United Nations Economic Commission for Europe

Increasing Energy Efficiency to Secure Energy Supplies in the CIS region

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Abbreviations

ANRE	National Agency for Energy Regulation, Moldova
bbl	barrel
bcm	billion cubic meters
CAC	Central Asia Center pipeline
CHPP	combined heat and power plant
CIS	Commonwealth of Independent States
COTC	EPC Commission for Operational Technological Coordination
EBRD	European Bank for Reconstruction and Development
EPC	Electric Power Council of the CIS
ESCO	Energy Service Company
Gcal	Gigacalorie
GDP	gross domestic product
GWh	gigawatt hour
HPP	hydroelectric power plant
IBRD	International Bank for Reconstruction and Development, World Bank
IDA	International Development Association
ISEDC	International Sustainable Energy Development Center
kWh	kilowatt hour
mm	million
MW	megawatt
NPP	nuclear power plant
PPP	purchasing power parity
SHPP	Small hydropower plant
tce	tons of coal equivalent
tcm	trillion cubic meters
toe	tons of oil equivalent
TWh	terawatt hour
UES	Unified Energy System
UPSCA	Unified Power System of the Central Asia.
US AID	United States Agency for International Development

Introduction

The strengthening of integration processes in the world economy encourages better interaction and coordination of energy policies of the countries that are members of various economic associations. One of the examples of international cooperation in the area of energy is the Energy Efficiency 21 Project of the United Nations Economic Commission for Europe (UNECE). Among the participants of this Project there are representatives of government organizations, industries, investment companies, financial institutions, and several international NGOs.

In 2001, in the framework of this Project, and in accordance with the joint statement of September 4, 1997, made by the UNECE Secretariat and the Interstate Economic Committee of the CIS Economic Union, the project "Energy efficiency and energy security in the Commonwealth of Independent States" was carried out by the CIS Executive Committee, national experts from twelve CIS member-states in collaboration with the ministries and agencies of the respective countries, and research institutes of the CIS countries.

Under the contract signed in 2010 between the UNECE and the International Sustainable Energy Development Centre (ISEDC), on the basis of materials and data provided by the CIS countries, specialists from ISEDC conducted a study of the production and consumption of fuel and energy in the CIS member states, reviewed the situation in their energy markets, generalized the energy conservation policies in these countries, reviewed standards and regulations in the area of energy saving, and considered possible ways of attracting financing for energy conservation projects in these countries.

In general, the situation in the energy sectors of the CIS countries are still characterized by the following:

- low efficiency of fuel and energy consumption and large energy losses in all sectors of the economy;
- critical deterioration of fixed assets in the fuel and energy sector;
- a lack of investment into the fuel and energy industries;
- a lack of current construction of new power plants and a slow upgrade of operating plants;
- a reduction in the reliability of external energy suppliers, and insufficient capacity of cross border transportation and power supply channels;
- the underdevelopment of large share of the fuel and energy resources of the region.

One of the main objectives not only for the energy sector but for the entire economy of the region is to implement a feasible and efficient approach to the use of the available fuel and energy resources.

The aim of the regional analysis is to identify impediments to the improvements that can be made in energy efficiency. In this report an attempt is made to find ways to enhance the situation in general in order to mitigate risks related to the security of energy supplies in the CIS countries.

1. Energy sectors of the CIS countries: rationale for increasing energy savings and energy efficiency

In the majority of the CIS countries energy conservation is considered one of the main ways to ensure energy security.

After the disintegration of the USSR the newly independent states found themselves facing severe challenges that had suddenly emerged in the energy sector; these challenges were related to providing a sustainable power supply. Countries with scarce fuel and energy resources had to spend substantial amounts of hard currency to acquire fuel and energy abroad, while countries with sufficient reserves faced a problem of mobilizing capital investment in the fuel producing industries and the electric power industry in order to support their operation and, not only ensure stable electric power supply for enterprises and households, but also to be able to export energy products, as taxes and duties imposed on fuel exports were very important sources of budget revenues in these countries.

Another serious problem in the CIS countries is the increased share of fuel and energy used in the production cost of their manufactured goods due to the increase in prices for energy products. This has resulted in decreasing competitiveness of domestically produced goods in both internal and external markets. One should mention the dependence of the majority of the CIS countries on the imported equipment for fuel production and electric power generation, something that requires extensive hard currency expenses, especially taking into account the old age and depreciation of the existing plants.

Thus, almost all CIS countries are, to a greater or lesser extent, preoccupied with ensuring their energy security and seeking more efficient and less capital intensive ways to achieve it. The most realistic way for all of them is to switch to energy saving technologies.

A serious problem related to the energy security of the CIS countries is the uneven distribution of fuel reserves over the territory of the CIS region. The main reserves of natural gas are located in Russia, in the northern part of West Siberia, far from consumption centers in Russia and those in the CIS countries that are the main gas importers (mainly Ukraine and Belarus). At present, about 10% of the produced natural gas is spent on transporting gas to consumers in Russia and in the CIS, and in Central, Eastern, and Western Europe. It is possible to save about 15 billion cubic meters of gas per year by upgrading the gas transport infrastructure; this would increase the energy security for consumers in these countries. One of the most important ways to increase energy efficiency in the economy is to upgrade the processes used to convert fuel into electric power. Modern combined cycle gas fueled power plants achieve efficiencies of electricity generation of close to 60%. It is believed that in near future they may reach 70%, thus it will be more than twice as high as the average efficiency of electricity generation at conventional steam turbine thermal power stations.

It is especially important to increase the efficiency of electricity generation on the basis of fossil fuels, especially because in the future electricity will be used more and more as an energy source. It is widely acknowledged that the share of electric power in total energy consumption will grow continuously, as at present electricity is the most flexible, efficient and ecologically sound energy source.

Energy savings and the reduction of energy intensity are important but not the only factors that contribute to a higher level of energy security.

The effect of energy saving and energy efficiency on the energy security would be stronger, especially in the CIS countries, if these factors worked in combination with other factors, for example:

- An enhancement of the economic, scientific, and technological cooperation in the energy sector and in the area of energy conservation;
- For national economies to achieve greater independence from the use of external energy sources by economically feasible expansion of local energy sources, by attracting national and foreign investors;
- The establishment of sufficient strategic reserves of oil, gas, and coal.

In this context the regional cooperation of all CIS countries becomes more important. In October 2008 it was agreed to define cooperation in the energy sphere as a key sphere of interaction of the CIS member-states. In accordance with the Action Plan for the implementation of the first stage (2009-2011) of the CIS Development Strategy up to 2020, the CIS Concept on cooperation in the energy sphere was drafted.

This document presents common views on and a coordinated approach to cooperation in the energy sphere of CIS member states and it lays out goals, tasks, principles, mechanisms, and main areas of such cooperation.

This document emphasizes that it is important:

- to meet internal needs of CIS member states for energy resources from internal and external sources;
- to increase export capacity and the volume of energy product exports from the CIS countries;
- to ensure sustainable growth of national economies on the basis of the efficient use of energy resources and of the opportunities provided by foreign trade in energy products.

It is necessary to emphasize the important contribution of the Electric Power Council of the CIS countries (EPC CIS – founded in 1992) to the interaction and coordination of interstate relations in the sphere of electric power.

In accordance with the decision made at the 6th meeting of EPC CIS on October 23, 1993, the Commission for Operational Technological Coordination (COTC) of the power systems of the CIS and the Baltic states was established. The Commission was organized with the aim of coordinating the activity of energy companies so as to secure reliable operation of the power systems of the CIS and the Baltic states and their interaction with the power systems of other countries. The organization of such an interstate partnership in the 1990-s has made it possible to start restoration of the integration of the power systems of the CIS and Baltic states.

In June 2000, the parallel operation of the UES of Russia and the national power system of Kazakhstan was restored; and in September 2000 for the first time the power systems of Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan, comprising the unified power system of the Central Asia, were interconnected for parallel operation with the national power system of Kazakhstan. In August 2001, the power systems of 11 out of 12 CIS countries (except for Armenia) operated in parallel within the CIS power pool.

At present the power systems of Lithuania, Latvia, Estonia, and Mongolia operate in parallel to the power pool of CIS member states.

There are electricity transmission and power interchanges between the power systems of the CIS and neighboring countries: Norway, Finland, Poland, Slovakia, Hungary, Turkey, Iran, China, and Afghanistan.

So at the turn of the 21st century, a certain stabilization of the operation of electric power sectors in the CIS countries was achieved; a slight growth in generation and consumption of electricity and some improvements in quality were observed. Since 1998, the power system pool of CIS member states demonstrated sustainable growth of electricity generation and consumption. In 2008, by comparison with 1998, electricity generation had grown by 22.8% and reached 1,462.6 TWh, while consumption of electricity had increased by 21.4% since 1998 to 1,442.3 TWh.

There are several unsolved problems in this critical sphere of cooperation. Up to now the power system of Armenia operates in isolation to the CIS power systems pool and in parallel to the power system of Iran. The Armenian power system has redundant capacity; it exchanges electricity with Iran and exports electricity to Georgia.

Adoption of technical requirements developed by the Commission for Operational Technological Coordination (COTC) and submitted for approval to the Electric Power Council assists in ensuring stable parallel operation of the power systems included in the CIS pool.

Among the most important documents approved by the EPC CIS in recent years, one

should mention 1) a concept paper for frequency and power flow control in the power systems of the CIS and the Baltic States, 2) Rules for planning interchange schedules, and 3) Rules and recommendations for frequency and power flow control. It should be, emphasized, however, that as important as these technical requirements for the parallel operation of the CIS power systems are, the issue of the mandatory character of the adopted documents has not been solved yet.

In clause 13 of the Agreement on parallel operation of the power systems of the CIS countries it is stated that the parties will take steps to form and develop an open and competitive market for electric power and for capacity based on the electric power systems of the countries that are parties to the Agreement. We are talking here about forming a common market for energy within the CIS.

Practical steps towards this target were taken in December 2001, when the Working Group of EPC CIS for the establishment of a common electricity market for the CIS countries was organized. The first fundamental document prepared by the Working Group was the basic principles for the organization of electric power market for the CIS member states. On the basis of these principles, a concept paper for the CIS common electric market was prepared and approved by the Council of Heads of Government.

Later, in 2005-2008, the Council of Heads of Government and the EPC CIS adopted a package of documents dealing with the common electric power market of CIS member states. Among these documents are: the Agreement on the formation of the Electric Power Common Market of the CIS countries signed on May 25, 2007; the Agreement on harmonization of customs procedures during the transit of electric power through the customs borders of the CIS countries of November 22, 2007; and General principles for electric energy transit via the electric networks of CIS member states, adopted by the EPC on May 19, 2006.

In October 2007, the EPC CIS approved the steps to be taken to form the CIS electric power common market and to determine its main characteristics. In October 2008, the EPC CIS approved a draft protocol on the stages of formation for a CIS electric power common market; this document was considered by the Commission for economic issues of the CIS Economic Council in May 2009.

On the basis of the report prepared in 2008 by the Energy Research Institute of the Russian Academy of Sciences (ERIRAS) the following conclusions can be drawn:

CIS member states have huge potential for energy conservation that is estimated by experts at 420 to 450 million tons of oil equivalent (mm toe). At present, the energy intensity in the economies of some CIS member states is three to three and a half times higher that in the industrial countries. Among the CIS member states, the highest levels of energy intensity per unit of GDP are observed in Kazakhstan, Turkmenistan, Uzbekistan, and Ukraine.

Between 2000 and 2008, crude oil production in the CIS states grew by more than 60% to a total of 609 mm tons. The main oil producing countries in the CIS are: Russia (77% of the total CIS production), Kazakhstan (11%), and Azerbaijan (about 9%). In comparison with 2006, crude oil production in Azerbaijan has increased more than four times while in Kazakhstan production has doubled, and in Russia it has increased by 51%.

By the beginning of 2008, Russia was the largest natural gas producer and exporter in the world (79% of the total CIS production). The second largest gas producer in the CIS was Turkmenistan (8% of the CIS production) followed by Uzbekistan with slightly lower production volume. In 2000-2008, Kazakhstan demonstrated the highest increase in natural gas production. In 2008, production of natural gas in all CIS states amounted to 734 billion cubic meter (bcm), while gas consumption was 540 bcm.

In 2008, coal production in the CIS amounted to 496 mm tons, which was 80% higher than the volume produced in 2000. In the meanwhile

coal consumption stabilized in this period at a level of 100 mm tons. The main producers and consumers of coal in the CIS are Russia, Kazakhstan, and Ukraine.

In recent years the share of nuclear power plants (NPP) in total electricity production was about 40% in Armenia, 16% in Russia, and 48% in Ukraine. Overall in the CIS region, the share of nuclear power in electricity production is approaching 18%.

Statistical data for 1990-2008 on the production and consumption of primary energy in the CIS demonstrate that the total production of primary energy exceeded the 1990 level by the beginning of 2008. In 2008, the production of primary energy in the whole CIS region was 27% higher than in 2000; while the respective growth in Azerbaijan was 250%, in Kazakhstan 80%, in Russia 27%, and in Turkmenistan 40%. In the CIS region consumption of primary energy dropped in 1990-2008 by almost 23%. However, in comparison with 2000, by 2008 there had been an increase in primary energy consumption of almost 12%.

Thus one may conclude that a combination of social, economic, and technological factors (GDP growth, increase in living standards of the population, still unrealized energy saving capacity) would result in higher demand for energy in almost all CIS states.

Differences in the structure of production and consumption of energy resources form an objec-

Table 1. Production and consumption of primary energy in the CIS states: "base case" scenario

	Primary energy (million tons of oil equivalent)				
	2008	2009	2010	2015	2020
Production					
Armenia	1.0	1.1	1.2	1.5	2.0
Azerbaijan	59.5	78.4	90.5	104.6	95.4
Belarus	3.8	3.9	3.9	5.0	6.6
Kazakhstan	151.8	148.6	161.0	226.1	268.5
Kyrgyzstan	1.4	1.7	1.9	2.9	3.6
Moldova	0.1	0	0	0	0
Russia	1,289.1	1,284.3	1,295.8	1,361.3	1,460.5
Tajikistan	1.5	1.9	2.0	3.6	4.7
Turkmenistan	70.2	82.8	95.4	136.2	168.8
Ukraine	78.2	75.8	75.0	114.5	124.6
Uzbekistan	61.0	62.4	64.9	68.7	72.4
Consumption					
Armenia	3.0	3.0	3.1	3.5	4.2
Azerbaijan	14.6	15.9	16.8	19.6	22.4
Belarus	27.4	28.0	29.1	32.1	36.6
Kazakhstan	59.3	61.9	66.4	79.8	86.9
Kyrgyzstan	2.7	3.2	3.3	4.3	5.0
Moldova	3.3	4.0	4.1	5.0	7.0
Russia	715.7	691.4	703.0	764.8	835.5
Tajikistan	3.2	3.4	3.8	4.5	6.0
Turkmenistan	22.3	22.3	22.3	22.9	25.9
Ukraine	134.1	135.7	137.7	172.5	190.9
Uzbekistan	46.1	45.6	45.0	46.3	46.7

tive basis for expanding energy trade and integration between CIS states in the energy sector.

Through 2020, the potential to export energy resources (primarily natural gas) from the CIS states is quite large, and even taking into account intra-regional trade, it can still increase by implementing energy efficiency programs in all CIS states.

Natural gas is one of the main energy resources in the CIS. In the majority of countries (both energy surplus and energy deficient) programs are outlined for reducing the share of this fuel in energy consumption, not only by energy conservation but also by substitution with other energy sources.

Researchers of the Russian Academy of Sciences have proposed three scenarios for forecasting the CIS fuel and energy sector: a base case and two alternative scenarios.

The "base case" scenario uses the results of the national economic development and energy forecasts provided by the CIS states.

In general, the "base case" scenario of forecasting energy production and consumption in the CIS states for 2008-2020 is characterized by a high growth in primary energy production (by 39% for the period), while growth rates for the production of natural and associated gas are estimated at 38%, coal - at 36%, and oil – at 27%. Under this scenario, the total

Table 2. Production and consumption of primary energy in the CIS states: "energy efficient" scenario.

	Primary energy (mm toe)				
	2008	2009	2010	2015	2020
Production					
Armenia	1.0	1.1	1.2	1.5	2.0
Azerbaijan	59.5	78.4	90.5	104.6	95.4
Belarus	3.8	3.9	3.9	5.0	6.6
Kazakhstan	151.8	148.6	161	226.1	268.5
Kyrgyzstan	1.4	1.7	1.9	2.9	3.6
Moldova	0.1	0	0	0	0
Russia	1,289.1	1,284.3	1,295.8	1,361.3	1,460.5
Tajikistan	1.5	1.9	2.0	3.6	4.7
Turkmenistan	70.2	82.8	95.4	136.2	168.8
Ukraine	78.2	75.8	75	114.5	124.6
Uzbekistan	61.0	62.4	64.9	68.7	72.4
Consumption					
Armenia	3	2.94	3.01	3.33	3.86
Azerbaijan	14.6	15.58	16.3	18.62	20.61
Belarus	27.4	27.9	28.3	30	32.1
Kazakhstan	59.3	60.67	64.42	75.77	79.95
Kyrgyzstan	2.7	3.14	3.2	4.09	4.6
Moldova	3.3	3.92	3.98	4.75	6.44
Russia	715.7	677.58	681.88	726.56	768.66
Tajikistan	3.2	3.82	3.88	4.28	5.52
Turkmenistan	22.3	19.89	20.66	21.76	23.83
Ukraine	134.1	147.66	153	163.84	175.66
Uzbekistan	46.1	44.66	43.63	43.97	43.01

production of electricity will increase over the period 2008-2020 by 49%. The surplus production of natural gas will be directed to exports. Kazakhstan, Russia, Turkmenistan, Uzbekistan, and later Azerbaijan will be leaders in this sector. The share of the Russian Federation of the total oil and gas production of the CIS region will decrease by the end of the forecast period mainly due to the increase in the share of the Central Asian states. The CIS states in the forecasting period will increase volumes of their oil and gas exports, while resources for coal exports will shrink mainly due to a projected increase in domestic consumption for the purposes of electricity generation. Exports of electricity may increase primarily because of growing demand in the Asian markets.

