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Yessekina B.K.[1], Opitz P.[2], Bekturganova M.S.[3]

[1]Doctor of Economics, Professor, Scientific Research and Education Centre «Green Academy», Kazakhstan, Astana, e-mail: Byessekina@green-academy.kz
[2]PhD of Economics, DIW econ, the research center of the German Institute of Economic Research (DIW), Germany, Berlin, e-mail: opitz@diw-econ.de
[3]PhD student, Joint Educational Program, Kazakh National University al-Farabi and Institute of Economics MES RK, Institute of Economics Ministry of Education and science of the Republic of Kazakhstan, Committee of science, Kazakhstan, Almaty, e-mail: maka_91@inbox.ru

ASSESSMENT OF THE POTENTIAL OF DECARBONIZATION OF THE BASIC SECTORS OF KAZAKHSTAN'S ECONOMY

This article suggests theoretical-methodological and scientific-practical basis to transition of low-carbon economy in the key sectors of the Republic of Kazakhstan.

In the framework of the development of the theoretical and methodological foundations of a low-carbon economy, the authors proposed the definition of a category of a «low-carbon» economy.

Based on methodology preconditions potential low-carbon development and the basic industries of the national economy were defined. Authors analyzed a present situation with the consumption of energy resources and indicators of energy intensity of Kazakhstan's GDP in mining and energy sectors and develop recommendations for the future transition to low carbon of the basic industries of national economy.

In the article the authors propose approaches to the assessment of the carbon potential of the basic sectors of the economy in the implementation of the Paris Climate agreement. Using the indicator approach and economic and mathematical modeling, the authors propose forecast scenarios of emissions growth in sectors energy and transport.

It is concluded that the main sectors of the economy of the Republic of Kazakhstan have great potential for the transition to low-carbon development.

Key words: low-carbon development, decarbonization of national economy, energy efficiency, emissions trade system, greenhouse gases, «green» energy, scenarios.

Есекина Б.К.[1], Опитц П.[2], Бектурганова М.С.[3]

[1]э.ғ.д., профессор, «Жасыл Академия» Ғылыми білім беру орталығы, Қазақстан, Астана қ., e-mail: Byessekina@green-academy.kz
[2]PhD докторы (Экономика), Экономиялық зерттеулер Неміс институтының зерттеу орталығы (DIW) менеджері, DIW Econ, Берлин, Германия, e-mail: opitz@diw-econ.de
[3]PhD докторанты, Бірлескен білім бағдарламасы, әл-Фараби атындағы Қазақ ұлттық университеті мен БҒМ Ғылым Комитеті «Экономика Институты», Қазақстан, Алматы қ., e-mail: maka_91@inbox.ru

Қазақстанның негізгі экономика секторларының декарбонизацияның әлеуетін бағалау

Мақалада Қазақстан Республикасының негізгі секторларының төменкөміртекті даму экономикасына көшуінің теория-әдістемелік және ғылыми-практикалық негіздемесі ұсынылады.

Авторлардың төменкөміртекті экономиканың теориялық-әдістемелік негіздерін әзірлеу шеңберінде «төменкөміртекті» экономика санатының анықтамасы ұсынылған.

Методологиялық алғышарттардың негізінде төменкөміртекті дамудың әлеуеті халық шаруашылығының негізгі салаларында анықталды. Авторлар қазіргі жағдайдағы тау-кен өндірісі мен энергетикалық салаларда энергоресурстарды тұтыну және Қазақстанның ЖІӨ энергосыйымдылық көрсеткіштеріне талдау жасап және халық шаруашылығының негізгі салаларына болашақта төменкөміртекті даму жолына көшуіне ұсыныстар жасалынды.

Авторлар мақалада Париждік Климаттық келісімді өткізу шарты бойынша негізгі экономика секторларының көміртекті әлеуетін бағалау тәсілдерін ұсынады. Авторлар индикатор тәсілі және экономика-математикалық модельдеуді пайдалана отырып энергетика және тасымалдау секторларында шығулардың өсу болжам сценарийларын ұсынады.

