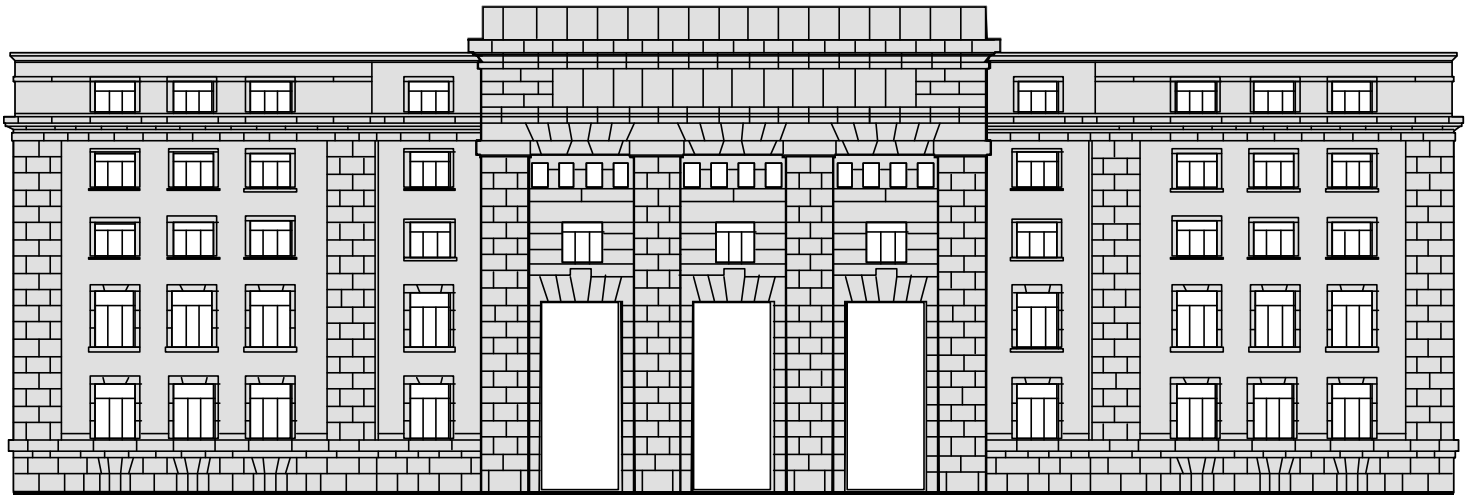
ECONOMIC COMMISSION FOR EUROPE

THE ECE ENERGY SERIES

ENERGY EFFICIENCY AND ENERGY SECURITY IN THE CIS



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FOREWORD

This study has been prepared as part of the project "Energy Efficiency and Energy Security in CIS and its Member-States" that is being implemented in the framework of the UNECE Operational Activity Programme. It was initiated by the United Nations Economic Commission for Europe in cooperation with the Executive Committee of the Commonwealth of Independent States in accordance with the Joint Statement of the UNECE secretariat and the CIS Executive Committee of the CIS Economic Union dated 4 September 1997, with support of the UNECE Energy Efficiency 2000 Project and the Ministry of Industry, Science and Technology of the Russian Federation. It represents the first phase of the project. Further analyses and publications with the support of the United Nations Foundation and United Nations Fund for International Partnerships are underway.

The purpose of this initial study has been to assess the potential for energy conservation in CIS member countries to the year 2010 and to explain how improvements in energy efficiency of member countries could contribute to enhancing their energy security. The project has been designed to examine the key role of international co-operation between CIS member countries and with other ECE member states in Europe and North America in promoting energy conservation and energy efficiency. The analysis was carried out by the Group of Experts on the basis of information provided by National Experts appointed by the Governments of the CIS member-states (see National Experts and Work Group below). The methodology used for this study has been developed by the Energy Research Institute, Russian Academy of Sciences (INEI) and the Energy Policy Centre (CEP) in Moscow, with overall co-ordination provided by the Russian Ministry of Industry, Science and Technology.

International experience has shown that vigorous energy efficiency measures can reduce the growth of national energy demand, lower energy imports and ease the energy constraints of economies in transition. At the same time, carefully designed international co-operation projects for promoting energy efficiency can help reduce the impact of energy supply constraints – thus contributing to the energy, economic, environmental and national security of participating countries.

At present, the CIS member countries have an enormous potential for energy conservation estimated to be between 600 and 650 million tons of oil equivalent. This amounts to well over half the annual total energy consumption of CIS member countries. According to experts, a considerable part of this potential could actually be achieved. This would improve the energy balances and balances of trade of most CIS countries. Achieving even part of this large potential would have important environmental benefits since much of the savings would come from fossil fuels and reduce greenhouse gas emissions. Preliminary estimates show that the costs of the efficiency improvements would be lower than the investments needed for a commensurate increase in energy supplies.

Three key factors will determine how large the energy efficiency improvements will be in the CIS. First, greatly expanded economic, scientific and technological co-operation is needed to help establish liberal and competitive markets for energy resources, and to provide energy conservation equipment and services. These market formation activities need to foster consumer choice and promote improvements in end-use applications of energy. Second, the time horizon, scope and sequence of tasks envisaged will influence what can be achieved. The study recommends a series of linked solutions to be implemented in stages as short, medium and long-term activities.

The third factor is the amount, priority and efficiency of investments. Given the actual capabilities of CIS member states to finance energy efficiency investments, this report suggests priorities depending on the amount of investments needed and sequence in which they would be implemented. Clearly, low-cost and no-cost energy management and administrative reforms should come first. Through a variety of energy policy reforms, these initial measures can help finance technical solutions requiring relatively small investments. As market formation activities begin to have an effect, international financial institutions, targeted funds and commercial banks can help finance larger investments.

A second phase of this initiative is being pursued in the United Nations Foundation supported project on Energy Efficiency Investments for Climate Change Mitigation (ECE-CIS-99-043) as part of the UNECE Energy Efficiency 21 Project. It examines more closely the investment requirements of national energy efficiency programmes for a selection of CIS countries: Belarus, Kazakstan, Russian Federation and the Ukraine. This will also include descriptions of several best practice case studies of energy efficiency projects already financed in these countries.

As we issue the present report and continue our co-operation on the complementary study of energy efficiency investment needs, we propose to co-ordinate the dissemination of recommendations from both studies to the Governments of CIS countries and to Governments of other ECE member states. In this way, we believe that the member countries of both institutions can be best served by the results of our co-operation.

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Energy Efficiency and Energy Security in the Commonwealth of Independent States

Table of Contents

PREFACE

The UN ECE Energy Efficiency 21 Project

Central and Eastern European energy economies are half as efficient as those of market economies. To a large extent, this 'gap' simply reflects inefficient energy use, but there are other reasons as well. Efficiency gaps also exist between market economies.

This project is to assist central and eastern Europe and CIS countries to enhance their energy efficiency and security to ease the energy supply constraints of economic transition and to meet international environmental treaty obligations under the UN FCCC and the UN ECE. Reducing the energy efficiency 'gap' by half would save 600 million tones of oil equivalent in year 2010 of which 90 per cent would be fossil fuels. Harmful emissions of SO_2 and CO_2 would be reduced by 20-25 per cent in comparison with continuing trends in the ECE region. Reducing CO_2 emissions by 10 per cent in the ECE region translates into a 5 to 6 per cent reduction of global CO_2 levels.

In the Bergen Ministerial Declaration on Sustainable Development in the ECE Region of the World Commission on Environment and Development Regional Follow-up Conference in May 1990, governments agreed 'to initiate an ECE region wide campaign "ENERGY EFFICIENCY 2000". It was designed to enhance trade and co-operation in energy efficient, environmentally sound techniques and management practices to close the energy efficiency gap between actual practice and best technologies, and between ECE countries, in particular East and West, through national actions, bilaterally and especially through the Economic Commission for Europe'. After completing ten years of project operations, Energy Efficiency 2000 was launched with a new mandate as Energy Efficiency 21.

