Energy Charter Protocol on Energy Efficiency and Related Environmental Aspects

PEEREA

KAZAKHSTAN

Regular Review of Energy Efficiency Policies 2006

Energy Charter Protocol on Energy Efficiency and Related Environmental Aspects PEEREA

Kazakhstan

REGULAR REVIEW 2006

Part I:

Trends in energy and energy efficiency policies, instruments and actors

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EXECUTIVE SUMMARY

Kazakhstan is one of the ten largest countries in the world with very important energy and mineral resources. 1 200 types of mineral resources in 2 806 registered deposits have been identified. Kazakhstan is one of the ten countries with largest resources of uranium, coal, manganese, tungsten, molybdenum, gold, phosphorites and iron including the largest resources of uranium and lead in the world, the second largest resources of zinc and chromate ores, the fourth largest resources of copper, and the seventh of gold.

About 0.5% of world's mineral energy resources are located in Kazakhstan; that is equal to 90 billion tons of oil equivalent (toe). This amount includes 70% of coal, 22% of oil and oil condensate and 8% of gas. Forecast extractable resources of the Kazakhstan continental part are estimated at 10 billion tons of oil and oil gas, and more than 7 000 billion m^3 of natural gas. The Kazakhstan's sector of the Caspian Sea is extremely promising with estimated resources of about 13 billion tons of oil equivalent. Since 2000, stable growth in production and consumption of coal, oil and gas is observed.

Kazakhstan possesses significant renewable energy resources, such as hydro, solar and wind energy. The hydro-energy potential of Kazakhstan is estimated at 163 billion kWh, production of 62 billion kWh is technically feasible and that of 27 billion kWh is economically expedient.

Energy policy objectives are presented throughout a number of documents (strategies, concepts etc.). One of the most crucial is the Development Strategy of Kazakhstan until 2030, which focuses on energy as one of the priority areas and determines the necessity of a "rapid increase of production and export of oil and gas in order to receive revenues that would contribute to sustained economic growth and an improvement of the living standard of the people". "Strategy 2030" is the strategy of the development of the fuel and energy sector of the country and has been developed for both the period until 2015 and the period up to 2030. This document contains sections concerning energy efficiency and energy saving.

Kazakhstan has a substantial electric power industry - third largest in the former Soviet Union after Russia and Ukraine -- 54 power generation plants with installed capacity of around 18500 MW. The goal and the basic priorities of the development of the sector are presented in the "Programme for the Development of the Electricity Sector up to 2030" (adopted as a special Resolution of the Government of the Republic of Kazakhstan, April 1999). The principal strategic directions of the development of the sector are:

- creation of an integral power system of Kazakhstan; simultaneous operation with the integral power system (IPS) of Russia and the power systems of the Central Asian republics
- further development of an open competitive power market
- maximum use of the existing power stations with reconstruction and modernisation thereof
- improvement of the power generation structure by developing technologies using renewable energy resources
- reconstruction and modernisation of the existing heating systems with combined generation of heat and electricity as effective power saving technology, allowing to significantly lower the consumption of fossil fuel and reduce the greenhouse gases emissions

- implementation of modern autonomous high-quality sources of heat, wherever it is reasonable in economic and environmental terms, in comparison to the combined generation of heat and electricity and to the centralised delivery of heat from boiler-houses.

The Ministry of Energy and Mineral Resources of the Republic of Kazakhstan (located in the capital Astana), being an executive and coordinating body of state management in the country's fuel and energy complex, ensures the implementation of the state policy, including the sphere of energy saving. Among the functions of the Ministry is the elaboration of programmes of the energy sector strategic development as a constituent part of the development strategy of the Republic of Kazakhstan, implementation of the strategy and organisation of the implementation of the state energy saving policy. The main objective of the Committee for State Energy Supervision under the Ministry of Energy and Mineral Resources of the Republic of Kazakhstan is supervision and control of the reliability, security and efficiency of energy generation, transmission, distribution and consumption.

The special State Energy Saving Programme was elaborated and adopted by a special Resolution of the Government of Kazakhstan in 1996. This Programme envisages the consistent realisation of the energy saving potential throughout the entire energy cycle from energy production to consumption.

"The Law on Energy Saving of the Republic of Kazakhstan" came into force in December 1997. It authorises public information and awareness in the sphere of energy saving with the aim to create the economic and organisational conditions for effective use of fuel and electricity resources of Kazakhstan and to protect the environment. The Law established the system of energy saving, the mandate of the Government of the Republic of Kazakhstan in the sphere of energy saving, the mandate of the body empowered by the Government in the sphere of energy saving and the rights and duties of the local representative and executive authorities in the sphere of energy saving. The problems of registration, establishment of consumption standards, standardisation and certification in the sphere of energy saving and examination of energy saving have been legally defined. A special chapter is devoted to renewable energy sources. Ways of carrying out education, information support and scientific research in the sphere of energy saving have been authorised.

The economy of Kazakhstan has significant energy saving potential provided by certain factors. The most important are obsolete and inefficient technologies and equipment used in industry, and high energy intensity of GDP as compared to similar indicators in developed countries. There are a number of international organizations that are providing assistance to the Government of Kazakhstan to increase the energy efficiency and to reduce the environmental impacts of Kazakhstan's energy sector (USAID, UNDP, UNECE, EU/TACIS/SYNERGY/BISTRO, EBRD, IBRD).

Kazakhstan had real GDP growth of 9.1% in 2003 and 9.3% in 2004. The growth of GDP can be explained by firstly, favourable situation in the world market: in particular, high prices for the main exports from Kazakhstan: oil, ferrous and non-ferrous metals. Secondly, there have been quite high industrial growth rates, especially in construction. These high rates are also typical of transport and communications, and other service sectors.

1. INTRODUCTION

Kazakhstan is a huge country covering a territory of 2 717300 square kilometres. Kazakhstan borders with the Russian Federation in the north and west, Turkmenistan, Kyrgyz Republic and Uzbekistan - in the south, China - in the south-east. Borders also align the Caspian seashore on the southwest. The country has considerable mineral wealth and vast areas of arable land. Total population residing in the country is about 15 million people. That makes it largest country in Central Asia and one of the most sparsely populated in the world with density of 5.5 people per square kilometre. 56.4% of the population lives in urban areas.

Kazakhstan is a unitary state with a presidential form of governance. Nursultan Nazarbaev is the President of the Republic of Kazakhstan.

Kazakhstan inherited significant infrastructure from the Soviet times and has a relatively well-educated population. The country's capital since 1997 is the city of Astana with continuously growing population, currently amounting to 502 000 people. The biggest city in the country is the former capital Almaty with population of 1 147 500 people. Kazakhstan is administratively divided into 14 provinces, with 2 cities (Almaty and Astana) holding special status due to "republican significance" and the territory of Baykonur, which contains the space launch centre that is leased by the Russian Federation.

By estimates of scientists of many countries Kazakhstan takes up the sixth place in the world by useful minerals reserves: 99 out of 110 elements of the periodic table are found in the subsurface of Kazakhstan, 70 of them are prospected, while deposits of only 60 elements are produced and used. Kazakhstan is the second largest producer of oil and coal among the CIS countries. Kazakhstan has considerable reserves of oil and gas concentrated in its western part, which makes it one of the largest oil producing countries in the world.

The economy is heavily dependent on a few commodities and faces the challenge of diversification. Oil extraction and oil-related construction, transportation, and processing accounted for more than 16% of GDP in 2004, and fuel and oil products made up 63% of exports. Ferrous and non-ferrous metals and grains are the only other significant export products. While exports of non-extractive commodities increased considerably in 2004, the share of manufactures in total exports fell to half the 1999 level. In an effort to reduce Kazakhstan's exposure to price fluctuations for energy and commodities exports, the government created the National Oil Fund of Kazakhstan.

Agriculture accounted for 7.4% of Kazakhstan's GDP in 2004. Grain (Kazakhstan is the sixth-largest producer in the world) and livestock are the most important agricultural commodities. Agricultural land occupies more than 84.6 million hectares.

Following independence in 1991, Kazakhstan was one of the earliest and most vigorous reformers among the countries of the former Soviet Union. In the early years of transition prices were liberalized, trade distortions reduced, and small- and medium-scale enterprises privatized. The treasury and budget processes were dramatically improved. Kazakhstan scores much less favourably, however, in the land reform in rural areas, in creating an enabling environment for small and medium sized enterprises, and in the elimination of corruption.

The government established a basic framework to attract foreign direct investment into its resource-rich oil and mineral sector. Banking reforms and state-of-the-art pension reform followed, together with the unbundling and partial privatization of the electricity sector.

Real GDP grew by 9.1% in 2003 and 9.3% in 2004. The growth of GDP can be explained firstly, by the favourable situation on the world market, in particular, high prices for the main exports from Kazakhstan: oil, ferrous and non-ferrous metals. Secondly, there have been quite high industrial growth rates, especially in construction. These high rates are also typical of transport and communications, and other service sectors.

To ensure that a larger share of the population reaps the benefits of recent growth, the government is looking for ways to improve spending policies, particularly in the social sectors, and to promote economic diversification and non-oil sector growth.

The crucial principle behind the policies of the government in Kazakhstan is that "economy should not only be aimed at import substitution, but rather be export-oriented". This principle has an impact on any other policy instruments and methodology.

According to the Strategic Plan for the Development of Kazakhstan until 2030, the state industrial and technological policy aims to "form an industrial complex in the country with a competitive edge in domestic and foreign markets under conditions of globalization of world economy, with stable and reliable outlets, and a clearly defined and expanding specialization in the international division of labour". This document states that pursuing this policy means integrated development of the industrial, agricultural, scientific and technological sectors, together with flexible regulation of the foreign economic activity in these spheres. The objective of industrial sector's further development is not only production stabilization and growth, but also deep structural changes in production which will greatly influence the economic development of the country over the years to come.

2. BACKGROUND: ENERGY POLICIES AND PRICES

2.1. Energy Policy - General Trends and Objectives

Energy resources

Due to its vast primary energy resources, Kazakhstan is one of the countries, which is not only able to meet domestic energy demands, but also to export energy resources in significant amounts.

Kazakhstan is one of the ten largest countries of the world with excess energy and mineral resources. 1 200 types of mineral resources in 2 806 registered deposits have been identified. Kazakhstan is one of the ten countries with largest resources of uranium, coal, manganese, tungsten, molybdenum, gold, phosphorites and iron including the largest resources of uranium and lead in the world, the second largest resources of zinc and chromate ores, the fourth largest resources of copper, and the seventh of gold.

About 0.5% of world's mineral resources are located in Kazakhstan; that is equal to 90 billion tones of oil equivalent (toe). This amount includes 70% of coal, 22% of oil and oil condensate and 8% of gas.

In addition, the largest uranium reserves that amount to 29% of the world reserves are located in Kazakhstan and 1.6 thousands tons of uranium are annually extracted.

Prospective oil- and gas-bearing areas comprise 62% of the entire country's territory, and only roughly half of them has been explored. 197 oil and gas deposits have been discovered with explored resources of hydrocarbons amounting to more than 2 billion tons of oil, 0.7

billion tons of oil gas and some 2 000 billion m^3 of natural gas. Forecast extractable resources of the Kazakhstan continental part are estimated at 10 billion tons of oil and oil gas, and more than 7 000 billion m^3 of natural gas. The Kazakhstan's sector of the Caspian Sea is extremely promising with estimated resources of about 13 billion tons of oil equivalent.

The hydro-energy potential of Kazakhstan is estimated at 163 billion kWh, production of 62 billion kWh is technically feasible, and that of 27 billion kWh is economically expedient.

Energy resources are unevenly distributed over the territory of the Republic: major coal deposits are located in the northern and central regions; oil and gas deposits are located in the western region and minor resources of gas and coal are in the southern region; hydro-energy resources are located in the eastern and south-eastern regions.

The total value of already explored and forecast subsoil resources of Kazakhstan is estimated at US$ 10 400 billion including US$ 8 000 billion for solid and US$ 2 400 billion for hydrocarbons.

Energy balance

Table 2.1. Energy Balance

	1990	1995	1998	1999	2000	2001	2002	2003
Production								
Coal, million tons	131.5	83.4	69.77	58.26	77.4	79.08	73.73	84.9
Oil, million tons	25.82	20.64	25.78	30.18	35.32	40.09	47.27	51.45
Natural gas, billion m^3	7.7	5.92	7.95	7.2	9.09	8.28	6.02	7.56
Consumption								
Coal, million tons	89.7	65.1	47.45	43.14	52.92	50.64	51.52	57.02
Oil, million tons	18.95	16.64	9.1	7.51	7.15	8.60	9.55	8.66
Natural gas, billion m^3	14.45	11.3	8.7	6.15	7.83	5.87	7.21	7.79
Export								
Coal, million tons	32	23.0	23.55	16.26	25.71	27.51	22.73	27.03
Oil, millions tons	21	11	16.39	23.57	29.35	32.40	34.09	44.27
Natural gas, billions m^3	4.7	0.62	2.3	3.83	5.22	5.54	10.44	11.01
Import								
Coal, millions tons	10.2	1.0	1.23	1.14	0.69	0.21	0.20	0.36
Oil, millions tons	14	7	0.29	0.9	1.0	2.34	2.63	2.48
Natural gas, billion m^3	11.45	6	3.05	2.78	4.22	4.28	8.17	8.7

The analysis of the data presented proves that the production of primary energy resources decreased within the 1990-1998 period due to political and economic transformations in the country. In 1998, coal production decreased by 47% as compared to 1990. However, oil and gas production, after having recovered from a sharp fall, show a growth tendency: in 1998 oil production reached 99.8% of the level of 1990 and natural gas production had increased by 3.2%. Since 2000 stable growth in production and consumption of coal, oil and gas is observed.

The fuel and energy complex of Kazakhstan plays an important role in the economy of the country[1]. The energy system of Kazakhstan is founded and is being developed on the basis of

[1] Oil and gas industries account for 30% of government revenues and up to 65% of total exports, the share of enterprises involved in producing crude oil and natural gas accounts for half of the total volume of investments

the energy system of the former Soviet Union. Therefore the integration and joint development with the fuel and energy complex of other former Soviet Union states is the main factor in the elaboration of all aspects of the energy policy of Kazakhstan. Thus, while clearly being energy exporter, as more than 50% of the energy produced is exported, Kazakhstan's energy imports are still in place, being, among other reasons, mainly a result of the Soviet energy system.