In the "base case" scenario the main economic development framework in the CIS states is preserved, which includes substantial growth in primary energy consumption, low utilization of alternative energy sources, high energy intensity per unit of GDP in comparison with developed industrial countries.

Under the "base case" scenario, the development framework observed in 2000-2008 in the CIS states has been preserved concurrent with the growth in the population wealth, which is characterized by a nearly direct correlation of economic growth to fuel and energy consump-

Table 3. Production and consumption of primary energy in the CIS states: "high" scenario.

	Primary energy (mm toe)				
	2008	2009	2010	2015	2020
Production					
Armenia	1.0	1,1	1,2	1,6	2,1
Azerbaijan	59.5	79.6	92.5	108.3	100.6
Belarus	3.8	3.9	3.9	5.0	6.6
Kazakhstan	151.8	150.9	164.5	234	283.3
Kyrgyzstan	1.4	1.8	2.0	3.0	3.8
Moldova	0.1	0	0	0	0
Russia	1,289.1	1,303.5	1,324.3	1,409.0	1,540.8
Tajikistan	1.5	1.9	2.0	3.8	4.9
Turkmenistan	70.2	84.0	97.5	141.0	178.1
Ukraine	78.2	90.1	97.1	118.5	131.4
Uzbekistan	61.0	60.2	62.2	71.1	76.4
Consumption					
Armenia	3.0	3	3.1	3.5	4.2
Azerbaijan	14.6	15.9	16.8	19.5	22.2
Belarus	27.4	28.0	29.1	31.9	36.3
Kazakhstan	59.3	61.9	66.5	79.3	86.2
Kyrgyzstan	2.7	3.2	3.3	4.3	5.0
Moldova	3.3	4.0	4.1	5.0	6.9
Russia	715.7	691.3	704.1	759.9	828.6
Tajikistan	3.2	3.9	4.0	4.5	6.0
Turkmenistan	22.3	20.3	21.3	22.8	25.7
Ukraine	134.1	150.6	158.0	171.4	189.3
Uzbekistan	46.1	45.6	45.1	46.0	46.4

tion. In the majority of the CIS states the growth in overall energy consumption will occur due to higher fuel needs for electric power generation and increased consumption in the housing and utilities sector.

Under this scenario structural changes in energy production and consumption of the CIS states will remain slow during the forecast period.

The reality of the scenario targets is supported by the development targets for the fuel and energy sectors specified in the national programs, and by forecasts of mutual energy trade and energy exports of the CIS states.

Two "alternative" scenarios were considered: "energy efficient" and "high".

Under the "energy efficient" scenario a lower (in comparison with "base case" scenario) internal demand for energy resources in the CIS countries is assumed, i.e. there is the assumption that energy conservation policies will be adopted and implemented. In this scenario priority was also given to ecological factors. The volumes of fuel and energy production were set at the level of the "base case" scenario. This scenario looked at the possibility of increasing energy exports capacity from the CIS states by increasing energy conservation and improving energy efficiency. This scenario results in a 6 to 7% lower estimate for the consumption of fossil fuels than the "base case".

The implementation of an intensive energy saving policy on the basis of the experience of the industrially developed countries would allow CIS states to achieve more efficient use of fuel and energy resources; this would require a priority investment into R&D and new generation technologies. Talks are ongoing about how to guarantee the innovative development for all sectors of the CIS economies, to support their competitiveness in the world market.

The assumption of the «high» scenario was high economic development rate of the world economy due to fast economic development in the Asian countries (India and China). This scenario assumes high world energy prices due to the increased demand on world markets, and high energy production growth, including that in the CIS states. Here the assumed GDP growth is higher by 2 to 3.5% in comparison with "base case" scenario. For the whole CIS region the production of primary energy resources at the end of forecast period under this scenario is higher that under the "base case" by 5.5%, while their consumption is lower by 0.9% due to higher energy prices both in the domestic markets of the CIS states and in the intra-regional market.

Development under the "alternative" scenarios (in comparison with the "base case") would change the balances of production and consumption of energy resources at the national and regional levels.

So, it is quite important for the CIS states, where the energy intensity of the economy is high and, hence, there is good potential for energy saving, to implement economic policies with the aim that projected economic growth should be higher that demand growth for primary energy. The following estimates have been done: if average annual economic growth rates of the CIS as a whole in the first two decades of the 21st century were 3%, and energy consumption growth rates were 2%, then the annual demand for primary energy resources would increase by 2020 by no more than 50% in comparison with the present level. If the economy and energy consumption demonstrated the same growth, then the respective increase in energy consumption would be 80% with all the consequences for the energy security and the environment.

In the long run, it should be one of the important responsibilities of governments to create the conditions to achieve such (or close) growth rates for the economic development and energy consumption.

In the future, the energy security of the CIS will be to a great extent determined by internal economic development of the member states, as well as by relations between them and third parties in the energy market.

Intra-regional cooperation in the CIS will promote the issues of energy efficiency, sustain-

able electricity supply, environmental protection, and enhanced investment attractiveness of the fuel and energy sectors in view of their future development.

In the long term the following areas of cooperation will be important:

- the development of bilateral and multilateral partnerships within the CIS states in the energy sphere;
- the elaboration of bilateral and multilateral cooperation programs;
- the development of a modern infrastructure for the power market;
- the development of technologies to support the functioning of the power market;
- the development of the interstate economic environment for the energy market, working out coordinated measures as regards ways and means for market liberalization and competition;
- working out standards and development of the legal documents to support formation of an electric power common market;
- the development of an optimum pricing scheme in the electric power common market of the CIS states;
- the elaboration and implementation of programs to regulate the electric power common market.

However to be able to establish intra-regional partnerships in the energy sphere and to found energy associations and unions in order to support integration in the energy sphere, it is necessary to comply with the whole range of political, economic, social, and technological requirements.

The CIS states need to undertake efforts to develop their relationship in the energy sphere both on a bilateral and multilateral basis. However, up to now there is a certain disappointment in the results of the integration processes within the CIS.

It is expedient to give a renewed impetus to the creation of collective systems for cooperation in the energy sphere within the CIS and with other foreign countries. It is time to stop underestimating this issue. The potential loses may be too large. As it was mentioned in several documents of the international organizations, the largest consumers would be likely to adhere to three main strategies in order to ensure energy security in the medium term. These strategies are: bilateral agreements between a supplier and a consumer; collective regional cooperation; and the use of threats and force to control energy resources.

There is a well understood need for coordination of energy policies and development plans for the fuel and energy sectors in the CIS region given that there are limited investment resources, institutional barriers, and existing inconsistencies and contradictions in the rules for intra-regional and foreign energy trade. It is necessary to create a system of partnerships in the energy sphere using bilateral and multilateral cooperation schemes.

Energy trade within the CIS has good potential and may become a strong unifying factor. In the oil and gas sector there are several options: from establishing an oil alliance of Russia with the Central Asian countries to the formation of a common oil and gas market for the CIS states, including new building and reconstructing the existing transport infrastructure with aim of increasing export flows of oil and gas.

Cooperation may be developed both at the interstate level and at the company level.

One means of acceptable cooperation may be the implementation of specific projects by international consortia, where responsibilities and risks are shared by all parties. Involvement of international consortia may be of the greatest interest in the construction and management of interstate gas pipelines, oil pipelines, and power transmission lines. The project participants and their stakes may vary depending of the particular country where specific sections of the energy infrastructure are constructed.

Globalization and the concentration of international capital pave the way for the implementation of large interstate projects in the energy sphere. This assumes developing common strategies in various fields.

In the majority of the CIS states energy conservation is considered one of highest priorities of their governments' energy policies. In order to join the efforts for achieving this goal, in May 2005, the Economic Council of the CIS approved main directions and principles of interaction of the CIS states in the sphere of energy efficiency and energy saving.

The common interest of the CIS states to increase efficiency of fuel and energy consumption and the necessity to overcome common barriers on the way to energy conservation create real opportunities for developing and strengthening cooperation within the framework of the CIS in order to achieve progress in this sphere in each country and in the CIS as a whole. Elsewhere there is a positive experience in cooperation by foreign countries and organizations in the sphere of energy saving; for example, that of the European Union and of the countries in Asia-Pacific region.

A full scale implementation of the energy conservation potential of the CIS states could yield a total annual benefit in the total CIS economy of about 60 to 70 billion US dollars, if one takes into account savings on investments into the expansion of fuel and energy sectors (including exploration, production, transportation and conversion of fuels), savings on expenses for acquisition of primary energy resources and machines and equipment for the energy sector, and the mitigation of negative environmental impact of the energy industries.

2. Review by CIS states
2.1. Republic of Armenia

General information
Territory – 29.8 thousand km^2
Population (2009) – 3.249 million people[1]
GDP (2009) – USD 11.9 billion

Structure of GDP (2009):
- Agriculture –22.5%
- Industry – 43.5%
- Services – 34.1

Fuel and Energy sector

Main energy resources traditionally consumed in Armenia are: natural gas, oil products, nuclear power, hydroelectric power, and coal.

Total installed capacity of the power system in Armenia is 3,110 MW, of which technically available capacity is 2,465 MW.

The installed capacity of thermal power plans is 1,670 MW. Thermal power plants were designed to operate both on natural gas and on residual fuel oil.

The nuclear power plant in Armenia was put into operation in 1976 (Unit 1) and in 1980 (Unit 2). The plant was constructed with two VVER-440/270 nuclear reactors with a total rated capacity of 815MW. In 1989 the power plant was closed after the Spitak Earthquake (December 7, 1988) for safety concerns, though there were no technical reasons for it. In 1995, after a severe energy crisis in Armenia (1993-1995), Unit-2 was reopened (the installed capacity was 407.5MW).

The installed capacity of all hydroelectric power plants is around 1,124 MW, of which small hydroelectric station are responsible for about 92 MW.

In the territory of Armenia there are occurrences of coal, oil shale, peat, bitumen, bituminous sand, oil and signs of natural gas. Estimated reserves of coal and oil shale are approx. 23-24 mm tons, prospective reserves of coal are about 100 mm tons, and prospective reserves of oil shale are about 130 mm tons. In recent years, in parallel with exploration, a trial coal mining project was carried out at some sites (Ijevan, Demajur). Prospective oil and gas structures have been discovered in two regions of the country where exploration works were restarted with attraction of foreign investment on a production-sharing basis.

At present an advertising campaign is under way to attract foreign companies to unoccupied licensed sites.

The hydropower potential of Armenia is estimated at 21.8 TWh/year, of which the potential of large and medium-size rivers is 18.6 TWh/year and of small rivers 3.2 TWh/year. The economically feasible hydropower potential is 6 TWh/year, of which 2.5 TWh/year is exploited.

The potential of renewable energy sources is rather large, first of all that of solar and wind energy. In Armenia it is considered economically feasible to generate electric power with photovoltaic cells and to use flat solar thermal collectors to produce hot water.

Theoretical wind power potential is estimated at 10.7 TWh/year, of which technically feasible potential is preliminarily estimated at 1.6 TWh/year. Geothermal fields located in

1 http://www.armstat.am/file/doc/99461548.pdf , p.25

Table 4. Balance of energy production and consumption (2008).

	Oil and condensate (mm tons)	Oil products (mm tons)[2]	Natural gas (bcm)[3]	Electricity (TWh)[4]
Production	–	–	–	5.77
Imports	–	0.38	2.02	0.33
Exports	–	–	0.028	0.36
Consumption	–	0.32	1.99	5.74

2 http://www.iea.org/stats/oildata.asp?COUNTRY_CODE=AM
3 Conversion of tons of oil equivalent into billion cubic meters (for natural gas) was done in accordance with http://www.dolgikh.com/index/0-34
4 http://www.iea.org/stats/electricitydata.asp?COUNTRY_CODE=AM

Armenia may be exploited only for the purpose of space heating.

Policies and measures in the sphere of energy saving and energy efficiency

Armenia has a limited access to energy resources; there are no local oil and gas reserves. Power is imported from Russia, Georgia, Iran, and EU. The high dependence on energy imports and an increasing instability of electricity generation at hydroelectric and nuclear power plants, have made energy security of the country a strategy of high importance where priority is given to energy saving measures. At present difficulties in ensuring energy security pose substantial obstacles to economic and ecologically sustainable development of the country.

In Armenia the average energy consumption per capita is very low, approx. 20% of the level in more industrially developed CIS countries, such as Russia and Ukraine, but like these countries Armenia has inherited low energy efficiency in industry. The energy intensity of the economy is 5 times higher than in the USA, and ten times higher than in those EU countries that use advanced energy efficiency technologies.

In 2008, power losses in the national electricity transmission networks amounted to 13.5%.

Provisional studies showed the possibility of energy savings up to 600 thousand tons of coal equivalent (tce) per year in the gas distribution networks of the residential sector and up to 47 thousand tce (125 GWh) in the electricity networks by reducing power losses in the process of transmission and distribution. Works on improving the insulation of buildings and on upgrading heat supply networks are underway; these should provide substantial energy savings.

In Armenia the issues regulated by the government in the sphere of energy include stimulation of local power generation, energy saving, environmental protection, scientific and technological progress, personnel training and retraining.

In March 2001 the "Law on Energy" came into force; it is the major legal document regulating relations in this sphere.

The Law on Energy stipulates the right of a consumer to receive on a contract basis electric power, heat, and gas for the need of production and private consumption. In December 2004, President of Armenia, Robert Kocharyan, signed the Law "On energy savings and renewable energy". The purpose of the Law is to define the principles of state policy on ensuring energy saving and developing renewable energy and the mechanisms of the enforcement of those. It is targeted at strengthening the economic and energy security of the country and reducing adverse technogenic impacts on the environment. The law regulates the relations of the state administration and local self-government bodies, legal entities and physical persons arising from and in connection with the activities in the sphere of energy saving and renewable energy.

The Law stipulates the framework for conducting energy examination and audit to support the implementation of the provision of the Law. Changes were introduced into the administrative and criminal codes. The amendments are related to the higher responsibility for violations in the energy area. The new version of the "Rules for usage of electricity, heat energy and natural gas" was adopted. A provision on revaluation of capital assets was introduced into practice, a transfer to international accounting standards has started, a provision on technical surveillance in the power sector and the authorized bodies came into force, etc.

The issues of further development and regional cooperation were presented in detail in the "Action Plan for the Ministry of Energy of the Republic of Armenia stipulated by the provisions of the national security strategies of the Republic of Armenia", adopted by the Government on November 1, 2007.

The following development strategies for the power system were set:

- ensuring reliable power supply for the customers;

- supporting possible low rates for energy products;
- promotion of energy saving;
- using domestic renewable energy resources ;
- ensuring safe operation of the Armenian nuclear power plant during its lifetime and proceeding with continuous safety upgrades;
- meeting the requirements of environmental protection;
- improved rules for the functioning of the internal market for electric power and capacity;
- providing attractive conditions for private investors;
- ensuring financial stability of the power system;
- upgrading the electric power system to enhance its export capacity.

The development strategies also set priorities for the Ministry of Energy and Natural Resources of the Republic of Armenia:

- ensuring maximum possible and economically feasible level of energy security and independence;
- maintaining the existing nuclear power plant and future development of nuclear energy;
- diversification of energy sources;
- integration into regional markets for electric power and other energy resources;
- pursuing socially oriented policies, ensuring financial stability and economic efficiency.

The activities of the Armenia Renewable Resources and Energy Efficiency Fund should be mentioned. The Fund operates in several areas: renewable energy, financing investment projects, financing research projects to identify renewable energy sources, which can be useful for potential investors for decision making. One of the Fund's successful projects is the rehabilitation and development of new local heating systems in 100 schools. The total program cost was USD 15 million paid out of World Bank funds and USD 1.7 million of co-financing from the state budget.

The Fund participates in government projects on building small hydropower plants (SHPP). During the last two years financing was extended to the construction of 25 SHPPs, of which 8 have already been put into operation. The installed capacity of these 25 SHPPs exceeds 50MW. A special Geo-Information System (GIS) was created where all sites of renewable energy resources are shown: wind, solar, and hydro. The map shows the possible sites for building small hydropower plants in Armenia. For implementation of these projects the Fund received financing from the World Bank and the Global Ecological Fund in the amount of USD 3 million. As regards construction of SHPPs, the Fund participates in the investment program for building small hydropower plants with USD 5 million. This money was allocated by the government using the World Bank financing vehicle. So the total amount of joint investment reached USD 15 million plus 30% co-financing from the SHPP project owner.

Implementation of the policy by the Ministry of Energy and Natural Resources of the Republic of Armenia on the basis of the national program for energy saving and renewable energy provided for Armenia's participation as a reliable and equal partner in the Energy Charter, as well as in such international organizations as the Black Sea Economic Cooperation and the Energy Council of the CIS.

In Armenia, thanks to the adoption of the national program for energy saving and renewable energy, control over electric power usage was enhanced by establishing metering centers accessible for the power supply organizations managing electric power distribution to end users. Load management was improved and an uninterruptible electricity supply without the so-called rolling blackouts was restored.

Potential for energy saving

Possible energy savings due to energy efficiency measures may reach 2 mm tce, or USD 19.5 million per year.[5]

5 Unified register of legal acts and other CIS documents: Main principles for member states interaction in the field of energy efficiency and energy saving.

