UDC 338.43:338.24
DOI: 10.17072/2218-9173-2018-3-489-501

RURAL TERRITORIES DEVELOPMENT THROUGH THE GOVERMENT SUPPORT OF BIOENERGY

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For citation:
Petrović, M. D. and Vuković, N. A. (2018), "Rural Territories Development through the Government Support of Bioenergy", *Ars Administrandi*, vol. 10, no. 3, pp. 489–501, doi: 10.17072/2218-9173-2018-3-489-501.

Introduction. Sustainable economic development of rural territories, especially remote areas development, is one of the priorities in government management in many countries in the world. The basis of sustainable development is the renewable energy. The paper looks at the relevant issues related to the rural areas' development under government policy in the field of sustainable development and bioenergy. The study investigates the issue through the case study of Russia. The paper looks at the relevant issues related to the rural areas' development under the alternative energy and bioenergy. The study presents an overview of scientific research in government policy instruments for bioenergy under in the frame of sustainable development and economic aspects. The most relevant issue for the rural territories - the implementation of small energy generation based on biofuel – should be dealt with comprehensively and viewed from economic to socio-environmental prospective. The role of government is to provide government support for such projects at the state level.

Aims. The main aim of this article is to investigate the theoretical base of the government policy in the field of government support of bioenergy. Also the article looks at how the problem of energy supply for remote rural areas in Russia can be settled successfully by developing the network of small bioenergy plants, which are quickly growing in rural forested areas. Bioenergy development in the rural territories also will allow starting new high-tech production in remote and northern regions, providing them with an autonomous energy sources. The methods of theoretical research (systems analysis, abstraction and concretization, idealization, etc.), as well as the methods of empirical research (method of expert assessment, comparison, analogy, and generalization) are applied in the study.

Results. Theoretical and practical solution of the research task will allow to complete and develop the domestic and world scientific knowledge in the field of alternative ecologically safe energy, to promote the development of mono-economy regions and to stimulate economic development and growth of the bioenergy capacity in the largest forested regions of Russia (with the possible establishment of export-oriented industries). The results that will be obtained during the project implementation are of high scientific and practical value for popularization of the green economy concept based on renewable energy, for its development in Russia and in countries with similar economic and climatic conditions, such as Canada, Finland, Norway, Switzerland and others.

Conclusion. The research shows how the usage of local fuel solves the problem of providing electricity and heating to the remote settlements regardless of their remoteness and availability of transportation routes. Besides, the implementation of a small boiler operating on wood chips will help to create employment of local population, which has a very positive social

impact. Creating boiler systems based on bioenergy generated with woodchip in municipalities will reduce the transportation costs of electricity and heating.

Key words: rural territory; rural development; government policy; bioenergy; renewable energy; wood chips; remote areas; government support; regional green economy

INTRODUCTION

Energy consumption is an objective condition for the existence of mankind. The population is growing steadily. Naturally, the amount of consumed resources is continuously increasing. This fully applies to energy resources that are used in all sectors of the economy and spheres of social life. The growth of consumption of various kinds of energy and resources sharply increases with the promotion of world economy on the path of industrialization and accelerated economic development. So, compared to the mid-twentieth century, the consumption and generation of electricity in the world has increased more than 15 times; in the past 5 years, energy consumption in the dynamically developing countries increased in China by 76 %, in India – by 31 %, in Brazil – by 18 %. With the existing rates of economic growth and the consumption, resources or traditional sources of fuel and energy (coal, oil, gas, etc.) would be exhausted in the next 100-150 years. Thus, the costs of their extraction are constantly increasing.

The Russian energy supply system on the major part of its territory (65 %) is largely decentralized, resulting in problems of sustainable energy supply for the rural areas residents. The usage of coal, oil, gas and refined products as fuel for remote territories is always connected with the problem of transporting fuel over long distances, which is not only costly, but also risky. There is no guarantee against untimely or not fully performed purchase and delivery of fuel, and consequently, it is a great risk for the life of local population. The problem is not resolved by bringing electricity to these settlements, because there is always a danger due to natural (freezing rain, hurricanes) and anthropogenic (theft of wires, etc.) factors. At the same time Actual Statistics shows that the cheapest and most available raw material for bioenergy is wood chips. Also bioenergy generation units based on wood chips do not require big investments and use simple technology. So the problem of energy supply for rural remote areas in Russia can be settled successfully by the development of the network of small bioenergy plants, which are quickly growing in rural forested areas.

At present, the drop in oil prices under liberal currency regime stimulates a high inflation and collapse of credit activity (Domashchenko, 2016); that is why the bioenergy sector based on wood chips, while producing a complex positive effect on the economy, can provide for a prospective development of state-private partnership.