Energy strategy

Energy policy objectives are presented throughout a number of documents (strategies, concepts etc.) One of the most crucial is the Development Strategy of Kazakhstan until 2030, which focuses on energy as one of the priority areas and determines the necessity of a "rapid increase of production and export of oil and gas in order to receive revenues that would contribute to sustained economic growth and an improvement of the standard of living of the people".

"Strategy 2030" is the strategy for the development of the fuel and energy sector of the country and has been developed for both the period until 2015 and the period up to 2030. This document contains sections concerning energy efficiency and energy saving.

The energy policy of the Republic of Kazakhstan within a long-term outlook pursues four main goals:

- to ensure reliable power sources required for sustainable economic growth
- to meet the demand of the population for energy services at acceptable prices
- to develop reliable energy saving systems that would guarantee energy security
- to preserve a sound environment and prevent uncontrolled climatic changes.

It is feasible for Kazakhstan to succeed in these main goals, since it has considerable fuel and energy resources combined with a developed energy infrastructure.

The main objectives of the governmental policy in the energy sector are:

- to ensure fuel and electricity independence of Kazakhstan
- to create fuel and electricity markets in Kazakhstan
- to work out legislation that will encourage development of the energy sector
- to implement energy saving policy
- to improve the ecological situation in Kazakhstan
- to involve renewable energy sources into the energy balance of the Republic
- to attract foreign investors.

As opposed to the former orientation towards a large-scale energy production, *enhancing efficiency of energy consumption and energy saving* is the supreme priority of the energy strategy.

The new structural policy in the area of energy sector development within the following 15-30 years provides for:

- growth in oil production, more efficient oil use, increased domestic consumption and export of oil
- more efficient natural gas utilisation, increased domestic consumption of natural gas

(US$ 30 billions since 1993)

- priority of fine processing and complex utilisation of hydrocarbon raw materials
- as ecologically acceptable technologies will be introduced, improvement of quality of coal products through increased volumes of high calorific coals, and stabilisation and further building up of coal production rates (mostly by surface mining)
- intensified development of local energy resources (hydro energy, minor deposits of hydrocarbons, etc.), greater use of non-conventional and, first of all, renewable resources (wind, solar and geothermal energy, mine methane, biogas, etc.).

Prospectively, the structural policy is to provide for opportunities for wide use of both conventional and new kinds of energy resources.

The new *technical policy* in the energy sector development is directed towards:

- a fundamental increase in economics and energy efficiency at all stages of energy production, conversion, distribution and use
- ecological and emergency safety of energy sources and reliable energy supplies to consumers
- use and development of new quality technologies and techniques to ensure sustainable energy sector development, including environmentally friendly coal power plants, as well as efficient technologies for the use of new energy sources, production and processing of hydrocarbon raw materials, etc.

Due to the lack of reliable statistics it is not possible to provide proper conclusions regarding energy consumption balance between sectors. The main consumer of primary energy resources is the heat and power sector (30-50% of total primary energy consumption). Industry is a significant energy consumer of up to 50% of the overall energy consumption (mining and iron and steel manufacturing[2] being mostly energy intensive). In order to provide further analysis of demand pattern, additional statistics (presumably from Government) is needed.

Table 2.2. Structure of Energy Resources Consumption by Principle Groups of Consumers in Kazakhstan

	1990			1995			1998			1999		
	coal	oil*	gas	coal	oil*	gas	coal	oil*	gas	coal	oil*	gas
	10^6t	10^6t	10^9m^3	10^6t	10^6t	10^9m^3	10^6t	10^6t	10^9m^3	10^6t	10^6t	10^9m^3
Total	89.7	36.3	14.4	65.1	26.5	11.5	47. 45	16.3	8.7	43.14	10.2	6.15
Industry	50.9	26.1	9.7	53.1	23.0	9.16	44.0	12.9	6.45	39.88	5.07	5.48
Inc. - Electricity	48.9	4.5	5.6	42.0	1.6	3.94	30.0	1.39	3.65	20.49	0.75	2.85
Transport	0.08	7.0	0.23	0.56	1.0	0.27	0.55	0.8	0.02	0.15	0.35	0.01
Population and Service	21.0	1.0	2.37	6.45	0.4	1.85	1.42	0.34	2.05	2.27	0.86	0.64
Agriculture	0.38	2.3	0.01	1.5	2.1	0.02	0.60	0.57	0.02	0.80	0.88	0.03

* Oil for refinery and petroleum

[2] according to IEA statistics

Energy subsectors

Coal

The coal-mining industry of Kazakhstan comprises 24 coal mines and 11 coal pits with the total planned production capacity of 162 million tones. As indicated above, major coal deposits are located in the central part of Kazakhstan, which provides geographical advantages for transporting coal over the territory of the Republic. Major power plants are located near the deposits, which facilitates fuel supply.

Over 3% of the world's industrial reserves of coal, about 164 billion tons, are located in Kazakhstan. Coal reserves of Kazakhstan are estimated at 38-39 billion tons, which is 23% of total geological reserves. Kazakhstan coals can be subdivided by energy value into hard coal and lignite. Over 60% of coal reserves are presented by hard coals.

The Karaganda, Ekibastuz and Kuuchekinsk Coal Fields are the major deposits in the country. Coke is processed at the Karaganda coalfields only. It should be noted that coals are excavated here by the underground method (deep mining) and used mostly in metallurgy. Coals from other fields are excavated by the surface method (open pit mining) and are used for energy production.

The total potential of forecasted coal reserves produced by the surface method is estimated at 400 million tons per year, while industrial reserves of coal that can be excavated by the surface method make up 21 billion tons, concentrated mainly at the Ekibastuz coal fields.

Oil and Gas

The strategy for the development of the oil and gas complex has the following priority objectives:

- ensuring energy independence of Kazakhstan
- stabilising the fuel and energy complex as a condition for overcoming the overall crisis of industrial production
- strengthening the export potential of primary and secondary oil and gas resources
- ensuring transport independence of Kazakhstan for the export of oil and gas resources.

There are three refineries and three gas processing plants in Kazakhstan. The Atyrau refinery on the Caspian coast is the only one in the country built to operate exclusively on domestic crude. The Pavlodar refinery uses Russian crude oil from western Siberia, Shymkent is refining domestic product. Since domestic prices for refined products have remained low, oil producers have more incentive to export crude oil to international markets instead of refining it locally. Consequently, this has affected refinery performance, and Kazakhstan's refineries currently operate at only 51% of their nameplate capacity. As a result it has created severe problems for the agricultural sector, which is largely dependent on government support and subsidized inputs for its survival. Because of the shortages, the Kazakh government has frequently imposed a ban on product exports.

Taking into consideration the geographical location of gas fields and gas consumers, gas reserves and gas composition, the following possible ways of gas utilisation can be considered:

- to develop minor gas fields to supply gas locally to adjacent inhabited areas
- to supply gas to power production facilities (CHP plants, condensing power plants, district boiler houses)

- to utilise gas on the spot in gas turbine units and combined-cycle units and supply the generated power to the common power grid and additionally utilise the generated heat for local needs
- to process associated gases on the spot to produce liquid fractions and utilise them as fuel or chemical raw materials
- to use gases in technological processes at industrial facilities
- to use worked-out oil and gas fields as regional underground storages.

In order to support positive dynamics of oil extraction and export, a proper concept for stable and diversified utilization of redundant volumes of associated petroleum gas shall be elaborated.

Kazakhstan is willing to end its dependence on imported supplies for its southern regions. Although Kazakhstan has considered the construction of an internal north-south pipeline, thereby alleviating import dependency, the prohibitive cost of such a pipeline has delayed any decision to proceed with the project.

Market changes were made in the oil and gas sectors. The government keeps control over the transportation systems.

Power sector

Presently the power plants of Kazakhstan dispose of a potential capacity that can entirely meet the domestic demand, but due to the existing structure of electricity transmission and the state of the market, the South and West Kazakhstan regions import electricity and capacity from the neighbouring states.

Kazakhstan has a substantial electric power industry -- third largest in the FSU after Russia and Ukraine -- 54 power generation plants with installed capacity of around 18 500 MW -- 88% in thermal power plants and the rest in hydroelectric plants.

Table 2.3. Historical electricity balance of Kazakhstan, billion kWh

	1990	1995	1998	2000	2003
Total electricity consumption	104.72	74.38	53.40	54.38	61.98
Electricity generation	87.38	66.98	49.59	51.42	63.65
Deficit(-), surplus(+)	-17.34	-7.40	-3.81	- 2.96	+1.63

Table 2.4. Structure of the installed capacity of power plants by energy type in 2003

Type of Power Plants	Capacity, MW	%
Coal Thermal Power Plants	12 440	67.4
Gas and Oil Thermal Power Plants	3 774	20.4
Hydro Power Plants	2 247	12.2
Total	18 461	100.0

Main characteristics:

- high concentration of electricity generation (7 400 MW of thermal capacity at just three sites: Ekibastuz-1 (8 X 500 MW)/Ekibastuz-2 (2 X 500 MW) and Aksu (8 X 300 MW)

- location of large plants mostly close to fuel deposits
- high share of co-generation of electricity and heat for industrial and community use - 38 CHP, 32 of which are in urban or suburban locations (38% of the total capacity)
- insufficient share of hydropower plants (8 hydroelectric plants) – only 12% is the share of hydropower, whilst hydro potential is estimated at 27 billion kWh per year
- developed network of electricity lines with voltage of 220, 500 and 1150 kV
- system of control relays and safety automatic equipment
- deteriorating infrastructure (average of 15% of the electricity generated in Kazakhstan is lost before it reaches consumers)
- unified vertical system of operative supervisory management.

Table 2.5. Electricity Generation Structure, billion kWh

Types of Power Plants	1990	1995	1998	2000	2003
Electricity generation, total:	87.38	66.98	49.59	51.42	63.65
Including:					
Coal Power Plants	62.33	47.37	33.60	37.26	46.99
Gas and Oil Power Plants	17.70	10.80	7.99	6.65	8.05
Hydro Power Plants	7.35	8.31	7.70	7.51	8.61
Nuclear Power Plant	0.50	0.50	0.30	0.00	0.00

Installed co-generation capacity is 6 918 MW, 77% of which are operating on coal. Co-generation power plants in Kazakhstan meet about 40% of the domestic heat demand and 48% of the electricity demand.

Kazakhstan possesses significant renewable energy resources, such as hydro, solar and wind energy. Apart from a small amount of hydropower, these resources have not really been utilized until now.

The goal and basic priorities of the sector development are presented in the "Programme for the Development of the Electricity Sector up to 2030" (adopted as a special Resolution of the Government of the Republic of Kazakhstan in 1999). These are the following:

- achievement of security of domestic power supply for the economy and the population and, consequently, reaching energy independence as an element of the national security
- development of competitive power resources for export, with the option of offering it at the power markets of the bordering and "third" countries
- development of a competitive power market on the basis of a commonly available transportation and distribution grid, as well as a system of dispatch operation of the producers' power flows.

The principal strategic directions are:

- creation of an integral power system (IPS) of Kazakhstan
- simultaneous operation with the integral power system (IPS) of Russia and the power systems of the Central Asian republics
- further development of an open competitive power market
- maximum use of the existing sources of energy with respective reconstruction and modernisation

- improvement of the power generation structure by developing technologies using renewable energy resources
- reconstruction and modernisation of the existing heating systems with combined generation of heat and electricity as an efficient technology, allowing to significantly lower the consumption of fossil fuels and reduce the greenhouse gases emissions
- implementation of modern autonomous high-quality sources of heat wherever it is reasonable in economic and environmental terms in comparison to the combined generation of heat and electricity and to the centralised delivery of heat from boiler-houses.

The power (electricity) sector of Kazakhstan is in transition now. New market relations are presently being established in the energy sector of Kazakhstan. Restructuring of the electric power sector has been completed: close to 100% of the national power generating capacities have been privatised or placed under management of private companies. The National Electricity Grid has been formed and the open competitive market of electricity has been created. The government approved the programme for further electricity market development.

District heating

The governmental policy in the sphere of heat supply is directed to privatization, involvement of market mechanisms for its development and a policy of energy savings. As it is stated in the Energy Sector Development Program until 2030, the development of centralized heating systems on the basis of co-generation plants where it is economically feasible is one of the main directions of heating systems development. The autonomous heating systems will be applied in the zones where there is no co-generation plant service.

Based on statistical data and reports from co-generation power plants (TETs) and big district heating boilers, heat demand and supply balance in Kazakhstan has been prepared.

Table 2.6. Heat balance of Kazakhstan, million Gcal

	2000	2001	2002
Heat demand	150.8	155.9	160.7
Heat supply			
Including:			
- Co-generation Power Plants	46.4	45.1	46.9
- District heat boilers (more than 20Gcal)	12.4	15.4	15.9
- Other sources and Furnace heating	92.0	95.3	97.9

The share of rural consumers is around 30% of the overall heat demand of Kazakhstan. This demand is being covered through burning of various fuels in heating furnaces and small independent heating systems.

Of the overall demand of urban consumers, 43% are provided by co-generation power plants, around 14% - by district heat boilers, and 43% - by independent heating systems and heating furnaces.

Table 2.7. Forecast of Electricity and Heat Demand (max)

	2010	2015	2020	2030
Electricity, TWh	72	86	100	130
Heat, million Gcal	162	168	173	178

Summary Table I: Priority of Policy Objectives

The objectives of the energy policy are prioritised from 1 (the highest) to 5.

Policy objective	Mark
Reduce total final consumption / GDP	1
Reduce dependency on energy imports	2
Diversification of fuels	5
Reduction of CO_2	4
Increase utilisation of indigenous primary energy sources	3

2.2. Energy Policy Implementation

The Ministry of Energy and Mineral Resources of the Republic of Kazakhstan (located in the capital Astana), being an executive and coordinating body of state management in the country's fuel and energy complex, ensures the implementation of the state policy, including in the sphere of energy saving. Among the functions of the Ministry is the elaboration of programmes for strategic development of the energy sector as a constituent part of the development strategy of the Republic of Kazakhstan, carrying out the implementation of the strategy and organising the implementation of the state energy saving policy.

The Ministry has a wide range of functions, divided into the following groups[3]:

- Strategic functions, designing the state energy policy (including elaboration of state programmes, concepts regarding energy saving and use of renewable and non-traditional energy sources; reproduction of mineral resources base and rational use of mineral resources, etc.)
- Implementation functions, aiming at realisation of the state energy policy (e.g. supports efficient functioning and development of the energy complex, develops fuel balances, including production, processing and transportation of petroleum)
- Control functions on the realisation of the state energy policy (e.g. licensing functions, functions of coordination of activity of national companies).