Қорытындылай келе, авторлар Қазақстан Республикасының негізгі экономика секторларының төменкөміртекті дамуға өту үшін үлкен әлеуеті бар екені туралы болжам жасайды.

Түйін сөздер: төменкөміртекті даму, ұлттық экономиканың декарбонизациясы, энер-гиялық тиімділік, шығуларды сату жүйесі, парниктік газдар, «жасыл» энергия, сценариялар.

Есекина Б.К.[1], Опитц П.[2], Бектурганова М.С.[3]

[1]д.э.н., профессор, Научно-образовательный центр «Зеленая Академия»,
Казахстан, г. Астана, e-mail: Byessekina@green-academy.kz,
[2]доктор PhD (Экономика), DIW Econ, Научный центр Немецкого института
экономических исследований (DIW), Германия, г. Берлин, e-mail: opitz@diw-econ.de
[3]докторант PhD, Совместная программа Казахского национального университета им. аль-Фараби и
Института экономики КН МОН РК, Казахстан, г. Алматы, e-mail: maka_91@inbox.ru

Оценка потенциала декарбонизации базовых секторов экономики Казахстана

В этой статье предлагается теоретико-методологическая и научно-практическая основа перехода к низкоуглеродной экономике в ключевых секторах Республики Казахстан.

В рамках разработки теоретико-методологических основ низкоуглеродной экономики авторами было предложено определение категории «низкоуглеродной» экономики.

На основе методологических предпосылок был определен потенциал низкоуглеродного развития в основных отраслях народного хозяйства. Авторы проанализировали нынешнюю ситуацию с потреблением энергоресурсов и индикаторами энергоемкости ВВП Казахстана в горнодобывающих и энергетических отраслях и разработали рекомендации для будущего перехода к низкоуглеродному развитию основных отраслей народного хозяйства.

В статье авторы предлагают подходы к оценке углеродного потенциала базовых секторов экономики в условиях реализации Парижского Климатического соглашения. Используя индикаторный подход и экономико-математическое моделирование, авторы предлагают прогнозные сценарии роста выбросов в секторах энергетики и транспорта.

В заключении делается вывод, что основные сектора экономики Республики Казахстан имеют большой потенциал для перехода к низкоуглеродному развитию.

Ключевые слова: низкоуглеродное развитие, декарбонизация национальной экономики, энергоэффективность, система торговли выбросами, парниковые газы, «зеленая» энергия, сценарии.

Introduction

Long-term Strategy «Kazakhstan-2050» (Nazarbayev 2012) and adopted in 2013 by the Decree of the President of the Republic of Kazakhstan N. Nazarbayev's Concept on transition to «green economy» (hereinafter – the Concept) (Nazarbayev 2013) identified priorities to implement «green», low carbon technologies and reduce the carbon intensity of the national economy. Within the concept of the task of achieving the share of renewable energy sources (RES) in the total energy balance of the country by 2020 – 3%, by 2050 – 50%, which will reduce greenhouse gas emissions in the energy sector. Achievement of target indicators, as well as the international obligations of the country in the framework of the implementation of the framework Convention on climate change (UNFCCC), the UN and the Paris climate agreement suggest the need for research in mitigation of climate change and transition to low-carbon development. Currently, Kazakhstan's economy is at the stage of structural transformation and the implementation for the second program of industrial-innovative development, designed to change the raw material orientation and to eliminate economic imbalances in development of industries that create new benefit. At the same time, long-term and dynamic development of industries of fuel and energy and mining complexes led to high energy and carbon intensity of gross domestic product. Thus, the level of carbon intensity of GDP of our country exceeds 3-5 times the OECD countries that, in aggregate, reduces the competitiveness of domestic products on world markets and creates serious risks in the implementation of the Paris climate agreement and preserve the quality of the environment in the country.