The objective of the Energy Efficiency 21 Project (2000-2003) is to enhance regional co-operation on energy efficiency market formation and investment project development to reduce greenhouse gas emissions in economies in transition in accordance with a Project Plan. The Plan provides for the following activities: accelerated regional networking, promoting energy efficiency investments, developing and harmonising regional policies and standards. Activities of the Energy Efficiency 21 Project are supported by governments, private sector companies, international organisations, the United Nations Foundation, the United Nations Fund for International Partnerships and the UN General Assembly Development Account.

Within the UN ECE, the present report is implemented under Energy Efficiency 21 Objective 3: Development of regional policies and standards to support energy efficiency investments and the Kyoto Protocol mechanisms. For further information about the Energy Efficiency 21 Project, please contact:

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INTRODUCTION

DEFINITION OF THE CONCEPT ENERGY SECURITY

The concept energy security started to be widely used in the CIS several years ago. An international advisory meeting on Energy Security in the Commonwealth of Independent States was held in May 1996 in Moscow at the initiative of the Security Council of the Russian Federation. During this meeting the Heads of Governments of the CIS countries, management representatives of large fuel extracting and energy supplying companies and leading scientists of these countries exchanged views on factors determining the level of energy security in terms of the domestic and international situation and in relation to the different branches of the fuel and energy complex and major economic sectors. They analysed the causes jeopardising secure energy supplies and ways of eradicating them.

The participants in the meeting defined energy security as a status of a society, which allows to maintain, in the context of internal and external threats and the influence of destabilising factors of economic, social, political, natural and technological origin, a required level of national security of the country by removing and setting off the adverse effects of these factors.[1]

It was noted in this respect that energy supply is one of the factors contributing to raising the level of energy security.

Energy security, irrespective of whether it is considered in the context of the energy exporting or energy importing countries, remains one of the main elements of economic and, finally, national security.

In the first half of the 1970s in the context of the energy crisis after the embargo on oil export introduced by a group of oil exporting countries in respect of a number of western industrial countries, the latter decided, in order to alleviate the adverse effects of this measure and ensure their energy security, to combine their efforts in this direction and create the International Energy Agency (IEA). The main purpose of creating the IEA was to raise the level of energy security through collective measures, particularly through the creation of strategic oil reserves in case of disruption of oil supplies from external sources, and to reduce the energy intensity of their economies. Nowadays these tasks continue to remain its major areas of activity.

The World Energy Council defines the concept «energy security» somewhat differently, however its substance remains the same, as was noted at the above meeting: «Energy security (or security of energy supplies) is expressed in the assurance that energy will be available in the quantities and qualities required under given economic conditions» (World Energy Council. Energy Dictionary. 1992).

Ensuring energy security in the aforementioned sense is the most important element both for individual countries and for groups of countries irrespective of whether they are net exporting countries of energy resources or importing ones. It goes without saying that the problem of ensuring energy security for those countries (groups of countries) whose energy supply entirely or considerably depends on the external suppliers, is more difficult to solve.

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[1] A National Expert from Tajikistan suggests the following definition of the term “energy security”: the provision of a state with energy carriers in a sufficient amount that allows keeping a necessary level of energy consumption in case of threats of an internal or external character and influence of destabilising factors of an economic, socio-political and technological origin. In this connection it should be noted that there are other and more detailed definitions, which are presented in a book by a group of authors “The Energy Security of Russia” (Novosibirsk, “Nauka”, 1998, 311).

In the vast majority of the CIS countries energy conservation, in terms of their energy security, is considered to be one of the major activities, if not the most important one.

