



BUSINESS PERSPECTIVES



LLC "CPC "Business Perspectives"  
Hryhorii Skovoroda lane, 10, Sumy,  
40022, Ukraine

[www.businessperspectives.org](http://www.businessperspectives.org)

**Received on:** 12<sup>th</sup> of October, 2017  
**Accepted on:** 4<sup>th</sup> of November, 2017

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# IDENTIFICATION OF THE BASIC ELEMENTS OF THE INNOVATION-ANALYTICAL PLATFORM FOR ENERGY EFFICIENCY IN PROJECT FINANCING

## Abstract

This analytical study focuses on the financing of energy efficiency projects in Ukraine. In this article, the authors analyze the state and dynamics of the modern market of energy resources both on a global scale and within Ukraine, and it was discovered that the potential of the energy efficiency market is extremely large and interesting for different groups of bank investors. In the course of the study, it was revealed that private households and industrial enterprises are the largest energy consumers in Ukraine, which confirms the necessity of implementing a public program for financing energy efficiency projects. The study of Ukraine's legislative framework has made it possible to clearly define the concept of energy efficiency and to highlight which projects can be considered energy-efficient. It is noted that the state actively develops and implements a policy to increase energy consumption savings both among private individuals and among producing enterprises, which is implemented at the state level by a specially created Energy Efficiency Fund. As a specific tool for analyzing energy efficiency projects, the authors suggest using benchmarking technology, which provides the opportunity to highlight the strengths and weaknesses of a specific energy saving project, as compared to the top project in the industry. As a result, in the course of the conducted analytical studies, the authors proposed a specific tool for the analysis of energy efficiency financing projects in Ukraine, which includes five priority areas for which it is necessary to build a methodology for assessing the borrower's creditworthiness, which seeks to implement a project in the field of energy saving.

## Keywords

financing, energy efficiency, project analysis, energy efficiency improvement, benchmarking, bank investor

**JEL Classification** G21, G23

## INTRODUCTION

The development of the economic potential of each country depends on the state and specificity of the use of energy carriers. In Ukraine, where the share of imported energy resources is about 50-60% of the overall balance, the problem of implementing measures to improve energy efficiency is extremely relevant.

Among the major global issues, energy supply is one of the key issues. During the last quarter of the 20th century, the percentage of annual growth in gross domestic product in almost all developed countries of the world was accompanied by approximately one percent of the increase in primary energy consumption.

In a study made by Ganda and Ngwakwe (2014) "Role of energy efficiency on sustainable development", it is stated that global concern on continued exploitation of non-renewable resources, use of inefficient

technology in the production process, employment of weak structures and policies in energy consumption has been raised if an ideally sustainable future is imperative. Thus, energy efficiency refers to different policies, technologies and strategies that are aimed at solving issues related to energy use whether at residential, commercial, industrial and national capacities so as to minimize emission of greenhouse gases which cause global warming together with reducing financial costs. Consequently, this practice on energy efficiency must be applicable in every sector of the economy and ultimately at national level.

## 1. LITERATURE REVIEW

According to the study by Kirchko and Shcherbak (2015) "Basic Principles of State Energy Efficiency and Renewable Energy Policy in Ukraine and in the World", energy consumption in all countries of the world constantly continues to grow.

Energy consumption in all countries of the world is growing steadily. Thus, over 100 years (from 1900 to 2000), energy consumption has increased by 17 times. The structure of energy consumption is also changing. If, in 1900, oil consumption amounted to 3.8%, natural gas – 1.4%, renewable energy sources – 0.4%, atomic energy – 0%, coal – 94.4%, then, in 2000, oil consumption was 38.2%, natural gas – 24.0%, renewable energy sources – 6%, atomic energy – 7%, coal – 24.4%. At the same time, in 2010, when consuming primary energy resources, 120 billion tons of CO<sub>2</sub> was thrown into the environment, the consequences of which are difficult to predict.

According to the forecasts of the experts of the International Energy Agency (IEA, 2017), at the current level of consumption of energy resources, the total amount of explored world reserves of coal, oil and gas will be enough for about 100 years.

According to estimates of "British Petroleum" (2016), at the current consumption level, all the world's energy carriers explored until 2012 will end after 2178. After this time the only fossil energy source will remain only peat.

According to the energy balance of Ukraine for 2015, the total supply of primary energy to the country amounted to 90 million tons of oil equivalent, where 60% is of own production and 30% of imports.