Material and methods

Methodological basis of article were publications of national and international experts on climate change, assessment of the Global Energy Statistical Yearbook 2016, FEB of the RK, KS MNE RK reports on energy efficiency, carbon intensity, decarbonization, etc.

Energy efficiency in basic sectors of industry and transport contributes to the decarbonization and overall competitiveness of the national economy.

According to the statistics Committee of the Ministry of national economy of Kazakhstan, the dynamics of total consumption of electricity in Kazakhstan reflects the overall macroeconomic situation. For the period from 2008 to 2015, total final energy consumption in Kazakhstan shows a steady increase from 36 802 thousand t.o.e. to 38 779 th. t.o.e. (Satybaldin 2016) (figure 1).

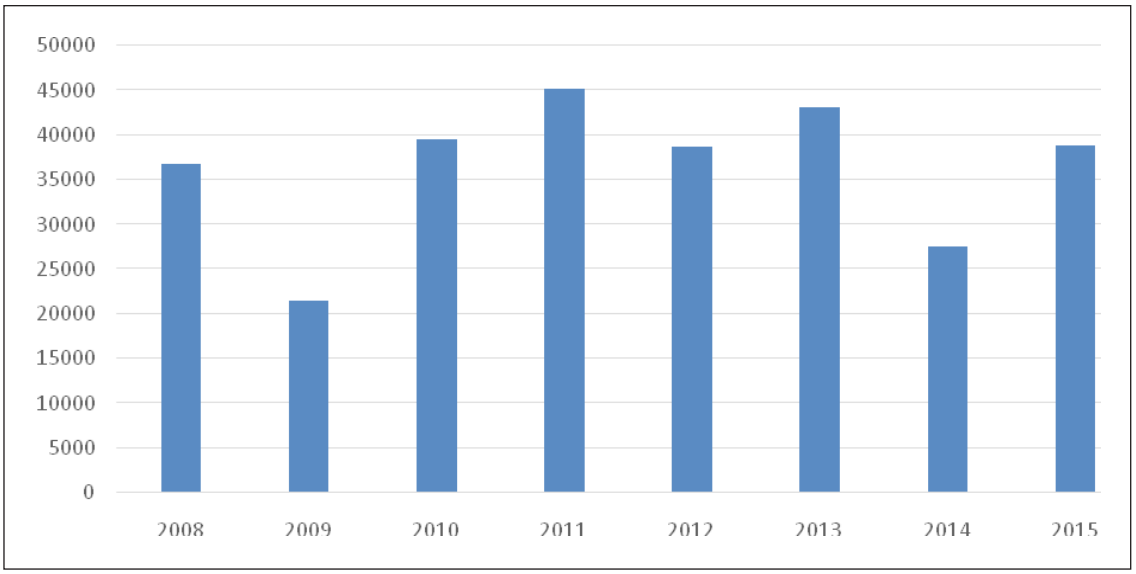

Figure 1 – Total final energy consumption, in thousand t.o.e.

Note – based on data FEB of the Republic of Kazakhstan 2010-2015 [3]

In recent years a tendency of increasing energy consumption in the service sector, transport and transportation (the average annual growth of energy consumption by 5%). This trend occurs against the background of declining energy consumption in industry.

One of the main indicators for determining the efficiency is the energy intensity.

General form of the energy, intensity measured by the indicator, which characterizes the ratio of energy consumed by the system, the value that reflects the result of this system.

Indicator may have a different numeric expression depending on the scope of application: kw/hr per unit of production (for electricity); the cost of energy and fuel to the income of the enterprise; t.c.f./unit of the product; Gcal/unit of product (for warmth), etc.

Structure and dynamics of the consumption of fuel and energy resources results in high values of specific energy intensity of GDP of Kazakhstan, which country by the end of 2015, ranked 7th, losing to the following countries: Russia, Ukraine, Uzbekistan, South Africa, Iran, Taiwan[1] (figure 3).