In spite of its attractiveness, bioenergy based on wood chips is still not developed enough due to bureaucracy procedures.

THEORETICAL BASIS

At the same time, this approach has been actively investigated world-wide, many scientists resuming about effectiveness of bioenergy based on wood chips in rural areas. In Europe, the issue of forest biomass sustainable utilization, especially wood chips, for energy is investigated by many scientists (Sikkema and Fiorese, 2014; Busch and Thiele, 2015; González et al., 2015). The experience of bringing a low carbon energy supply for rural areas into practice in Germany is investigated by T. Jenssen, A. König and L. Eltrop (Jenssen et al., 2014). In Belgium it has been researched by B. Rugani, K. Golkowska, I. Vázquez-Rowe et al. (Rugani et al., 2015). In Italy the economic assessment of biomass production is studied by F. Sgroi, A. Di Trapani, M. Foderà et al. (Sgroi et al., 2015). B. Cavicchi, J. Bryden and M. Vittuari look at the experience of using biomass in Norway (Cavicchi et al., 2014). In Sweden the issue is investigated by C. Waldenström, R. Ferguson, C. Sundberg et al. (Waldenström et al., 2016). In the UK we can find a similar research in the works of P. Sinclair, B. Cohen, Y. Hansen et al. (Sinclair et al., 2015).

Changing residential energy demand can play an essential role in transitioning to a green economy (Huang et al., 2018; Niamir et al., 2018), especially in non-industrial remote areas. Subsidizing alternative sources of energy has an important environmental impact of stimulating replacement of non-renewable resources and thus promoting low-carbon transfer. (Gu et al., 2018; Li and Sun, 2018). Extending green supply chain management activities to manufacturing small and medium enterprises in a developing economy have lately been thoroughly researched both in Russian and abroad (Mafini and Loury-Okoumba, 2018; Mingaleva et al., 2017), the research being extremely important for the development of mono-oriented economies and non-industrial remote areas.

In Russia the development of bioenergy is outlined in the following basic documents (Makar and Yarasheva, 2017):

1) Energy Strategy of Russia until 2030[1];

2) State program "Energy savings and improving energy efficiency for the period until 2020"[2];

3) State program "Industry development and increasing competitiveness until 2020[3];

4) State program "Agriculture development and regulation of markets for agricultural products, raw materials and food for 2013–2020[4];

[1] *Energy* strategy of Russia until 2030 [Online]: Order of the Russian Government dated November 30, 2009 no. 1715-r, available at: http://www.consultant.ru/document/cons_doc_LAW_94054/ (Accessed July 1, 2018).

[2] *On approval* of the state program "Energy saving and improving energy efficiency for the period until 2020" [Online]: Order of the Russian Government dated December 27, 2010 no. 2446-r, available at: http://www.consultant.ru/document/cons_doc_LAW_109625 (Accessed July 1, 2018).

[3] *On approval* of the Russian Federation state program "Industry development and increasing competitiveness until 2020" [Online]: Government resolution dated April 15, 2014 no. 328, available at: http://www.consultant.ru/document/cons_doc_LAW_162176/8d648bec4eab78b541d473f109d614c798e52283/ (Accessed July 1, 2018).

[4] *On State* program for agriculture development and regulation of markets for agricultural products, raw materials and food for 2013–2020 [Online]: Government resolution dated July 14, 2012 no. 717, available at: http://www.consultant.ru/document/cons_doc_LAW_133795/5303cbf5887f046040d640a02a9a5be568d44695/ (Accessed June 28, 2018).

5) "Road map" "Biotechnology and genetic engineering development" for 2018–2020[5].

Also the Government of the Russian Federation issued a whole set of instructions regarding the implementation of the bioenergy strategy:

– Main directions of the state policy in the sphere of increasing the energy efficiency of the electric power industry using renewable energy sources for the period to 2020, approved by the Order of the Russian Government dated January 8, 2009 no. 1-r;

– the Order of the Russian Government dated May 28, 2013 no. 861-r "On Amendments to Main directions of the state policy in the sphere of increasing the energy efficiency of the electric power industry using renewable energy sources for the period to 2020, approved by the Order of the Russian Government dated January 8, 2009 no. 1-r".

However, the above programs do not include provisions for bioenergy, being limited to energy generation from sun, wind and water. (Table 1, Table 2), which can be viewed as a significant drawback of the government programs.

Table 1 / Таблица 1

Target indicators of generating facilities capacity based on renewable energy sources in the Russian Federation, MW / Целевые показатели мощности энергогенерирующих объектов на базе биотоплива в Российской Федерации, МВт

Generating units functioning on the basis of renewable energy sources by groups	2014	2015	2016	2017	2018	2019	2020	Total
Generating units functioning on the basis of wind energy	100	250	250	500	750	750	1000	3600
Generating units functioning on the basis of solar energy	120	140	200	250	270	270	270	1520
Generating units functioning on the basis of water energy with capacity under 25 MW per year	18	26	124	124	141	159	159	751
Total:	238	416	574	874	1161	1179	1429	5871

Source: Compiled by the authors on the basis of Main directions of the state policy in the sphere of increasing the energy efficiency of the electric power industry using renewable energy sources for the period to 2020[6].

[5] *On approval* of the action plan (the "road map") "Biotechnology and genetic engineering development" for 2018–2020 [Online]: Order of the Russian Government dated February 28, 2018 no. 337-r, available at: http://www.consultant.ru/document/cons_doc_LAW_292369/f62ee45faefd8e2a11d6d88941ac66824f848bc2/ (Accessed June 28, 2018).

[6] *On Main* directions of the state policy in the sphere of increasing the energy efficiency of the electric power industry using renewable energy sources for the period to 2020 [Online]: Order

Table 2 / Таблица 2

Target indicators of electrical generating equipment production based on alternative energy in the Russian Federation, MW / Целевые показатели производства электроэнергии объектов, работающих на базе биотоплива в Российской Федерации, МВт

Generating units functioning on the basis of renewable energy sources by groups	Commissioning	Allocation
Generating units functioning on the basis of solar energy Generating units functioning on the basis of wind energy	2014	35 %
	2015	55 %
	2016–2017	65 %
	2018–2020	65 %
Generating units functioning on the basis of solar energy	2014–2015	50 %
	2016–2020	70 %
Generating units functioning on the basis of wind energy	2014–2015	20 %
	2016–2017	45 %
	2018–2020	65 %

Source: Compiled by the authors on the basis of Main directions of the state policy in the sphere of increasing the energy efficiency of the electric power industry using renewable energy sources for the period to 2020[7].

In 2012, the government made efforts to improve regulations relating to bioenergy, specifically related to production of renewable resource for generating electrical power and development of biotechnology. Russia adopted the Comprehensive Program on Development of Biotechnology through 2020 (BIO 2020) in April 2012. Also in 2008, following orders issued by President of the Russian Federation (dated March 4, 2008 no. Pr-347), the Russian Government (dated March 6, 2008 no. R-834) and the Ministry of Agriculture (dated August 11, 2008 no. AC-13/4789), the Federal Center for the Development of Bioenergy was established on the basis of the State Scientific Institution "All-Russian Research Institute of Agricultural Mechanization" (GNU VIM) of the Rosselkhozakademia.

RESULTS

Currently, the situation with energy supply in rural areas is inconsistent. The southern, northern western and central parts of Russia mostly have centralized energy supply, while Urals, Siberia and Far Eastern regions have low energy security, both centralized and decentralized systems.

The share of bioenergy generation units in the total number of energy generation in the country is unreasonably small and wood chips mainly remain in the forest as a by-product. Russia is annually cutting about 130 million cubic meters of wood, and this indicator may increase to 550 million cubic meters (275 million tons),

of the Russian Government dated January 8, 2009 no. 1-r, available at: http://www.consultant.ru/document/cons_doc_LAW_83805/ (Accessed June 27, 2018).

[7] Ibidem.

with wood chips (the cutting waste) amounting approximately to 40 % or 370 million cubic meters (185 million tons).

The model of bioenergy based on processing wood chips which is the waste of the logging process dominates in science and practice. The authors propose to change the existing approach and consider using wood chips from cleaning and thinning cuttings for bioenergy in forested distant territories. Should this develop, wood chips can become the main raw material for generating bioenergy. In addition, one of the sources for wood chips can be low-quality wood, which is mainly the waste of logging and is not used by enterprises, for example, in Russia.

Implementation of the solution offered by the authors makes it possible to build a complex approach to the development of the remote territories, with the following effects:

– utilization of low-quality wood, obtained during logging, cleaning and thinning cuttings in forestry, especially after forest fires;

– solving finance problems in cleaning and thinning in forestry, by including these activities into the complex budget of bioenergy generation thus making them free for forest management;

– ensuring forest maintenance promoting the cultivation of highly resistant plantings, which effectively performs a protective forest function;

– creation of new jobs at bioenergy facilities (provision of raw materials; operating and maintenance of energy generation facilities);

– generation of cheap energy for the needs of local population in non-urban distant areas which is mainly the great problem for local authorities.

Most studies of economic aspects of undeveloped regions were effectively carried out in close regional frame within sector approach, determining factor of achievement of optimal sector and global development at the level of state and region (Kubović, 1974). Regional development is considered as a dynamic process of improvement of regional structures in order to create new potentials (Bogunović, 1991). The main resource for development in remote forested areas is forest (wood). The efficient consumption of wood in timber industry, economic accessibility of forest resources and the methods of evaluation of economic availability of forest resources are deeply considered in a majority of modern scientific research (Tretyakov, 2015; Fedorenchik and Lednicky, 2010; Gerasimov et al., 2013).

In the authors' point of view, using bioenergy based on wood chips from cleaning and thinning in forest is most appropriate for the "growth and development of poles" model of regional development (Perroux, 1970). In Perroux's original theory the growth pole referred to linkages between firms and industries. "Propulsive firms" are those that are large compared with other firms and generate induced growth through inter-industry linkages as the industry expands its output. It means that due to cheap energy generation from wood chips it is possible to attract and stimulate new business projects, which will develop and diversify local economy.

The creating of small individual bioenergy enterprises based on wood chips derived from low-quality wood in remote areas provides solutions for the following:

– generation of cheap energy for remote settlements for electricity and heating systems;

– uninterrupted supply of bioenergy produced from wood chip for electricity and heating sys-terms;

– implementation of a cost-effective investment project in economically underdeveloped regions, resulting in the growth of the gross regional product;

– provision of new employment;

– improvement of the ecological situation in the regions by forest rehabilitation and recovery and ecological recycling of wood waste produced during harvesting and silvicultural operations.

Bioenergy development in the Russian Federation will also allow creating new high-tech production in remote and northern regions, providing them with an autonomous energy sources.

To achieve these goals it is necessary to develop theoretical and methodological provisions in the field of alternative power engineering, in particular, bio-energy and green economy, in the context of Russia, as well as the development and testing of program-methodical complex evaluation of the potential of alternative energy development in Russia's regions during the formation of the national model of "green" economy. This formulation of the problem corresponds to modern research trends in the world of science, aimed at looking for the solution of economic and social development issues, overcoming the threat of "energy hunger", preventing further contamination of the environment and global climate change, preventing the reduction of life quality of population. Development of alternative energy is directly connected with these important issues, as it ensures the necessary volumes of energy production and consumption based on renewable resources, eliminates pollution and raises energy production efficiency.

The solution of this problem is possible on the basis of the development of promising energy - bioenergy wood fuel. This kind of energy production is economically feasible through the use of wood waste, reducing dependence on a monopoly supplier, and also allows using autonomous energy installation. Autonomous energy installation, being a number 1 world's natural resources reserve according to FAO (Food and Agricultural Organization) can turn out to be very promising for Russia.

The development of green economy is possible through creating prerequisites for a significant development of modern scientific knowledge in the field of green economy aimed at the following:

1) to determine the factors promoting development of alternative energy in the Russian regions, with focus on bioenergy, based on wood fuel, under the transition to the national model of "green" economy;

2) to define the basic conditions necessary for the successful development of alternative energy in the regions of Russia with emphasis on bioenergy wood fuel under transition to the national model of "green" economy" with the consideration of the "green" economy" practice in countries close to Russia's economic and climatic conditions, such as Canada, Finland, Norway, Switzerland and others.

Theoretical and practical solution of this task will allow to complete and develop the domestic and world scientific knowledge in the field of alternative ecologically safe energy, to resolve the problem of mono-economy regions development

and to stimulate economic development and growth of the bioenergy capacity in the largest forested regions of Russia (with the possible establishment of export oriented industries).

CONSLUSION

The research shows how the usage of local fuel provides a solution to providing electricity and heating to the remote settlements regardless of their remoteness and availability of transportation routes.

Besides, the implementation of a small boiler operating on wood chips will help to create employment for local population, which has a very important social impact. Creating boiler systems based on bioenergy generated with wood chips in the municipal units will reduce the transportation costs of electricity and heating. It will stimulate the development of small enterprises for harvesting of fuel wood and its preparation, improve the ecological situation and the fire extinguishing systems in the neighboring settlements and eliminate the risk of default situations in heat and electricity supply in winter. Nowadays all necessary conditions for the project implementation of distributed low power generation on renewable biofuels in remote forested areas are present, with available modern high-efficiency equipment production for bioenergy generation from wood chips.

Investments into projects of bioenergy based on wood are effective and they will be attractive as being economical, for banks not only in Russia, but also worldwide (Jovanović et al., 2012). The real-life practices in Russia demonstrate the effectiveness of bioenergy based on wood chips as a tool of neo-industrialization of regional industrial systems with multiplier effects (Lavrikova et al., 2015).

Finally, the implementation of bioenergy generation based on wood chips in remote areas has complex multi-sector effects in economy, ecology, forestry and social sphere.

Although there are indications that bioenergy generation based on wood chips will give a vigorous development impulse to business activities in the rural forested areas, given the strong economic reasons it might not be that quickly introduced at municipal enterprises, because the government is very conservative and slow to introduce innovations in energy sector

ACKNOWLEDGMENTS

The research has been done as based on the objectives of the Russian Federation Ministry of Education and Science government contract on research for Ural State Forest Engineering University (topic no. 26.8660.2017/8.9 “The Re-search Methodology of Forms of Economic and Technological Reality in the Aspect of Sustainable Forest Management”).

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Received July 28, 2018

УДК 338.43:338.24
DOI: 10.17072/2218-9173-2018-3-489-501

РАЗВИТИЕ СЕЛЬСКИХ ТЕРРИТОРИЙ ЧЕРЕЗ ГОСУДАРТВЕННУЮ ПОДДЕРЖКУ БИОЭНЕРГЕТИКИ

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Для цитирования:
Petrović M. D., Vuković N. A. Rural Territories Development through the Government Support of Bioenergy // Ars Administrandi. 2018. Vol. 10, № 3. P. 489–501. DOI: 10.17072/2218-9173-2018-3-489-501.

Введение: устойчивое экономическое развитие сельских территорий, в особенности отдаленных, является приоритетной задачей государственного управления во многих странах мира. Возобновляемые источники энергии лежат в основе такого развития. В статье рассматриваются проблемы сельских территорий в свете государственной политики в области биоэнергетики и устойчивого развития на примере Российской Федерации. Представлен обзор научной литературы по теме исследования. Определено, что создание малых энергостанций, работающих на биотопливе, является актуальным для сельских территорий и должно изучаться комплексно, как с точки зрения экономических, так и социально-экологических эффектов. Обосновывается необходимость государственной поддержки проектов малой энергетики на биотопливе.

Цель: изучение государственной политики в сфере поддержки проектов в области биоэнергетики. Кроме того, рассматриваются возможности решения проблемы снабжения энергоресурсами отдаленных сельских территорий в России путем развития сети малых энергостанций, работающих на биотопливе, все чаще появляющихся в районах, имеющих значительные лесные ресурсы. Развитие биоэнергетики также может стимулировать создание высокотехнологичного производства в отдаленных территориях и северных регионах, обеспечивая их автономными источниками энергии.

Методы: теоретического исследования (системный анализ, методы абстрагирования и конкретизации, идеализации и др.), а также методы эмпирического исследования (экспертной оценки, сравнения, аналогии и генерализации).

Результаты: дополнена научная база проектов по созданию альтернативных, экологически безопасных энергоресурсов, способствующих экономическому развитию моноотраслевых территорий и стимулирующих рост биоэнергетического потенциала регионов России, обладающих большими лесными ресурсами. Полученные результаты имеют важное научное и практическое значение для популяризации концепции «зеленой» экономики, в основе которой лежит идея возобновляемых источников энергии, для ее дальнейшего распространения в России и странах, имеющих сходные экономические и климатические условия (Канада, Финляндия, Норвегия, Швейцария и др.).

Выводы: исследование показало, что использование местных топливных ресурсов может решить проблему электро- и теплоснабжения сельских территорий, независимо от их удаленности и наличия транспортных магистралей. Использование малых котельных станций, работающих на древесной щепе, способствует снижению затрат на транспортировку электро- и теплоэнергии, а также созданию рабочих мест для местного населения, тем самым оказывая положительное социальное воздействие.

Ключевые слова: сельские территории; развитие сельских территорий; государственная политика; биоэнергетика; возобновляемые источники энергии; древесная щепа; отдаленные районы; государственная поддержка; региональная «зеленая» экономика

БЛАГОДАРНОСТИ

Работа проведена на основании задания на выполнение государственных работ в сфере научной деятельности в рамках базовой части государственного задания Министерства образования и науки Российской Федерации ФГБОУ ВО «Уральский государственный лесотехнический университет» (тема № 26.8660.2017/8.9 «Методология исследований форм экономико-технологической реальности в аспекте устойчивого управления лесопользованием»).

Статья получена 28 июля 2018 года