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State Regulation of Enterprise Resource Saving Development Management: Experience of Different Countries

Regulación estatal de la gestión del desarrollo de ahorro de recursos empresariales: experiencia de diferentes países

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Contents

ABSTRACT:
The article describes the main factors of impact and directions of state regulation of the management system of the enterprise resource-saving development in different countries. The tendencies of changes in GDP energy indicators and the dynamics of energy production and consumption in Ukraine, China, USA, France, Canada, Great Britain and other countries for the period 1990-2018 are analyzed. The factors that had an impact on the change in these indicators are determined. The factors of external and internal impact on enterprise resource saving development management are grouped. The key importance of the state policy in the sphere of enterprise resource saving development is substantiated, since large-scale reforming, modernization and re-equipment of enterprises are impossible without strong support from the state. The directions of the state policy in the system of resource saving management are determined using the example of different countries. The system of principles of resource saving in developed countries is proposed and substantiated. The main motivational incentives for the use of renewable energy by the countries of the European Union are outlined. The main problems of state regulation of managing enterprise resource saving development are identified.
Keywords: renewable energy, state regulation, energy intensity, resource utilization

RESUMEN:
El artículo describe los principales factores de impacto y las direcciones de la regulación estatal de la gestión del desarrollo de ahorro de recursos empresariales en diferentes países. Se analizan las tendencias de los cambios en los indicadores de energía del PIB y la dinámica de la producción y el consumo de energía en Ucrania, China, Estados Unidos, Francia, Canadá, Gran Bretaña y otros países para el período 1990-2018. Se determinan los factores que tuvieron un impacto en el cambio en estos indicadores. Los factores de impacto externo e interno en la gestión del desarrollo de ahorro de recursos empresariales se agrupan. La importancia clave de la política estatal en el ámbito del desarrollo de ahorro de recursos empresariales está demostrada, ya que la reforma a gran escala, la modernización y el reequipamiento de las empresas son imposibles sin un fuerte apoyo del estado. Las direcciones de la política estatal en el sistema de gestión de ahorro de recursos se determinan utilizando el ejemplo de diferentes países. El sistema de principios de ahorro de recursos en los países desarrollados se propone y fundamenta. Se describen los principales incentivos motivadores para el uso de energías renovables por parte de los países de la Unión Europea. Se identifican los principales problemas de la regulación estatal de la gestión del desarrollo del ahorro de recursos empresariales.
Palabras clave: energía renovable, regulación estatal, intensidad de la energía, utilización de recursos

1. Introduction

In the face of constant changes and uncertainty, development of the enterprise plays a key role in ensuring its competitiveness. Today, when the enterprise functions as an open system and is influenced not only by internal factors but also by external ones, the purpose of its activity is not only profit, but also increase of efficiency of its activity in all directions: an efficient use of material resources, a rational use of human and information resources, a time factor in production process, etc. In order to increase efficiency of enterprise activity, industry and national economy, the ability to manage resource saving development of the enterprise is of great importance. Factors that directly impact on implementation of managerial innovations in terms of resource saving play an important role in solving the problems of developing and implementing an effective enterprise resource saving management system. External factors deserve special attention, as they form the main trends in the field of resource saving.

1.1. Analysis of the latest research on the problem

Theoretical, methodological and practical aspects of resource saving management and management of enterprise resource saving development, as well as the impact of external and internal factors on them are studied by many modern scientists. Arginbayeva (2017) considers energy security as one of the most important problems, solution of which will ensure sustainable development of Kazakhstan's economy. The scientist researches different directions of solving this problem: improvement of energy efficiency, state regulation of resource efficiency issues, ensuring environmental protection and social stability. The experience of such countries as USA and Russia is studied and compared.

The role of non-renewable and renewable energy consumption in 16 Latin American and Caribbean countries was examined by Le & Bao (2020). The results of their research have led to the conclusion that a long-term use of renewable and non-renewable energy, as well as other factors, including government spending, gross domestic product, financial development, have a positive impact on economic growth in the countries studied. It has been proposed to implement fiscal policy in combination with financial and international trade policy, as well as effective energy strategies for macroeconomic stabilization and sustainable development of these countries.

García-Gusano, Iribarren and Garrain (2017) studied resource security covering such issues as security of supply, infrastructure reliability, accessibility and environmental friendliness. Scientists have developed a Renewable Energy Safety Index, which is built using a combination of environmental life cycle assessment and modeling of feasible energy systems.