The share of energy supply from renewable sources according to the State Statistics Service for 2015 is

only 3% of the total supply, of which 0.5% is hydropower, 2.3% – biofuels and energy, 0.1% – wind and solar energy. For comparison, in 2007, the share of energy from renewable sources was 1.7%.

The statistics show that Ukraine is trying to get rid of the traditional supply of energy carriers at the expense of imports, but in the field of renewable energy, development is under way too slowly.

The evident global problem of increasing use of energy resources has led to an increase in the attention of scientists from different countries to energy efficiency and its financial support, as reflected in the scientific papers of Bliss and Savage (2011), Vovchak (2003), Gasho (2011), Zaverbnyi (2011), Kostiuk (2014), Kuzmin (2007), Amosha (2009), Zerkalov (2012), Gorobets (2007), Mikitenko (2006).

At the same time, most scholars consider this problem from the point of view of the enterprise itself, provide theoretical and methodological approaches to increasing energy efficiency of enterprises, analyze and develop the policy of companies in the sphere of energy saving. At the same time, insufficient attention is paid to the peculiarities of bank financing of energy efficiency projects, there are no methodological developments and analysis of specific features of lending such projects.

Among the authors who study the issues of banking lending to energy efficiency in Ukraine, attention should be paid to Ryzhkova. Her paper titled "Threats and Risks in the Development of Bank Lending for Energy Productive Energy Efficiency Projects" (2013) reveals the major problems in the development of bank lending for enterprise energy efficiency projects in Ukraine, in particular: unfavorable macroeconomic factors; the narrow demand for loans; the instability of the Ukrainian banking system; lack of incentives and financial instruments; insufficient information on avail-

**Table 1.** Energy consumption in Ukraine in 2007–2015

No	Consumer	Units of measurement (tons of oil equivalent, t.o.e.)	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	Energy consumption	thsd t.o.e.	85,955	83,283	67,555	74,004	75,852	73,107	69,557	61,460	50,831
<b>Including</b>											
2	Industry	thsd t.o.e.	32,852	30,942	22,629	25,327	26,253	24,845	21,864	20,570	16,409
3	In % to the total	%	38.2%	37.2%	33.5%	34.2%	34.6%	34.0%	31.4%	33.5%	32.3%
4	Transport	thsd t.o.e.	15,417	15,141	12,396	12,627	12,611	11,448	11,280	10,327	8,750
5	In % to the total	%	17.9%	18.2%	18.3%	17.1%	16.6%	15.7%	16.2%	16.8%	17.2%
6	Households	thsd t.o.e.	23,001	22,845	22,084	23,813	23,604	23,466	23,495	20,384	16,554
7	In % to the total	%	26.8%	27.4%	32.7%	32.2%	31.1%	32.1%	33.8%	33.2%	32.6%
8	Sector of services	thsd t.o.e.	4,956	4,952	4,176	4,643	4,802	5,037	5,745	4,663	3,838
9	In % to the total	%	5.8%	5.9%	6.2%	6.3%	6.3%	6.9%	8.3%	7.6%	7.6%
10	Agriculture, forestry and fisheries	thsd t.o.e.	2,018	2,107	1,994	2,036	2,246	2,195	2,242	2,16	1,961
11	In % to the total	%	2.3%	2.5%	3.0%	2.8%	3.0%	3.0%	3.2%	3.3%	3.9%
12	Non-energy use of energy	thsd t.o.e.	7,712	7,295	4,269	5,547	6,008	6,116	4,932	3,500	3,318
13	In % to the total	%	9.0%	8.8%	6.3%	7.5%	7.9%	8.4%	7.1%	5.7%	6.5%

able investment projects. Due to the application of the methodology of SWOT analysis of lending to energy efficiency projects in Ukraine, the author identified the strengths and opportunities for the development of this direction.

## 2. METHODOLOGY

The theoretical and methodological basis of this study consists of a set of basic provisions and classical theories of lending, the use of a wide range of general scientific (analysis, synthesis, scientific abstraction, causal relationships), interdisciplinary and applied methods. In the course of the research, the methods of structural, functional and system analysis are used to determine the role and place of financing projects for energy efficiency in the total loan portfolio of banks; economic and statistical methods are used to assess the state of energy efficiency in the country as a whole; methods of comparative analysis are used for introduction of elements of technology of benchmark; methods of factor analysis and key components are used to develop key areas for analysis of financing energy efficiency projects and to build a system of key components (factors) that determine the procedure for the bank-creditor structural analysis of the project and the borrowing company itself.

