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Deliverable 4.3

Abstract version of Master Plan

for innovative energy structures in Saaremaa Island in Estonia, which could be feasible for funding in the Structural Funds Programmes in the period 2007- 2013.

Elaborated by Archimedes, November 2007

1. Background

Regional focus - Targeted towards Structural Fund Support

The cornerstone of the E4C – strategy is to support the implementation of energy pilot actions in the selected region feasible for public financial support, with main focus on **European Structural and Cohesion Funds (SF and CF)** during the funding period from 2007-2013. E4C strives to overcome the various constraints which currently hinder the broader use of Structural Funds for innovative energy actions in less developed and rural regions of Europe.

The general objective of this Master Plan is to evaluate current energy situation, potential for renewable energies, to develop energy vision and select the most interesting Energy Actions for funding from Structural Funds in Saaremaa Island. Thus, the document aims at undertaking action to utilization of local renewable energy sources and potential of energy savings in the region.

Saaremaa Island was selected as Energy 4 Cohesion (E4C) target region for its suitability for extended use of renewable energies and energy efficiency actions, namely:

- Rich resources for renewable energy generation particularly biomass resource
- Clear support of the political and administrative decision makers
- Availability of an extended knowledge and data basis for the planning process.

Master Plan is based on a comprehensive document “Saare County Energy Utilization Strategy and Action Plan until 2015” (<http://www.saare.ee/smv.nsf/> in Estonian language, 2001) - a strategy document giving a basic picture about the county’s energy sector, summarizing the possibilities of higher utilization of RES, energy saving measures as well as potential for energy efficiency implementation in building sector.

Regional energy planning is the basic precondition for better energy supply and demand management in the region resulting in several economical, environmental and social benefits for target groups and stakeholders in the region.

The main factors that influence a stable functioning of the energy sector in Lithuania (and in Kaunas Region) are:

- I. Prevalence of import of primary energy resources from Russia, dependence of Lithuania's gas supply and electricity systems on Russia's energy systems as well as absence of interconnections with Western European energy systems;

- II. The decommissioning of the Ignalina NPP in 2009, which has a considerable detrimental effect on the structure of electricity sources, primary energy balance and electricity price in 2010-2015;
- III. The strict environmental requirements set forth to energy enterprises, including restrictions on carbon dioxide emissions.

Improving efficiency of energy generation and consumption and increasing usage of renewable energy sources could mitigate the negative impact of the above-mentioned factors.

Cooperative Approach

In the region all main stakeholders were brought together for a successful and efficient definition of innovative energy actions in the respective region. The E4C actor cycle includes municipalities, households, media, capital provider and financial experts. Within this actor cycle Estonian project partner Archimedes was responsible for the coordination of the different actors, and the preparation of the regional Master Plan. Main focus was put to integrate suggestions and ideas existing in the region rather than exposing priorities from outside.

2. Master Plan Structure

Comprehensive investigations were undertaken, starting from an abstract and general view on the regions, leading to concrete innovative energy set-ups, consisting of a range of RE and EE projects. A comprehensive and detailed methodology was used, including 3 main elements:

1. **Target region portrait** – The target region portrait presents a first overview of the region including characterisation of the actual energy situation (production and utilisation). The collected data are the base for launching the development of local and regional energy planning.
2. **Energy Vision of Kaunas Region** - The Energy Vision and the goals of the energy strategy of the county will be upgraded up to the end of 2007. The energy sector of Saare County with introduction of innovative energy technologies and maximum use of local RES will be analysed to ensure sustainable development and minimum disturbance of environment at the same time. The first step is to find out the real energy needs of the target region and estimate the ecologically and economically reasonable and feasible amount of RES for covering local and regional energy demand. The second step is to facilitate the development of sustainable, diffuse and decentralised energy systems and the use of local RES in all municipal and rural communities and ensure clean energy production with rational use of land.
3. **Identification of concrete actions or action bundles** – The prepared Energy Vision considers several adapted initiatives ('Energy Actions'). The four most interesting Energy Actions feasible for Cohesion and Structural funding were selected. These are presented in chapter 4:
 - I. **Implementation of a biomass-fired CHP at the district heating company Kuressaare Soojus Ltd on the island Saaremaa**
 - II. **Renovation of district heating boiler plant and switch to biomass fuel in Kärla municipality.**
 - III. **Switch from fossil fuel to solid biofuel in the district heating boiler plant in Salme village**
 - IV. **Renovation of district heating boiler plant, connecting pipelines and installation of heat substations in the buildings of Liiva village in Muhu island**