[3] Decree of the Government of the Republic of Kazakhstan N 1105, October 28th, 2004 "Issues of the Ministry of Energy and Mineral Resources"

In addition, other state bodies (e.g. the Agency for the Regulation of Natural Monopolies, the Ministry on Environmental Protection, etc.) play an important role in the state management of the energy sector.

The Joint-Stock Company KazMunayGas National Company was founded in 2002 with the aim of comprehensive development of the Republic's petroleum industry to ensure rational and efficient operation of hydrocarbons, which in turn, will contribute to social and economic development of Kazakhstan and its successful integration into the world economy. KazMunayGas (KMG) participates in the development and implementation of the state policy and strategy in the petroleum sector.

As a result of the reforms in the energy sector, the electricity sector of the Republic has the following institutional structure, involving economically independent institutions:

- The National Transmission System - Kazakhstan Electricity Grid Operating Company (KEGOC, 100% state owned) - established on the basis of the system-based (inter-state and inter-system) 220-500-1150 kV transmission grids, the transmission grid, which provides electricity to large consumers
- Regional distribution companies own distribution networks with voltage of 110 kV and below, and distribute electricity on a regional level
- Producers of electricity are independent power producers, or power plants integrated with major industrial power consumers.

Institutionally, the Common Electricity Grid is based on the existing integral system of operation-dispatch control under the national transmission grid, regional distribution companies and independent power producers. Operation-dispatch control is carried out by the Central Dispatch Centre of the National Transmission Grid of Kazakhstan, based on standards and legislation of the wholesale and regional electricity markets and on the base of the Electricity Law.

2.3. Energy Prices

2.3.1. Energy pricing policy

Kazakhstan has recently pursued a partial liberalisation policy. Wholesale electricity prices are determined by the market, transit prices by the Agency for the Regulation of Natural Monopolies and end-use prices by local government committees, in particular Natural Monopolies Committee.

The 1998 "Law of the Republic of Kazakhstan on Natural Monopolies" determined the legal foundation for the prices and tariffs for the natural monopolies services, which include, according to the law, oil and gas pipelines and transmission and distribution of electricity and heat. Although Article 5 of the law prohibits natural monopolies from charging prices above those established by authorised agencies, Article 18 states that "prices must not be lower than the cost required for delivery". This provides for a return sufficient "to ensure efficient operation".

In accordance with the economy liberalization and successful implementation of energy, oil and liquefied gas markets, currently there are no subsidies.

As part of the overall restructuring process, a national power grid was formed and a wholesale market for electricity trade was established. Regional distribution companies were scheduled for privatization by June of 2004, with foreign investment encouraged. Kazakhstan's electricity sector is structured as follows:

- *Power Producers:* independent power plants and large industrial power producers supplying electricity to the national grid
- *Trading Intermediaries:* legal entities that do not own and lease electricity distribution grids
- *The National Electricity System (NES).* NES is operated by KEGOC, which is 100 percent state-owned. KEGOC manages the overall inter-state and inter-system grid network in Kazakhstan. Its assets include 220 to 1 150 kilovolt (kV) transmission lines and master substations forming the national power grid and providing power to regional power grid companies and large industrial consumers.
- *Regional Power Grid Companies (RPGCs).* The RPGCs manage distribution lines of 110 kV and less, and distribute power at the regional level.
- *Power Systems of Neighboring Countries.* Power systems in neighboring countries can buy or sell electricity in the Kazakh wholesale electricity market.

In the wholesale market, large industrial consumers and the RPGCs purchase electricity from power producers, industrial entities or trading intermediaries and then transmit the electricity through transmission lines (KEGOC) to the end-users. Large industrial consumers connect directly to the national grid operated by KEGOC, while all other end-users receive their power through the RPGCs. Due to the restructuring of the wholesale market and the recent electricity oversupply in most parts of Kazakhstan, annual wholesale prices have declined. In 2002, annual average electricity prices ranged at US¢ 1.2 per kWh for industrial consumers and US¢ 3.2 per kWh for retail consumers. The low electricity prices have reduced profit margins and discouraged large-scale investment in new generating capacity.

The latest stage of reform (2004-2006) aims at:

- Improvement of regulatory and legal base governing the relationships between the power sector participants
- Increase of safety and balance of working regimes of Electric Energy System of Kazakhstan and quality of supplied energy by participation of wholesale market participants in spot-sales “day ahead” and on balancing market in real time mode
- Creation of objective prerequisites for the development of competition on the retail market with regards to diversification of competitive (electricity generation on combined heat power plants, retail sale) and monopolised (distribution) activities (primarily in Regional Energy Companies (RECs))
- Electric energy prices stabilisation at the retail market basing on development of competition between energy providers to retail customers.

At present, state regulation of prices in the energy sector is carried out in accordance with the Laws "on Natural Monopolies", "on the Development of Competition and Restriction of Monopolist Activities", "on Power Industry", etc. State regulation includes power transmission and distribution, technical dispatching, generation, transmission and distribution of heat.

The tariffs established by the Agency for the Regulation of Natural Monopolies should:

- not be lower than the costs of the provision of services (production of goods, execution of works)
- allow for profit
- foresee justified amount of costs to be covered and justified revenue from the invested capital.

Petroleum product market faces major governmental intervention mainly aiming at guaranteed loading of available refineries, as due to low internal prices, incentives are directed towards maximum crude export. KazMunaiGaz not only contributes to Governmental initiatives on stabilising internal market of petroleum product by providing low prices for fuel, but also provides discounted fuels to agriculture sector, rural areas etc. Moreover, in some regions (e.g. Pavlodar province) memoranda between local executive institutions and industry are practiced in order to stabilise energy and commodities prices[4].

In order to hold the price fluctuations in certain regions (e.g. Aktubinsk province), gas prices are also stabilised by executive bodies.

2.3.2. Price Levels

After implementation of the wholesale electricity market in Kazakhstan the prices for electricity became stable. As a result of this, prices for primary energy recourses (first of all for coal and mazut) consumed in electricity generation got stable too. In accordance with significant reduction of fuel and electricity consumption, production is currently substantially exceeding the demand at the market. As a result, the market electricity prices stabilized at a low level.

According to forecasts, when the level of electricity demand approaches the level of its supply on the market, electricity prices will rise. This process will take place in the next 5 years. This relates to the fact that electricity generators, as well as transmission companies, start huge rehabilitation programmes. In the near-term outlook a number of new generating capacities construction projects (such as construction of hydropower plants in the southern and eastern regions of Kazakhstan) will enter the phase of practical implementation, and this will also influence the dynamics of electricity prices rise. It is forecasted that during the period 2010 – 2015 the price of 1 kWh in the wholesale market can increase from 1.1 US cent to 3 US cents. Relatively low electricity price will remain due to low prices of the main fuel for power plants – coal, mined open-cut and not demanded on the world market.

Summary Table II Energy Prices

Energy Prices	Yes	No	Partly
Is there an independent regulator of energy prices?			X
Are there any subsidies on energy prices		X	
Are there any cross-subsidies		X	
Are the environmental costs fully internalised?		X	
Do you have a tax related to energy consumption?		X	
Do you have a tax related to CO2 emissions?		X	

[4] see for instance
http://www.prof.in.kz/?mod=text&tx=54564&lit=цены%20на%20нефть%20казахстан%20внутренние

3. END-USE SECTORS

Due to the economic reform, changes in the structure of electricity consumption took place during the period 1990-2003. Despite a fall in industrial production rates, the share of industrial sector in the total electricity consumption remains high, with major shares of the fuel industry (owing to increased oil and gas production) and metallurgy. The inadequately equipped power plants consume more electricity for own needs, although power production decreased by 43% during this period. With increased electricity production and more full loading of the equipment of the power plants, there was a decrease of the current consumption for own needs of the power industry after 1999. The current consumption of the population and services is within the limits of 18-22%.

Table 3.1 indicates the development of electricity consumption by various sectors of the economy during this period.

Table 3.1. Electricity Consumption by Sectors, %

Industries	1990	1995	1998	2000	2003
I. Industry	63.9	56.4	67.3	72.5	72.2
1.1 Power	11.8	18.3	21.3	16.0	15.3
1.2 Fuel	8.0	10.7	13.5	19.1	23.6
1.3 Ferrous Metallurgy	21.5	24.7	25.0	25.5	22.0
1.4 Non-ferrous Metallurgy	17.7	19.8	25.9	22.7	22.8
1.5 Chemistry	19.4	9.7	3.3	3.3	4.8
1.6 Others	21.6	16.8	11	13.4	11.5
II. Construction	2.3	2.2	0.6	0.6	0.9
III. Transport	6.7	5.9	7.5	5.6	6.7
IV. Agriculture	8.2	10.3	2.3	1.5	1.3
V. Services	11.3	12.5	9.6	8.3	8.6
VI. Population (Public utilities)	7.6	12.7	12.7	11.5	10.3
Total	100	100	100	100	100

3.1. Residential Sector

In Kazakhstan three types of heat supply to the residential sector have been developed: heating systems from co-generation power plants (TETs), centralized heat supply from district, block and grouped heat boilers, and decentralized heat supply from individual heat boilers and furnaces.

As mentioned above, the share of rural consumers of the overall heat demand of Kazakhstan is around 30%. The demand is covered by burning of various fuels in heating furnaces and small independent heating systems.

Of the overall heat demand of urban consumers, 43% are provided by co-generation power plants (TETs), around 14% - by district heat boilers, and 43% - by independent heating systems and heating furnaces.

At present the prevailing fuels used for heat supply in towns and urban-type communities are coal (55-56%) and fuel oil (mazut) (26%). The share of gas being burnt to produce heat is not big and does not reach 20%.

In Kazakhstan centralized heat supply based on co-generation of heat and electricity in co-generation power plants (heating systems) evolved in mid-thirties and has become the prevailing heat supply system in Kazakhstan's industrially developed cities in the period 1960 - 1990. The installed electric power capacity of TETs, built mainly for heat production and currently operating, exceeds 6700 MW (38% of the total capacity of all power plants). This covers around 40% of the heat consumption and around 46% of the electricity consumption in Kazakhstan.

The concept of centralised heating systems provided conditions for removing a great number of small heat boilers from the towns. The efficiency of such heat boilers was no higher than 50-60%, causing excess consumption of million tons of fuel, pollution of towns with untreated stack emissions, heaps of ash and flows of motor vehicles carrying fuel for heat boilers and ash-and-slag waste. Moreover, residential houses have become provided with hot water from the centralized heating systems, thus enabling to dismantle a great number of gas and solid fuel water heating units located in individual flats and polluting the air inside residential areas.

The highly developed infrastructure of centralized co-generation heat supply systems in Kazakhstan towns, and the current housing development is based on the use of such systems, has become the same feature of social conditions as running water supply and sewerage system. In addition, the heating systems contribute to improving the environment and provide skilled jobs.

The towns with developed capital assets should be provided with all conditions to keep and improve the centralized heat supply systems. This requires renewal of worn out equipment and implementation of the best world achievements in heating systems.

In the towns with no TETs, in urban-type communities, in villages and in towns with low density of housing (usually one-, two and three-storey buildings) heat is being supplied by furnaces, house or local heat boilers with a capacity up to 20 Gcal/hour or by district heat boilers of higher capacity. For the most part these heating sources are of low efficiency and low level of operation; they have no treatment facilities and therefore do not meet the environmental requirements. The share of heat consumption outside the county's heating system amounts to nearly 60%.

The heat supply network, being one of the most important elements of the centralized heat supply system, is the most unreliable chain in this system. Due to unsatisfactory condition of nearly half of the heat mains and distribution networks in the towns, energy consumption for heat transportation is too high to be justified. Heat supply networks installed underground in non-accessible service ducts operate under varying conditions of temperature and humidity that contribute to corrosion processes. The service life of corrosion preventing and heat insulation coatings is two or three times less than designed. Above-ground installation is often impossible because of town-planning requirements.

Construction of new heat supply networks and rehabilitation of the existing ones should be based on the achievements of European countries that are developing centralized heat supply and heating systems.

Residential houses are built mainly of bricks and concrete. Some of the buildings constructed earlier need 15-30% more heat than average buildings with normal insulation. However, this situation is not likely to be improved soon, as it is too costly to change building insulation.

What can be done at the moment is installation of double or triple windows or thermal blocks. Regulation of the indoor temperature will also offer options for energy saving. Heat losses in buildings in Kazakhstan are 50-60% higher than heat losses in developed countries. Large investments requiring 3-15 years of payback would be needed to improve efficiency in buildings energy use.

The use of day-night electricity meters for households is low in Astana and Almaty, and absent in some of the oblasts. Incidence of heat metering at building level varies widely from oblast to oblast. Heat metering and control at the household level is absent in Kazakhstan. Household warm water meters are very popular in Kazakhstan, as consumers discovered that installation of this relatively low-cost technology could substantially lower the water bill. Almaty city installs 'free' water meters in low-income households.

More than 90% of the Kazakhs own their own homes and apartments, which is significant for two reasons. Firstly, there is potential to stimulate households to invest in the thermal performance of the building, which implies that if other barriers to energy efficiency were removed (low prices, lack of metering), households would be motivated to conduct energy-efficiency measures. Secondly, the potential for the government, municipalities or international donors to conduct mass weatherization of state-owned housing is low, as most apartments are privately owned.

At present, Kazakhstan practices extensive construction of new residential houses, meeting the established regulations and standards. Due to improving the well-being of the population, household appliances (refrigerators, TV sets, washing machines, microwave ovens, etc.) are being replaced with new low-energy equipment.

On the whole, energy consumption in the residential sector decreased during the last 10 years (1993 – 2003) by 30%, while the population lowered by 10%.

3.2. Industrial Sector

The industrial base in Kazakhstan is directed towards heavy industry and processing of raw materials, which require significant amount of energy. The industrial branches in Kazakhstan, including the energy sector, are highly power consuming and cause considerable environmental pollution.

As shown in Table 3.1, the share of industry (including power industry) is 72% of the electricity consumed in the country in 2003. The share of ferrous and non-ferrous metallurgy amounted to 44.8% of the electricity consumed by industry, and mining consumed 22.8%.

On the whole, the share of energy consumed by industry in the total energy consumption in the country in 2003 amounted to 45% (in 1992 – 51%). Compared to the year 1992, energy consumption by industry decreased by 55%, but since 1999 there is a steady growth of energy consumption by industry (during 1999 through 2003 the growth was 30%).