Bompard, Carpignano, Erriquez, Grosso, Pession and Profumo (2017) considered the problem of interconnection of energy resources supply to the country and economic and social growth of well-being; they characterized the influence of the state on the resource saving problem. The authors outlined a common methodology for assessing energy security, which considers and integrates its external and internal dimensions: security of energy supply from abroad (external) and security of national energy infrastructures (internal).

Ozturk (2010) pays great attention to the progress in literature on economic growth and electricity consumption, defines the relationship between resource saving and economic growth at the national level. Taking into account this research, it should be noted that the literature has yielded conflicting results, and there is no consensus on either the existence or the direction of the relationship between energy consumption and economic growth.

Kumar, Stauvermann, Patel and Kumar (2014) studied years-long co-integration between production, capital and energy consumption per employee for Albania, Bulgaria, Hungary and Romania. They found out that the balance between efficient energy consumption and effective government policy on energy saving would support economic growth in four countries in the future.

Kumar (2013) studied the problem of resource use in Kenya and South Africa. As a result, the author found out that Kenya has greater potential for capital growth through joint consideration of energy with capital and production respectively. Cui, Sun and Xia (2019) considered the problems of

resource saving at a micro-level; they suggested ways to improve the system of resource management at an enterprise to increase performance indicators.

Thus, most scientific papers deal with resource saving in general, and a managerial aspect of this process is not sufficiently considered. So, authors examine resource saving development of the enterprise in the context of enterprise innovative development. In addition, there are a number of contradictions in the understanding of the state's participation in issues of managing resource saving development of the enterprise and the country as a whole.

1.2. Formulation of the purpose and tasks of the article

The purpose of the article is to identify the main factors impacting on enterprise resource saving development management and to study the experience of different countries in resource saving regulation. To fulfil the purpose, the following tasks are outlined: to generalize and evaluate the impact of external and internal environmental factors on the system of managing resource saving development of the enterprise; to study the peculiarities of state regulation of resource saving in different countries.

2. Methodology

During the research, the following methods were used: general scientific methods (analysis, synthesis, induction, deduction) – for study of scientific literature and expert materials on the problem of state regulation of resource saving issues; theoretical prediction for identifying ways to use the ideas and experience of different countries in Ukraine; specific scientific methods, such as a retrospective method for determining the specific features of countries such as Japan, Russia, the USA and others; formation and development of the content, forms and methods of state management of resource saving; a systematic and structural method – to summarize the experience of resource management in Japan, Germany, France, Poland and other countries.

In addition, this study is based on the method of horizontal, vertical and factor analysis (when comparing the indicators of energy consumption and production, as well as GDP energy intensity), a statistical method, a graphical method (reflecting the dynamics of GDP energy intensity in Ukraine and the world), a method of generalization that enables to determine the factors of impact and directions of state regulation of enterprise resource saving development management. Other research methods include monographic, abstract-logical methods, grouping method.

For the sake of objectivity of the analysis, GDP energy consumption indicators of 19 countries of the world for the period 1990-2018 were used based on data from Global Energy Statistical Yearbook (2019). The countries were selected on the basis of energy consumption indicators. Thus, the research concerns the countries with the highest energy consumption (Ukraine, Russia, Taiwan, South Africa, Kazakhstan, Canada, China) and the lowest one (Australia, United Kingdom, Turkey, USA, India, Japan, Portugal, France, Germany, Poland, Belgium, Sweden).

3. Results and dicsussion

Considering a high level of resource intensity of the economy and import dependency of the country and the inefficient use of resources, improving resource efficiency is a major issue for the country's energy and economic security nowadays.

Effective management of resource saving and resource saving development both at the level of an individual entity and at the national level is a means of reducing import dependence and a guarantee of generating the necessary potential for further development of the state and society's economy (Markina et al., 2018a; Akhmetshin et al., 2019).

According to the data of 2018, Ukraine ranked first in the world in terms of GDP energy intensity. In addition, since 1990, Ukraine has been dominant in consumption of energy resources (Tables 1, 2).