3. Proposed Energy Project Proposals for Saaremaa Island

<p>Project Proposal 1 – Implementation of a biomass-fired CHP at the district heating company Kuressaare Soojus Ltd on the island Saaremaa</p>
<p>The main idea of the proposal is to launch a biomass-fired CHP unit at the district heating plant of Kuressaare town.</p>
<p>Current state</p>
<p>Kuressaare Soojus Ltd is a 100% municipal owned district heating company with 43 employees. They operate 2 bigger boiler plants - Kalevi boiler plant and Luha boiler plant as well as some smaller units. The boiler plants supply heat for approximately 8,000 inhabitants in Kuressaare equal to 50% of the population in the town. Kalevi boiler plant was constructed in 1973 and reconstructed in 1983 and 1998. Luha boiler plant was launched in 1986 and the boilers were reconstructed in 1997. In Kalevi boiler plant a wood chip fired boiler was installed in 1998 consisting of a furnace manufactured by the Estonian company Tamult in cooperation with Saxlund from Sweden. The furnace is connected to a boiler type VVS 7, manufactured by the Danish company Danstoker. Further on, a heavy oil fired DKVR 10 steam boiler has recently been converted to use wood chips by installation of a step grate in the DKVR boiler.</p>
<p>Technological solution</p>
<p>1. The first CHP option includes construction of a CHP plant with low investment costs by using the existing fuel handling system and the existing combustion unit. The existing Danstoker VVS 7 boiler shall be replaced by a new steam boiler with a thermal input equal to the thermal output of the existing combustion unit. A new steam turbine and a generator shall be installed including DCS system and necessary auxiliary components. Maximum power output will be 850 kW_e for this option.</p> <p>2. The second CHP option aims to build a base load power plant with a few annual start/stop sequences and to gain a high annual power production. The new CHP unit will be erected on a free territory beside the existing boiler house owned by the company. Maximum power output of the selected size will be 1,800 kW_e and the heat output from the new CHP plant will be 7,400 kW_{th} and will be transmitted to Kalevi Boiler house and from there distributed to the connected consumers. The solution includes also upgrading of the network connection between Kalevi and Luha.</p> <p>3. The third CHP option is to build a base load power plant with a few annual start/stop sequences and to gain very high power efficiency. The new CHP unit has to be erected on a free territory as above. The solution is based on gasification of wet wood fuels, cleaning of gas especially from tar before the wood gas is used as a fuel for gas engines, which draw the generator for production of electricity. The capacity is approximately 2 MW of electricity and 4 MW of heat.</p>
<p>Investors</p>
<p>The investment will be covered with the combination of Structural Funds, National budget, municipal resources and bank loan. In case of direct involvement of the Estonian Energy Company - Eesti Energia, considerable share may come from them.</p>
<p>Benefiting groups</p>
<p>Forest owners – possibility to sell felling residues</p> <p>Timber companies – possibility to sell by-products and waste wood</p>

<p>Farmers — cultivation of energy crops will provide a possibility for alternative income and efficient and attractive use of agricultural land</p> <p>Local population – sustainable and secure electricity supply for a remote area</p> <p>Energy producer – flexibility of fuel supply, independence of fuel transportation from the mainland</p> <p>The whole region - Successful implementation of the project and installation of a biomass fired CHP plant will be a substantial contribution to the principle of distributed energy production and sustainability and security of energy supply in the region. Besides, the project increases the consumption of biofuel which will bring along additional jobs</p> <p>Estonia – launching of a biomass-fired CHP contributes to achievement of the national target of CHP produced electricity – 18% by 2010 and 20% by 2015</p>
<p>Logistics</p>
<p>The fuel logistics includes necessary equipment and personnel to be a self-supplier of fuel (wood-chips).</p>
<p>Financing</p>
<p>3 515 140 € will be applied from Structural Funds, the rest of 5 272 710 € will be covered as 4 393 925 € bank loan and 878 785 € from own resources</p>
<p>Expected investments costs</p>
<p>Estimated cost of the project is about 8 787 851 €</p>
<p>Expected implementation time</p>
<p>Year 2009</p>