The energy saving potential in industry is high (it is estimated at 10% of the consumption), this being related to the use of obsolete technologies and equipment. Currently, all industrial enterprises in Kazakhstan have been privatized and are the property of private owners (both residents and non-residents of the Republic of Kazakhstan). To maintain competitive positions in the world market (since considerable portion of the industrial products is being sold abroad), implementation of advanced technologies is required. Such technologies are more energy-efficient than those used earlier, and their implementation will result in lower energy intensity of the products. The process of modernization and implementation of new

technologies in Kazakhstan's industry has started; however its rate is still not as high as needed.

3.3. Services Sector

During the years of transition from a planned to a market economy, the services sector also experienced great changes. The government involvement in the sector decreased considerably, and because of insufficient budget funds, the state executive authorities (town, province and village "akimats") have established tight control over energy consumption in the services sector. This fact can also explain sufficiently fast and extensive implementation of energy saving projects in street lighting and power supply of medical, educational and cultural institutions.

Commercial services sector experiences rapid development, and the number of service companies (small and medium-size businesses) grows every year. Under such conditions new companies use the best scientific achievements and the most advanced equipment available currently in the world. However, the development of this sector is still insufficient and this can explain its small share in the overall energy consumption as compared to developed countries.

In 2003 the share of energy consumption in the services sector amounted to 1.7% of the country total. The share of electricity consumption in 2003 was 8.6%. As compared to 1992, energy consumption in the services sector decreased by 57%.

Since 1999 there is a steady growth of energy consumption in the services sector (during the period 1999 through 2003 the growth was 43%).

3.4. Transport Sector

The transport infrastructure in the Republic of Kazakhstan is represented by the developed network of railroads, as well as by air and motor transport. The Ministry of Transport and Communications of the Republic of Kazakhstan is responsible for the development and operation of this sector. During the years of Kazakhstan independence the aircraft fleet has been renewed considerably (due to purchase of new Western airliner), and electricity has been provided to certain sections of railroad where diesel traction had been used earlier. Fleet of motor vehicles increased significantly both due to the raised volume of cargo transportation via motor roads and improved well-being of citizens. The country does not produce automobiles, and therefore the fleet of those is being increased through purchasing of motor vehicles made in Japan, the European Union and USA.

All these market development trends led to lower unit energy consumption in the transport sector.

In 2003 the share of energy consumption in the transport sector in the total volume of energy consumption in the country amounted to 10.4% (12.3% in 1992). The share of electricity consumption in the total volume of electricity consumed in 2003 was 6.7%. As compared to 1992, energy consumption in the transport sector decreased by 56%.

4. ENERGY EFFICIENCY POLICIES

4.1. Energy Efficiency Policy

A special State Energy Saving Programme was elaborated and adopted by a special Resolution of the Government of the Republic of Kazakhstan in 1996. This Programme envisages the consistent realisation of the energy saving potential throughout the entire energy cycle from energy production to consumption.

The Programme for Development of Renewable Sources in the Republic of Kazakhstan, approved by the Minister of Energy and the Minister of Science in 1995, has become a constituent part of the State Energy Saving Programme.

In the framework of the "Hydrocarbon Initiative", initiated in 1997 by the Ministry of Ecology and Natural Resources together with the Ministry of Energy, Industry and Trade with a view to reduce the emission of greenhouse gases into the atmosphere, energy saving entered the list of priority directions for the implementation of this initiative.

The Ministry of Energy, Industry and Trade elaborated and adopted in 1999 the Energy Sector Development Program until 2030. Rehabilitation and energy efficiency improvement of existing power plants are the main strategy for the development of the energy sector in the period 2000 - 2030. In the heat supply sector, the focus is on rationalization of heat supply schemes of cities and towns according to economic and environmental considerations, on the basis of development of central heating systems and autonomic heating systems.

Energy saving is an important line of the economic development of Kazakhstan. It is particularly important during the period of transition, since:

- Kazakhstan economy has high energy intensity
- prices of energy carriers gain much more influence in the period of market transition
- energy saving is an energy resource
- Kazakhstan has considerable energy saving potential
- environmental situation is deteriorating and further extensive development of the fuel and energy complex will aggravate the situation
- energy efficiency will help to resolve some social problems.

The energy efficiency policy formulated in the above documents is being developed further in the documents and regulatory acts at other levels of management.

At present all programmes for sectors development being elaborated under the auspices of respective ministries (Ministry of Energy and Mineral Resources, Ministry of Industry and Trade, Ministry of Transport and Communications, Ministry of Economy and Budget Planning, Ministry of Environment) reflect the energy efficiency aspects. Such programmes for development are being elaborated by local executive authorities and national companies.

To prepare proposals for shaping the state policy and for improving the inter-departmental coordination and inter-sectoral integration for efficient transition of the Republic of Kazakhstan to sustainable development, the Government of the Republic of Kazakhstan, pursuant to Government Resolution No. 345 dated 19 March 2004, has established the Council for Sustainable Development of the Republic of Kazakhstan.

The Council for Sustainable Development (further - the Council) is the advisory body under the Government of the Republic of Kazakhstan. The main objective of the Council is to promote the formation of the state policy for sustainable development and fulfillment of

decisions of the World Summit for Sustainable Development based on inter-sectoral cooperation of governmental bodies, private sector and public organizations, as well as integration of economic, social and environmental sectors of Kazakhstan development.

The members of the Council are the Prime Minister (Chairman), members of the Government, representatives of the President's Administration, local executive authorities, deputies of the Mazhilis and Parliament Senate, scientists, representatives of non-governmental organizations, youth organizations and business. Among the nine priority directions of the Council activities, energy efficiency and energy saving is specifically outlined.

The main driving forces for energy efficiency in Kazakhstan under market economy conditions are such factors as the need to maintain the competitiveness of the industrial products and the need for efficient use of the available energy, financial and other resources.

4.2. Legal Framework

"The Law on Energy Saving of the Republic of Kazakhstan" came into force in December 1997. It authorised public information and awareness in the sphere of energy saving with the aim to create the economic and organisational conditions for effective use of the fuel and electricity resources of the country and to protect the environment. The Law established the system of energy saving, the mandate of the Government in the sphere of energy saving, the mandate of the body empowered by the Government in the sphere of energy saving and the rights and duties of local representative and executive authorities in the sphere of energy saving. The problems of registration, establishment of consumption standards, standardisation and certification in the sphere of energy saving and examination of energy saving have been legally defined. A special chapter is devoted to renewable energy sources. Ways of carrying out education, information support and scientific research in the sphere of energy saving have been authorised.

4.3. Energy Efficiency Targets

Pursuing an energy saving policy does not imply any reduction in the volume of consumed energy resources, but it guarantees utilising energy resources to a maximum efficiency. Thus, the main goal of such policy is to reduce specific consumption of all types of energy carriers per unit of product, works and services while preserving efficiency of their use. This will provide economic and environmental benefits, and ensure continuity in energy supplies, which is important for sustainable development of the economy as a whole.

The goal of the energy saving policy is to transfer Kazakhstan economy from the path of energy-intensive development to the path of energy saving. The main elements of the energy saving policy can be categorised as follows:

- economic block
- institutional and legal block
- technical block
- information and educational block.

According to the Law "On Energy Saving" the main lines of energy saving are as follows:

- to stabilise energy production and consumption, required for intensive national economic development
- to optimise energy production and consumption

- to manage energy accounting and control at all stages of energy production, transportation, distribution, storage and end use
- to manage energy efficiency studies of enterprises, institutions and organisations, and also household consumers
- to perform expert examination of energy saving parameters of products, technologies and equipment, as well as that of enterprises that already exist or are under reconstruction and commissioning
- to develop norms, standards, rating and labelling; to effect certification based on international norms and standards, etc.
- to develop renewable energy sources
- to recycle secondary energy resources and wastes
- to implement projects aimed at introducing energy efficient equipment, products and advanced technologies
- to introduce research findings and new managerial procedures in this field
- to reduce losses of fuel and energy resources during their production, conversion, transportation, storage and consumption
- to ensure accurate, reliable and unified metering for the purposes of accounting energy resources supplied and consumed
- to introduce new and improve effective building codes, which will ensure saving energy resources.

4.4. Energy Efficiency Priorities

In the framework of the State Energy Saving Programme the following problems and directions of energy saving have been examined:

- development of the state energy saving policy
- description of energy consumption by fuel source
- estimation of the energy saving potential in all sectors
- legal provision of the state energy saving policy
- management systems for energy saving processes
- economic mechanisms to promote energy saving
- environmental aspects of energy saving policy
- technical problems of energy saving
- issues concerning the creation of the market of energy saving equipment and materials
- lists of measures and energy saving programmes were developed for individual sectors, including: power industry, heat supply industry, coal industry, industry of building materials, housing and municipal services, agriculture, transport, production of mineral fertilizers, non-ferrous metallurgy, oil refining.

Kazakhstan's economy has significant energy saving potential provided by certain factors. The most important are obsolete and inefficient technologies and equipment used in industry; and high energy intensity of GDP as compared to similar indicators in developed countries.

The energy saving potential (ESP) of Kazakhstan as a whole and for individual sectors and types of energy carriers has been assessed earlier, but this assessment is conditional because it depends on the selection of unit indicators for energy consumption (that vary depending on

technological advancement) and on selection of limiting factors. Three types of ESP have been assessed:

- technological ESP – the maximum potential that can be achieved upon possible implementation of all technological achievements available during a given period of time
- economic ESP - the potential that can be implemented under actual economic limitations for possible investments in the energy saving measures
- market ESP – the potential that can be achieved actually under comprehensive accounting of all possible limitations resulting from the actual economic, political, structural and organizational situation in the country.

Assessment of the energy saving potential enables to rank the sectors in the descending order of this potential value, and on the whole this corresponds to the priority of the sector for implementation of the energy efficiency policy. The priority ranking is as follows: a) electric power industry; b) non-ferrous metallurgy; c) ferrous metallurgy; d) coal industry; e) engineering industry and metal-working; f) oil-and-gas and oil-processing industry. Then transport and agriculture are ranked. In the market economy of Kazakhstan the energy efficient practice is being implemented in all sectors simultaneously under the action of market signals, and it is rather difficult to determine the priority exactly.

4.5. Energy Efficiency Financing

Energy saving programmes are financed out of a number of sources, such as the state budget, internal funds and loan proceeds of enterprises, organisations and other sources deemed eligible pursuant to the legislation.

Other sources come from various international institutions like the International Monetary Fund, World Bank, UNDP/Global Environment Facility, governmental and non-governmental institution, established by economically developed countries, rendering assistance to developing countries, etc.

The main resources are the assets of industrial, transport and service enterprises that are mostly in private ownership, and they themselves determine the ways for the most efficient use of their resources and energy efficient development. In the residential sector the main financial resource is also being accumulated by house-owners. There are other examples, such as the Almaty City's Government initiative to provide 'free' hot and cold water meters to low-income households, which is a small, but worthwhile example of best practices in this area.

4.6. International co-operation

There are a number of international organizations that are providing assistance to the Government of Kazakhstan to increase energy efficiency and to reduce the environmental impacts of the Kazakhstan energy sector.

In 1995-1996, the USAID, EBRD and ABD provided assistance for improving the energy efficiency and reducing the environmental impacts of the big thermal power plants in Kazakhstan.

In 1995-1997, the EU/TACIS and USAID provided support to the Government on the legal and regulatory aspects of the energy sector market transformation.

EU

In 1994-1996, under the support of the European Commission within the framework of the TACIS Program, the Energy Centre of Kazakhstan was established. This project supported local enterprises in implementing energy saving policies, following a model that had been successful in several CEE countries, leading to sustainable organizations that continued after the EU withdrew. However, the Centre failed to achieve either commercial sustainability or governmental financing, and hence closed when the EU withdrew its support in 1996.

EC TACIS also supported an energy efficiency demonstration project in an Almaty hospital (The 'Bistro' Project, 1999). Energy efficient technologies reducing energy costs in the hospital were implemented and demonstrated. Specialists from Germany and Belgium took part in the project.

Central Asia Energy Advisory Group was established in 1997 (Project of the European Commission, SYNERGY Programme). Within the activity of this group the following energy efficiency actions have been undertaken: education, workshops for experience exchange in the region and with participation of European countries representatives, and pilot projects. Specialists from Germany, Switzerland, France and other European countries took part in these actions.

In 1997-1998, the Government of the Netherlands provided financial assistance for the implementation of the project "Wind Energy in Kazakhstan", with an objective to evaluate the potential for wind energy development. As a conclusion, Kazakhstan was determined from the wind resources point of view as one of the most appropriate countries in the world to develop wind energy.

In addition to the above mentioned activities, EU/TACIS and USAID have assisted the Government in the legal and regulatory aspects of transforming the energy sector towards market economy.

In 2001, EBRD funded a study for the tariff regulation in the energy and heat sector of Kazakhstan with the focus on designing an incentive-based "forward looking" regulatory regime.

In autumn 2002 the Norwegian Ministry of Foreign Affairs decided to start up a program to contribute to increased energy efficiency in industries and buildings, reduced pollution loads and improved environment. The content of the program in Kazakhstan is divided into five main directions:

- establishment and development of an Energy Efficiency and Cleaner Production Centre
- combined training and project development
- implementation of demonstration and commercial projects
- various information activities
- co-financing and international co-ordination.

UNECE

Under the Energy Efficiency 21 Project (EE 21) of the United Nations' Economic Commission of Europe a number of potentially bankable energy efficiency projects in Kazakhstan were identified:

- increasing the economical and ecological efficiency of the North-Eastern thermal complex
- increasing the efficiency of district heat supply in Astana

- increasing heat use efficiency in Astana Technopark
- street lighting energy efficiency in Astana
- energy saving and increasing the efficiency of heat supply in Atyrau.

UNDP

1. Project "Kazakhstan – improving the energy efficiency of municipal heat and hot water supply" (2006-2010).

In 1999, at the request of Kazakhstan's Ministry of Environment, a grant of Global Environmental Facility (GEF) amounting to USD 236.9 thousand has been allocated to Kazakhstan to prepare a project for improving the energy efficiency of heat supply in the country. Based on the project preparatory phase developed, the Project Brief for the project "Kazakhstan – improving the energy efficiency of municipal heat and hot water supply" has been elaborated in 2004 to the total value of USD 10.5 million including GEF grant - USD 3.27 million. This Project Brief has been agreed on with the major participants in the Project and then submitted to GEF for consideration and approval.