Table 1
World GDP energy intensity for the period 1990-2018, koe/$2015p

Country	GDP energy intensity, koe/$2015p											
	1990	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017	2018
Ukraine	0.42	0.515	0.388	0.346	0.314	0.303	0.387	0.28	0.273	0.271	0.25	0.238
Russia	0.286	0.298	0.233	0.207	0.206	0.204	0.195	0.195	0.196	0.203	0.211	0.215
Taiwan	0.273	0.261	0.268	0.239	0.227	0.217	0.216	0.211	0.207	0.206	0.2	0.198
South Africa	0.233	0.238	0.218	0.211	0.209	0.196	0.19	0.198	0.187	0.192	0.186	0.187
Kazakhstan	0.323	0.226	0.197	0.198	0.206	0.188	0.196	0.177	0.178	0.184	0.181	0.181
Canada	0.234	0.213	0.202	0.184	0.181	0.178	0.177	0.177	0.175	0.173	0.174	0.176
China	0.474	0.227	0.224	0.187	0.183	0.176	0.169	0.16	0.151	0.14	0.135	0.131
United Kingdom	0.125	0.106	0.093	0.083	0.076	0.077	0.074	0.066	0.067	0.065	0.063	0.062
Turkey	0.08	0.082	0.072	0.077	0.074	0.073	0.067	0.068	0.066	0.068	0.068	0.066
Japan	0.109	0.112	0.107	0.102	0.094	0.091	0.089	0.086	0.084	0.082	0.081	0.079
Portugal	0.077	0.083	0.085	0.073	0.073	0.071	0.072	0.071	0.072	0.071	0.072	0.069
USA	0.194	0.164	0.148	0.136	0.133	0.127	0.128	0.126	0.121	0.118	0.116	0.117
France	0.121	0.112	0.11	0.102	0.097	0.097	0.096	0.092	0.92	0.089	0.087	0.086
Germany	0.131	0.102	0.1	0.091	0.083	0.083	0.084	0.08	0.079	0.078	0.077	0.072
Poland	0.252	0.151	0.134	0.116	0.111	0.105	0.104	0.097	0.094	0.096	0.097	0.097
Belgium	0.144	0.14	0.128	0.123	0.113	0.108	0.112	0.105	0.104	0.109	0.105	0.099
Sweden	0.167	0.136	0.132	0.12	0.114	0.116	0.113	0.107	0.097	0.102	0.101	0.098
Australia	0.169	0.152	0.136	0.132	0.13	0.124	0.121	0.117	0.114	0.115	0.113	0.111
India	0.188	0.158	0.133	0.121	0.119	0.118	0.113	0.111	0.104	0.1	0.098	0.095
World	0.176	0.15	0.143	0.134	0.131	0.128	0.126	0.123	0.12	0.117	0.115	0.114

Data from the Global Energy Statistical Yearbook (2019)

Table 2
Growth rate of GDP energy intensity in the world for the period 1990-2018

Country	Growth rate of GDP energy intensity		Country	Growth rate of GDP energy intensity	
	From 2018 to 1990	From 2018 to 2017		From 2018 to 1990	From 2018 to 2017
Ukraine	0.57	0.95	Portugal	0.90	0.96
Russia	0.75	1.02	USA	0.60	1.01
Taiwan	0.73	0.99	France	0.71	0.99
South Africa	0.80	1.01	Germany	0.55	0.94
Kazakhstan	0.56	1.00	Poland	0.38	1.00
Canada	0.75	1.01	Belgium	0.69	0.94
China	0.28	0.97	Sweden	0.59	0.97
United Kingdom	0.50	0.98	Australia	0.66	0.98
Turkey	0.83	0.97	India	0.51	0.97
Japan	0.72	0.98	World	0.65	0.99

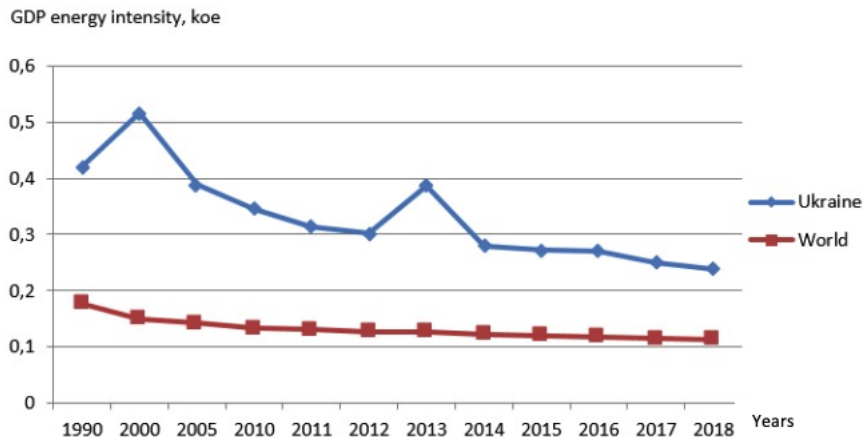
Formed by the authors on the basis of Global Energy Statistical Yearbook (2019)

