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"Strengthening cooperation of Central-Asian countries in using advanced technologies in energy efficiency and renewable energy sources"

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List of Content

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I. Progress in energy efficiency and renewable energy in the countries of Central Asia

All the countries of Central Asia possess energy resources. Kazakhstan, Uzbekistan and Turkmenistan have essential reserves of hydrocarbons, while Tajikistan and Kyrgyzstan are notable for their huge hydroelectric potentials. At the same time, the region suffers from disproportional placement of generating capacities, as a result of the disruption of the united system formed in the times of the USSR.

In recent years, energy saving is given much attention from the viewpoint of compensating the deficit of generating capacities and/or release of additional volumes of power resources for exports, while the development of the renewable energy is considered, first of all, as a measure to mitigate climate changes and environment protection, as well as a method to supply power to remote and hard-to-reach areas.

The low efficiency of using the available fuel and energy resources has to do with the poor state of the acting legal and financial-economic mechanisms, technological backwardness, and quite a lot of other factors. They fail to stimulate the power generators and consumers to reduce their costs.

All the countries of Central Asia are facing the following problems, which hamper the operation and progress of the energy sector:

- The high wear rate of the generating capacities and infrastructure, and, accordingly, huge commercial and technical losses. At present, in all the considered countries, the wear rate of the basic equipment of power grids makes 50% and more; in a number of cases, a pretty great share of networks and equipment are unfit for further operation;
- The problems of consumers' non-payment and a poor metering system of really consumed electric power make it difficult to attract investments into the sector;
- The existing system of subsidized tariffs fails to stimulate both the producers and consumers of power resources to decrease their energy costs. Even in the Republic of Kazakhstan, which was most consistent in market reforms, the electricity tariffs are close to the generation prime cost, disregarding the necessary depreciation deductions, needed for replacing the obsolete equipment;
- The high power intensity of the Gross Domestic Product GDP is associated, among other things, with the physically and morally outdated equipment, used by most enterprises and a high wear rate of grids and networks;
- The limited paying capacity of the population;
- A deficit of duly qualified personnel;
- The inaccessibility of credit resources because of high interest rates and short terms of them is essentially restricting the enterprises' capacity to finance technical retooling, use of advanced technologies and implementation of projects aimed at improved energy efficiency and development of renewable energy sources (RESs).

A general feature of all the countries in question is the need to upgrade the equipment in practically all sectors of economy, but, especially, in energy, industry and housing and utilities.

In the region, the market of energy services is underdeveloped. Private investments into the energy saving and renewable energy are very low. The measures taken to improve the energy efficiency have mainly to do with the industry upgrading; however, as a rule, no budget funds are allocated on the projects related to increased energy efficiency.

Another problem is a very low level of awareness of the population and managers about the opportunities of increasing the energy efficiency and use of RESs.

In general, the level of funding the research-and-design works (R&D) in the spheres of en-

ergy efficiency and RESs; for lack of standards, they manufacture little machinery, materials and equipment, corresponding to the modern requirements of energy efficiency; accordingly, they are weak in introducing the advanced energy-saving technologies. This situation is aggravated by the absence of the due information basis, market of energy-saving equipment and technologies, funds at the disposal of potential producers and consumers, and by essential problems of receiving loans on innovative developments. Until now, the governments of the above states fail to provide the budget support to development and introduction of energy-saving technologies.

The study was made with account of the best 25 practices, as identified by the International Energy Agency (IEA). See Annex 1 for the "Matrix of indicators of the status of the electric-power industry and RESs in the countries of Central Asia", compiled from the information from the studied, conducted by national experts.

- ***Review of the status of the energy efficiency sector in the countries under study***

Kazakhstan

Kazakhstan is the regional leader in the sphere of forming and implementing the state policy in the sphere of increase of energy efficiency.

This state policy in the area of energy saving in the republic was initiated by the Law of the Republic of Kazakhstan of December 25, 1997, No. 210-I "On Energy Saving". The Law made the problem of increase of the efficiency of using the fuel-and-power resources a top priority of the state energy policy.

However, the Law was declarative in nature, and its many provisions proved to be inoperative. The result is that today the indicators of energy efficiency in the Republic of Kazakhstan are a lot behind the level of industrially developed states. The specific power intensity of the GDP of the Republic of Kazakhstan is 2.5 times higher that in the USA, by 3.5 times higher than in Denmark, and by 4 times higher that in Japan. The efficiency of utilization of power resources in the republic does not exceed 30%, that is, over 2/3 of the consumed energy is lost in the process of utilization.

However, practically no funds are allocated from the state budget on the issues of energy saving and decrease of energy intensity in the republic. As a result of the weak of state regulation of the energy saving, the victims are the energy, ecology, budget and the population because of the unbearable burden of tariffs. The estimated potential for energy saving of the republic, both in the heat and electric energy, makes at least 25-30%.

Decreasing the energy intensity of the GDP is one of the main objectives of the Republic of Kazakhstan for the nearest future. Therefore, the 2010-2014 State Programme of Boosted Industrial-Innovative Development of the Republic of Kazakhstan assumes a decrease of the energy intensity of the GDP by at least 10% against the level of 2008.

In late 2011, the republic adopted the 2012-2015 Complex Plan for Improving the Energy Efficiency in the Republic of Kazakhstan. It includes a number of initiatives, offered and discussed within the cooperation with the European Union (EU) and international organizations, the implementation of which will receive the technical and financial support of the World Bank, the United Nations Industrial Development Organization (UNIDO), etc. In particular, the measures and actions, offered by the UNIDO, for example, the energy management systems (EnMS), standards and improvement of experts' potentials, were included into the above plan.

The country has also adopted the Modernization Programme of the housing and utilities infrastructure till 2020.

The main goal of the above 2012-2015 Complex Plan for Improving the Energy Efficiency in the Republic of Kazakhstan Complex Plan is a decrease of the energy intensity of the GDP by at least 10% against the level of 2008.

The target indicators for the main sectors of economy are as follows:

- Industry – to ensure the annual economy of primary power resources equal to at least 2.0 million tons of oil equivalent (TOE);

- Energy – to ensure the annual economy of primary power resources equal to at least 3.0 million TOE;
- Housing and utilities, and the budget-funded sector – to ensure the annual economy of primary power resources equal to at least 3.7 million TOE.

The aim of the plan is to draft a complex of legislative, organizational, scientific, technical, economic and financial measures, directed towards decreasing the inefficient use of the fuel-and-power resources.

At present, country experts have drafted and provided for consideration of the Government the Concept of Development of the Electric Energy Branch of the Republic of Kazakhstan till 2030, on the basis of which the Branch Programme for Energy Sector till 2030 will be developed. The Programme assumes a section on energy efficiency.

Thus, in recent years, Kazakhstan has done a lot to improve the normative-legal basis of energy saving; the country improves its management system; it has studied the sectoral potentials for increasing the energy efficiency, formed a system of branch-related target indicators and first-order measures; and the government pays attention to personnel-training issues. It is also important to note the work undertaken to study and adapt the international experiences in the sphere of energy efficiency and systematization of international cooperation.

Kazakhstan has in place the necessary legal basis for investment activities. The legislation guarantees complete protection of investors' rights and stability of concluded contracts, and very clearly regulates the work of state bodies in relation to investors (free movement and repatriation of capital, free use of profits, the right to privately own land, including for foreign companies). Measures of state support have been defined for the investments made into the priority sectors of economy of Kazakhstan.

The new Taxation Code of the Republic of Kazakhstan, enacted since January 1, 2009, has simplified the order of application by investors *of taxation investment preferences*. These preferences assume a possibility to allocate the cost of preferential objects and further expenses on reconstruction and modernization to deductions. The allocation period of the losses has been increased from 3 to 10 years, which allows extracting benefits from the taxation preferences for investments. It was also assumed to decrease the corporate income tax from 2009 – down to 20%, from 2010 – down to 17.5%, and from 2011 – down to 15% (in 2008 it was 30%). The VAT rate was brought down to 12%.

There is a possibility for co-funding investment projects through state-owned financial development institutes (the National Innovation Fund, Corporation for Insuring Export Credits and Investments, Development Bank of Kazakhstan, Investment Fund of Kazakhstan, Corporation for Exports Development and Promotion KAZNEX).

A new impetus was given to such instruments of economic stimulation like industrial and special economic zones, and technoparks.

With support of the World Bank, within the Ministry of Economy and budget-based planning, the country has launched the Centre for State-Private Partnership.

The country's attractive business climate is supported by the favourable investment legislation, and by economic and political stability. The available legislative basis favours and supports private investments into energy; however, low electricity tariffs deter investors. Besides, for lack of any long-term state strategy, it is difficult to forecast the future level of tariffs.

To stimulate investments into the electricity sector, the republic has adopted a programme of step-by-step increase of electric energy prices up to 2015, by groups of power sources. Despite the relatively favourable investment climate, there are practically no investments into the area of energy saving.

Kyrgyzstan

At present, in general, the specific power intensity of the republic's economy is very high, and, by expert estimates, can be decreased by several times.

The main factors, which stipulate the current situation, are a low level of modernization of the economy and decrease of the efficiency of work of the energy sector.

The legal platform for realization of requirements of energy saving and efficient functioning of enterprises has been formed. The Law "On Energy Saving" and the Law "On Energy Efficiency of Buildings" set the legal standards of realization of state policy of increase of the efficiency of using energy, as well as the legal standards of creation and functioning of institutional economical and informational mechanisms of realization of this policy.

The priorities of development of the electrical energy industry for the nearest future are as follows:

- Development and realization of practical measures on energy loss reduction;
- Strengthening of commercial and financial discipline and achievement of profitability of the subjects of the sector;
- Modernization and escalation of the production potentials and generating capacities of the electric power sector and improvement of its efficiency based on using new equipment, implementing automated control systems and optimizing the load diagrams;
- Launching new generating capacities and delivery power lines;
- Active participation in the processes of inter-state integration of Central-Asian countries, the CIS in the area of electrical energy on the bilateral basis, in preparation and creation of the united competitive market of electric energy and power;
- Reforming the control system of the electric power sector, improvement of management, creation of necessary institutional frameworks and the regulatory legal base, completion of the structural reforming the sector;
- Introduction of a well-balanced tariff and pricing policy, which ensures the coverage of actual expenses of energy companies on the producing, delivery and distribution of the electric and heat energy, and decrease of cross-subsidizing;
- Improvement of the technical equipment of the fiscal metering systems with transition to creation of automated power supply monitoring and control systems (APSM&CS);
- Creation of a valid domestic energy market with ensuring a competitive environment in the area of generation and sale of electricity through building minor HPPs and other alternative energy sources;
- Taking measures on preserving a competitive advantage of Kyrgyzstan in the regional market of electricity and developing export potentials;
- Improvement of conditions for attracting private investments into development of the sector based on the principles of state-private partnership;
- Strengthening of the potentials of energy saving at producing, delivering and consuming the power resources.

The outdated equipment, imperfections of the tariff policy and the accounting system responsible for the actual consumption of electricity are the barriers that hamper attraction of investments and development of the competitive environment in the energy sector.

Most of the hydroelectric power plants (hereinafter – the HPPs) are located in the south of the republic, while the major consumers are in its north. Thus, the installed power of the generating capacities in the south of the country makes 2920 MW, or 79.4% of the total republic's installed power. A low utilization level of minor HPPs and alternative power sources is observed.

An updating of the standards of energy saving (energy efficiency) and bringing them to conformity with the international standards are required.

The major power consumers in Kyrgyzstan are the housing sector (buildings – 37%), industry (34%) and transports (29%).

The consumption pattern of the fuel-and-power resources (hereinafter – the F&PRs), when split by sectors, shows an essential growth of the utilities sector and a decrease of consumption by industry and agriculture.

In early 1990s, the population of the Kyrgyz Republic consumed about 16% of the total electricity supplied to the domestic market; budget-funded entities – 19%; and industry, agriculture,

and commercial consumers – 65%. This was caused by the fact that the extraction of coal made over 5 million tons per year; of them, 4.5 million tons were consumed inside the republic; the volume of the received natural gas was 2.5 billion cubic meters, and the residual fuel oil (mazut) – 600 thousand tons.

At present, the consumption pattern of electricity has reversed. Thus, the population now consumes about 60.5% of the total electricity, supplied to the domestic market; budget entities – 10.5%; and the industry, agriculture, and commercial consumers – 29%.

Until now, many industrial consumers of power pay for maintenance of their unused or inefficiently loaded production capacities.

The housing and utilities infrastructure is characterized by a non-optimized consumption of gas, water and heat energy, usage of inefficient, from the viewpoint of saving of power resources, projects of buildings and structures, building materials and designs. The country is not using any individual meters of heat energy, while the installed apartment meters of gas and water are scanty. Therefore, the losses of heat in the housing stock are several times higher than in other countries with a similar climate.

As to the budget-funded organizations, in the modern economic conditions, the main factor that hampers any energy-saving measures is the absence of mechanisms to stimulate the energy saving, and a deficit of funds for enforcing such mechanisms.

Estimates show that in the near future the total consumption of power by the sectors of the republic's economy can be reduced by 13% through the technical and organizational measures that demand no essential capital investments, which will allow saving 550 thousand tons of oil equivalent (TOE). By means of reconstruction and modernization of the existing power equipment and introduction of energy-saving technologies, it is possible to save up to 25% of electricity and about 15% of heat.

The priorities of the national policy in the sphere of energy saving and energy efficiency are as follows:

1. To ensure, through improvement of management and a complex of organizational measures, within a short-term period, the volume of saved energy up to 1.2 million TOE;
2. To ensure, through stimulating the designing and use of energy- and gas-efficient technical means, technologies and materials at generation, transfer and consumption of energy, in the mid-term period, the volume of saved energy of 0.7 million TOE;
3. To reduce, through the structural modernization of the economy, in the long-term period, the indicators of the specific energy intensity and electricity intensity of the GDP, and bring the volume of saved energy up to 1.0 million TOE.

In the near future, the measures and actions aimed to improve the energy efficiency will follow the following directions:

- Drafting legal and normative documents for enforcing the requirements of the Law "On Energy Saving" and implementation of measures aimed to boost the energy efficiency;
- Reconstruction of the existing power and energy-intensive enterprises, modernization of the energy sector, thermal insulation of buildings, and construction of buildings, which consume power resources more efficiently;
- Use of local power resources;
- Restructuring of the industry, manufacturing building materials, launching production facilities of energy-saving and heat-insulating materials; and
- Designing, production and installation of the equipment and systems for accounting and regulating the consumption volumes of hot water, steam, natural gas and electricity.

Tajikistan

Tajikistan experiences a serious deficit of energy at the background of growing demand, which dictates the need to increase energy efficiency and develop RESs, which are considered as a

component of national development.

Tajikistan is notable for unfavourable business climate, which decreases the interest of potential investors to exhibit their activeness. In the annual index of the freedom of entrepreneurship of the World Bank, Tajikistan takes the 159th out of 183, which essentially hampers attraction of investments into development of the energy sector.

The main goals of the national energy policy include the following:

- Boosting the production of power resources to cover the domestic demand and enter international markets of power resources;
- Development of the fuel-and-energy infrastructure;
- Development of the regional cooperation in the fuel-and-energy sphere;
- Efficient exchange of power carriers inside the region, which will allow using the existing energy potentials with the maximum efficiency;
- Use of ecologically clean non-traditional renewable energy sources – the sun, wind, geothermal water, minor water streams, etc.
- To increase the country's energy efficiency the following is assumed:
- Introduction of energy-saving technologies;
- Utilization of the available hydro-power resources through construction of large, minor and micro-HPPs for solving the power-supply problems in towns, rural areas and remote and hard-to-reach territories;
- Creation of conditions (scientific-technical, organizational, legislative, financial and informational), which ensure the introduction of RESs and energy-saving technologies into the sectors of the country's economy;
- Transition to the energy-saving type of economic growth;
- Elaboration and implementation of a coordinated policy in external markets of energy carriers;
- Reorganization and optimization of the management structure of the water (hydro) and energy sectors at the national level.

The national development strategy of the Republic of Tajikistan till 2015 is the main programme document based on the following principles: energy security, energy efficiency of the economy, budgetary efficiency of the energy, and ecological safety of the energy.

The state energy policy is aimed, first of all, at the following: decrease of the dependence on the imported power resources; increasing the electric power generation from renewable energy sources; and the efficient to the maximum use of natural fuel-and-power resources and potentials of the energy sector for the growth of the economy and improvement of the quality of life of the population of the republic.

The national energy policy assumes the following measures:

- Increase of electricity tariffs;
- Improvement of attractiveness of investment energy projects and increased inflow of funds into the state budget;
- Holding an intensive dialogue with potential importers of electricity;
- Continuation of negotiations with the neighbouring countries on mutually beneficial management of water resources;
- Increased efficiency of management and transparency in the energy sector;
- Elaboration of stimuli for increasing the generation of energy from renewable energy sources, including prospecting and extraction of natural gas, mining and transportation of coal for the needs of the population, and restoration of heat-generating plants.

The government of Tajikistan has drafted extensive plans of reconstruction and modernization of the existing objects of hydro power industry, completing the construction of unfinished and building new HPPs and trans-border power transmission lines. The major plants of this sort are as follows: Sangtudin HPP-1 – for the power of 670 MW; Sangtudin HPP-2 – for the power of 220 MW (built in cooperation with Iran); Rogun HPP – for the power of 3600 MW; and Dashtidjum

HPP – for the power of 4000 MW. It is planned to expand the existing HPP chains and develop the resources of the Zeravshan, Panj and other rivers. However, the implementation of all these projects seems difficult because of an acute deficit of investment funds, a poor ability of the republic to negotiate with potential investors, and the presence of problems on water use with the neighbouring countries.

Tajikistan has formed a comprehensive normative and legal basis in the sphere of increase of energy efficiency and use of RESs. A complex 2012-2016 programme for efficient utilization of hydro-power resources and energy saving is implemented, which assumes the following:

- Attraction and encouragement of investments into generation of ecologically clean electricity and realization of energy-saving projects;
- Restructuring the electric power sector;
- Setting up the tariffs and conditions that will ensure the discipline of payments in the electric power sector;
- Gradual transition to the use of energy-saving technologies, means, equipment, instruments and materials;
- Broad use of renewable and non-traditional energy sources;
- Holding examination of project solutions for their compliance with the requirements for energy efficiency;
- Development and improvement of mechanisms of economic incitement towards energy saving;
- Introduction of unified standards of energy efficiency, sealing and certification of electric equipment;
- Rational distribution of loads in the electric energy system and improvement of the efficiency of generating capacities;
- Conversion of boiler houses into combined heat-and-power plants with the use of alternative energy sources;
- Introduction and improvement of new accounting (metering) systems and decrease of technological and commercial losses;
- Efficient use of secondary power resources;
- Adoption and approval of investment plans and measures in the area of energy efficiency and energy saving;
- Ensuring the profitability of investments into energy efficiency;
- Building enterprises for manufacturing energy-saving equipment;
- Repair and modernization of main heat-supplying networks and heating systems in administrative buildings, dwelling houses and industrial facilities;
- Introduction of multi-sectoral training system in the area of energy saving;
- Creation of educational-methodological and scientific-research centres, improvement of experts' qualification; creation of inter-sectoral and inter-state scientific-research and educational centres for conducting scientific-research and experimental studies in the area of advanced energy-saving technologies;
- Adoption on the international level of normative-legal acts on the use of hydro-power resources.

Turkmenistan

Turkmenistan is among the leading countries in the world by the resources of hydrocarbons; in particular, it is in the top five by reserves of natural gas. According to the official data, as of October 1, 2011, the confirmed stocks of natural gas in Turkmenistan make 25.2 trillion cubic meters, plus about 20.8 billion tons of oil and gas condensate. In this context, the energy sector of Turkmenistan develops in the condition of state-regulated prices; the population is provided with free of charge electric energy, gas and water.

With account of the above circumstances, the energy sector is not attractive for private investments.

In accordance with the National Programme of Social and Economical Development of Turkmenistan for the period until 2030, the producing of electricity will significantly increase due to domestic consumption and exports. It is planned that in 2030, the total output of electricity in Turkmenistan will reach 35.5 billion kWh.

At present, the power intensity of the country's GDP is one of the highest in the CIS. However, as of today, there is no policy in the sphere of increasing the energy efficiency as a separate direction of state policy. The normative-legal basis and the institutional frameworks have not been created. At the same time, certain steps have been made towards optimization of the fuel and energy balance, generating capacities and progress of renewable energy within the framework of implementing the energy policy and modernization of the economy, as well as a certain progress towards renewable energy. The country has many remote and hard-to-reach regions, where it is difficult to use any centralized approach to deliver the energy by means of power lines. RESs and development of respective technologies are supposed to solve this problem.

At present, Turkmenistan is implementing, jointly with the UN Development Programme (UNDP) and the Global Environmental Facility (GEF), the Project "Improvement of Energy Efficiency of Dwelling houses of Turkmenistan" (in 2010-2015). This is the first project of this sort for Turkmenistan. Its budget makes 46 million US dollars; most of it was contributed by national partners, such as the State Concern "Turkmengaz", the administration of the city of Ashkhabad and the Ministry of Construction of Turkmenistan. The project has also involved the State Concern "Neftegazstroy", the Ministry of Energy and Industry, the Ministry of Municipal Services and the Polytechnic Institute of Turkmenistan.

The project includes two basic directions: accounting of the principles of energy efficiency in the process of designing, constructing, and servicing of dwelling houses; and the rational use of energy in dwelling houses.

Uzbekistan

The energy system of Uzbekistan entirely covers the demand of the branches of the national economy and population of the republic for electric energy and exports of the electric energy abroad.

The price for natural gas in the republic differs from the worldwide average and is set significantly lower than the prices that can be seen in international markets. This tariff makes an essential component in the cost of electricity, which is favourable for the population and other consumers.

The energy saving and use of RESs are becoming the most important direction in the energy sector of the country, since they allow decreasing the demands for large investments into the energy sector. The law on rational use of energy has been passed. Contrary to the previous orientation to large-scale production of power resources, now the top priority of the sector is to increase the efficiency of using the available equipment.

In this context, the priority directions of the future advance of the energy sector are as follows:

- Technical retooling, reconstruction and modernization of the energy equipment directed towards maintaining the installed power of electric power plants, improving their technical and economical characteristics;
- Introduction of modern high-efficiency technologies and equipment, which should ensure the saving of the fuel-and-power resources and reducing the impacts on the environment.

The main aims of the country's policy in the sphere of energy efficiency are as follows:

- Reduce the consumption of the final energy covering the respective requirements;
- Increase the efficiency of utilizing power resources and improving the whole chain "extraction-conversion-distribution-utilization" at each of its steps;
- Replace the expensive and limited energy sources by the cheaper renewable sources;

- Use advanced technologies, which increase the energy efficiency of utilization of power resources and meet the ecological requirements.

The basic tasks of the system of state regulation in implementing the energy saving policy at the current stage are as follows:

- Create the respective regulatory, normative-legal and methodological basis, which promotes realization of energy-saving measures;
- Set up conditions for legal and economical motivations;
- Define the level of the efficiency of use of power resources by enterprises, and identify potentials for energy saving.

The country is enjoying a favourable investment climate; a comprehensive system of legal guarantees and preferences for foreign investors is in place, and an integral system of measures for stimulating the activities of enterprises with foreign investments has been developed. Foreign investors are also attracted by a steady growth of the economy, a stable banking system, and a well-balanced credit and investment policy.

The investment legislation of the Republic of Uzbekistan is one of most advanced among the CIS countries. It includes the basic provisions of the international investment law, in particular, provisions on guarantying rights of foreign investors, providing certain preferences to investors and others.

The current control system of consumption of power, as well as the outdated standards, rules and approaches to building houses fail to meet, in full measure, the modern requirements; they are insufficiently stimulating the increase of energy efficiency and, therefore, promote excessive energy consumption. It is planned that the realization of the Programme of Energy Saving of Uzbekistan will cost 34.6 million US dollars, including 25 million US dollars provided by the World Bank in the form of a preferential credit for realization of energy-saving measures in industry, and 9.6 million US dollars, provided by banks and industrial enterprises of Uzbekistan.

At present, about a half of the total consumption of energy in Uzbekistan falls on buildings and structures. The government plans to reduce the power consumption by buildings by 25% through introduction of new energy-efficient standards in construction.

However, in the opinion of a number of experts, the annual total expenses needed to introduce the principles of the so-called "green" construction, in the current market conditions, are essentially less than the expected benefits.

- ***Review of the sector of renewable energy sources (RESs)***

Kazakhstan

The Republic of Kazakhstan has a high energy potential of RESs. For example, by using, without any damage to the environment, only 1-1.5% of the solar energy that falls on the territory of the republic, they can obtain some $1.0\text{-}1.5 \cdot 10^{13}$ kWh per year, which is equivalent to 1.2-1.8 billion TOE. Along with that, today the share of RESs in the country's energy balance is insignificant, making 0.02% of the total energy consumed by Kazakhstan.

At the same time, we should note here that in recent years, renewable energy sources have been paid much more attention to. The progress of RESs is supported by the availability of huge potentials for such sources, which makes this sector a promising one, and a potentially investment-attractive direction of the progress of the republic's energy sector. Apart from ecological advantages, RESs provide essential economic benefits. The use of RESs for generating and delivering electricity into the existing network power grids can be economically reasonable in energy-deficient remote regions of Kazakhstan, where the renewable energy sector can become a key factor of progress.

The following renewable energy sources are most promising for Kazakhstan:

- wind energy;
- minor hydroelectric power plants (HPPs); and

- solar installations for generating heat and power.

According to the Strategic Progress Plan of the Republic of Kazakhstan till 2020, the share of alternative energy sources in the general volume of energy consumption will make 1.5% by 2015, and over 3% – by 2020.

In accordance with the 2010-2014 State Programme of Boosted Industrial-Innovation Development of the Republic of Kazakhstan, by 2015, the following is planned:

- To commission wind turbines with the total installed power of 125 MW and with the total electric power yield of 400 million kWh;
- To commission new minor HPPs with the total installed power of over 100 MW, with the planned yield of electric power of 300 million kWh;
- To commission of photo-electric installations with the total power of 91 MW.

Within the frameworks of the project of the Government of the Republic of Kazakhstan and the United Nations Development Programme (UNDP) on wind energy, a wind atlas of the Republic of Kazakhstan has been compiled. According to the atlas, in a number of districts of Kazakhstan having the total area of about 50,000 sq. km, the average annual wind velocity makes over 6 m/s. It makes them attractive for the progress of wind energy. The largest wind power resources are present in the Djungar Corridor (17,000 kWh per sq. m). In accordance with the Progress Programme of Electric Power till 2030, the following sites have been chosen for building wind power plants (WPPs): Djungar WPP – for the power of 40 MW; Shelek WPP – 140 MW; Saryozek WPP – 140 MW; Alakol WPP – 140 MW; Karoy WPP – 20 MW; Shengeldin WPP – 20 MW; Kurday WPP – 20 MW. The will be able to generate about 1.8-2 billion kWh of electricity per year.

The potentials for generating solar energy are assessed as 2.5 billion kWh per year. The solar energy can be used in two thirds of the territory of the Republic of Kazakhstan (to the south of the 50° northern latitude). The solar energy can be used to generate not only electricity, but also heat, which makes it possible to build solar installations in particular localities, including the regions remotely located from the centralized system of power-and-heat supply.

By its hydro-power resources, Kazakhstan is in the third place in the CIS, behind Russia and Tajikistan. The main hydropower reserves are concentrated in the eastern and south-eastern parts of the republic. The technically available potential of minor HPPs makes about 8 billion kWh. The conducted studies have confirmed that it is potentially possible to realize at least 480 projects of minor HPPs with the total commissioned power of 1868 MW (with the average annual 8510 GWh of generated electricity).

The most promising for building HPPs are the following rivers of the region: Ili, Charyn, Chilik, Karatal, Koksu, Tentek, Khorgos, Tekes, Talgar, Large and Small Almaatinka, Usek, Aksu, Lepsy and Jyrgaity.

In accordance with 2010-2014 State Programme of Boosted Industrial-Innovation Development, the republic plans to commission – by 2015 – new minor HPPs with the total installed power of over 100 MW, with the scheduled yield of electric power of 300 million kWh. In recent years, the Almaty Region has commissioned 5 minor HPPs, and the Jambyl Region has launched one minor HPP with the power of 1.5 MW.

Processing of agricultural wastes can yield annually up to 35 billion kWh of electricity and 44 million Gcal of heat energy. At present, the activities to use the **biomass** energy are directed, first of all, towards solution of environmental problems.

A broad introduction of biogas technologies in agriculture could contribute to environment protection and decrease of total methane emissions into the atmosphere with a parallel prevention of soil and groundwater pollution, causing an efficient positive effect on the living standards of rural residents.

Kyrgyzstan

At present, the share of RESs in the country's energy balance is less than 1%. It is planned to bring it up to 4% by 2025.

The specificities of Kyrgyzstan, where about 90% of the total area is covered by mountains, and over 60% of the population live in foothill and mountainous localities, where it is difficult to bring traditional fuels, create preconditions for active use of local autonomous systems based on RESs.

According to experts' estimates, the technical annual potential of solar heating installations in the conditions of Kyrgyzstan can reach 1.7 million MJ; however, the economic potential is much lower – at 26,000 MJ per year.

The wind energy is estimated approximately as 2 billion kWh. At the same time, the essential part of the flat and foothill area, inhabited by the main part of the population, has a low wind energy potential. On the other hand, the areas with strong winds have practically no electricity consumers.

The vastest opportunities are in the sphere of minor hydro power industry. At present, the technical hydro-energy potential makes 73 billion kWh. The economic potential of the minor hydro power industry of Kyrgyzstan exceeds the potentials of all other renewable energy sources altogether.

About 90% of the potential energy of minor water streams is concentrated in the upper and middle river sections, where the main consumers of energy are located. The commissioning of minor HPPs, especially in mountain areas, will reliably ensure the development of agriculture, industry and tourism; improve the social-economic conditions of the population, engaged in the sphere of free-range animal husbandry, seasonal processing of agricultural products and production of building materials.

They have 20 geothermal sources; their power can be used for heating and hot water supplies, mainly, in recreational areas of the Issyk Kul Region.

There are opportunities to use agricultural wastes; however, currently it is quite low, just heating dwelling premises by burning dry cattle manure (called kizyak – dung brick fuel).

The technically available potential of agricultural and forestry biomass is assessed as about 12,000 TJ per year.

It should be noted that the country has actively designed and introduced technologies based on the use of RESs into the country's industry. At the same time, the low level of the payable demand of the domestic market is essentially decelerating the progress of own production facilities. Besides, the complexities associated with the many-years-long political instability are also hampering the progress of the respective industries.

Quite a lot of undertakings related to the renewable energy are within the framework of the projects of international technical assistance. In particular, since 2005, jointly with the UNDP, they implement the project "Development of Minor HPPs". Its main objective is to set up conditions for attracting investors into the sector minor hydro power industry, drafting and development of the normative-legal basis in the areas of RESs and minor HPPs, development of the cadre potential, and development of the project aimed at decreasing the emission of greenhouse gases on the basis of pilot projects of minor HPPs within the framework of the Kyoto protocol on climate changes.

In the aim of implementing particular measures aimed to attract investments into the development of the minor and medium energy, a special programme was designed and adopted with the aim to advance the sphere of minor and medium energy sectors in the Kyrgyz Republic up to 2012.

Tajikistan

The Republic of Tajikistan has essential reserves of fuel-and-power resources. The total annual potential resources of the hydro power industry in the republic make about 527 billion kWh. The technically possible and economically expedient hydro power resources make 202 billion kWh. However, given all these reserves, today Tajikistan is making use of only 5% of the total calculated hydro-power resources.

Today, the installed power of the available HPPs allows generating over 5 million kWh per day, while the average annual generation of electricity, within the last three years, made about

16.256 billion kWh.

The total domestic consumption of electricity in 2011 made 16.2 billion kWh. The share of RESs in the overall power consumption made 0.07% (120.9 million kWh). The domestic deficit of electricity makes 4 billion kWh.

In general, the republic experiences serious problems associated with the deficit of electricity (it has to introduce limits on electricity consumption, especially in the winter season), which is mainly caused by the country's limited financial resources, huge capitals required for the modernization and construction of major HPPs, production of alternative energy types, construction of new power transmission lines, including those needed to export electricity abroad.

Tajikistan possesses a huge potential of renewable energy sources, which in many cases can substitute the traditional sources. Among them, apart from the hydro energy of minor rivers, there is also the solar energy.

The Tajikistan's deficit of electricity is also caused by the lack of funds needed for prospecting and extraction of natural gas, coal, oil, and production of alternative energy types.

All the experts link the need to develop the use of RESs mainly with the need to deliver energy to remote areas and the country's energy security, and only then – with the environment pollution and global climate change. According to national experts, the share of RESs in the total country's energy production volume is characterized as "insignificant" and makes less than 0.1%.

Opportunities to efficiently use of solar energy are available over the whole territory of Tajikistan. Only thanks to the Sun, the country could satisfy some 10-20% of its total energy demand. Estimates show that some 60-80% of the need of the population for electricity can be covered within 10 months of the year by the solar energy. If calculated as tons of oil equivalent (TOE), it makes about 400,000 TOE, or 460 million cubic meters of gas or 528,000 tons of mazut.

The development of wind energy is also highly promising. The strongest winds are registered in high mountain areas, where open forms of relief dominate (Fedchenko Glacier, Anzob Passover, etc.), and in those regions, where orographic factors contribute to an increase of atmospheric pressure gradients (Khudjand, Faizabad, Shuroabad, Ishkashim and Murgab). It can be supposed that in Tajikistan the most suitable territories for using the wind energy are the Faizabad mountain region, Fergana Valley, Murgab Hollow, and the mountain Passovers Khaburobad, Shakhristan and Aznob. From the viewpoint of economic efficiency, under the existing broad-scale use of the hydro energy, the development of wind energy can be reasonable only in certain regions and objects as autonomous or additional small-power energy sources (1-50 kW).

Biomass is the most promising type of RESs in Tajikistan, which has a huge potential of using the wastes of agriculture, woodworking, food industry and urban purification facilities. In its turn, the most attractive for investors segment of bio energy is the production of biogas, which can be viewed as a source of additional incomes from sale of organic fertilizers and payments for safe disposal of organic wastes.

The potential of minor hydro power industry in Tajikistan makes over 18 billion kWh per year. The diversified hydrological network of Tajikistan, which comprises plenty of large and small rivers, creates a sound basis of the use of hydro power industry, especially in mountainous regions of the country. Minor HPPs (or micro- and mini-HPPs) with the power of 1-10,000 kW can be built with the use of local resources.

In the Kalay-Khumbur, Vanch and Rushan Regions (Western Pamir), over 20 minor HPPs can be built. The Central Tajikistan has good conditions for progressing with the minor hydro power industry; here, it is possible to build over 100 micro- and mini-HPPs. The technical-economic calculations made for 14 promising minor HPPs show that the annual average generation of electricity by them can reach 348 million kWh. The use of energy of minor rivers can cover the power demand of remote regions by 50-70% and more.

The government supports the development of minor energy. In 1994-2000, the following minor HPPs were built: "Tekharv" for the power of 360 kW; "Khistevars" – 630 kW; "Khazara-1" and "Khazara-2" – 250 kW each; "Kyzyl-Mazar" – 70 kW; and "Anderbag" – 300 kW. In late 1990s, 12 minor HPPs of the total power of 540 kW were built in the Pamir.

Apart from building minor HPP, the country is working within the framework of international projects with attraction of international financial institutions and private investors. The UN Development Programme (UNDP) and the German organization "AgroAction" have also funded the construction of several minor HPPs in Tajikistan. The Asian Development Bank has financed a construction programme of minor HPPs in Tajikistan. Since 2007, they commissioned two HPPs in the Rasht Valley; two more plants are built there.

The Islamic Development Bank (IDB) has financed the construction of eight minor HPPs in rural regions of Tajikistan. A loan in the amount of 9.3 million US dollars, provided by the IDB, will go to the construction of five minor HPPs in rural areas of Tajikistan.

A number of bilateral donors (Switzerland, Germany and Japan) have supported the construction of mini-HPPs in Tajikistan.

The government of Tajikistan, which was represented by the Company "Barki-Tojik", has allotted 2.4 million US dollars to build three more minor HPPs.

From the start of 2009, the country has commissioned a total of 43 new minor HPPs having the power from 4 to 400 kW. The total number of minor HPPs has reached 190, and the total installed power – 14 MW. Of them, 96 plants operate all year round, while 94 – in autumn and winter.

The programme "Efficient use of energy of renewable resources in the Republic of Tajikistan in the aim of sustainable development up to 2020" stipulates that the share of alternative energy sources on the total volume of power consumption will make: in 2015, 32,850 kWh; in 2020, 104,000 kWh (with the total annual generation of 898.56 million kWh), or 5.54% of the total country's generation.

Turkmenistan

While scaling up the exports of energy carriers to global markets, Turkmenistan, at the same time, has taken the course of a broad introduction of innovation, resource-saving and ecologically safe technologies, having declared the alternative energy as one of the priorities of the national fuel-and-energy complex.

Since 2007, Turkmenistan started actively studying the international experience of using the ecologically pure energy-saving technologies, based on the use of renewable energy sources – the Sun and wind, which in the conditions of Turkmenistan are measureless resources. The potential of RESs in Turkmenistan is assessed at the level of 110 billion TOE per year. The solar and wind energies are the most promising RESs.

Turkmenistan has adopted the development strategy of renewable energy sources, which assumes a broad use of the solar and wind energy potentials for addressing the major environmental, economic and social problems of the country.

The annual energy potential of solar energy is assessed at the level of 110 billion tons of oil equivalent (TOE). The distribution of the solar energy potential across the territory of Turkmenistan can be considered uniform in view of the country's latitude location.

Up to 40% of the territory of the country is favourable for using the wind energy. The wind situation is most attractive in the western and north-western regions of the country, where the winds at the velocity of over 4 m/s dominate. In the northern coastal area of the Caspian Sea, the specific power of the air flow is rather high and makes about 110-135 W/m^2. A high level of the wind energy potential is characteristic for the Balkhan-Kopetdag Corridor – over 150 W/m^2. In the central part of the country and up to the northern border, the specific wind power of up to 100 W/m^2 dominates. In total, the wind energy potential can be assessed as 5.5 billion TOE per year.

The country's hydro energy resources are presented by major trans-border rivers Amu-Darya, Murgab, Tedjen and Etrek, and by 20 smaller rivers that flow sown the northern slopes of Kopetdag. Amu-Darya is the largest river, providing about 95% of all the country's water resources. It flows across the flat part of the territory of Turkmenistan for 1000 km, and construction of HPPs on this river is inexpedient; while building HPPs in the beds of other rivers (Murgab, Tedjen and Etrek) is economically unreasonable, because they are too shallow. The development of minor hy-

dro energy is promising on of minor fast mountainous rivers for supplying power to individual consumers.

The Institute of the Academy of Sciences of Turkmenistan named "Sun" has successfully implemented a number of projects. Its activities is directed, first of all, to satisfaction of the needs of the population, living and working in the regions, located remotely from industrial centres, by using the potential of RESs, first of all – of the solar and wind energy – to solve the problems of energy supplies, pumping water from dug and bored wells, as well for heating, cooling and drying. They also study such opportunities like growing and use of biomass of micro-sea grass, disposal of domestic and industrial wastes and production of bio fuels and organic fertilizers. The achievements of the Institute include non-waste autonomous wind-solar complexes with a complete system of life support; a universal solar drying installation; a solar energy-based desalter and a solar heating module; a unit for growing micro-sea weeds in solar photo-bio-reactors; a "solar" furnace for high-temperature studies; different designs of solar greenhouses; and an installation for producing biogas. The wind power plant (WPP) for supplying power to the school, operating in the Gyzylsu Island in the Caspian Sea is notable for its high parameters.

We should note here the active development of the international scientific-technical cooperation with the leading global research centres and joint projects with scientists from Germany – one of the recognized leaders in the area of practical application of RESs. It is worth to note the project aimed at training and retraining specialists on the basis of the world-renowned pioneer of solar technologies – the "Mountain Academy" University in the city of Freiberg.

Jointly with the Companies "Goetzpartners" and "Concentrixcolar" (Germany) a possibility has been considered and the expediency has been justified of building photovoltaic solar power plants; a pilot project was developed to build such a plant near Ashgabat. The Institute "Sun" has used the funds allocated by the Islamic Development Bank (IDB) to perform a project on exploring the possibilities of extracting silicon from the Kara Kum sand for making solar photovoltaic cells.

Uzbekistan

Uzbekistan has an essential potential of renewable energy sources (RESs), which is three times higher than the current production volume of all types of organic fuels. The climate and natural conditions of Uzbekistan provide a vast room for using RESs. According to conducted estimates, the gross potential of RESs makes about 51 billion TOE, and the technical one – 179 million TOE. At present, they have coped only with 0.6 million TOE (0.3%) of the technical potential, only through the use of hydro energy of natural and man-made water bodies.

Efforts are undertaken to promote the scientific-industrial potential in the sphere of RESs, including studies and experimental industrial projects in the sphere of alternative energy sources, practical use, with account of the world experience, of individual solutions aimed to apply alternative energy sources in the conditions of Uzbekistan, as well as organization of the domestic production of modern equipment and use of technologies for this sphere.

In particular, the Decree of the President of the Republic of Uzbekistan of March 1, 2013, "On Measures for Further Development of Alternative Energy Sources" is aimed at creation of the International Institute of Solar Energy with participation of the Asian Development Bank and other international financial institutions based on the Scientific-Production Association (SPA) "Physics-Sun" of the Academy of Sciences. The main goals and directions of the Institute have been defined as follows:

- Execution of hi-tech designs the area of industrial use of solar energy;
- Drafting proposals on practical use of the potentials of solar energy in various branches of the economy and social sphere based on the advanced and economically efficient technologies;
- Conducting applied studies, associated with the use of the solar energy in various branches of the economy, including technologies for synthesis of special materials and thermal treatment;

- Coordination of development of documentation on major projects in the sphere of the solar energy.

They have prepared a bill on renewable energy sources, a bill on alternative energy sources, a draft Concept of the Republic of Uzbekistan on the progress with alternative fuels and energy for 2012-2020, and the State Programme "Prospects of Advancing the Branch of Alternative Energy Sources and Fuels for 2013-2020".

The country forms its legal framework aimed at stimulating the progress of the renewable energy with the involvement of the state and private sectors, and attraction of national and foreign investments.

Besides, in order to further advance the issues of using RESs in the republic, they have developed the "Conceptual provisions and directions of the long-term use of renewable energy sources for generation of electricity and heat in Uzbekistan".

The Companies "Uzbekenergo" and "Suntech Power" (from China) have reached an agreement to set up – within the free industrial-economic zone "Navoi" – a joint venture for the production of photovoltaic panels for the power of 100 MW based on the latest technologies with the equal financing of the development of project documents and commissioning of the first stage of the plant with the power of 50 MW in October 2013, and reaching the project power in 2015. Special attention is given to a deep analysis of the demand and the market for the products manufactured by the joint venture.

At present, they prepare a plan of experimental and pilot projects with the use of the solar and biogas energy with attraction for the purpose of the funds of the Asian Development Bank (ADB) and other international financial institutions; the tools are being developed to stimulate the producers and users of the solar and biogas energy, as well as to provide them with tax and customs privileges and preferences, with account of the experience of foreign countries.

For today, the republic has realized, within the framework of implementing projects of technical assistance funded by international organizations and financial institutions, several demonstration projects in the sphere of RESs. In particular, in recent years the UNDP has finalized, in cooperation with national partners, a few projects, aimed at the development of the national market of technologies of RESs, and increased use of RESs in the Republic of Uzbekistan.

The gross potential of solar energy is assessed roughly as 99.9% of the total potential of RESs, while its technical one – as 98.9%. The greatest potential (19,548 million TOE) belongs to Kara-Kalpak, the smallest one (129 million TOE) – to the Andijan Region. The republic has stocks of industrial silicon – the main raw material for the production of photovoltaic installations. The development of the industrial stock of silicon and the establishment of high-tech industrial production facilities of photovoltaic installations can be a good incentive for wide -scale progress of the solar energy in Uzbekistan.

The estimated gross potential of wind energy makes 2.2 million TOE, the technical potential makes 0.4 million TOE. Wind streams are seasonal. Only some areas of Uzbekistan can be used to set the modern wind generators. However, in each case a more detailed study of wind speeds at different elevations is needed.

The energy potential of major rivers of the country, as well as of the existing channels and reservoirs, where 32 HPPs has been built, is assessed as 88.5 billion kWh (9.2 million TOE), including the technical potential of 27.4 billion kWh (1.8 million TOE). At present, they make use only of 30% of the existing potential. In 1995, the country adopted a programme for the development of the minor hydro power industry, which assumed the construction of 141 minor HPPs. In 2004-2010, within the programme they commissioned 4 minor and medium HPPs with the total installed power of 102.5 MW.

At present, the following is demanded in Uzbekistan:

- Systemic minor and autonomous micro-HPPs in remote regions;
- Wind generators, connected to under-loaded power grids, which power remote regions;
- Solar water-heating units for hot water supplies to domestic consumers;
- Biogas installations for producing electricity and heat;

- Combined wind-solar low-power installations for the regions of grassland farming.

The demonstration projects have shown that use of wind energy and solar photocells is the most economically efficient combination, in which the wind and solar energy are substituting and complementing each other in supplying power to remote and hard-to-reach dwelling settlements.

The use of biogas technologies is reasonable in the countryside as an efficient way to process wastes of the animal husbandry.

- ***Review of the legislative base in the area of energy efficiency and renewable energy sources (stimulation mechanisms, main barriers for implementing projects in energy efficiency and renewable energy sources) and key institutions and organizations, responsible for implementing the policy in the sphere of increase of energy efficiency and use of RESs***

Normative-legal base

Kazakhstan

The foundation of the normative-legal base of Kazakhstan in the sphere of energy efficiency and RESs is made up of the following Laws:

- "On Energy Saving and Increase of Energy Efficiency";
- "On Supporting the Use of Renewable Energy Sources";
- "On Making Changes and Additions in Certain Legislative Acts of the Republic of Kazakhstan on Support of Use of Renewable Energy Sources";

And the following programme documents:

- Programme of energy saving for the period to 2015;
- Branch development programme of electric power for 2010-2014;
- Complex plan in the sphere of energy saving. It assumes a decrease of the specific energy intensity of the GDP by 10%. The annual savings will make 16 billion kWh of electricity, 7 million tons of coal, or 1.3 billion US dollars in money terms;
- The Action Plan of the Government of the Republic of Kazakhstan for implementing the State Programme of Boosted Industrial-Innovation Development of the Republic of Kazakhstan.

Also in November 2009, the Government of the Republic of Kazakhstan made a decision on adoption of voluntary quantitative obligations to reduce the national emissions of greenhouse gases by 15% by 2020, and by 25% – by 2050 relative the basic level of 1992.

Besides, within the framework of implementing of the Law of the Republic of Kazakhstan "On Supporting the Use of Renewable Energy Sources", a number of bylaws were adopted, including the following:

- Rules of monitoring the use renewable energy sources;
- Rules of buying electric power from the qualified generating organizations;
- Rules of defining the closest connection point of object using renewable energy sources;
- Rules of coordinating and approval of feasibility studies and economic justification of projects of construction of objects using renewable energy sources.

Kyrgyzstan

In the Kyrgyz Republic, the energy-saving policy is regulated by the Laws of the Kyrgyz Republic "On Energy", "On Electric Energy", "On Energy Saving" and "On Energy Efficiency of Buildings".

With the aim to improve the legislation in the area of energy saving, on July 26, 2011, they adopted the Law of the Kyrgyz Republic "On Energy Efficiency of Buildings".

The issues of RESs have been also included into the Development Strategy of the Fuel-and-

Power Complex till 2025.

The country has also approved the Regulations on the order of construction, acceptance and technological connection of minor HPPs to power grids, which regulate the procedure of construction, technological connection to power grids of minor HPPs; and the order of acceptance of finished minor HPPs.

Despite the taken measures, the analysis of the current legislation and the practice of its enforcement indicate the need to improve it. Since the measures stipulated in the Law of the Kyrgyz Republic "On Renewable Energy Sources" of economic stimulation for attracting investments were insufficient, on August 3, 2012, they adopted the Law of the Kyrgyz Republic "On Making Changes and Additions in the Law of the Kyrgyz Republic 'On Renewable Energy Sources'".

The main aim of the new law is to improve the economic mechanisms for stimulation of the use of renewable energy sources (RESs), including minor HPPs, and for attracting investments.

The law envisions to set up extra charges on electricity tariffs, if it is generated by means of RESs and of by minor HPPs for the period of payback of the projects with the use of RESs. It is suggested to make this period of up to 8 years. That is, a privileged period is introduced, when the special higher tariff for the installations using RESs, during which the expenses should be recovered.

The law also assumes to oblige the distribution companies to buy all the electric energy, generated with the use of RESs and by minor HPPs, not consumed by the owner and not sold to other consumers under concluded contracts. That is, each territorial-administrative formation shall appoint – as the buyer of the electric power generated by installations of RESs and by minor HPPs – the major distribution company that dominates the local electric power market, where the RES unit or minor HPP are located. This provision is in line with the international practice and creates conditions for selling the electricity generated by RESs.

This mechanism combines the transparency and clarity for the potential investor, since the extra tariffs are fixed in the law, same as the buyers of the electricity generated by RESs. This situation improves the competitive strength of RESs against traditional energy sources.

Tajikistan

The normative-legal base of Tajikistan in the sphere energy efficiency and RESs is formed by the following legislative documents:

- The Law of the Republic of Tajikistan "On Energy". With the aim to promote the energy saving and support the introduction and use of alternative and renewable energy sources, on June 30, 2007, the parliament of the republic adopted the Law "On Additions to the Law 'On Energy'". The changes were intended to stimulate the use of alternative energy sources and assumed to introduce the "green" tariff for selling the electricity, generated from renewable energy sources;
- The Law of the Republic of Tajikistan "On Energy Saving";
- The Law of the Republic of Tajikistan "On the Use of Renewable Energy Sources";
- The Law of the Republic of Tajikistan "On Investments";
  And the following programme documents
- The long-term programme of construction of a chain of minor HPPs for 2009-2020, where the main goal is to make use of the hydro-power resources of small rivers and creating the respective infrastructure; design the Feasibility Study for construction of minor HPPs; attract foreign and local investors for construction and reconstruction of minor HPPs; and define the demand/generation balance of electricity in hard-to-reach dwelling settlements of the republic;
- The Action Plan of implementing priority projects in the electric energy sphere for 2003-2015;
- The Action Plan of implementing priority projects in the energy branch of the Republic of Tajikistan for 2010-2015, which defines particular projects of construction of HPPs, CHP

(combined heat and power) facilities, restoration and reconstruction of the existing HPPs, construction and restoration of power transmission lines of domestic and regional value with indication of the volumes of investments, as well as the sources of domestic and foreign investments. The total power of the power plants being built and planned for construction in 2010-2015 makes 3670 MW;

- The Programme of efficient use of hydro-power resources and energy saving for 2012-2016, which envisions measures in the area of energy efficiency and energy saving; rational use of electricity and decrease of losses of energy; efficient use of hydro power resources; attraction and encouragement of the investments directed to the generation of ecologically pure electricity and introduction of energy-saving means and equipment on the basis of normative-legal acts; and the ways of reaching the goals and main tasks; and
- The Programme of Use of Renewable Energy Sources for 2007-2015.

Turkmenistan

Turkmenistan has not yet formed any special normative-legal base in the sphere of energy saving and support of RESs; these problems are addressed within the framework of the general regulation of the progress of the economy and the energy sector.

At the same time, in 2012-2013, the country developed the "National Strategy of Turkmenistan on Climate Changes", which assumes to draft an "Action Plan" to contain measures both to counteract climate changes and to adapt the sectors of the country's economy to the envisioned changes. The plan will cover the development issues of all the branches of the economy with special accent on industry, transports, and housing and utilities. The priority directions are as follows:

- Introduction of energy-efficient and of energy-saving technologies;
- Development of the sphere of RESs;
- Technological modernization with the aim of ensuring the future progress and competitiveness of the economy.

Uzbekistan

In Uzbekistan, the normative-legal base in the sphere of energy efficiency comprises the Law of the Republic of Uzbekistan "On Rational Use of Energy".

Within the framework of implementing the Law of the Republic of Uzbekistan "On Rational Use of Energy", the SJSC "Uzbekenergo" has drafted and implements the "Programme of Energy Saving for the Period of to 2020", which assumes a system of measures for implementing the potentials of energy saving in the branch, the volume of which is assessed as about 3-5 million TOE.

The normative-legal base for development of RESs is being actively formed today; the following has been drafted: a bill "On Alternative Energy Sources"; Draft Concept of the Republic of Uzbekistan for development of alternative fuels and of energy for 2012-2020; and the State Programme "Development Prospects of Alternative Energy Sources and Fuels for 2013-2020"; and the "Long-term conceptual provisions and development directions for the use of renewable energy sources for the production of electric and heat energy in Uzbekistan".

The President of Uzbekistan has signed a Decree "On Measures of Further Development of Alternative Energy Sources". The Decree encourages to continue the studies and experimental-industrial designs in the sphere of alternative energy sources at the high technical and scientific level, practical use, with account of the global experience of using alternative energy sources in the conditions of Uzbekistan, as well as organization of the domestic production of modern equipment and technologies for this sphere.

At present, the government of Uzbekistan is developing a list of experimental and pilot projects aimed to use the solar and biogas energy, and a complex of measures to stimulate the producers and users of the solar and biogas energy, as well as to provide them with taxation and customs preferences, with account of the experience of foreign countries.

It should be noted here that in of the countries of Central Asia, the normative-legal base is mainly of rather declarative character. In most of the countries, the laws on energy saving have no direct-action mechanisms; they are weakly interrelated with other legislative acts that regulate various issues of energy, ecology, etc. Often, the norms of the energy legislation are not interrelated; the have gaps and unregulated issues. At the same time, practically all the countries are actively studying the international experience, trying to adapt it to national conditions. In particular, we can mention the trend to harmonize the legislation in the sphere of energy efficiency with the legislation of the European Union.

Review of the climate policy of the countries of the region in the part related to the increase of energy efficiency and progress with RESs

Kazakhstan is pursuing the most consistent climate policy among the countries of Central Asia, has announced an adoption of voluntary obligations to reduce the emissions of greenhouse gases by 15% by 2020, and by 25% by 2050 relative the level of 1990, and has applied for the inclusion of the country into Annex B to the Kyoto Protocol, which was fixed in the respective Annex to the Copenhagen Agreement.

In particular, in 2009, in the Republic of Kazakhstan, the total emissions of pollutants into the atmosphere made 3.4 million tons, of them, 85% was made by 43 major enterprises.

The energy sector is responsible for 87% of the total national emissions of greenhouse gases, or 214.4 million tons of CO_2 equivalent. At present, in Kazakhstan, up to 85% of the total electricity is generated by means of incinerating organic fuels, mainly, local coals, and to a lesser extent – of hydrocarbons. About 10% of all emissions into the atmosphere of the country originate from stationary sources; and an essential share of toxic wastes is formed by the enterprises, engaged in the sphere of extracting raw oil and accompanying gas.

The total decrease of emissions of greenhouse gases from energy facilities, when using RESs, can make from 0.5 up to 2.5 million tons of CO_2 equivalent.

Kazakhstan was the first among the countries of Central Asia to draft a strategy for transition to the low-carbon economy, where there is room for RESs, and undertook to reduce its emissions by 15% against the level of 1992. The target will be hard to achieve only through the decrease of the specific energy intensity of the economy. Thus, the role of RESs in decreasing the emissions of greenhouse gases will be essential for Kazakhstan.

In particular, within the framework of the Branch Programme "Zhasyl Damu" for 2010-2014, it is assumed to decrease the emissions to the atmosphere by at least 5.9% compared with 2009.

Other countries of the region are also trying to account for the issues of counteracting the climate changes, when implementing the state policy in the sphere of energy efficiency and RESs. The region has implemented quite a lot of projects of international technical assistance with attraction of donor funds, within the framework of which they studied the potential use of RESs (detailed atlases have been compiled by types of RESs for individual countries); the following was also elaborated:

- Drafts of normative-legal acts in the sphere of supporting RESs and increase of energy efficiency;
- Drafts of special programmes for the use of RESs;
- Complex of measures of financial stimulation of development of the renewable energy;
- National reports on the issues of counteracting climate changes.

In particular, Kyrgyzstan is implementing – jointly with the UNDP – the project "Development of Minor HPPs", where one of the main tasks is development of a project to reduce emissions of greenhouse gases based on the pilot projects of minor HPPs within the framework of the Kyoto Protocol on climate changes.

Turkmenistan drafted, in 2012-2013, its "National Strategy of Turkmenistan on Climate Changes".

Uzbekistan is also paying great attention to the issues of counteracting climate changes. In particular, with the support of the UNDP, they implement the following programmes and projects in the sphere of counteracting climate changes:

- The Programme of Minor Grants of the Global Environment Facility;
- The Central-Asian Regional Programme of the UNDP on managing risks in the area of climate changes – the Project "Managing Climate Risks in Uzbekistan";
- The "Support of Uzbekistan in Transition to Low-Carbon Development of National Economy".

The aim of the above projects and programmes is to improve the national potential of Uzbekistan for an efficient transition to the low-carbon economy by means of the following:

- Mobilization of resources and execution of strategy of low-carbon development;
- Attraction of financial assets from international carbon markets, including through mechanisms of clean development;
- Integration of the activities to mitigate the implications of climate changes, including stimulation of the renewable energy, and the use of the available international financing mechanisms.

Main institutes, responsible for implementing the state policy in the sphere of energy efficiency and RESs

In Kazakhstan, the policy in the area of energy efficiency and energy saving is defined by the Ministry of Industry and New Technologies (MINT); however, the coordination, implementation and monitoring of all the above activities will be imposed on the authorized body in the sphere of energy saving, local executive bodies and the Institute for Development of Electric Power and Energy Saving. Most probably, this authorized body in the sphere of energy saving will be the Committee of State Energy Supervision and Control of the MINT, which will also accredit energy auditors and run the State Energy Registry.

It should be noted that the country has launched a special Kazakhstan Institute for Development of Electric Power and Energy Saving. Its aim, in the part of energy saving, is to analyze the status of the sector of energy saving in Kazakhstan, the normative-technical support of the sphere, etc.

In Uzbekistan, the main regulating body the area of the electric power is the State Inspectorate for Supervising the Electric Power Sector (Uzgosenergonadzor). Besides, the State Joint-Stock Company (SJSC) "Uzbekenergo" and the National Holding Company "Uzbekneftegaz" are responsible for the introduction of energy-efficient and of energy-saving technologies in the respective branches.

In Tajikistan and Kyrgyzstan, the leading role in formulating the policy in the sphere of increase of energy efficiency and use of RESs is performed by the Ministries of Industry and Energy.

Mechanisms to stimulate the increase of energy efficiency and progress of RESs

The Republic of Kazakhstan is the most advanced country in creating mechanisms for the stimulation of investments into the energy saving and development of RESs.

The Law "On Supporting the Use of Renewable Energy Sources" has set up the legal, economic and organizational bases for stimulating the use of RESs for the production of the electric and heat energy and defines the support measures.

The Law assumes the following measures:

- Reservation and priorities at allocating land plots for the construction of objects of renewable energy sources;
- Liabilities of the energy-transmitting organizations at buying the electricity, generated with the use of renewable energy sources;
- Exemption of renewable energy sources from any payment for the delivery of electricity

across the grids;

- Support at connecting of the objects that use renewable energy sources to the networks of energy-transmitting organizations; and
- Provision of individuals and legal entities, who are engaged in designing, construction and operation of the objects that make use of renewable energy sources, with investment preferences in accordance with the legislation of the Republic of Kazakhstan on investments.

In particular, the above Law envisages the provision of investment preferences for the projects of RESs; the priority of using the "clean" electricity in the market and at transfer within the grids; and support through the system of certificates controlled by the state.

The following bylaws have been adopted:

- Rules of buying electric power from qualified energy-generating organizations, approved by the Order of the Ministry of September 29, 2009, No. 264;
- Rules of defining the closest connection point for the objects that use renewable energy sources, approved by the Order of the Minister of September 1, 2009, No. 270;
- Rules of coordinating and approving the technical-economic justifications and projects of construction of objects that use renewable energy sources, approved by the Resolution of the Government of Kazakhstan of December 25, 2009, No. 2190.

Kazakhstan has drafted and approved the Placement Plan of objects that use renewable energy sources, which is a visual tool for potential investors in defining the most promising sites for building wind and hydro energy installations in the territory of the republic.

In 2003, the country passed the Law "On Investments", which regulates the legal and economic bases for stimulating investments. According to international experts, the Law is one of the best of the kind in the area of investments among the countries with transient economies.

Also, the above Law defines the measures of state support of the investments, made into the priority branches of the economy of Kazakhstan.

Thus, when implementing projects in non-raw materials sectors of the economy of Kazakhstan, investors are provided with the following investment preferences:

1. ***Exemption from customs duties*** of equipment and components imported for implementing an investment project;
2. ***State grants in kind*** (the state grants in kind can have the form of land plots, buildings, constructions, machines and equipment);
3. ***Investment and tax preferences***.

The new Tax Code of the Republic of Kazakhstan, enacted on January 1, 2009, has introduced the procedure of applying by investors ***of tax investment preferences***. These preferences assume that the cost of the objects of preferences and further expenses on reconstruction and modernization of them can be referred to deductions.

The term for this transfer of losses has been extended from 3 to 10 years, which will allow extracting benefits from the investment tax preferences. The Tax Code also assumes a decrease of the corporate income tax as follows: from 2009 – down to 20%, from 2010 – down to 17.5%, and from 2011 – down to 15% (in 2008, it was 30%).

The VAT tax has been dropped down to 12%.

Besides, it should be noted that one of the measures to support investments by the state is a possibility of co-funding the projects through the state financial development institutions (National Innovation Fund, Corporation for Insuring Export Credits and Investments, Development Bank of Kazakhstan, Investment Fund of Kazakhstan, Corporation for Exports Development and Promotion "KAZNEX").

A new impetus was given also to such tools of economic stimulation, like industrial and special economic zones and technoparks.

With the support of the World Bank, within the framework of the Ministry of Economy and Budget Planning, they created the Centre for State-Private Partnership.

Thus, the available legislative base allows and ensures private investments into the energy branch; however, low electricity tariffs frighten off investors. Besides, for lack of any long-term

state strategy, the existing level of tariffs is unpredictable.

In order to stimulate investments into the electric energy sector, the republic has adopted a programme of step-by-step increase of electric energy tariffs till 2015 by groups of energy sources. These are the so-called "limit tariffs".

Despite all the above measures, investments into the energy saving are practically absent. At the same time, the recent steps to improve the normative-legal base on the use of RESs have increased investors' interests, including foreign ones (first of all, from China and Germany), to RES projects in Kazakhstan.

Other countries of the region are also attempting to stimulate the development of RESs; however, their normative-legal base is still underdeveloped; and the required institutional basis is absent. The measures to stimulate the progress of RESs are point-wise and non-systemic. As a rule, certain privileges are set up for implementing pilot projects within the framework of the programmes of international technical assistance. Besides, certain budgetary funds are allocated within the framework of governmental development programmes of decentralized power supplies.

Quite topical are the issues of updating the legislation, namely, of introduction of market mechanisms and improvement of tariff-setting, and creating conditions for state-business cooperation.

It is quite important to have a special body of state management responsible for drafting and implementing the policy in the sphere of increase of energy efficiency and development of RESs. Such a body will have a special importance in the countries possessing essential resources of hydrocarbons.

Main obstacles to increase of energy efficiency and progress of RESs

The main obstacles on the way of introducing energy-saving measures can be listed as follows:

- The imperfections of the tariff policy and the presence of the practice of cross subsidizing;
- Poor development of the market of energy services and of energy-saving technologies;
- Indefinite status of the budgetary support of the energy saving in the long-term perspective;
- High investment risks;
- Low qualification level of specialists working in localities;
- Insufficient level of awareness and culture of the population in the sphere of economic utilization of power resources;
- Insufficient development of market relations;
- Absence of real economic stimuli for making investments into fixed assets and implementing energy-saving projects;
- Poor state management and regulation in the sphere of energy saving, especially at the regional and local levels.

Practically in all countries of the region, the main obstacle to introduction of the renewable and alternative energy is the high specific cost of production as compared with the traditional sources of energy. Under the existing system of cross subsidizing and low paying capacity of the population and other consumers of energy, any investments into the energy are loss-making or highly risky.

A huge negative effect is also caused by the absence of access to financing – the credit rates are high, while the access to the so-called "long credits" is very difficult.

The imperfections of the current legal and financial-economic mechanisms are also essential.

Even in the Republic of Kazakhstan, is most consistent in pursuing market reforms, the electricity tariffs are close to the prime cost of electricity generation, with no account for depreciation deductions needed for replacing the obsolete equipment. At present, in all the considered countries the wear rate of the main equipment of power grids makes about 50% and over; and in a number of cases, a great percentage of the grids and equipment are unfit for further operation. The obsolete

equipment and a poor accounting of the real consumption of electricity make it difficult to attract investments and develop the real competition in the energy sector.

The today's low rates of the progress of the energy based on the use of RESs are essentially defined by the following factors:

- Low competition strength of the projects based on the use of RESs in the existing market environment, as compared with the projects based on the use of fossil organic fuels;
- The presence of institutional barriers, associated with the absence of the necessary normative-legal acts, stimulating the use of RESs in the sphere of the energy; and the lack of long-term national strategies and integrated programmes to support a broad-scale use of RESs;
- Absence of the infrastructure, required for successful development of the energy based on RESs, including the insufficient level and quality of scientific and financial support; the absence of the proper information environment, including the information about potential resources of RESs; the absence of the normative-technical documentation and software means necessary to design, construct and operate generating facilities; insufficient qualification of the personnel' and absence of the mechanisms for using public resources for supporting the development of the energy based on the use of renewable energy sources.

II. Analysis of results of fulfilment of national programmes in the area of renewable energy sources

1. Analysis of the goals of national programmes

Kazakhstan

Today, the development and use of RESs have been regarded as one of the priority directions of the energy sector and solution of the country's environmental problems. The message of the President of the Republic of Kazakhstan of December 14, 2012, named "Strategy of Kazakhstan-2050", says: "The new political course of our country points to the need of development of production of alternative energy types and active introduction of the technologies, using the solar and wind energy."

The potential of renewable power resources (hydro, wind and solar energy) in Kazakhstan is quite essential; however, its use is at the initial stage. In 2007-2010, Kazakhstan commissioned 5 minor HPPs of the total power of 20 MW, 10 wind power plants (WPPs) with the total installed power of 100 kW, and 2 solar power plants (SPPs) with the total power of 3 kW.

One of the stimuli for using RESs is the obligation of Kazakhstan to reduce emissions of greenhouse gases by 15% against the level of 1992.

The directions and tasks for the RES development in Kazakhstan have been defined by the "2010-2014 State Programme of Boosted Industrial-Innovation Development of the Republic of Kazakhstan", approved by Decree of the President of the Republic of Kazakhstan of 19.03.2010. The Programme has set a target indicator – reaching the share of RESs in the total volume of energy consumption of over 1% in 2014.

In accordance with the "Strategic Development Plan of the Republic of Kazakhstan till 2020", the share of alternative energy sources in the total volume of energy consumption shall make 1.5% by 2015, over 3% – by 2020, and up to 5% by 2024. One of the target indicators of the Strategic Plan is the achievement of the volume of electricity generated by means of RESs in 2014 – 1 billion kWh per year.

In 2009, the Republic of Kazakhstan adopted the Law "On Supporting the Use of Renewable Energy Sources", which has legitimated the state support to the production and use of the renewable energy, and attraction of investments to objects of RESs. The measures envisioned by the Law include the support of construction and connection of RES objects to electric grids, transportation of the electricity generated by RESs by the grids and its sale to the regional electricity transportation companies and the Kazakhstan Electricity Grid Operating Company (KEGOC).

Ratification by the Republic of Kazakhstan in February 2009 of the Kyoto Protocol allows using the financial mechanisms of supporting projects based on RESs.

On March 21, 2013, President N. Nazarbaev signed the Law of the Republic of Kazakhstan "On Ratification of the Charter of the International Renewable Energy Agency (IRENA)", thus ensuring the access of the country's scientists and specialists to new RES-technologies and mechanisms for using renewable energy.

Kyrgyzstan

The Kyrgyz Republic possesses a high potential of RESs, which is assessed as 840.2 million TOE per year. The main country's RESs are the solar energy, the energy of small rivers and water courses, the energy of geothermal water and the biomass energy.

At present, the practical use of the renewable energy is insignificant: it makes less than 1% in the country's energy balance. The explanation is in a number of factors, the main being a weak mechanism of economic stimulation of the use of RESs.

The basis of the current system of power supply of the country was formed back in the USSR time, when it was a part of the regional (Central-Asian) system, where the dominating energy

carrier was water (the HPPs of Kyrgyzstan and Tajikistan), and the fossil fuel, brought from Kazakhstan, Turkmenistan and Uzbekistan, was used as an additional energy source.

The main source of energy in the republic is the power of hydro resources. Their energy potential is assessed as 142 billion kWh of possible generation of electricity per year. This potential is used today by 10%. The hydro potential of small rivers is used by about 3%.

The complexity of the situation in the energy sector of Kyrgyzstan is caused by the fact that its main generating sources – 5 major HPPs, which generate 90% of the total installed power of the energy equipment, are concentrated in the central and southern regions, while the main consumers (about 60%) are located in the north of the country. The energy is partly transported across the territory of Kyrgyzstan, and partly looped via Uzbekistan, Kazakhstan and Tajikistan.

In its northern part, Kyrgyzstan has a huge hydro-energy potential of minor water courses. The sector of minor hydro energy sector in the country's northern areas could ease the solution of the problems of the energy sectors and improve the energy security of the country.

The national energy programme of the Kyrgyz Republic for 2008-2010 and the strategy of development of the fuel-and-power complex till 2025, approved by the Resolution of the Government of the Kyrgyz Republic of February 13, 2008, No. 47, assume the development of RESs.

For the conditions of Kyrgyzstan the most promising RES areas are decentralized objects, located in remote mountainous regions: farms and animal husbandry complexes; geological and mining enterprises, road maintenance services, hydrometeorology scientific monitoring stations; radio and TV transmitters; tourist and recreational facilities; pumping stations; objects of forestry and hunting grounds, etc.

Tajikistan

The total domestic consumption of electricity in the country in 2011 made 16.2 billion kWh; while the share of RESs in the total energy consumption made only 0.07% (120.9 million kWh).

In the national generation structure of electricity, the share of HPPs is about 98%, the CHPs – 2%; while the average annual production of electricity is at the level of 16.5 billion kWh.

The deficit of electricity was 4 billion kWh. The existing deficit of electricity and the introduction of consumption limits, especially in winter, are cause by the limited hydro-power resources of the Nurek Reservoir. This largest republic's water body (10.5 km^3) has a peculiarity – a seasonal water regulation; therefore in autumn and winter the deficit of electricity makes 4-4.5 billion kWh. Another reason of the deficit of electricity is in the incomplete operation of the Dushanbe CHP (198 MW) and the Yavan CHP (120 MW) in autumn and winter, because of the decreased shipments of natural gas and petroleum products to the Republic of Tajikistan and a permanent growth of the cost of energy carriers.

The above factors dictate the need to develop RESs in the country. In the conditions of Tajikistan, the most promising are the following RESs: minor HPPs, solar units for production of heat and electric power, the wind energy sector and biogas units.

The territory of Tajikistan has different geo-climate zones – from hot deserts to eternal glaciers. Mountains cover 93% of the territory of the country; almost half of the territory is above 3000 meters. These circumstances allow viewing Tajikistan as a natural laboratory for testing installations and units of RESs in various climate conditions.

The country is among ten top countries of the world (8^{th} place) by the potential of hydro energy. Prior to collapse of the USSR, Tajikistan had built 15 HPPs with the total installed power of about 5 GW. At present, for technical reasons, the total installed power of HPPs makes about 3.5 GW. The hydro nodes are used not only to generate electricity, but also for irrigation purposes.

In 2009, the President signed a Decree "On Additional Measures of Energy Saving". In 2011, it served the basis for the "Programme of Efficient Use of Hydro-Power Resources and Energy Saving for 2012-2016". The Programme indicates such directions as a broad use of renewable and alternative energy sources.

Among other programmes adopted by the government of Tajikistan and having relation to

the development and use of RESs, the following ones should be noted:

- The "Complex Targeted Programme of Using RESs of Small Rivers, Sun, Wind, Biomass and Geothermal Sources for 2007-2015" (31.01.2007). The Programme assumes the works in the following directions:
    - Designing, creation, research and introduction of promising systems of renewable energy,
    - Manufacture of experimental prototypes of RES installations,
    - Building the production base for manufacturing assemblies and parts for installations and systems of renewable energy,
    - Training of highly qualified specialists in the area of renewable energy, etc.
- The "Long-Term Programme of Construction of Chain of Minor HPPs in 2009-2020"; the tasks of the Programme are as follows:
    - Utilization of hydro-power resources of small rivers and creation of the respective infrastructure,
    - Elaboration of the Feasibility Study for construction of minor HPPs,
    - Attraction of foreign and local investors for construction and reconstruction of minor HPPs,
    - Definition of the demand/generation balance of electricity in hard-to-reach dwelling settlements of the republic.

  The above long-term Programme of construction of minor HPPs consists of three stages:
  1. The first stage of three years (2009-2011) assumed construction of 66 minor HPPs with the total installed power of 43530 kW;
  2. The second stage of 4 years (2012-2015) – 70 HPPs with the total installed power of 32,850 kW; and
  3. The third stage of 5 years (2016-2020) – 53 HPPs with the total installed power of 26,801 kW.

  The legal and organizational bases of the use of RESs are defined by the Law of the Republic of Tajikistan No. 587 "On the Use of Renewable Energy Sources", adopted on January 12, 2010. Its adoption has accelerated the commissioning in the country of minor HPPs and use of the solar and wind energy; and improved the conditions for attracting foreign investments into the energy sector of the country.

Turkmenistan

The nature has granted Turkmenistan with the huge reserves of natural gas – the main source of energy for the country. It is surely one of the reasons of the absence of any use of RESs in the fuel-and-energy balance of the country.

However, the country's leadership understands the topicality and prospects of developing RESs. By initiating large-scale reforms in sciences, President of Turkmenistan Gurbanguly Berdymukhamedov has highlighted the alternative energy as one of priority directions of progress.

At present, the country is completely covering the domestic demand for the electric power by the use of own generating facilities.

In 2012-2013, the country developed the "National Strategy of Turkmenistan on Climate Changes", according to which an "Action Plan" will be drafted, containing measures both to counteract climate changes and to adapt the sectors of the country's economy to the respective changes. It is assumed that the Plan will cover all the branches of the economy; however, the accent will be made on its key segments – industry, transports, and housing and utilities. The following are the priority directions:

- Introduction of energy-efficient and energy-saving technologies;
- Development of the sphere of RESs;
- Technological modernization with the aim to ensure the future progress and competitive strength of the economy.

The energy potential of RESs in Turkmenistan is assessed at the level of 110 billion TOE per year. The most promising RESs are the Sun and wind.

In June 2009, the Cabinet of Ministers of Turkmenistan made practical steps to set up the structural subdivisions in the Academy of Sciences in the sphere of wind energy. The performed projects are mainly oriented for the future. At the same time, the remote regions of Turkmenistan need the practical utilization of the solar energy for local needs already today. 80% of the territory of Turkmenistan is covered by deserts and mountains. This territory is inhabited by about 10% of the population; the farms here are engaged in distant-pasture cattle tending. Naturally, it is not expedient to lay individual gas pipes or power line to every small farm. From the economic, environmental and investment positions, it is better to make use, in these regions of the country, not the imported fuel, but RESs.

The duration of sun shining in Turkmenistan makes 300 days per year – almost all the year round. In the pre-Caspian area, the wind velocity is sufficient for the operation of wind power plants all the year round. Thus, the country has a powerful potential of renewable energy, which is reasonable for using in the desert and mountains, as well as in the oasis area.

On February 24, 2010, at the international scientific conference "Issues of Using Alternative Energy Sources in Turkmenistan", the President of Turkmenistan stressed the priority of development of the alternative energy. With the support of the Supreme Council for Sciences and Engineering under the President of Turkmenistan, the Scientific and Production Association (SPA) "Gyun" has developed a strategy for RESs.

Uzbekistan

Uzbekistan has an essential potential of RESs, where about 99% takes the solar energy. At present, the share of RESs makes only about 1% of the total country's consumption of energy.

The analysis conducted within the framework of the studies of the local Centre for Economic Studies, has shown that the main problem that hampers a broad use of the renewable energy in the country and attraction of foreign direct investments into the process is the absence of the normative-legislative base, which could set up stimulating conditions for replacement of traditional fuels for renewable ones in the conditions of the higher unit production cost of the latter as compared with traditional energy sources.

On March 1, 2013, the President signed a Decree of the Republic of Uzbekistan "On Measures of Further Development of Alternative Energy Sources". One of the main initiatives of the Decree is the proposal to draft a bill "On Alternative Energy Sources".

The programme, aimed at modernizing the electric power sector in 2009-2013, approved by the Resolution of the Cabinet of Ministers of the Republic of Uzbekistan of 13.02.2009, gives an important role to the use of non-traditional and renewable energy sources.

With the aim to advertise and broadly introduce RESs, the State Committee of Nature of Uzbekistan has launched and operates a specialized Scientific and Implementation Centre "Ecoenergy".

2. Implementation of national programmes by types of RESs

Sector of hydro energy

For decades, the development of the hydro power industry has been traditionally given a great attention in Tajikistan, Kazakhstan, Kyrgyzstan and Uzbekistan.

Kazakhstan

By the stock of hydro-power resources, Kazakhstan is in the third place in the CIS, behind Russia and Tajikistan. In the balance of the installed power of the Kazakh power grids, HPPs make

12.3%.

In the years to come, they plan to realize several major projects of HPPs: the Moinak HPP with the installed power of 300 MW; the Kerbulak HPP – 49.5 MW; and the Bulak HPP – 68.25 MW.

In accordance with the 2010-2014 State Programme of Boosted Industrial-Innovation Development, the republic plans to commission – by 2015 – new minor HPPs with the total installed power of over 100 MW and planned output of electric power of 300 million kWh.

The technically available potential of minor HPPs makes about 8 billion kWh. The conducted studies show that it is potentially possible to realize at least 480 projects of minor HPPs with the total commissioned power of 1868 MW.

Kyrgyzstan

The utilization of the hydro power industry potential of Kyrgyzstan is the main targeted strategic direction of the development programme of the country's energy sector.

In total, the national energy system operates 20 electric power plants with the total installed power of 3786 MW; the power of HPPs makes 3070 MW and two CHPs with the power of 716 MW. The average annual generation of electricity makes 12-15 billion kWh. The basis of HPPs is made up of the chain of the Toktogul HPPs with a powerful water body, regulated for many years – the Toktogul Reservoir having the capacity of 19.5 billion cubic meters of water, which provides Kyrgyzstan and the neighbouring countries of central Asia not only with electricity, but also with water to irrigate the main agricultural crops.

Today, the sector of minor hydro energy is a major direction, intended to be developed by the government of the Kyrgyz Republic with the aim of sustainable supplies of the electric energy to consumers of the north of the country and to decrease the emission of greenhouse gases.

For example, in the basin of the Juuku River, 5 minor HPPs can be built with the total power of 6 MW. There are dozens such rivers in the Jeti-Oguz, Aksui, Tyup and Ton Regions. According to the Association of RESs of Kyrgyzstan, the use of the hydro power industry potential of small rivers of the Jeti-Oguz Region can cover the demand of the region of electricity by 70%.

Tajikistan

According to the "2012-2016 Programme on Efficient Use of Hydro-Power Resources and Energy Saving", the generation volume of electricity by minor HPPs of Tajikistan under a complete utilization of the hydro-power resources of minor rivers can reach 184.46 billion kWh per year under the installed power 21,057 MW.

The major place in the above Programme is given to the use of the hydro power resources of the major, medium and minor rivers of the republic, such as Vakhsh, Panj and Zeravshan. Their resources are estimated as 407.9 billion kW. The use of the basin of the Vakhsh River is considered in nine stages with the following hydro nodes: Rogun, Shurob, Nurek, Baipazin, Sangtudin-1, Sangtudin-2, Basic, Drop and Central. Seven HPPs are already in place and operate, while two more (the Rogun and Shurob ones) need to be built. The hydro energy potential of the Panj River is assessed as 119 billion kWh, and of its basin – as over 150 billion kWh.

With the country's technically available potential of hydro resources of 202 billion kWh, the potential of minor HPPs makes additional 18.0 billion kWh. Tajikistan has 947 small rivers with the total length of 28,000 km. The development of the minor hydro power industry will contribute to decentralization of energy systems, which allows solving the problems of energy supply of the hard-to-reach rural areas.

As of August 2013, Tajikistan had 305 minor HPPs with the total installed power of 26.4 MW; by the end of 2013, they plan to commission some 5-8 minor HPPs.

In 2012, the country's minor HPPs produced about 45 million kWh, under the overall generation of electric energy in the country of above 14 billion kWh.

In the recent 5 years (2007-2011), with the aim to ensure the national energy security, the Government of Tajikistan has realized the following investment projects:

- Construction and commissioning of the Sangtudin-1 HPP (the installed power of 670 MW) and of the first unit of the Sangtudin-2 HPP (with the power of 220 MW);
- According to Resolution of the Government of the Republic of Tajikistan of February 2, 2009, No. 73 "On Long-term Programme of Construction of Chain of Minor HPPs in 2009-2020", they have built and commissioned 70 minor HPPs with the total power of over 22 MW (11.6 million US dollars).

By 2016, the country plans to implement – both for its own funds and attracted funds of international financial institutions – the projects of reconstruction of the Nurek HPP (300 million US dollars), the Kairokum HPP (126 MW, 127 million US dollars), the chain of Vakhsh HPPs (250 million US dollars), and the chain of Varzob HPPs (40 million US dollars).

Turkmenistan

The territory of the country is crossed by major trans-border rivers Amu-Darya, Murgab, Tedjen, Etrek and 20 smaller rivers, flowing down from the northern slopes of Kopetdag. The largest river is Amu-Darya, which supplies about 95% of the country's water demand. It flows on the flat part of the territory of Turkmenistan for 1000 km. The building of special dams here is inexpedient. The building of HPPs in the beds of other rivers (Murgab, Tedjen and Etrek) is economically unreasonable, because these rivers are shallow. The fast-flowing minor mountainous rivers are nicely fit for small hydro turbines with the power of 0.5-2.0 kW for supplying energy to individual consumers.

Uzbekistan

The resources of the 650 rivers flowing across the territory of Uzbekistan, numerous irrigation canals and reservoirs are providing a huge potential for building minor HPPs.

The overall gross theoretical hydro-energy potential of the rivers of Uzbekistan is estimated as 88.5 billion kWh per year. The technical hydro-energy potential of the republic is assessed as 27.4 billion kWh per year, of which currently only 6.28 billion kWh, or about 23%, is used.

On September 5, 2012, the President of the Republic of Uzbekistan issued his Resolution No. R-3902 "On Setting Up Working Group for Development of the Programme of Development of Alternative Energy Sources". The Working Group is prescribed to draft the above Programme for 2013-2017.

The 29 HPPs of the State Joint-Stock Company (SJSC) "Uzbekenergo" with the installed power of 1.4 million kW are mainly united into chains of HPPs and operate by using the direct water flow.

Apart from the HPPs, working in the system of the SJSC "Uzbekenergo", the republic also has HPPs belonging to the Ministry of Agriculture and Water Economy. Their power makes 433.6 MW. Six more plants are in construction; the largest one is near the Tupolang Reservoir with the power of 175 MW and the output of 514 million kWh; its first phase with the power of 30 MW was commissioned 2006

The Ministry of Agriculture and Water Economy has designed and is implementing the "Development Programme of Hydro Power Industry", which assumes to build 15 new minor HPPs with the total power of 420 MW for the production of 1.6 billion kWh/year.

Wind energy sector

Kazakhstan

By its geographical and meteorological conditions, Kazakhstan is a favourable country for a

large-scale use of the wind energy. The economically possible potential of the wind energy in Kazakhstan makes 3 billion kWh per year. The studies conducted within the framework of the UNDP project on wind energy show the presence in a number of regions of Kazakhstan with the total area of about 50,000 sq. km, where the average annual wind velocity is above 6 m/s. It makes them attractive for the progress of wind energy. The greatest potential belongs to the wind power resources of the Djungar Corridor (17,000 kWh per sq. m). The promising regions for the wind energy are also the Shelek Corridor, the Akmolinsk (Ereimentau) and Jambyl (Korday) Regions and other areas.

They have compiled the wind atlas of Kazakhstan and studied 10 sites for building wind energy parks.

In order to cope with the wind energy potential, the Ministry of Energy and Mineral Resources of Kazakhstan has drafted, with support of the UNDP, the Programme of Development of Wind energy in the Republic of Kazakhstan till 2015, with Prospect till 2030; the Programme assumes to build WPPs with the power of 250-300 MW by 2015, and up to 2000 MW – by 2030. These WPPs will generate up to 1 billion kWh of electricity by 2015, and up to 5 billion kWh by 2030. The information about the wind projects can be found on the website http://www.windenergy.kz/.

In March 2011, the Jambyl Region of Kazakhstan began implementing major projects – the Janatass (400 MW) and Shokpar (200 MW) wind energy complexes (WECs). The total investments into construction will make about 1 billion US dollars.

By 2014, with the support of the country's budget, it is planned to build WECs in the following regions:

- The Shelek Corridor with the installed power of 51 MW;
- Jungar Gate (50 MW at the first stage);
- Ulan – Eastern-Kazakhstan District (24 MW);
- And some others.

The supposed districts for placement of the first WPPs include Astana, the Akmolinsk Region, the Jungar Gate and the Shelek Corridor – in the Almaty Region. It is planned that at the first stage the generated electric power can make 50-100 MW.

The following directions of the wind energy are promising for the Republic of Kazakhstan:

- Autonomous WECs of small power: 2, 5, 10, 20, and 100 kW for powering individual objects;
- Medium-power WECs of 200-800 kW for powering distributed loads in the territories with low population density;
- Energy complexes with high-power units – 1600-5000 kW for using in synchronized energy systems.

In the markets, minor WECs have a very high cost per unit of power as compared with high-power units, because of the need of accumulation batteries, automation systems and individual converters. Nevertheless, this is an independent the energy sector; and the demand for such equipment is high, since there are consumers, who need reliable supplies, and there are vast territories, not covered by centralized sources of energy.

Tajikistan

As calculated by experts, in Tajikistan, the potential of wind energy reaches about 25-150 billion kWh per year, and in general, is comparable with the technically available hydro potential.

Among the dwelling settlements, without account of mountain passovers, the most promising are Khudjand, Kairakkum, Faizabad and Murgab, where WECs can be used for generating electricity, lifting water, milling grains, etc. The average annual wind velocity in these regions reaches 5-6 m/s. At mountain passovers, the WECs can be used for powering meteorological stations.

Thus, the wind energy sector in Tajikistan has a local value, that is, its use is reasonable only in particular geographic areas. With account of the efficiency factor of WECs and the ease of locat-

ing them, the technically feasible potential makes about 30 million kWh/year. The strongest winds are met in high regions, in open reliefs (Fedchenko Glacier, Anzob Passover, etc.).

Turkmenistan

Turkmenistan is characterized by a high potential of the wind energy – 640 billion kWh per year.

About 40% of the territory of the country is favourable for using the wind energy. The best conditions are observed in the western and north-western regions of the country, including the pre-Caspian zone. The wind velocities of over 4 m/s are dominating. In the northern shore area of the pre-Caspian zone, the specific power of the wind flow is rather high, reaching about 110-135 W/m^2. A high level of the wind energy potential is characteristic for the Balkhan-Kopetdag Corridor – over 150 W/m^2. In the central part and up to the northern border, we see the dominance of the specific wind power of up to 100 W/m^2. In general, the technically feasible potential of the wind energy can be assessed as 5.5 billion TOE per year.

However, at present, the country has no operating WPPs.

Uzbekistan

In Uzbekistan, until now, the wind was not used for the electric power generation. By experts' estimates, the potential of the wind energy in Uzbekistan is assessed as 2.2 million tons of oil equivalent (TOE). According to the SJSC "Uzbekenergo", the most favourable areas for building WECs in the country are the Bukhara, Navoi, Kashkadarya and Tashkent Regions, and the Autonomous Republic of Karakalpakstan.

The SJSC "Uzbekenergo" and the Company "Xian Electric Engineering Co., Ltd." have signed a memorandum of understanding on development of wind energy in Uzbekistan. The Chinese party is ready to investigate the wind potential of the republic with providing the Feasibility Study of construction of wind energy parks. The working groups are already choosing the best locations of wind turbines. In the settlement "Yubileiny", Bostanlyk District of the Tashkent Region, the Chinese Company is finishing the construction of the first experimental wind energy unit for the power of 750 kW. In future, the "Uzbekenergo" plans to launch a whole park of wind energy installations with the estimated cost of 250 million US dollars and the power of 100 MW, which will allow generating 170 million kWh of electricity.

Solar energy, including photovoltaic

According to the European Photoelectric Industry Association (EPIA), the total power of solar units installed in the world has surpassed a meaningful threshold of 100 GW. In 2012, the overall power of solar energy installations went up by 31 GW; and in the EU it reached 70 GW. In Italy, solar cells are already supplying about 7% of the total consumed electricity, in Germany – 6%, and in Bulgaria, Czechia, Belgium and Spain – 3% each. In 2012, the EU installed new photoelectric cells for the total power of 17 GW. About half of this surplus (8 GW) was ensured by Germany. For comparison: the total power of European wind energy went up during the same period by 12 GW, and that of the gas power plants – by 5 GW.

The use of solar energy in the countries of Central Asia is insufficient, in spite of favourable climate conditions, especially in Uzbekistan, Tajikistan and Turkmenistan. The solar energy can be used not only to generate electricity, but to produce heat, which offers a possibility of point-wise introduction of solar installations, including in the regions, located remotely from the centralized power and heat supplies.

Kazakhstan

Kazakhstan has some 2500-3000 sunny hours per year. The potentially possible generation of solar energy is assessed as 2.5 billion kWh per year. In late June 2012, a solar power plant (SPP) was commissioned in the aul of Sarybulak, Almaty Region.

Till 2015, it is assumed to commission solar installations with the total power of 91 MW.

Kyrgyzstan

The use of solar photoelectric converters for generating electric power is one of the most promising and rapidly developing spheres. Kyrgyzstan possesses a unique chance of a fast progress in this direction and entering the international market thanks to two major factories, involved in the production and processing of silicon (JSC "Kristall" and the JSC "KKhMZ") – the basis for producing solar photovoltaic cell (PVCs). However, today, these systems are not yet competitive against the traditional energy systems. One of the main restraints is a high cost of polycrystalline or monocrystalline silicon.

Tajikistan

The overall duration of sun shining in Tajikistan makes from 280 to 320 days per year. Estimates show that 60-80% of the demand of the population of the country can be covered during 10 months of the year by the solar energy.

However, the country's huge potential of solar energy is practically unused. According to the Physical-Technical Institute of the Academy of Sciences of the Republic of Tajikistan, the country could satisfy its electricity demand by 10-20% by the solar energy.

Turkmenistan

The country's potential of the solar energy is assessed as 1.4 billion TOE per year. The country has 300 sunny days per year. In the vast territory of the country the average annual intensity of solar radiation makes about 700-800 W/m^2, which is equivalent to the arrival of the power of about 2000 kWh/m^2 per year. The annual energy potential of solar energy is assessed at the level of 110 billion TOE.

Uzbekistan

The gross potential of solar energy of Uzbekistan is assessed as 50,973 million TOE, which makes 99.7% of the total gross potential of all the RESs, studied so far in the territory of the republic; the technical potential makes 176.8 million TOE, that is, 98.6% of the total technical potential of RESs. The annual energy of solar irradiation, falling on the territory of Uzbekistan, by its absolute value is higher than the energy potential of all the country's prospected resources of hydrocarbons. At present, only 0.6 million TOE of solar energy is used (0.3% of the technical potential).

President of Uzbekistan Islam Karimov has approved, by his Decree, the proposal of the Ministry of Economy and Ministry of Finance of the Republic of Uzbekistan, and of the SJSC "Uzbekenergo" about implementing a project of constructing a solar photoelectric plant with the power of 100 MW in the Samarkand Region. The SJSC "Uzbekenergo" was instructed to draft – within three months – and bring for approval the Feasibility Study and tender documents, having defined the sources of funding of the project with a preliminary cost of about 500 million US dollars with attraction of a privileged loan of the Asian Development Bank (ADB) and the Reconstruction and Development Fund of the Republic of Uzbekistan.

In 2012, the "Uzbekenergo" began designing a solar power plant in the Tashkent Region with the power of 50 MW and output of 110 million kWh of electricity per year. The project for 250 million US dollars will be credited by the ADB in the sum of 90 million US dollars and by the own funds of Uzbekistan. In future, it is planned to draft – jointly with the ADB – a Feasibility Study for

six more similar projects for the total installed power of 2 GW.

Use of biomass

Kazakhstan

In Kazakhstan, forests cover over 10 million hectares that makes 4% of the total territory of the country; of them, 4.7 million hectares are covered with saxaul. In 1990, the volume of timber procurement in the country made about 3 million m^3. The volume of wastes from tree felling and woodworking at factories, as well as the firewood, makes almost 1.3 million m^3, or 1 million tons. Thus, the energy potential of wood wastes makes over 200,000 TOE.

Straw of cereal crops is the most important renewable energy resource in the Republic of Kazakhstan. In 1990, the straw output made almost 37 million tons. If we assume that 20% of this volume can be used for energy purposes, the generation of power will make over 87 GW. The most promising projects of using biomass for energy purposes are associated with straw.

Another potential direction is the use of biogas. Kazakhstan has pretty plenty of cattle and poultry. The potential of producing methane from the cattle manure makes over 85,000 tons, or over 52,000 TOE. Every year, the country can have up to 35 billion kWh of electric and 44 million Gcal of heat energy through treatment of agricultural wastes. The potential of producing methane from treating communal wastewaters makes about 3 thousand tons, or almost 1.8 million TOE.

Kyrgyzstan

The use of biomass is considered as the second priority of using RESs in Kyrgyzstan. The total volume of collected manure in the republic makes over 7 million tons per year. In total, Kyrgyzstan has installed over 100 biogas units (BGUs); they are mainly in the Chuisk and Issyk Kul regions. BGUs can produce from 20 to 400 cubic meters of gas per day, depending on the loaded raw materials. The main enterprises, which introduce biogas units, are the Public Fund "Fluid", which has manufactured 24 BGUs with the reactor volume from 5 to 360 cubic meters, which can produce from 20 to 360 cubic meters of gas (methane) per day, as well as the JSC "Zhaz" and the Centre of RES problems. The "Fluid" has already shipped reactors with the power from 5 to 360 cubic meters into the agriculture of its own country, and to Kazakhstan, Uzbekistan, North Korea, Croatia and Russia. The cost of a BGU varies depending of the volume of the reactor: a BGU for 25 m^3 costs 16,500 US dollars; for 50 m^3 – 23,500 US dollars, and for 100 m^3 – 36,000 US dollars. The payback period of reactors of capacity of 25 m^3 is 2 years; of 50-100 m^3 – 1 year.

Tajikistan

Out of the known ways of obtaining biological fuel, the most acceptable and promising in the conditions of Tajikistan is obtaining biogas through anaerobic fermenting of agricultural wastes, including cattle wastes and manure. Tajikistan has over 20 animal complexes with 400-800 animal heads in each.

Experts have calculated that under efficient use of organic wastes from cattle complexes and from the animals kept by private households of Tajikistan, the volume of biogas can be obtained that will make about 8% of the volume of natural gas (1 billion m^3), bought annually by Tajikistan.

The works aimed at obtaining biogas are conducted at the S. U. Umarov Physical-Technical Institute of the Academy of Sciences of the Republic of Tajikistan. As particular examples, we can note the BGUs, made under direct consultations of the Institute at individual farms of M. Odinaev from the collective farm ""Zargar", Vakhdat District, and N. Makhsumov from the collective farm "Varzob", Rudaki District. These units were made with the financial support of the International Organization INTAS. The units look like a metal vessel with the volume of 10 m^3; 2/3 of the volume is filled up with an active mass – non-fodder wastes of plants and cattle manure.

Uzbekistan

The potential of biomass is assessed in the volume of 3500 MWh. The main raw materials for producing the biomass are cotton-plant stems (2-3 million tons per year), bulrush (10-15 million tons per year), solid communal wastes (30 million m^3 per year) and wastes of agriculture (100 million cubic meters per year).

Geothermal energy

Kazakhstan

The potential of the geothermal water resources of Kazakhstan is assessed as 520 MW without using heat pump units, or 4300 MW when using heat pump units. The confirmed resources, fit for electric power generation (Panfilov Field), make 12 MW for the Cretaceous aquifer.

Kazakhstan has some experience of using the geothermal energy. Thus, the geothermal deposit Kaplanbek (near Chimkent) with the temperature of 80°C is used for heating dwelling houses. Close to Almaty, a geothermal source with the temperature of 80-120°C is used for heating greenhouses in winter and air conditioning in summer. Since 2007, Kazakhstan is not using its geothermal resources for electric power generation.

The most promising geothermal reservoirs were discovered in the Cretaceous formations in the south and south-west of Kazakhstan. The main geothermal regions are as follows:

- Near the cities of Chimkent, Dzhambul, Kyzyl-Orda; depth of 1200-2100 m, temperature 45-80°C;
- The valley of the Chu River and the north of the Kyzyl Kum Desert; the geothermal gradient is 35°/km, temperature 80-90°C;
- The valley of the Ili River (Panfilov Field); Cretaceous aquifers – depth 2000-3500 m, temperature 90-115°C;
- Vicinities of Almaty; depth 2500-3500 m, temperature 80-120°C.

Essential reserves of hot water were also found in the Taldykurgan Region – 90°C, and on the Ustyurt Plateau (near the shore of the Caspian Sea) – 120°C.

Tajikistan

Tajikistan has an essential geothermal potential. The data about the most studied sites are presented in Table 3 below.

Table 3. Distribution of geothermal sources of Tajikistan

Area	Region	Debit, l/s	Temperature, °C
Khavatag	Istaravshan	28-47	55
Kalaizanku	Djirgital	-	35
Karatag	Dushanbe	0.2	23
Shaambary		11-15	-
West. Luchob		1.4-3	45
Komsomolskaya		1.4-13.6	39-64
Andygen	Vakhdat	07.-13.9	32-52
Ordzhonikidze-Abad		44	45.5
Gumbulak		0.4-14	38-42
Rengan	Rudaki	14	42
Karasyrt		22.5	40

Dangara	Khatlonskaya	20	35
South. Degimakhmud		-	66.4
Tebolay		-	115
Djilandy	Badakhshan	30	60
Tokuzbulak			

Turkmenistan

Turkmenistan has a huge potential of geothermal water (GTW). The prospects of using thermal water in Turkmenistan are considered, as a rule, in three directions:

- For medicinal (curative) purposes;
- As sources of chemical raw materials; and
- For heat and energy purposes.

The prospects of economically profitable use of the deep heat of entrails are defined by the character of temperature distribution at the depth of 3000 m, which reflects the unique nature of the geothermal regime of individual regions of Turkmenistan. By the type of the geothermal regime, the regions are identified, which correspond to particular geotectonic elements: the Kara Kum (epi-Hercynian platform), the Kopetdag (orogenic geosyncline) and the Western-Turkmenian (inter-mountain geosyncline depression). Within these regions, the temperature at the depth of 3000 m is within 80-110°C.

3. Overview of the developed technologies and renewable energy equipment produced in Central Asia countries. Their effectiveness

Kazakhstan

The main technical areas of renewable energy development in Kazakhstan are the creation and exploitation of its own wind turbines and solar panels to generate electricity.

Vertical axis wind turbine (VAWT). VAWT concept was developed by Kazakh and Russian experts based on the study of wind as an energy carrier for its main parameters - speed and direction with the continuous change of these parameters over time called ripples, waftages and squalls.
Vertical axis wind turbine (VAWT) is characterized by a set of advantages listed in Note 1.

Note 1: Operating wind speed of 3 m / s and higher, without limitation (tested up to 45 m / s), high starting torque, low energy use and high wind speed impulses and ripples, and increase of power output is adequate to the growth of the wind speed, work with winds of any direction without adjusting operations, guiding unit, concentrating modular design of the wind-mechanical part; fast commissioning, widely available construction materials, recycles sudden impulses and high-frequency pulsations of the wind; rotor rotation starts independently, increasing the stability of the structure with increasing of rotational speed due to the gyroscopic effect; low noise level and the possibility of location in close proximity to the consumer, eliminating the need to build expensive transmission lines, ease of installation and maintenance; original generator with possibility of simultaneous counter-rotation of the rotor and the stator, and the power generation at low wind speeds; high survivability of VAWT at critical temperatures , snow storms and glaze; possibility of creating multirow wind dams of high power; high operational properties and stability as the generator and other equipment located on the ground level for the safety of animals and birds; possibility of changing the diameter, height and number of modules required for the turbine power in accordance with the properties of wind; possibility of independent rotation of the turbine rotors, located in different speed and direction of air flow zones, high utilization of wind power, especially at low speeds ; possibility of work independently or in parallel with other sources of double current, solar inverters, battery, diesel stations or grid; electric generator and automatic of original design with high efficiency, which is coordinated with wind-mechanical part of wind-power station and is connected directly without a gear unit with the rotor shaft;; safety caused by the

lack of rotating blades, high reliability design.

Kazakh and Russian companies jointly develop, manufacture and commission complex energy systems CES VAWT model range 2 ÷ 5 ÷ 10 ÷ 20 kW. They are manned by solar inverters and batteries, smart chargers and protective equipment required for autonomous facility, providing a reliable supply of energy to consumers.

In Jungar Gates 2 kW CPP VAWT supply Transtelekom facilities in extreme wind and weather conditions: temperature to - 40 ° C, wind speeds up to 45 m/s.

On the territory of the Republic of Kazakhstan more than 40 CPP VAWT of different capacity are successfully used forming testing ground for new energy IP Country in a wide range of climatic conditions.

Production of solar panels (PV). In October 2010, Kazakhstan (Kazatomprom) signed an agreement with France (Commissariat for Atomic Energy and Alternative Energy Sources) on the project KAZPV on the establishment and development of silicon solar industry in Kazakhstan. The basis for its implementation is the presence in the depths of Kazakhstan of huge reserves of high-purity quartz. The parties signed a Memorandum of Intent for joint R & D programs in the field of new materials for different types of renewable energy sources. It was also reached an agreement on transfer of technology CEA, which will allow Kazakhstan to maximize its potential to create new sources of energy. France, responsible for the transfer of technologies and knowledge is one of the world's top institutions in the field of renewable energy – The French National Solar Energy Institute (INES). This center has the most advanced technology in the field of photovoltaics.

In 2010 between JSC Kazatomprom, TOO MK Kaz Silicon and the French CEIS an agreement on the development of technologies in Kazakhstan, solar energy and the creation of a fully integrated production line for the production of photovoltaic panels was reached. According to the agreement, at the first stage the French Institute for Solar Energy INES of the Committee on Atomic Energy in France confirmed the quality of the silicon, produced by TOO MK Kaz Silicon.

The design capacity of the enterprise for the production of these panels will be 60 MW with extansion up to 100 MW. Completion of the construction is scheduled for December 2012, the output to the production capacity is scheduled for the first quarter of 2013. The production cycle of the project consists of four inseparable parts:

- Quartz mining on Sarykulsk field Almaty region (TOO Quartz, Ushtobe);
- Creation of metallurgical Kazakh silicon production (TOO MK KazCilicon, Ushtobe, Almaty region.)
- Construction of the plant for the production of photovoltaic plates - TOO Kazakhstan Solar Silicon (it was called before Bergstein Construction, Ust-Kamenogorsk);
- Factory assembly of PV modules - TOO AstanaSolar.

Preliminary cost of the project - 39,73 billion KZT (about $ 270 million), 48% of which is for the purchase of equipment.

Kyrgyzstan

The Kyrgyz Scientific and Technical Center Energy for more than 40 years worked on the creation of micro and small HPPs. Developed by the institute small HPPs were installed in Cuba, in Mongolia.

There are the following capacities in Kyrgyzstan:

- 3.5 kW - 30 kW small HPPs can be produced at the plant OREMI.
- The company producing biogas plants. The Public Fund Fluid has already made 24 biogas

plants (100, 150, 250 m^3).

- Production of thermal collectors for households;
- Biogas plants with reactor 5-360 m^3 (total installed more than 100 biogas plants);
- Heat pump units (TNU-3, 12.15);
- Technology of production of cheap silicon for solar cells

The country has industrial plants that can produce solar panel batteries. There are 2 plants that can produce monosilicon of polysilicon - Orlovsky and Tashkumyr plants.

In Kyrgyzstan there are home-grown technologies that use solar, wind, biomass, small streams energy.

For example, the project Kun launched production of solar thermal panels for water heating needs and cooking for the rural population. This production is in Karabalta.

There is a scientific research on wind energy plants that can operate at wind speeds of 2 times lower and give usual power for wind turbines.

Environmental movement BIOM is working on a development in the field of renewable energy that will be profitable for Kyrgyzstan. Several of the developed hardware were brought to the serial industrial production and started their practical use in various industries of the country. These solar thermal collectors and various modifications of the solar plants, various types and sizes of micro hydropower plants (micro-HPP), household biogas plants.

A demonstrational micro HPP was commissioned this year in August in Bishkek (know-how together with Korean partners). A generator and a turbine are placed inside the pipe. This technology is 20-25% cheaper than the traditional one. Next year there are intentions to apply it in the Issyk-Kul region. The Association of RES plans to disseminate these renewable energy technologies, the main metal structures will be manufactured in Kyrgyzstan.

Solar collectors KSLT-22 and micro hydropower plants (micro-HPP-0,9) was mastered by JSC ZNVOD.

Solar absorbers of bimetal were mastered by JSC KAM and collectors with the specifications of international standards were mastered by JSC Electroterm. At the same factory was mastered the production of solar hot water systems either seasonal or year-round operation.

Turkmenistan

Scientists and engineers of the Scientific and Production Association GUN of Turkmenistan Academy of Sciences has successfully implemented a number of projects for the development and testing of the experimental plants. Experimental wasteless, fully autonomous helio complexes for sheep-breeding were built. Two complexes are located in the depth of the desert and removed from the cultural area of 100 and 230 kilometers respectively. The structure of each includes wind diesel unit, hydraulic system to raise salt water and a park of distilling installations, as well as a house, locked with the solar greenhouse which allows the use solar energy for heating. Comprehensive wind-solar autonomous installations of this type are capable to provide a team of shepherds with electricity, hot and cold drinking water, as well as keep thousand heads of sheep all year round. Their main value is that these complexes can be constructed anywhere in the desert where there are

rich pastures.

Uzbekistan

The main scientific and innovation company of Uzbekistan is the Institute of SPA Physics-Sun of Uzbek Academy of Sciences.

Towards implementation of renewable energy sources the following facts should be mentioned:

- February 16, 2012 signing of the Agreement on the Establishment of the International Institute for Solar Energy with the Asian Development Bank (ADB);
- Creation of the Navoi Free Industrial Economic Zone (Navoi FIEZ) to produce 100 MW PV panels per year; development of 750 kW wind turbines;
- Plan - project of the construction of 100 MW PV plant in the Samarkand region.
- At TSTU were mounted 2 modules of solar plants of 3.2 kW and 1.6 kW and 2 wind turbines of 1.5 kW.
- In 2012, on the basis of the farm Mullah Saidkul, Farish district, Jizzakh region, Ecological Movement created an educational center for renewable energy where were installed pilot plants on solar and wind energy, as well as for the production of biogas.

4. Review of international cooperation in the field of energy efficiency and renewable energy

All over the world there has been an increased interest to use RES in various industries. This is due to changes in the energy policy of the world powers. Transition to energy saving and resource saving production technologies and use of energy, large-scale development and introduction of renewable energy sources are becoming more important.

United Nations organizations and other international organizations pay considerable attention to this problem. Significant EU funds are allocated to works in the field of renewable energy.

An international cooperation is required for a concentration of financial, scientific and human resources for the development and production of renewable energy.

This chapter analyzes the international cooperation of the countries of Central Asia in the field of renewable energy sources and perspectives of cooperation in this area.

Kazakhstan

To Kazakhstan, as the country with a huge potential of natural resources, which develops in the market conditions, attracted the attention of international organizations and foreign businesses.

First of all, international financial donors work in the country. With the support of USAID is executed a project of CTI-PFAN on RES. CTI-PFAN was created to overcome the lack of coordina-

tion between investors, financial institutions and project developers in the field of renewable energy.

The Ministry of Energy and Mineral Resources of Kazakhstan and the United Nations Development Program "Kazakhstan - Wind Power Market Development Initiative" developed a project of the National Program of wind energy development until 2015 with prospective until 2030.

The EU is the single largest investor in Kazakhstan, which accounts for more than half of total foreign direct investments in the country. December 4, 2006 the Republic of Kazakhstan and the EU signed a Memorandum of Understanding on energy issues, under which regular meetings on cooperation are held. So, April 25, 2013 hosted the fifth meeting of experts.

Since 1991, the EU allocated to the Republic of Kazakhstan as a technical assistance more than 130 million EUR on strengthening of energy and transport links, including for the implementation of regional programs with the participation of Kazakhstan. Most of the funds allocated to the programs to provide advice and technical assistance to the Government of Kazakhstan, on the basis of EU best practices in priority areas, including the use of renewable energy.

The participation of the Republic of Kazakhstan in the new large-scale EU initiative "Covenant of Mayors", combining local, regional and national authorities in achieving voluntary commitments to reduce CO2 emissions by at least 20% by 2020 by increasing energy efficiency and introducing renewable energy sources is very important. Two Kazakhstan cities have already signed the Covenant of Mayors.

EBRD supports Kazakhstan within the project KazSEFF with allocated credit line for projects on energy efficiency and renewable energy (75 million USD), implemented via Kazakh banks. Grant support for the project KazSEFF (2.6 million EUR) is carried out with EU funds.

The Republic of Kazakhstan develops bilateral cooperation with other countries in the field of renewable energy, either through the Agency for International Development of countries or directly with the business.

First of all, it should be noted the agreement with the French CEIS - the first joint project of Kazakh-French Technology Transfer Centre for research on the production of photovoltaic modules from Kazakhstan silicon, based on French and European technologies.

Kazakhstan develops cooperation with several Japanese companies. Among them: NEDO (New Energy and Industrial Technology Development Organization), JICA (Japanese International Cooperation Agency) and JAPC (Japan Atomic Power Company). In particular, NEDO identified areas of cooperation for the development of such important areas for Kazakhstan as technologies for the production of thermocouples and solar cells, green technology and energy efficiency, technology for the production of next-generation batteries, water treatment technologies,

June 3, 2010 was signed the Memorandum of Understanding between the Ministry of Industry and New Technologies of the Republic of Kazakhstan and the Korean Consortium - Corea Electric Power Corporation and Samsung C&T Corporation. In 2010 – 2016 in the Republic of Kazakhstan it is planned to implement some projects in the field of renewable energy of installed capacity of 1 GW (950 MW wind-power station; 50 MW solar plants).

The German concern Vestas is considering the possibility to invest about 200 million euros in the construction of wind power plants in Kazakhstan. Currently, the concern developed a business plan for the installation of wind turbines near Astana, Ereimentau and Shelek corridor. Power wind farm is up to 500 MW.

Kyrgyzstan

Kyrgyzstan actively participates in international cooperation with international donors of technical assistance, as well as directly with companies in other countries.

2 cities involved in the Covenant of Mayors

Within the UNDP project "Promotion of renewable energy for the development of remote regions of Kyrgyzstan", UNDP and GEF implement a project "Development of small hydro power plants." The main objective of the project is to accelerate the construction of small hydropower plants, as well as biogas plants, solar water heaters, power plants, wind power plants.EBRD supports Kyrgyzstan under the project KyrSEFF, allocated credit line (20 million USD) for projects on energy efficiency and renewable energy, realized through the Kyrgyz banks. Grant support (6.8 million EUR) under the project KyrSEFF is carried out by resources of te Investment Fund of the European Union in Central Asia (IFCA)

EBRD is implementing the project "Strategic planning of small hydropower development in the Kyrgyz Republic".

In 2008, the German Agency for International Cooperation (GTZ) started to carry out study on the potential of Kyrgyzstan in the field of energy saving and renewable energy sources in order to continue providing technical assistance to the country for the development of investment projects, including those for individuals.

12 biogas plants were installed at the cost of JICA`s grants (Japan International Cooperation Agency).

The public fund Fluid is engaged in the development and implementation of biogas plants. Fluid has already installed reactors from 5 to 360 m^3 in Kazakhstan, Uzbekistan, North Korea, Croatia and Russia.

Tajikistan

Tajikistan has more than half of the water resources of the region and the country is ready to develop mutually beneficial cooperation and integration on water and energy issues with the countries of the region and the world.

Cooperation between Tajikistan and the EU is developing through regional projects: INOGATE, TEMPUS, ERASMUS MUNDUS. The program CAIF is implementing: this is a special EU plan aimed at the creation of a special mechanism for investment in the energy and environment in Central Asia countries. Somonion involved in the Covenant of Mayors.

There is a tendency of bilateral cooperation between the EU and fuel and energy complexof the Republic of Tajikistan. In 2010 the EU Special Representative for Central Asian countries Pierre Morel, being in Dushanbe with the official visit, said that the EU was ready to allocate $ 60 million for the implementation of two large energy projects. It is referred to the reconstruction Kayrakum HPP and construction of some small hydropower plants on the river Surkhob. However, it is still unclear when and by whom the above-mentioned funds will be allocated. Even if the European Union will provide Tajikistan the above amount, it can be argued that the EU move will be dictated only by political considerations.

The Ministry of Energy Industry of the Republic of Tajikistan plans bilateral Tajik-German cooperation in energy and industry, in particular the construction of small hydropower plants in Tajikistan,

establishment of joint ventures for the production of solar cells. The German side suggested to accelerate the modernization of small hydro power plant "Oksu-1" and the construction of a small hydropower plant "Oksu-2" in the Murghab district of Gorno-Badakhshan Autonomous Region. Modernisation and construction of these plants is carried out by the German government grant assistance. In March 2012, the German Fichtner completed preliminary calculations on the feasibility study of the construction of small hydropower plants in Murghab districtby submitting its findings to the company Pamir Energy. This project involves the modernization of HPP Oksu-1 (800 kW) and the construction of HPP Oksu-2 (1000 kW).

Turkmenistan

May 26, 2008 Turkmenistan and the EU signed a Memorandum of Understanding on Energy Issues.

According to the Decree of the President of Turkmenistan Gurbanguly Berdimuhamedov an agreement on new project "Investigation of the possibility of producing silicon for the solar photoelectric converters" was signed. As a result of researches scientists shall develop practical recommendations on obtaining technical silicon from the Karakum sands on an industrial scale. If all the objectives of the project will be achieved, Turkmenistan has a chance to join the ranks of states that have mastered the production of silicon.

The Belgian ENEX is ready to start in Turkmenistan construction of a plant for the production of synthetic polymer - silicone. Belgian side noted that Turkmenistan has all important resources for the establishment of the company for the production of silicon - the main substance of silicon batteries.

In 2009, the Islamic Development Bank allocated funds for the implementation of the project "Investigation of possibilities of the production of silicon for solar photoelectric converters".

Uzbekistan

January 24, 2011 Uzbekistan and the the EU signed a Memorandum of Understanding on Energy Issues.

February 16, 2012 the Government of Uzbekistan and the Asian Development Bank signed a memorandum on the establishment of the International Institute of solar energy in Tashkent, which will allow Uzbekistan to become an international hub of knowledge and exporter of solar technology.

III. Recommendations for the implementation of advanced technologies in the field of energy efficiency and renewable energy sources and strengthening of regional cooperation

1. The main directions of harmonization of national programs for energy efficiency and renewable energy

Central Asia countries have significant potential for energy efficiency and renewable energy. The priority directions in its implementation are determined by the national programs of each country.

As shows the analysis of the implementation of national programs, the potential of little use and planned activities are often not implemented in the specified amounts as scheduled. It causes significant economic damage of each country. Active promotion of technologies to improve efficiency and renewable energy in Central Asian countries would have a positive impact on economic growth rates, living standards, scientific development and technology in these countries.

The information presented in this report has shown that the significant impetus to the implementation of advanced technologies in the field of energy efficiency and renewable energy can provide regional cooperation between the countries of Central Asia. The basis of such cooperation should be:

- cooperation in order to build closed chains (cycles) of the production and use of renewable resources;
- interstate (regional) coordination of the RES participation in national energy systems, energy saving for the energy security of the Central Asia region;
- exchange of know-how, best practices in energy efficiency and renewable energy;
- development of common approaches to the creation of infrastructure for renewable energy and energy efficiency.

The basic element of regional cooperation should be the harmonization of national programs for energy efficiency and renewable energy of Central Asia countries. In our opinion, the main directions of harmonization are:

- Development of common approaches to the structure and content of the national programs in the field of energy efficiency and renewable energy.
- Inclusion in the program of each country of the region of a special section reflecting and evaluating the potential of bilateral and regional cooperation. It is important to specify the technical and economic potential for the realization of this potential, the stages of the national programs.
- In the same section of national programs is useful to determine the appropriate set of joint projects and activities of the two cooperating countries or the countries of the region to realize the potential.
- Critical condition for effective collaboration is the availability of funding. Therefore, the most important area of harmonization is to develop schemes and instruments of cofinancing of joint projects and activities that will be planned in the specified section of the national programs.
- Coordination of enforcement mechanisms, establishing responsibility and monitoring the implementation of joint projects and activities.

Harmonization of national programs should be preceded by harmonization of the relevant provi-

sions and necessary additions of national legislation in the field of energy efficiency and renewable energy.

2. Recommendations for the implementation of advanced technologies in the field of energy efficiency and renewable energy sources

The growth of the share of renewable energy sources (RES) in the fuel and energy balances of industrialized countries has become one of the tendencies of modern economic development, determining its stability. In the advanced countries of the European Union (EU), according to the International Energy Agency (IEA), energy production from renewable energy sources is growing annually by 10-20%.

According to Eurostat, if in 2004, 7.9% of EU electricity was obtained from renewable energy sources, in 2011 the figure was over 13%.

According to the European Council for Renewable Energy by 2040, renewable sources could provide 50% of energy production in the world. In accordance with the decision of the European Parliament the share of renewable energy in the EU energy balance in 2020 should be 20%, in 2040 - 40%.

Energy development in the countries of Central Asia is largely determined by their role in the energy system of the former USSR and by the facilities that were built before its fall down. So, thanks to built in the former USSR powerful cascades of hydropower plants on the mountain rivers of Tajikistan, Uzbekistan and Kyrgyzstan, the share of renewable energy (RE) high and makes more than half and about a third of the energy balance in those countries. While in Kazakhstan and in Turkmenistan, which has rich reserves of traditional energy resources, the use of renewable energy is practically absent (Table 1).

Table 1.

Country	Kazakhstan	Kyrgyzstan	Tajikistan	Turkmenistan	Uzbekistan
percent of RES, %	1,0	28,4	58,2	0,0	1,8

Source: IRENA

Since the 90's, after the fall down of the Soviet Union. the Central Asian states have begun to build their own independent energy policy, a specific place in which is allocated to RES. If not take into account large HPPs (over 30 MW), the amount of electricity from renewable energy sources by the countries of Central Asia, determined by the data of Table 2.

Table 2.

Country	Kazakhstan	Kyrgyzstan	Tajikistan	Turkmenistan	Uzbekistan
percent of RES, %	less than 1,0	less than 1,0	0,07	0,0	1,0

Source: reports of the national experts

According to expert estimates the potential of energy saving and renewable energy in Central Asia is significant and requires its use.

At the moment, the state programs which aim to realize the potential of energy saving and renewable energy sources were developed and adopted in each of the five countries of Central Asia. However, the improvement of energy efficiency in various sectors of the economy and the development of renewable energy are carried out at different rates and in various fields, depending on climatic and economic conditions in these countries.

The analysis showed that the main driving forces in the development of renewable energy in Central Asia countries are:

- Striving for energy security,
- Providing flexibility of national power grid in order to participate in the regional electricity markets,
- Possibility of energy supply in remote regions where there is no electricity infrastructure,
- Reduction of greenhouse gas emissions in accordance with the country's obligations and / or recommendations of the relevant international institutions.

Production of renewable energy in Central Asia is particularly important for remote areas where there are no electric networks. Increased use of renewable energy will have a positive impact on the quality of life of the population, its employment, will contribute to the growth of the economy, science and technology of Central Asia.

However, today despite the government decision making, the pace of development of energy efficiency and renewable energy are obviously insufficient. The solution of these problems in national programs is behind the practical implementation. For example, any major project in the field of renewable energy is not implemented in the republics.

Taking into account the similarity of natural and climatic conditions, economic structures, common borders of Central Asian countries it should be recommended to collaborate and share knowledge and practices in the field of energy saving and renewable energy. It will provide synergistic effects with saved resources.

In recent years, in Central Asia countries a great importance is attached to energy saving in terms of compensation for the lack of generating capacity and/or release of additional volumes of energy resources for export, and the development of renewable energy is seen primarily as a means to prevent climate change and environmental protection, as well as in the framework of energy supply in remote and inaccessible areas. Energy efficiency and renewable energy in the countries is becoming the most important area in the energy sector, as it allows to reduce demand for solid investment in the energy sector.

For the conditions of Central Asia countries the most advanced fields of application of renewable energy sources should be considered decentralized facilities located in remote mountainous and desert areas: farming, cattle-breeding complexes, geological and mining enterprises, road services, hydrometeorological scientific observation stations, radio repeaters, objects of tourist-health centers, pumping stations, forestry and hunting farms, etc.

On the one hand, these countries should improve the efficiency of conventional energy, for example, introducing more efficient combined heat and power units at CHPs, on the other hand they should increase energy efficiency in industry, housing and utilities sector, agriculture, in transport and in social sphere. It is also required the development of renewable energy sources, taking into account the specifics of each country.

General recommendations

A common feature for these countries is the need for additional development of economic incentives for energy efficiency and renewable energy, taking into account a strong competition from conventional energy.

We think it is necessary to develop intergovernmental **Cooperation Strategy for Central Asia countries** in the field of renewable energy and energy efficiency, as well as a **Roadmap** for its implementation.

Both projects should be aimed at the agreed approach formation of Central Asian countries to improve energy efficiency and renewable energy sources and the creation of conditions promoting energy security and sustainable development of Central Asia countries.

The Cooperation Strategy provisions will be the basis for the development and conclusion of international contracts and other international and national regulations of Central Asia as well as international programs in the field of energy efficiency and renewable energy.

The Strategy will be implemented through:

- improvement of the mechanism of interaction and coordination of Central Asia countries (development of financial and economic, regulatory and legal mechanisms of cooperation of Central Asia countries);
- harmonization of Central Asia legislations in the field of energy efficiency and renewable energy and the development of subsidiary legislation;
- harmonization of national energy efficiency programs and renewable energy development
- creation of favorable environment for the development of renewable energy (creation and development of favorable economic conditions in Central Asia countries for joint implementation of projects on effective use of renewable energy);
- development of proposals for the introduction of economic incentives and mechanisms for the development of renewable energy in Central Asia countries (increasing the volume of substitution of traditional energy resources to renewable energy, formation and development of an effective technical and technological basis for the use of renewable energy sources; consideration of possible approaches to harmonization of technical standards and regulations of Central Asia countries using renewable energy, etc.);
- development and implementation of joint projects;
- development and implementation of research programs (development of scientific and technological base and joint research in renewable energy, joint training of specialists in the field of energy efficiency and renewable energy);
- information exchange and knowledge base formation (development of common informational space in the field of renewable energy, study and dissemination of international practice and experience of Central Asia countries in the development of RES; ensure the availability and harmonization of statistics in the field of renewable energy sources).

In addition to general recommendations for the implementation of advanced technologies in the field of energy efficiency and renewable energy, *we will give additional guidance on practical cooperation mechanisms* for cooperation between Central Asia countries to promote renewable energy technologies.

Windpower engineering.

- Taking into account explosive development of windpower engineering in Central Asia it should be recommended to establish on parity terms **joint engineering and consulting center**, which list of services can include:

- feasibility studies development;

- wind speed measurement (it is necessary to have specialized equipment and calculation methods);

- erection;

- lifting works (including the weight of the individual elements of the wind turbine, it is necessary to have a heavy lift mobile crane).

- Taking into account studying and good technical characteristics of vertical axis wind turbine (VAWT) (Kazakhstan) it necessary to consider recommendations for VAWT introduction in Central Asia.

- 750 kW wind turbines (development of Uzbekistan) should be recommended for consideration

Solar energy

Taking into account scientific and technological activities in Kazakhstan and creation, in prospect, a closed-cycle production of solar panels (PV), as well as the existing production capacity to produce solar panels in Kyrgyzstan, Turkmenistan's intention to develop its own engineering and manufacturing base and available in these countries, raw materials it can be recommended to draw up a business plan for the establishment of scientific and industrial holding companies between Kazakhstan, Kyrgyzstan and Turkmenistan for joint development and production of solar panels.

Small hydropower engineering

- It is necessary to study the experience of countries which have production of small hydro turbines (the Czech Republic, Russia, etc.) and make recommendations on the types and capacity of hydroelectric power plants.

- Taking into account that Kyrgyzstan has arranged production of 3.5 - 30 kW small hydropower plants (plant OREMI) (Kyrgyzstan) it could be recommended to consider the implementation of small hydro turbines in the region.

Biomass

- Taking into account the specifics of the development of cattle breeding in the countries of the region, consisting in small cattle farms, it should be recommended to consider the introduction of a biogas plant of the Public Fund Fluid (Kyrgyzstan) with reactor of 5 - 360 m^3.

- Is useful to establish a joint service center on complex service of biogas plants.

3. Determination of joint activities and ways of cooperation of Central Asia countries to introduce advanced energy efficient technologies and renewable energy sources.

Taking into account identified common factors for the development of energy, energy efficiency and increased use of renewable energy, regional cooperation of the Central Asia countries it is reasonable to develop the following areas:

Strategic, institutional and legislative mechanisms

In recent years in the countries of the region the regulatory framework and the institutional structure of energy efficiency and renewable energy were actively formed. Considerable experience of practical policy implementation in this area has been accumulated.

It is important to establish a permanent mechanism of experience exchange in this area, especially on such topical issues as:

- access of independent power producers to the networks of power supply companies;
- issues in tariff regulation;
- measures for the development of technical, scientific and educational potential;
- economic incentive measures, etc.

It is important to analyze the experience and to prepare:

- the draft model law on renewable energy;
- a set of recommendations for the formation of national strategies for the development of renewable energy;
- a set of recommendations for the formation of national comprehensive programs of use of renewable energy, which is closely integrated with national sustainable development strategies.

Economic and financial mechanisms

Economic conditions and financial incentives are important prerequisites for the successful implementation of new technologies.

It is important that the policy aimed to support energy producers using renewable energy sources, systematically provide guarantees to investors in this sector.

The strategy of projects support in the field of energy efficiency and renewable energy should be as simple as possible and ensure low administrative costs. However, it should be flexible to win the market and to ensure cost-effectiveness, as it leads to the gradual decline in prices.

Lack of awareness of potential users of energy efficiency technologies and renewable energy on possibilities of cost effective use and technologies applicable to the the specific conditions prevent large-scale involvement of organizations and enterprises to achieve national goals in this area.

The most of modern renewable energy technologies in the region, are little used (photovoltaic stations, micro-hydro power plants, wind turbines, biogas plants, boilers, biomass, etc.).

Among other things, many enterprises have limited financial resources to purchase imported equipment, and the banking system is often insufficiently involved in the financing of renewable energy projects. Potential investors and project owners should also have more information on the criteria, rules, and the amount of possible financial support.

It is important to analyze the experience of economic incentives for energy efficiency and renewable energy development in the region, to compare it with the experience of most developed countries and to prepare a set of recommendations to incorporate the most effective measures in national legislation in the field of regulation of the renewable energy development.

It is proposed pay special attention to such measures as:

- realization of special programs and demonstration projects;
- preferential loans for the purchase of energy efficient equipment and renewable energy equipment and partial return of investments to the customer;
- accelerated amortization of the equipment;
- tax exemptions and reductions in tax rates, taxes on fossil fuel taking into account CO2 emissions or tax on electricity generated of fossil fuels;
- establishment of special tariffs on the purchase of electricity produced of renewable energy sources, as well as commitments for the grids to buy this electricity;
- subsidization of energy efficiency investments and renewable energy;
- funding of research and development works in the field of energy efficiency and renewable energy;
- creation of state institutions and support of public organizations whose activities are aimed at promoting and developing initiatives in the field of energy efficiency and renewable energy.

It is important to make recommendations regarding the capacity for adaptation and use in the region of incentive mechanisms for energy efficiency and renewable energy sources such as:

- green certification;
- tax benefits;
- standards for renewable energy;
- progressive electricity tariffs;
- revolving funds for financing projects on energy efficiency and RES;
- microcredit schemes;
- concession.

Scientific and technological support for the development of renewable energy sources

It is important to make an inventory and cataloging of scientific and technical developments and manufactured equipment, and to provide information to all potential investors and project owners in energy efficiency and renewable energy.

In order to successful commercialization of advanced developments it is useful to make a list of enterprises and organizations that can develop commercial production of the devices, units and other equipment, and collaborate with scientific organizations at least in the form of an exchange of views and information.

An important direction of cooperation should be the organization of joint research and development with the potential of the regional market.

States may also establish cooperation in such areas as:

- implementation of joint projects and programs;
- creation of a common fund of information, libraries, reference and normative literature, analytical reviews of advanced achievements in the field of energy efficiency and the development experience of foreign technologies in the region;
- scientific exchange and training of experts, publication of academic periodicals;
- conferences and seminars;
- scientific cooperation.

For successful commercialization of research results it makes sense to consider the establishment of intergovernmental research center for renewable energy in order to implement a joint research program, and the harmonization of standards.

Personnel training

Personnel training is critical for solve the problem of the industry. Courses on energy efficiency and renewable energy sources should be in all educational institutions. The level of detail

depends on the specialization of students and professionals.

States are encouraged to expand cooperation in the field of education and to provide individual programs of cooperation on training of experts in the field of energy efficiency and renewable energy, including exchange of methodological and information materials, training for students and experts in the field of energy efficiency and renewable energy.

Informational and outreach work in the field of renewable energy

For the successful implementation of the main objectives is necessary the active participation of the experts and the public in solving the problems in the field of energy efficiency and renewable energy, understanding the role and potential economic and environmental benefits of renewable energy.

Therefore, it is useful to organize an exchange of knowledge on the most effective forms and methods of work to clarify and provide methodological assistance to the local authorities, businesses and individuals, as well as to support social organizations and initiatives to improve energy efficiency and development and use of renewable energy.

4. Opportunities for regional cooperation to enhance the use of advanced technologies in energy efficiency and renewable energy within the international intergovernmental organizations

At the regional level within the CIS

In order to increase the capacity of Central Asia countries on promotion of international cooperation in the field of energy efficiency and renewable energy, including international technical cooperation and the use of international financing mechanisms for renewable energy, it is recommended to provide an overview of international intergovernmental and non-governmental organizations working in the field of renewable energy and financial mechanisms that may be attracted by the countries of the region at governmental level by the project owners to obtain information, methodological, technical and financial support, and publish methodological guidance on existing rules and procedures for cooperation.

It is important to increase cooperation within the CIS on deepening cooperation in the field of energy efficiency in order to:

- improvement of energy security and optimization of energy resources,
- finding ways to harmonize the legislative and form unified regulatory framework in the energy and energy efficiency;
- joint research and development of advanced energy saving technologies;
- coordination of joint actions in the field of environmental protection, monitoring and analysis of the main directions of development of energy saving.

It is important to explore the formation of a single regulatory space of the CIS in the field of energy efficiency, including the development of common approaches and harmonization of the regulatory and normative and technical base of energy saving.

As the main tool of integration and interaction of energy saving policies is appropriate to develop a framework program of energy saving and energy efficiency on the basis of national programs. Development of a joint comprehensive plan of action on energy efficiency for the long term with targets indicators and with specific activities and funding, state support mechanisms, changes in the regulatory framework, etc. can be an effective tool for development. In order to involve all the national authorities responsible for the implementation of energy efficiency policies, it is important to establish close cooperation at the level of sectoral and regional authorized authorities, development

institutions, technological agencies, innovation funds, etc.

At this stage the countries of the region should carefully study the experience of other CIS countries, especially Belarus and Ukraine, which have been forced form and realize national policies in the field of energy efficiency almost since their independence and which already have considerable experience in the transition to the market economy, and analyze the possibilities of its application and adaptation. The Republic of Belarus has already implemented a full range of low-cost interventions in the field of energy saving and has achieved significant results.

Within the CIS is also advisable to consider at a high level the issue of establishing a specific authority / management center of energy saving, as well as the fund on energy efficiency and energy saving, be funded by the the joint contributions of its members, as well as by other sources.

The above authority could address the following issues, which are necessary for the promotion of energy efficiency and energy saving:

- strengthening of the coordination of national energy efficiency programs;
- completion of the formation of legislative base for the effective implementation of energy-saving policies and the promotion of this base at the municipal and local levels with the development of specific rules and regulations;
- development of economic mechanisms, funding schemes and management organization on implementation of energy saving projects;
- facilitate the establishment of joint ventures, including ESCO for the implementation of new energy saving technologies and management of energy saving projects;
- projects assessment;
- exchange of scientific, technical and economic information in the field of energy efficiency and energy saving;
- trainings and seminars for experts;
- development and promoting the implementation of joint programs of energy saving and environmental protection;
- joint development and implementation of advanced energy efficiency standards;
- methodological support for energy saving:
    - preparation of recommendations to improve the quality the basic statistics of supply and energy consumption;
    - development of tools to monitor the impact of the actions of state policy and the creation of models for energy projections for short, medium and long terms. The tools are required to estimate strategies of energy policies and their potential impact on the supply and consumption of energy resources;
    - analysis of the barriers to the implementation of the state policy in the field of energy efficiency and RES and the development of recommendations to overcome them;
- in the field of information support on energy saving is necessary to provide the following:
    - creation of automated data bank on available energy-efficient technologies, installations, instruments in the CIS and in the world;
    - creation of a data bank of regulatory and legislative information;
    - organization of international seminars and conferences on the most important issues of energy efficiency and energy saving;
    - exchange of training programs on energy efficiency and energy saving;
    - demonstration projects and areas of high energy
    - efficiency, exchange of experience in this field.

The objectives of the Fund would be:

- strengthening of relationships with international financial institutions in order to to develop schemes of financial support of projects and attract investment for energy saving projects;
- implementation of projects for the organization of production of modern energy efficient equipment and plants on RES;

- provision of financial guarantees for the implementation of energy efficiency projects;
- implementation on a competitive basis of energy efficiency projects in the CIS countries;
- R & D funding.

The key partners in the development of intergovernmental cooperation on energy efficiency and energy saving could be large energy companies of the CIS countries that are interested in developing business in the CIS countries. A promising area of cooperation is the implementation of joint projects to build CHPs, mini CHPs for the production of thermal and electric energy; pilot projects to promote best practices for energy saving in the CIS countries.

Moreover, the overall concept of cooperation within the CIS should provide comprehensive development of scientific and technical cooperation in the energy sector in the following areas:

- increase of the economic and energy efficiency at all stages - from production, transformation, transportation, distribution, storage to end use of energy resources;
- the development and introduction of new technologies and methods of use of alternative and renewable energy sources;
- environmental and emergency safety of energy sources and reliability of of energy and fuel supply of consumers.

First steps to deepen integration processes in the energy sector can be concentrated mainly on the creation of a common informational space in the field of energy saving through the creation of expert-consulting network, including a continually expanding knowledge base in the following areas:

- modern technologies and equipment for energy saving;
- regulatory mechanisms for the implementation of measures to improve energy efficiency and energy saving;
- implemented pilot projects, both successful and unsuccessful;
- intellectual products used in the development of design solutions, optimization of technological solutions in the field of energy efficiency and energy saving;
- regulatory and technical documentation.

Formation of expert community and open network communication, together with informational exchange of experience in joint forums, exhibitions dedicated to energy saving, specialized seminars may provide additional impetus to the development of cooperation, attraction of investments, accelerating the pace of the integration process and the quality of decision-making will positively influence on the effectiveness of national programs.

The establishment of such network can be implemented within the further implementation of the relevant projects of UNECE and UNESCAP that initiated the creation of the expert community on energy efficiency and have made a significant contribution to the development of integration processes in the CIS countries in the field of energy saving, or within the CIS.

Within the UN

In 2011, the United Nations Secretary-General came forward with an initiative "Sustainable Energy for All" (SE4All), which provides the solution of three interdependent objectives by 2030: providing of universal access to modern energy sources, double energy efficiency increase and double renewable energy increase in the global energy balance.

In this connection currently is rethinking approaches to solving the problems of energy development within sustainable development, and in practical terms of the organization of international energy cooperation.

It is advisable to develop cooperation between the CIS countries within the implementation of the UN Secretary-General's initiative "Sustainable Energy for All" as a format of exchange of

views and participate in the preparation of program / concept documents, and through the development of regional technical assistance projects that can be implemented with the support of UNECE, UNESCAP, United Nations Development Programme, United Nations Environment Programme, the Global Environment Facility.

The active involvement of the World Bank and other international financial institutions in the implementation of the initiative SE4All in practice means a fundamental shift in the development of international cooperation in the field of energy efficiency, new opportunities by the states and real prospect of overcoming one of the major obstacles to the implementation of energy efficiency projects - the lack of effective financial mechanisms.

During its existence, since 2011, the initiative has achieved significant results:

- plans of action for more than 70 countries that have joined the initiative have been developed;
- the initiative relies on the support of the international community, its voluntary member are 60 developing countries;
- on the implementation of the initiative private sector and investors have mobilized funds of more than 50 billion USD;
- international development banks in Asia, Europe and Latin America have allocated tens of billions of dollars for the implementation of the initiative;
- to support three main objectives pursued by the initiative, hundred of mechanisms were put into operation and hundreds of commitments have been taken;
- formation of public-private partnerships in the field of transport, energy, finance, clean technologies, and access to modern energy services for the poor.

In the report "Towards Sustainable Energy for All" (2013) the World Bank emphasizes the country and regional differences and the importance of the development of each country and the region as a unique set of mechanisms for achievement the goals.

It seems appropriate for the countries of Central Asia to consider the possibility of participation in the initiative, in particular, in the development of sub-regional action plan for implementation of the initiative SE4All and identify priorities and areas of cooperation. It is also important to actively develop cooperation with the World Bank and other international donors to develop effective mechanisms for financing energy efficiency projects.

Appendix 1.

Matrix of indicators of energy efficiency and renewable energy in Central Asia countries

(from the point of view of the 25 best practices identified by the IEA)

	Indicators	**Kazakhstan**	**Kyrgyzstan**	**Tajikistan**	**Turkmenistan**	**Uzbekistan**
1.	Legal framework that promotes the use of renewable energy	Law of the Republic of Kazakhstan of 25.12.1997, No210-I on Energy Saving Law of the Republic of Kazakhstan of 4.07.2009 on Supporting the Use of Renewable Energy Sources. Laws and regulations: - Rules for monitoring the use of renewable energy sources approved by the Resolution of the Government of the Republic of Kazakhstan of October 5, 2009 No1529. - Rules of purchase of electricity from qualified energy producing organizations, approved by the Decree of the Minister of 29.09.2009 No 264. - Rules for determining the nearest point of connection of renewable energy facilities, approved by Order of the Minister of 01.09.2009 No 270. - Rules of coordination and approval of feasibility study and construction projects on the use of renewable energy sources, approved by the Decree of the Government of the Republic of Kazakhstan of 25.12.2009 No 2190. - Resolution of the Government of the Republic of Kazakhstan on the development of wind energy. Project of the Government of the Republic of Kazakhstan and the UN Develop-	Law of the Kyrgyz Republic on Energy of 07.06.1998 Law of the Kyrgyz Republic on RES of 08.2008 Law of the Kyrgyz Republic on Changes and Amendments to the Law on RES 3.08.2012 (improvement of promoting the use of renewable energy sources)	Law of the Republic of Tajikistan on Energy. Law of the Republic of Tajikistan on Energy Saving. Presidential decree on Additional Measures for Energy Saving, 2009 Presidential decree on Additional measures for Energy Saving", 2009 Law on the use of renewable energy sources, 2010 (declarative character)	Development of a national law on energy saving and regulations in the field of energy saving and energy efficiency	Law of the Republic of Uzbekistan on the Rational Use of Energy. Law of the Republic of Uzbekistan on Electric Power Industry of 30.09.2009 No 225. Presidential decree on measures for the further development of alternative energy sources 01.03.2013. It is necessary to take a number of laws and regulations in the first place Draft law on Alternative Sources of Energy (before the end of 2013), Law on Solar Energy

		ment Programme, Kazakhstan - Wind Power Market Development Initiative.				
2.	National strategies and action plans	Strategy Kazakhstan-2050: new political course of the state, in 2050 50% of energy consumption from renewable energy sources. State Program of forced industrial and innovative development of the Republic of Kazakhstan for 2010 - 2014, including the use of renewable energy resources. Comprehensive plan to improve energy efficiency in the Republic of Kazakhstan in 2012 - 2015. Plan of placing of facilities on the use of renewable energy sources. Project of power development program for 2010-2014. -section of the Program on development and use of RES, attraction of investments. Currently the mechanism of support the production and use of RES is not thought out. Concept of the electric power industry of the Republic of Kazakhstan to 2030 - the section on energy efficiency is under development.	Program of development of small and medium energy in the Kyrgyz Republic by 2012, (Directorate of the project on development of small and medium energy in the Kyrgyz Republic of 14.10.2008 No 365 National Energy Program of the Kyrgyz Republic for 2008-2010. Strategy of the development of fuel and energy sector until 2025, approved by the Decree of the Government of Kyrgyz Republic of 13.02.2008 No 47. The Government of Kyrgyz Republic of 28.06.2009 No 476 approved the Regulation on the construction, acceptance and grid connection of small hydropower plants, which regulates the procedure for construction of technological connection to the grid of small hydropower plants, as well as commissioning of constructed hydroelectric plants.	Energy policy is formed on the basis of the National Development Strategy of Tajikistan until 2015. National Development Strategy is based on the following principles: energy security, energy efficiency of the economy, budget energy efficiency, environmental safety. Program on the effective use of hydropower resources and energy saving for 2012–2016 No 551. Construction program of small power plants for 2009-2020. Strategy on RES and EE. Resolution of the Government of the Republic of Tajikistan of 2.02.2007 No 41 approved a program for the use of RES for 2007-2015	Energy Strategy till 2030. In 2012–2013 was developed a National Strategy of Turkmenistan on climate change, according to which will be created an Action Plan, which contains measures to combat climate change, including development of RES	Presidential decree on the establishment of the working group on the development of programs of alternative energy sources, Order of the President of the Republic of Uzbekistan of 05.09.2012: -draw up a development program of alternative energy sources for 2013-2017. Hydropower development program includes the construction of 15 new small hydro power plants total capacity of 420 MW (1,6 billion kWh / year)
3.	Competitive energy markets with appropriate regulation	There is an open competitive market of electricity. Adopted a program of a phased increase of electricity prices by 2015 by groups	Electric power industry has been restructured	Restructuring and corporate management of the electric power sector is recommended		Presidential decree on the deepening of economic reforms in the energy sector of

		of energy sources, so-called cap rates.		(progr.No551);		the Republic of Uzbekistan No 2812 of 22.02.2001
4.	Investment climate, Investments in energy efficiency and renewable energy sources (preferences for investors)	Kazakhstan has received investment-grade rating Moody's (in 2002), Standard&Poor's and Fitch (in 2004). Kazakhstan was put on the list of 25 most attractive countries for investment according to the rating of internationally recognized consulting company AT Kearney. Tax Code of the Republic of Kazakhstan of January 1, 2009 ***1. Relief from customs duties*** of imported equipment and accessories; ***2. Government land grants*** (transferred plots of land, buildings, structures, machinery and equipment). ***3. Investment tax preferences:*** - reduction of corporate income tax rate from 2009 up to 20%, from 2010 up to 17.5%, from 2011 up to 15% (in 2008 - 30%); - VAT rate is reduced to 12%. - bilateral agreements on mutual protection and promotion of investments with 41 countries are signed. - co-financing of projects through public development finance institutions - industrial and special economic zones, industrial parks. Center of public and private partnership. Program of phased increase of electricity prices by 2015 by groups of energy sources.	Regulatory document "Oblige distribution companies to purchase all electricity generated using renewable energy sources and small HPPs". Insufficient.	Creation of an energy-saving state fund for the development of new environmentally friendly energy technologies is recommended.	Preferential taxation and loans for developers (recommended). Preferential tariffs for users (recommended). It is recommended to establish the State fund for the development of new energy-saving and clean energy technologies.	Investment Legislation of the Republic of Uzbekistan is one of the most advanced in the legislation of CIS countries. -establishment of enterprises with 100% investment capital; -acquisition of a part or full package of shares of privatized enterprises. Presidential decree on additional measures to stimulate the attraction of direct foreign investments of 10.04.2012 additional guarantees and incentives for investors: -investment of at least 5 million USD received a 10-year delay of transition to the new tax regimes; -investment of over 50 million USD and the share of foreign

						investors at least 50%: construction of engineering services outside the production site publicly-funded
5.	Stimulation of RES development, Feet-in tariff	The existing Kazakh regulatory framework in the field of energy, until recently, was focused on "traditional" power generation. The use of RES in it have not been reflected, which is one of the main obstacles to the development of renewable energy sources in Kazakhstan. There is a clear uncompetitive renewable energy in the electricity market (small capacity, high capital costs, low capacity utilization, high cost of electricity). Introduced a new concept of the draft law of the Republic of Kazakhstan on amendments and additions to some legislative acts of the Republic of Kazakhstan for supporting the use of renewable energy, which is based on the introduction of fixed tariffs. Fixed rates will be set by the Government for the long period of time, which will also be recorded. The value and the duration of tariffs will be different for different types of renewable energy.	For plants using the power of water - 2.1, for plants using energy from the sun - 6.0, for plants using biomass - 2.75 for plants using wind energy - 2.5, for plants using energy of the earth - 3.35; - Marginal payback period on the use of renewable energy sources is proposed to install no more than 8 years. That is, is installed a grace period for the establishment of special tariffs for renewable energy plants during which the plants should pay off. Oblige the distribution companies to purchase all electricity generated with renewable energy sources and small hydro power plants, not consumed by the owner of the installation on their own needs and unrealized by other customers on a contract basis. Determine as a buyer of electricity produced by renewable energy plants and small HPPs the largest distribution company, which occupies a dominant position in the market of energy in the administrative-territorial entity, which houses the installation of renewable energy and small hydropower plant.	In the adopted laws there are no specific proposals for stimulating and mechanisms of implementation of investment projects in energy efficiency and renewable energy. The country has low electricity tariffs for the majority of consumer groups	Not determined terms of state support for the development of renewable energy with the adoption of relevant legal documents defining and providing conditions for the development of renewable energy - not defined development strategy of renewable energy,making it difficult to the development of the investment program for the creation and implementation of systems and renewable energy plants Is planned to provide tax incentives for investors in the renewable energy sector;	The current tariff system in the country and the lack of an appropriate legislative framework in the field of renewable energy sources do not contribute to investment in renewable energy.

6.	Increasing of energy efficiency in the existing buildings		Law on the energy efficiency of buildings of 26.07.2011		Implemented in cooperation with UNDP and GEF. The project "Improvement of energy efficiency in buildings in Turkmenistan" (2010-2015).	
7.	State authority responsible for the development of RES	The Ministry of Industry and New Technologies determines policy in the field of energy efficiency and energy saving It is planned to establish the Committee of State Energy Supervision and control	The Ministry of Industry and Energy.	The Ministry of Industry and Energy. No structures responsible for the coordination of investment activities in the field of energy efficiency and RES.	Establishment of a special state authority responsible for sector of energy saving is planned	State Inspectorate for Supervision of electricity (Uzgosenergonadzor)
14/ 15	Degradation failure of ineffective lighting products Implementation of energy efficient lighting technologies	The problem of intensive energy consumption is actual for Kazakhstan, thus in 2009, the share of energy consumption for lighting was 13%, and by 2015 it is expected that it will reach 36%. Kazakhstan consumes nearly 10 billion kWh of electricity for lighting. In accordance with the Law of the Republic of Kazakhstan on energy saving and energy efficiency was introduced a phased ban on the use of incandescent electric lamps. It is proposed a gradual transition from compact fluorescent lampsto LED lamps. Include measures for: modernization of the interior lighting in buildings of public sector, reconstruction of street lighting in cities and settlements; study of the marking question of energy efficient of lighting products, implementation of	In Kyrgyzstan, the international project SPAR is implemented. The National Project Coordinator is BIOM. The purpose of SPARE is education in the field of energy efficiency through interdisciplinary education and practice, as well as attraction of attention of the population, businesses and public authorities to the possibility of initiatives in the field of energy efficiency and renewable energy. The program focuses on the dissemination of ideas of sustainable energy and energy saving methods in all society, including the introduction of energy efficient lighting systems. Negotiations with representatives of OSRAM and Philips for the calculation of lighting in schools and the	The annual deficit of electricity in Tajikistan is about 4.5 billion kW / h The use of modern energy saving lamps in the country reduces the power consumption by five times and increases their life by 8-10 times. With complete switch to energy saving lamps the country can save up to 3.5 billion kW / h of electricity per year. In April 2009, the President of Tajikistan signed a decree on the transition to energy saving lamps. Until the	Within the UNDP seminar "Improvement of energy efficiency in the housing sector of Turkmenistan" were discussed issues of the transition to energy efficient lighting. In October 2012 was held a study visit to Germany and Denmark. Were considered: efficient energy use, building regulations, legislation to support energy-efficient construc-	The Government of Uzbekistan takes measures to improve the energy efficiency of lighting. According to state inspection Uzenergonadzor, during 2007 - 2008 Toshshaharnur (Tashgorsvet) 9300 of traditional incandescent lighting has been replaced by modern gas lamps, which reduced total capacity of these lamps from 1940 kW to 930 kW, without reducing the quality of lighting.

		demonstration pilot projects on energy efficient lighting; study of a question on the adoption of minimal energy efficiency standards to ensure the availability of high quality and high efficiency of lighting products, including standards on maximum allowable mercury content in lamps; development of mechanisms and measures to restrict the supply of inefficient lighting products and to support the demand for energy efficient products; study of a question on phased restrictions on the production and sale of mercury-containing lamps, SNiP and SanPin changes and introduction of new technical regulations, modernization of electrical lighting and power supply in multi-storey buildings with the installation of automatic shutdown devices of the network, carrying out activities on the organization of recycling mercury-containing energy saving lamps. In the country is implementing a project of the Government of the Republic of Kazakhstan and UNDP / GEF "Promotion of energy efficient lighting in Kazakhstan". The main objectives of the project: development and implementation of the policy, development of the market of energy efficient lighting; training and raising activities, demonstration projects, including best practices and technology. Within the project will be identified the barriers that prevent the market transformation of energy efficient lighting,	purchase of lighting equipment have been held.	end of 2009, all companies and organizations in Tajikistan were obliged to ensure the transition to energy saving lamps. Since October 1 the importation of incandescent lamps has been prohibited. Tajikistan in fact in six months completed the transition to energy saving lamps.	tion, energy audits, energy efficient lighting systems.	It is provided replacement of 93,300 of lighting lamps (annual electricity saving makes more than 58 million kW h). Resolution of the Cabinet of Ministers of May 1, 2013 approved the priority measures for the implementation of the project "Implementation of energy efficient technologies in street lighting in Tashkent" with the Islamic Development Bank.

		on the basis of which developed an action plan; analyzed international experience of existing programs to stimulate the introduction of energy-efficient lighting; overview of international best practices in the field of "green" procurement. In March 2010, TOO Energy-Taraz opened an assembly workshop for energy saving lamps from 5 to 125 watts. Their annual output makes 1 million units per year.				
22	Highly efficient industrial equipment and systems	In Kazakhstan, the industry consumes more than 70% of all electricity. Energy conservation and energy efficiency of all sectors of the economy is the priority, which will help to solve problems: energy, environmental and economic. The President has set the task to reduce energy intensity of gross domestic product in the field of energy efficiency by at least 10% by 2015 and 25% by 2020. The basis for energy saving policy is the existing legal framework. The President of the Republic of Kazakhstan January 13, 2012 was signed the Law on energy saving and energy efficiency and on amendments and additions to some legislative acts on issues of energy saving and energy efficiency. Resolution of the Government of the the Republic of Kazakhstan 30 November 2011 approved the _Comprehensive Plan for Energy Efficiency of the Republic of Kazakhstan for 2012-2015. It is a set of incentives through the laws and regulations. Within the comprehensive plan	In the Kyrgyz Republic, the inefficient use of fuel and energy is associated with the imperfection of existing technology, legal, financial and economic mechanisms. They do not promote producers and consumers to reduce energy costs. The country has huge reserves of growth for energy efficiency that can be achieved through: improvement of tariffs for electric and thermal energy, improvement of the accounting of energy consumption, replacement of outdated equipment; renovation of energy efficiency standards (energy efficiency), and bringing them in compliance with international standards, improved outreach of effective saving methods in energy consumption and the production and in everyday life. The total energy consumption in the economy of the republic in the near	Most of the electricity is consumed in the industry, and the Tajik aluminum plant about 50% of total amount of electricity consumption in the Republic of Tajikistan or 6.7 billion kWh in 2011. Power shortages in other industries is more than 800 million kW / h The highest rates of growth in industrial electricity consumption for the period were observed in non-ferrous metallurgy 20%, ferrous metallurgy - 18.9%, in the building materials industry - 7.3%, in the food industry - 12,7%. Significantly behind the machinery - 1.0%.	According to the IEA, in 2010, primary energy consumption in Turkmenistan was 21.3 million tonnes of oil equivalent, and production - 46.3 million tonnes of oil equivalent In fuel and energy balance of the country dominate natural gas and oil; in the structure of energy production, their share is 79.7% and 20.3% respectively, and in the structure of consumption - 81.4% and 19.6%. Nuclear power, hydropower and renewable energy in the country	The Cabinet of Ministers has adopted decree on additional measures for the implementation of the project, Improving the energy efficiency of industrial enterprises with the participation of the International Development Association. The document was adopted in order to attract additional financial resources for modernization, technical and technological renovation of enterprises in the real sector of the economy, improving their energy efficiency, accelerate the introduction of energy-

		was carried out energy audits of industrial enterprises 50/50 (50% of the funding is own funds of enterprises, the remaining 50% is the state budget). Following the results of the energy audit system measures were developed to reduce the energy intensity of the industry, including power industry. The share of the fifteen largest enterprises of the republic in 2010, we had 35.2% of the total electricity consumed. The Comprehensive Plan of the Republic of Kazakhstan for Energy Efficiency for 2012-2015 indicates that the required size of reduction of primary energy consumption in the country can be achieved through the implementation of the following measures: Optimization of power consumption modes; Energy audits of industrial enterprises, Energy-efficient equipment; Introduction of variable frequency electric drive; Implementation of automatic system for commercial accounting of power consumption; Improvement of technological processes, Elimination of overloaded equipment, Compensation of reactive power. Thirty most energy intensive enterprises in Kazakhstan together with the authorities for the acquisition of new methods of compliance with the law of the Republic of Kazakhstan on energy saving and energy efficiency. USAID and the Government of the Republic of Kazakhstan cooperate on the reduction of greenhouse gas emissions by promoting investment in energy efficient technologies and pro-	future may be reduced by 13% due to the technical and organizational measures that do not require significant capital investment that will save 550 million tons of equivalent fuel. Due to the reconstruction and modernization of existing power equipment, due to energy saving technologies introduction can be obtained by 25% of electricity and 15% heat.	The main activities to optimize energy consumption in the industry: introduction at the industrial enterprises of the Republican standard Power management system; restructuring of enterprises, aimed primarily at production of less energy-intensive high tech competitive products; update of fixed assets of enterprises of the republic on the basis of the introduction of advanced technology and engineering with high economic impact, definition of the energy saving potential in all types of energy use through energy audits, development and periodic updating of energy certificate of enterprises; improvement of the regulation of the process equipment and optimization of equipment operation modes with the creation of technical diagnostics at the enter-	are not developed. Turkmenistan is completely self-sufficient in energy resources, and is a major net exporter. In 2010, net exports was 24.6 million tonns, or 53% of total domestic production. The most important energy source of Turkmenistan is natural gas. In 2011, the proven gas reserves in the country were 24.3 trillion m^3 (+81% compared to 2010), which is the forth in the world. The largest deposits are South Yolotan (reserves - 22 trillion m^3, discovered in 2006), Dovletabad (1.3 trillion m^3). Natural gas production in Turkmenistan is growing rapidly after a sharp fall (-46%) in 2009 compared to 2008. In 2011, the country produced 54.6 billion m3, mostly in the fields of	efficient equipment and technologies through attraction of funds of the International Development Association (IDA) of the World Bank. April 26, 2013 the Board of Directors of the World Bank approved the grant of Uzbekistan to finance the project "Improving the energy efficiency of industrial enterprises" of additional IDA credit of 66.1 million of special drawing rights (100.0 million USD) with a maturity of 25 years, including a 5-year grace period and the interest rate of 1.25% per year. According to the Law on the Rational Use of Energy № 412-I of 25.04.1997 the main directions of the state policy in the field of energy efficiency are: implementation of national, sectoral and regional programs

		grams. Analysis of the energy management systems several largest industrial companies to international standards has identified potential annual energy savings measures for more than $ 1 million. Kazakhstan has already implemented 80% of all measures of Comprehensive Plan for energy efficiency for 2012-2015. For the implementation the Law on energy saving and energy efficiency approved 22 regulatory acts under which was established the State Register of energy, energy regulations, requirements for energy efficiency. In accordance with the Comprehensive Plan the MINT prepared and sent to the regional akimats guidelines for the development of comprehensive plans for improving energy efficiency; at their base akimats developed 16 regional and 5 sectoral plans for energy saving, to create systems of technical regulation 170 technical standards were adopted, in addition, together with the World Bank starts the project of grant funding in the amount of nearly $ 24 million. At the same time an infrastructure base is created. 11 training centers were opened, more than 1,000 experts were prepared. Kazakh-German Centre for Energy Efficiency was created. In the sector of industry and energy 30 industrial companies are under energy audits, at 50 companies is implemented energy management system, 200 large enterprises regions until 2015 will invest in energy		prises; revision of specific norms, rules and regulations of energy consumption per unit of production and maintenance of the control over their observance; establishment of standards for energy consumption and limit energy losses, mandatory certification of energy consuming devices and equipment; development of its own energy base mainly due to the introduction of renewable energy sources; use of secondary energy resources and alternative fuels; organization of modern metrology equipment; equipment of enterprises with modern appliances of technical accounting and control at all stages of the energy consumption; implementation of automatic system for commercial accounting of power consumption in order to reduce	Southern Yolotan and Dovlatabad. During 2000-2011 domestic gas consumption almost doubled to 25 billion m3 in 2011. More than half of gas (53%) Turkmenistan exports it to China, Russia and Iran. Deliveries are carried out on the pipeline system. Turkmenistan aims to diversify gas supplies, which resulted in the start of gas deliveries to China in 2009, the volume of which will be increased in the future. There are also plans to export gas to Europe (via Azerbaijan) and South Asia (TAPI gas pipeline project). UNDP within the joint project organized by the Forum for the efficient and rational use of energy, which was attended by experts of the Ministries of	and projects, improvement of legal and regulatory framework, stabilization of production and consumption of energy, definition of public authority to coordinate and organize the work on energy saving and energy efficiency; improvement of rate policy; optimization of energy production and consumption, organization of its accounting ; stimulation of the production of energy efficient equipment with minimal energy consumption; energy efficiency regulations for equipment and products; organization of state control and supervision over the quality of energy, energy efficiency and energy consumption of the products, organization of energy audits, energy examination of products, existing and recon-

		savings 300 billion tenge. The expected effect of these measures is about 3 million tons of equivalent fuel (reference: equivalent to 35 billion kWh of electricity). The Government of the Republic of Kazakhstan 29.08.2013, approved the program "Energy 2020". The goal: to create conditions for reducing the energy intensity of the Republic of Kazakhstan and the improvement of energy efficiency by reducing energy consumption and reducing the inefficient use of energy resources Objectives: modernization and energy efficiency of industry in the country; Reduction of losses in energy and heating systems; The scale promotion of energy saving among the population; Development and implementation of mechanisms that promote energy saving and energy efficiency; Formation of mechanisms to encourage energy service companies; Training in the field of energy saving and energy efficiency; reduction of fuel consumption in the transport sector; Decrease in specific expenses on the generation of 1 kWh of electricity. The results of energy audits have shown significant potential for energy savings from 13% to 40% (by JSC Kazzinc - 13%, JSC Aksu Ferroalloy Plant - 15%, JSC Himfarm - 32%, JSC Petropavlovsk Heavy Engineering Plant - 40%). The main rule of the Law is to		wastage of energy resources, optimize their consumption at peak hours; encourage the development of specialized businesses in the area of energy efficiency. National Aluminium Company TALKO with more than 13,000 employees is an example of modern industry. This is one of ten largest aluminum plants in the world, which provides up to 70% of foreign exchange earnings to the country, consuming up to 30% of domestic electricity. Recommended Action Plan on energy efficiency TALKO includes 33 measures to reduce energy consumption in the process of electrolysis, anode production and maintenance of the plant. Implementation of the plan will allow TALKO annually save up to 1,155 GW / h of electricity and 197 GW / h of natural gas. It would reduce the	Energy and Industry of Turkmenistan, environmental protection, building materials industry, public utilities, the State Concern Turkmengaz, as well as international experts and consultants from Russia , Ukraine, Armenia, Central Asian countries, etc. During the forum, the participants noted the particular relevance of the initiatives of the President of Turkmenistan aimed at the efficient use of energy, which is one of the priorities of the state policy. The State Energy Institute of Turkmenistan in Mary, with the support of the Ministry of Energy and Industry of Turkmenistan formed Training and Production Center. In the Training and Production Center will	structed facilities, technology and equipment, creation of energy efficiency demonstration zones for implementing energy efficiency, improving energy efficiency advocacy. The Board of Directors of the World Bank on April 26 approved a loan to Uzbekistan of 100 million USD in additional funding for the project of improvement of energy efficiency of industrial enterprises in the country.

		create a registry of the State Energy. In accordance with the Government of the Republic of Kazakhstan of February 5, 2013 No 86 was defined the operator of the state energy registry. The entities of the state energy registry are individual entrepreneurs and legal entities that consume energy resources in the amount equivalent to over 1500 tons of equivalent fuel per year, as well as government agencies and quasi-public sector entities. The entities of the state energy registry, consuming energy resources in the equivalent of over 1500 tons of equivalent fuel per year pass mandatory energy audit at least once every five years, and since 2014 have to establish, implement and organize the work of the energy management system in accordance with the requirements of the international standard for energy management. The standard ST RK ISO 50001-2012 "Energy Management Systems was approved. Requirements with guidance for use and the technique of the energy audits in buildings. Currently Kazakhstan Association of Energy Auditors successfully operates, which includes 13 companies and 6 training centers for retraining and professional development of staff carrying out energy audits and (or) the examination of energy saving and efficiency, as well as the development, implementation and organization of the energy management system. Within a comprehensive plan are implemented 16 regional and 5 sectoral plans for energy		consumption of electricity and natural gas by 20 and 37 percentin comparison with the average rate in 2009-2011. The load on the national grid would be reduced by 132 MW.	be held practical and laboratory works, research in the field of efficient energy using alternative and renewable energy sources. It is planned to develop energy saving technologies using solar, wind, hydro, biofuels and local fuels in combination with conventional energy equipment (diesel generators, gas turbines, and other units). The Center's work is intended to provide and participate in collaborative, including foreign, innovative projects on renewable energy, research, compilation and implementation of best practices and the latest innovative technologies in the energy industry.	

		saving. A technical committee for standardization in the field of energy saving and energy efficiency was created. International cooperation in the field of energy conservation is developing. So, are implemented agreements and memorandums with the Governments of Germany, the USA, Japan, the Kingdom of Norway and the Netherlands. According to the cooperation with Federal Republic of Germany and the German Energy Agency was set up a center for energy efficiency.				
24	Additional measures to support energy efficiency in industry	The country pays much attention to improvement of the mechanisms and methods to promote energy efficiency. In particular the Government of the country are developed the following activities: - allow to local authorities decide the question of temporary grant of benefits, their amount and other terms of providing tax benefits to enterprises that implement energy efficient technologies; - at the national level to solve the issue of the promotion of energy saving and reduction of customs duties for enterprises importing energy efficient and energy saving equipment; - establish the possibility of concluding special agreements that aim at providing services in the field of energy efficiency in the public sector; - create conditions in the implementation of mechanisms of attraction of private	The Government of Kyrgyzstan set priorities of the development of energy saving and energy efficiency. To achieve the main objectives were defined three priorities of the development. The first priority is aimed at making that through the qualitative organizational and managerial support the process of development of energy saving in the country, to provide a short-term period the volume of energy savings up to 1.2 million tons of equivalent fuel. To do this is necessary to: - provide adequate institutional support for public policy of energy conservation; - increase the level of energy savings for budget organizations; - improve the the regulatory framework in the field of energy saving;	For strengthening of Tajikistan energy policy in the field of energy efficiency and a wide use of renewable energy is proposed: - develop a large-scale comprehensive energy efficiency target program based on the specific implementation of renewable energy projects, and ensure corresponding implementation of the program; - provide in the legislation legal regulations concerning the introduction of energy efficient technologies to reduce energy intensity of production, de-	To provide state support for renewable energy and energy efficiency development the following measures are recommended: - Regulations on energy saving and energy efficiency. - National Program / Strategy for the development of renewable energy by 2020. - Creation of the state energy-saving fund for the development of new clean energy technologies. - Preferential taxation and loans for	For energy saving the Government of the Republic of Uzbekistan provides the following benefits to entities and persons: • funding due to the state soft loan of national, sectoral and regional programs and projects in the field of rational use of energy; • funding of intersectoral research and development work, production of pilot lots of energy efficient equipment; • custom duties and taxes on the

		investment in energy saving measures in housing. The plans for the modernization of enterprises that are part of regional plans for energy savings will be implemented by 2015. All of the above measures require investments and costs that will be borne by the company. In this regard, is necessary to implement additional measures of economic incentives of enterprises to improve their energy efficiency. To support small and medium businesses is offered by the government to provide preferential loans and leasing programs for buy energy efficient technologies and equipments. In addition, on the basis of energy audits is necessary to revise standards of energy consumption for industrial plants in towards toughening, as well as to introduce a system of benchmarking of energy efficiency. The system of technical regulation is a key instrument of the state influence on the processes of energy saving. In this regard, it is necessary to review the current technical standards and adopt new energy efficiency standards for various equipment and technologies. Analysis of the current policy of the state regulation and the existing mechanisms to stimulate energy saving and energy efficiency in Kazakhstan. The Government of the Republic of Kazakhstan has ambitious targets for energy efficiency and is already implementing a number of activities. In general, the effective policy of energy saving is the	- develop and implement mechanisms for financial support and encourage individuals and legal entities engaged in energy saving measures; - reduce the level of commercial and technical losses to the approved standards in 2015; - introduce a tariff system that encourages energy saving in energy; - provide a full accounting of energy and gas in 2015 after 100% equipment with modern appliances account for all subjects of economic activity; - optimize the management of demand to ensure a uniform and allowable load of the power system; - provide fuel savings in the production and consumption of energy annually at a rate of 0.5 million tons of equivalent fuel; - develop mechanisms for financial support for the implementation of energy saving policy; - improve the statistical reporting and monitoring in the field of energy efficiency.	velopment of renewable energy, recycling of water and energy resources, process optimization of power plants, reduction of heat loss of production, administrative and residential buildings, energy efficiency of residential buildings; - предусмотреть специальные credit instruments (revolving funds and credit lines), tax incentives for investment, comprehensive application of energy certification; - create training programs and hold information campaigns; - in developing appropriate amendments to the legislation of Tajikistan should take into account international experience in supporting the development of RES and energy efficiency.	developers. - Preferential tariffs for users. - Creation of a modern technological base.	import of equipment, devices and materials, the use of which greatly increases the efficiency of energy use; • other matters in accordance with their competence. The Government of the Republic of Uzbekistan has the right to apply reduced rates for energy to entities and persons who: • provide reduction of energy consumption against established standards; • produce competitive products with low energy consumption; • use fuel as a raw material for the production of bulk products.

		main tasks: 1) establishment of the regulatory framework, 2) approval of the regional and sectoral plans for energy saving, 3) formation and maintenance of the State Registry of energy; 4) implementation of the technical regulation; 5) training and promotion of energy efficiency, 6) development of international cooperation; 7) business involvement in energy saving policy. In particular, a significant stage in the development of energy saving and energy efficiency was the adoption in January 2012 of the laws of the Republic of Kazakhstan on energy saving and energy efficiency.				
25	Power supply companies and their impact on energy efficiency	The new Law of the Republic of Kazakhstan on energy saving and energy efficiency," introduced the concept of "Innovative Energy. In the energy sector, it is important to effectively implement the activities under the investment agreements with the energy companies. In this case, very effective strategy is the following measures: 1) ban on the separate production of heat and electricity in the designed energy sources without evaluation of the applicability of cogeneration technology. 2) requirement of mandatory energy efficiency of enterprises that will not only improve the efficiency of investment programs for modernization, but also will have a positive impact on the final result for increase the efficiency of plants and reduce network losses; 3) revision of technical standards on coal. The Ministry of Energy has devel-	The energy policy of the country, the general trends and objectives are: Achieve by 2014-2015 the financial and economic recovery of the industry; ensure sustainable development of the power industry, technological upgrading; commissioning of new generation and transmission capacity, increase the share of renewable energy in the structure of production, increase energy efficiency through energy saving, increase the reliability of power supply. The development priorities of electric power industry in the near future include the development and implementation of practical measures to reduce energy loss, strengthening of commercial and financial discipline and achieve-	Energy policy is formed on the basis of the National Development Strategy of the Republic of of Tajikistan until 2015 (NDS). It is based on the following principles: energy security, energy efficiency of the economy, budget energy efficiency, clean energy. The program for the effective use of hydropower resources and energy saving for 2012-2016 includes measures for the implementation of plans and activities in the	The national program of social and economic development of Turkmenistan until 2030 provides a significant increase of production of electricity due to the increase of it own consumption and export. In 2030, it is assumed that the production of electricity in Turkmenistan will reach 35.5 billion kWh. In 2009 was produced 15.61 billion kWh. To increase the power generation it is expected to in-	In 2010, Uzbekistan was generally produced 50.6 billion kWh and 7,790 Gcal. of thermal energy, in 2011 these figures were more than 51.4 billion kWh and 8070 Gcal. respectively. Technical energy losses of Uzbekenergo is approximately 13%. Strategic objectives of the electric power industry in Uzbekistan consist of the following objectives: deepening of economic reforms, formation and develop-

		oped a project on Sectoral power development program for 2010-2014 and Comprehensive plan to improve the energy efficiency of the Republic of Kazakhstan for 2012-2015., which indicates that the required size of reduction of primary energy consumption in the country can be achieved through the following activities:Reduction of specific consumption for electricity generation from existing 350 tons of equivalent fuel / kWh to 300 tons of equivalent fuel / kWh; reduction of specific consumption of heat supply from the existing 190 kg / Gcal to 170 kg / Gcal; Reduction of total energy losses in distribution networks to 15.1% from the current 25.9%; Reduction of total losses of heat in distribution networks up to 18% from the current 32.8%; In the accepted power development program until 2030 identified areas of energy saving policy in the production of electricity. Priority technologies for electricity production:: thermal power plants, based on the gasification of coal; thermal power plant based on fluidized bed systems for brown coa;, coal generating units that use the technology of using supercritical steam parameters. With the transfer of energy between 2005 and 2009 in Kazakhstan succeeded to reduce excessive losses of electricity in three times, in two times in heat ener-	ment of profitability of entities in the industry; modernization and increase of generating capacity, improvement of their efficiency through the use of new technology and management of load schedules, introduction of new generation capacities and transmission lines, active participation in the processes of intergovernmental integration with Central Asia countries, the CIS in the preparation and creation of a single competitive market of electric energy and power; reform of the management system of the electric power sector, improvement of management, creation of the necessary institutional framework and the regulatory framework, completion of the structural reform of the sector, implementation of a balanced tariff and pricing policies; improvement of the technical equipment of commercial accounting systems with the transition to automatic system for commercial accounting of power consumption; creation of the internal energy market with ensuring a competitive environment for the development and sale of electricity through the construction of small hydro power plants and other alternative sources; measures to preserve the competitive advantages of Kyrgyzstan at the regional export market of electricity and the development of ex-	field of energy efficiency and energy saving, rational use of energy and reduction of energy losses, determines the state policy on achieving energy independence through: efficient use of water and energy resources, attraction and promoting investment for the development of clean energy and the introduction of energy saving, restructuring and corporate management of the electricity sector, establishment of tariffs on the basis of actual costs in the production and electricity transmission; extensive use of renewable energy sources; examination of design solutions on energy efficiency and energy saving, development and improvement of mechanisms and tools of economic incentives in the process of electricity production and consumption, rational distribution of loads in the power system and	crease capacity due to: modernization of eight power units at Mary HPP and two power units at Turk-menbashinsk CHP. To date, six power units at Mary HPP have worked out their resource (27 years). Two power units of Mary HPP and two units of Turkmenbashi CHP are operating time of more than 22 years and are close to working out the resource. For the modernization of power units are required investments of 684 million USD. Carried out calculations show that costs of modernization of power units will pay off for Turkmenistan only from the export of gas savings within 3-5 years. Transfer of gas turbine plants to combined cycle.	ment of the energy market, reliable supply of the economy and population with quality electricity, technical re-equipment and modernization of the energy enterprises, improving the efficiency of their production activities, reduction of negative impact of energy production on the environment ; further development of integration processes within the United Energy System of Central Asia. Currently, the organizational and technological potential of energy saving industry is estimated at 2.5-5 million tons of equivalent fuel per year. In 2012, the implementation of 54 investment projects in the electricity sector for more than 7 billion USD was provided: 17 investment projects for 4.5 bil-

		gy. This evaluation of the effect of the introduction of reactive power sources in the distribution network in Kazakhstan showed that the electricity consumption at the level of 2009 annual savings by reducing energy losses could amount to more than 28 million USD per year.	port potential, improvement of the conditions for attracting private investment in the sector and on the basis of a public-private partnership.	increasing the efficiency of power generation capacity, the conversion of boiler plants to CHPs using renewable energy; implementation and improvement of new forms of accounting systems and reduction of technological and commercial losses; efficient use of water and energy resources ; adoption and approval of investment plans and activities in the field of energy efficiency and energy saving. The task of improving the efficiency of the electric power industry due to the implementation of the following measures: reconstruction of boilers of industrial enterprises into mini-CHPs with gas turbines units. The total electrical capacity of mini CHPs will be 230 MW, and the maximum heat load will exceed 300 Gcal / h; replacement of outdated boilers with new ones.	The transfer of one power plant of 254 MW from the simple to combined cycle will annually save about 250 million m3 of gas, reduce by 500 thousand tons of CO2 per year. While the unit costs of 1 MW of installed capacity of steam turbines in 2,5 times higher than the unit cost of gas turbine power plants, these costs will be repaid in 5-6 years from the export of saved gas. Transition of gas turbine plants to combined cycle can increase the capacity of the Turkmen energy system to 720 MW. To carry out work on transfer of gas turbine power plants of simple to combined cycle, is required an investment of 972 million USD. - Construction of four new power plants with a com-	lion USD in the field of power engineering; 8 investment projects totaling 217 million USD in the field of hydropower, 19 investment projects totaling more than 1 billion USD in the modernization and construction of power grids; 10 investment projects totaling over 1.31 billion USD in other areas of energy aimed at the introduction of innovative technologies. The implementation of these investment projects will allow the country to ensure the introduction of additional modern facilities in the amount of more than 2,520 MW power lines 500

					bined cycle of work with a capacity of 374 MW each one, with a total investment of 564 million USD. The total investment in generating capacity to ensure the growth of electricity generation until 2020 will reach 2.22 billion USD. In the power grid construction the program provides the construction of 220 kV ring around Ashgabatthat will significantly improve the reliability of Ashkhabad power supply because is achieved mutual redundancy of Ashkhabad, Abadan and Akhal power plants. It is planned to loop the Turkmen energy system on the overhead lines of 500 kV and until 2020 is planned to build 500 kV transmission line Turkmenbashi-Ashgabat-	

					Balkanabad that will allow to carry out mutual redundancy of eastern and western parts of the Turkmen power grid.	