## 3. KEY RESEARCH FINDINGS

The analysis of final energy consumption in Ukraine for 2007–2015 (see Table 1, formed by the author on the basis of the Ministry of Statistics) shows that since 2011, Ukraine has clearly taken the course on energy efficiency improvement, which is confirmed by the decrease of the total energy consumption from 75.9 million tons in 2011 to 50.8 million tons in 2015.

According to the structure of consumers, the largest share of energy consumption is taken by industry (32.3%), households (32.6%) and transport (17.2%). It is worth noting that in terms of years, the share of each group of energy consumers, with a constant decrease in overall energy consumption, remains relatively stable, which testifies to the high efficiency of implementation of energy efficiency programs in Ukraine.

After examining the current state and trends of the energy consumption market in Ukraine, it is worth noting that, according to IFC data, the potential of the energy efficiency market is extremely significant and is at least as high as:

- UAH 75 bn – potential of investments in heat and power consumption reduction projects;

- 4.1 billion m<sup>3</sup> (12% of the total volume) - the potential for saving gas consumption;
- 8.9 billion kW \* hr/year (7.5% of the total volume) - the potential for saving electricity;
- 11.3 million tons/year – the potential for reducing CO<sub>2</sub> emissions.

In particular, according to the International Finance Corporation, financing of energy-efficient projects that consume 4.1 billion cubic meters of natural gas consumption represents an investor's potential for investing in such projects in the amount of about 1.72 billion USD.

Potential projects of the Ukrainian manufacturing sector and the Ukrainian population for energy saving and CO<sub>2</sub> emissions reductions amount to about 1,049 million USD.

According to the submitted analytical data, investors are keenly interested in projects aimed at increasing energy efficiency and the use of renewable energy sources.

The experience of developed economies shows that their economic growth is based, in essence, on three components:

- in using, first of all, own energy resources;
- compliance with economic laws;
- on balanced state policy in the energy sector, including in the field of renewable energy and energy efficiency.

According to the Law of Ukraine "On Energy Saving" as of July 01, 1994, energy-efficient products, technology and equipment are products or methods, means of its production that ensure the rational use of fuel and energy resources in comparison with other variants of use or production of products of the same level of consumption or similar technical and economic indicators.

According to PJSC "Kyivenergo" (2017), energy efficiency is a branch of knowledge at the junction of engineering, economics, jurisprudence and sociology, which means the rational use of energy

resources, the achievement of economically feasible efficiency of the use of existing fuel and energy resources at the actual level of development of technique and technology and compliance environmental requirements.

Consequently, the concept of "energy efficiency" can be interpreted as the rational use of energy resources, reducing the use of resources while ensuring the same level of productivity, comfort, etc. Increasing energy efficiency means achieving a certain result, such as home heating, using less energy than is usually required.

In turn, the law stipulates that an energy efficient project is a project aimed at reducing energy consumption, namely: reconstruction of networks and systems of supply, regulation and accounting of water, gas, heat and electricity consumption, modernization of fencing structures and production process technologies.

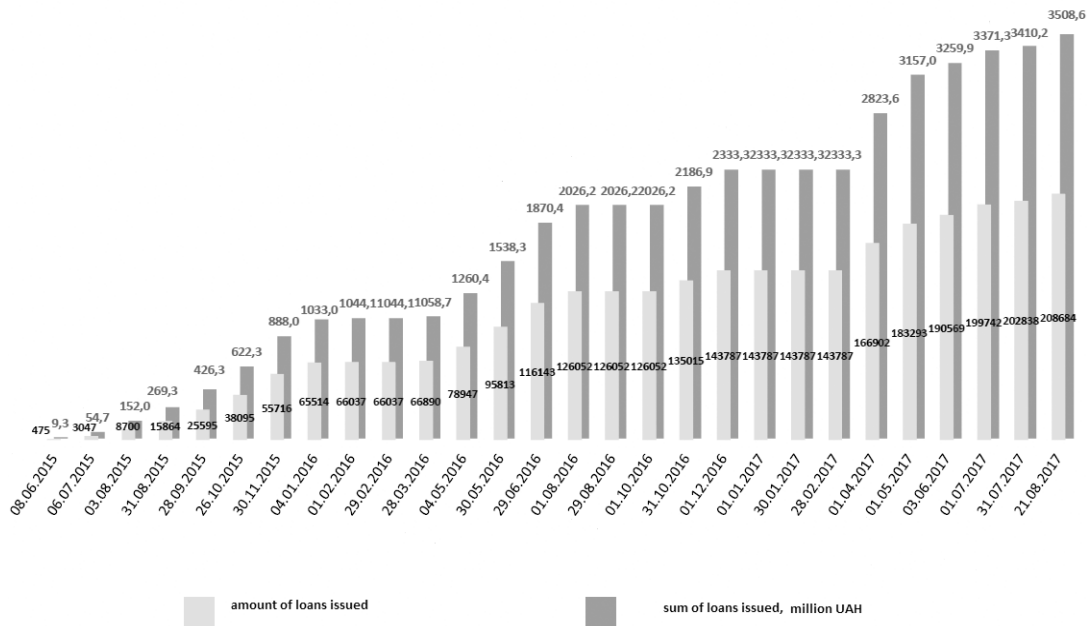
Article 14.1 of the Law "On Energy Efficiency", which was introduced into the law by June 8, 2017, stipulates that, in order to encourage individuals and legal entities to implement energy saving and energy efficiency measures, an Energy Efficiency Fund is established in Ukraine, the procedure for which is determined by law.

