Peat in the innovative policy of regions of Russia

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Summary

This paper presents the experience of work required for study and research on Agroindustrial districts (*AIDs)* and on local and regional development especially in the context of the new economy and the knowledge-based industries. New methods of modifying peat raw material are a basis for new manufacture. It comprises mechanical, physical and chemical processing, together with the introduction of various additives. Peat fuel has sufficient characteristics in terms of durability, friability, density, hygroscopicity, water resistance and heat of combustion. The fuel manufacture is carried out industrially, in an all-the-year-round mode that provides stability of the technological process as well as independence from weather conditions. The nature of polluting substances changes according to the fuel being used. The scale of manufacture of the peat fuel depends on the needs of nearby consumers and, as a rule, does not exceed 5-10 kt per year. The cost price of peat fuel is 20-25 €/t, in comparison with coal (45-50 €/t).

Key index words: agroindustrial districts, heat production, local fuel resources, sod peat.

Introduction

Tver Region (Tverskaya Oblast), populated by 1.6 million people, covers 84.1 square kilometers and is the largest region in Central Russia (see Fig. 1).

Figure 1. Agroindustrial districts based on small power and local fuel resources

Agroindustrial Districts (AIDs) are evolutionary networks of heterogeneous, functionally integrated, specialized and complementary firms, which are clustered into the same territory and around the energy service center as organizational forms that are created throughout an historical process rooted in the economic and social dimension of a specific place. AIDs are viewed here as densely populated industry-specific organizations composed of complementary enterprises, territorial identity, embedded institutions, trust, and social capital (see Fig. 2).

The district heat production of the Tver Region of Russia is focused on imported fossil fuel - gas, black oil, coal, oven fuel. The annual volumes of fuel consumption for the region are as follows: coal - 140-150 thousand t, black oil - 150-160 thousand t, oven fuel - 15-20 thousand t, natural gas - 650 million m^3 (see Fig. 3).

The consumer market for household fuel is based on the demand for more than 1600 boiler-houses dispersed in 37 areas of the Tver Region. The purchase price of this fuel is currently estimated at more than € 20 million. The conclusion from this is that budget-related shortages occur and the solution is to change to local fuel resources where peat is dominant. The Tver Region has the largest reserves of peat in European Russia, estimated at 2,182 million t (at 40 % moisture) and are concentrated to more than 2 600 peat deposits located practically in all administrative areas of region.

There is a great deal of practical interest in new technologies for local fuel production along with traditional technology of sod peat and briquettes. For example the method of extrusion formation in shop conditions. As a rule, such manufacture would be organized in separate administrative areas, with peat resources and industrial wastes.

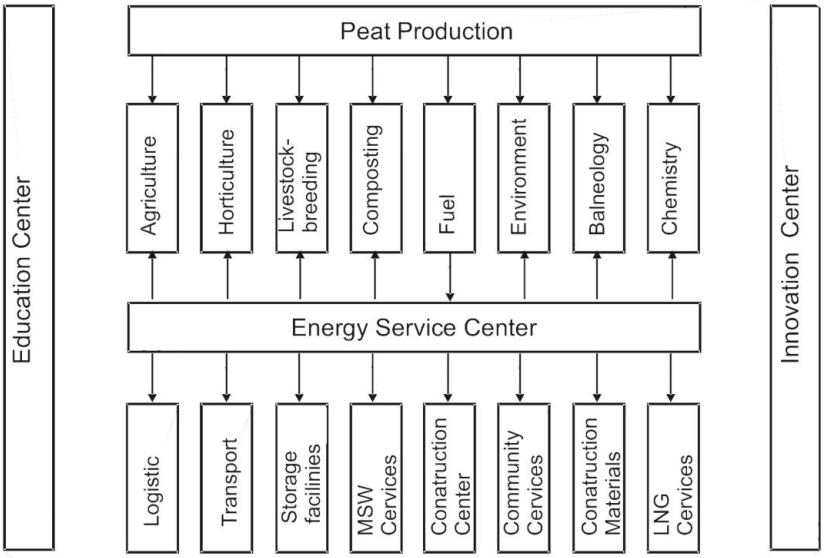

Figure 2. Network analysis scheme of AIDs.

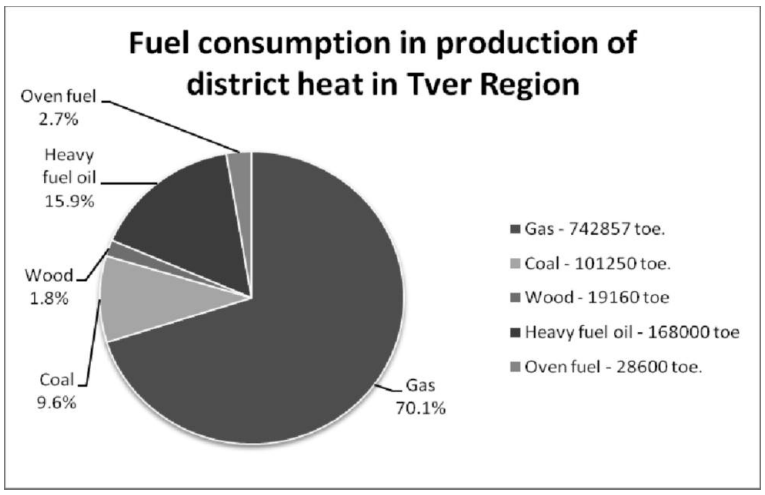

Figure 3. Fuel consumption in production of district heat in Tver Region

This would facilitate the supply as much as possible of locally manufactured fuel to consumers competitive on both price and quality. It would mean the lowering of transportation costs, the provision of stable employment, fuel price stability and the circulation of money through the local economy. Furthermore, if such an enterprise were bwing set up it would be worthwhile involving local wood and flax processors as the waste from these activities should be considered a valuable resource. The common volume of such waste is estimated at 600-800 thousand m^3/year.