Conclusions and recommendations

At present in order to preserve and enhance energy security and independence it is necessary to develop the power system of the Republic of Armenia by:

- constructing new thermal and nuclear power units on the basis of modern, reliable and safe technologies;
- using domestic, renewable energy sources;
- promoting measures on energy savings and implementing energy efficient technologies;
- establishing an export-oriented power system;
- ensuring the maximum possible regional integration;
- attracting local and foreign investors to participate in energy saving projects and building power units operating on local fuel and energy resources.

These are all prerequisites for the integration of Armenian energy systems into regional energy markets and its participation in regional energy projects, which is considered as one of the priorities of ensuring a reasonable level of energy security.

2.2. Republic of Azerbaijan

General information
Territory – 86,600 km^2.
Population – 8.997 million people (2009)[6]
GDP (2009) – USD 88.67 billion

Structure of GDP (2009):
• Agriculture – 5.6%;
• Industry – 61.4%;
• Services – 33.0%.

Fuel and Energy Sector

Resources. Azerbaijan has sufficient oil and gas reserves for its own internal consumption and for export.

The installed capacity of the power system in Azerbaijan is 7,100MW, of which hydroelectric power is 1,020 MW.

In 2006, proved oil reserves in Azerbaijan were estimated at 7 billion barrels (1 billion tons), which is 0.6% of the world recoverable reserves. At present, the largest oilfield in Azerbaijan is Azeri-Chirag-Guneshli filed where light oil is produced.

Gas production in Azerbaijan grew in 2008 as compared to 2007 and reached about 15.2 bcm against 11.0 bcm in 2007.

The Oil and gas sector is the main driver of the state income.

In Azerbaijan a special agency JSC Azenergy deals with all issues related to electricity generation in the country and supervises all power plants, including thermal and hydroelectric power plants. JSC Azenergy is a 100% state owned company. About 90% of electricity is produced by thermal power plants and about 10% by hydroelectric power plants. In 2008, total electricity production of all thermal and hydroelectric power plants reached 23.7TWh.

With the participation of the government the construction of the Yenikand Hydropower station was completed; it was the first electric power plant in the country financed by a multinational financial organization (EBRD, 1994). Works were carried out to reconstruct the Shimal power plant and Baku combined heat and power plant (CHPP), to upgrade the Mingechevir Hydropower plant, to build several electric substations, etc. According to official information, in 2006 in Azerbaijan four modular power plants of 87 MW each were put into operation and this has substantially increased the overall capacity of the power system. The Nakhichevan power plant was switched to gas and new capacity was installed. Unit 5 of the Azerbaijan thermal power plant, which is one of the largest plants in the South Caucasus, was restored. The construction of an electric power facility with the highest capacity in the whole CIS region, the Sumgait combined-cycle plant of 506 MW, was commenced. The competitive bidding for this project was won by «Siemens», which proposed the best terms. The new plant will replace the obsolete CHPP-1 and CHPP-2. According to the state program on the development of the fuel and energy sector of the Republic of Azerbaijan (2005-2015) there are plans to commission new generation facilities with more than 4,000 MW of capacity.

6 http://www.cis.minsk.by/main.aspx?uid=210

Table 5. Balance of energy production and consumption (2008).

	Oil and condensate (mm tons)	Oil products (mm tons)[7]	Natural gas (bcm)[8]	Electricity (TWh)[9]
Production	44.5	7	15.2	23.9
Imports	–	0.04	–	0.8
Exports	36.9	2.9	4.9	0.2
Consumption	7.6	3.7	9.9	23.3

7 http://www.iea.org/stats/oildata.asp?COUNTRY_CODE=AZ
8 Conversion tons of oil equivalent into billion cubic meters (for natural gas) was done in accordance with the algorithm described in http://www.dolgikh.com/index/0-34
9 http://www.iea.org/stats/electricitydata.asp?COUNTRY_CODE=AZ

It should be noted that in accordance with legislation, private companies are allowed to generate, transmit, and distribute electric power. Azerbaijan has such experience; however transfer of the power distribution networks in Baku and some other regions to private hands has had rather disappointing results.

Policies and measures in the sphere of energy saving and energy efficiency

Up to the present in Azerbaijan, there is no legislative regulation in the sphere of energy saving, with a single exclusion of the "State program on the use of alternative and renewable energy sources in the Republic of Azerbaijan" that was adopted in October 2004. The adoption of this program was related, first, to the depletion of hydrocarbon reserves, and second, to an intention to diversify sources for electric power generation to provide for internal consumption and exports. The intention to develop alternative energy sources began in November 2003. There were plans to build, for the first time in the history of Azerbaijan, a wind power generator of 750 kW jointly with German company "Nord Wind". It was planned to build 100 wind power generators with total capacity 81.25 MW. The following benefits of this project were seen: it was supposed, on the one hand, to create several hundreds of new jobs, and on the other hand, to reduce by 40-50% the production cost of all manufactured wind generators due to cheap work force. However at that time, this project was not implemented.

Most recently the improvement of fuel and energy efficiency in the housing and utilities sectors has become one of the priorities for the government of Azerbaijan.

In accordance with the draft state program for energy saving standards, in 2011-2013 it is planned to use about 70 energy saving standards in Azerbaijan. In September 2010, the package of these standards was agreed with relevant organizations and submitted to the leadership of the country by the Cabinet of Ministers for consideration. Political figures in the country believe that using new energy conservation standards will lead to a 30% saving in energy across the country.

The main impediments to the implementation of an energy saving program in Azerbaijan are the following:

- Poor organizational efforts to conclude contracts for implementing energy saving projects;
- Irregular disbursement of the allocated funds;
- Unsolved pricing issues;
- A lack of auditing and control of energy consumption.

Potential for energy saving and conservation

A comprehensive assessment of the energy saving potential has not yet been made in Azerbaijan, as promoting energy efficiency has not been among the main government priorities.

Conclusions and recommendations

At present, the fuel and energy sector of Azerbaijan supplies the domestic needs in fuel and energy. However the expected recovery of economic activity in the country will result in increased demand for fuel and energy.

The use of the existing potential for energy saving would lead to a higher level of energy security in the country, allowing it to free up energy resources for export which in turn provides the hard currency needed for economic development, and would promote the shift to an energy efficient pattern of development.

To achieve these targets it is recommended:

- to develop rules and regulations in the sphere of energy and energy saving and work out procedures for the realization of their provisions;
- to develop a strategy of energy development for 15-20 years with the consideration for the integration with the CIS states and European countries;
- to establish an independent government agency in the sphere of energy conservation;
- to prepare a targeted program and a plan of priority measures to improve energy efficiency; to identify stages and estimate necessary in-

vestments (with the consideration of the experience of European countries);
- to develop scientific, technical, and economic cooperation in the area of energy efficiency;
- to implement joint projects with other CIS states and international organizations in the field of energy efficiency;
- to increase the share of renewable energy sources in the total energy production in the country;
- to develop a program to upgrade power plants and electric networks providing for the restoration and extension of the power links with neighboring countries, in the first place with the CIS states.

2.3. Republic of Belarus

General information
Territory – 207.56 thousand km^2.
Population – 9.49 million people (2009)[10]
GDP (2009 estimate) – USD 24.510 billion

Structure of GDP (2009):
- Agriculture – 9.2%
- Industry – 41.8%
- Services – 49.0%

Fuel and Energy Sector

The present situation in the fuel and energy sector as in the entire country is characterized by acute problems related to price rises for primary energy resources, shortages of operating capital, insolvency of consumers, below capacity production and lack of financing to upgrade capital assets.

The installed capacity of the electric power plants in the system is 8,261.7MW.

One can mention the following weaknesses, challenges, and threats in relation to the energy sector of Belarus:
- high energy-intensity, low efficiency of supplied energy, high losses;
- obsolete infrastructure, considerable wear and tear;
- mainly state owned property and limited commercial relationships in some segments of the energy sector;
- weak legislation and regulation, unfavorable investment climate, poor investment opportunities in the sector;
- low tax collectability due to implicit and direct subsidies in the energy sector;
- insufficient information for consumers about future price dynamics which prevents them from timely investment into energy efficient projects;
- strong dependence on Russia as regards gas supplies and lack of transparency in the gas supply contracts.

Despite the limited domestic energy resources, the energy sector of Belarus has several strengths, including a well-developed network of oil and gas pipelines, a favorable geographic location, substantial available capacity in the electric power sector and in oil refining. Among the main challenges are the needs to implement reforms in the energy sector and to improve the investment climate.

Policies and measures in the sphere of energy saving and energy efficiency

The legal basis for activities in the sphere of energy saving is formed by the "Law of the Republic of Belarus on Power Saving" adopted in 1998 and several legal acts.

On June 14, 2007 the President of the Republic of Belarus signed Directive No 3 "Economy and thrift as the main factors of economic security of the state". The Directive requires the undertaking of more persistent actions towards resource saving, including fuel and energy, and wider use of local fuels, indicates new approaches and ways, stipulates responsibilities of the managers and specialists at all levels for efficient usage of resources.

10 http://belstat.gov.by/homep/ru/indicators/population.php

Table 6. Balance of energy production and consumption (2008).

	Oil and condensate (mm tons)	Oil products (mm tons)[11]	Natural gas (bcm)[12]	Electricity (TWh)[13]
Production	1.74	18.4	0.177	35.05
Imports	21.46	1.9	19.4	7.09
Exports	1.45	15	–	5.25
Consumption	21.4	4.56	19.49	36.89

11 http://www.iea.org/stats/oildata.asp?COUNTRY_CODE=BY
12 http://www.iea.org/stats/balancetable.asp?COUNTRY_CODE=BY
13 http://www.iea.org/stats/electricitydata.asp?COUNTRY_CODE=BY

The "Concept Paper on energy security of the Republic of Belarus" was approved by decree of the President of the Republic of Belarus No 433 of September 17, 2007. The "National comprehensive program for upgrading fixed production assets of Belarus' power system, promoting energy saving, and increasing the share of local fuel and energy resources for the period through 2011" was approved by the decree of the President of the Republic of Belarus No. 575 of November 15, 2007.

This Concept Paper set out goals and objectives for ensuring energy security, identified the main ways for strengthening energy security, including modernization and development of energy facilities, development of energy infrastructure, diversification of energy resources, efficient use of fuel and energy, increase in the use of local fuels, alternative and renewable energy sources.

The main objective of the national comprehensive program is to identify the specific activities, determine an implementation schedule and necessary investment, which would provide for the energy security of the Republic of Belarus, allow faster renewal of fixed assets, ensure reliable, efficient, and ecologically sound energy supply for enterprises and households.

In compliance with the provisions of the Directive No 3, the Government of the Republic of Belarus, National Academy of Sciences, and Republican authorities revised the Concept Paper for energy security and energy independence of the Republic of Belarus; the National Comprehensive Program for upgrading fixed production assets of the Belarusian power system, promoting energy savings, and increasing the share of local fuel and energy resources, for the period in 2006-2010; the Republican Energy Saving Program for 2006-2010, and other documents. In accordance with the mentioned documents, in 2006-2010 the following results were achieved:

- the reduction of energy intensity per unit of GDP by at least 31% in comparison with 2005 levels;
- savings of fuel and energy of 9.14-9.87 mm tce through the use of modern technologies, equipment, and other energy saving measures;
- an increase in the usage of domestically sourced fuels, secondary energy resources, alternative and renewable energy sources up to 25% of the total production of electricity and heat;
- the commissioning of power generators with total electricity generating capacity over 1,000MW.

The implementation of the planned measures will enhance energy security in the country, upgrade fixed assets in the fuel and energy sector and increase their reliability, diversify the types of consumed fuel and the sources of supply; optimize the fuel and energy balance by increasing the share of domestic fuels and renewable energy sources, increase efficiency of energy use, cut costs in production, transportation, and consumption of fuel and energy, and thereby lower the fuel and energy costs of Belarusian manufacturers and increase the competitiveness of their goods.

The main program documents that stipulate the priorities in implementing government policy in the sphere of energy conservation in view of available potential for energy savings and important tasks are the Five year energy saving programs approved by the Government of the Republic of Belarus.

At present the energy saving program for 2006-2010 is underway; it was approved by the Resolution of the Council of Ministers of the Republic of Belarus No 137 of February 02, 2006. It is planned to achieve the set objectives by implementing high-efficiency projects with short payback periods, such as:

- using modern power generating technologies at enterprises and converting boiler houses into combined heat and power plants by installing gas-piston and gas-turbine units, providing for electricity generation with specific fuel consumption at 150-170 grams of coal equivalent per kWh (gce/kWh), to substitute for electric power generation at Lukoml and Berezovo state regional power plants with specific fuel

consumption over 320 gce/kWh; and eliminate losses in transmission networks;

- implementation of new energy efficient manufacturing technologies in all sectors of the economy, which will yield in some cases an energy consumption per unit of production at one-tenth current levels;
- recycling heat and combustible secondary energy resources, primarily in the petrochemical industry, for technological use and heat generation which allows a reduction in the energy component of production costs;
- optimization of heat supply networks and moving heat generation from enterprise boiler houses to Combined Heat and Power (CHP) plants to increase electricity generation using combined cycle;
- decentralization of heat supply in rural areas; elimination of extensive heat supply networks and installation of local heating systems, which will eliminate losses in the heat supply networks which are comparable in volume with the end users' consumption;
- introduction of controlled electric drives for devices with variable load, which provide for 25-40% power savings, and hence, for reduction of electricity generation at condenser type power plants; a two-fold cost savings for consumers, and other measures.

In the framework of the Five-year energy saving programs, annual programs are prepared for the regions, industries, and enterprises; these programs are designed to support the implementation of specific energy efficient technologies and equipment in various sectors of the economy.

The priority of the energy policy of Belarus is to create conditions for economic development through efficient use of energy. The effectiveness of the government's energy efficiency policy is confirmed by the fact that since 1996 GDP growth has not been accompanied by an increase in the energy intensity relative per unit of GDP. Moreover, during the last 10 years, Belarus' energy intensity has fallen by almost half. It was a result of implementing energy savings programs financed from various sources, including out of the own funds of enterprises, innovation funds in industry, national and regional budgets, loans and grants of the international financial organizations.

In 2009, consumption of local energy resources in the power system of Belarus, including secondary energy, reached 178.4 thousand tce. Projects on using local fuels were carried out in the towns of Osipovichi, Vileika, Pinsk, Zhodino, Bobruisk, Orekhovsk and Pruzhany; a steam boiler aggregate with capacity of 60 tons of steam per hour supplied by local fuel was installed at Zhodino CHP plant. Two small hydropower plants were commissioned in Zelvensk and in Minichi. The small CHP plant using domestic fuel is under construction in Rechitsa. Operation of these units in 2010 provided for a 2.1% share of domestic fuels in the total fuel consumption within the power system. Taking into account the necessity to diversify the fuel supply and to lower the share of natural gas in the energy balance, a nuclear power plant and a coal-fired power plant will be built. The Ministry of Energy has planned to build power units operating on local fuels. As a result, by 2020 the consumption of nuclear fuel will reach 5 mm tce. (30% of the total fuel consumption in the power system), coal – over 1 mm tce (6.3%), locally sourced fuels (peat, wood, hydropower, wind, and secondary resources) – around 0.7 mm tce (4.3%). Thanks to the diversification of primary energy consumption in the power system, the share of natural gas is expected to drop from 94% in 2008 to 55% in 2020.

In Belarus the main obstacle to investing in energy efficiency projects is the strong state participation in the economy, which slows down the development of private sector (the majority of Belarusian companies that are not 100% state owned, nevertheless, to a large extent still belong to the state). In addition, cost savings obtained by the company receiving government financing should be returned to the state budget and cannot be used to pay return on investment (except for the cases when the state is the investor). This is

an obstacle for the business development of energy service companies (ESCO). Among other legal and institutional barriers in Belarus there is a poor legislative basis in the sphere of energy (e.g. absence of a framework law on the electric power sector) and lack of transparent information about government plans for reforms.

The leadership of the Republic of Belarus is trying to conduct some reforms in the energy sector. Among recent successes one may note several strategic programs for upgrading the energy sector, increasing energy efficiency, and development of renewable energy sources. It would be recommended to introduce a transparent system of policy implementation monitoring. In order to allow state owned enterprises to earn returns on investments into energy efficiency projects and renewable energy projects, the Government should guarantee conclusion of long-term contracts and application of flexible budget mechanisms. Establishment of a transparent system of state procurement and developing guidelines for conducting competitive bidding will help attract private investments, including those in energy efficiency projects.

Potential for energy saving

The total potential for energy saving in the Republic of Belarus is determined by the conceptual tasks through the end of 2010 and is estimated at the level of 5.57–7.27 mm tce, of which by sector:[14]

- Utilities and housing — 2.87–3.61 mm tce
- Power sector — 0.75– 0.9 mm tce.
- Chemistry and Petrochemicals — 0.33– 0.59 mm tce.
- Agriculture — 0.38–0.54 mm tce
- Construction materials — 0.36– 0.38 mm tce
- Machine building — 0.34– 0.54 mm tce
- Fuel sector — 0.1– 0.13 mm tce

Food industry — 0.07– 0.1 mm tce.

- Other industries — 0.15— 0.2 mm tce
- Other consumers — 0.22— 0.24 mm tce.

By the year 2020, Belarus intends to lower the energy-intensity of GDP from 400 kg of oil equivalent (2005) to 210-220 kg of oil equivalent per US $1,000 of GDP, and reach the level of Canada and Finland. In 2015, the energy-intensity of GDP should decrease by at least 50%, and by 2020 by at least 60% of the 2005 level. However, at present the energy-intensity of GDP in Belarus is 50% to 100% higher than in the developed countries with similar climate.