The authorized capital of the Energy Efficiency Fund is formed at the expense of the State Budget of Ukraine and other sources not prohibited by law. The Energy Efficiency Fund can receive financial contributions and grants from governments, agencies and institutions of foreign states, as well as international financial organizations, in the form of targeted grants or otherwise through a relevant contract.

The Energy Efficiency Fund provides partial reimbursement of the cost of energy efficiency measures for individuals and legal entities in accordance with the fund's programs.

Turning to the energy efficiency program, a large number of banks in Ukraine launched large-scale programs to finance projects to reduce energy consumption and increase energy efficiency.

According to the Government Energy Efficiency Program, the general state of distribution of bank



**Figure 1.** Distribution of total loans granted to the population for the purchase of energy-efficient equipment

credit resources among the population that attracts funds for the purchase of energy efficient equipment is shown in Figure 1.

According to Figure 1, it is shown that during 2015–2017, the level of loans to the population increased to UAH 3,508.6 million, which is quantified in the provision of more than 200 thousand loans. At the same time, the activation of the population’s demand for loans took place during April-September each year due to the impossibility of replacing the power equipment in the cold season. At the same time, the provision of credit data took place with state support, which was manifested in the partial reimbursement by the state of funds for the purchase of energy-saving equipment.

From the point of view of a potential legal entity borrower who plans to raise funds for the purpose of implementing an energy efficient project, the benefits are:

- reducing the cost of energy use in the future;
- reduction of energy dependence on a certain energy carrier;

- “synergy effect” – improving the quality of the products manufactured by the borrower, eliminating weak manufacturing sites, increasing the value of assets, etc.

From the perspective of a potential investor (bank), the benefits of financing energy efficient projects are:

- fewer risks associated with the initial infrastructure of the project (permits, licenses, approvals, etc.);
- projects of such direction are simpler and more transparent than turnkey business financing;
- the vast majority of projects relate to the financing of an existing business;
- the borrower’s ability to repay energy loans does not depend on political decisions, because of the availability and the possibility of applying the “green” tariff.

As defined in the collective work of the authors Bilotskiy, Danylova, Grinenko, Karmaza, and Koucherets (2017), “Legal and economic as-

pects of Ukrainian enterprises activity at the European renewable energy market” the presence of clearly defined standards and certificates of quality for the European market allows producers to show the competitiveness of Ukrainian products in the international market and stimulate Ukrainian manufacturers to improve product quality, to invest in innovative methods and the newest equipment that positively appears on the satisfying generated demand in the EU market.

The benchmarking technology is an important tool for energy efficiency research. As stated in Wikipedia, benchmarking is a process of finding a standard or benchmarked, cost-effective competitor for comparing with one’s own and taking advantage of its best practices.

As a simple and convenient tool, benchmarking gives a chance to compare global best practices with other players in a particular energy sector or region by comparing energy efficiency within a company between its individual divisions or sectors.

In the process of benchmarking, an enterprise can:

- identify the potential of saving energy and money;
- determine the efficiency of the production process as a whole and to select key areas for improvement of efficiency;
- have a good demonstration effect that is easy to use.

Comparison of benchmarking can be performed on two levels of accuracy:

1. Total energy consumption (electricity and gas) per unit of production with benchmarks.
2. Separate consumption of gas and electricity consumption per unit of output.

