



ACTIVITY 4. UTILITIES NETWORK ANALYSIS IN THE PILOT TERRITORIES: HEATING AND ELECTRICITY INFRASTRUCTURE

KOSTOMUKSHA CITY AND KALEVALA MUNICIPAL DISTRICT

KRIMEL

Elena Zavarkina

Report for WP 1. Spatial planning of remote regions

This project is co-funded by the European Union,
the Russian Federation and the Republic of Finland



This is an English summary about a report dealing with Utilities network analysis of Kostomuksha City and Kalevala Municipal District, which are located in northern parts of the Republic of Karelia. This report has been compiled as part of "Green cities and settlements" (GREENSETTLE) project, which has been financed by Karelia ENPI CBC programme. The original report in Russian is available at project's Russian website at <http://greensettle.krc.karelia.ru/section.php?id=10>

Introduction

Analysis of the engineer infrastructure, including heat and electricity infrastructure is essential for the optimal spatial planning, taking into consideration forecast scenarios of climate change, environmental issues and nature management economics. Analysis of heat and electricity infrastructure is essential for energy networks capacity identification, local renewable energy potential sources estimation and plans to expand the network of utilities. In addition, one of the major purposes of this analysis is that it can and should be used to develop local programs (projects) of spatial planning in the villages and municipalities. The development of such programs is strongly motivated by the recently approved by the RF Government order dated 08.11.2012 № 2071-r Concept of the federal target program "Sustainable rural development for the years 2014 - 2017 and for the period up to 2020." According to this concept, granting of subsidies to the budgets of the Russian Federation subjects is planned to be on a competitive selection of regional programs (projects) for sustainable development of rural areas, based on an integrated approach to the development of social and physical infrastructure of rural settlements and project financing. One of the criteria for competitive selection will be the presence of territorial planning program.

In view of the above, the analytical work on spatial planning carried out within "Green cities and settlements" project by the support of the Russian-Finnish ENPI Karelia program, is extremely important and promising for the development of the study area and the settlements (Kalevala National District and Kostomuksha city district) and well as the Republic of Karelia in general.

Below is the brief analysis of the engineer infrastructure analysis (heating and electric power infrastructure) of Kalevala region and the city of Kostomuksha conducted in 2012 by experts and representatives of the Karelian regional institute of management, economics and law of PetrSU. The analysis was conducted based on information provided by the municipal

administrations, data from public sources, information obtained in the meetings with the beneficiaries.

1. Kalevalsky National district

Electric power

Actual consumption of different types of energy resources in the Kalevala region over the past six years and projections till 2015 correspond to overall Russian tendencies. According to specialists, primary energy consumption in Russia will increase by 2020 by 27% in moderate, and 40% in the optimistic scenario. With respect to the most universal, high-quality source of energy – electric power consumption will grow between 37 to 49%. Forecasts of the experts Kalevala region objectively fit into overall Russian realities.

Heating power

Stabilization of heating power consumption growth is noticed in the region which seems to be associated with a slight increase in the centrally heated areas.

General characteristics of the housing stock and centrally heated areas in Kalevala region are shown in Table 1.

Table 1 Housing stock

| Criterion | Unit | Amount |
|-------------------------------------|---------------------|---------------|
| Number of apartment houses | Pcs. | 856 |
| Number of private houses | Pcs. | 822 |
| Total living area | ths. m ² | 273 |
| Centrally heated | ths. m ² | 54,3 |
| Electrically heated | ths. m ² | 7,8 |
| Firewood heated | ths. m ² | 156,6 |
| With central water supply | ths. m ² | 54,3 |
| Population | prs. | 9574 |
| Using central water supply | prs. | 3016 |
| Using central heating system | prs. | 3100 |

It is also to be mentioned that there is no commercial control for energy consumption which impedes objective assessment of the actual consumption.

Local fuel

Having a considerable stock for local fuels production and consumption, however, about 40 percent of heating power generated in Kalevala district heat is produced using fossil fuels, delivered over long distances both by railway and roads. The remaining amount of heat is produced by burning wood chips and firewood.

For Kalevala settlement the share of fossil fuels makes as much as 89 percent. Despite all attempts to replace coal for firewood, the fuel consumption records still show coal and diesel fuel still remain the most used.

