems. More energy efficient user behavior was estimated to result in 0.36 tons of greenhouse gas emission reductions, while more energy efficient household appliances were estimated to bring an emission reduction of 0.34 million tons (Nissinen et al., 2015)p. 461.

2.4. Side effects of politics (also those targeting something else)

In line with a primate on growth policies growth aspects are often contradicting the benefits gained from energy efficiency politics. The national energy target (see 2.2) illustrates this quite well. One of the main problems - emphasized by all experts (Lorek, 2015) – is the low price for energy, especially for heating energy. District heating holds a high share in apartment blocks and it is argued, that the heat is available anyway as a co-product from electricity production. Also electricity is rather cheap. Still the Finnish Government has decided to build up a second new nuclear power plant.

A big obstacle for effective renovation is rooted in the public policy to go for the cheapest offer for a bit. This often leads to bad quality of construction, often in combination with workers purely educated on energy efficiency matters. In the private sector the rather high and complicated legislative regulations for renovation often make housing companies shy away from modernization or, even worse, administration is bypassed.

The financial support for regional energy advisors was cut for budget reasons. Another unfortunate situation is the lack of metering for heating in lots of apartments which are provided with district heating. Newly build houses have to have meters but older have not.

Other specific policies not in line with the task of energy saving are the subsidies for heating oil and the tax exception for peat. Generally efficiency standards are rather weak compared what would be necessary from an environmental perspective. Passive or zero energy houses get nearly no support.

On a more individual level, for example, Finnish population on average has more living space per person than other European nations and it is still growing (see Figure 4, in section 1.2Figure 4 Finland's final energy consumption per dwelling 1995-2012 (toe/dwelling).). A further problem is the computerized homes which generally raise the ground load.

Based on experiences in the 1970s people are often concerned about bad air and mold resulting from isolated flats. So they contradict the benefits of isolation though exaggerated airing or resistance to renovation. While the problem generally is solved through technology, informational policies haven't managed so far to prove the argument as outdated.

3. Private sector support complementing public policies

3.1. BOX: Motiva

Motiva Group is an expert company promoting efficient and sustainable use of energy and materials. It is in Finnish state ownership and operates as an affiliated Government agency (an in-house unit). Motiva is the main organisation in Finland in contact with companies, public sector and consumers provides and provides them with information and solutions leading to resource efficient and sustainable choices. Its services are used by the public administration, businesses, communities, and consumers.

Different ministries contribute approximately EUR 3 million to Motiva's communications each year (Finnish Ministry of Employment and the Economy, 2014; Lorek, 2015). Motiva is concentrating on communication and networking on the broad range of energy efficiency topics from renovation to choice of appliances. Motiva among others fulfill the following tasks:

- coordinating a network of regional consultancy organisations and energy companies which provide of energy advice targeted at consumers
- disseminate information about the energy performance of buildings and energy certificates
- advice on themes such as property management and maintenance, material efficiency, damp and mold problems
- advising consumers on eco-design and energy labelling requirements
- a joint website with lighting companies containing information about lighting products for households

In 2016 Motiva will concentrate on electricity, especially in smart metering in electricity heated households.

Motiva is responsible for the development of the energy audit models, training and authorisation of the auditors (see 3.2.)as well as maintaining monitoring and supportive marketing activities and for development and follow up of energy efficiency agreements in Finland (see 3.3.) This ensures that energy auditing, energy efficiency agreement and reporting of it are very well linked together (Lorek, 2015).

Motiva is the coordinator of the National Energy Awareness Week in Finland, which since 1996 is an annual theme week in October during which schools, companies and other organisations concentrate on promoting energy efficiency. In 2016 Motiva concentrate on electricity, especially in smart metering in electricity heated households. Key words here are for example: smart grids, automatic control, wireless sensors. This technology would work also with solar energy systems when installing larger water tanks. All around the year Motiva strives to integrate energy education into school teaching programs is also an important part of creating the bases of comprehensive sustainable development, with energy use efficiency as one aspect of it.

The Motiva website and other material provide information for homes and households how to affect energy consumption at home through own activity or already when obtaining fittings. There are separate sections for residents belonging to housing companies and for house managers, which give information on energy auditing and the basic regulations concerning the heating system.

Internationally, Motiva is active in European and international energy networks and participates in international projects in the fields of energy efficiency and renewable energy sources. It provides as well information and assistance to Finnish companies and organisations on IEE – Intelligent Energy Europe programme as the national contact point.

3.2. Energy audits

An energy audit is an inspection, survey and analysis of energy flows in a building, of a process or system with the objective of understanding the energy dynamics of the system under study. Beyond simply identifying the sources of energy use, an energy audit seeks to prioritize the energy uses according to the greatest to least cost effective opportunities for energy savings. In addition energy audits look into the possibilities of renewable energy use. Also the effects of the proposed savings methods on CO_2-emissions are taken into consideration.

Motiva has been providing energy auditor training on commission from the Finnish Ministry of Employment and the Economy since 1993. By the end of 2013, a total of almost 1 900 energy auditors had been trained and certified to carry out audits in the service sector, industrial sector and energy sector. In the last five years, between approximately 85 and 95 new energy auditors have obtained the qualification each year. Qualitatively and quantitatively speaking, Finland has enough qualified energy auditors. As of the beginning of 2014, responsibility for organising energy auditor training was transferred from the Finnish Ministry of Employment and the Economy to the Finnish Energy Authority. Some changes were designed then to respond to the new challenges presented by the Energy Efficiency Directive (Finnish Ministry of Employment and the Economy, 2014).

Energy companies advise their customers in how to make use of the information generated by new meters as part of normal customer service as well as via the internet.

3.3. Energy efficiency agreements

From as early as the 1990s, Finland has employed voluntary agreement schemes to promote energy efficiency which prove to be a powerful tool. Especially the ones with industry work out quite well. Decision makers there normally see the economic benefits. In addition they prefer to follow the agreements to avoid regulation on the issues.

The purpose of the energy efficiency agreement scheme is to contribute, in accordance with the national energy and climate strategy, to the fulfilment of international commitments. This new agreement scheme is especially important to the implementation of the Energy Services Directive. Under the new agreement scheme, efforts have been made to take the obligations of this Directive into account, and Finland succeeded in negotiating agreements on the implementation of these obligations as alternatives to regulatory steering.

There are contracts for voluntary commitments from the business sector and municipalities. The energy efficiency measured as a result of the implementation of this agreements from 2008-2013 were 2,4% of Finland's total energy consumption. Almost one-third of the saved energy is electricity. The agreements mainly go hand in hand with energy audits. There are also subsidies for investment measures. The share of households engagement in this, however, is not reported.

