ENERGISE

EUROPEAN NETWORK FOR RESEARCH, GOOD PRACTICE AND INNOVATION FOR SUSTAINABLE ENERGY

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ESTONIA

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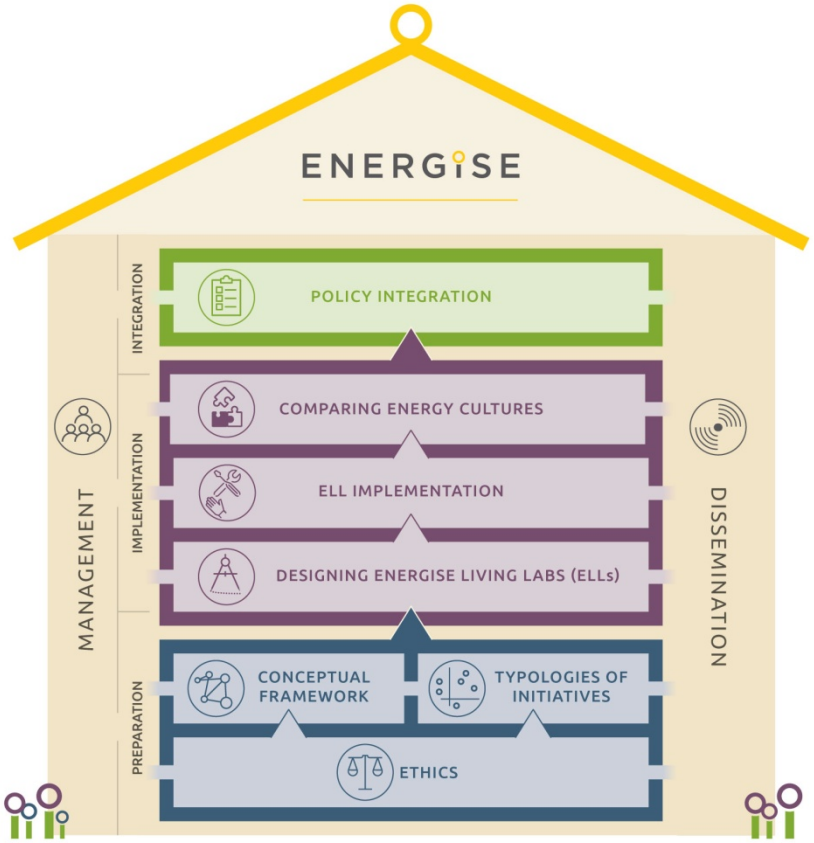
ENERGISE PROJECT

ENERGISE is an innovative pan-European research initiative to achieve a greater scientific understanding of the social and cultural influences on energy consumption. Funded under the EU Horizon 2020 programme for three years (2016-2019), ENERGISE develops, tests and assesses options for a bottom-up transformation of energy use in households and communities across Europe. ENERGISE's primary objectives are to:

- **Develop an innovative framework** to evaluate energy initiatives, taking into account existing social practices and cultures that affect energy consumption.
- **Assess and compare the impact** of European energy consumption reduction initiatives.
- **Advance the use of Living Lab approaches** for researching and transforming energy-related practice cultures.
- **Produce new research-led insights** into the role of household routines and changes to those routines towards more sustainable energy.
- **Encourage positive interaction** between actors from society, the policy arena and industry.
- **Effectively transfer** project outputs towards the implementation of the European Energy Union.



INTRODUCTION

This document is one of 30 national briefs, demonstrating key aspects of national energy supply and demand dynamics. Each brief is comprised of five sections:

Section 1 summarises the energy profile of the country. The section provides basic quantitative information of demand demographics and usage profiles, market trends and energy supply profiles, as well as qualitative reflections on current national energy policy. ***For all the briefs, the quantitative information is derived from ec.europa.eu/eurostat (2015 data), eea.europe.eu (2015 data), and climate-zone.com, unless otherwise stated.***[1] The qualitative reflections are based on a literature reviews and desk-research. References for the literature review and the desk-research are provided in footnotes or in section five.

