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**INVESTMENT IN ALTERNATIVE ENERGY SOURCES**

V.Y. Konyukhov (a) \*, O.M. Stefanovskaya (b), N.A. Shamarova (c)  
\*Corresponding author

- (a) Irkutsk National Research Technical University, Irkutsk, Russia, c12@istu.edu, +79148851700  
(b) Irkutsk National Research Technical University, Irkutsk, Russia, olyastefanovskaya@mail.ru, +79641044985  
(c) Irkutsk National Research Technical University, Irkutsk, Russia, k15@istu.edu, +7908641356

*Abstract*

One of the issues of the modern energy industry is limited energy sources. When oil and gas reserves are depleted, it will be necessary to use new sources of energy and develop clean energetics. The key solution of the problem is application of alternative energy sources which will sharply reduce the consumption of fossil fuels. Alternative energy sources can fully satisfy the demand of most nations. Wind energy, hydro energy, forest industry, the volume of precipitation for growing biomass influence the choice of alternative energy sources. The task is to create favorable conditions for producing alternative energy by attracting investment in the alternative energy sectors. At the moment investment in alternative energy sources is a topical issue

It is necessary to analyze the global experience in financing of large and medium projects on development of renewable energetics and energy-efficient technologies and identify transplantation possibilities for existing financial mechanisms in legal, social and economic conditions.

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## **1. Introduction**

People found a lot of substitutes for traditional energy sources (coal, oil or natural gas) a long time ago. They have been using different forms of energy sources for a long time, but the scale of their application is a serious global issue for the environment. First, the level of carbon dioxide emissions is constantly increasing. Second, use of traditional energy sources causes a greenhouse effect which leads to global warming. Dreaming about inexhaustible or fully renewable energy sources, people are searching for promising ways of energy production, use and transfer taking into account ecological and economical aspects of non-traditional energy sources, etc. (Alekseenko & Ratner, 2014). The need for using alternative energy sources is always increasing, so new searching and implementation methods are being developed. Today, a majority of countries implement programs aimed to reduce energy consumption by purchasing alternative power systems. The issue of non-traditional energy sources is relevant and highly researched. The key economic focus is financing of the industry as far as purchase, operation and maintenance of alternative power systems are very expensive. Thus, investment in alternative energy sources is a topical issue.

## **2. Problem Statement**

Increase in energy rates, unproductiveness of energy companies, problems with technological systems force investors to search for alternative ways of satisfying needs of energy companies. Improving renewable energy production technologies and energy-saving technologies in certain economic and infrastructure conditions can compete with traditional patterns of energy production and consumption. Their off-grid use is economically reasonable when achieving a certain minimum threshold energy consumption level typical of large companies or clusters of small enterprises, ect. (State and Trends on the Carbon Market, 2016.). The wide industrial application of these technologies is held back by a lack of financing schemes for designing and developing energy facilities. So, it is reasonable to analyze the global experience in financing of large and medium projects on development of renewable energetics and energy-efficient technologies and identify transplanted possibilities for existing financial mechanisms in legal, social and economic conditions.

## **3. Research Questions**

The global market of alternative energy financing is a system of commercial and financial mechanisms which aims to improve the environment. The mechanisms are as follows:

- regional and national carbon trading markets;
- green investment schemes;
- trading mechanisms for voluntary company liabilities, ect. (Porfiryev, 2015).

The most widespread method for alternative energy financing is attracting foreign investment by means of joint projects. One more method is a quota exchange for investment between countries with transition economies and technologically developed countries.

## 4. Purpose of the Study

The article analyzes different investment schemes for alternative energy production and energy-saving using international mechanisms. Advantages and disadvantages of the schemes are analyzed. Their potential for Russian large and small industrial enterprises is identified.

## 5. Research Methods

### 5.1. Financing mechanism for alternative energy sources

As any other large long-term infrastructure projects, engineering and construction of alternative energy facilities are carried out using a project financing method, which became a widespread fund-raising scheme. Energy facility financing and construction functions are performed by engineering companies. The government can help implement the project through indirect warranty and energy facility option purchase, ect. (GWEC, 2014).

The main advantages of the project financing are as follows:

- possibility to attract more participants (including foreign companies and financial organizations);
- risk distribution, ect. (Li Junfeng, et al., 2013).

The financing scheme is efficient if there is a real project owner who intends to consume energy which is generated by a constructed energy facility. For example, the scheme is efficient for construction of biogas plants designed to satisfy energy demands and recycle waste of processing companies. For example, in Krasnodar Krai, a construction project for a large 650 kW biogas station is being developed. Klaas-Kuban is the main consumer of its energy products. The company supports development of alternative energy sources and is ready to purchase green energy.

### 5.2. Credit financing

Despite new possibilities for alternative energy project financing, in Russia, the most common scheme is credit financing and carrying an energy facility as an asset of the project initiator. The main advantages are as follows:

- cost reduction for dangerous organic waste recycling, electric and thermal energy consumption, network connection;
- additional items of surplus power and fertilizer production revenues, ect. (Bojar & Gajak, 2015).