Another important contribution appears through building up competencies for construction workers, architects etc how to best consider energy efficiency matters in practice. The public authority approach to accept the cheapest offers often leads to bad quality of construction, often in combination with workers purely educated on energy efficiency matters (Lorek, 2015).

There are no legislative barriers to prevent landlords and tenants in Finland from agreeing to implement energy efficiency measures and to split any energy savings thus achieved. One good example of ways to enable benefit sharing between landlords and tenants is the development and promotion of the so-called Green Lease concept. To set an example in the public sector, Senate Properties developed the first Green Lease contracts in 2011.

3.4. Bank loans

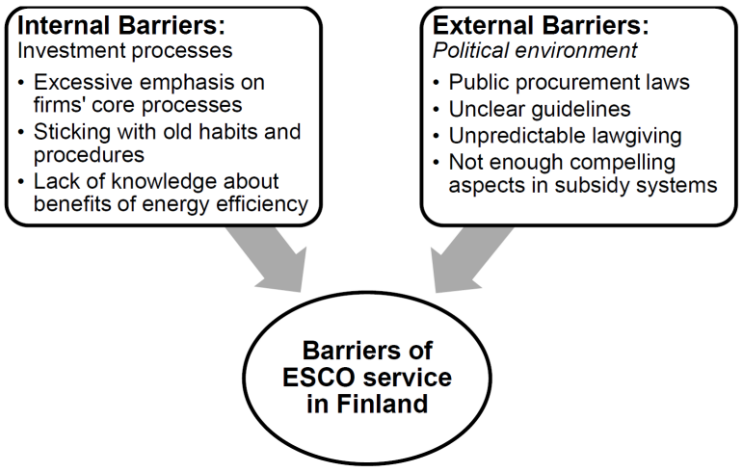
Next to public funds bank loans in general are a tool to finance in energy efficiency measures. Financial support from the banking sector could include easier access to loans e.g. through tailored and actively promoted credits for such investments.
Also longer loan periods (which are actually available) would share the costs and benefits more fairly between residents (older residents do not have to pay a lot of the loan back during their lifetime).
Offers here are rare in Finland. Only the Local Savings Bank, a regional bank with about 10 offices, is offering tailored money e.g. for heat pumps. This could serve as an example for other credit institutions.

3.5. Energy Service Companies (ESCOs)

As the NEEAP 3 recognises, the market for ESCO services is rather small in Finland. Motiva (see 3.1) maintains lists of ESCOs that have submitted information to the ESCO project register. Due to the limited number (3−5 companies), there is no separate qualification or certification scheme for service providers nor is it foreseen in the near future (Finnish Ministry of Employment and the Economy, 2014).

A study carries out at the University of Lappeenranta (Pätäri & Sinkkonen, 2014; Sinkkonen, 2013) analyse the reasons for the limited market. As most significant barriers it identifies problems in legislative and political frameworks, and in customers' investment processes. Political barriers are unsuitable procurement processes, unclear and unpredictable laws, and lack of compelling factors in subsidy system (see Figure 8).

Figure 8 Barriers of ESCO services in Finland



Source: (Sinkkonen, 2013), p. 97

Investment process hurdles are also caused by customers' lack of interest to change course of action. These are things in which ESCOs can have influence in. There is still quite some unawareness of ESCO project's benefits and inability to assess investment possibilities objectively which decreases demand for ESCO service. A survey carried out for the study shows that customers might fear that ESCO service provider is trying to benefit excessively from the contract or that ESCO service provider is giving exaggerated estimates about achievable savings and so trick customer to award the contract to ESCO. Where ESCO service provider has given savings guarantees, however, there is no reason for the client to doubt project's future cash flow. So, generally, mistrust is one but not a major barrier of ESCO business in Finland. Yet, some difficulties are caused by a limited awareness of

ESCO model among potential customers. So a lack of knowledge sometimes manifests in form of mistrust. Even though a lot of work promoting ESCO model has been done, for instance, by Motiva Oy, the level of awareness is not yet sufficient. Therefore the study recommends ESCO should become more active and sharpen their own communication and take larger role in promoting ESCO model and energy efficiency in general. ESCOs should try to make potential customers see benefits of ESCO projects and asses ESCO projects objectively.

As major reasons for poor success of ESCO service in Finland problems in political environment and in investment processes were discovered. In public sector unsuitable procurement laws are highly problematic for ESCO projects as they make tendering process of ESCO service contracts extremely difficult. Private sector suffers from energy policy guidelines in other ways. In general, political guidelines concerning energy efficiency are far too unclear and unpredictable. For this reason, willingness to invest in energy efficiency remains at relatively low level.

In municipal sector energy efficiency agreements were seen a major incentive to carry out ESCO projects. Local governments that have signed the local government energy efficiency agreement have committed themselves to acquiring sufficient expertise in considering and subscribing to ESCO services whenever a viable energy efficiency investment would otherwise need to be abandoned due to lack of funding (Finnish Ministry of Employment and the Economy, 2014). But here as well public procurement rules in municipal ESCO projects create a major barrier for successful ESCO projects. Generally speaking, political guidelines are somewhat unclear and hard to predict which makes it difficult to make investment decisions for the future, and reduces overall willingness to get involved with energy efficiency investments. In addition, political discussion concentrates too much on energy production, and in many ways ignores possibilities of energy efficiency.

As a further result Sinkkonen emphasis the importance of the starting phase of a ESCO project. The beginning of the project determines, by far, the overall success of the whole ESCO project. At the beginning trust is formed between ESCO and the client because at this point savings potential, project design and investment negotiations are done. If savings potential is calculated carelessly and investment decisions are done according to erroneous calculations success of the whole project is questionable. Failure in the starting phase also ruins trust between ESCO and the client, and consequently preclude possibility to carry out any future energy efficiency projects. For this reason, ESCO's are recommended to focus extremely well on the first stages of ESCO projects (Sinkkonen, 2013))

3.6. Housing companies

Housing companies in Finland are important but not necessarily proactive agents when it comes to energy efficiency measures. In Finland a common way of flat ownership is that people buy a flat in form of shares of a building. The sums of shares form the housing company. All parts of the building relevant for energetic modernization, like the heating and pipe system, belong to the housing company. The company is governed by a board which consists of elected owners. Issues like major renovations, as renovations for efficiency purpose, have to be made unanimous by all owners. This already cause quite some problems as 'normally' there is at least one voice not in favor of any change which implies money. Blocks of flats are typically managed by a housing board and a professional house manager. The housing board consists of elected representatives of the flat owners. The role of the board and the manager are essential when major renovations are prepared and the guidelines for the maintenance work are set. The flat owners are collectively responsible for the costs of major renovations and maintenance. Space heating energy (typically also including centrally heated water) in the whole building and the electricity used in common areas are usually collectively paid for by the owners. The electricity used in the flats is paid by the users. When major

renovations are needed, there is a need for unbiased information, independent from any single technical solution, to find the best solution for the house (Salo et al., 2014) (see 4.3 EcoHomes).