Section 2 summarises the nationally based sustainable energy consumption initiatives (SECIs) that have been identified as part of ENERGISE WP2 framework (Jensen, 2017). Each SECI has been coded according to the Problem Framing Typology developed in ENERGISE WP2 (Jensen et al, 2017b).

Section 3 provides a *good practice* example of a national SECI that corresponds to category 3: “Changes in Everyday Life” or 4: “Changes in Complex Interactions” in the Problem Framing Typology. Please refer to Jensen (2017) and Jensen et al (2017b) for more information on the way the data for the good practice SECIs has been researched and documented.

Section 4 provides a brief summary of major nationally specific trends and their implication for energy consumption policies.

Section 5 provides an overview of sources used for qualitative assessments, and can be used as inspiration for further reading.

The national briefs provide contextual socio-material information for the further work to be carried out in Work Package 4, Work Package 5 and Work Package 6 in ENERGISE.

1.1 WP2: TYPOLOGIES OF ENERGY INITIATIVES

ENERGISE WP2 is a systematic criteria-guided review and classification of existing sustainable energy consumption initiatives from 30 European countries (EU-28, Switzerland, and Norway), which provides a comprehensive European database of energy initiatives involving households, and related typologies of sustainable energy consumption initiatives. This extensive synthesizing work guides the selection of Living Lab design elements for ENERGISE and future energy consumption research, policy and practice.

[1] Some piecharts will be empty, as no information is available.

This is done in order to

- Construct innovative typologies of sustainable energy consumption initiatives that can inform further research and action.
- Identify key success factors and related indicators, focusing on individual-level, collective, organizational, institutional and societal aspects of energy consumption, which will inform subsequent WP 3 (Designing Living Labs), WP 4 (ENERGISE Living Labs) and WP 5 (Capturing Energy Cultures).
- Progress the goals of the European Energy Union by creating a publicly archived open access dataset of sustainable energy initiatives across 30 countries in Europe.

Suggested further reading:

Jensen (2017) *Identification of key success factors and related indicators.* ENERGISE – European Network for Research, Good Practice and Innovation for Sustainable Energy, Grant Agreement No. 727642, Deliverable 2.2.

Jensen et al. (2017a) *Establishment of a comprehensive open access dataset of sustainable energy consumption programmes and Interventions.* ENERGISE – European Network for Research, Good Practice and Innovation for Sustainable Energy, Grant Agreement No. 727642, Deliverable 2.3.

Jensen et al. (2017b) *Constructions of typologies of sustainable energy consumption initiatives (SECIs).* ENERGISE – European Network for Research, Good Practice and Innovation for Sustainable Energy, Grant Agreement No. 727642, Deliverable 2.4.

Sources of quantitative statistics (unless otherwise stated):

Climate data:
http://www.climate-zone.com/continent/europe/

Demography data:
http://ec.europa.eu/eurostat/statistics-explained/index.php/Population_structure_and_ageing

http://ec.europa.eu/eurostat/statistics-explained/index.php/Educational_attainment_statistics

Dwelling type data:
http://ec.europa.eu/eurostat/statistics-explained/index.php?title=File:Distribution_of_population_by_dwelling_type,_2015_(%25_of_population)_YB17.png

Energy demand and supply quantitative data:
http://ec.europa.eu/eurostat/statistics-explained/index.php/Energy_consumption_in_households

Final energy consumption of households per capita data: https://www.eea.europa.eu/airs/2017/resource-efficiency-and-low-carbon-economy/household-energy-consumption

MWh conversion data:
https://www.unitjuggler.com/convert-energy-from-toe-to-MWh.html?val=893.9