<p>Project Proposal 2 – Renovation of district heating boiler plant and switch to biomass fuel in Kärla municipality.</p>
<p>The idea of the project is to switch from shale oil to locally available biofuels for heat production. Additional investments are needed for general reconstruction of the production unit, although regular investments and maintenance have been made.</p>
<p>Current state</p>
<p>A couple of years ago biomass-fired out-dated boilers were exchanged for shale-oil ones. At the present time the existing boiler house with the capacity of 0,7 MW running on shale oil (heavy fuel oil) is located in the centre of Kärla village. Consumption of oil is 170 t/year. The heat is provided to 3 dwelling houses (21 366 m³), 4 social buildings and 1 public building. Total length of network is 850 m. Calculated network losses remain within 15%. The decision has been made to switch back to biomass, including the use of local reed resource and energy crops, which are an attractive alternative to conventional agriculture. The company sees an opportunity and has an interest to extend the consumer side and to connect the buildings of Sõmeru Special Care Home and Retirement Home to Kärla village district heating network</p>
<p>Technological solution</p>
<p>With longer distribution network and new customers the needed total capacity will grow up to 2,5 MW and total of 488 t/y of shale oil consumption can be avoided and replaced with biomass based fuels. The length of connection pipelines between the existing boiler house of the village and the network of Sõmeru Special Care Home is approximately 1500 m, out of which 400 m has been reconstructed with pre-insulated pipes.</p>

Investors
Local municipality, the State as the owner of two social institutions to be connected to the DH network – Sõmera Special Care Home and Retirement Home, private district heating company SW Energia Ltd, also other interested private entities are invited. The success of the project relies of the support from Structural Funds. Bank loan is also needed
Benefiting groups
<p>local population – switch to biomass helps to control the heat price for consumers. In addition more intensive production of biofuels will create new jobs and additional income. Clean air and improved environmental conditions attract more tourists which again gives additional income</p> <p>heat producer – competitive heat price may attract new consumers to connect to district heating</p> <p>local farmers – possibility to cultivate energy crops and sell fuel to the energy company</p> <p>local municipality – increasing incomes give additional tax money for local administration for the local benefit</p>
Logistics
Fuel will be supplied by forestry companies and farmers, also small local wood industries
Financing
Combination of public and private funding with involvement of Structural Funds and if needed, also bank loan
Expected investments costs
The cost of new 2,5 MW biomass boiler house with the connection pipes will be approximately 0,7 MEUR
Expected implementation time
2008-2009

<p>Project Proposal 3 – Switch from fossil fuel to solid biofuel in the district heating boiler plant in Salme village.</p>
<p>The idea of the proposed project is to switch from hard coal to locally available biofuels. Special focus is on the possibilities of using straw for heat production.</p>
<p>Current state</p>
<p>Salme village has managed to preserve their district heating system although it is in urgent need for major reconstruction, especially the boiler plant. The main problem is a drastic decrease of the number of consumers. Although years ago the boilers were operated mainly with wood based fuels, they had to switch to coal due to shortage of biofuel and limited market at that time (Salme village is located on a narrow and long peninsula with low quality soil and very scarce biomass resources. The existing boiler house with 3 boilers exceeding 25 years of age and the total capacity of 1,8 MW (out of which only 0,8 MW is in use) is located in the centre of Salme village and is running on hard coal. Consumption of coal is around 350-370 t/year. The length of DH network is 990 m. Estimated network losses are within 20-25%. The company is operated by a municipally owned DH company Salme SVK Ltd. At the moment heat is provided to 3 block buildings, 4 social buildings and one company. Local municipality has expressed an interest to extend the consumer side and re-connect the dwelling houses, which have been disconnected from the district heating network during the recent years to Salme village district heating network again.</p>
<p>Technological solution</p>
<p>The needed total capacity will grow up to 1,5 MW and the of total 3 200 sm³/y of wood chips or solid biofuels would be needed after renovation of the boiler house. The length of the connection pipelines is approximately 990 m and a part of it has to be replaced. One option is to use straw as a fuel, which means that an additional boiler with the capacity of about 450kW has to be installed. From a 350 kg dry straw ball it is possible to get about 850 kWh of heat. The limitation is the moisture content which should remain within 20%.</p>
<p>Investors</p>
<p>Project will be co-funded by local municipality and Structural Funds combined with bank loan. Private investors have not expressed any interest so far.</p>
<p>Benefiting groups</p>
<p>local municipality – reasonable heat prices and well-functioning heating system allows to save on the expenses on heating public buildings. Increasing income of local people increases also tax money transferred to the municipal account.</p> <p>local inhabitants – competitive heat prices encourage former customers to re-connect to the network and enjoy the comfort district heating. Those already connected will save money with lower heat priced. Extensive use of biomass creates new jobs both among potential fuel producers and transport companies.</p> <p>wood-processing companies – possibility to earn money from selling by-products and wood waste</p> <p>farmers – possibility to be involved in a traditional trade and cultivate energy crops</p>
<p>Logistics</p>
<p>Fuel transport will be provided by fuel producers or specialised transport companies</p>