The existing regulatory framework sets guidelines on energy efficiency improvements. Carrying out ambitious energy efficiency improvements exceeding the minimum level set by the regulations would require advocacy from a board member or a consultant to motivate the board and flat owners concerning the advantages of the energy efficiency improvements.

The concept of an energy expert was originally developed by Motiva (see 3.1). Energy experts are elected and specially trained members of the housing company board who are familiar with energy- and water saving potential. They have the task, and relatively easy access, to check if something in the house could be improved concerning the energy performance. Energy experts also have a role in communicating with other residents, the housing manager and the housing board. Depending on the level of adjustments and maintenance, consumption can be 20% higher or 10% lower than the baseline. Behaviour changes may increase or decrease energy consumption by 5% (Salo et al., 2014). Despite their important role energy experts often feel like sitting between the chairs, as was pointed out in the interviews (Lorek, 2015). Some more attention and reward to their work could strengthen their mandate and generally raise recognition for the topic.

The complicated decision-making process in the housing companies often hinders the progress of energy efficiency. The role of the housing manager is essential as attitudes and practices of the managers showed having an impact on the energy performance of the buildings (Kyrö, Heinonen, & Junnila, 2012). The value of the energy efficiency study is not always fully appreciated by the board members as this lay team is not often not familiar with life cycle calculations therefore require education, explicit examples and consultation support. This would help to communicate to and convince board members about the potential benefits of the energy efficiency measures.

3.7. Other initiatives by or in cooperation with the private sector

3.7.1. Housing Fair Finland (Suomen Asuntomessut)[5]

Since 1970 a Housing Fair is organizes in Finland nearly every year for about two month in another town. The concept is rather open in general and depends on the organizing municipality. To indicate the variety: the exhibition area during the last 45 years ranged from 3 ha to 33 ha and the number of exhibition homes from 6 to 59. The amount of visitors however does not depend on the size. It reaches up to 271.000 and has an average of 150.000.The principal function of the Housing Fair Finland Co-op is to improve the quality of housing and living conditions in Finland, in co-operation with local partners. This is achieved by providing information about housing issues and promoting industry standards and skills, as well as organizing the annual Housing Fair and Holiday Home Fair.

The Housing Fair is a meeting point where consumers and producers are brought together. The fairs showcase the latest research in construction and housing related issues, thus increasingly ecological aspects. This research produces practical applications that provide innovative examples and concrete visions of excellence in living/housing standards, for both consumers and professionals within the industry. For more details from the housing fair in Tampere in 2012 see 4.1.3. The fair area was one of the first residential areas in an new energy efficient suburb.

3.7.2. DEMOS/ PELETON Club

Demos Helsinki started its operations in 2005 by conducting a research for Sitra, on the future of public services and the changes in sources of wellbeing. During 2011–2012 Demos Helsinki was part

[5] http://www.asuntomessut.fi/en/english-home

of a European Commission consortium that created a roadmap for strategic action AND created four alternative scenarios for future lifestyles. In 2014 Demos Helsinki opened a Nordic management consultancy, Demos Effect, which offers strategy and innovation services to companies globally.

From the very beginning DEMOS was engaged to support energy efficient and energy saving solutions for consumers. The ambition is to engage gatekeeper into decision processes to offer better solutions to consumers. Generally this ranks from more ecological food in canteens via different mobility opportunities to energy consumption in housing.

DEMOS runs and supports the PELOTON Club[6], a network for startups for energy efficient society. It brings together different organisatons to work together in workshops to develop new ideas. Lots of new companies were started this way (smart ups[7]). The PELOTON Club (named after the first project of the organization) by now has over 400 members which have the possibility to meet once a month to present business ideas, critically discuss them and develop them further. From time to time the meetings are visited also from people from ministries (even up to the minister).

Peloton Club is a dynamic and open community of entrepreneurs. The purpose of the community is to provide consumers with products and services that allow e.g. low emission and resource-smart housing, transport or food.

3.7.3. BOX: Heat pumps

According to NEEAP-3, one of the most important energy efficiency measures with regard to buildings are heat pumps in terraced and detached houses. Also the expert interviews confirm that heat pumps are currently a main topic. Heat pumps are able to produce about 3-4 kWh of heat, using about 1 kWh of electricity. The rest of heat is derived from the surroundings which can be air (air to air heat pumps or water/rock/soil in case of ground based heat pumps.

Heat pumps already were an issue in Finland in the late 1990s but lost attraction in-between due to some technical problems. The second rise of the heat pump demand in Finland came over from Sweden and was a coincidence of raised awareness in energy consumption issues and related interest in renewable energy with a good positioning of the heat pump industry which had set up the Finnish Heat Pump Association SULPU in 1999.

The advantage of heat pumps is that they are comparing easy to install, at least air to air heat pumps, partly even ground source heat pumps. Therefore the technical aspects of heat pumps, up to 'do-it-yourself' heat pumps get great attention. Websites and blogs on the issue raised more than 55 million hits by end of 2015, which means an average assess of 10 times from each Finn. The internet sources offer peer-to-peer learning which sometimes result in face to face contact, self organised local exhibitions and trainings (Heiskanen, Hyysalo, Jalas, Juntunen, & Livio, 2014).

A further advantage is the relatively low investment costs. For historical reasons lots of residential buildings in Finland have a size of 100 m² and more expensive investments do not pay out for them – at least not in an adequate time. According to the Finnish heat pump association costs for air to air heat pumps start from 1.500€ with annual savings of 250€ compared to electricity or oil based heating. For ground source heat pumps the investment costs range from 14.000 to 20.000€ with savings between 1800-2200€ per year[1]. This indicates savings from about 60-70%. A problem with air-to-air heat pumps however is, that it causes quite some rebound effects because they are used for cooling as well. Surveys on real live performance therefore do not confirm such good results but energy savings of about 20% in case of air-to-air heat pumps and a range from 14 to 70% for ground heat pumps (Heiskanen et al., 2014).