ESTONIA

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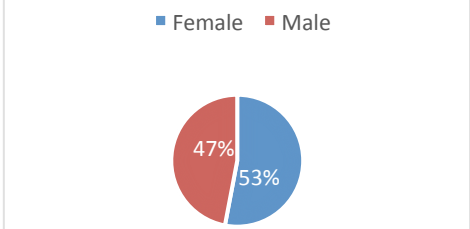
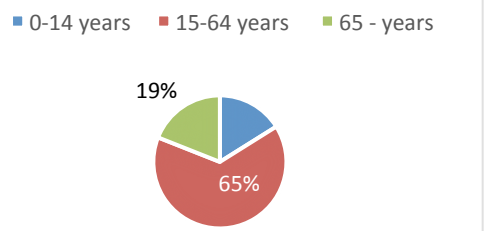
DEMOGRAPHY, ENERGY CONSUMPTION AND ENERGY SUPPLY

GENDER PROFILE



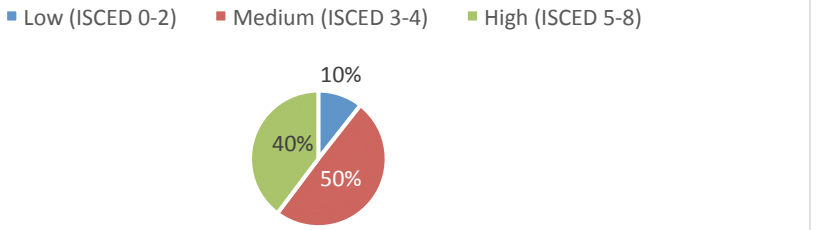
AGE PROFILE (2016)



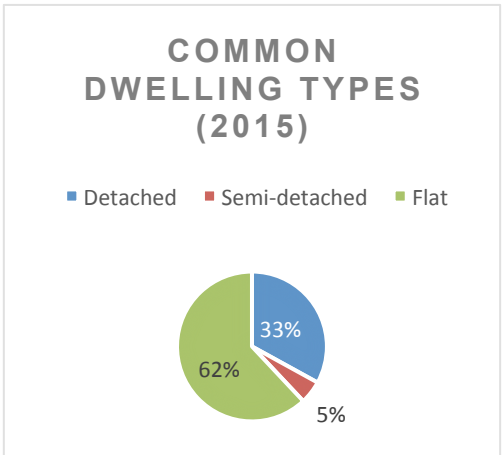
CLIMATE:

maritime, wet, moderate winters, cool summers

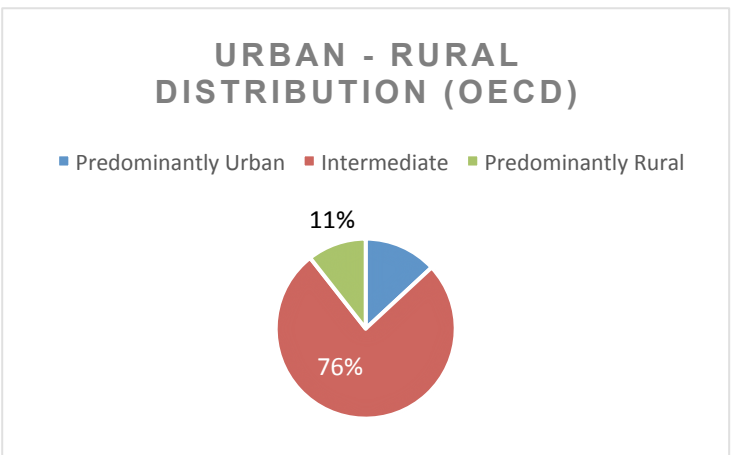
EDUCATIONAL PROFILE (25-54 Y, 2016)