Kalevalsky district possesses second largest reserve of energy peat and sufficient supplies of raw materials for production of energy wood. However, three out of nine boilers providing municipal heating of the region are designed to burn coal (2714 tons per year) and one for diesel fuel combustion (400 tons per year).

Closeness to the state border and potential consumers of energy peat, along with energy wood, near the border areas also makes production and exporting of local fuel energy attractive.

Therefore, enhancement of energy supply system in Kalevalsky district implies replacement of fossil types of fuel (coal, diesel) by local fuel (energy peat and wood). Priority is given to energy peat as the most high-energy fuel and cheap type of fuel. Still usage of both interchangeable local fuels may be worth considering.





2. Kostomuksha Municipal district

Electric and heating power

The structure and amount of sales of utilities for heat supply by year is presented in Table 2.

Table 2- Heat supply

| <i>Years</i> | <i>Heatsupply, Gcal</i> |
|--------------|-------------------------|
| 2007 | 228 713 |
| 1008 | 214 647 |
| 2009 | 228 694 |
| 2010 | 252 072 |
| 2011 | 207 206 |

Programs of energy saving and energy efficiency are developed by municipal institutions and envision minimum 3% annual reduction in energy consumption. Budget savings should be directed for the improvement of the technical characteristics of the objects controlled by municipal institutions.

Types and volume of energy consumption by municipal institutions for 2009 - 2011 are presented in Table 3

Table 3 - Consumption of energy resources.

| <i>Criterion</i> | <i>Unit</i> | <i>Years</i> | | | <i>ER decline rate,%</i> | | |
|---------------------|-------------------------|-----------------|-----------------|-----------------|--------------------------|-----------------------|-----------------------|
| | | <i>2009</i> | <i>2010</i> | <i>2011</i> | <i>2010/ 2009</i> | <i>2011/ 2010</i> | <i>2011/ 2009</i> |
| <i>Heat supply</i> | <i>Gcal</i> | <i>22863,86</i> | <i>22951,37</i> | <i>21563,31</i> | <i>0,38</i> | <i>-6,05</i> | <i>-5,69</i> |
| <i>Water supply</i> | <i>M3</i> | <i>106211,4</i> | <i>96655,1</i> | <i>92027,44</i> | <i>-9,00</i> | <i>-4,79</i> | <i>-13,35</i> |
| <i>Power supply</i> | <i>Thousand kWh</i> | <i>4035,701</i> | <i>3788,039</i> | <i>3770,148</i> | <i>-6,14</i> | <i>-0,47</i> | <i>-6,58</i> |

The development of Kostomuksha heating systems including reconstruction of existing and construction of new heating sources and heating lines would significantly increase the heat power output and area covered by central heating.

Widely used energy-saving technologies with better production and improved heating energy transportation will allow to save energy with the possibility of its redistribution.

Using local sources for heating private houses (including the use of natural gas boilers and heat pumps) will expand the technical capabilities as well as enhance the level of comfort for living. Currently, the coverage by central heating makes 98.9%. The fuel used is oil M-40 (M-100). The boilers tanks of the central boiler were installed in 1979, repaired in 2010 and have significant resource of exploitation.

Electric and heating power at JSC "Karelsky okatysh"

The city making enterprise is JCS "Karelsky okatysh" - factory for extraction and processing of iron ore. Annual electricity consumption by the factory makes 1509.0 million kWh. Maximum load (nominal) - 180.0 MW. Maximum load (actual), 175.9 MW.



Estimate of electric power consumption by the factory by the year is presented in Table 4.

Table 4 – Estimate of electric power consumption, million kWh.

| <i>Years</i> | <i>Heatsupply, Gcal</i> |
|--------------|-------------------------|
| 2012 | 1504,0 |
| 2013 | 1484,0 |
| 2014 | 1548,0 |
| 2015 | 1569,0 |

External power supply of Kostomuksha city and JSC "Karelsky okatysh" is carried out through two 220 kV transmission lines with insufficient capacity. By the end of 2010 Kostomuksha was listed among energy-deficient areas of the Republic of Karelia.

In coming years, power consumption of JSC "Karelsky okatysh" and the city is expected to grow, which requires the solution of power deficit problem. In this respect the construction of 220 kV line Ondskaya hydro power plant - 220kV Kostomuksha substation.