Thus, global energy intensity (total energy consumption per unit of GDP) in 2018 decreased by 1.3%, which is slightly below its historical trend (on average –1.6% per year between 2000 and 2017). The level of the indicator and its dynamics vary considerably in different parts of the world, which reflects differences in the economic structure and the achievements of resource saving (Global Energy Statistical Yearbook, 2019).

China's energy intensity improved by nearly 40% from 2000 to 2018 and 2.7% over the last year driven by resource saving policy oriented on resource-intensive industry. US energy intensity increased by 0.6% in 2018 compared to the downward trend (-1.9% per year) from 1990 to 2017. Improvement in energy efficiency is also observed in the European Union, the region with the lowest energy intensity in the world. Energy intensity in the CIS countries has been steadily declining since 2000 (-2.7% per year), but remains the highest in the world (75% above the world average). High energy intensity in the CIS countries, the Middle East and China is explained by dominance of energy-intensive industries, an export-oriented economy and low prices for energy resources that do not contribute to resource saving (Global Energy Statistical Yearbook, 2019).

GDP energy intensity indicator in Ukraine is much higher than in the world. However, during the period 1990-2018 there was a positive trend in the decrease of this indicator. Thus, in 20 years GDP energy intensity was almost halved (from 0.42 in 1991 to 0.238 in 2018) (Figure 1). This indicator increased significantly in 2013 (from 0.303 to 0.387 koe / $ 2015p). This is most likely due to the decline in GDP because of worsening political situation in the country.

Figure 1
Dynamics of GDP energy intensity in Ukraine and the world for 1990-2018

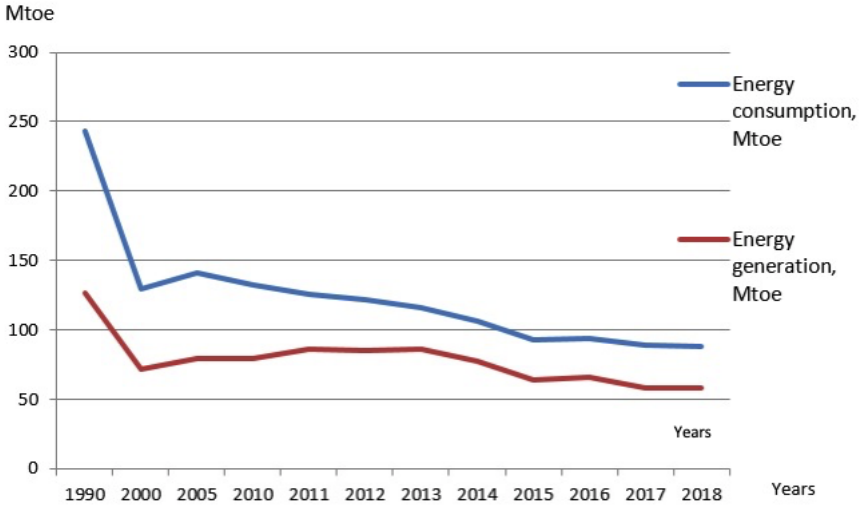


Data from theGlobal Energy Statistical Yearbook (2019)

In 2018, global energy production continued to grow (by 2.8%). The increase in world energy production was mainly driven by the US and China (increase of 54% in 2018). Energy production in the EU countries continued to decline due to a climate policy, slight decrease in generation of electric power from nuclear power, depletion of oil and gas resources (Global Energy Statistical Yearbook, 2019).

Today energy consumption in Ukraine exceeds production by 50%. In addition, there was a negative dynamics of the ratio of these indicators from 2014 to 2018 (Figure 2). This is due to the decrease in energy generation in 2014 because of the loss of control over the Autonomous Republic of Crimea and the Donbas.