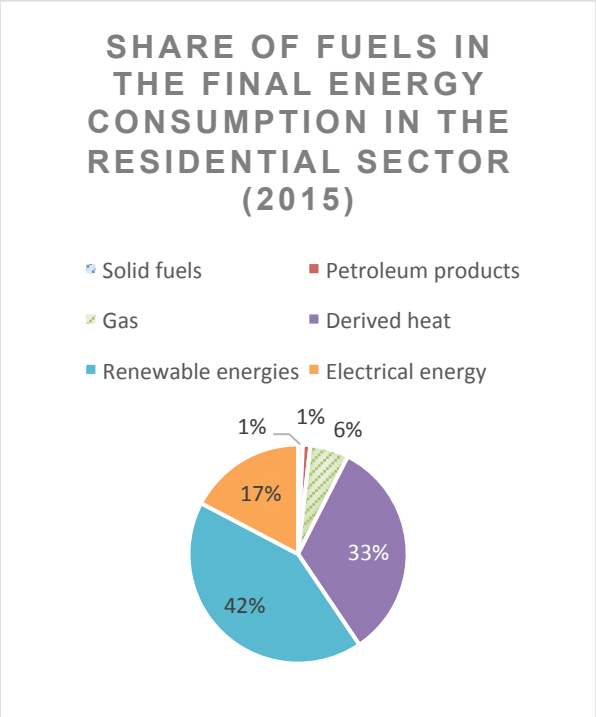


COMMON DWELLING TYPES (2015)



URBAN - RURAL DISTRIBUTION (OECD)





FINAL ENERGY CONSUMPTION FOR HOUSEHOLDS, PR CAPITA (2015)

7.586 MWh

ENERGY SYSTEM AND ENERGY POLICY TRENDS

Energy system

What is unique about the Estonian energy sector is that it is dominated by one primary source of energy – oil shale. Because of its large domestic oil shale reserves, the country could be considered as relatively independent in energy. About 70% of the total energy supplies are generated by domestic energy production. The other 30% are ensured through imported energy resources (including natural gas, gasoline and diesel fuel).

In order to diversify electricity supply, the government of Estonia is planning to invest in renewable energy sources. The highest potential is accounted to biomass, biogas, wind and hydropower. Smart grid solutions are also on the agenda.[2]

Electricity production in Estonia is dominated by Eesti Energia, which is a state-owned company holding the largest share of electricity sales – 82.9% of sales in 2012. Other players in the retail market of electricity are Imatra Elekter AS (holding 2.7% of the sales for 2012), VKG Elektrivõrgud OÜ (holding 2.6% of the sales for 2012), which are both private companies. The remaining 10% of sales are distributed among 39 smaller electricity retailers.[3]

Estonia has an isolated gas market. The country's major supplier of natural gas is Gazprom, and the sole wholesaler is AS EestiGas. There are two other companies with a license for the gas market – AS Nitrofert and Baltic Energy Partners OÜ – but they obtain gas only for their own needs. It could be claimed that there is no competition between the sellers and traders in the gas market in Estonia and therefore there is no organised gas hub.[4]

According to statistics, 60% of the population in Estonia uses district heating, which is among the highest percentage in the EU. Estonian district heating sector has been in the focus of the Estonian National Development Plan of the Energy Sector Until 2030, setting that the sector will use local fuel as much as possible, not relying on expensive and imported fuels in the production portfolio and will ensure efficient operation without requiring any additional investment support from the state.[5]

A partial liberalisation of the Estonian electricity market began in 2010, when the large-scale electricity consumers became obliged to buy electricity on the free market. In 2013 the market was fully lliberalised and became open for small and household consumers as well.[6]

Particular socio-material aspects that influence energy consumption

95% of residential dwellings in Estonia were built before 1991, in accordance with the Soviet Union and pre-war building standards that were not focused on energy saving. Almost half of the country's residential housing stock represent multi-flat panel blocks that have very thin outer walls and poor quality windows, resulting in high thermal losses. All these factors cause lavish energy use in the

[2] Expert.gov (2017). *Estonia – Energy*. Available at: https://www.export.gov/article?id=Estonia-Energy;
Rucinski, P. (2016). *Production and Consumption of Renewable Energy*. Available at: https://gain.fas.usda.gov/Recent%20GAIN%20Publications/Production%20and%20Consumption%20of%20Renewable%20Energy_Warsaw_Estonia_7-7-2016.pdf;
OECD/IEA (2013). *Executive Summary and Key Recommendations*. Available at: http://www.iea.org/Textbase/npsum/estonia2013SUM.pdf