By the end of 2015 the GDP energy intensity in Kazakhstan is 0,217 kg BC the USD. Billion, exceeding the same indicator in the whole world 45.6% (0,149), the average of the OECD countries by 72% (0,126). At the same time, in comparison with Russia and Ukraine, the energy intensity of Kazakhstan's GDP of the order of 1.5 times lower than these countries. The lowest energy intensity of GDP observed in developed countries and the countries of Germany (0,101), Japan (0,106) and countries low levels of industrial development.

[1] According to World energy statistics (Global Energy Statistical Yearbook 2016), the energy intensity of GDP measured at purchasing power parity in kilograms of oil equivalent, converted to 2005, in US dollars

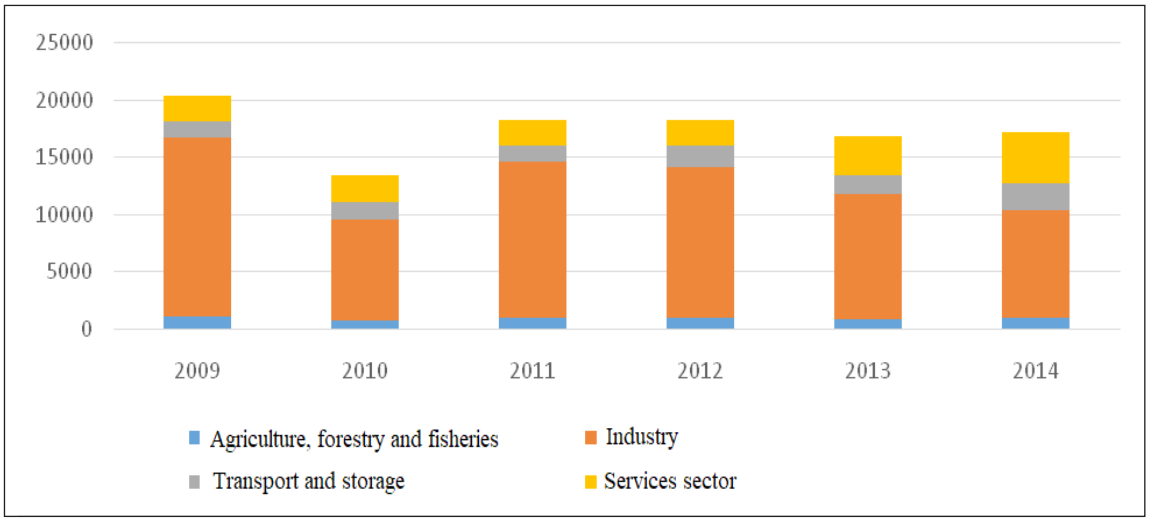

Figure 2 – Dynamics of structure of final consumption by sector, thousand t.o.e.

Note – based on data FEB of the Republic of Kazakhstan 2010-2015

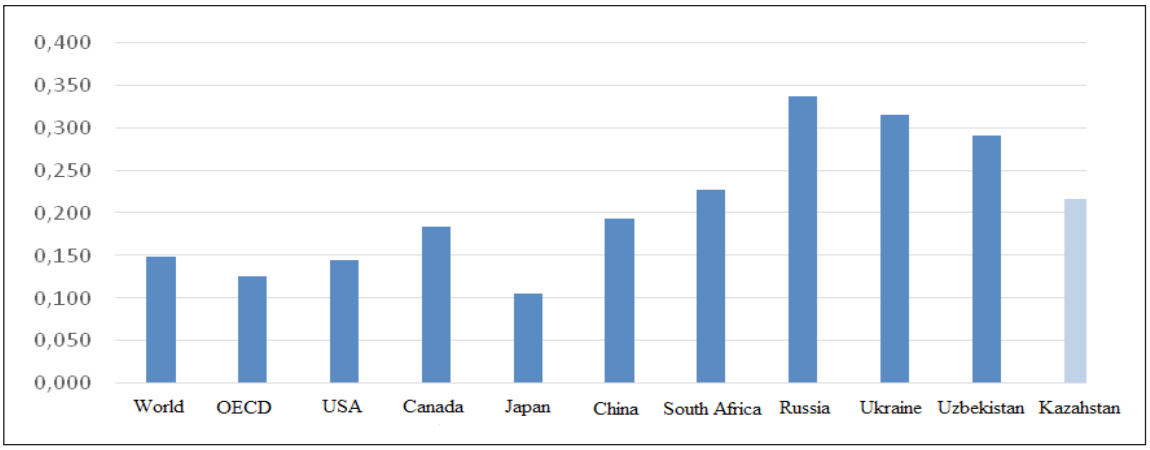

Figure 3 – Energy intensity of GDP at PPP for 2015, in kg. o.e. in 2005 prices in US dollars

Note – Based on data (Global Energy Statistical Yearbook 2016)

The energy intensity of Kazakhstan's economy is largely due to its structural features, in particular, the predominance of energy-intensive industries – oil and gas sector, mining and metallurgical complex and coal industry that characterized by large depreciation of fixed assets and, accordingly, the use of obsolete technology.

One of the indicators of energy efficiency is ***the carbon intensity.*** Since more than half of Kazakhstan's power plants running on coal, carbon intensity of produced goods and services is currently high.

According to the Global energy statistical yearbook, Republic of Kazakhstan up to 2015 is included into the five of world powers with a high carbon intensity of the economy second only to: Russia, South Africa, Uzbekistan, and Ukraine (figure 4).

In 2015, the carbon intensity of Kazakhstan amounted to 0,646 kg CO_2/GDP, which is almost two times higher than the global average (0,339), and the average level of OECD countries where the figure is 0,283 kg-CO2/GDP. For the period between 1990 and 2015, the carbon intensity of Kazakhstan's GDP has declined by about half, from 1,253 to 0,646 kg CO_2/GDP, due to the overall decline in industrial production of energy-intensive sectors of the economy in the period up to 2000.

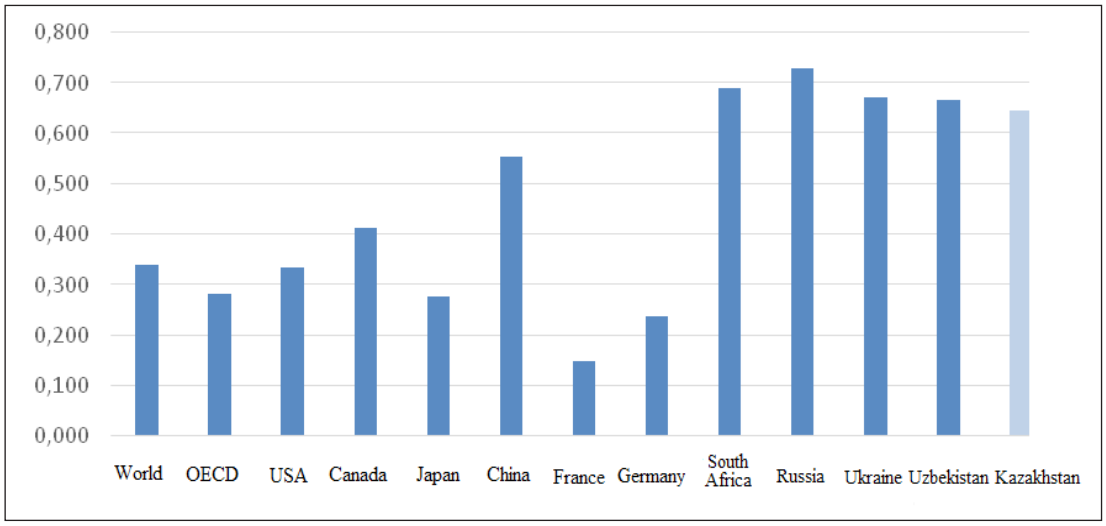

Figure 4 – The carbon intensity of the economy of the Republic of Kazakhstan in comparison with other countries in 2015, at PPP, in kg CO_2/GDP, in 2005 prices in US dollars

Note – Based on data (Global Energy Statistical Yearbook 2016)

Currently, indication of the gross volume of greenhouse gas emissions Kazakhstan is inferior to countries such as USA, EU, China, at the same time, indication of emissions per capita (12,94 t. – 2014) our country exceeds the order of three times the world level (4,47) and one and a half times the average level of OECD countries (9,36) [5].

The increase in greenhouse gas emissions over the period can explain the dynamic growth of production, particularly in the mining industry. Analysis of greenhouse gas emissions by sector showed that a large part of the emissions (about 85%), mainly on stationary sources in the energy sector (IEA 2015).

For the period from 2000 to 2014, the greenhouse gas emissions from this sector increased by about 42%; in agriculture, 9.6%; in sector «industrial processes and product use» is 41%. The waste sector accounts for a small part of greenhouse gas emissions, which amounted in 2014. 6 million tons of CO_2 (figure 5).

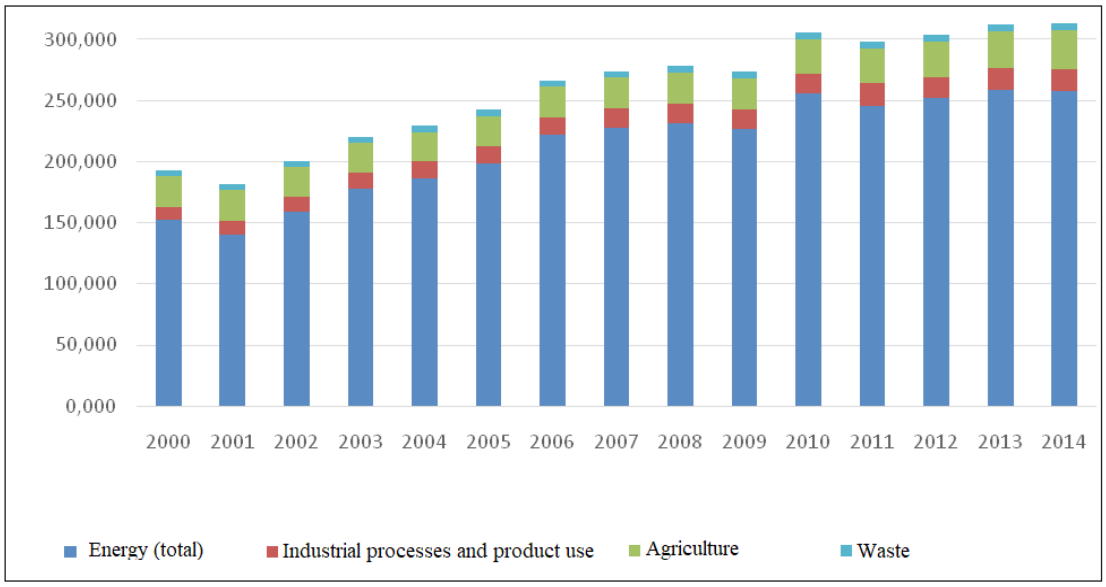

Figure 5 – Total greenhouse gas emissions by sectors (CO_2 equivalent) million tons/year

Note – Based on data KS MNE RK

Greenhouse gas emissions in the transport sector of Kazakhstan includes all domestic transport subcategories: road transport, off road transport, railway transport, water transport, civil aviation, pipeline transport (delivery to the consumer of the fuel by the transportation of oil and petroleum products, natural gas through pipelines).

The share of greenhouse gas emissions by mode of transport for the year 2014 are distributed as follows: road transport – 85,1 %; pipeline transport and 6.4 %; railway transport – 5,1 %; civil aviation and 3.1 %; water transport is 0.3 %. As can be seen from figure 6, the share of emissions from road transport is the highest.

Prospects for the transition to low-carbon development of national economy determined primarily by the potential for the development of RES, the ETS and the efficiency of production.

According to the program presented in section 2.1, the share of RES and alternative sources of generation should increase by 2030, and continue intensive growth until 2050. This applies not only to the total generation but also to exclusively renewable wind and solar energy (figure 7).

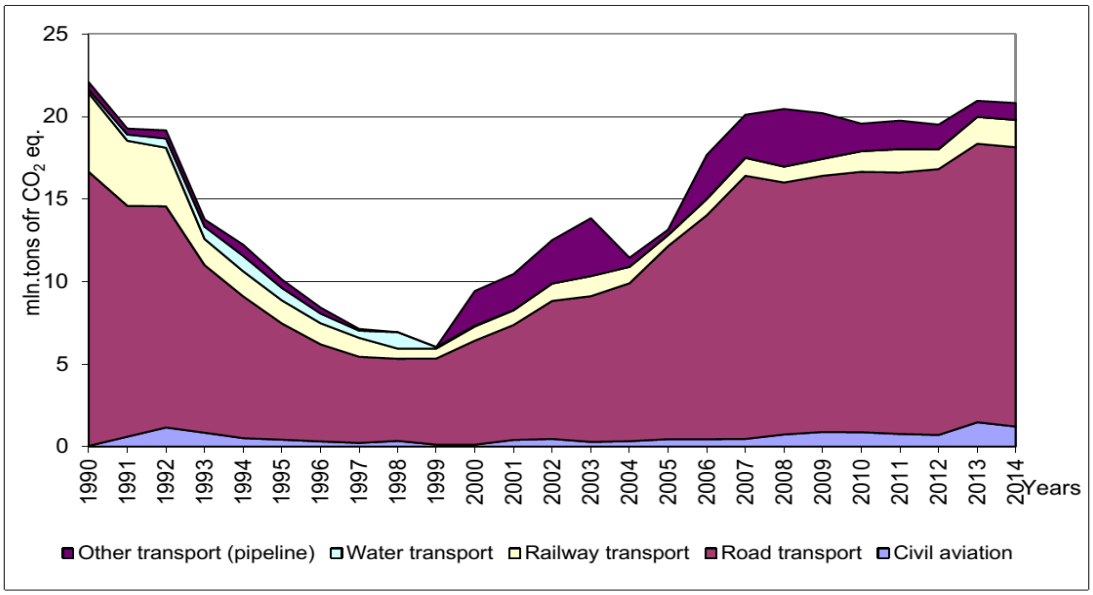

Figure 6 – Greenhouse gas emissions in the transport sector in 1990 – 2014
(the Committee of environment monitoring Ministry of Energy of RK 2016)

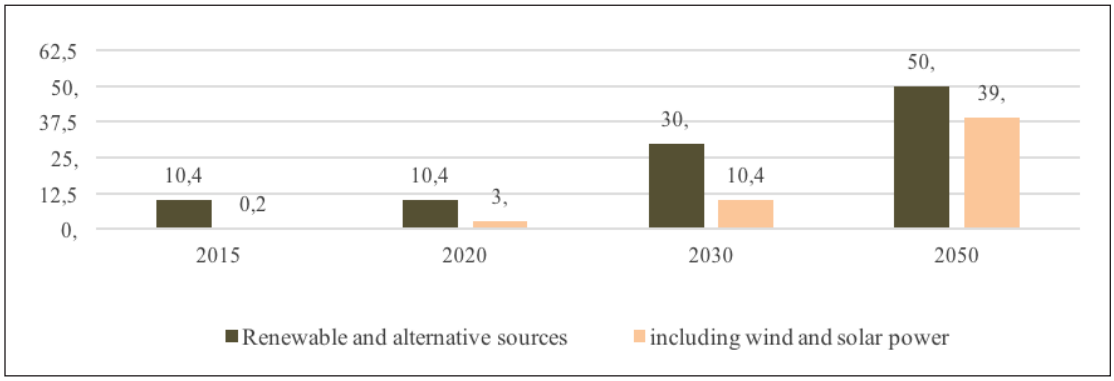

Figure 7 – Dynamics of growth in the share of RES and alternative
energy sources in the generation of electricity in the RK until 2050, in %

Analysis of energy efficiency in the FEC, MMC and transport sector have shown that despite the fact that the country has a developed legal framework for energy efficiency targets to reduce energy intensity not achieved in these industries. Given an appropriate monitoring of the implementation of sectoral programs in the field of energy efficiency and effective development of the allocated funds, it is possible to achieve reduction of energy intensity of GDP by 25% of the level of 2008.

Literature review

The initial theoretical and methodological basis of this research have formed the scientific and practical developments of foreign and domestic scientists in the field of sustainable low carbon development of economy.

The definition of the concept of sustainable development traced in the works of foreign researchers (Brown 1982, Losev 2001, Begun 2012: 158-163, Danilov-Danilyan 2000 and Bobylev 2004) divide sustainable development into three components: sustainable social development, economically sustainable development and ecologically sustainable development. The formulation ecologically sustainable development considered in the works (Gusev 1997, Steiner 2001: 739, Moiseev 2011 and Israel 2011). Some scientists analyzed issues of «green economy» and low carbon economy (Bobylev 2004, Belik 2016: 10, Yessekina 2016).

The significant contribution to implementation of concept of low-carbon development, as gradual transformation of world power brought by such foreign scientists as (Rifkin 1991 and Sachs 2014). In certain researches highlighted of the area of low-carbon economic development and the transition to low-carbon development carried out (Bashmakov 2009, Alinov 2016 and Yessekina 2016).

A common feature of low-carbon development in different countries use less carbon to promote economic growth in the future (Mulugetta and Urban 2010).

(Ebinger 2009: 85-93) states that the potentials of emission reduction in energy efficiency, consumer management, electricity generation from renewable energy sources, low-carbon transport are the main areas of focus of the World Bank.

The low-carbon economy as general – purpose technologies have spread rapidly across all sectors of the economy transforming business organization and increasing competition (Moshiri and Simpson 2011: 1601-1636).

The ecological – economic approach which assumes assessment of economic validity, the analysis of efficiency of the directions and methods of decarbonization, ecological and financial processes (Becker 1968: 169-217).

Institutional approach is approach, which considers or investigates various aspects, legislative and legal support, which is laws, the official rights, institutes, etc. Institutional approach is often use for the analysis of political and economic processes (North1991: 97-112).

In the report «Low-Carbon Way of China's Development by 2050», the Energy Research Institute of China National Development and Reform Commission Indicate that the essence of low-carbon development in the social economic system, which can be implemented in the form of low-carbon emissions (EIT 2009).

Conclusion

In the framework of the development of the theoretical and methodological foundations of a low-carbon economy, definition of the category of a «low-carbon» economy was proposed, which is a new social and economic and innovative and technological model of economic development that stimulates a reduction in greenhouse gas emissions without affecting the pace of social and economic development of the country.

And the main principles of decarbonization are:

– separation of economic growth from rising energy consumption and emissions of greenhouse gases and other pollutants, with the help of technological innovation, infrastructure change and behavior patterns;

– achievement of social and economic development goals, including sustained economic growth, job creation, reduced consumption of resources and accelerated scientific and technological progress;

– Increasing the level of energy efficiency and energy saving.

The analysis shows that the basic sectors have a great potential for transition to low-carbon development, but it is necessary:

1. Improvement of the regulatory and legal framework;

2. Restart of the national Emissions Trading System (ETS);

3. Development of financial and economic mechanisms to reduce emissions in these industries.

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