[6] http://www.pelotonclub.me/what-is-peloton-club/

[7] http://www.pelotonclub.me/tiimit/

Demand for heat pumps primarily is coming from private house owners but they are an option for apartment blocks as well. Exhaust-air heat pumps started to become more demanded in apartment buildings. In 2014 a few hundred apartment buildings were fitted with a heat pump that retains the heat of exhaust air, which reduces about 50% of district-heating or other energy expenditure of the buildings. Even district heating companies are considering heat pumps as a supplementary source of energy production.

SULPU reports of installation rates for heat pumps between 60.000 and 80.000 each year since 2008[1]. Already more than 50% of constructors choose a ground-source or exhaust-air heat pump solution. Air source heat pumps dominate the market with 53,000 pumps sold in 2014 followed by 11,000 ground source pumps. They replaced approximately 6,000 oil-fired boilers or at least the oil consumption of the boilers was reduced with air-to-water heat pumps. Also technological solutions though ground source heat pumps are rather fashionable. Permission for them is easier to get meanwhile and there is a tax reduction for heat pump drills. So concerning all power ranges for household use, ground source heat pump installations have gathered the greatest total investment

The housing market affects GSHP investment in multiple ways. Both the volume of new building and the volume of transactions in the market place of existing houses support RES-investments in the residential market. In 2010 the share of heat pumps in newly built detached houses was 25%. Since then ground source heat pumps became the most popular source of heat for new detached houses. In addition a sample of 185 GSHP permits issued in 2009-2014 in the metropolitan area city of Vantaa analysed by Jalas et al. showed that also ownership changes create a window of opportunity for GSHP investments. They found the year after ownership change highly overrepresented in the sample (Jalas, forthcoming).

The amount of investment for heat pumps in 2014 was about 400 million €. The 670,000 new installed heat pumps in that year draw 5 TWh annually. Within this households are the largest investor category in renewable heat and power in Finland. With mortgage rates of 2%, and investments made out of perceived need or for improved comfort, rather than with high expectations for returns, this category of investors seems to offer untapped potential. And this is despite the fact that Finnish energy policy has not significantly encouraged household investments in renewable energy. Annual variations in subsidy levels, coupled with overall high information search costs and overall uncertainty are more obstacles than support to household investment. In the light of this and a declining housing and new construction market, Finnish households have made significant investment in heat pumps.

Experts don’t see indication that the rise of heat pumps was driven by policies but seem to be more on consumer demand and progressive marketing. E.g. heat pumps played a leading role at various housing fairs (see above). Still, permission for ground source heat pumps is easier to get meanwhile and there is a tax reduction for heat pump drills. Jalas et al. recommend policies should be developed on the basis of an understanding of the logics of different investors. Thus, more investment from households and other real estate owners could be drawn into renewable energy like heat pumps, given that policies are long-term, stable and investment are easy to make (Jalas, forthcoming).

Finally, several other policies, in addition to energy policy (building codes, rural development policies), can influence renewable energy investment. Hence, policy makers should strive for policy integration that serves to broaden the investor base. A diverse mix of policies is required to maximize the contribution of different sectors to filling the renewable energy investment gap.

4. Initiatives targeting household behavior

4.1. Initiatives by Municipalities

Energy Efficiency Agreements are also applied for municipalities, the sector closest in touch with households and consumer decision making. Here the picture looks different and not as homogenously successful as in the private sector. Some towns are very enthusiastic but some of them appear to be less engaged. The incentive for municipalities to sign such agreements is to have better access and higher shares to state subsidies. Less engaged municipalities which do not report first get a warning (yellow card) and after 2 years lose the contract (red card) after several contacts. This however only happened only few among over 100 contracts. The problem appears mainly for small municipalities where staff capacity is very low.

4.1.1. CANEMU Forum - Towards Carbon Neutral Municipalities[8]

Through the Carbon Neutral Municipalities (=CANEMU, HINKU in Finnish) project initially five small Finnish municipalities committed themselves in 2008 to reducing their greenhouse gas (GHG) emissions more extensively and more rapidly than would be required according to current EU targets – to become carbon neutral. The project aims to create new tools and procedures to reduce GHG emissions and promote the adoption of climate-friendly technologies. Feasible solutions are being sought through close collaboration between researchers, the public sector and businesses. Successful practices devised during the project are hoped to be applied more widely both in Finland and abroad. On the basis of five years' experience this bottom up approach shall induce climate change activities in society. All the CANEMU municipalities have adopted effective and innovative approaches to reduce GHGs with the help of local co-operation between the municipality, businesses and residents. By end of 2015 the number of municipalities in the CANEMU Forum increased to 26 and the amount of inhabitants involved in the project comes close to 400 000. The goal of the next step is to share the progress of the carbon neutral municipalities with larger Finnish towns in order to accelerate the transition towards a low-carbon society in Finland.

In the CANEMU municipalities all the participants – the municipality, the inhabitants and local businesses – are working to reduce their greenhouse gas emissions in both the short term (2-5 years) and the long term (6-20 years). The aim is to create 'win-win-win" situations where efforts to mitigate climate change give full consideration to economic, environmental and social factors. The project aims to treat the participating localities as miniature versions of Finland, where the activities of local authorities, businesses and residents can be examined in detail with a view to identifying new ways to curb greenhouse gas emissions. The project is ongoing and does not have an end date. The municipalities have committed to reduce GHG emissions in their area by 80% by 2030 compared to the GHG emissions for 2007.

In the beginning of the process public seminars are arranged in the joining municipalities to discuss the initial emission levels and the aims of the project. Feedback from local people is gathered for planning the next steps of the project. At the same time media (newspapers, radio and TV) is engaged to get media coverage for the launch of the project.

In the municipalities, every target group – municipal authorities, residents and business – are encouraged to participate to reduce their GHG emissions. Actions include measures to save energy and improve energy efficiency, particularly in homes, public offices, companies and transportation, as well as measures to promote the production and use of renewable energy.

[8] http://www.hinku-foorumi.fi/en-US

The project enhances municipal activities through various voluntary schemes and research projects. About 40 Finnish companies offering climate friendly technology and services have through participation in this project found new customers in the municipalities. In addition, R&D projects and pilot scale trials have initially been organised with the help of different funding organisations. It is important to note that the municipalities are now the testing ground for several national ongoing projects. The EU project 'Changing Behaviours' is also involved in the municipality of Mynämäki.