The main objective of the project is providing technical assistance to Kazakhstan in removing barriers to and in leveraging additional financing for improving energy efficiency of the municipal heat and hot water supply systems, thereby lowering their fossil fuel consumption and the associated greenhouse gas emissions.

Major participants in the project: Agency for Regulation of Natural Monopolies of Kazakhstan, Ministry of Energy and Mineral Resources, Akimat of the city Almaty, Akimat of the city Kokshetau, Heat supply companies, UNDP.

Project financing: total USD10.47 million, including: GEF – USD 3.29, Government – USD 0.13 (in-kind), Akimats – USD 4.19, heat supply companies – USD 2.86 million.

Anticipated results of the full-scale project:

- legal and regulatory framework as well as tariff policy will be formulated to attract financing for the investments in improving the efficiency of the municipal heat and hot water supply sector in Kazakhstan
- the capacity of local heat supply companies will be built to attract financing for the investments needed to improve efficiency of the heat supply systems
- the capacity of local heat consumers in the municipal sector will be built to implement cost-efficient energy saving measures
- the investments amounting to USD 7 million in rehabilitation of District Heating Systems in Kokshetau will be attracted
- Energy Service Company will be established in Almaty to implement cost-efficient energy saving measures at the level of residential and budget-financed buildings to the amount of around USD 3 million.
- the fossil fuel consumption for heat supply will be lowered due to implementation of demonstration projects by around 8 thousand tons of equivalent fuel per year, and the associated greenhouse gas emissions will be reduced by 18 thousand tons per year.
- experience in improving the energy efficiency of the municipal heat and hot water supply systems in Almaty and Kokshetau will be disseminated throughout Kazakhstan and CIS countries.

Benefits for Kazakhstan provided by the project implementation: building the conditions for attracting investments in improving the efficiency and reliability of the municipal heat and hot

water supply systems, thereby saving around 2.5 million tons of fuel equivalent annually throughout the country and lowering the associated greenhouse gas emissions by 6 million tons of CO_2 per year. Improving the cost-efficiency and reliability of heating and hot water supply provides conditions for sustainable social and economic development in urban areas.

Current project status: The project has been approved by GEF Secretariat. Official confirmation of GEF decision on providing the grant for the project is expected. Project start is anticipated in 2006.

2. Project "Kazakhstan - Wind Power Market Development Initiative" (2004-2007)

Project objective: assisting Kazakhstan in using significant wind power potential to generate clean energy, to improve the energy balance by involving renewable energy sources, to increase the reliability and economic efficiency of power supply to remote areas experiencing power shortage, and to mitigate environmental pressure.

The project is being implemented pursuant to a Government Resolution from 2003 "On wind power development" and complies with the laws "On Electric Power Industry", "On Energy Saving", the Programme for Electric Power Development till 2030 and the Programme for Development of Unified Power System of Kazakhstan for the period till 2010 and long-term development till 2015.

Project Document for the project implementation has been signed by the Ministry of Energy and Mineral Resources, the Ministry of Economy and Budget Planning and the UN Development Program in 2004.

Project partners: Ministry of Energy and Mineral Resources – governmental executive body, KEGOC, Almaty Province Akimat, UNDP, Private investors (ALD Consulting, National Innovation Fund, EBRD).

Project value and financing facilities – USD 7.27 million, including: MEMR – KZT 24 million, UNDP/GEF – USD 2.55 million, private investments – USD 4.56 million.

Main project components:

- Assessment of Kazakhstan's wind power potential, wind atlas of Kazakhstan, justification of construction of 4-6 wind farms
- Elaboration of a National Programme for Wind Power Development
- Elaboration of laws for renewable energy sources development
- Construction of the Djungar Gate pilot 5 MW wind farm.

3. Project "Renewable Energy Use for Potable Water Supply in Remote Villages of Depressed Region" with total budget of US$ 115 000.

The project goal is to promote wind and solar water pumping system for clean water supply in a remote village of depressed and poverty-stricken region of Aral Sea basin in Kazakhstan. The project will directly benefit the local population, especially women, in meeting their clean water supply need. At the same time this pilot initiative will advance the renewable energy use for similar initiatives in rural areas of Kazakhstan. The activities of the project will demonstrate the practical implementation of sustainable development approach, mobilizing local population to address their problems and better manage energy and water sources. The project has two parts:

3.1 Renewable Energy Use (Solar Energy) for Mobile Electrification in Remote Villages of Depressed Region in Kazakhstan - Village Bogen

3.2 Renewable Energy Use for Potable Water Supply in Remote Villages of Depressed Region in Kazakhstan - Capacity Building and Renewable Energy Resource Centre (RERC)

4. GEF Small Grants Programme in Kazakhstan (Total budget of US$116 670) is composed of the following projects.

- Biogas (Clean rivers)
- Demonstration of solar energy use alternatives for water and premises heating purposes in Kyzylorda maternity house
- Energy created by wind
- Planning grant for «Water warmed by sun» project proposal development
- Planning grant for the pre-project activity "Energy created by wind"
- Water of life.

USAID

The United States Agency for International Development (USAID), Regional Mission for Central Asia has provided some US$300 million in assistance to Kazakhstan since 1992, working in the areas of small and medium enterprise (SME) development, democracy, environment, primary healthcare, fiscal policy and local government accountability.

The energy-related programs have included: the National Program for Energy Savings (1994-95); Energy Efficiency and Market Reform Project; Environmental Policies and Institutions for Central Asia; Central Asian American Enterprise Fund; and Ecolinks. In addition, the Antimonopoly Agency is involved in USAID-funded activities involving the United States Energy Association (USEA); National Association of Utility Regulatory Commissioners (NARUC); and the Energy Regulators Regional Association (ERRA).

In 1997-1998, USAID financed a pre-feasibility study to explore the possibilities to increase the energy efficiency of the heat supply system of the north-eastern boiler house of Almaty.

Some of the USAID Projects:

(1) Retrofit of Heating System Facilities (Atyrau)

This demonstration project that the consulting firm PA conducted involved determining the optimal depth for underground placement of district heating pipes, upgrading selected equipment for the Atyrau District Heating System, and designing an automated temperature control system for a school.

The original scope of work included a 70-unit apartment building retrofit at the level of individual radiators, but this work was replaced by a much cheaper, quicker and easier to install and maintain action to control temperature and save energy at the building level, for one public building and one private building. The Anti-Monopoly Agency supported the proposal to change the scope of work on the grounds that it could encourage other building owners and tenants to purchase and install similar equipment.

USAID Kazakhstan provided a summary report on the status of heating system demonstrations in 2002.

(2) Feasibility Assessment: Supporting Increased Energy Efficiency

Bechtel National Inc. conducted out this assessment and produced in September 1999 the final report.

The study objective was to assess the feasibility of an energy-efficiency and conservation activity that would complement ongoing energy-efficiency and environmental initiatives. The main identified energy-efficiency constraints were market conditions, limited managerial capacity, limited deployment of energy conservation technologies, and low levels of awareness of opportunities for energy efficiency.

(3) Support for Developing a National Program for Energy Savings

Burns and Roe Enterprises Inc. conducted this project in 1994-95. The identified barriers to energy efficiency were low subsidized energy prices; weak institutional structure and legislative framework; weak energy conservation 'ethic', owing to low prices and the historical perception of energy as a free good; inefficient practices, equipment and technology; and inadequate access to capital.

Seven recommendations were made:

- Accelerate economic reform
- Increase end-user energy pricing
- Put in place incentives to install equipment that measures energy consumption
- Establish the Energy Conservation Department within the Ministry of Economy as the coordinator of the government's energy savings policies and establish an independent Energy Conservation Agency to implement the programs associated with these policies; involve a diversity of organizations, especially in the private sector, in the pursuit of energy efficiency
- Assess various financing options and focus in the short term on demonstration zones, an energy savings fund, and multilateral bank-funded projects
- Focus initially on energy savings in the industrial sector and on those energy savings investments whose costs are recoverable in less than one year once the investments are operational. Ensure that industrial facilities scheduled for energy conservation investments can survive in their market sector and are economically viable in the long term
- Focus initially on policies and programs achievable in a timely and effective manner during the next three years as the country progresses to a market based economy, and then consider policies and programs that will yield energy savings in the longer term.

The 280-page Burns and Roe study represents a thorough road map towards energy efficiency, setting out energy pricing principles and guidelines, identifying financing options, recommending institutional reforms, and providing specific recommendations for the power, district heating, fertilizer and nonferrous metals sectors. Relevant examples from other countries illustrate how Kazakhstan could move towards an energy-efficient future and identifies specific energy-efficiency opportunities for Kazakhstan.

In the seven years since the study was finalized, there has been substantial progress towards the general macroeconomic recommendations such as acceleration of economic reform and privatization of the industrial sector. However, adoption of the energy efficiency related recommendations has been insignificant, and in particular, energy prices remain too low to stimulate widespread interest in energy saving.

(4) USAID Development Credit Authority (DCA) program

The United States Agency for International Development (USAID) and Kazkommertsbank JSC (KKB) in September 2004 signed a guarantee agreement to support lending to energy efficiency projects in Kazakhstan. The guarantee agreement was signed as part of USAID

Development Credit Authority (DCA) program. The main goal of such DCA programs is to provide needed credit in underserved sectors. The programs mobilize local private capital by establishing risk-sharing relationships with private financial institutions throughout the world. Under the terms of agreement with Kazkommertsbank, USAID provided a 50 percent guarantee to a loan portfolio totalling US$15 million over a seven-year period, reducing risk to KKB, to promote energy efficiency projects.

Loans will be made to qualifying borrowers who will use the proceeds to pay for such projects as heat efficiency upgrades, electric distribution system upgrades, and gas conversion projects in municipal and privately owned buildings. Previous USAID projects have resulted in energy savings of up to 25%.

Since 2002, the Asian Development Bank has been carrying out a project to support energy supply for the rural areas of Kazakhstan with focus on using renewable energy sources.

4.7. Energy Efficiency Institutions

The Ministry of Energy and Mineral Resources (MEMR) of the Republic of Kazakhstan is carrying out the implementation of the state energy saving policy. The Ministry is the central executive body for implementing the overall energy policy. Naturally, the Ministry is more energy supply-oriented, as would be expected in an oil-rich country such as Kazakhstan. A department of the MEMR nominally looks after energy efficiency issues. However, the Ministry is mainly orientated towards improving efficiency in power and heat supply.

Other ministries involved in various aspects of energy efficiency are the Ministry of Industry and Trade (with the Construction Committee being its part), the Ministry of Transport and Communications, the Ministry of Economy and Budget Planning, the Ministry of Environment, and the Agency for Regulation of Natural Monopolies. The Council for Sustainable Development is the coordination and advisory body under the Government of the Republic of Kazakhstan, whose activities cover the aspects of energy efficiency and energy saving.

An institutional structure for energy saving in Kazakhstan, as well as standard-and-normative, legal and economic mechanisms for saving energy and motivating energy saving are presently being developed in support of the National Energy Saving Program and the Law On Energy Saving.

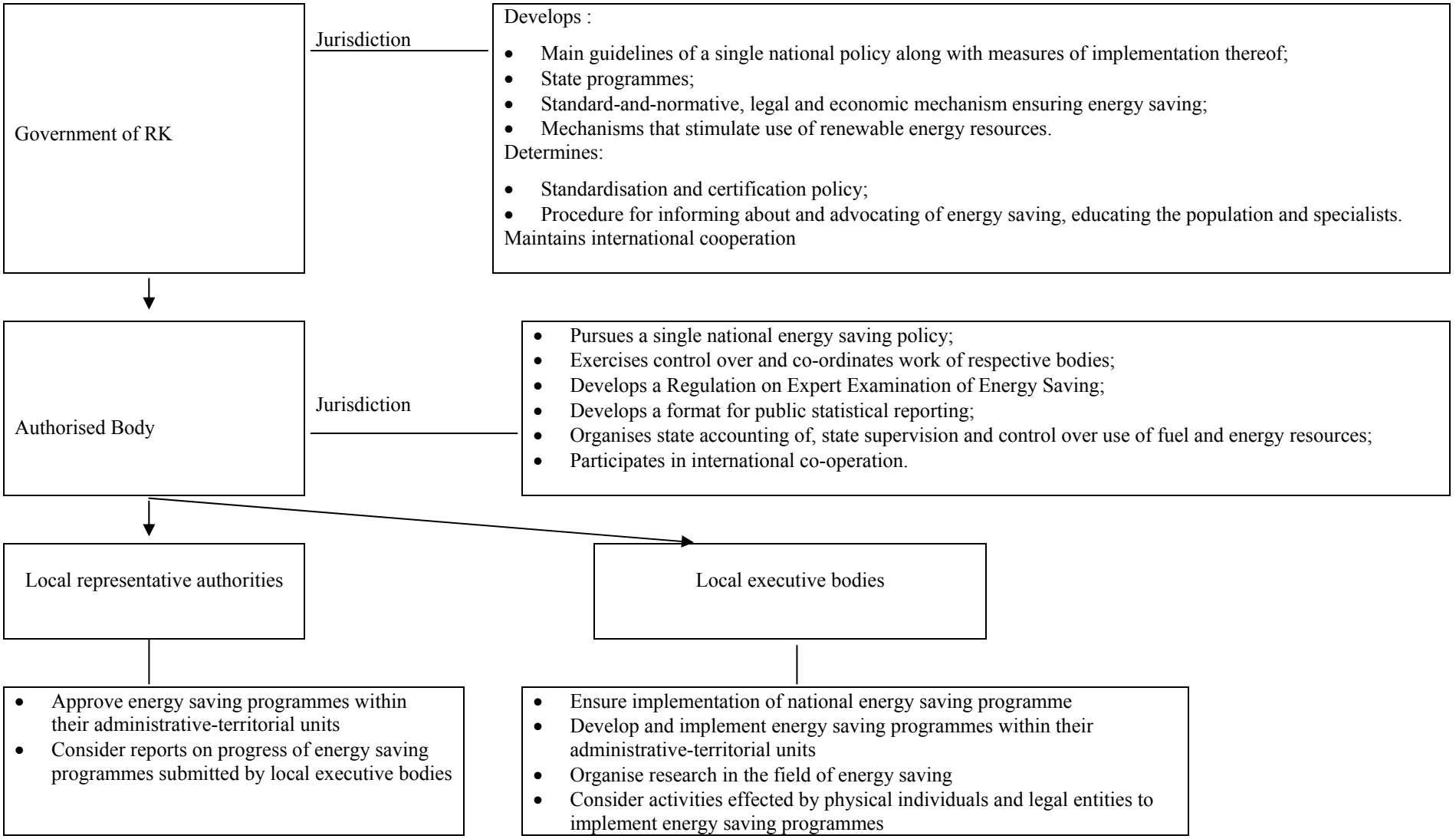

Figure 4.7.1. Institutional Structure of the National Energy Saving System

4.8. Energy Efficiency Monitoring

Regulations for the Committee for State Energy Supervision under the Ministry of Energy and Mineral Resources of the Republic of Kazakhstan (Komgosenergonadzor) have been approved by a Government Resolution in 2004.