Materials and Methods

The Yuryevskoe peat deposit was the sie selected for research. This site is located in the Vesyegonsk area of Never Region. The area of the peat deposit is 1,261 ha; depth: maximum 4.3 m, mean 1.97 m; peat reserves (at 40 % moisture content) 5,279 thousand t; peat types: sphagnum peat, low-more peat and mixed peat; decomposition degree: 10–62 % (mean 39%); ash content: 1-22% (mean 6%); natural moisture content: 79.8-86.4%; ph: 2.8-6.8; stump content: 2.2%.

A 60 hectare portion of the deposit was drained and prepared for milled peat production at the end of the 1980's. Distance of the site from Vesyegonsk is 7 km. where there are 67 boiler units with the total installed capacity of 89.4 Gcal/hour.

The volumes of fuel currently used in the area are: black oil - 1680 t; firewood - 9240 m^3; coal - 6867 t. For equivalent replacement of coal, 11-12 thousand t of sod peat is required. For peat extraction about 3.0-3.5 hectares are required per year. Hence, the prime site (60 hectares) will provide the program of peat fuel production for 18-20 years.

Laboratory experiments have been carried out with the purpose of developing a technology and establishing the optimum parameters for raw material preparation, dewatering and drying.

Results

First of all peat was exposed to mechanical processing in a worm-type leveling device. The controllable parameters of the raw material were: moisture content, dispersion ($P_{<250}$ μm), pH, mass concentration of addition.

Sod peat was formed in the screw press with a forming nozzle of diameter 40mm. The peat was then dried in a drying chamber at a temperature of 80°C and air speed 3 m/s. After drying was complete the physical-mechanical properties of the sod peat were assessed. The results are presented in Table 1.

Table 1. Parameters of raw material and physical-mechanical properties of peat fuel

Parameters	Meas. unit	Results
Moisture content of peat, W	m-%	82.8
Ash content, (A) in dry matter	w-%	8.0
pH		6.5
Degree of decomposition, R	%	31
Peat type		Woody-grassy peat
Dispersion ($P_{<250}$ μm),	%	
before processing		60.0
after processing		89.2
Moisture content be processing	%	79.4
Moisture content after drying	%	30.0
Density	kg/m^3	710
Compression strength	MPa	3.0
Friability	%	0.6
Water absorption for 1 hour	%	133
Mass concentration of addition	%	20
Net calorific value as received	kWh/kg	3.6

An analysis of the experimental data shows that the friability (i.e. the quantity of pieces less than 25mm which broke from the sample during drying) of the samples formed from natural peat reaches 100 %. The mixing of peat with wood waste markedly improves this and other parameters.

The block diagram outlining the technology of shop manufacture of lumpy fuel is shown in Fig 4.

Co-combustion of wood and peat is a good solution in terms of reducing fine particle emissions and thus favorable from the health hazards point of view: Linna, V. et al. (2004).

Technical and economic calculations show that the cost of this fuel comes to 25 €/t (at the cost price 14.4 €/t); that is significantly below coal and peat briquettes (45-50 €/t and 58-68 €/t accordingly) on a like-for-like basis. Thus the cost of thermal energy at a price for coal 50 €/t and sod peat 25 €/t provides a clear competitive advantage to sod peat.

Conclusion

Development of innovative policy in the field of small power systems allows a science-based solution for the whole complex of problems associated with sustainable development of Russian regions. The most significant parameters are:

- Association of agricultural and industrial small business in the closed industrial-transport chains on the basis of small power and local fuel resources;
- Enhancement of investment appeal of municipal initiatives on the basis of agroindustrial districts.

Creation of agroindustrial districts on the basis of small power and local fuel resources will allow:

- Successful development of commodity-producing business sector;
- Security of supply of power to municipal-based territories;
- The provision to consumers (boiler-houses and private sector) of accessible , cheap and good quality local fuel.

Advantages of the "know-how" of local fuel on the basis of peat and wood waste:

- Variety of options for modifying peat raw material for production with given parameters;
- Rational use of peat resources and recycling of wood waste;
- Stability of supply and quality manufacture of local fuel;
- Favorable conditions for duplicating technology;
- Decrease in atmospheric emissions through use of local fuel.

Acknowledgements

This work has been partially supported by the Administration of the Vesyegonsk area of Tver Region. This study is part of a research project of the Center for Research of Sustainable Development (North-West Academy of Public Administration). We appreciate the cooperation with "Vslet" Ltd. for their support with preparing this work.

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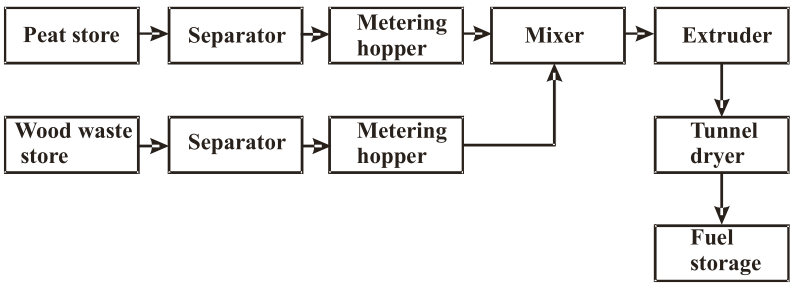

Figure 4. The technological scheme of local fuel production based on peat and wood waste