Financing
Additional funding will be applied from the Structural Funds. The share of different funding sources including also municipal money and bank loans can be determine after final selection of equipment
Expected investments costs
The cost of the new 1,5 MW biomass boiler house with connection pipes will be approximately 0,45 M€ In case of installation of a separate straw burning boiler, additional 120 000 € has to be invested.
Expected implementation time
2008-2009

Project Proposal 4 – Renovation of district heating boiler plant, connecting pipelines and installation of heat substations in the buildings of Liiva village in Muhu island.
The project aims at making investments needed to enable the extension of the heating system and connection of new consumers. The installation of heat substations will allow controlling the consumption and balancing the system even better than it is done today. Energy saving measures including insulation of buildings will help to save fuel and increase efficiency of energy production.
Current state
Muhu island may be regarded as a real national success story in Estonia demonstrating in the best possible way the advantages of professional management, well-coordinated cooperation between local inhabitants – farmers, land-owners, industrial people and local administration and the possibility to solve local problems in a sustainable manner with sufficient amount of good will and mutual trust and clever combination of patriotic feelings and economic interest. Muhu Rural Municipality can enjoy one of the best functioning district heating systems in the region, which is based almost completely on locally supplied fuel. Only a limited amount of sod peat is purchased from a company outside the municipality. The bottleneck of the district heating system is bad quality of distribution network and poor insulation of the public and block buildings (except recently renovated Muhu Basic School). It is one of the very few places in the region where the number of customers and heat consumption are growing. Today heat is provided to 3 block buildings (9600 m ³) and 4 social buildings (34 400 m ³). Total length of distribution network is 660 m, estimated network losses remain within 15-20%.
Technological solution
The capacity of the existing boiler house is limited for connecting new consumers and to satisfy peak load during very cold periods. Wood chips (and peat) burning boiler was installed 11 years ago and a peak load boiler (light fuel oil) 6 years ago. Necessary total estimated heat production capacity is around 0.8 MW, at least 1,1 – 1,2 MW is needed. Renovation of 25 years old district heating pipelines and decreasing of heat losses in the

network and at the consumer are most urgent works. If to install new substations in the dwelling houses and renovate 650 m of pipelines, approximately 0,25 MW of heat would be saved.
Investors
Preferably municipal funds and bank loan. Application for Structural funding may be submitted.
Benefiting groups
local population – increased capacity of the boiler plant will allow to connect new customers who have expressed their willingness local municipality – more efficient heating system enables to save on fuel price tourist companies – well kept landscape is a pleasant surrounding for spending a holiday tourist companies, tourist farms – clean and well-kept surrounding attracts more tourists to visit the place and spend money
Logistics
well-functioning fuel logistics
Financing
combination of public and private funding
Expected investments costs
405 153 €
Expected implementation time
2008

4. Conclusion and Outlook

Development of a master plan for implementation of Structural Funds for investments into local energy sector is a unique exercise in Estonia, although development plans of local or regional energy sectors, mapping the existing situation, analysing production and consumption side and calculating energy saving potential, sometimes including also a forecast, is becoming rather a rule than an exception, although often incomparable with each other due to sometimes questionable reliability of initial data, varying quality and depth of analyses and qualification and expertise of the specialists compiling the development plans.

All preliminary activities, including direct interviews with local actors, collecting information by questionnaires, round tables discussions and seminars etc made the involved parties to think more seriously about their real needs, possibilities and perspectives, which may be called a very valuable contribution of the project to the regional development towards sustainability and energy efficiency.

Deeper analyses of collected project ideas, consultations with the national Ministry of Economic Affairs and Communications and the implementing agency of energy part of Structural Funding and involvement of the two mentioned institutions in the seminars and information dissemination events improved considerably the general knowledge and understanding about the development of investment projects, possibilities of grant funding, importance of investment into the energy sector for sustainable development etc, again an obvious added value of the project.

Three stages of national seminar, the second including a training in Austria encouraged the actors of the target region to go on with their initial project ideas – they had the opportunity to see with their own eyes different technologies used for heat and electricity production from biofuels, well functioning energy production systems including fuel supply chain, well-organised cooperation schemes between local administrations, farmers and entrepreneurs of smaller or bigger settlements or regions... They could see in practice more implemented ideas than they could imagine. They understood that self-sustainable regions, independent in terms of energy supply are realistic and achievable. This could be pointed out as the most important achievement of the project which allows to believe, that all four pilot projects described in detail on the previous pages will be successfully implemented.

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