The main objective of the Committee is supervision and control of reliability, security and efficiency of energy generation, transmission, distribution and consumption. The Committee, under the procedure established by laws, carries out the following and other functions:

- provides for reliable, secure and efficient functioning of the participants in energy generation, transmission, distribution and consumption
- carries out monitoring of the most important technical and economic indicators, unit consumption of fuel, losses of electricity and heat energy in electric and heat networks, and fulfilment of obligations accepted by the owners of energy facilities for lowering these indicators
- carries out monitoring of the activities of strategic investors aimed at improving the capital assets in the electric power industry, as well as equipment reconstruction and rehabilitation
- prepares proposals for the activities of strategic investors related to improving the efficiency of power equipment, its reconstruction and rehabilitation
- arranges for energy audits at energy facilities relating to safe and efficient generation and use of electricity and heat energy, as well as control over the implementation of energy saving policy
- arranges for examination of energy efficiency of legal entities
- controls the efficient and economic use and optimization of the regimes of generation, transmission and consumption of electricity and heat energy.

Summary Table III Energy Efficiency Policies

The table indicates (x) what status is applicable regarding the following issues on energy efficiency policies.

Energy efficiency policies	Yes	No	Partly
Has an energy efficiency policy been developed?	X		-
Is energy security a driving force for energy efficiency?	X		
Is climate change/environment a driving force for energy efficiency?	X		
Is sustainable development a driving force for energy efficiency?	X		
Is employment creation a driving force for energy efficiency?		X	
Is industrial competitiveness a driving force for energy efficiency?	X		
Is export of technology a driving force for energy efficiency?			X
Is comfort perceived as a priority for improving energy efficiency?	X		
Are international obligations a driving force for energy efficiency?	X		
Is there a special fund for energy efficiency?		X	
Is there an energy efficiency law?	X		
Is energy efficiency incorporated in other legislation?	X		
Have national targets been formulated?			X
Is there international cooperation in the field of energy efficiency policies?	X		

5. ENERGY EFFICIENCY INSTRUMENTS AND MEASURES

5.1. Cross-sectoral Instruments and Measures

The policy instruments and measures for increased energy efficiency and renewable energy which follow from the energy efficiency policy (see section 4) are used in all sectors (see table IV).

Table 5.1. Cross-sectoral instruments and measures

TYPE OF INSTRUMENTS	PROGRAMME DESCRIPTION AND AIMS	IMPLEMENTATION STATUS	BUDGET*	(EXPECTED) RESULTS

Please, provide budget in Euro or USD and specify the currency used.

5.2. Instruments and Measures in the Residential Sector

The fulfilment of the programme for installing control and measuring equipment in the municipal-consumer sector, adopted in 1997, has been accelerated.

The State Program for Poverty Reduction in 2003 - 2005 mentions implementing electric power metering as one of the strategic measures to improve the provision of housing and utilities as a component of the government strategy to reduce poverty levels.

Article 7 of the Law on Natural Monopolies provided for mandatory installation of basement heat meters throughout Kazakhstan by April 1999.

The Agency for the Regulation of Natural Monopolies issued a regulatory order for the mandatory installation of basement heat meters on April 1, 1999, specifying that the meters should be financed using internal or borrowed financial resources of the natural monopolies and that the return on invested capital will be through depreciation of installed meters, with the depreciation rate being set in consultation with the local regulatory committees.

The Ministry of Energy and Mineral Resources estimated that 70 percent of all district heated buildings are metered and that all new buildings are metered.

The Almaty Energy Institute has a number of successful experiences in Almaty with heat meter installation in public buildings.

Almaty Akimat has conducted two programs to install hot and cold water meters in the homes of pensioners and handicapped people. In 2001, 1 586 meters were installed at a cost of 6 million KZT ($42 250). The average cost per meter, including installation, was $26.64. The program was not financed in 2001, but resumed in 2002 when a further 11 419 water meters were installed at a total cost of 44 million KZT ($285 714). The average cost per meter fell to $24.02. According to Almaty Akimat's Department of Labor and Social Protection, installation of hot and cold water meters is the main reason that the number of total number of housing assistance beneficiaries fell from 7 071 to 4 864 between the winters of 2000/2001 and 2001/2002.

Of Kazakhstan's 1 660 737 gas customers, 1 289 093 live in urban apartments that are metered at the building level rather than the apartment level.

Projects have been elaborated (to be financed by the UN Development Programme from the GEF funds) for the creation of demonstration zones of high energy efficiency in the sector of district heat supply and in new municipal construction

Table 5.2. Instruments and measures in the residential sector

TYPE OF INSTRUMENTS	PROGRAMME DESCRIPTION AND AIMS	IMPLEMENTATION STATUS	BUDGET*	(EXPECTED) RESULTS

* Please, provide budget in Euro or USD and specify the currency used.

5.3. Instruments and Measures in the Industrial Sector

Table 5.3. Instruments and measures in the industrial sector

TYPE OF INSTRUMENTS	PROGRAMME DESCRIPTION AND AIMS	IMPLEMENTATION STATUS	BUDGET*	(EXPECTED) RESULTS

* Please, provide budget in Euro or USD and specify the currency used.

5.4. Instruments and Measures in the Services Sector

Table 5.4. Instruments and measures in the services sector

TYPE OF INSTRUMENTS	PROGRAMME DESCRIPTION AND AIMS	IMPLEMENTATION STATUS	BUDGET*	(EXPECTED) RESULTS

* Please, provide budget in Euro or USD and specify the currency used.

5.5. Instruments and Measures in the Transport Sector

Table 5.5. Instruments and measures in the transport sector

TYPE OF INSTRUMENTS	PROGRAMME DESCRIPTION AND AIMS	IMPLEMENTATION STATUS	BUDGET*	(EXPECTED) RESULTS

* Please, provide budget in Euro or USD and specify the currency used.

Summary Table IV: Instruments and Measures

*The table indicates (with **X**) the availability of different policy instruments and measures groups in the national energy efficiency policy:*

Sectors	Instruments					
	Normative	Financial	Information /awareness	Education/ advisory	Voluntary agreements	R&D
Residential	X	X	X	X		X
Industry	X		X	X		X
Services			X	X		X
Transport		X	X	X		X

6. ACTORS IN ENERGY EFFICIENCY

Non-governmental organizations:

- KSKs (Co-operatives of Apartment Owners/Condominium Associations)
- Center for Energy Efficiency and Clean Production
- JSC "Center for Engineering and Technologies Transfer"
- Coordination Center for Climate Change
- Republican Research Center for Atmospheric Air Protection
- Regional Environmental Center of Central Asia, and others.

Associations:

- Kazakhstan Electric Energy Association
- Kazakhstan Association of Natural Resources Users for Sustainable Development and others.

Research organizations and universities:

- KazNIPIenergoprom
- Kazselenergoproject
- Almatyhydroproject
- Almaty Institute of Energy and Communications
- National Technological University
- Academy of Engineering
- and others.

7. RENEWABLE ENERGY

7.1. Renewable Energy Potential and Supply

Kazakhstan's Electricity Development Program until 2030, adopted by the Government in 1999, names the utilization of renewable energy resources among the priority directions for the electricity sector development and environmental problems solving in the Republic of Kazakhstan.

According to the Programme, total generation of electricity based on renewables (including hydro energy) in Kazakhstan has been 8.3 billions kWh in 1995, and it is projected to reach up to 9.8 billions kWh by 2015.

Kazakhstan's hydro potential is estimated roughly at 170 TW a year; only 62 TW of them are technically available for use, economically available are 27 TW, and 7-8 TW of these are currently produced (8860.9 million kWh in 2002).

The Electricity Development Program until 2030 provides for creation of 564 new HPS and rehabilitation of 14 HPS: 38 large HPS (output more than 30 MW) and 540 small HPS. The total capacity of the 38 large HPS is 3296 MW, the output – approximately 12 billion kWh. The total capacity of small HPS is 2412 MW, the output – 11 billion kWh.

The Programme defines 22 priority perspective projects. There is a number of abandoned and conserved small HPS. Costs of renovating renewable energy plants will depend on the amount of damage. Rehabilitation mainly consists of major change of hydro-mechanical and electro-mechanical equipment, while diversion and water-pressure facilities, as well as road connections are in good conditions. Small-scale hydropower plants can be also built on the premises of the existing facilities or by using water supply systems of industrial enterprises and villages. It is more financially viable to build these plants in places with developed infrastructure.

Kazakhstan has attractive opportunities to use wind energy, particularly in the Djungar Gate regions and in the Chilik corridor, where average annual wind speed is 7-9 m/sec and 5-9 m/sec respectively. Preliminary researches envisages possibilities for installation of wind energy power stations (WEPS) with total capacity of 1000 MW in Djungar Gate region, and a bit lesser in Chilik corridor. The proximity of existing power lines, sound correlation between the windy season and growth in electricity demand creates the right conditions for effective use of these resources.

Based on existing meteorological data, first platforms for construction of WEPS were specified in the Programme:

Djungar WEPS - 40 MW
Chilik WEPS - 140 MW
Saryozen WEPS - 140 MW
Alakol WEPS - 140 MW
Karoy WEPS - 20 MW
Shengeldin WEPS - 20 MW
Kurday WEPS - 20 MW.

Total capacity - 520 MW, output – 1.8 - 2 billion kWh a year. Required investments – approximately USD 500 billion.

A GEF project for accelerating wind energy development in Kazakhstan is studying the wind potential in the regions mentioned within the UNDP project "Wind Power Market Development Initiative" and is a part of the Government strategy of fulfilling its commitments to the UNFCCC by utilising the country's huge wind resources. The project "Kazakhstan: Study of Wind Market Development" on the wind potential in central Kazakhstan is being done by a Dutch contractor and financed by the Government of the Netherlands.

Main purposes of the aforementioned projects are removal of barriers to commercial generation of wind energy, its distribution to national grid and development of project evaluation for model WEPS.

Taking into account the future rehabilitation needs, the average power generation costs of rehabilitated coal power plants (using cheap local coal as fuel) have been estimated at about 2.2-3.5 US cents per kWh, while the generation cost of the new fossil fuel and hydro power plants have been estimated at 4 -5 US cents per kWh.

Based on the forecasted growth of the power demand and the aging of the existing power plants, it is expected that the electricity tariff will increase up to 4-5 c/kWh in remote regions reflecting the shortage of supply and the marginal costs of the new power generation capacity. This would already present wind power as commercially competitive alternative, eventually starting with small remote settlements, which do not have reliable power supply now. According to the study "Wind Power in Kazakhstan", there are some 5000 such settlements. Based on the estimate of the local institute "KazSelenergoProject", the total capacity demand of these settlements would be 80 MW. The average generation costs for wind power have been estimated to range from 3.5 US cents to 5 US cents per kWh depending on the location and with the turnkey investment costs of a wind farm at about US$1100/kW.

There is also some local cost reduction potential for wind turbines in Kazakhstan by involving local manufacturing and assembling. Kazakhstan has well developed machinery building industry, used mainly for military purposes in the Former Soviet Union. The Government of Kazakhstan tries to convert this industry to civil goods production. It has been estimated that in co-operation with western producers at least some of the former machinery plants could be converted to produce some components of wind turbines.

Kazakhstan is characterised by its significant solar energy resources. Annually, it receives 2200-3000 hours of sun, generating 1300-1800 kW/mÂ² a year. This enables the use of solar water heaters and solar batteries, particularly portable photoelectrical systems on farms in agricultural regions.

In July 2003 Kazakhstan launched its first solar energy project in Almaty, funded by UNDP and the Canadian International Development Agency (CIDA). As part of the initial scheme, 1500 residents are to benefit from the programme.

According to the Electricity Development Programme, analysis of existing geothermal and biological resources shows not enough quality and potential for energy generation. More appropriate is utilization of geothermal energy for heat distribution and of biological resources for production of bio gas with subsequent use for heat and fertilities.

7.2. National Policy for Renewables Deployment – Policy Instruments

At present, the national legislation on renewables, as in Article 15 of the Law "On Energy Saving", is providing for:

1. Utilization of renewable energy resources is considered a priority of energy development programmes and solving of environmental issues in Kazakhstan.

2. In the Republic of Kazakhstan, necessary legal and economic conditions are created in order to involve renewable energy resources into the energy balance and develop energy facilities on their basis.

3. An authorised body coordinates and is responsible for elaboration and realisation of programmes for involving renewable energy resources into the energy balance.

Currently, the project "Kazakhstan - Wind Power Market Development Initiative" is under implementation. Results to be achieved upon project completion are (see section 4):

- Assessment of Kazakhstan wind power potential, wind atlas of Kazakhstan, justification of the construction of 4-6 wind farms
- A National Programme for Wind Power Development with indicative plans for long-term wind power development
- A draft law on renewable energy sources.

7.3. Renewables Policy Implementation

The organisations responsible for and involved in renewable energy policy implementation are:

- Ministry of Energy and Mineral Recourses Republic of Kazakhstan
- Ministry of Environment.

Non-governmental organizations:

- Centre for Energy Efficiency and Clean Production
- JSC "Centre for Engineering and Technologies Transfer"
- Coordination Centre for Climate Change
- Regional Environmental Centre of Central Asia.

Associations:

- Kazakhstan Electric Energy Association
- Association of Engineers.

Research organizations and universities:

- KazSelenergoproject
- Almatyhydroproject
- Almaty Institute of Energy and Communications
- National Technological University
- Academy of Engineering.

8. ENERGY AND ENVIRONMENT

8.1. General trends and objectives

Transition to environmentally safe and sustainable development is becoming one of the priority directions of the Kazakhstan Development Strategy. Starting from 1989-1990, a new environmental policy of the transition period was formed in Kazakhstan, oriented towards the development of economic instruments for regulating natural resources use, and expanding the rights and authority of local governments. A large-scale experiment on implementing the economic mechanism of payment for pollution has been carried out. The work on an inventory of polluting emission sources has been made more active, the role of territorial bodies in efficient energy resources management has increased, the attitude of enterprises to planning their activities has changed, and formation of an economic incentive mechanism for environmental activity has been started.