Figure 2
Dynamics of energy generation and energy consumption in Ukraine for 1990-2018

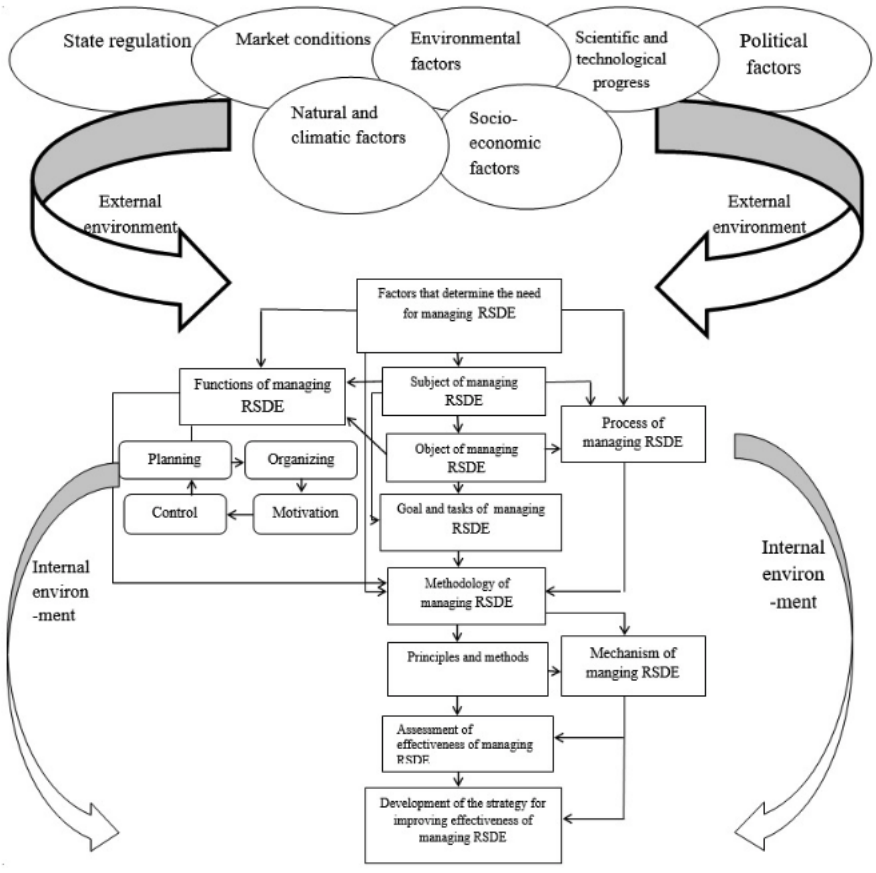


Formed by the authors on the basis of
Global Energy Statistical Yearbook (2019)

The system of managing resource saving development of the enterprise is influenced by a number of factors that have a positive effect on resource saving development of the enterprise or hinder it. Depending on the environment of the enterprise these factors are divided into two groups: factors of external and internal impact (Figure 3). External factors are factors that impact on the system of managing resource saving development of the enterprise (RSDE) from the environment of an organization.

It is reasonable to divide these factors into the following groups: government regulation, market conditions, scientific and technological progress, political, socio-economic, environmental, natural and climatic factors. Internal factors are factors that impact on RSDE within the internal environment of an enterprise. Internal factors are nothing but a reaction to the impact of external factors. However, internal factors determine the direct level of resource use at the enterprise.

Figure 3
Impact of the external and internal environment
on resource saving development management



Developed by the authors

The most important internal factors impacting the system of managing RSDE are the following: introduction of new equipment with improved technical characteristics, modernization and reconstruction of the existing one; improving the quality of consumed materials; replacement of expensive and scarce materials, use of secondary resources; introduction of advanced resource saving technologies; improvement of production technology; increasing the level of mechanization and automation of production; innovative development of the enterprise; enterprise management; improvement of manufacturing process management, the system of resource costs rationing; quality control; staff structure, movement and qualification; staff motivation system; indicators of financial and economic activity (Markina et al., 2018b).

It is advisable to group external factors impacting the management system of resource saving development of the enterprise as follows: state regulation, market conditions, scientific and technological progress, socio-economic factors, environmental, natural and climatic, political factors, political situation in the country, etc. (Markina et al., 2018b).