[3] European Commission (2014). *Estonia*. Available at: https://ec.europa.eu/energy/sites/ener/files/documents/2014_countryreports_estonia.pdf

[4] European Commission (2014). *Estonia.*

[5] Ministry of Economic Affairs and Communications (2016). *Possibilities of Efficiency in Heating and Cooling in Estonia. Assessment of Heating and Cooling Potential of Estonia*. Available at: https://ec.europa.eu/energy/sites/ener/files/documents/Art%2014%281%29%20Estonia%20EN.pdf

[6] Schneider, T. (2013). *Energy Policy in Estonia. A Comparative View on Party Positions*. Available at: http://www.kas.de/wf/doc/kas_33609-1522-2-30.pdf?130222203647

residential sector. It is estimated that around 80% of the total energy used in the residential sector goes for space heating and hot water.[7]

The energy consumption habits of Estonians were formed during a period when the topics of resource depletion and sustainable energy consumption were still not on the agenda. Moreover, the introduction of new technologies and developments in the country has led to the growing use of products and services, which in turn resulted in increased demand for energy. Consequently, Estonia's share of household energy consumption in total energy consumption is one of the largest in the EU. Keeping in mind that household energy consumption depends not only on geographical location and income level but also on cultural background and traditions, it is assumed that a lot of educational work needs to be done in order to make Estonians change their energy usage habits and customs.[8]

Recently, overheating in summer has become an issue, especially in modern buildings, which are typically with larger windows. The average room temperature in these buildings is higher than in the old buildings, which makes the dwellers use more energy to cool their homes.[9] According to the results of a survey among 7,000 households conducted in 2011, more and more residents pay attention to the indoor climate of dwellings. About 80% of the respondents indicated that they enjoy normal indoor climate in the heating season, while 15% considered their dwellings to be too cold and only a few percent replied that their dwelling was too warm or too damp.[10]

With regard to electricity prices, Estonia has among the cheapest average price of electricity for household consumers and for industrial consumers. In the first half of 2017, the Estonian household consumers were paying 12.07 euro cents per kilowatt hour of electricity, while the average electricity prices for households in the EU for the same period was 20.41 euro cents per kilowatt hour.[11]

Current Trends in Energy Policy

Two strategy papers give direction to the Estonian energy policy agenda. These are the Development Plan of the Estonian Electricity Sector until 2018 and the National Development Plan of the Energy Sector until 2020. The objective of the two documents is to move electrical energy production in Estonia from oil shale to other energy sources and thus to balance the overall energy mix. According to the papers, it is expected that each of the available energy sources such as wind, potential nuclear energy, timber, gas and liquefied fuels should account for a share of 20% of energy production in the very near future.[12]

Current trends show an increased efficiency in the use of energy and local resources. More than 600 apartment blocks were renovated by 2015 through financial incentives provided by the national government or by EU structural funds for the renovation of living stock. There were also activities towards the introduction of nearly zero buildings.[13]

[7] INFORSE-Europe (2011). *Sustainable Energy Vision for Estonia. A Path to Make Estonian Energy Independent and Sustainable by 2050*. Available at: http://www.inforse.org/europe/pdfs/Estonia-note.pdf
[8] INFORSE-Europe (2011). *Sustainable Energy Vision for Estonia*;
Raudjärv, R. and Kuskova, L. (2013). 'Energy Consumption in Households.' *Quarterly Bulletin of Statistics Estonia*.
[9] Maivel, M., Kurnitski, J. and Kalamees, T. (2014). 'Field Survey of Overheating Problems in Estonian Apartment Buildings.' *Architecture Science Review*, Vol. 58, Issue 1.
[10] Raudjärv, R. and Kuskova, L. (2013). 'Energy Consumption in Households.'
[11] Statista (2018). *Electricity Prices for Households in Estonia from 2010 to 2017*. Available at: https://www.statista.com/statistics/418080/electricity-prices-for-households-in-estonia/;
Statista (2018). *Electricity Prices for Households in European Union (EU-28) from 2010 to 2017*. Available at: https://www.statista.com/statistics/418049/electricity-prices-for-households-in-eu-28/
[12] Schneider, T. (2013). *Energy Policy in Estonia*.
[13] Leppiman, A. (2015). *Estonia's Energy Strategy: Directions and Priorities*. Available at: http://www.lsta.lt/files/events/2015-10-15_Valstybes%20konf/17_Leppiman.pdf