Understanding of the fact that the success of social and economic transformations depends a lot on the environmental policy carried out in the country has been reflected in the governmental resolutions and in the Long-term Strategy of Kazakhstan development up to the year 2030 and its component – Strategy "Ecology and Natural Resources – 2030".

The National Environmental Action Plan (NEAP/SD) is a process, started at the first Conference of Environmental Ministers of the European countries in 1991. After adoption of the Environmental Action Program (EAP) for all countries of Central and Eastern Europe, the development of National Programmes has been started on its basis. The National Environmental Action Plan process in the Republic of Kazakhstan has become a successful example of joining efforts of the government of the country, wide section of the public and international organisations around environmental priorities.

Despite the economic difficulties, the government of Kazakhstan and local authorities pay more and more attention to environmental issues. Work on implementation of priority actions is going on in the country, and development of large-scale umbrella projects and programmes is implemented jointly with international organisations and donor countries.

The main goal of the Long-term Environmental Strategy is harmonisation of the interaction between society and environment, and creation of an environmentally favourable habitat.

For achieving the goal set out, four priority directions have been selected: creation of environmentally safe environment, balanced use of natural resources, conservation of biological diversity, and environmental education.

The Republic of Kazakhstan has ratified more than twenty international environmental treaties. Additionally, over thirty international environmental agreements were concluded and are now effective, including those with the USA, the Russian Federation, Turkey, China, Israel, Central Asian states and other countries.

An environmental regulatory base was developed in the Republic, which includes a package of national laws, presidential decrees and resolutions of the Government, authorised Ministry and also local representation and executive bodies. The Laws "*On Environmental Protection", "On Environmental Expert Examination", and "On Specially Protected Natural Territories", adopted in 1997* are integral in nature and contain basic principles of the environmental policy.

Legislative acts, regulating the legal status and specificity of environmental activities by individual types of natural resources that are subject to environmental protection, were also enacted.

The effective laws and by-laws determine the legal status of the facilities and natural resources environmentally protected; a system of measures has been developed to ensure quality of the environment; an environment monitoring procedure and the principles of the environment audit system were determined along with the functions of central and local environmental authorities.

In the framework of the "Hydrocarbon Initiative", initiated in 1997 by the Ministry of Ecology and Natural Resources of Kazakhstan (at present - Ministry of Environment) together with the Ministry of Energy, Industry and Trade of the Republic of Kazakhstan (at present - Ministry of Energy and Mineral Resources and Ministry of Industry and Trade), with a view to reduce the emission of greenhouse gases into the atmosphere, energy saving became a priority in this initiative.

The Republic of Kazakhstan signed the United Nations Framework Convention on Climate Change (further – the UNFCCC or the Convention) in June 1992, and ratified it in May 1995. Currently Kazakhstan does not belong to any Annex of the Convention.

Climate change issues are considered important in Kazakhstan. In Kazakhstan, as in any transition country, climate change is a priority only to the extent that it is related to the main national concept for environmental protection and sustainable development.

In November 1997, on the threshold of COP-3, Kazakhstan Ministry for Foreign Affairs released a statement that the country was ready to participate in the discussion regarding measures to reduce and stabilize GHG emissions, proceeding from the 1990 level. In this statement, Kazakhstan supported the initiative of the World Bank to create an international carbon credit market. In March 1999, Kazakhstan signed the Kyoto Protocol without joining the Annex 1 to the Convention and Annex B to the Protocol. Consequently, Kazakhstan did not take on any quantitative obligations on emissions abatement. Later, in May of the same year, Kazakhstan declared its intention to join Annex I of the Convention.

According to the results of the inventory of greenhouse gases in Kazakhstan, the total emissions of gases with direct greenhouse effect in 2003 amounted to 188.8 million tons CO_2-equivalent, including 150.9 million tons of emissions from energy activity, 15.9 million tons from industrial processes, 17.3 million tons from agriculture, and 4.7 million tons from wastes. The absorption of CO_2 by forests in 2003 amounted in 8.3 million tons. Thus, net emissions taking into account the absorption (sequestration) of CO_2 by forests were estimated at 180.5 million tons CO_2 - equivalent. Total emissions of CO_2 come to 150.4 million tons without absorption of CO_2 by forests, and 142.1 million tons if taking absorption into consideration.

Total specific GHG emissions in 2003 amounted to more than 12.6 t per capita, of which about 10.0 t are CO_2 emissions.

Table 8.1. Total emissions of gases with direct greenhouse effect (million tons CO_2-equivallent)

IPCC sources categories	1990	1992	1994	2002	2003
CO_2	238.4	274.7	179.4	142.6	150.4
Energy activity	218.3	257.8	171.9	128.3	134.5
Fuel combustion	213.5	252.9	168.1	119.4	124.9
Volatile emissions	4.8	4.9	3.8	8.9	9.7
Industrial processes	20.0	16.9	7.5	14.4	15.8
Land tenure change and forestry	-10.5	-10.4	-10.0	-8.3	-8.3
CH_4	58.1	51.3	39.5	25.7	28.1
Energy activity	38.7	32.6	23.6	13.2	15.9
Fuel combustion	1.5	1.9	1.1	0.4	0.5
Volatile emissions	37.2	30.7	22.5	12.7	15.4
Industrial processes	0.04	0.03	0.02	0.03	0.03
Agriculture	16.5	16.1	13.4	7.9	7.9
Wastes	2.7	2.7	2.5	4.6	4.3
N_2O	26.9	24.9	17.2	10.2	10.3
Energy activity	0.8	0.9	0.6	0.4	0.5
Fuel combustion	0.8	0.9	0.6	0.4	0.5
Agriculture	25.6	23.6	16.1	9.4	9.4
Wastes	0.5	0.4	0.5	0.4	0.4
Total emission	323.3	351.0	302.7	178.5	188.8
Net-emissions (sources and effluent)	312.8	340.6	292.7	170.2	180.5

8.2. Environmental Policy Implementation

The Ministry of Environment of the Republic of Kazakhstan is the central executive body in the sphere of environmental protection. At the local level, the Akimats and Oblast Departments of the Ministry perform the environmental management functions.

There are other governmental bodies authorised for managing natural resources, implementing departmental governmental supervision of specific environmental protection activities:

- The Committee for Environmental Control of the Ministry of Environmental Protection
- The Committee for Geology and Mineral Resources Conservation of the Ministry of Energy and Mineral Resources
- The Agency on Land Resource Management
- The Committee for Forestry and Hunting of the Ministry of Agriculture
- The Committee for Fishing of the Ministry of Agriculture
- The Committee for Water Resource of the Ministry of Agriculture.

The National Environmental Action Plan (NEAP/SD) includes 14 projects in the southern part of Kazakhstan. The concept for "Environmental improvement along the Great Silk Road for sustainable development of the Southern region of the Republic of Kazakhstan" has been developed.

Together with Umbrella project activities, implementation of its specific components on the most urgent environmental problems of the region is continued. Within the agreement under the Umbrella project of August 17, 1998 between the Japanese International Cooperation Agency (JICA) and the Government of the Republic of Kazakhstan, research work is funded, envisaging the development of the General Plan on solid waste management for the city of

Almaty. Active works are carried out on the projects: "Reduction of drinking water consumption and losses in the municipal sector in Almaty-city" (Government of Germany). "Reduction of the negative impact of vehicles on the environment and health of population in the city of Almaty" (TACIS).

On a number of projects so far only donors' interest has been expressed or preparatory works are being carried out to start their funding.

Climate change studies have been carried out in Kazakhstan with support of the US Country Studies Programme from 1994 to 1998. The Netherlands Climate Change Studies Assistance Programme supported development of GHG inventory for 1994 as well as the preparation and publishing of the Initial National Communication.

The most recent studies have been performed under the Environmental Policies and Institutions for Central Asia Programme (EPIC) of the US Agency for International Development (USAID). The Kazakh Scientific-Research Institute for Environment Monitoring and Climate Change participated in all stages of the studies.

A Climate Change Coordination Centre has been established with the following functions:

- survey and control of greenhouse gas (GHG) reduction projects and advise to the Government of Kazakhstan on the issuance of credits (future guarantees)
- evaluate potential GHG reduction projects on the basis of environmental national development and financial considerations, and provide investors with advice on attractive carbon offset projects
- arrange for the monitoring, verification and tracking of reductions implemented in Kazakhstan.
- create the basis of a national system for legal and institutional regulation of environmental activities taking into account flexible market mechanisms.
- consolidate activities on climate change abatement within the country and at the international level
- develop a National Strategy for GHG reduction
- host climate change forums for business, NGOs and the general public
- compile a library of international experience on climate change topics
- inform the public on the challenges of climate change and its impacts on environment, health and economic development.

8.3. Future plans

The main consumer of primary energy resources in Kazakhstan is the electricity and heat production sector (about 50% of the total consumed fuel), which is therefore the main source of emissions that pollute the atmosphere. Significant air pollution is due to the use of low quality coals and a lack of emissions-cleaning equipment at the thermoelectric power stations and boiler houses.

Kazakhstan is the largest producer of anthropogenic greenhouse gas in Central Asia and is third among the former Soviet republics. According to the 2002 greenhouse gas inventory, net emissions in Kazakhstan, accounting for CO_2 absorption by forests, were 178.6 t of CO_2 equivalent. In 2003, net emissions reached 180.5 million t of CO_2 equivalent. Excessive greenhouse gas emissions lead to climate change, which may intensify desertification and land degradation processes, reduce agricultural productivity and increase water resources deficits.

Current economic development trends hinder the process of reversing the loss of environmental resources. Kazakhstan's economy is characterized by fast and exhaustive use of non-renewable resources, excessive exploitation of renewable resources, and the accumulation of large amounts of all types of wastes.

Industrial and oil-and-gas enterprises and transport, especially in large cities where the number of vehicles is drastically increasing, are the main sources of air and soil pollution. Throughout the country, the amount of polluting emissions from stationary sources is increasing and this trend will most probably persist given the current production growth rate.

The most acute environmental problems (climate change, ozone layer depletion, acid rains, etc.) are in one way or another related to energy production or consumption. Therefore, the solution to environmental problems largely depends on the possibility of solving energy-related problems. Reducing primary energy consumption, increasing energy and production efficiency and improving power supply are necessary measures for achieving sustainable development and raising the standard of living in Kazakhstan.

Stabilization of the amount of emissions can be achieved through the introduction of clean and energy-efficient technologies in power engineering, change from solid fuels to the more environmentally friendly gaseous ones, the use of alternative sources of energy (wind, solar, falling and thermal water) and utilization of oil-well gas and mine methane.

The Government should create better policy foundations to differentiate the forestry management system by regions, gradually delegate well-defined functions to the oblast and rayon levels and create a basis for delegating certain forestry management responsibilities to the local population, farmers and the private sector.

Kazakhstan needs to evaluate the condition of biodiversity and conduct its inventory, create a unified monitoring system and introduce an internationally compatible system of sustainable development indicators.

It is necessary to restore and develop the economy along with stabilizing the levels of discharge of polluting substances in the environment. Therefore, the development of any branch programs of industrial development, town-planning and other large-scale programs include the assessment of the possible impact on the environment.

9. ASSESSMENT AND FUTURE PLANS

9.1. Successful instruments

9.2. Barriers

Estimates of prospective electric power demand allow for a reduction in energy intensity of consumption through price incentives and use of energy efficient technologies, i.e. the market will finally stimulate more efficient use of existing equipment in parallel with purchasing and production of energy-efficient models. However, there are a number of reasons why making decisions based on market incentives will be delayed in countries in transition, as:

- producers and consumers lack information and experience required to invest in new energy saving equipment
- restricted access to capital and grants/preferential loans
- no appropriate devices for metering or equipment control are in place
- demand for consumer goods is restrained, which can rather make consumers concerned about larger quantities of goods without paying due attention to quality thereof (both of new goods and of second hand ones).

The obstacles arising here are due to:

- low prices for energy
- lack of information and experience
- energy efficiency projects that are minor in scale
- lack of experience in obtaining loans.

These barriers and consequences are given in Table 7.1.

Table 9.1.

Barriers	Consequences
Energy Prices	
- Low energy prices;	- Undermined efficiency of investments; - Delays in implementation of energy efficiency projects;
Institutional Structures and Ownership Structures	
- Weak institutional structures or absence thereof.	- No funds to implement an energy saving policy.
Energy efficiency projects are minor in scale	- Projects are not attractive for international banks or developers; - High cost of transactions; - Project decision-makers are decentralised.
Lack of Experience in Obtaining Loans	
- Municipalities. enterprises and other loan borrowers have inadequate experience in obtaining loans; - Low cash ceilings; - Insufficient mortgage resources.	- Limited access to capital - High cost of transactions.

9.3. Improvements

At the present time the main goal is to implement the developed National Programme for Energy Saving.

9.4. Recommendations

A number of recommendations came out of various studies and projects undertaken in Kazakhstan, including with international financial and expert assistance.

Economic measures for implementation of energy saving policies in countries in transition range from market-oriented policies to administrative-driven and imposed ones. Transition to a market economy and formation of an energy resources market will facilitate creating a system of consumption where the consumer will be interested in increasing energy efficiency, i.e. in reducing specific consumption of energy resources while producing and transporting one unit of product, as well as in creating a system of control and metering of energy consumption.

These measures can be defined as:

- Macroeconomic measures
- Tax and financial measures
- Administrative (regulatory) measures.

Macroeconomic Measures

Macroeconomic measures are generally aimed at creating energy markets and shall include the following:

- liberalisation of the market
- funding of reforms
- energy prices are to reflect limiting expenses for a long period.

Liberalisation of the market primarily provides for energy resources pricing based on the demand and supply of energy resources. With this in place, growth of prices for energy resources will be restrained by competition among energy producers and by consumers' right to have a free access to and free choice of goods and services most acceptable in cost and quality.

Tax Abatements and Loan Granting

The stimulative function of a tax policy shall consist of providing tax concessions and tax abatements, including abatements for:

1. Expenses related to purchasing for account of profit and using new high-tech equipment including devices for metering and control of energy resources
2. Expenses related to development and commercialisation of energy saving technologies and equipment
3. R&D expenses in the field of energy saving
4. Profit received due to lower costs of production and services by way of using energy saving technologies
5. Reduction of or complete exemption from customs duties on imports of energy saving equipment and devices for metering and control of energy resources

6. Exemption of physical persons and legal entities who introduce energy saving technologies and equipment from tax payments (income tax, land tax, property tax), up to 100% for a period of 5 years and up to 50% for subsequent 5 years
7. Provision of preferential loans to physical persons and legal entities who introduce energy saving technologies and equipment
8. Provision of grants/non-risk loans for auditing and engineering studies in the field of energy saving

Financial measures shall include:

1. Introduction of a system of incentives and penalties (including penalties for environmental pollution)
2. Energy prices and tariffs shall stimulate investing in end-use energy consumption characterised by a higher efficiency
3. New depreciation policy
4. Building up investment resources to be allocated for energy saving.