World experience in developing and implementing programs for resource efficiency has a wide variety of mechanisms and economic methods to ensure the efficiency of resource consumption in all areas of economic activity (Sklyar & Kushnir, 2018). For many years the EU countries have implemented a systematic approach in the policy of efficient resource consumption, which involves harmonization of such important components as the legislative and regulatory framework, development and implementation of energy saving technologies, organization of effective management of

resource consumption at the state and municipal levels, use of economic incentives, creation of systems and tools for monitoring of energy consumption at production site and in a municipal sphere, information and public support of energy efficiency (EU countries' experience, 2017).

The state system for managing the issues of resource saving and energy efficiency improvement includes a number of directions (Table 3).

Table 3
State policy directions in resource saving management system using the example of different countries

№	Actions	Country
1	Formation of a multi-level structure of state management	USA, Canada
2	Creation and implementation of the system of objective key indicators of resource efficiency	Great Britain, France, Germany, Switzerland, USA, etc.
3	Introduction of national and international standards for resource efficiency	Austria, Spain, Belgium, Germany, France, Finland, United Kingdom, Ukraine
4	Soft-window facilities	China, Sweden, Italy, Slovakia, Ukraine, Lithuania, Germany, Japan, South Korea, Japan, United Kingdom, Italy, Netherlands
5	Government subsidies	Germany, China, Netherlands, Spain, Italy, United Kingdom, Ukraine
6	Implementation of the system of resource audit and resource management	USA, Denmark, Ireland, Sweden, Ukraine
7	System of grants	USA, Denmark
8	Regulation of energy prices (tariffs)	Sweden
9	System of penalties	Japan
10	Certification programs	USA

Developed by the authors on the basis of EU countries' experience (2017).

1) Formation of a multilevel structure of state management of resource saving with a sectoral area of responsibility and the presence of coordinating bodies, as well as with distribution of separate functions within the framework of implementation of the state policy between separate bodies of the executive power.

2) Creation and implementation of the system of objective key resource saving indicators into development plans in all sectors of the economy and field of activities, as well as introduction of management incentives to improve resource efficiency. Leading countries actively applies the procedure of imposing responsibility on public authorities for improving resource efficiency in economic branches, control by federal (regional) agencies over implementation of measures aimed at achieving state-level targets. In such a case, various categories of measures are actively applied to implement the mechanisms of resource saving.

3) The practice of introducing national and international resource efficiency standards, sometimes referred to as “portfolio efficiency standards”. For this purpose, the system of marking by efficiency classes is developed (A, A+, A++, A+++). Introduction of incentive pricing and taxation of energy resources, stimulation of investments in resource efficiency, measures of tax support are one of the most widespread forms of state stimulation of resource saving and improvement of resource efficiency (EU countries' experience, 2017).

4) Soft-window facilities. In particular, Japan provides enterprises that use renewable energy resources with a ten-year soft-window facility (Kuksa & Sudarkina, 2017). In Sweden, Italy, Germany, Japan, South Korea and other countries, subsidies and tax benefits are provided for the purchase of energy efficient industrial equipment (Sotnyk et al., 2018). Poland has long been introducing energy saving technologies. Energy produced from alternative sources is used extensively and its share constantly increases. The country has a flexible system of tax benefits for obtaining credit for energy saving activities, and there is an expanded system of creditors who are ready to give long-term loans for large-scale energy saving measures (Carragher et al., 2018).

5) Government subsidies. In particular, the government of Germany subsidizes the use of alternative energy. In addition, private investors have the opportunity to install solar panels on rooftops of public buildings with the possibility of transmitting surplus electricity to the grid (Markina et al., 2017).

6) Implementation of the system of resource audit and resource management.

7) System of grants. Governments in some countries (USA, Denmark, etc.) assist enterprises in the form of grants to implement resource efficiency programs. In particular, investment grants have been introduced in Denmark for building district heating networks and repairing heating networks with a compensation of 30-60% of capital investments, provided they are sure to be connected to the backbone network (EU countries' experience, 2017).

8) System of penalties. In Japan, while developing measures to reduce electricity consumption, the need to rationalize the process of fuel use and reduce energy losses during transportation is legally determined. If the requirements of the legislation are not fulfilled, penal fines are imposed.

9) Certification programs. To improve the level of energy efficiency of enterprises, while maintaining their competitiveness, in the United States, since 2012, the certification program “Superior Energy Performance” has been in effect. In Sweden, “green certificates” are granted for electricity generated from the use of wind, sun, waves, peat, geothermal energy, certain types of biofuels and hydropower. All electricity consumers are required to purchase certificates according to their share of electricity consumption (Markina et al., 2018c).