The disadvantages are as follows:

- limited target project participants;
- need for credit security;
- high interest rates on loans.

The following factors result in increased investment risks:

- lack of information about technologies and renewable energy resources;
- lack of standards for using similar project implementation methods;
- difficulties in selling surplus power, ect. (Nechaev & Prokopyeva, 2014)

### 5.3. Regional ecological funds

Regional ecological funds play an important role in project financing. Accumulating funds from ecological fines, finances of international and national institutes of development and sponsor financial resources, they are effective tools for supporting clean energetics as they have specific knowledge of social needs and ecological problems of the region. The Regional fund for environmental protection and water management of Ljubljana province (Poland) is a good example, ect. (Shamarova, Suslov, & Konyukhpv, 2016). About 28 billion € or 42 % of the total volume of financial resources of the fund are resources of different European sustainable development programs. 9,7 billion € are government investments, ect. (Suslov, Konyukhov, & Subanova, 2017). All other financial resources were attracted by the fund itself. That financing system is typical of most European funds.

In Russia, regional ecological funds are focused on rights protection and perform the following tasks:

- regional legislation improvement;
- elimination and minimization of ineffective nature-protection institutes;
- drawing public attention to glaring violations of ecological laws (for example, Arkhangelsk regional ecological fund *Biarmy*, Samara regional ecological fund, inter-regional non-governmental organization *Strizhi*), ect. (Shamarova, Suslov, & Konyukhpv, 2016).

### 5.4. Alternative energy is getting more advantageous

According to the data of the Investment Bank Lazard (Levelized cost of energy analysis – 9.0), industrial wind energetics and solar energetics in the USA became the most economical energy production methods. Alternative energy production costs were \$32–77/MW\*h.

Currently, solar energy prices are decreasing. In the beginning of 2017, in the Dubai tender, the price was \$58,4 per 1 MW\*h. Today the price is \$48. In the Mexican tender, the price was \$36 per 1 MW\*h. In the UAE, the price of the recent tender was extremely low - \$29,9/MW\*h, ect. (Shipunov & Chemezov, 2017).

In Russia, the economically reasonable energy price exceeds current energy rates due to the fact that the rates are not the only source of investment in the energy industry. Government supporting measures also play an important role. Market development and manifestation of economies of scale require fewer preferences, and specific volumes of financial support are reducing.

For example, in 2004, in Germany, the green rate paid to clean energy producers was 0,574 € per 1 kW\*h. Today, the rate is €0–0,13 per 1 kW\*h depending on the category of facilities. The energy price of most industrial power plants is set based on tender results, ect. (Nechaev, Antipin, & Antipina, 2014).

## 6. Findings

The modern world cannot reduce energy consumption rates. But they damage the environment and have serious effects on human lives. The only way to improve the situation is to use alternative energy sources. Governments invest in researches on this innovation field and develop the alternative energy industry. At present, only application of alternative energy sources can save the environment and improve living standards of humans.

Contribution of renewable energy sources to solving social tasks in Russia is dependent on social and economic reforming rates. Clear economic measures taking into consideration all possible primary energy sources are required. The reforms will change their relative efficiency. Profitability of renewable energy sources should be treated in the context of changes occurring in the energy industry, ect. (Fedchishin & Soykin, 2017).

## 7. Conclusion

The analysis of different financing schemes for the alternative energy industry allows concluding that Russia uses not all the possible financial tools and schemes, and the access to some of them is restricted by bureaucratic barriers. At the same time, increasing interest of regional governments and collaboration of energy companies with international organizations in some regions index shows that renewable energy sources will be applied in future and enhance energy efficiency. One of the most promising schemes for attracting investment funds for alternative energy facility construction and maintenance is a project financing scheme BOO (Build – Own – Operate), ect. (Gerasimov, Ukolova, & Suslov, 2017). A regional cluster of enterprises (a large single enterprise or a municipal formation) is a commissioner. It builds, maintains and owns an energy facility. The ownership term is not limited, ect. (Fedchishin & Masyukov, 2016) A key project investor is an international financial company (IFC, IBRD, EBRD, etc.) investing financial resources in “clean” development. A regional government is a guarantor. Active involvement of regional governments aims to:

- ensure a high level of coordination of actions of project participants (especially if several companies are investors and potential energy consumers);
- protect economic, ecological and social interests of small enterprises and population;
- eliminate administrative and bureaucratic barriers, ect. (Vasilyeva, Semenov & Chemezov, 2017).

For regional governments, collaboration with international financial organizations is a good possibility to attract additional investment in regions, create new jobs, improve the environment and solve energy supply problems which restrict economic growth in some energy-deficient Russian regions, ect. (Nechaev & Antipina, 2014).

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