Implementation of an energy saving policy shall be financially supported out of governmental and other sources. To this end, a special non-budgetary energy saving fund shall be set up. Assets of the fund shall be formed out of direct and indirect sources.

Direct sources:

- deductions from cost of fuel and energy resources actually consumed by enterprises irrespective of their forms of ownership
- penalties for exceeding rates and limits of energy consumption
- foreign investments and grants
- deductions from profits of enterprises on a return basis
- funds received from accelerated depreciation of energy saving equipment

Indirect sources:

- tax abatements
- customs duty preferences
- budgetary allocation preferences

Facilities of the fund can be granted in the form of credits or donations provided to finance energy efficient projects.

Administrative measures

Taking administrative and enforcement measures shall facilitate more efficient energy saving at enterprises irrespective of the form of their ownership. The following types of measures are provided for:

- regulation of activities of energy companies based on incentives
- rationing of energy per product unit
- limiting of consumption rates
- approval of seasonal and time-of-day tariffs for heat and electric power
- environmental regulation

One of the most important issues is energy saving pricing and rating. The pricing and rating policy is presented in the Energy Saving Programme. As, according to USA experts' estimate,

the market is getting more liberalised, the priority will be given to the following main pricing principles:

- the level of prices shall be established by X% higher than that of expenses, where "X" will represent a level of returns on investments required to meet the projected demand
- the level of retail prices shall be established by X% higher than that of expenses including profit required to allocate subsidies in the energy sector and measures stimulating energy saving
- the level of prices shall be established so as to allow for complete recovery of limiting expenses on energy supplies; all variable production costs shall be included into the short-term period, while all fixed costs shall be included into the long-term period
- when selling on world markets, energy prices shall reflect a complete marginal equivalent, which is used now at export markets and also completely cover transportation expenses and differences in quality
- the tariffs shall reflect cost of services for various categories of consumers, e.g. domestic, agricultural and industrial consumers
- regional prices for energy shall reflect differences in transportation and distribution costs and also differences in regional demands
- when considering tax legislation, special attention shall be given to objectives of the energy saving policy.

Technical Measures

The major process equipment available now in Kazakhstan is characterised by low energy efficiency as compared with analogous equipment existing in the world. Moreover, starting from the 80-s the process base installed has been getting more and more obsolete due to depreciation. This conditioned further reduction of this index. Use of energy-intensive technologies was necessitated by insufficiency of automation facilities required for control and monitoring and by technical inadequacy.

Technical energy saving measures represent a set of actions intended to form an energy saving mechanism at specific enterprises and other energy consumers. It is natural that particular attention is given to the fuel and energy complex, which is both a power generator and a major consumer of primary and secondary energy resources. The main objectives of the technical measures are as follows:

- to review and describe the specific circumstances of energy consumption of Kazakhstan economy and to develop technical and organisational measures for control and monitoring of energy consumption in the long, medium and short-term
- to restructure the industry and improve the inter-branch structure
- to involve non-traditional and renewable sources of energy
- to form a market of energy saving equipment and materials
- to perform standardisation, certification and rating in compliance with EMAS, ISO International Standards, etc.

Education, Provision of Information and Research in the Field of Energy Saving

Dissemination of knowledge on energy saving within the educational system by means of mass media is a critical aspect in implementation of the energy saving policy. Thus, educational and information programs are intended to:

- inform organisations and the population of the Republic of Kazakhstan of energy saving programmes
- perform inspections of enterprises and public buildings
- demonstrate technologies
- disseminate information, technical support
- provide consulting services
- set up regional information centres
- develop rating and labelling (identification) systems

R&D work in the field of energy saving is carried out on a competitive basis by specialists from any country of the world with compulsory involvement of specialists from the Republic of Kazakhstan.

Energy Saving Measures in the Power Industry

Energy saving measures in the power industry shall be effected in three phases: the short-term phase covers the first three years from the inception of the energy saving programme and requires minimum input, the medium-term phase timed for 4-6 years and the long-term phase.

Short-term measures:

1. Installation of burners with higher fuel combustion efficiency and low NOx emissions
2. Adjustment and replacement of deficient valves installed in water, steam and condensate systems to more efficient ones
3. Replacement of control and metering systems of major substation equipment
4. Installation of oxygen analysers
5. Replacement/repair of insulation in pipeline systems
6. Replacement/repairs of inadequate fans on cooling (quenching) towers
7. Installation of steam traps, development and introduction of steam trap selection and maintenance programme

Medium-term Measures:

1. Replacement of obsolete equipment at power plants and introduction of more efficient thermal cycles (co-generation. combined cycle)
2. Rehabilitation of power stations in order to increase their efficiency and extend their service life
3. Increase in quality of fuel utilised at power stations (washing of high-ash coals, etc.)
4. Reactive power compensation and regulation of reactive flows in transmission networks

Long-term Measures:

1. Installation of power generating units with the circulating fluidised bed boilers, combined-cycle plants operating on natural gas, combined-cycle plants burning coal in pressurised fluidized bed, combined-cycle plants with partial coal gasification and burning coke in circulating fluidised bed.
2. Adoption of engineering standards, codes and regulations approved by the International Organisation for Standardisation.
3. Development of renewable sources of energy.

Energy Saving Measures in Heat Supply Industry

Short/Medium-term Measures:

1. Installation of devices required for metering, monitoring of and control over heat flows in boilers and distribution lines
2. Installation of heat consumption metering devices
3. Installation of steam traps in heating mains supplying industrial consumers or at boiler houses
4. Improvement of heat insulation and corrosion resistance capability of pipelines
5. Installation of gas turbines at enterprises equipped with hot-water boilers, which will enable to ensure combined production of heat and electric power and increase energy efficiency thereof (in the north-western part of the Republic).

10. CONSULTED SOURCES

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7. Government Resolution of RK No. 857 dated 25 August 2003 “On wind power development”.
8. Law of Repablic of Kazakstan “On Electric Power Industry”, 2004
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Energy Charter Protocol on Energy Efficiency and Related Environmental Aspects PEEREA

Kazakhstan

REGULAR REVIEW 2006

Part II:

Indicators on Energy. Energy Efficiency. Economy and Environment

Based on IEA data

a. Introduction

This document is Part II of the Review Format of the Energy Charter Protocol on Energy Efficiency and Related Environmental Aspects (PEEREA). Part I covered qualitative data on energy and energy efficiency policies, measures and instruments, and actors. This part focuses on quantitative data.

The tables include data relevant to the use of energy. Furthermore information is asked on end-use energy prices and CO2 emissions.

Conversion of units:

Units are converted to Mtoe using the general conversion factors for energy.

b. Macro-Economic Data

Table b.10. Gross Domestic Product

(billion US$2000)

	1992	1995	1999	2000	2001	2002	2003
GDP	22.207	16.178	16.659	18.292	20.761	22.796	24.893
GDP (PPP)	80.555	57.892	60.976	69.188	77.619	84.377	93.764

Sources: IEA Statistics. Electronic Version 2005

Table b.2. Number of inhabitants

(million)

	1992	1995	1999	2000	2001	2002	2003
Population	16.518	16.066	15.289	15.059	14.909	14.875	14.878

Sources: IEA Statistics. Electronic Version 2005

c. General Energy Data

Table c.1.

(Mtoe)

Indicators	1992	1995	1999	2000	2001	2002	2003
Total Primary Energy Production	89.007	63.470	65.528	78.469	88.388	95.780	105.522
Net imports	35.729	11.349	5.176	6.891	8.366	12.006	12.090
Total Primary Energy Supply (TPES)	79.661	52.246	35.796	39.687	45.543	46.930	49.829
Total Final Consumption (TFC)	53.165	31.126	19.701	22.489	24.852	25.820	27.678
TFC/GDP (toe/thous.US$)	2.394	1.924	1.183	1.229	1.197	1.133	1.112
Total Electricity Consumption*	7.570	4.438	3.143	3.397	3.553	3.723	3.877
Electricity produced from RES*	0.617	0.715	0.651	0.646	0.693	0.762	0.740
Heat produced from RES**							

Sources: IEA Statistics. Electronic Version 2005

* 1 Mtoe = 11.63 TWh

** 1 Mtoe = 4.1868×10^4 TJ; 1 Mtoe = 10^7 Gcal

d. Sector Consumption: Parameters and Energy Efficiency Indicators

Table d.1. Total Final Energy Consumption (TFC) by end-use sector

(Mtoe)

Sectors	1992	1995	1999	2000	2001	2002	2003
Residential	0.716	0.696	0.487	0.477	0.444	0.471	0.492
Industry	27.468	16.344	8.887	9.981	10.961	11.818	12.552
Services	1.064	0.145	0.266	0.396	0.432	0.454	0.462
Transport	6.664	3.716	2.510	2.726	2.959	3.046	2.907
Agriculture	2.278	1.775	1.047	1.128	1.218	1.355	1.316
Others*	15.892	8.509	6.716	8.121	9.207	9.067	10.355
Total (TFC)	54.082	31.185	19.913	22.829	25.221	26.211	28.084

Sources: IEA Statistics. Electronic Version 2005
* Others include Non-specified other sectors and Non-energy use

Table d.2. Energy Efficiency Indicators for Households: Final Consumption of the Residential Sector by Energy Source

(Mtoe)

Indicators residential sector	1992	1995	1999	2000	2001	2002	2003
Total Final Consumption	0.716	0.696	0.487	0.477	0.444	0.471	0.492
a. Electricity	0.716	0.696	0.486	0.472	0.439	0.466	0.487
b. Heat	0	0	0	0	0	0	0
c. Oil products	0	0	0	0	0	0	0
d. Gas	0	0	0	0	0	0	0
e. Coal	0	0	0.001	0.005	0.005	0.005	0.005
f. Combust. Renew. & Waste	0	0	0	0	0	0	0
g. Others	0	0	0	0	0	0	0
Floor Area ('000 m^2)							
No. of dwellings ('000)							
Residential use per dwelling (toe/dwelling)							
Residential use per surface (toe/m^2)							

Sources: IEA Statistics. Electronic Version 2005

Table d.3: Final Consumption of the Industry Sector by Energy Source in 2003

(ktoe)

Indicators industrial sector	Mining	Manufacturing							Construction	Total
		Iron and steel	Chem. and petrochemical	Non- ferrous metals	Food and tobacco	Paper pulp and print	Non- metallic minerals	Other		
Coal	0	1153	0	0	0	0	0	5750	0	6903
Petroleum products	1054	328	222	287	138	3	13	45	52	2142
Gas	0	0	0	0	0	0	0	569	0	569
Electricity	809	753	165	781	80	4	68	237	40	2937
Heat	0	0	0	0	0	0	0	0	0	0
Combust. Renew.&Waste	0	0	0	0	0	0	0	0	0	0
Total	1863	2234	387	1068	218	7	81	6602	92	12552
Value added per sector (1995 USDx10^6)										
Energy/value added (Mtoe/ 10^6 USD)										

Sources: IEA Statistics. Electronic Version 2005

Table d.4. Energy Efficiency Indicators for Services (commercial and non-commercial): Final Energy Consumption of Services by Energy Source

(Mtoe)

Indicators services sector	1992	1995	1999	2000	2001	2002	2003
Total Final Consumption	1.064	0.145	0.266	0.396	0.432	0.454	0.462
a. Electricity	0.917	0.059	0.212	0.340	0.369	0.391	0.406
b. Heat	0	0	0	0	0	0	0
c. Oil products	0.147	0.086	0.054	0.056	0.063	0.063	0.056
d. Gas	0	0	0	0	0	0	0
e. Coal	0	0	0	0	0	0	0
f. Combust. Renew. & Waste	0	0	0	0	0	0	0
g. Others	0	0	0	0	0	0	0
No. of employees (mil.)							
Floor area ('000 m^2)							
Value added (10^6 USD)							
Energy/value added (Mtoe/10^6 USD)							
toe/Employee							
toe/m^2							

Sources: IEA Statistics. Electronic Version 2005

Table d.5. Transport indicators (2003)

Indicators transport sector	Freight	Travel	Total
Total Final Consumption (Mtoe)			2.907
10^9 Tonne-km		-	
TFC/10^6 tonne-km		-	
10^9 Person-km	-		
TFC/person-km (TFC/10^6 person-km)	-		
Number of cars/1000 inhabitants			

Sources:

e. End-Use Energy Prices for Various Market Sectors

Table e.1. Energy prices for end use sectors 2003

(USD per Unit)

Sectors	Un-leaded gasoline 95 RON (litre)	Light fuel oil ('000 litres)	Diesel (litre)	Heavy fuel oil (tonne)	Nat. Gas (10^7 kcal GCV*)	Steam Coal (tonne)	Electricity (KWh)
Industry	x	140.97	Not available	68.07 (high sulphur)	34.38	6.80	0.01
Households (Incl. …% VAT)	Not available	181.51	Not available	x	52.29	16.87	0.03
Electricity generation	x	x	x	40.31	42.0	5.1-16.6	x

* Gross Calorific value

Sources: Agency on statistics of RK, "Social and economic development of Kazakhstan 2003".

f. CO_2 Emissions

Table f.1. CO_2 emissions from fuel combustion

Indicators	1992	1995	1999	2000	2001	2002	2003
Total CO_2 emissions (Mtons/year)	252.9	168.1	88.4	102.1	107.8	119.4	124.8
Share electricity and heat production (%)	38	44	43	48	48	45	47
Share residential sector (%)	8	6	5	5	4	4	4
Share industrial sector (%)	28	26	26	26	26	24	23
Share transport sector (%)	10	9	5	6	6	6	7
Share other sectors (%)	19	19	11	10	9	9	10
Total CO_2/GDP (kg/USD '95)	11.4	10.4	5.3	5.6	5.2	5.2	5.0
Total CO_2/capita (tons/inhabitant)	15.3	10.5	5.8	6.8	7.2	8.0	8.4
Total CO_2/ TFC (tons/toe)	4.8	5.4	4.5	4.5	4.4	4.6	4.5

Sources: