

"Invisible fuel"

The analysis of opportunities for raising energy efficiency in the industrial sector of the CIS countries

This study analyses the main trends in the field of energy efficiency, and the dynamics of changes in corresponding indicators at three basic levels, namely,

1. economies of the countries studied (Russia, Ukraine, Belarus, Kazakhstan);
2. branches of industry; and
3. individual businesses - survey respondents.

The analysis of some of the most pressing energy efficiency issues in the industry of the CIS countries resulted in the following main conclusions.

Main conclusions:

• The tendency for changes in energy efficiency indicators at the level of national economies.

The energy intensity of the analysed economies remains sufficiently high. However, the macroeconomic indicators of energy use (in particular, the energy intensity of gross domestic product, GDP) show a generally positive downward trend in the period 1990-2011. This is against the background of a general decline in energy consumption due to the economic recession of the 1990s, and the formation of market-based operational models.

In addition, all of the countries analysed are characterised by a redistribution of the internal balance of fuel and energy resources consumption. In particular, an increase in the share of consumption has been registered in the services and transport sectors due to their development.

The analysed economies are characterised by a considerable lag in terms of world average GDP energy intensity. This is due to both a high proportion of energy-intensive industries in need of radical overhaul, and reduced rates of value-added products. The ever-growing cost of energy is one of the factors affecting the production cost parameters (especially in energy-intensive sectors).

• The change in companies' energy intensity indicators.

According to the survey, in the period from 2005 to 2011 most companies reported an invariable share of energy expenses in the cost composition of output. However, energy use per value added reduced in the same period. This indicates the non-technical factors in forming the energy intensity indicator, and the possibility of adjusting the market prices of outputs without changing the structure of production and associated costs.

• The companies' on-going plans for production development and energy efficiency improvement.

Representatives of business communities in the countries studied are looking for ways to adapt to new challenges in the field of power supply and energy consumption. Power-consuming industries (metallurgy, chemical and petrochemical production, oil refining, fossil fuel power generation, pulp and paper production) have not demonstrated a significant reduction in macroeconomic energy intensity. This may indicate that these industries lack a substantial renovation of basic production assets. However, improving energy efficiency is a key factor for many industries in increasing the value-added products in the context of market constraints. This requires the development of appropriate investment plans for modernisation of production and energy supply systems, as well as their adaptation to various scenarios of the forecast development of relevant markets.

The vast majority of respondent companies (almost 90%) plans to reduce the energy intensity of production over the next five years. According to the respondents, this is due to: the ever-growing cost of energy; the need for hardware upgrades; and reduction of production costs. Many companies have more or less developed investment plans for raising the efficiency of use of fuel and energy resources.

- **Factors promoting the implementation of energy efficiency projects.**

There are key factors that motivate the development of energy strategies, and the implementation of investment renovation projects leading to a reduction in energy consumption. Among them the companies single out: (i) continuous and inevitable rise in energy prices; (ii) the need to replace old and outdated equipment; and (iii) the need to reduce production costs to retain market positions. Moreover, many companies face limited access to energy which results in the need to reduce energy consumption and develop their own generating facilities.

It should be noted that none of the survey respondents mentioned legislation in the field of energy efficiency, and state support measures as a motivating factor. This demonstrates that existing instruments of state support to encourage investment in energy efficiency are not enough.

- **Constraints to implementation of energy efficiency projects.**

Companies respondents defined financial difficulties (lack of own resources, limited access to debt financing, complexity of assessment, and reliable confirmation of the projects implementation effect) as being the first and foremost group of limiting factors and barriers to system implementation of investment energy efficiency projects. This group of factors was specified by a majority of companies from various sectors (~ 60%). Among other substantial limiting factors they named administrative (complexity of approval and licensing procedures, lack of state support, and outdated regulatory framework) and technical barriers (complexity of technical solutions, and lack of successful planning and projects implementation experience).

- **The practices of implementing investment energy efficiency activities.**

Virtually all survey respondents mentioned their successfully implemented projects (represented as Cases) that drove the decrease in the energy intensity of production. However, in most cases, the resulting energy efficiency improvement was seen as only one of the components of the projects' main implementation effects.

The main investment priorities are to maintain the working condition of the equipment that exceeded its service life period, as well as the production of new or improved existing products. In many cases, the best industry indicators of energy intensity of production have not been achieved as a result of such initiatives. Moreover, large-scale investment projects are fragmented among industries and implemented by individual enterprises. A strategy must be developed for investing in projects that result in improving the efficiency of fuel and energy consumption. This is a necessary prerequisite for a fundamental change in the energy intensity indicators of various industries. Such a strategy should be adapted to the various scenarios of corresponding markets' development.

- **Operational improvements related to increasing energy efficiency.**

The study examines the individual company practices in implementing operational improvements programmes for increasing energy efficiency, developing automated energy resources monitoring systems, and implementing energy management systems. Implementation of ongoing energy efficiency activities (organisational initiatives and activities within the framework of the operating budgets) should be carried out on a regular basis by assuring the continuous analysis of energy efficiency and energy planning. To create a concept of such planning it would be wise to centralise these activities under a special unit with the appropriate level of authority within the company, such as Chief Resource Officer Department.

- **Financing energy efficiency projects.**

According to the company survey, the most significant barrier to improving the companies' energy efficiency is the complexity of raising funds. The majority of respondents use their own resources for implementing energy efficiency projects. They are unable to attract external funds due to the high interest rates of debt financing, and the complexity of projects' economic evaluation. However, financing of projects, especially the large ones, solely with the companies' own budgets leads to "freezing" of working capital. This may ultimately create a number of threats to their financial stability.

In order to find a solution to such problems, it is advisable to consider a wider range of sources and schemes of financing, including those discussed in Chapter 4 of the current study. The best source of funding must be chosen depending on the particular project profile and conditions.

The methodology of the study

The main methodological task of the study was to perform a multi-level analysis of trends in the field of energy efficiency in order to identify the progress of the surveyed countries, industries and individual enterprises in implementing energy policies.

The presented analysis of changes in energy efficiency indicators was structured on a three-level basis:

- **The first level** covers the analysis of macroeconomic energy intensity trends at the level of the countries studied and certain economy sectors (industry, transport, services, etc.), presented in Chapter 1, "Prerequisites to Improving Energy Efficiency in the Countries Studied";

- **The second level** provides the evaluation of dynamics of changes in basic energy intensity indicators, typical for the industrial sectors of each of the countries studied, presented in Chapter 2, "Energy Intensity of Industry in Countries Studied";

- **The third level** covers the analysis of changes in energy intensity indicators at the level of individual enterprises in various industries (presented in Chapter 3, "Energy Efficiency Practices in Industry"), as well as the analysis of trends in funding energy efficiency measures (presented in Chapter 4, "Sources and Instruments of Financing").

The **first level** covered the analysis of macroeconomic energy intensity trends in the countries studied and certain economy sectors (industry, transport, services, etc.), including such indicators as:

- GDP energy intensity, calculated as the ratio of consumed energy (toe¹) to GDP (US dollars, USD) in a given year. The two indicators are available at the open World Bank Database. GDP of the countries studied is converted to USD using purchasing power parity exchange rates of 2005;

- energy consumption per capita, source - open World Bank Database;

- energy use patterns of developed and developing countries (in 1,000 tce²), including Germany, Japan, USA, Poland, China, Brazil, South Africa, India, Russia, Ukraine, Belarus and Kazakhstan, source - the International Energy Agency open data.

¹ toe (tonne of oil equivalent) – is a unit of energy defined by the International Energy Agency and equal to 41.868 GJ or 11.63 MWh.

² tce (tonne of coal equivalent) – is a unit representing energy generated by burning one metric tonne of coal, equivalent to 29.31 GJ.

The results of the analysis are presented in Chapter 1 of the current study, "Prerequisites to Improving Energy Efficiency in the Countries Studied".

The **second level** provided the evaluation of dynamics of changes in basic energy intensity indicators, typical for the industrial sectors of each of the countries studied, based on open data published by official statistical agencies. The following indicators in the period 2005-2011 were used as input data:

- consumption of fuel (tce), electric (kWh) and thermal (Gcal) energy by industries;
- industrial output in monetary terms (in million RUB, UAH, KZT, BYR);
- industry's value added (in million RUB, UAH, KZT, BYR);
- output in physical terms (tonnes, GJ for electric and thermal energy industry) for each of the industries.

The specified data was used to calculate the rates of gross energy consumption by industries (in gigajoules - GJ) based on conversion factors for units of energy. Production output and value added indicators have been converted to 2005 USD using purchasing power parity (PPP) exchange rates (based on data from open sources). The cost of production index (2005 USD based on PPP rates) was calculated as the difference of output and value added.

Indicators of average energy consumption per unit (GJ/tonne), product unit cost (USD/tonne) and the value added per unit of output (USD/tonne) were calculated and analysed for each of the selected industries in the retrospective dynamics (2005-2011). The results of comparisons and conclusions are presented in Chapter 2 of the current study, "Energy Intensity of Industry in Countries Studied".

The **third level** of the research covered the analysis of changes in energy intensity indicators at the level of individual enterprises in various industries. It defined trends in companies' financing of energy efficiency measures based on the questionnaires and interviews with representatives of large companies engaged in energy-intensive industries of the surveyed countries. A total of 48 companies-respondents took part in the survey and interviews.

To analyse changes in energy intensity indicators at individual enterprises level the value added energy intensity index (GJ/USD 1,000) has been identified as a typical indicator with 2005 and 2011 as the base years for comparison. The results of comparison, as well as examples of completed investment energy efficiency projects are presented in Chapter 3, "Energy Efficiency Practices in Industry".