The key success factors identified for positive results are: - Municipality leadership commitment– climate change mitigation seen as an opportunity – understanding the benefits of the process - Different actors build networks and support each other – researchers as facilitators - Practical tools and 'face to face" guidance are available for different target groups - Project staff in municipalities – short pay-back time due to significant energy savings in municipal operations - Active involvement of NGOs - Online monitoring of measurements (database online) - Effective media communication of good practices in emission reductions as well as related costs and benefits (HINKU Forum, 2015; SYKE, 2013)

4.1.2. Finnish Sustainable Communities FISU[9]

No waste, no emissions, no overconsumption. These are the elements four Finnish cities, Jyväskylä, Lappeenranta, Turku and Forssa, have committed to working towards becoming carbon neutral and waste-free and curbing overconsumption by 2050. The cities form the FISU network (Finnish Sustainable Communities)to support each other. A service centre consisting of experts from the Finnish Environment Institute (SYKE) and Motiva has been established to support and coordinate its work.

4.1.3. City example: Tampere[10]

With a population of: 220, 000 in 2013 Tampere is the third largest city in Finland and one of its three most rapidly growing regions. Tampere is part of the national 'innovative cities programme[11]' where some of the larger Finnish towns intend to generate new business and new companies from high-quality competence. Tampere has leadership for the theme 'smart cities and industrial regeneration'. From 2010 to end of 2015 was running the ECO_2 project to create a low carbon and eco-efficient city.

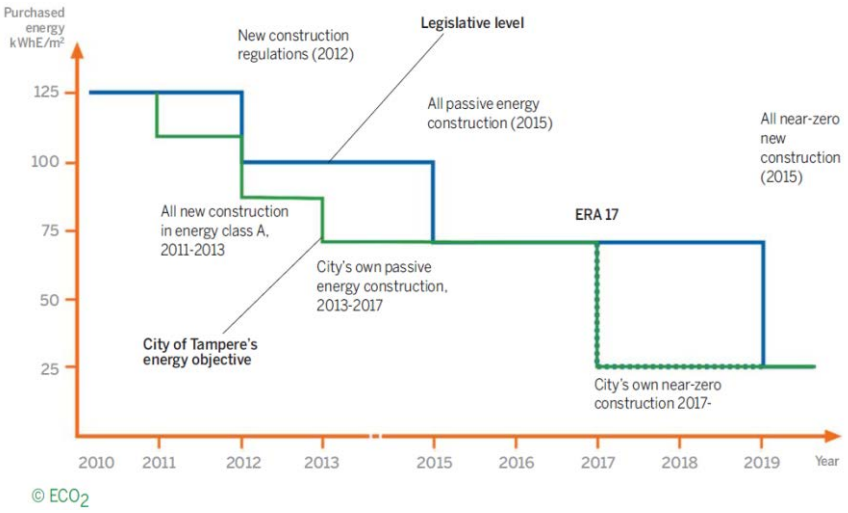
ECO_2

The city of Tampere was conducting a program called ECO_2-Ecoefficient Tampere from 2010 to 2015. During the first three years it was funded by Finnish innovation fund SITRA the remaining two by the city of Tampere. One of the stated goals is to reduce carbon dioxide emissions by 40% of 1990 levels by 2025. To reach this Tampere set earlier timelines for the construction of near-zero buildings in cities own construction.

[9] http://www.fisunetwork.fi/fi-FI

[10] Sources for all the section: (City of Tampere, 2013) and (Lorek, 2015)

[11] https://www.tem.fi/en/innovations/strategic_centres_and_clusters/innovative_cities_programme_(inka)



Source: City of Tampere 2013

In addition to new construction, Tampere tries to increase of energy efficiency of old buildings. Most buildings constructed between the 1960s and the 1980s can be renovated and so significantly reduce their energy consumption and CO_2 footprint. This creates opportunities for cost savings in the private and public sectors.

ECO_2 ordered an assessment of the energy repairs of the existing building stock in Tampere from the Department of Civil Engineering of the Tampere University of Technology. It recognised, that with the current rate of repairs, only 6 % energy savings will be achieved by 2020 compared to the 20% objective established by the EU. To reach the 20% objective, normal repairs must be supplemented with energy-efficient repair measures.

To promote energy-efficient repair construction in the Tampere district Tammela, for example, the city participates in the EU-GUGLE projects starting in 2013 together with many other EU cities. During the project, energy repairs are intended to be made in cooperation with housing companies with the aim to reduce energy consumption by the minimum of 50%. The housing companies will receive funding from the EU-GUGLE, which is up to €50/m2 and 50% of the total energy repair budget.

While ECO_2 explicitly claimed to involve city organizations, business and citizens, in fact active citizen involvement is limited to indirect activities carried out by direct ECO_2 partners only. Nevertheless, some decisions made impact citizens options and behavior. This e.g. manifests in the consequent shift from private to public transport respectively non-motorizes transport. First results are available already. While car driving remained stable (41%) between 2005 and 2013 'transport' by food reduced (28→25%) towards bus use (16→19%) and cycling (6→8%). For increased bus use ECO2 claims the establishment of an expanding bus services, however, aging population might influence the picture as well. Regarding bicycle use Tampere launched a city bike system in 2010 with a net of improved or new cycling routes from 472 km in 2005 to 602 km in 2011 including a tunnel and a bridge for pedestrian and cycling traffic and high speed cycling routes. This increased the smoothness of the cycling routes in the city centre through easier crossing railway and river. As a result the number of cyclists has increased by 47% between 2000 and the end of 2012. The network of cycling municipalities selected Tampere the cycling municipality of the year in 2013. In addition individual traffic excluded from some inner city streets all to provide the liveliness in the city. A bus line based on electricity and a tram line are under development, the latter depending on financial support from the national government. In the future a specific app should support Tampere citizens

to move within the city without individual car use (under development in the EU project 'move us[12]'. For the time being a competition is running on how to increase the electricity based transport in the city which is open for suggestions from companies and citizens.

With the end of 2015 the ECO_2 program is coming to an official end. This however only means that the crosscutting umbrella is not promoted anymore. All projects are continuing (including the staff involved) but integrated into different departments now. The group will still meet regularly to ensure crosscutting exchange (Lorek, 2015).

According to Tampere's own estimations the approach towards the targets set is on a good way so far generally. Still the achievements are mainly through changes of the power company to increasingly use wood pallets for electricity production. Electricity consumption of households is still going up in Tampere as well as the energy consumption for transport.

ECOfellows

Ecofellows is the energy consultancy of Tampere for citizens. It supports the inhabitants with information and practical advice how to reduce energy consumption. It is mainly financed by the city budget; however it is recognized as an independent agency which receives more trust than direct administrative departments. The office offers public hours twice a week but mainly appointment are made in advance or advice is given on the phone. Nowadays people mainly come with concrete questions and/or problems. These have shifted from previously dominating 'how can we save energy' towards 'my energy ill is too high, there must be something wrong, how can I find where the problem is'. For this Ecofellows e.g. provides test meters which can be borrowed for free from some weeks to measure energy use of appliances in a household. The service includes an evaluation of the data collected and recommendations what to change or where to complain in case of inefficiently working appliances. This service is free of charge.

TARMO

TARMO is a project administered by ECO2. Within the project, housing companies cooperate to improve the energy efficiency of various suburbs. The aim is to train volunteer 'energy experts" within the housing companies and to encourage the housing companies to cooperate in monitoring energy consumption and in energy repairs.

An easy-to-use energy consumption calculation tool will be developed as part of the TARMO project for housing companies. With the tool, the housing companies will be able to compare their own energy consumption with that of the other buildings within the project and assess the impact of different energy saving measures on energy consumption and carbon emissions. The project also encourages housing companies to jointly plan energy repairs.

In Finland a common way of flat ownership is that people buy a flat in form of shares of a building. The sums of shares form the housing company. All parts of the building relevant for energetic modernization, like the heating and pipe system, belong to the housing company. The company is governed by a board which consists of elected owners. Issues like major renovations, as renovations for efficiency purpose, have to be made unanimous by all owners. This already cause quite some problems as 'normally' there is at least one voice not in favor of any change which implies money. Ecofellow's service, lately through their project 'Tarmo', is to find ways to convincingly bring the need for energy renovation across.

One way which proved to have some beneficial aspects is going beyond talking but literately drawing pictures how the building and its surrounding might look like in a future after renovation.

[12] http://www.moveus-project.eu/

For example quite some houses stand on property which includes some green area as well as a quite relevant size of parking slots. One suggestion developed from such an exercise is to commonly sell the parking space (for another housing company to build flats upon) and to use the money for energy renovation. As normally a fear appears about losing the parking space or a wide view a common visualization of possible options of such a situation can change the attitude. Such events increasingly gain interest. Participation in public meetings continuously rose since the first meeting.

Another tool motivating for renovation is the 'energy triathlon' where housing companies compete and get awarded for best performance in electricity, heating and water consumption.

RANE

The City of Tampere in 2011 also established the Energy Consultancy Centre for Construction and Housing (RANE) for the municipality's residents. Although targeted at constructors and renovators, the Centre provides energy consumption consultancy services to households. RANE began as a joint project between the Building Control Department and Housing Department of the city of Tampere, Sustainable Community unit, and ECO2.

RANE is a major project of Ecofellows and provides consultancy services online and by phone and email. In addition, information events have been organized within the projects on topical themes. Staff of Rane offer on-site visits to buildings, individually build owns as well as multi apartment flats of housing companies. Services reach from heat pictures to a 'full check' of energy and water consumption in households ('transformator from district heating to in-house heating system, electricity consumption, `water pressure, etc.). Rane provides information what could/should be improved and what to do next. In nearly all cases where Rane service was called some major items for improvement were found. Rane does not compete with maintenance companies. Some of the service is finances by the city and thus free of charge for the customers, some services are free for members of housing associations and on cost (about 100€) for all others. Rane also train maintenance people who to do energy renovation in the right way.

Housing fair 2012

In 2012 Tampere hosted the annual Finnish housing fair. The fair area was on one of the first residential areas in the new suburb of Vuores, which is about seven kilometres from the centre of Tampere. It had 39 homes that are open to the public and provide an overview of state-of-the-art developments in building design and construction. Examples include an ecological low-carbon-emitting wooden house, a home that supports the wellbeing of its residents, a functional house that is designed for active families with children, a modifiable loft semi-detached house, and a zero-energy house that is self-sufficient when in comes to energy production.

The focus of the Housing Fair was on architecturally modern detached houses that include unique designs and prefabricated house models. Construction materials include wood, stone, brick, and logs

The fair area also included ten apartments in semi-detached and terraced houses, and residential blocks. They vary in size from one-bedroom apartments to large family apartments. The fair area had examples of all forms of living, from owner-occupancy to rental and right-of-occupancy apartments.

Expert reflections

The city of Tampere is quite engaged in energy efficiency matters, in line or ahead national or European demands. However, the interviews also pointed towards room for improvements to be taken at all levels of governance.

The rather high and complicated legislative regulations for renovation often make housing companies shy away from modernization or, even worse, administration is bypassed. Also the new energy label for houses appeared not to be really helpful in this context as it only give theoretically

calculated figures but do not reflect at all the real energy situation of a building. A problem that frequently appears is the lack of subsidies or other financial support. Ecofellows now plan to set up structures where the Tampere energy company, banks and housing companies cooperate and develop contracting models.

Policies which prove to be useful are the EU and national policies and climate targets. As Finnish mentality tend to keep rules pointing towards obligations proved to be a good basis for arguments to do something. In this context also the voluntary Energy Efficiency Agreements develop as a strong instrument. For Tampere new one is already under negotiation and will enter in to force in 2017. The yearly reports to the various institutions (Motiva, Ministry, the Government of Majors) sets up pressure and initiate activities. In this context more explicit obligations to work with citizens would encourage and help to finance consumer consultancy. EU as well as national regulation still has some potential here as neutral information and 'translation' function between companies and consumers still can be improved.

4.2. Initiatives by NGOs

Citizens and relevant stakeholders need relevant information and motivation for taking action and to be able to make informed decisions and choices towards energy efficiency measures. The challenge is to provide the right information when decisions and choices are made, in a format that the citizens find interesting, useful and trustworthy. Information and advice about sustainable choices are normally provided in Finland by municipal energy offices and energy management companies, but also NGOs. The information is available on the internet, by phone and in person. The effectiveness of the information distribution alone is frequently questioned, because environmental action is affected by the personal and shared values of the community, situational factors and the type of motivation. So better and more personalized dissemination channels are needed (Salo et al., 2014).

The ***Finnish Association for Nature Conservation*** (FANC) is the major NGO in Finland. Among others it runs projects on energy policy but as well on more systematic approaches towards reduced energy consumption like the SITRA funded project on Degrowth. FANC developed a 10 points recommendation list for Finnish atmosphere and energy policies, with the following ones especially relevant in the context of this report[13]:

1. Saving energy and energy efficiency will be the first priority
- The overall energy saving target for buildings will be raised to 40 percent by 2030 and to 80 percent by 2050. The need of district heating will be reduced with building services, flexible energy management and apartment specific heat measurement.
- Energy norms for nearly zero energy buildings will be set to 40-50 kWh/m2 level and solar power panels and collectors, small wind turbines for own energy production, heat pumps and fireplaces will be accepted in the building's energy certificate.
- The Government will triple the funding for energy renovations. Funding will include the housing cooperatives and residents' own energy production. An advancement program will be made for local energy where the administrative practices will be harmonized. The value added tax for equipment used in local energy production will be lowered to 15 percent or the equipment costs will be given a tax credit for domestic costs.

6. Finland will proceed to use 100 percent renewable energy sources by 2050
- Guarantee price system will create effective stimulants and home markets for solar power.

[13] Translation provided by FANC

- Add more wind power whilst considering nature sights, landscape, noise borders, gleam, environmental value of the location and important locations for birds and other fauna. When locating the wind turbines, focus will be on industrial areas instead of natural areas, former peat lift areas, major road areas, greater field areas and other strong human interaction cycle areas.
- Producing electricity and heat by burning will be reduced by replacing the communal production electricity with renewable electricity and replacing district heating with energy refurbishments and heat pumps. The energy companies will be obligated to buy electricity from small producers, make investments to smart electricity nets, flexibility and storage capacity of electricity.

7. Finland to be a pioneer for international climate policy
- EU's emission reduction target will be raised to 60 percent by 2030 and to 95 percent by 2050.
- EU's renewable energy and energy efficiency targets will be made obligatory after 2020.
- Finland commits to preventing and adapting climate change in a fair manner by transferring funds to international climate fund as planned.

9. Finland's attractiveness for environmental investments will be added
- Environmentally harmful subsidies will cease.
- When making decisions for new public purchases and business support, the natural and environmental impact will be the foundation.
- The amount of emission permits will be cut from the markets and all emission permits will be auctioned so the price would rise to 30 euros per carbon dioxide ton by 2020. Carbon dioxide will be taxed.

The expert interviews referred to various further campaigns and initiatives. Especially highlighted were the campaign ***energiaremontti***[14] or the NGO controlled certificate ***EKOenergy***. FANC as well as Vaihda virtaa[15] collaborate in the international network EKOEnergy where NGOs from six countries joined forces in 2010 to develop an international ecolabel for electricity. EKOenergy promises electricity from 100% renewable sources and even more like: strict criteria for the tracking and auditing of green electricity, proper information for consumers, and investing parts of the green premium in new projects through their own Climate Fund[16].

Since the *EKOenergy Network* opened up in November 2012 for new partners 40 organisations have signed the agreement ranging from Iceland to Georgia and from Tampere to Crete and even beyond Europe[17]. In 2013 a secretariat was set up to manage and promote the label and a team of international trainees and volunteers was hired focusing on Finland, Spain, Italy and Latvia in the beginning.

Setting slightly different perspectives than energy efficiency is set in a FANC project elaborating about the concept of a ***sufficiency economy*** which links to the degrowth concept in other countries. Aim of the project is to develop and communicate the often rather academic ideas of a sufficiency economy towards a broader audience in civil society but as well mainstream them within a traditional NGO. Among others seminars and exchange with initiatives working in a similar direction are main tools of dissemination. The main event of the project, a seminar at AALTO University attracted more than 650 participants.

[14]

[15] http://www.vaihdavirtaa.net/page/show/id/etusivu - information available in Finnish only

[16] http://www.ekoenergy.org/our-results/climate-fund/

[17] as of January 2016

In Eastern-Finland a local ***Degrowth*** movement exists which is rather active for various years now. Among others it organizes bi-annual events (festivals). The group is organized on a purely voluntary basis. It works on a variety of issues, among them energy, and applies a variety of methods like cultural events, publications, seminars or position papers. http://www.kohtuusvaarassa.com/

According to the expert interviews consumer organizations are rather silent on energy measures in Finland.

4.3. Research

Finland has a lively and reputational research on household related energy efficiency. Besides frequent participation in EU projects also various national funding sources support research on energy efficiency topics like the Finnish Funding Agency for Innovation TEKES, the Finnish National Fund for Research and Development SITRA, or the Finnish Academy of Science.

Resource wise trials[18]

A research project funded by the Finnish Innovation Funds SITRA (Maija Mattinen, Antikainen, Salo, & Suomen ympäristökeskus, 2014) investigated on resource wise trials to – among others – foster energy efficiency. Most of the trials also identified positive effects related to well-being and the local economy. One of the results was a successful trial of a housing company to reduce energy use for lighting through innovative promotion of LEDs. They offered occupants a testing box with various LED's to learn through experience how they affect light in different rooms of an apartment. The experiment resulted in a reduction of energy consumption for lighting by up to 75%.

Trials and experiments, continuous reform and changes to existing structures and operating models are integral to working towards a more resource-wise society. This has been recognised in Finland at strategic level also, for example in research and innovation policy outlines. The authors are aware that Individual trials, of course, cannot be generally applied to other situation or upgraded to national level. This needs systemic changes. However, they point out, it is important to continue encouraging operators from all spheres of life to become more involved in experimentation, which provide new information, knowledge and experiences.

EcoHome

The Ecohome project aimed to help households to decrease their energy consumption through changes in lifestyles, and renovations improving the energy efficiency at home (Salo et al., 2014). It focused on both everyday consumption patterns and more effective but much less frequent actions, e.g. the changing of a heating system.Recognising the limits effect of pure information provision Salo et al. investigated which agents are of specific help for households to live more energy efficiency lifestyles. They identified four groups of specific importance to support households in increasing energy efficiency. On one hand it is teachers of general education, regional advisory centers for energy and environmental issues, and NGOs. They generally pave the floor and raise awareness among population for more sustainable consumption. On the other hand professionals and small and medium-sized enterprises (SMEs) providing maintenance and renovation services for households and housing corporations are targeted as they play an important role in specific situations of decision making.

Regarding the more general awareness raising the concepts of carbon emissions and footprints, as well as direct energy consumption at home, provided best meaningful and understandable information for households and thus were the most commonly used units of measurement in the project.

[18] Jyväskylän resurssiviisaiden kokeilujen vaikutusarviointi sekä laajenemisvaikutukset

Regarding the very concrete and specific questions which appear when renovation decisions have to be made the lack of reliable and competent third party information on energy renovations was identified as a challenge for owners of detached/terraced house as well as decision makers in housing companies. It showed that there are not many small consultant companies or individual experts that can cover the essential aspects of an energy efficiency improvement: housing technology, renovation construction and the prevention of moisture and mould risks. Furthermore, the consultants do not always have the skills for properly communicating the technical alternatives to the average house owner or housing boards. Therefore, the training of experts and support in development of networks appeared to be essential. To meet that need the project developed a training programme for related SMEs. The participation in training for professionals provided advantages for the SMEs as participants not only increase their current knowledge and are provided with tools and a concept to conduct energy efficiency surveys of residential buildings. Throughout the trainings they also could build up a network of experts. Advantages for consumers were unbiased support to a variety of technical solutions to help identify required renovation measures and potential options, as at least three options are always given for any location, a cost efficient service concept taking into account the limited financial resources of the house owners and housing boards.

Nevertheless, from here a next challenge appeared, because especially in those households living in detached houses there was mixed interest paying for planning, instead of the installation of products and technical systems. In a survey only half of the respondents were willing to pay for this type of service whereas the other half did the work themselves. So, proper planning was seen as important to house owners, but the extra costs were not welcome. Salo et al. therefore recommend that service providers could offer a planning service as a package, with other more desirable services, possibly combine energy efficiency plan with mandatory energy performance document. Beneficial would be as well extending the tax reduction from installation to planning, could encourage house owners to use the service.

Recommendations from the EcoHome study were:

Recent ***regulations*** require house owners to prove that their renovation project (e.g. renewal of roof) will also improve the energy efficiency of the building (Ministry of Environment, 2013). To prove this, the applicant of a construction permit must provide appropriate energy calculations or other verification. The implementation of these regulations in case of detached houses is facing problems, because of the very limited resources in municipal offices.

A more radical policy instrument which has provoked some discussion is a mandatory regular 'inspection" of buildings by some authorised service provider covering fire safety, moisture and mould risks and an energy efficiency audit.

Expanding the ***deduction of tax payment*** (see 2.3.2) to energy efficiency studies. They are not eligible for this deduction so far, because it is only partly work done at the residence. Interpretation of the guidelines might be changed to make this eligible.

Further on, families on lower incomes or retired residents cannot utilise this deduction to its full extent. In such cases, income tax should be negative, i.e. a compensation could be paid. ***Social grants*** can be applied for house renovations, but the budget allocated for this is scarce and restricted mainly to older people and those with limited mobility. ***Subsidies*** for energy renovations are also available for housing companies.

To raise the ***informational basis*** there are many web-based and personal advisory services promoting energy efficiency and sustainable consumption. For example, web-based carbon footprint calculator are important to communicate the difference that households can make with their

consumption and life-style choices and are an important basis for discussing carbon footprint and mitigation measures with ordinary people in different occasions. Especially NGOs are in a good position to raise the knowledge about such calculators among households and connect the calculator and related activities with stakeholders' own agendas and activities. However, the public and free information services can rarely go into detail for an individual house owner. Computerised monitoring and feedback on individual energy use has the potential to reduce households' energy consumption but often even this is not enough to encourage behaviour change. Often only personal feedback mechanism close to real life actions and accompanied by interviews with the families they provided a real insight into the possibilities for change and make it possible to give relevant advice. This opens a niche for commercial advisory and consulting services, even for individual house owners. The budget for such services is often project-based and thus limits continuity. One option for financing such advisory services is to encourage power companies to outsource their obligation for providing energy efficiency information to their clients. EcoFellows (see 4.1.3) is an example of a public agency with financing coming from the municipal power company and the municipalities. This model could be replicated to other regions.

Municipal authorities or public advisory services have an important advisory role as well but cannot officially recommend named companies or consultants, unless there is a public list of authorised experts. Such a list on certain public websites would act as a meeting point for service users and providers. What building permit authorities in municipalities could do is to generally advise the permit applicants to use a qualified consultant for conducting the energy efficiency study – without naming anyone specifically. The same applies to relevant NGOs in this field.

Finally the project has identified the need for interactive websites for transferring know-how on energy renovations. A 'case bank" for small energy consultants collecting typical cases and one for House owners to collect simplified case studies for peer support.

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In the context of the Finnish Country report on household energy efficiency the need appeared to carry out interviews because no one in the SERI team (leader of WP5) was able to read the Finnish material dealing with less common policy instruments and initiatives for saving energy in households. Seven of the interviews documented here were made on the 02. and 03. of November 2015. Four further were conducted on the 04. and 07. of December. In few cases also substantial information were gained through email exchange. Results of the interviews are taken up in the report, the document summarising the interviews, however, is confidential.

The selection of interviewees was based on literature research and recommendations by Finnish experts working on sustainable consumption.

Interview partners were:

1. Annukka Berg, Researcher, Environmental Policy Centre/Environmental Governance, Finnish Environment Institute (SYKE), Environmental activist and blogger on sustainable lifestyles.
2. Eva Heiskanen, senior expert, Institute of Political and Economic Studies, University of Helsinki, (previously National Consumer Research Center)
3. Mikko Jalas, Researcher, Department of Management Studies, Alto University
4. Satu Lahteenoja, DEMOS
5. Päivi Laitila and Irmeli Mikkonen, Motiva, Head of Unit *Sustainable Consumption and Society*, Member of the EUFORIE advisory board
6. Anna Latva-Puttila, Finnish Association for Nature Conservation (SLL)
7. Maija Mattinen, Senior Research Scientist, Centre for Sustainable Consumption and Production/Environmental Efficiency, Finnish Environment Institute (SYKE)

A second round of Interview was conducted to complement the results on one hand on ministerial level and on the other on the city level. Focus here was on the city of Tampere,

8. Timo Ritonummi, Ministry of Employment and the Economy
9. Taina Nikula, Ministry of Environment.
10. Elli Kotakorpi, ECO_2 Efficient Tampere
11. Suvi Holm, Ecofellows, Tampere

All interviews were conducted in a semi-structured interview. While some of the more general questions were asked to all interviewees of the first round other, more specific ones were developed according to the expertise of the interviewee. The general questions were:

1. General political climate: Is energy (efficiency) an issue in political, societal debates?
2. Which actual policies do you observe as the most relevant to increase energy efficiency of households?
3. Which policies do you miss?
4. Are there policies contradicting energy saving?
5. What is your specific focus regarding energy efficiency of households?
6. Beside political initiatives: What are important private sector supports?
7. Compared to other countries heat pumps seem to be a relevant issue in Finland. Do you have data or specific examples here?