10) Regulation of energy prices (tariffs). In Germany, “Renewable Energy Act” was adopted in 2004, under which energy companies are obliged to buy electricity produced from renewable energy sources at fixed tariffs. In addition, each type of renewable energy source has a separate tariff, which is stimulant for development of this industry (EU countries' experience, 2017).

In developed countries, the following principles of resource saving are observed: improvement of the structure of consumed resources by reducing the share of export of raw materials resources, increasing the share of environmentally friendly and efficient types of resources; increasing the degree of efficiency during extraction of mineral resources; increasing the share of resource saving technologies; analyzing the use of resources at each stage of the lifecycle of objects; developing methods of analysis, forecasting, optimization and stimulation of improvement of resource use; effective management of solving resource saving problems (Markina et al., 2018c).

Energy saving policy in the EU countries points to understanding of importance of reducing energy consumption and the need to use all possible leverage to influence this process. The great success of Central and Eastern Europe and the Baltic states is due to the effective implementation of energy saving technologies and the use of alternative fuels from energy crops. A significant role for this direction is played by saving of raw materials, which is achieved through the use of secondary materials – scrap metal, waste paper, plastics. In many countries, their stocks are so large that they can considerably offset the deficit of natural resources. In old industrial areas of Western and Eastern Europe, the volumes of secondary resources procurement are so large that they overlap local needs and some are exported to other countries (Borisova et al., 2019; Markina, 2016).

In the EU countries, there are the following motivational incentives for the use of renewable energy by the state:

- direct incentives - financial incentives for renewable energy producers realized through the use of certain economic mechanisms (reduced tariffs, “green” certificates, tender schemes, tax and customs benefits, subsidies, bonuses, etc.);

- indirect incentives - encouraging the use of renewable energy sources directly by reducing attractiveness of fossil substances through introduction of environmental taxes, CO2 taxes, etc.;

- voluntary programs based on willingness of consumers to pay high prices for the energy generated from renewable sources due to environmental concerns in order to maintain a stable situation in the long term. Such programs include programs and charitable projects aimed at encouraging donations (Markina et al., 2018c).

Though the state policy of Ukraine is also aimed at reducing resource and energy intensity production, domestic product is 3-4 times higher than similar indicators of the EU countries. The problem of further reduction of resource and energy intensity is that effective management mechanisms of resource saving development of enterprises have not been created at the appropriate levels (Sotnyk et al., 2018).

Legislative and regulatory acts of Ukraine provide for a number of types of state support for enterprises and farms in the field of resource efficiency: direct budget financing; exemption from VAT, import duties; exemption of a part of the profit from taxation; setting economically reasonable utility tariffs; provision of government guarantees for credit lines opened in credit institutions, etc. (Markina, 2016).

The problem of high energy intensity of products of Ukrainian enterprises can be solved only in case of joint provision of resource saving by the state and enterprises under the conditions of economic modernization. Such a partnership in the field of resource saving should be formed in the context of the following directions: energy saving; use of secondary material resources; minimizing resource losses; ecotechnology; use of social modernization resources. These are the directions of resource saving that are the result of state and corporate resource saving policies, they are interconnected, interdependent and presented in current concepts of resource saving (Borysova et al., 2017) .

4. Conclusions

Organization of efficient production requires introduction of innovative technologies and tools, motivation of all participants in the process to achieve high overall performance. One of the ways to increase efficiency and rationality of activity is introduction of the system of managing resource saving development of the enterprise. Both external and internal factors impact the management system of RSDE. One of the main factors of the external environment is state management in the direction of resource saving, because a small number of economic entities can switch to the resource saving type of enterprise development without the state support. Different countries are at different stages of implementation of resource saving programs, however, there is a clear and consistent tendency of encouraging by European countries to make more efficient use of all types of resources.

According to international standards, Ukraine's economy is one of the most resource-consuming economies in the world due to the large share of resource-intensive sectors, outdated and inefficient technologies, extremely worn-out assets, inefficient transformation and energy supply systems.

The research made it possible to identify the main problems in terms of management of resource saving and resource saving development for Ukrainian enterprises. Today it is extremely important to find ways to solve these problems, to identify the main ways of motivating the management team and staff of enterprises to form and implement an effective system of resource saving development.

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