These targets are to be achieved through the adoption of new technologies and by increasing by 1.7 mm tce the consumption of locally sourced fuels, secondary, alternative, and renewable energy sources.

Conclusions and recommendations

The Republic of Belarus has achieved a considerable success on the way to the energy savings development; this is considered the most important factor of the country's energy security policy. The experience of organizing and implementing the energy savings policy could be rather useful to other CIS states. In order to intensify work on leading the country along the energy efficient way of development and thus increasing its energy security, it is considered advisable:

- to develop a national program for the wider use of advanced technologies employing locally sourced fuels and energy resources, including renewable resources;
- to develop the legislative basis in the sphere of energy, to foresee mechanisms to encourage energy and fuel suppliers to implement energy savings projects at the consumers' side;
- to create information systems on energy saving to be used by all types of consumers;
- to tighten control and increase responsibility, first and foremost, of large energy users for inefficient use of fuel and energy;
- to organize manufacturing of energy efficient equipment, instruments, and materials;
- to develop scientific and technical cooperation in the sphere of energy saving with other CIS states and European countries;
- to attract domestic and foreign investors to participate in energy savings projects;.

14 Energy saving program for 2001-2005 with extension to 2006-2010.

- to work out measures to ensure integration of the Russian and Belarusian power systems, first of all in the field of harmonization of regulations, standards and tariff policy;
- to abandon gradually the use of subsidized tariffs and switch to market prices for energy resources;
- to introduce a transparent system for monitoring policy implementation;
- to introduce a transparent system of state procurement and develop guidelines for conducting competitive bidding what will attract private investments, including those in the energy efficiency projects.

2.4. Republic of Kazakhstan

General information
Territory –2,724 million km^2.
Population – 16.30 million people (2009).[15]
GDP (2009) – USD 182.044 billion

Structure of GDP (2009):
• Agriculture – 6.0%
• Industry – 42.8%
• Services – 51.2%

Fuel and energy sector

The fuel and energy sector of Kazakhstan is the major contributor to the production of gross domestic product. Annual growth in the sector for the last 5 years has been estimated at the level of 8-9%.

The development strategy for the fuel and energy sector is determined in the program documents that were adopted for the medium and long terms.

Kazakhstan is one of the top 10 countries of the world in terms of hydrocarbon reserves; in the CIS its reserves are second largest after Russia's. In terms of explored natural gas reserves Kazakhstan ranks 15th in the world.

The largest explored reserves of gas condensate are found in the large developed fields of Karachaganak, Tengiz, and Zhanazhol.

The Kashagan field is situated in the northern part of the Caspian Sea; its discovery turned Kazakhstan into one of the leading countries in the world in terms of oil and gas reserves. This discovery attracted enormous international interest to the Caspian basin and substantially increased the investment attractiveness of the Kazakhstan's sector of the Caspian Sea.

Kazakhstan has large reserves of coal; 80% of the power plants in the country are coal-fired ones. The total installed electricity generating capacity is around 1,600MW.

Policies and measures in the sphere of energy savings and energy efficiency

In 1996 a special government program on energy savings was developed and approved by a resolution of the Government of the Republic of Kazakhstan.

The program envisages the realization of an energy saving potential throughout the whole cycle from production of primary energy to consumption of energy by end consumers. The program for development of renewable energy in the Republic of Kazakhstan -- approved by the minister of energy and minister of science in 1995-- became part of the state program on energy saving. In the framework of "The Hydrocarbon Initiative" that was initiated in 1997 by the Ministry of ecology and natural resources of Kazakhstan, energy savings was made one of priorities of this undertaking

In 1999, the Ministry of energy, industry and trade developed and adopted the energy sector development program through the year 2030. The main energy sector development strategy for 2000-2030 is to modernize existing power plants and to improve their energy efficiency.

In the heat supply sector most attention is paid to the optimization of heat supply networks

15 http://www.stat.kz/news/Pages/pr_04_02_10.aspx

Table 7. Balance of energy production and consumption (2008).

	Oil and condensate (mm tons)	Oil products (mm tons)[16]	Natural gas (bcm)[17]	Electricity (TWh)[18]
Production	70.67	12.019	30.6	80.32
Imports	3.2	1.92	5.7	2.76
Exports	60.3	3.96	5.73	2.48
Consumption	12.8	9.24	29.6	80.6

16 http://www.iea.org/stats/oildata.asp?COUNTRY_CODE=KZ
17 http://www.iea.org/stats/balancetable.asp?COUNTRY_CODE=KZ
18 http://www.iea.org/stats/electricitydata.asp?COUNTRY_CODE=KZ

in cities and towns in view of improving their economics and ecological soundness, taking into account the existing district heating systems and stand alone systems.

Energy saving is a very important issue for the economic development of Kazakhstan:

- specific energy consumption in the economy of Kazakhstan is very high;
- energy prices are usually greatly affected during transition periods;
- energy saving provides additional energy resources;
- the country's energy saving potential is high;
- the ecological situation is deteriorating and further development of fuel and energy sector will make it worse;
- improvement of energy efficiency could resolve some social problems;
- the energy saving policies stipulated in the above mentioned documents are further elaborated in documents and regulatory acts at other levels of governance.

In July 2009 the President of Kazakhstan signed a Law "On Support for the Use of Renewable Energy Sources". This law is aimed at greater use of renewable energy sources to decrease the energy-intensity of the economy and to lower the impact of electric power plants on the environment, including reduction of greenhouse gas emissions. This law stipulates the state's responsibilities in respect to the regulation of economic and social relations in the sphere of renewable energy sources. The Government of Kazakhstan expects that the adoption of this law will create favorable conditions for the construction and operation of power units using renewable energy sources, and will facilitate compliance with international obligations of Kazakhstan to reduce greenhouse gas emissions.

At present all energy sector development programs prepared under the auspices of responsible ministries pay attention to the issues of energy efficiency. Similar development programs are prepared by local executive authorities and by national companies.

According to the "Kazakhstan Development Strategy for 2030" and the Law "On Energy Saving" the most important issues of energy saving in the country are the following:

- elaboration of government policy in the area of energy saving;
- description of energy consumption by fuel sources;
- assessment of the energy saving potential in all sectors of the economy;
- legislative support for government policy in the area of energy saving;
- control systems to support energy saving processes;
- incentive mechanisms to promote energy saving;
- ecological aspects of the energy saving policies;
- technical issues of energy saving;
- creation of a market for energy efficient equipment and materials.

The lists of energy savings measures were developed for each sector of the economy, electric power industry, heat supply, coal industry, construction materials, housing and communal services, agriculture, transport, production of mineral fertilizers, nonferrous metallurgy, and oil refining.

The sources of financing for energy saving programs can be budgetary funds, internal and borrowed funds of enterprises and organizations, and other legal sources. Funds can be also provided by international organizations, such as the International Monetary Fund, the World Bank, the UN Development Project/Global environment facility, government and non-government organizations established by the developed countries for rendering technical assistance.

Potential for energy saving

According to expert estimates, under the assumptions of the forecasted GDP growth of 8.8% to 9.2% till 2015 and a two-fold reduction in energy-intensity in 2015 in comparison with 2000, one may expect annual savings in fuel and energy consumption in Kazakhstan up to 20 to

35 mm tce in 2010-2012, and up to 40 to 60 mm tce in 2013-2015.[19]

There is a considerable energy savings potential in the housing and utilities sector in Kazakhstan. However few energy saving work programs and action plans were developed at the level of specific regions and industries. As of 2009, only 6 regions out of 16 submitted their action plans. Usually these documents contain bare declarations, while specific measures and actions to support energy savings are not proposed.

Conclusions and recommendations

For the Republic of Kazakhstan the implementation of an energy saving policy is especially important for the economy in general and for the energy security of the country, due to a high share of production of the energy-intensive industries in the total production of GDP. In order to accelerate the transition of the country to the energy saving development pattern, it is expedient:

- to develop the national energy saving program;
- to delegate regulation and administration functions related to energy efficiency from the national to the regional level, taking into account differences in economic development of various regions and the large size of the country;
- to establish a network of regional energy agencies subordinate to the National Energy Agency for implementation and monitoring policies on energy efficiency and development of renewable energy sources;
- to elaborate the existing special purchase rates for power produced by renewable energy capacity, in order to provide potential investors with transparent information and avoid discrimination;
- to develop small gas fields and increase utilization of associated gas, upgrade energy transport systems with the purpose of reducing their power costs, and to increase the utilization of secondary energy resources in industry;
- to organize information campaigns, awareness programs and training courses in order to create a positive image and to attract investment into the area of sustainable energy. Training and programs for certification of energy auditors should be focus of the capacity building programs

19 http://www.unece.org/energy/se/pp/adhoc/adhoc9May07/trofimov_01060_r.pdf

2.5. Republic of Kyrgyzstan

General information
Territory – 198.5 thousand km^2.
Population – 5.418 million people (2009).[20]
GDP (2009) – USD 5 billion.

Structure of GDP (2009):
- Agriculture – 26.9%
- Industry – 18.4%
- Services – 54.7%

Fuel and energy sector

Kyrgyzstan has sufficient fuel and energy resources. The fuel and energy sector comprises two large branches: fuel production (coal, oil, and gas) and electric power generation. These two branches are closely related to the industrial sector and supply with power housing and utilities, agriculture, and transport.

Kyrgyzstan operates 15 hydropower plants and 2 combined heat and power plants with a total capacity of 3,600MW.

There is a cascade of five high capacity hydropower plants on the Naryn River. Kyrgyzstan exports part of its generated electricity to Kazakhstan, Uzbekistan, Tajikistan, China, and Russia.

The gross potential for electricity generation was estimated on the basis of a large number of feasibility studies at 168 TWh/year. The largest contributor is hydropower with an estimated potential of 142.5 TWh/year, of which only about 10% is developed at present. The economically feasible potential is estimated at about 100 TWh/year which is six and half times higher than current electricity production level.

Construction of the first hydroelectric plant sites on the Naryn cascade could yield annual electricity generation of 22 TWh.

So the main energy resource of the Republic of Kyrgyzstan is hydropower. Kyrgyzstan possesses abundant water and hydropower resources; they are the third largest in the CIS after Russia and Tajikistan.

The electric power industry produces about 5% of GDP and 16% of the total output of the industry sector; it contributes 10% to budget revenues.

In 2009, generation and distribution of electric power decreased by 5.8%. According to the estimates of the Ministry of industry, energy and fuel of Kyrgyzstan in 2010 total estimated shortage of electricity in the country will exceed 2 TWh.

Annually Kyrgyzstan exports up to 2.5 TWh of electric power to Uzbekistan, Kazakhstan, and Tajikistan. Despite the fact that Kyrgyzstan is an exporter of electricity, there are shortages in the internal market. It was expected that by the end of 2010 gross electricity generation would grow up to 16.5 TWh (up to 22 TWh in 2015), including production of thermal power plans that will add by 0.7 TWh, while production of hydropower plants will increase output by 1 TWh. The volume of electricity exports to the markets of South Asia is expected to reach 1 TWh per year.

20 http://www.stat.kg/stat.files/tematika/демограф/Кыргызстан%20в%20цифрах/демо1.pdf

Table 8. Balance of energy production and consumption (2008).

	Oil and condensate (mm tons)	Oil products (mm tons)[21]	Natural gas (bcm)[22]	Electricity (TWh)[23]
Production	0.07	0.13	0.02	11.87
Imports	0.12	1.20	0.67	0.01
Exports	0.53	0.27	–	0.54
Consumption	0.014	0.71	0.69	11.34

21 http://www.iea.org/stats/oildata.asp?COUNTRY_CODE=KG
22 http://www.iea.org/stats/balancetable.asp?COUNTRY_CODE=KG
23 http://www.iea.org/stats/electricitydata.asp?COUNTRY_CODE=KG

Annually over 2.5 million Gcal of heat energy is generated for the purposes of space heating and hot water supply (of which approx. 60% is produced by Electricity Plants Inc.). Around 600 thousand tce are consumed by all heat generating units for heat production (natural gas – 53%, coal – 29%, residual fuel oil – 18%). In 2009; generation of heat energy reached around 2,262 million Gcal.

Kyrgyzstan has second largest coal reserves in Central Asia after Kazakhstan. There are about 70 discovered coal deposits and occurrences in Kazakhstan. Probable reserves of the main coal deposits are estimated to exceed 2.2 billion tons while recognized recoverable reserves are estimated at 1.317 billion tons. In 2009, coal production reached 402.5 thousand tons (321.1 thousand tons in 2006), in 2010 – about 460 thousand tons with further planned increase up to 1,700 thousand tons in 2025.

In 2009, 14.9 million cubic meters of natural gas were produced. It is planned to produce 25 million cubic meters of gas each year through 2011.

Policies and measures in the sphere of energy saving and energy efficiency

It should be mentioned that in Kyrgyzstan less attention has been paid to the issues of energy efficiency than in other CIS states. The Law of energy saving was adopted in 1998. This law established the legal basis for state policy in the sphere of energy efficiency and outlined the institutional, economic, and legal mechanisms for policy implementation.

The main objectives of the Government in this sphere have been:

- an efficient use of energy resources during production, processing, transportation, storage, and consumption;
- government supervision over efficient use of energy resources;
- development of renewable energy sources capable of replacing expensive and scarce types of fuel;
- development and use of energy savings technologies, construction and insulation materials, metering and control instruments, implementation of automatic system for energy consumption control;
- taking accurate, reliable, and uniform measurements of energy supplied and consumed;
- providing information on energy savings opportunities, use of new energy sources and types of fuel; measurement instruments, types of control over energy consumption;
- technical regulation, standardization, certification and metrological support of the power supply sector.

In April 2008, the "National energy program of Kyrgyzstan for 2008-2010" was adopted. This program sets development strategies for the fuel and energy sector and determines the main spheres of the government energy policy. The highest priority in the energy strategy of the Republic of Kyrgyzstan is a highly efficient use of fuel and energy resources and available technological, scientific, and human resource capacities of the fuel and energy sector to ensure energy independence and security of the country, sustainable economic development and improvement of living standards of the population.

The main objectives are: ensuring energy security of the country, energy efficiency, clean energy, sustainable subsurface use, reasonable balance of fuel and energy. In addition a very important objective of the energy program is to ensure uninterruptible power supply primarily to domestic consumers.

In 2008, the Energy Saving Fund was established, which should promote development and implementation of energy saving technologies, support upgrading of the power companies' equipment, and allow for partial switching to renewable energy sources. The government believes that thus Fund may contribute to solving local problems in the energy sphere. The Fund may extend program financing for implementation of new energy technologies, provide benefits to persons and organizations using power saving equipment, extend credits and grants to

those who wish to work in this area. The Fund is supposed to mobilize financing by receiving loans, grants, and contributions from energy sector companies.

After reviewing the priorities of the national energy strategy of the Republic of Kyrgyzstan and the policy measures, there is an impression that the Government just recently has paid serious attention to the issues of energy efficiency and development of renewable energy sources. The draft laws targeted at improving energy efficiency are still in revisions mode. Time is needed for these documents to be approved, come into force and to start to be implemented. Only after that it would be possible to assess the potential benefits. In addition, the country is missing secondary legislation: construction and marking standards, regulations for energy audits, and the legal framework for establishing energy supply companies. From the economic point of view, the main obstacle for successful implementation of the projects is lack of economic incentives in the sphere of energy efficiency. It does not help that the special guidelines for determining purchase rates for electricity generated by using renewable energy sources are still in preparation.

As a support to the national energy program the law of the Republic of Kyrgyzstan "On renewable energy sources" was adopted in 2008. The goals of this law is to support development and utilization of renewable energy sources, improvement of energy balance structure, diversification of energy sources, improvement of the social situation in the country, ensuring energy security of the Republic of Kyrgyzstan, environmental protection and sustainable economic development. This law regulates relations in respect to production, consumption and supply of heat, electricity, and fuel using renewable energy sources as well as manufacturing and supply of equipment and technologies related to renewable energy in the territory of the Republic of Kyrgyzstan.

Potential for energy saving

Kyrgyzstan has substantial potential for increasing energy efficiency. According to preliminary estimates, the theoretical fuel and energy savings gained through realization of energy saving measures may reach 0.5 mm tce per year. A decrease in fuel and energy consumption will allow a 10% reduction in the fuel component of production costs, and will prevent the emission of about 0.1 mm tons of pollutants into the atmosphere, the accumulation of 0.3 mm tons of ash slag waste, as well as the emission of 0.6 mm tons of CO_2.

The projected needs for heat and electricity in the country can be met with lower costs if demand side management is used.

It would be possible to achieve the projected GDP growth of 8% which should improve competitiveness of the economy, only if consumption of energy resources declines at least twice. This may be achieved in three ways:

- high quality management of energy savings activities in the country;
- promotion of development and implementation of energy saving technologies and development of renewable energy sources;
- introduction of structural changes into the economy with the purpose of manufacturing goods with lower energy-intensity.

Taking into account what was outlined above, one can assess the energy savings potential in the Republic of Kyrgyzstan:

Table 9. Potential for energy saving in Kyrgyzstan[24]

Possible energy savings (mm tce) due to:					
organizational measures		technological measures		structural changes	
2011	2015	2011	2015	2011	2015
0,89	1,21	0,98	2,22	0,31	0,63

24 Program on energy saving of the Republic of Kyrgyzstan for 2009-2015. Section 3. Main objective and forecast.

Conclusions and recommendations

At present in the Republic of Kyrgyzstan, there is neither organizational, nor legislative framework to implement energy saving policies. However in a situation where there is high dependence of power supply on primary energy imports, the improvement of energy efficiency of the country's economy could positively affect energy security, enhance competitiveness of national industries, and solve ecological problems.

To be able to achieve these objectives it is necessary:

- to develop a national program for energy savings taking into account the use of renewable energy sources;
- to accelerate the realization of the law of the Republic of Kyrgyzstan "On energy saving", to work out management system, benefits, and incentives for enterprises involved into energy saving activities;
- to attract domestic and foreign investors to participate in energy saving projects and to design energy efficient equipment;
- to install energy consumption controls and increase responsibility for inefficient use of fuel and energy;
- to adopt a package of regulatory and legal acts and documents to support implementation of the Law "On energy saving" of the Republic of Kyrgyzstan";
- to prepare intergovernmental agreement on mutual supplies of fuel and energy with the purpose of establishing an energy common market of the CIS states, of ensuring a reduction in the costs for developing locally sourced fuel and energy resources and of using energy efficient technologies.

2.6. Republic of Moldova

General information
Territory – 33.8 thousand km^2.
Population – 3.65 million people (2009).[25]
Moldova is an agrarian country.
GDP (2009) – USD 6.1 billion

Structure of GDP (2009):
- Agriculture – 16%
- Industry – 19.9%
- Services – 64.1%

Out of all CIS countries per capita GDP in Moldova is one of the lowest; only Kyrgyzstan and Tajikistan are lower.

Moldova has a good climate and agricultural land, but lacks mineral resources. The country's economy is based on agriculture. Almost all energy resources have to be imported.

Fuel and energy sector

The Republic of Moldova does not have reserves of coal or natural gas and has low hydropower potential. According to recent data, the explored oil reserves are 15 mm bbls. This looks rather insufficient for long-term investment projects. So the country is highly dependent on energy imports (98%).

Electric power is the main type of energy consumed in Moldova. According to EPC CIS, electricity generation capacity in the country comprises four thermal power plants, of which Kuchurgan power station (Moldavskaya GRES) is the largest power station of Moldova, with a capacity of 2,520MW, and two hydropower plants in Dubosari and Kostesh. Total installed capacity of the power system in Moldova is 2,984MW.

High voltage transmission lines (110, 330, and 440 kV) connect the power grid of Moldova with Ukraine, Bulgaria, and Romania. The Moldavian power system has sufficient throughput for internal interchanges, however it needs a capacity upgrade for interconnection with the power grids of Romania (130-150 MW) and Ukraine (130-400 MW).

In Moldova electricity generation is almost 100% gas-fueled. The hydropower potential is situated mainly in Transnistria, which has an uncertain administrative status (Pridnestrovie).

In Pridnestrovie two power plants are in operation: Kuchurgan regional power plant and Dubosari hydropower plant; they both need reconstruction. At present, the capacity of Dubosari HPP is 48 thousand kW; it could be increased up to 64 thousand kW by installing new equipment. This will require capital investment of about USD 50 million. The power plant does not have enough of its own funds to make such an upgrade.

The build-up of capacity of the Dubosari HPP would provide sufficient power to the population of Pridnestrovie. At present, annual electricity consumption in this sector reaches 300-320 GWh, while maximum electricity output of HPP is 280 GWh. The Kuchurgan regional power plant is in even greater need of modernization. This is the largest electric power plant in the

25 http://www.md.spinform.ru/people.html

Table 10. Balance of energy production and consumption (2008)

	Oil and condensate (mm tons)	Oil products (mm tons)[26]	Natural gas (bcm)[27]	Electricity (TWh)[28]
Production	0.014	–	–	3.6
Imports	–	0.7	2.22	2.95
Exports	–	0.05	–	–
Consumption	0.014	0.67	2.22	6.58

26 http://www.iea.org/stats/oildata.asp?COUNTRY_CODE=MD
27 http://www.iea.org/stats/balancetable.asp?COUNTRY_CODE=MD
28 http://www.iea.org/stats/electricitydata.asp?COUNTRY_CODE=MD

region. It was privatized some time ago and is now in private hands. Nevertheless no serious changes in its situation have occurred.

Today the heat supply networks are in urgent need of large scale reconstruction. The accumulated depreciation of equipment is 70-80%. The efficiency of the heat supply system is about 60%. Heat is just lost, and the process of its transportation to the consumers contributes a lot. The networks should be replaced but there are no available funds for that.

The present situation in the fuel and energy sector is aggravated by the "gas debt" to Russia. In 2009 the gas debt of Pridnestrovie grew by more than USD 100 million and exceeded USD 1.5 billion.

The Republic of Moldova needs to reduce consumption of imported primary energy. Increases in gas prices are pushing the country towards the use of energy savings technologies.

Besides gradual renewal of equipment, which is supposed to reduce energy costs, there are other ways to achieve these ends. It is recommended to use small hydro, wind generators, and biomass fuel. These sources will not replace primary energy but may reduce the country's dependence on the primary energy imports.

Being heavily dependent on primary energy imports, Moldavian economy is nevertheless characterized by a high level of energy-intensity.

Policies and measures in the sphere of energy savings and energy efficiency

Increasing energy efficiency is a high priority task for the Republic of Moldova. The energy strategy assumes an annual 2 to 3% reduction of energy-intensity and several measures to enhance energy efficiency. In December, 2000, the Law "On energy saving" was adopted. In 2003, the national "Program for energy saving in 2001-2010" was prepared.

In 2000, in Moldova the "Energy strategy through 2010" was developed and adopted as a basis for further elaboration of energy policy. The main emphasis in the strategy is given to increasing energy efficiency at the stages of production, transmission, distribution, and consumption of power and to using locally sourced energy sources, including renewable resources.

The Ministry of energy was organized in 2001. It has the responsibilities and the authorities in the area of development and implementation of energy policy in Moldova.

Energy saving programs for the power sector and the "National gasification program" were prepared. For the next 20 years, growth in consumption of natural gas is the priority. It is planned to lay new gas pipelines and build gas distribution networks.

The "Law on Energy" of 1998 introduced energy pricing on the basis of cost accounting. Adoption of this law, along with establishment of the National Agency for Energy Regulation (ANRE) in 1997 and the adoption of laws on electricity and gas in 1998, were important steps in applying adequate economic principles of price regulation to the energy sector.

In the situation of serious economic problems faced by the country, the pricing policy of the ANRE was affected by political and social factors. In 2003, ANRE finally managed to get approval of differentiated rates for electricity and gas which took into account actual costs, consumed power, and voltage. Electricity price above 5 US cents per kWh is comparable with prices in OECD countries. In 1999, pricing in the heat supply sector was delegated to municipal authorities.

A strong increase in energy prices and low household income levels resulted in poor collections of bills. Subsidized tariffs for electricity and gas were introduced for minor consumption levels. In addition, direct subsidies were provided for the indigent, invalids, veterans, etc.

Since 2002, the Ministry of energy has been the coordinator of all efforts in the sphere of energy efficiency. The National Energy Saving Agency has the authority to develop and realize energy savings programs. The State Energy Inspection checks compliance with technical norms and standards and safety standards. The State Energy Inspection, along with overseeing

compliance with technical standards and norms and safety standards for security, controls the levels of energy consumption in different areas of the economy. Other government and non-government organizations are involved in implementing energy saving measures.

In Moldova, the energy efficiency measures have been realized mainly for upgrading centralized heating systems and improvement of residential, public, and industrial buildings.

A whole package of government documents was prepared concerning the central heat supply system: A concept paper for the restoration of the heat supply systems; a Program for the reconstruction and decentralization of the heat supply systems; the draft Heat Law. The draft Heat Law envisages liberalization of the heat supply market and is targeted at supporting a private initiative in the heat supply sector.

The "Program for reconstruction and decentralization of heat supply systems" adopted in 2003 provides for upgrading of local heat supply systems in 36 towns in the country. Several projects were implemented under agreements with international and foreign financial organizations and aid donors (EBRD, IBRD, US AID).

The energy efficiency of buildings is an important issue to be considered by the government of Moldova. In the housing sector some drastic and large scale measures targeted at enhancement of energy efficiency were undertaken. Among them was introduction of "Energy certificates" ("Energy passport") for new and reconstructed buildings.

The National Energy Saving Agency has conducted over 80 energy audits in industry, mainly in the branches dealing with processing of agricultural produce. Several audits and projects for public and industrial buildings were done with the support of the Norwegian Government. These audits were conducted along with providing training for the personnel of the enterprises. The program ended when about 60% of the proposed projects had been completed.

Moldova has an urgent need to invest in modernization and reconstruction both in the public and in private sectors; however, the availability of investment capital is rather limited. It is inadequate to finance developing energy efficiency programs and this impedes implementation of already adopted programs.

The National Fund for Energy Saving started operation in 2003 with a rather small budget financing. To provide financing for the implementation of the energy efficiency programs, the government made a decision to allocate 20% of revenues from national and local budgets to investment in the energy sector, including investment in energy efficiency.

As the dependence of Moldova on primary energy imports is strong, use of local resources, including renewable energy sources, has become a priority. The obligations for buying electricity from the combined heat and power stations (CHPP) and electricity generated on the basis of renewable energy sources were introduced.

In the framework of the environmental policy of the Republic of Moldova an increase in energy efficiency is considered an important ecological tool for reducing emissions and for fulfilling obligations in compliance with several international conventions ratified by Moldova, in particular the UN Framework Convention on Climate Change and the Kyoto Protocol.

Potential for energy saving

The total potential for energy saving in Moldova is estimated at 3 mm tce, or USD 25-40 million.

The main difficulties in assessment of the energy saving potential are caused by lack of reliable data on energy consumption because buildings are not equipped with metering instruments.[29]

Conclusions and recommendations

In the situation of almost full dependence of the economy of the Republic of Moldova on primary energy imports, improvement of energy efficiency is a very high priority for ensuring the energy security of the country.

29 Unified register of legal acts and other CIS documents: Main principles for member –states interaction in the field of energy efficiency and energy saving .

The energy savings potential in the country is rather high and its realization is much more effective per 1 toe than imports of any type of primary energy.

It is considered expedient to undertake organizational, legislative, and financial measures at national and international levels to approach the implementation of an energy saving policy:

- to develop a program for biomass fuels in order to utilize the substation potential of biomass energy in the country and to increase the share of renewable energy sources;
- to attract financing from domestic and foreign funds, local and foreign investors to invest into energy saving projects;
- to amend the Land Code in order to overcome fragmentation of land ownership rights and target territorial planning;
- to develop rules for competitive bidding and government procurement ;
- to carry out information campaigns and training to improve awareness for the local authorities, commercial banks, and project developers;
- to create management systems for energy saving programs with the account for international experience and best practices.

2.7. Russian Federation

General information
Territory – 17.075 million km^2
Population – 141 million people (2009)[30]
GDP (2009) – USD 2.225 trillion

Structure of GDP (2009):
• Agriculture – 4.7%
• Industry – 34.%
• Services – 60.5%

Fuel and Energy sector

The fuel and energy sector of Russia operates on the foundation of its own resources. In 1988, Russia produced 13% of the total energy output in the world, while its population comprises only 3% of the world's population.

Russia has one of the leading positions in the international energy trade and actively participates in international cooperation in the sphere of energy.

Recently Russia has become one of the world's largest crude oil producers and is responsible for 12% of the world oil trade. Over 80% of Russia's exports go to European countries; the share of Russian oil in the European market is around 30%. The European market is the main destination for the exports of oil products as well.

At the end of 2008, the total installed capacity of the power system of the Russian federation was 211.8GW, of which thermal power plants were responsible for 70%, hydropower plants – 20%, and nuclear – more than 10% of installed energy capacity.

Over 90% of the power generating capacity is connected into the Unified Energy System which embraces the whole territory from the Western borders to the Far East and is one of the largest power systems in the world with centralized control. Isolated power systems have limited interconnections with other territories where interregional interchange is possible.

The system framework of the Unified Energy System of Russia is transmission lines of 220kV and higher and distribution lines of 110kV and lower.

Industrial consumers are responsible for over 70% of power consumption, and housing and utilities sector account for about 20%. In 2008 thermal power plants produced 594.5 TWh, hydropower plants– 175.2 TWh, and nuclear power plants – 163.3 TWh.

Russia is ranked first in the world by reserves of natural gas (23% of world reserves) and, by its annual production; Russia's share in the world trade of natural gas is about 25%. The country dominates the European gas market and in the CIS market.

The thermal power plans of Russia are well provided by the reserves of combustible fuels. However extraction costs are continuously growing and ecological problems are aggravated. Production costs of electricity generated by nuclear power plants are approximately half that by thermal power plants.

30 http://www.gks.ru/free_doc/new_site/population/demo/demo11.htm

Table 11. Balance of energy production and consumption (2008).

	Oil and condensate (mm tons)	Oil products (mm tons)[31]	Natural gas (bcm)[32]	Electricity (TWh)[33]
Production	468.2	197.1	593.4	1,040.0
Imports	2.4	1.0	7.1	2.95
Exports	243.1	98.7	175.0	20.7
Consumption	242.0	105.4	406.4	1,022.0

31 http://www.iea.org/stats/oildata.asp?COUNTRY_CODE=RU
32 http://www.iea.org/stats/balancetable.asp?COUNTRY_CODE=RU
33 http://www.iea.org/stats/electricitydata.asp?COUNTRY_CODE=RU

Policies and measures in the sphere of energy saving and energy efficiency

Russia has a large underutilized potential for energy savings that can be a contributor to the economic development comparable with production growth of all primary energy resources.

The energy intensity per GDP (PPP adjusted) is much higher than in the USA, Japan, and industrially developed European countries.

An energy deficit may become an impediment to the economic growth in Russia. According to the estimates, the energy-intensity decline rate may slow down before 2015 if there is no coordinated state energy efficiency policy. This may result in even greater demand for primary energy in the country. There are substantial available oil and gas reserves in Russia, however, to increase their production and to construct a new transport infrastructure require large investment.

Energy efficiency measures undertaken in 1998-2005 proved insufficient to halt the growth of demand for power and capacity. The increase in demand for gas and electricity has exceeded the projections of the "Energy strategy of Russia up to 2030". The Energy Strategy was adopted in November 2009 by resolution of the government of the Russian Federation.

In accordance with the strategy, exports of fuel and energy will remain the most important factor of the national economy; however their impact on the economy is expected to weaken. It will be reflected in an exports growth rate that is expected to slow down gradually and to stabilize by the end of the period.

The main strategic guidelines of long-term state energy policy are as follows:
- energy security;
- energy efficiency of the economy;
- budgetary efficiency of the energy sector;
- environmental security.

The main components of state energy policy are as follows:
- subsoil use and management of state-owned subsoil resources;
- development of the domestic energy market;
- achieving a rational fuel mix in the energy balance;
- regional energy policy;
- innovative and scientific-and-technical policy in the energy sector
- social policy in the energy sector;
- foreign energy policy.

The main mechanisms of the state energy policy are as follows:
- creating a favorable economic environment for the operation of the fuel and energy sector (including coordinated tariff, tax, customs, antimonopoly regulations and institutional reforms in the fuel and energy sector);
- introducing a system of advanced technical regulations, national standards and norms improving and stimulating the implementation of key priorities and guidelines for energy development, including improving the energy efficiency of the economy;
- stimulating and supporting business entities' strategic initiatives in investment, innovation, energy saving, environmental and other priority areas;
- improving the management efficiency of state-owned property in the fuel and energy sector.

Russian state energy policy should be implemented in three phases to ensure:
- consistent progress towards achieving the objectives and goals of the strategy;
- coordination of state energy policy with the social and economic development of the country;
- better accounting for internal factors and the externalities of energy sector development and for the characteristics and vectors of the state energy policy at different implementation stages.

The first phase consists in overcoming the crisis and establishing the foundations of a new economy. Accordingly, the main task is to quickly overcome the crisis in the economy and the energy sector in order to achieve sustainable rates of economic and energy development

specified in the Concept paper, and to use the opportunities that have arisen during the crisis for renewal and modernization of the Russian fuel and energy sector.

The second phase consists in a transition to innovative development and establishment of the infrastructure of a new economy. Accordingly, the highlights of the second phase would be, on the one hand, an increase in energy efficiency in the fuel and energy sector and in the economy as a whole as a result of modernization of fixed assets and of the regulatory and institutional reforms undertaken during the first phase, and, on the other hand, realization of innovative projects and new capital intensive energy projects in East Siberia and the Russian Far East, on the continental shelf of the Arctic sea, and on the Yamal peninsula.

The third phase is devoted to the development of an innovation economy. Accordingly, this phase will be characterized by a gradual transition to the energy sector of the future on the basis of fundamentally different technological possibilities for development, supported by highly efficient use of traditional energy resources and new non-hydrocarbon energy resources and technologies.

To support the achievement of the strategic goal, the government of the Russian Federation undertook steps for improving energy efficiency. The legislative base in the sphere of energy saving has been established:

1. Federal law No 261-FZ of the Russian Federation of November 23, 2009 "Concerning Energy Conservation and the Raising of Energy Efficiency and Concerning the Introduction of Amendments to Certain Legislative Acts of the Russian Federation" was adopted;

2. In July 2009, the Federal Law "On changes and amendments to the Federal Law "On Technical Regulation" came into force, where energy efficiency is an obligatory requirement for the objects under technical regulation.