By introducing financing mechanisms for energy efficient projects and attracting powerful investment banks to such cases, the state accelerates economic development and helps to in-

crease the economic potential of both lenders and borrowers.

If, from the point of view of the borrower, the benefits and risks of obtaining a loan in order to improve energy consumption are obvious, then for banks that provide such loans, there is a need for a specific credit analysis.

The research of energy efficiency projects undertaken by the investor is based on the following priority areas of analysis:

3. Justification of the project’s energy efficiency.
4. Experience of the company and equipment supplier.
5. Financial indicators of the project.
6. Technical parameters of the project.
7. Infrastructure for project implementation.

At the first stage of the study of the justification of the energy efficiency of a particular project, an investor should identify a number of factors:

- what justifies exactly such a decision by the borrower to increase the energy efficiency of the project;
- does this decision correspond to the plans of the borrower to increase or decrease the productivity, the state of infrastructure, possible reduction or improvement of operating modes, etc.;
- was the borrower conducting an analysis of the status of other equipment that is associated with this project (for example, before putting a new boiler, it is expedient to reduce the heat cost of production). Maybe, it is firstly needed to replace the other equipment or infrastructure.

The obligatory element of the creditworthiness analysis of a borrower that attracts credit for the purchase of energy-saving equipment is the definition of the experience of the company and the equipment supplier:

- does the borrower have experience in working with new equipment;
- if the client does not have sufficient experience with the equipment, who will provide maintenance and uninterrupted operation of the new equipment;
- who is the supplier of equipment and what is his experience in the market of work with this product;
- who will implement the project;
- who will be the responsible person from the borrower for the implementation of this project.

The analysis of the financial structure of the borrower's company envisages, in addition to analyzing the general performance indicators of the company, to pay special attention to the financial indicators of the project on energy efficiency improvement:

- the amount of capital investment required by the borrower for the project, taking into account the costs of designing, transporting equipment, construction work, installation, commissioning, etc.;
- what will be the size of the operating costs after the project implementation (e.g., equipment maintenance, procurement of spare parts, etc.);
- what is the expected profit or cost savings from the implementation of this project by reducing energy costs;
- are there any additional benefits from project implementation (due to reduction of operating costs, improvement of quality of products, reduction of shortages, elimination of problem areas in the production sector at the enterprise, increase of productivity, working conditions, etc.);
- what is the monetary value of the specified additional benefits from the project implementation.

A specific study from a bank that finances an energy-efficient project requires technical parameters of the project:

- principal scheme of equipment, a brief description, due to which achieved energy savings;
- why is this manufacturer of equipment chosen, whether a comparison was made with other manufacturers of similar equipment;
- it is necessary to obtain and analyze a contract for the supply of equipment;
- explore the warranty and general life of the equipment;
- who will provide maintenance and delivery of spare parts and accessories to the selected energy saving equipment;
- mandatory separate research and analysis requires data on the supplier, if available – the designer, the general contractor, the contractor, the construction company and their experience in the implementation of similar projects.

The analysis of the infrastructure necessary for the implementation of the project will enable the creditor to verify the full success of the planned investment project:

- what is the state of the engineering communications necessary for the project to work. Do they need modernization (for example, replacing or repairing the heating main when replacing the boiler, replacing or repairing pipelines when replacing pumps);
- do you need additional permissions to launch the equipment for this project;
- was a study carried out to assess the impact of the project on the environment;
- do we need additional costs to reduce the negative impact on the environment;
- how is recycling or further use of old equipment planned?

## CONCLUSION

According to the given analytical research, it is possible to distinguish five main components of a successful process of implementation of energy efficiency projects:

1. It is expedient to analyze the efficiency of consumption of resources at the production in general (steam, cold, water, etc.) by conducting energy audits before implementing energy-efficient projects with a significant amount of investments (for example, replacement of boiler, refrigeration unit, wastewater treatment facilities, etc.).
2. Correct choice of equipment, power, manufacturer and supplier.
3. A rational decision on the ratio of capital costs to the purchase of equipment and its quality.
4. Considering the factor of additional benefit, not only from the saving of a certain type of energy resources, but also from improvement of quality, productivity increase, etc.
5. Energy efficiency projects should be considered in conjunction with the reconstruction of obsolete infrastructure, technology or engineering communications in order to obtain the desired economic effect from their implementation.

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