Household energy consumption efficiency in Estonia has started to improve also as a result of the renovation of building envelopes – additional thermal insulation of outer walls, replacing windows, etc. Heat and water metering devices were also introduced, which gave households incentives to save energy and to limit excessive water consumption. As a result of the more strict thermal standards that apply for new buildings, the specific heat consumption in new dwellings decreased.[14]

Trends in national campaigns

In 2003 the Estonian State support programme for the renovation of multi-apartment buildings started being implemented. The programme was administered by Estonian Credit and Export Guarantee Fund (KredEx) and continued until 2009. It included activities such as energy audits, preparation of building design documents and technical supervision, and renovation of multi apartment buildings.

Another investment support programme for reconstruction of public sector buildings started in 2011. It was coordinated by State Real Estate Ltd. which is an Estonian company engaged in real estate development and management. The programme targeted state agencies and local authorities and planned reconstruction of 480 public sector buildings.[15]

[14] Tallinn University of Technology (2012). *Energy Efficiency Policies and Measures in Estonia*. Available at: http://www.odyssee-mure.eu/publications/national-reports/energy-efficiency-estonia.pdf

[15] Bremere, I., Indriksone, D. and Aleksejeva, I. (2013). *Energy Efficient and Ecological Housing in Finland, Estonia and Latvia: Current Experiences and Future Perspectives*. Available at: http://www.ecohousing-project.eu/wp-content/uploads/2014/02/Energy-efficient-and-ecological-housing-in-FI-EE-and-LV1.pdf

OVERVIEW OF NATIONAL SECIS

Below please find a list of Estonian SECIs that have been researched and documented through WP2 of ENERGISE. The SECIs are researched, selected and documented based on a set of requirements and research interests (please see Jensen 2017 for details). The list should not be regarded as exhaustive or representative of all kinds of energy initiatives carried out in the country.

Powerhouse Nearly Zero Challenge (POWER HOUSE NZC)	 Changes in Technology
More biking in small and medium sized towns of Central and Eastern Europe by 2020 (MOBILE2020)	 Changes in Everyday Life Situations
Intelligent energy saving measures for municipal housing in Central and Eastern Europe (INTENSE)	 Changes in Individuals' Behaviour
Encouraging active travel for short trips to improve health and the local economy (ACTIVE ACCESS)	 Changes in Everyday Life Situations
EuropeaN Efficient Residential Lighting INitiative (ENERLIN)	 Changes in Technology
Promotion of the Passive House Concept to the North European Building Market (NORTHPASS)	 Changes in Technology
Raising awareness on renewable energy developing agro-energetic chain models (RADAR)	 Changes in Complex Interactions
Renewable Energy and Building Exhibitions in Cities of the enlarged Europe (REBECEE)	 Changes in Technology
RES and RUE Stimulation in Mountainous - Agricultural communities towards sustainable development (MOUNTAIN-RES/RUE)	 Changes in Technology
Social Housing Action to Reduce Energy Consumption (SHARE)	 Changes in Individuals' Behaviour

'GOOD PRACTICE' EXAMPLE OF ESTONIAN SECI

Raising awareness on renewable energy developing agro-energetic chain models (RADAR)

Brief Description

RADAR was an international project conducted in rural areas of 7 European countries. In Estonia, it was implemented on the territory of five rural municipalities (parishes) in South-East Estonia (Seto region), near the border with Russia. The main goal of the project was to raise awareness about possibilities for the use of renewable energy by setting up Rural Sustainable Energy Communities. These pilot projects involving the local communities were envisaged as starting point for facilitating the adoption of renewable energy and energy efficiency measures on a larger scale across the country. The creation of Rural Sustainable Energy Communities enabled the use of a bottom-up approach, and an adjustment of the activities according to the needs of the concerned areas. A pig farm Kimeko Ltd had a crucial role for the realisation of Estonian agro-energetic chain model based on conversion of pig waste into biogas and energy. In addition to pig manure, herbaceous biomass supplied by Kimeko fields and local farmers was also used to produce heat and electricity for the local use. The entire agro-energetic chain was operated by local actors.

Brief Contextualization

All electricity consumed in Seto region is produced and distributed by Estonian national electricity company Eesti Energia (Estonian Energy Ltd). As discussed in Section 2, almost all energy in Estonia is produced from oil-shale (95%), while the remaining 3% are obtained from the use of natural gas and only 2% from different renewable resources (wind, hydro, biogas). When the RADAR project started, the country had only two biogas stations – one located on an island off the Western shore of Estonia and fuelled by agricultural waste, and the second in the capital Tallinn, using city sludge for biogas production. A few more biogas plants were in the process of development. In 2018, there are already a total of 17 biogas plants (five agricultural biogas plants, seven sewage and industrial waste water treatment plant and five landfill gas production units).[16] The successful implementation of RADAR project could be therefore seen as a very important stimulus for further expansion in the production and use of biogas, increasing the share of energy from renewable sources in Estonia. The project has also revitalised the economy in Seto region, bringing new sources of revenue to local farmers, and reducing the energy costs for the local residents.

Aims and objectives

The central aim of RADAR project was to establish a biogas agro-energetic chain that would use local resources like agricultural waste (manure) and herbaceous biomass (green silage) supplied by local farmers. A biogas plant, producing heat energy and electricity, was constructed on the territory of Kimeko farm, which is also the main source of biofuel. Electricity is sold to the national grid, while the produced heat is used for heating

[16] Information from Estonian Biogas Association webpage. Available at: http://eestibiogaas.ee/

the local greenhouses and households in the nearby villages. Digestion material is also put to a good use as fertilizer for herbaceous biomass fields surrounding Kimeko farm.
Another important objective of the project was to engage the local actors in all stages of the chain operation – from supply of the biofuel, through production of energy, and finally the use of the energy.

Methods for Intervention
Promoting the energy citizenship by setting up Rural Sustainable Energy Communities and adoption of renewable energy and energy efficiency measures by local communities.

Steps of implementation
Agro-energetic biogas chain included three main steps:
1. The growing and stocking of raw material (manure and herbaceous biomass in the form of silage).
2. Harvesting and transportation of raw material and digestion waste.
3. Conversion of raw material into energy (heat and electricity) and fertilizer.

Results/outcomes

Type of Biomass	Total biogas production	Power production	Electrical capacity	Heat production	Thermal capacity
	m3	MWh	MW	MWh	MW
Pig manure from Meremäe Village	479,388	1,202	0.15	1,217	0.15
Pig manure from Obinitsa Village	516,265	1,295	0.16	1,310	0.16
Cow manure	81,320	204	0.03	206	0.03
Silage from Kimeko farm (140 ha)	646,800	1,622	0.20	1,642	0.21
Silage from rented land (210ha)	970,200	2,433	0.30	2,462	0.31
Summary	2,693,973	6,756	0.845	6,837	0.855

RADAR project was the pioneer in Seto region, bringing new knowledge into the community and establishing a new energy producing plant, based on the use of renewable energy sources. The project added an estimated 10% of renewable energy to the energy mix of the area.

The role of the households
Local households benefit from the biofuel combined heat and electricity plant as final users of heat produced by the plant. In winter, they use it for heating their homes and in summer for heating water. Since during the summer months plant produces more heat energy than needed by the local households, the surplus heat is used at the auxiliary business unit – a dryer of wood pellets. Successful implementation of the project has increased the awareness of the local residents about the necessity to reduce energy consumption. After seeing that waste can be used for producing energy, households have also become more sensitive towards protection of the environment.

Location
The biogas plant is located in the Meremäe village, where Kimeko pig farm is located, but other municipalities are also involved (Mikitamäe, Misso, Värska and Vastseliina) mainly as suppliers of biofuel, but also as users of the heat produced by the plant. The availability of sufficient capacities for the usage of heat produced by the CHP plant in Meremäe was a very important precondition for the project implementation. A higher concentration of farms and possibilities for development of greenhouses for vegetable production was a decisive factor for constructing the plant in Meremäe. In winter months, the heat produced by CHP station is also used for heating residential houses and public buildings in Meremäe village.

Was/is the initiative successful?
The initiative was successful – not just in the sense that the CHP plant was established and started producing renewable energy, but in several other important aspects as well. RADAR contributed to:

- Better planning of the balance of the biomass demand and supply possibilities.
- More efficient use of the biomass resources
- Successful introduction of new sorts of biomass (herbaceous biomass, residues from food processing, farm manure) into energy production.

The physical/technological aspects of the initiative
The biogas plant works on the principle of fermentation of raw materials during the anaerobic mesophilic process (35-37°C). The fermentation process lasts 24-28 days. The methane content of the biogas obtained is between 53 and 60%. Conversion efficiency of the plant is 84%. The bio-energy chain is based on pig and cow manure and silage from crops – all supplied by Kimeko Ltd. farmland and from local farmers. The capacity of CHP plant is 0.845 MW electricity and 0.855 MW thermal energy. Around 30% of produced heat is used by the plant itself for heating a fermentation tank, while the remaining 70% is used for heating greenhouses and the local households.

CONCLUDING REMARKS AND POLICY IMPLICATIONS

Given the overwhelming dependency of the Estonian energy sector on oil shale, it is not surprising that the main national documents outlining energy strategy focus on diversification of the energy mix. Special focus is given to the increase of the use of renewable energy sources.

The largest share (50%) of SECIs analysed by ENERGISE team concentrate on technological solutions for better energy efficiency (renovation of old apartment buildings, construction of passive houses, more efficient heating and lightning in households), followed by initiatives that try to influence people to change ways in which they consume energy – either inside their homes or in transportation. Two SECIs, however, reflect well the above stated goal of national strategy documents: ‘Raising awareness on renewable energy by developing agro-energetic chain models (RADAR)’ and ‘RES and RUE Stimulation in mountainous and agricultural communities towards sustainable development

(MOUNTAIN-RES/RUE).' Similarly to RADAR, described in more detail in section 3, MOUNTAIN-RES/RUE aimed to stimulate the use of renewable energy sources in rural communities, helping them to become self-sufficient in energy.

Both SECIs (RADAR and MOUNTAIN-RES/RUE) targeted households located in rural communities, where energy consummation is influenced by a set of rather specific circumstances. To begin with, rural residents typically live in detached houses, where heating costs can be substantially higher than in the multi-apartment buildings (longer heating season, external walls on all sides of the housing unit, individual heating systems). Rural dwellers are on average less informed and less conscious regarding energy efficiency, and somewhat less concerned about environmental protection (it needs to be noted, as discussed in section 1.2, that in general, energy consumption practices of Estonians are rather wasteful as a result of the patterns established in the Soviet period, when energy was exceptionally cheap – electricity prices in Estonia remain among the lowest in EU even today). Finally, people residing in villages usually produce an abundance of biofuel (manure, silage, wood waste), but have no capacity to use it for generating energy.

The successful integration of the biofuel electricity and heat plant into the social-economic and energy landscape of the village Meremäe shows that such projects can not only revitalise deprived and poor local communities (new jobs, new income for farmers providing biofuel, reduced heating costs for the local residents), but can also contribute to the national targets regarding reduction of greenhouse gasses and increase in the share of the RES in the energy mix.

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