3. To support the realization of the Federal Law No. 261-FZ of November 23, 2009, the government of the Russian Federation, with the participation of the Ministry of energy of Russia, worked out and adopted several resolutions:

- The resolution of the government of the Russian Federation No. 1220 of 31.12.2009 «On the definition of the indicators of reliability and quality of goods and services used for long-term tariffs setting».
- The resolution by the government of the Russian Federation No. 1221of 31.12.2009 «On approving rules to establish requirements of energy efficiency of goods, works, and services provided for the state and municipal needs».
- The resolution by the government of the Russian Federation of Ni.1225 of 31.12.2009 «On requirements for regional and municipal programs in the area of energy savings and increasing energy efficiency»;
- The resolution by the government of the Russian Federation No. 67 of 20.02.2010 «On amendments to some acts of the government of the Russian Federation concerning the authority of the federal executive bodies in the area of energy savings and energy efficiency».
- The resolution by the government of the Russian Federation No. 235of 13.04.2010 «On amendments to the structure and contents of the technical documentation»;
- The resolution by the government of the Russian Federation No. 391 of 01.06.2010 «On the establishment of the state information system in the area of energy conservation and energy efficiency and conditions for its functioning».

In addition to these regulatory documents, six projects on energy saving were approved, which were discussed on September 30, 2009 at a joint meeting of the Commission for Modernization and Technological Development of the Economy of Russia and the presidium of the Presidential Council for Science, Technology and Education.

Within the framework of these projects the economic incentives for enterprises using energy efficient technologies, including subsidizing interest rates and simplification of credit issuance, are suggested.

1. Project "Meter, save, and pay": mass installation of meters and control devices which help save power and reduce electricity bills. According to the Minister of economic development, Elvira Nabiullina, the implementation of this project may result in a reduction of power consumption of up to 20%. Within 3 years, it is planned to increase up to 80% the share of consumers equipped with metering instruments in their houses. According to her opinion, in case of installation of metering instruments and taking efforts in saving power, it will be possible to reduce utility costs even with growing rates.

2. Project "New lighting": replacement of incandescent light bulbs with more efficient light fixtures and developing domestic production of the latter. In the draft law on energy savings it is suggested to ban, starting from 2011, incandescent bulbs of 100W and over. Mrs. Nabiullina proposed to ban 75W incandescent bulbs from January 1, 2013, and totally ban them from January 1, 2014.

3. Project "Energy efficient neighborhood": upgrading city quarters and small towns, transferring the experience to the whole country.

4. Project for enhancing energy efficiency of the social sector: use of energy efficient technologies in public institutions, first of all, in clinics, schools, and hospitals. President Dmitry Medvedev has restated the importance of revising rules and regulations for the utilities sector and for the construction sector when new technologies are introduced. These new rules and regulations have to be prepared before December 1, 2010, as the law is supposed to come into force from 2010.

5. Project "Small power supply systems": manufacturing and installation of energy efficient equipment for local power supply systems (replacement of inefficient old heat supply technologies by small units using gas turbines).

6. Project "Innovative power": innovative projects related to use of superconductivity and of biomass fuels. Additional incentives will be provided to develop solar and hydrogen energy.

A decision was made to organize a massive promotional campaign to support the program. According to estimates of the Ministry of economic development, in order to reduce the energy-intensity of the Russian GDP by 40% by 2020 in comparison with 2007, it would be necessary to invest 10 trillion rubles of public and private money.

The following measures of the state energy policy, grouped by mechanisms of its implementation, will be applied to achieve greater energy efficiency in the economy.

- elaboration of comprehensive federal and regional legislation on energy saving;
- setting up an integral system of control over the process of energy efficiency enhancement;
- setting up a market for energy services;
- establishment of reasonable domestic energy prices through their gradual and controlled liberalization to promote careful use of energy in the economy and by the population;
- promotion of entrepreneurial activities in energy savings sphere assuming private reinvestment in energy saving

Potential for energy saving

Russia has a great unutilized potential to save energy which is estimated at 40% of total domestic energy consumption. The potential for energy savings and enhancing energy efficiency in the Russian Federation is estimated at 421 mm tce per year, while in the fuel and energy sector alone it accounts for 50% of the total potential of the country. According to expert estimates, a full realization of the technically feasible potential for enhancing energy efficiency will require USD 320-360 billion of capital investment.

The following estimates of the energy saving potential in various sectors are available:[34]

- residential buildings 758 – 80 mm tce
- electric power sector – 54.,7 – 63.2 mm tce
- industry – 54.73 – 63.2 mm tce
- transport – 54.7 – 63.2 mm tce
- heat supply – 37.9 – 42.1 mm tce
- services – 37.9 – 42.1 mm tce
- construction – 37.9 – 42.1 mm tce

34 Energy strategy of Russia up to 2030. Chapter V State energy policy. Section 2 Main strategic guidelines.

- fuel production – 21.1 – 25.3 mm tce
- gas flares – 21.1 – 25.3 mm tce
- power supply of public institutions – 21.1 – 25.3 mm tce
- agriculture – 12.6 – 16.8 mm tce

By realizing the potential for increasing energy efficiency Russia would be able to save:
- 240 bcm of natural gas – the main type of primary energy in Russia;
- 340 TWh of electric power;
- 89 mm tons of coal;
- 43 mm tons of crude oil and oil products (in oil equivalent).

In general, Russia might achieve energy savings with the energy equivalency of 300 mm tons of oil per year, or 2.1 tons per capita. Such volume of savings is comparable with the total volume of primary energy consumption in such countries as France and UK, and comprises 2% of the volume of world primary energy production in 2005.

The possibilities for the largest energy savings are in the housing sector (53.4 mm toe), in electricity generation (44.4 mm toe), manufacturing (41.5 mm toe), transport (38.3 mm toe), and heat supply systems (31.2 mm toe).

Conclusions and recommendations

In recent years in the Russian Federation the organizational and legal bases were established in the sphere of energy saving and the main vectors for energy efficient economic development were identified.

To accelerate the implementation of this energy saving strategy it is expedient:
- to finalize the legislation, to determine the organizational structures needed to support energy savings, sources of financing for energy saving activities, financial benefits for the energy saving project participants, standards for specific energy consumption in various sectors of the economy, and sanctions for excessive use of power;
- to develop incentive mechanisms for consumers to change power consumption patterns and to promote energy saving measures in all sectors of the economy;
- to promote investment into the energy efficiency projects of enterprises and organizations of mixed ownership with the help of pricing and taxation policies in the energy producing and consuming sectors;
- to continue restructuring of the economy with the purpose to reduce the share of energy-intensive production;
- to develop manufacturing of energy efficient equipment, instruments, and materials;
- to assist in attracting local and foreign investors into energy saving projects, to determine procedures for using off-budget funds at the federal level;
- to establish an independent national body (agency) in the sphere of energy saving;
- to assist regions in developing regional energy saving programs by identifying goals and objectives of the energy policy in the regions and suggesting mechanisms for their implementation and financing, to propose specific measures and projects and create necessary management system;
- to assist in organizing companies for developing technical documentation, installation and adjustment of energy saving equipment, providing technical services, to develop information system in the sphere of energy saving to be used by all types of consumers.

2.8. Republic of Tajikistan

General information:
Territory – 143.1 thousand km^2
Population – 7.5 million people (2009)[35]
GDP (2009) – USD 14.3 billion

Structure of GDP (2009):
- Agriculture – 49.8%
- Industry – 12.8%
- Services – 37.4%

Fuel and energy sector

The country has substantial hydropower potential which is poorly utilized. The gross theoretical potential of hydropower is estimated at 527 TWh/year, of which technically feasible capacity is 202 TWh/year, and economically feasible for construction – 172 TWh/year. This is one of the largest potential of this type of renewable resources (ranked 8th in the world by gross potential). Among the CIS countries only Russia has larger potential of hydro resources.

Almost all electricity is produced at hydropower plants.

The total installed capacity of hydroelectric power plants is 4,070MW, however at resent less than 5% of this capacity is in operation.

The explored reserves of oil, gas, and condensate comprise less than 1% of the total resources in place, which are estimated at 1,033 mm tce. To increase oil and gas production huge investments are needed to introduce new technologies due to the difficult geological conditions and stratification depth of 5-7 km. At present, probable coal reserves are estimated at 4-5 billion tons (of which only a small part is being developed; in 2001 only 25 thousand tons were produced). There are coal deposits in almost all regions of the country, but many fields are located in hard to access high altitude areas.

In spite of various available fuel and energy resources, Tajikistan imports almost all types of primary energy. Supply of primary energy is a critical issue for the country and an important goal of the energy policy.

The critical situation is observed with payments for consumed electricity and heat. Collection of bills does not exceed 60%, notwithstanding the very low rates charged even in comparison with neighboring countries. As a result, energy power companies are incapable of carrying out rehabilitation of power generation equipment, or of increasing production of coal, oil, and gas in the country.

The low solvency of the population is a crucial issue. Non-payments in the internal market and in interstate trade within the CIS dramatically reduce flows of funds into the fuel and energy sector, and that results in its operation with negative profitability. In general, the review of the situation in the fuel and energy sector shows that the negative trends of the last ten years were caused by the following factors:

- decreasing reliability of equipment operating in all branches of the fuel and energy sector, including electricity generating equipment, transmission networks, and gas pipelines, due to wear and tear;

35 http://www.stat.tj/ru/population-census/

Table 12. Balance of energy production and consumption (2008).

	Oil and condensate (mm tons)	Oil products (mm tons)[36]	Natural gas (bcm)[37]	Electricity (TWh)[38]
Production	0.14	0.01	0.03	16.14
Imports	–	0.43	0.46	5.2
Exports	0.02	0.01	–	4.4
Consumption	0.12	0.43	0.48	17

36 http://www.iea.org/stats/oildata.asp?COUNTRY_CODE=TJ
37 http://www.iea.org/stats/balancetable.asp?COUNTRY_CODE=TJ
38 http://www.iea.org/stats/electricitydata.asp?COUNTRY_CODE=TJ

- shrinking of the required reserve capacity for electricity and heat generation, a decline in oil, gas, and coal production;
- reduced volume of mutual trade in primary energy;
- a sharp decline in exploration as well as decline in production and processing of primary energy;
- lack of investment for recovery and development of the fuel and energy sector;
- inefficient and ineffective use of energy by all types of consumers;
- non-payments for electricity and gas in the domestic market.

Policies and measures in the sphere of energy saving and energy efficiency

As Tajikistan is incapable of overcoming the situation on its own, it is necessary to undertake coordinated actions with the countries of Central Asia and the CIS to provide an impetus for the development of the fuel and energy sector in the short and long run.

The energy policy in the country assumes integration of the power systems. The regulatory basis for development of the fuel and energy sector is the package of legal documents providing benefits for construction and operation of small hydropower plans (SHPP). This package comprises:

- The law "On energy saving" adopted in 2002. The aim of this law is to provide legal framework for the state policy in the sphere of energy saving in the Republic of Tajikistan with the consideration for the interests of consumers, suppliers and producers of energy resources and by promotion of research and development of the energy efficient technologies and implementation of information systems which increase efficiency of energy consumption;
- The law of the Republic of Tajikistan on energy of 2000. The aim of this law is to establish a legal framework for implementing state policy in the energy area within the Republic of Tajikistan on the basis of market, institutional, and information mechanisms with the purpose of ensuring reliability and development of the energy sector and to secure interests of the consumers;
- Program for the expansion of the use of renewable energy sources, 2007. This document is rather declarative and does not create incentives for renewable energy development, but only supports research;
- The law of the Republic of Tajikistan "On the use of renewable energy sources". This law is aimed at the efficient use of renewable sources of energy, it defines the legal and economic grounds for improving energy savings, reducing the manmade impact on environment and climate,

The following targets should be achieved to support development of the legal and regulatory framework in the country during period in question:

- Enhancement of the legal and regulatory framework and market conditions to support free movement of capital, human resources and technologies between the energy sectors of partner states;
- Development of the mechanism of mutual relations in the markets of the countries taking into account the mutual interests of partner states;
- Assistance in the creation and promotion of interstate fuel and energy companies, corporations, consortia;
- Develop a mechanism to address mutual non-payments in the energy sector, including settlement through clearing, bill of exchange agreements, netting agreements, joint ownership.

In 2006, the Ministry of energy developed a national program for construction of small hydropower plants. According to this program, it was planned to commission 13 units by 2010; 23 units in 2011-2015, and 25 more after 2015. Thus, in less than 20 years it was planned to put into operation 61 hydroelectric stations with a total capacity of 77.653 MW. The project cost of the first stage is estimated at USD 11.2 million. Financing should be provided by the Islamic Development Bank, Asian Development Bank, and "Barki Tojik" Company.

The most important ways to achieve the desired changes will be a more efficient use of domestic and imported primary energy, wider involvement of own funds through better collection of bills for consumed energy, and attraction of foreign investment in the fuel and energy sector. The need in investment into fuel and energy sector through 2015 is estimated to cost USD 1.5-1.7 billion.

Potential for energy saving

According to expert estimates, the energy savings potential in the economy of Tajikistan is about 2 mm tce, of which 30-35% exists in the fuel and energy sector and industry, 20-25% is to be found in the housing and utilities sector, 7-8% in transport, and 6-7% in agriculture.[39]

39 Unified register of legal acts and other CIS documents: Main principles for member – states interaction in the field of energy efficiency and energy saving.

Conclusions and recommendations

- to elaborate investment policy in the sphere of energy saving (concessional financing of the most efficient energy saving projects, concessional lending, attracting investors);
- to introduce in the domestic market discounts and markups for primary energy prices depending on their energy saving performance of businesses;
- to prepare training programs on project preparation and project financing in the sphere of sustainable energy;
- to introduce special purchase prices for electricity generated on the basis of renewable energy sources with the purpose to attract investors in this area.

2.9. Turkmenistan

General information:
Territory – 491.2 thousand km^2
Population – 4.9 million people (2009)[40]
GDP (2009) –USD26.5 billion

Structure of GDP (2009):
- Agriculture – 10.1%
- Industry – 30.5%
- Services – 59.4%

Fuel and energy sector

Turkmenistan is one of the world energy powers. The oil and gas sector is of vast importance to the country's economy; it provides for export opportunities and ensures economic independence and national energy security. The successes in this sphere are achieved through a comprehensive modernization of the oil and gas sector and the gas transportation system providing for the possibility to transport even greater volumes of natural gas.

Almost all electric power in Turkmenistan is generated at gas-fueled power plants. The total installed capacity of the power plants is 4,100MW.

The most important determinants of the activities of Turkmenistan as an exporter of primary energy and of the country's relations with its partners are the diversification of export destinations for Turkmen gas and establishment of a reliable and stable system for exporting Turkmen energy resources to international markets.

It should be emphasized that the advanced technical level and good performance characteristics of the existing gas transportation system including mains pipelines, distribution networks, modern measuring equipment, gas distribution and gas control stations, and underground storages allow for continuous growth of the production and export volumes of primary energy.

The diversification of export destinations expanding export to new countries and regions not only can provide vast economic benefits for the economy of Turkmenistan, but supports sustainable economic development in general terms. Constantly growing demand for primary energy in various regions of the world, especially in rapidly developing countries, stimulates the creation of an extensive, modern and efficient operating infrastructure for energy transit and delivery to consumers.

In Turkmenistan in accordance with the "Program for oil and gas sector development up to 2030", the annual production of natural gas is expected to reach 250 bcm and oil – 110 mm tons; in 2015 exports of natural gas is expected to reach 125 bcm per year.

In the framework of a radical modernization of the fuel and energy sector, in Turkmenistan the scope of works in exploration, geophysical investigations and drilling is increasing every year; new promising sites are developed; enterprises in the oil and gas industry and in petrochemical industry are reconstructed and upgraded. These enterprises produce high quality goods that are in demand on the international markets.

The hydrocarbon potential of the Caspian Sea comprises not only oil reserves but natural gas reserves. Exploration drilling done for existing

40 http://www.stat.gov.tm/Osn_pokaz/itogi_ru_god_2009.htm

Table 13. Balance of energy production and consumption (2008).

	Oil and condensate (mm tons)	Oil products (mm tons)[41]	Natural gas (bcm)[42]	Electricity (TWh)[43]
Production	11.17	7.31	63.71	15.04
Imports	–	0.08	–	–
Exports	2.40	3.65	48.48	1.47
Consumption	8.77	3.73	13.71	13.56

41 http://www.iea.org/stats/oildata.asp?COUNTRY_CODE=TM
42 http://www.iea.org/stats/balancetable.asp?COUNTRY_CODE=TM
43 http://www.iea.org/stats/electricitydata.asp?COUNTRY_CODE=TM

offshore projects allows us to conclude that in the near future production of natural gas may become an important and even a crucial factor for Caspian region's economy. Many onshore oil-bearing provinces and regions extend into Caspian Sea, so there are very good prospects for gas saturated rock below the sea bottom. In 2008, natural gas production in Turkmenistan reached 67.4 bcm, while in Russia 607.4 bcm was produced, in Kazakhstan – 27.3 bcm, and in Azerbaijan – 10.3 bcm.

Policies and measures in the sphere of energy saving and energy efficiency

In Turkmenistan no measures have been undertaken to improve efficiencies in primary energy consumption. To some extent, the reason is the excessive production of primary energy. In Turkmenistan there is no legal framework in the sphere of energy production and consumption and/or energy saving. It is obvious that at present the government does not consider energy efficiency of the energy sector as its priority. At the level of consumers there are almost no meters installed for measuring gas, electricity, or heat consumption. Electricity and natural gas produced in the country are distributed for the population free of charge. The energy surveillance agency (Energonadzor) has the following tasks:

- Inspection of large enterprises to identify the possibilities for electricity and heat savings;
- Organizing raids and inspections to detect evidence of theft and waste of electricity and heat by enterprises and organizations;
- Technical inspection of measuring systems for electricity and heat at industrial enterprises.

The national program for legislative activity in the country assumes development of the following laws and legal acts: on energy saving, on state regulation of electricity tariffs, on licensing in the area of electric power and heat generation, transmission and distribution; on increasing responsibility for damaging electric power networks. It is necessary to elaborate a concept for national energy development in new economic situation.

Potential for energy saving

There has been no assessment made of the potential for energy saving in Turkmenistan.