In order to improve the reliability of power supply and improve the load shortage the following steps are envisaged:

- development of Kostomuksha urban district electric power supply system through the construction of power sources and new electric power lines;
- increase supply reliability of Kostomuksha urban district, with the reconstruction of existing and construction of new electrical substations and transmission lines;
- introduction of saving technologies to increase the efficiency of production and transportation of electric energy;
- gradual putting in cable of overhead power lines, in residential areas.

Heat consumption by the Mining and dressing enterprise

Enterprise consumption in 2010 amounted to 364.7 thousand Gcal. The estimated consumption level until 2016 will make 347 thousand Gcal per year. For most heating systems years of installment are - 1981-1984, which requires their repair or replacement in the next 5-10 years

Energy saving activities at JSC "Karelsky Okatysh"

Till 2015 at JSC "Karelsky Okatysh" the prioritized investments to improve energy efficiency are:

- Switching over to two roasting machines to ensure production of 10.5 mln.tn of pellets per year. Increase in equipment productivity by 20%. Implementation time - 3 years from the start of investment. Investments - 400 million rubles.;
- Optimization of the treatment plant. Increased productivity of treating equipment by 15%. Implementation time - 3 years from the start of investment. Investments – 366 million rubles.;
- A pilot project of biofuels (peat) gasification. Switching from oil to alternative fuel (peat). Implementation time - 4 years. Investments – 545 million. rubles.

Expected financial results for Kostomuksha urban district 695.7 million rubles of annual savings on fuel purchases with replaced fossil fuels, including utilities savings - 185.9 million rubles.

Local types of fuel

Huge deposits of peat in the area of affordability in the territory of Kostomuksha urban district make it possible to consider full replacement of fuel oil used in the enterprise at present in the amount of 119,400 tons (during normal operation of the enterprise), including 31 900 tones - for providing municipal heat supply of Kostomuksha by energy peat.

There is the need to consider several options for the full replacement of fuel oil by the following fuels:

- Natural utility gas (taking into consideration the proposed gasification of the republic). Under this option, the enterprise is totally dependent on external supplies of fuel from outside the region, and

the threat of unpredictable changes in prices against their continued growth based on market conditions.

- Equal usage of natural gas and energy peat (grounded)
- Energy peat (grounded).

In case of option 2 or option 3 implementation both direct combustion of peat in specialized boilers as well as use of special machine for thermochemical gasification of peat followed by flammable gas and liquid fuel produced when using the technology of peat combustion in the boiler KVGM-100 and GM-50-14-250 (almost without retrofitting and upgrading) can be considered.

Conclusion

Analysis of the situation from the engineering infrastructure in: electricity and heat, as well as the problems and prospects of the use of local fuels, are important issues in the context of the plan of territorial planning and sustainable development of territories. The analysis on these topics in the Kalevalsky national district and the city of Kostomuksha showed that there are a number of challenges and risks associated with the utilities, prospects of power distribution. At the same time, recommendations to reduce or eliminate these risks, as well as proposals for the use of local fuels were made. These recommendations are the basis of local land use planning documents could be used to obtain federal grants under the Federal target program "Sustainable development of rural areas in the years 2014 - 2017 and for the period up to 2020."

References

1. Federal Law of 30.12.2009 N 384-FZ "Technical Regulations on safety of buildings and structures".
2. Federal Law of 23.11.2009 N 261-FZ "On energy saving and energy efficiency and on Amendments to Certain Legislative Acts of the Russian Federation".
3. GOST R 54860-2011 "Heating of Buildings".
4. The Government of the Republic of Karelia order dated September 8, 2006 N 275r-P [Approval of the Concept of the regional program "Active involvement in the fuel and energy complex of the Republic of Karelia of local energy resources, 2006-2010"].
5. General Plan provisions on territorial planning of the city of Kostomuksha; Inst. FSUE "ROSNIP Urbanism", St. Petersburg, 2009.
6. Strategic plan for socio-economic development of the city of Kostomuksha until 2020.
7. Gorodov R.V., Gubin V.E., Matveev A.S., Alternative and renewable energy sources, Publishing House of the Tomsk Polytechnic University, 2009.