Conclusions and recommendations

Turkmenistan has excessive capacity in the fuel and energy sector, that are several times larger than the country's needs; so energy conservation is not considered a priority. However enhancement of energy efficiency may be a very important factor for the economy, in particular for environmental protection and the expansion of the energy exports. With the purpose of improving energy efficiency in the country, it is considered advisable:

- to assess the energy saving potential;
- to work out a development strategy for the fuel and energy sector, to pay attention to the energy saving initiatives;
- to develop a national energy saving program with indication of phases and the needed investment with the account for the experience of the European countries;
- to create a regulatory and legislative framework for the sphere of energy saving.

2.10. Ukraine

General information
Territory – 603.7 thousand km^2
Population – 45.96 million people (2009)[44]
GDP (2009) – USD 337.2 billion

GDP structure (2009):
- Agriculture – 9.8%
- Industry – 30.7%
- Services – 59.5%

Ukraine has substantial natural resources, mainly coal, but there are also oil and gas deposits in the Pre-Carpathian basin and in the Black Sea-Crimea oil and gas province, including the sea shelf. Local oil reserves suffice only 15-20% of domestic needs of the economy, while for gas – Ukraine is 25% self-sufficient.

Fuel and energy sector

Ukraine has large reserves of natural resources, mainly coal and natural gas, but, nevertheless, the country is a net importer of primary energy. Nuclear energy is also a strategic industry in the national economy.

The total installed electric generating capacity is 52,957MW.

More than 40% of electric power in the country is generated by nuclear power plants, around 45% by gas and coal-fueled power plants. The hydropower potential of the country is underutilized. Hydroelectric power plants produce around 8% of total electricity generation.

By volume of proved recoverable reserves of natural gas (1 trillion cubic meters) Ukraine is ranked fifth in Europe after Russia, UK, Netherlands, and Norway. Gross theoretical hydroelectric power potential of Ukraine is estimated at 45 TWh/year, technically and economically feasible potentials are, respectively, 24 and 19 TWh/year. Small streams are responsible for a large part of this potential.

Ukraine has a large potential for alternative and renewable energy sources.

The technically feasible potential of wind energy is estimated at 20 mm tce/year, and of solar energy 400 billion tce/year.

Policies and measures in the sphere of energy saving and energy efficiency

Between 1997 and 2009 the energy-intensity of the economy decreased by 40%, but it is still one of the highest among CIS states. The main obstacles to enhancing energy efficiency are slow restructuring and upgrading of energy-intensive branches of the industry; low efficiency of power generation, obsolete infrastructure, and, hence, losses in the power networks; low tariffs in heat supply and power supply sectors, all of which deter investment in the country's fuel and energy sector.

The legal and regulatory framework governing the energy sector of Ukraine is rather complicated and not transparent. It is one of the impediments to capital inflow. An important event in the legislative sphere of the country was the adoption in 2009 of the Law "On efficient use of energy resources" which replaced the law "On energy saving" of 1994. An example of successful reforms in Ukraine is the adoption of the law "On amendments to some legislative acts of Ukraine

44 http://www.ukrstat.gov.ua/operativ/operativ2009/ds/kn/kn_u/kn1209_u.html

Table 15. Balance of production and consumption of energy (2008)

	Oil and condensate (mm tons)	Oil products (mm tons)[45]	Natural gas (bcm)[46]	Electricity (TWh)[47]
Production	4.3	10.08	20.0	192.5
Imports	6.7	6.56	48.84	2.1
Exports	0.009	0.20	0.004	8.83
Consumption	9.83	3.74	62.16	185.85

45 http://www.iea.org/stats/oildata.asp?COUNTRY_CODE=UA
46 http://www.iea.org/stats/balancetable.asp?COUNTRY_CODE=UA
47 http://www.iea.org/stats/electricitydata.asp?COUNTRY_CODE=UA

concerning the introduction of a Green Tariff" (the "Green Tariff Law") of 2008. The Green Tariff Law differentiates Green Tariffs depending on the source of alternative energy and the type and capacity of the generation facilities.

The law introduced a new system of special purchase prices to buy electricity from electric power plants built after 2009 which generate electricity from renewable energy sources; it introduced some changes into the Land Code providing for discounted purchase prices for land lots acquired to build power generators that use renewable energy. It is expected that these measures will stimulate the creation of a market for projects to develop renewable energy sources and will promote independent power generators from renewable energy. It is believed that this will improve the energy security of the country and diversify sources of power supply to the population.

As was mentioned, the energy policy of the country is targeted at reducing dependence on natural gas imports from Russia. Ukraine is importing around 53-54% of its primary energy, according to international criteria such dependence level is not considered excessive. However the problem is that Ukraine receives its main deliveries of primary energy (around 60% of imports) from only one country, Russia, either directly or though transit over its territory.

In these circumstances the imports dependency of the Ukrainian energy sector and the economy as a whole becomes critical. Supplies of imported primary energy are considered reliable if they come from at least three countries; otherwise the following negative consequences are possible:

- monopolistic price increases for primary energy and imposing restrictions on supplies by the exporting country in the case of a deterioration in interstate relations;
- critical dependence on the exporting country which complicates the development of equal bilateral relations;

Potential for energy saving

Table 16. Economically feasible energy savings due to technological factors in Ukraine.[48]

	2010	2015	2020	2030
	Fuel, mm tce			
Industry – total	20.98	34.08	49.49	71.16
of which:				
Electricity generation	5.46	8.64	12.22	18.50
Fuel	3.22	5.61	8.70	11.74
Ferrous metals	8.18	12.95	18.31	25.14
Non-ferrous metals	0.23	0.48	0.85	1.21
Chemistry and petrochemicals	2.11	3.34	4.70	6.76
Machine building and metal processing	0.40	0.70	1.09	1.92
Construction materials	0.42	0.73	1.14	2.13
Light industry	0.04	0.08	0.14	0.28
Food industry	0.65	1.04	1.49	2.49
Other branches of industry	0.27	0.51	0.85	0.99
Agriculture	6.13	11.33	14.30	17.97
Construction	0.35	0.64	0.81	1.02
Transport	5.89	10.88	13.72	17.24
Housing and utilities	5.16	9.53	12.04	15.12
Total	38.51	66.46	90.36	122.51

48 "Energy strategy of Ukraine up to 203"

- decrease in supplies of primary energy in case of decline in production (e.g. in Russia, a stagnation of natural gas production has been observed for several years);
- supply disruptions of primary energy in case of large accidents on the main oil and gas pipelines (e.g. due to emergency situations caused by natural or anthropogenic factors, terrorism, aging pipelines).

Conclusions and recommendations

In Ukraine the work is being done on developing the organizational, legal, and financial framework for enhancing energy efficiency in the economy. For further implementation of the energy saving policy it is expedient:

- to complete development of a legal framework in the sphere of energy consumption and energy saving; to enhance management of energy saving activities at all levels;
- to continue restructuring of the economy to reduce the share of energy-intensive industries, while increasing output of low energy-intensive products, primarily, high-tech ones;
- to develop a mechanism to promote energy savings measures, primarily in the housing and utilities sectors;
- to identify a mechanism to attract extra-budgetary sources of funding;
- to provide information support for the energy saving policy, primarily, at the level of small businesses and the population;
- to continue implementation of energy saving measures at the consumer's side by the government, regional and local administrations and fuel and energy companies.

2.11. Republic of Uzbekistan

General information
Territory – 447.4 thousand km^2
Population – 27.55 million people. (2009)[49]
GDP – USD 78.34 billion (2009)

GDP structure (2009):
- Agriculture – 26.7%
- Industry – 39.7%
- Services – 33.5%

Fuel and energy sector

The main primary energy resources in the country are: natural gas with proven reserves up to 2 trillion cubic meters, including large fields in Shurtan (0.5 tcm) and Alan (0.2 tcm), a large explored gas field, Urga, with reserves up to 1.5 tcm; brown coal (Angren deposit with reserves up to 1.9 billion tons); uranium ore deposits (total reserves up to 230 thousand tons of uranium), of which the largest is Uchkuduk site; and hydropower (rivers Chirchik, Arkhangaran (Angren), Surkhandarya, and many small rivers).

The installed capacity of electric power plants of Uzbekistan is around 12,300MW, which comprises approximately 50% of the electric generating capacity of the Unified Power System of the Central Asia (UPSCA). This system includes the power systems of Turkmenistan, Tajikistan, Kyrgyzstan, and South Kazakhstan.

The power system of Uzbekistan is the main link in the chain of production and transmission of power in the region. The geographical position of the country and availability of developed networks allows Uzbekistan be an organizer and active participant of the electric power and capacity market. The power system of Uzbekistan fully covers the needs of the country's economy and population in electricity and exports electric power.

The power system of Uzbekistan comprises 39 thermal and hydropower plants; with possible annual production around 47-48 TWh of electric power; 87% of the installed capacity comprise thermal power plants, and 13% - hydroelectric plants. The network of the power system of Uzbekistan has 230 thousand km of transmission lines and transformer stations of total capacity around 45 GW.

In Uzbekistan the oil and gas sector is of lower importance if compared with those of Kazakhstan and Turkmenistan. However its share of the national economy is constantly growing. In Uzbekistan there are five oil and gas bearing regions: Ustiurt, Bukhara-Khiva, South-West-Gissar, Sukhardarya, and Fergana. According to recent data, the expected money value of estimated resources is over USD 1 trillion. In 1996, Uzbekistan gained its oil independence by supplying its refineries with own production of crude oil. However the sphere of cooperation of Uzbekistan with CIS member states, and especially with Russia, is through the production and export of natural gas.

This area of cooperation is not trouble free. In the coming 8 to 10 years the annual volume of gas transited from Central Asia to Russia and other CIS states will increase from 15 to 30 bcm. However already today the gas arterial export lines are barely coping with the gas throughput:

49 http://www.stat.uz/STAT/index.php?%ru%&article=27

Table 17. Balance of production and consumption of energy (2008)

	Oil and condensate (mm tons)	Oil products (mm tons)[50]	Natural gas (bcm)[51]	Electricity (TWh)[52]
Production	4.8	3.0	60.9	49.4
Imports	–	–	0.9	11.5
Exports	–	0.2	13.5	11.5
Consumption	4.8	3.3	48.4	49.3

50 http://www.iea.org/stats/oildata.asp?COUNTRY_CODE=UZ
51 http://www.iea.org/stats/balancetable.asp?COUNTRY_CODE=UZ
52 http://www.iea.org/stats/electricitydata.asp?COUNTRY_CODE=UZ

gas pipelines constructed in the 1960s have not been upgraded for more than 30 years. Uzbekistan, Russian, and Turkmenistan are constantly holding consultations on reconstruction of the gas transportation systems, but they have not yet reached any final decisions.

Moscow has reached an agreement with Astana on preparation of the required documentation to carry out joint reconstruction of the gas pipelines Bukhara-Urals and Central Asia-Center (CAC) connecting the gas fields of Central Asia with European consumers. It was proposed to establish an international consortium for reconstruction of gas transit pipelines, as their depreciation has reached 70%.

In mid-December 2002, "Gazprom" and national holding company "Uzbekneftegaz" signed an agreement on strategic cooperation in the gas sphere. First, it stipulates annual supplies in 2003-2012 of natural gas going to Russia starting from 5 bcm with a gradual increase up to 20 bcm. Second, the companies agreed to develop jointly the fields of the Ustiurt oil and gas basin, where prospective reserves are estimated at 4 billion toe.

Uzbekistan sees in cooperation with Russia not only the opportunity to raise natural gas production, but, what is more important, the possibility of increasing exports via the CAC pipeline and entering new markets.

For Uzbekistan, opportunities to increase gas exports and the liberalization of a business framework will enable gas production companies and gas service companies to enter the market. Trinity Energy of Britain, Russian firms Itera and Lukoil, and other foreign companies plan to operate in Uzbekistan. The reasons mentioned above are likely to cause big changes in the near future in the oil and gas sector of Uzbekistan, Turkmenistan, and Kazakhstan. It is especially true in the fuel and energy sector of Turkmenistan. As restricted supply markets will impede further growth of natural gas production, Ashgabat will focus on the projects on production, refining, and export of liquid hydrocarbons. On the contrary, in Uzbekistan and Kazakhstan in this decade and possibly during first quarter of the century, the importance of the natural gas factor in export policy will rise. Tashkent plans to increase several times gas transit via CAC in 2011 by comparison with 2002. In the long run, gas exports will grow along with a certain decline in trading oil products from Uzbek crude.

In Uzbekistan, 80% of consumers are served by district heating systems which are very inefficient. Their low efficiency is explained mainly by their using open-circulation systems for hot water supply. This design was chosen many years ago due to the availability of equipment and materials and the simplicity and seeming cheapness of this solution. More than 30 years of operation of such systems has proved their inefficiency and low reliability. Due to intensive drainage of heat media (hot water) by consumers, the water treatment equipment operate in off design mode which reduces water quality and leads to a higher content of oxygen and carbon dioxide in the feeding water causing high internal corrosion of pipes and radiators and reducing their service life more than two times.

Over 11 thousand boilers are in operation in local boiler-houses; a large part of this equipment is not certified, are obsolete and depreciated (with efficiency below 75%); burners are obsolete and not equipped with automatic control systems.

A policy of "cheap" energy followed in past years has resulted in the construction of buildings with low thermal properties, while lack of control devices and meters for heat energy, hot and cold water, and gas lead to their wasteful use by households and other consumers.

Due to unfinished repair works in past years, a slow upgrade of equipment, lack of funds, at present the housing stock, the systems for heat, water, and gas supply are obsolete and deteriorated. The persistence of such a situation may lead to a sharp increase in operation and maintenance costs and, in general, in the cost of services in the housing and utilities sector, something that will deter foreign investors and private service firms from entering this sector.

Policies and measures in the sphere of energy saving and energy efficiency

The legal framework in the sphere is energy saving and energy efficiency is not up-to-date; it is based on the "Law on rational use of energy" adopted in 1997.

The purposes of the law were: the stimulation of development and the introduction of energy efficiency technologies of oil, natural gas, coal and other primary energy production; realization of state control and supervision of the efficient production and consumption of energy and quality of energy products, of the technical condition of the power equipment, and power supply systems.

However as there is no governmental agency in the country responsible for conducting a unified technical policy and coordination of activities of the ministries, agencies, and enterprises as regards energy saving, it is difficult to undertake targeted and effective measures to support energy saving in the housing and utilities sector.

In Uzbekistan, the main energy saving potential that can compensate in the coming years for the expected deficit in primary energy is concentrated in the above mentioned sectors. The fact that there are no institutions in the country dealing with the management and coordination of work in the sphere of energy efficiency, providing interagency and interregional coordination, and conducting a common technical policy is one of the disadvantages in this sphere.

The Energy Saving Program of the Republic of Uzbekistan for the period up to 2010 was developed. Its main characteristics are:

- considering energy efficiency a priority of the energy policy targeted at sustainable economic development;
- achieving a maximum increase in energy efficiency and creating conditions for sustainable energy development;
- decreasing energy-intensity of the sectors of the economy;
- creating a legal framework to support the enhancement of energy efficiency;
- attracting investment in energy saving projects;
- elaborating reforms, liberalizing of the economy;
- implementing market reforms in the energy sector.

The enhancement of energy efficiency of the economy requires a comprehensive approach to economic, organizational and technical tasks and is related to the increase in the overall efficiency of the economy. The undertaken analysis proves that the potential for primary energy savings through implementation of the mentioned above strategies exceeds 22 mm toe per year and can be realized during 15-20 years. However this will require an annual investment of over USD 6 billion.

The reconstruction and further development of electric networks is an important factor for the successful operation of the power system of Uzbekistan. Optimization of the electricity networks' design will enable an improved reliability and flexibility of power transmission, decrease losses, connect additional capacity in the situation of power deficit, and reduce dependence of the power systems on adjacent countries. It is planned to construct several substations in Tashkent, Samarkand, Fergana, and other regions. At present the total length of electricity transmission and distribution lines in the country is 240 thousand km; it will be increased by 1,355 km.

Among the important tasks facing the energy sector of Uzbekistan is reducing gas burning at the power plants and increasing the share of electricity generation by coal-fueled stations; conducting energy saving policy through implementation of new technologies. Recently, the works in the area of wind and solar energy have become more active. However the implementation of already developed domestic and foreign projects is halted by lack of financing.

Potential for energy saving

The development of energy saving capacity in Uzbekistan is supported by cooperation with the World Bank; a loan in the amount of USD 25 million was extended for development of energy efficiency capacity. The objective of the Project for Energy Efficiency for Industrial Enterprises

for the government of Uzbekistan is to improve energy efficiency in industrial enterprises by designing and establishing a financing mechanism for energy savings investments. One of the components of the project will address the lack of knowledge, experience and expertise in identifying, preparing and implementing energy efficient projects in the industrial sector and through targeted training. Workshops and seminars will be organized on energy efficiency, demand management, control over energy consumption. The information strategy for enhancement of energy efficiency will be developed to increase awareness.

The term of project implementation is 5 years; total project cost is USD 34.6 million. Total project cost includes funding from the IDA of the World Bank Group in the amount of USD 25 million, and USD 9.6 million of co-financing from participating banks and enterprises of Uzbekistan.

Conclusions and recommendations

Salient among the issues of enhancing the capacity the fuel and energy sector, there are the following tasks:

- to continue structural reform in view of the privatization of the enterprises of natural monopolies with maintaining government regulation;
- to improve investing policy to provide for attractiveness of the State Joint Stock Company "Uzbekenergo", for strategic investors and credit organizations;
- to complete the process of transforming the state-owned enterprises of the energy sector into joint stock companies;
- to work out and implement the investment plan for restoration of the systems of centralized power supply on the least cost basis;
- to increase the number of commercial banks participating in the energy efficiency projects;
- to ensure more active participation of the government representatives in the governing bodies of the joint stock companies;
- to support activities of the supervisory services in order to enhance control over observance of technical regulations in the sphere of energy efficiency;
- to undertake measures for harmonization of the national rules for regulation and control over the energy sector with international framework;
- to undertake actions for radical improvement of collection payments for the consumed electric power.

3. Conclusions and recommendations for the CIS region

Serious preparatory work is needed to identify the main directions and priorities of the energy savings policy at national and international levels. One of the areas of cooperation of CIS member states in the sphere of energy saving is joint investment into energy efficient projects. In this relation it is necessary to determine which industries and sectors in the economies of CIS member states are more attractive to investments in energy savings projects, where the energy savings, economic and ecological benefits can be the largest with the capital investment the lowest.

Several conclusions can be made on the basis of the conducted investigation:

1. Pursuant to the agreement on cooperation between CIS member states on energy efficiency and energy saving of October 7, 2002 and to the resolution of the CIS Economic Council of March 11, 2005, "On main directions and principles of cooperation of CIS member states to ensure energy efficiency and energy conservation" a large amount of work has been done in organizational, legal, technological, informational, financial and economic areas to enhance cooperation of CIS member states in the energy sphere.

2. The Republic of Belarus has been the most successful member state in the execution of these documents. Comprehensive measures in the sphere of energy efficiency and energy saving have been approved by special decisions at the government level. The dissemination of information and training on energy efficiency issues have been accomplished. GDP growth was not accompanied by a large increase in energy consumption. The energy-intensity of GDP during the last 10 years has almost halved.

The practice of the Republic of Belarus deserves attention and support, the country's experience can be recommended to other CIS member states.

3. However, in the CIS member states in general insufficient efforts have been undertaken to enhance energy efficiency and increase energy savings. The energy-intensity of GDP in CIS member states is still two and a half to three times higher than in the industrially developed countries.

The sections of national energy programs of CIS member states dealing with energy saving especially as regards the implementation of advanced technologies and actions to be taken to comply with Kyoto protocol need to be revised and updated.

Practices of the industrially developed countries demonstrate that it is expedient to revise energy strategies, to make energy saving a priority of innovative economic development, to invest into new technologies in all sector of the economy.

4. Renewable energy sources in the CIS are not yet being developed fast enough.

5. CIS member states should work out additional measures for energy saving policy implementation, develop standardization, certification and metrology, conduct adequate pricing policy, and provide access to domestic and foreign energy efficient technologies.

On the basis of the review and analysis specialists of ISEDC have worked out the following recommendations for enhancing energy efficiency and increasing energy savings in the CIS region.

General recommendations

- Governments of CIS member states shall ensure the necessary equilibrium between the efforts targeted at enhancing energy efficiency on the energy supply and demand sides, and better utilize the substantial energy savings potential in these areas.
- The majority of the countries shall develop long-term strategies for enhancing energy efficiency using different scenarios of economic development, reliability of supply, and environmental activities. In case of approval of such strategies, the governments shall take the responsibility including those for allocation of funds to implement these strategies and achieve the set quantitative target indicators.
- Governments shall provide for stronger participation of local authorities and civil society in the process of preparation and implementation of policies in the energy sphere.

Legal framework, policies and programs in the sphere of energy efficiency

- Governments should continue developing a legal framework in the energy efficiency sphere with due consideration for recent international documents including EU rules and regulations in this sphere.
- National programs for energy conservation should be launched immediately; later the programs can be adequately amended and updated.
- It is necessary to develop industry specific programs that will enable states to achieve target indicators of energy consumption in the national economy.
- In order to enhance the efficiency of state policy in the area of energy saving, it is necessary to work out implementation mechanisms and allocate the needed funds.
- Governments should develop new legislation that would allow tenants associations to implement decisions relating to investment in energy efficient projects in housing

Institutional framework

- Governments shall improve the institutional capacity of the energy ministries (in the majority of states) and respective agencies (in Moldova) to allow them to play a more active role in developing and coordinating policies in the sphere of energy efficiency and renewable energy sources.
- It would be advisable to delegate the functions of the energy ministries related to undertaking practical steps in the area of energy efficiency and renewable energy development to respective agencies and organizations.
- Governments should rely on the experience and the professional staff of various institutions and organizations, e.g. universities, projects centers for energy.
- It is expedient to attract local and regional participants (various NGOs, municipal authorities, power distribution companies) in the preparation and implementation of energy saving programs.

Primary energy prices

- Energy sector regulatory bodies should continue work on differentiating primary energy prices for various types of consumers for more adequate accounting of real expenditures on energy saving projects.
- Pricing mechanisms should reflect the efforts undertaken by energy companies to increase energy efficiency (both at the supply and demand sides) and promote wider use of renewable energy sources and combined heat and electricity production.

Financing of energy savings projects and budgetary and taxation policies

- Action plans included in the long-term energy saving strategies should be supported by state budget financing to ensure their implementation.
- Financing mechanisms used by the funds for energy efficiency should be elaborated to turn them into effective tools for providing the investment necessary to achieve the goals stipulated in the energy efficiency laws. It is expedient to investigate the opportunities to attract foreign financing
- It is necessary to create incentives for state organizations to invest in energy efficiency projects and benefit from the energy savings during the investment payback period.
- Governments should support third party financing and fixed-term energy contracts and consider these options important financial tools for improving energy efficiency.
- Taxation of energy consumption should be linked to the initiatives in the sphere of energy efficiency and the rational use of energy.

Energy efficiency, environment and other kinds of economic activity

- Energy efficiency should be better and more precisely integrated into various kinds of economic activity, which requires constant interaction and cooperation between various ministries in all countries, including energy ministries, ecology and natural resources ministries, economics ministries, and industry ministries.

- The Clean Development Mechanism (CDM) and Joint Implementation (JI) mechanism of the Kyoto Protocol shall be used to encourage energy efficiency projects and the development of renewable energy sources.
- Governments should ensure that introduced budgetary and taxation measures and ecological funds established under supervision of respective government institutions support the increase of energy efficiency, thus being important factors of achieving environmental and sustainable development goals.

Implementation of specific measures in the sphere of energy efficiency

- All CIS member states shall make assessments and take decisions on the basis of economic criteria regarding the maintenance and upgrading of district heating systems.
- In the majority of the countries the opportunities provided by state programs should be used with the purpose of supporting the remaining district heating systems on a decentralized basis and to construct small capacity units for combined heat and electricity production.
- Governments should continue their efforts to improve measurement of energy consumption and should consider the rationale for a long-term program on providing consumers with individual measuring instruments for metering heat, electricity, and gas consumption.
- It is necessary to improve construction rules and standards to promote the use of advanced technologies and best practices with consideration for international experience in this area (it is possible to be guided, for example, by the Directive of the European Parliament and of the Council on the energy performance of buildings).
- Government should continue efforts to introduce energy performance certificates for new buildings and should study the possibility of extending this system to buildings under reconstruction/upgrade.
- It is necessary to develop demand-side management, to carry out an information campaign, conduct energy audits, calibrate and mark measuring instruments, etc.

Providing incentives to the use of renewable energy sources and combined heat and electricity generation

- The majority of states have substantial potential in the area of renewable energy sources and combined heat and electricity generation. It is necessary to pay more attention to the available potential.
- Renewable energy should be considered one of the sources of the power supply for the population. This assumes more targeted studies of available renewable energy potential and its realization.

Data collection, monitoring, and forecasting

- It is necessary to create data bases containing actual and reliable data on end consumers. This will permit a more accurate assessment of the benefits of energy savings initiatives, and will facilitate monitoring, and identify necessary adjustments to the energy saving policies.

Development of regional cooperation in the energy sphere in the CIS

In spite of the substantial differences in the fuel and energy sectors of CIS member states, their development levels and the priorities of national energy policies, strengthening of regional cooperation may greatly contribute to sustainable energy development and energy security of CIS member states.

In the framework of bilateral and multilateral cooperation in the CIS region it will be possible to achieve sustainable development of national energy sectors and enter energy markets outside the CIS.

Many CIS member states intend to increase exports of electric power and oil and gas, which will require large investments in construction of high voltage transmission lines and main oil and gas pipelines crossing the territories of two and more countries (this is especially important for land-locked countries). The coordination of en-

ergy policies and the development of regional, sub-regional and bilateral cooperation will assist in optimization of oil and gas transport infrastructure and in joining efforts for implementation of large-scale projects on reconstruction of existing pipelines and construction of new ones, and will enable states to conduct a more effective pricing policy and risk management policy in primary energy trade with third countries.

CIS member states have attained the best results in cooperation in the electric power sector. However along with ensuring parallel operation of the power systems of the CIS states it is necessary to develop cooperation along the following lines:

- to provide available capacity of transmission systems for transiting electric power generated by member-states ;
- to create favorable conditions for rational use of hydropower resources and electric power;
- to render mutual assistance in mitigating and liquidating the consequences of natural disasters and accidents in the power sector;
- to harmonize and liberalize customs regulations as regards electric power trade and transit;
- to carry out comprehensive mutual exchange of information;
- to develop and upgrade the electric networks;
- to work out rules for cross border trade of electric power (capacity)

With the purpose of better utilization of the energy potential of CIS member states it is important to expand cooperation in the oil, gas, and coal sectors, in nuclear power sector and to develop alternative and renewable energy sources:

- to create conditions to carry out more effective joint exploration and development of oil, gas, and coal deposits;
- to establish joint ventures for manufacturing modern equipment for the energy sector;;
- to develop cooperation in the spheres of R&D and education, to carry out joint research and investigations in important areas, including enhancement of energy efficiency and use of renewable energy sources;
- to carry out new construction and reconstruct the existing infrastructure of pipeline transport and increase its throughput capacity;
- to work out the procedures, terms and general principles of cooperation in pipeline transport and optimization of main oil and gas transportation routes with the account for the national interests of the states as regards intraregional trade and trade with the third parties;
- to work out and implement measures for resources and energy conservation;
- to develop an information system to support cooperation of CIS states in the energy sector;
- to harmonize the legal framework of the national energy sectors of CIS member states;
- to solve the existing problems in the intraregional trade in primary energy (pricing, clearing, settlement, etc.).

Increasing Energy Efficiency to Secure Energy Supplies in the CIS region

In the framework of the project “Increasing Energy Efficiency to Secure Energy Supplies in the CIS region” the member states will identify the priorities in the sphere of their interaction and undertake actions aimed at and enhancing cooperation in order to improve energy security of all CIS member states and the region as a whole.

In conclusion we would like to mention once more that this work has been done in the framework of the project: Cooperation of CIS member states in the sphere of energy saving and energy efficiency to secure energy supplies. This project was carried out with the assistance of UNECE. The contribution of UNECE to the implementation of energy projects in the CIS region is very important.

Organizing the joint work of experts in the CIS region, the UNECE assists member states in solving practical problems in the energy sector. Such activities and practical results will enhance the energy potential of the CIS and assist to overcome the challenges of the economic crisis.

4. Decision of the international working meeting

Moscow
February 3-4, 2011

On 3-4 February 2011, a working meeting on Improving Energy Efficiency for Secure Energy Supplies in the CIS Region was held in the International Sustainable Energy Development Centre under the auspices of UNESCO (ISEDC). This event was organized by ISEDC in collaboration with the UN Economic Commission for Europe (UNECE). The working meeting was attended by leading experts and scientists from Armenia, Belarus, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan, Ukraine, and Uzbekistan, and also representatives of ISEDC and UNECE.

The following reports were presented at the working meeting:

- «Energy saving legislation, potential and energy saving forecast in the Republic of Armenia» (Hrach Tsughunyan, Ministry of Energy and Natural Resources, Armenia);
- «Energy efficiency increasing and local resources use in the Republic of Belarus» (Andrey Minenkov, State Standardization Committee, Belarus);
- «Energy saving policy in Kazakhstan» (German Trofimov, Alliance of power engineers, Administration on energy savings in cities, Kazakhstan);
- «Energy saving and export potential in the Kyrgyz Republic» (Dzhanybek Omorov, Ministry of Energy, Kyrgyzstan);
- «Energy efficiency in the Republic of Moldova: potential, policy, barriers» (Mirche Suruchanu, Administration of thermal engineering, Ministry of Economy, Moldova);
- «Basic goals and objectives of energy sector modernization program for the period up to 2020 (Mikhail Saparov, Krzhyzhnovskiy Energy Institute, chairman of the Working Group on environment of CIS Electric Energy Council, Russia);
- «Normative legal base of energy effectiveness increase in the Russian Federation» (E. Zenyutich, Investment Center, Nizhniy Novgorod, Russia);
- «Tajikistan hydro energy effectiveness in the conditions of complex water and energy resources use of the Aral Sea transboundary rivers» (Georgiy Petrov, Academy of Science, Tajikistan);
- «Energy efficiency and energy saving situation and prospectives in Ukraine» (Aleksandr Yerokhin, ARENA-ECO, Ukraine);
- «Energy saving as the priority of Uzbekistan sustainable development» (Elvira Bikeyeva, Institute of Prognosis and Macroeconomic Research, Uzbekistan);
- Russian State program on energy saving and energy efficiency for the period up to 2020 (Eugeniy Nadezhdin, ISEDC, Russia);
- Presentation of International Sustainable Energy Development Center (Eugeniy Nadezhdin, ISEDC, Russia).

A discussion took place during the meeting on the ISEDC Consolidated Report “Improving energy efficiency for ensure energy supplies in the CIS region”. Mikhail Saparov presented information about the activities of the CIS Electric Energy Council on energy efficiency and renewable energy development in CIS countries.

At the end of the working meeting participants made the following decisions to:

1. Approve in general ISEDC Consolidated Report “Improving energy efficiency for secure energy supplies in the CIS region”.
2. Request representatives of the CIS countries to send to ISEDC by February 11, 2011 their final comments on the Consolidated Report.
3. Approve in general conclusions and recommendations of the Consolidated Report for the CIS region as it is noted in Annex 1.
4. Recommend experts of CIS countries to use conclusions and recommendations in their countries in their activities on increasing energy efficiency and security of energy supplies.
5. Complete ISEDC Consolidated Report with up-to-date information within two weeks after receiving final comments from representatives of CIS countries.

6. Recommend ISEDC with the support of UNECE to publish Consolidated Report in both Russian and English for distribution at the 22-nd Session of the "Energy Efficiency 21" Project' Steering Committee at other UNECE international energy fora and in the CIS countries.
7. Consider efficient enhancement of coordination and collaboration between UNECE and CIS Electric Energy Council on energy efficiency and renewable energy sources.
8. Request by ISEDC in collaboration with UNECE and CIS Electric Energy Council to elaborate directions on enhancing coordination and collaboration between UNECE and CIS Electric Energy Council.
9. Request the UNECE Secretariat to investigate opportunities in organization of similar events for energy experts from CIS countries in the further prospective, taking into account the high evaluation of Moscow working meeting, usefulness of discussions and importance of such event for energy experts from the CIS countries.

5. Information Sources

Agency on Statistics under President of the Republic of Tajikistan
http://www.stat.tj

Center for Energy Efficiency (CENEf)
http://www.cenef.ru

CIS Statistical Committee
http://www.cisstat.com

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http://www.ebrd.com/pages/country/armenia.shtml

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http://energoeffekt.gov.by/

European Bank for Reconstruction and Development (EBRD)
http://www.ebrd.com

Green Building Council
http://www.rugbc.org

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http://www.iea.org/Textbase/stats/index.asp

Institute of Energy Saving
http://www.ines-ur.ru

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http://www.energystrategy.ru/

International Energy Agency (IEA)
http://www.iea.org/

International Finance Corporation (IFC)
http://www.ifc.org

International Monetary Fund (IMF)
http://www.imf.org/

Kazakhstan Sustainable Energy Financing Facility (KAZSEFF)
http://www.kazseff.kz

McKinsey & Company
http://www.mckinsey.com

Ministry of Economy of the Republic of Belarus
http://www.economy.gov.by/

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http://www.minplan.kz

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me.gov.ua

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http://www.economy.gov.az

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http://www.economy.gov.ru

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www.mineconomy.am/ru/

Ministry of Economy of the Republic of Moldova
http://www.mec.gov.md/

Ministry of Economy of the Republic of Uzbekistan
http://www.mineconomy.uz

Ministry of Energy and Industry of Turkmenistan
www.minenergo.gov.tm

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http://www.minenergy.am

Ministry of Energy of the Republic of Belarus
http://www.minenergo.gov.by

Ministry of Energy of the Republic of Kyrgyzstan
http://energo.gov.kg/ru/news/?d=211

Ministry of Energy of the Russian Federation
http://minenergo.gov.ru

Ministry of Finance of the Republic of Kyrgyzstan
http://www.minfin.kg/

Ministry of Fuel and Energy of Ukraine
http://mpe.kmu.gov.ua

Ministry of Oil and Gas of the Republic of Kazakhstan
http://mgm.gov.kz

National Atomic Company 'KAZATOMPROM'
http://www.kazatomprom.kz

National Bureau of Statistics of the Republic of Moldova
http://www.statistica.md

National Energy Regulatory Agency of Moldova
http://www.anre.md

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http://www.energystate.ru

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http://belstat.gov.by

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http://www.stat.kg

National Statistical Service of the Republic of Armenia
http://www.armstat.am

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http://rosenergo.gov.ru

Russian Federal State Statistics Service
http://www.gks.ru

State Bank for Foreign Economic Affairs of Turkmenistan
www.tfeb.gov.tm

State Committee on Statistics of the Republic of Uzbekistan
http://www.stat.uz

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http://www.uzbekenergo.uz/rus

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