The collapse of the USSR led to the emergence within its former territory of independent States with acute immediate problems in the energy sphere to be solved through their own efforts, in other words, with problems of ensuring their sustainable energy supply. Countries with limited fuel and energy resources have been faced with the problem of spending large amounts of currency for their purchases abroad. As to the countries whose energy resource base excited no apprehensions, they have been faced with a serious problem of ensuring investment support for their fuel extracting industries and electric power sector in amounts required to maintain them in such a state as to warrant both sustainable energy supply to economic entities and households and a proper level of export of energy resources in so far as deductions from receipts for these resources are, in these countries, major components of budget revenues.

Furthermore, the CIS countries have been faced with a serious problem of an increased energy component in the cost structure of their industrial production related to the rise in prices of energy resources, which has resulted in a reduction of its competitiveness on the foreign and domestic markets of these countries. It should also be noted that most of the CIS countries depend on imports of fuel extracting and energy producing equipment which require large currency expenditures in the context of considerable ageing of the productive assets of energy sector.

Thus, virtually all CIS countries face the problem, to a varying degree, of ensuring their energy security and identifying possibilities of its achievement by making use of the most effective and at the same time the least capital intensive ways and means, the most practical of which being transition of their economies to an energy conservation pattern of development.

As to the Commonwealth as a whole, the amount of economic potential in terms of energy conservation may be estimated at between 500-600 million tonnes of coal equivalent (tce) or somewhat less than 40% of total consumption of primary energy resources by all CIS countries.

ENERGY SECURITY IN THE CIS

Energy security within the CIS should be viewed at different levels: at the CIS level i.e. in terms of trade in energy resources and the energy industry within the CIS; at the state level i.e. in terms of securing sustainable energy supply within the country; and at the level of consumption i.e. in terms of meeting the energy requirements of its economy and population.

Energy security within the limits of the aforementioned definitions is characterised by many aspects. It means the reduction of vulnerability to short-term and long-term discontinuance in energy supply. It also means the need to supply local and imported energy resources at acceptable prices in order to meet growing energy requirements. From year to year energy security will contain a growing environmental component, which is already relatively important due to the commitments made by many states, including the CIS countries, under international agreements on protection of the environment.

Components of energy security which are new for the CIS countries in so far as they were lacking in the former Soviet republics impose heavy obligations on their governments, as well as on private and national fuel and energy supplying joint-stock companies and, finally, on energy consumers.

Disturbance of energy security or, in other words, discontinuance of energy supply, even

short ones, as well as sudden leaps in prices for energy resources may, as a rule, have adverse financial, economic and social effects. The consequences of these disturbances may show in two ways: jeopardising production activities and compromising the well being of consumers. As far as production activities are concerned disturbance of energy security might, in particular, discourage investors from investing their money in the development of domestic production.

While examining the problem of ensuring energy security in relation to the Commonwealth of Independent States or its members we should take into consideration the following:

1. Before the collapse of the Soviet Union the problem of ensuring energy security in some of its individual republics, which are now independent states, had hardly existed. However since then this situation has radically changed. Under present market conditions, which continue to develop, all CIS countries should deal with the problems of ensuring energy security.

The experience gained during recent years shows that CIS countries while ensuring their domestic energy security are faced with serious difficulties. These difficulties consist first of all in non-payments by consumers for energy supplied to them, in continuing increases in prices and tariffs on fuel and energy, in the lack of legislative settlement of responsibility of fuel and energy supplying companies for low quality of fuel and energy supplies. Some difficulties with ensuring energy security in individual regions of countries extending over large territories (for example Russian Federation) are linked to the delays in energy supplies to consumers distant from centralised systems of energy supply. The «gasoline crisis» that embraced some Russian regions and a number of other countries in mid-1999 originated from the economic, social and legislative non-preparedness of the CIS countries to shift to entirely market conditions of functioning. Bringing domestic prices in line with changing prices of oil products on international markets is not possible because of the relatively low incomes of the great mass of the population. Nevertheless, the drive of oil supplying companies to take the opportunity during the periods of high prices on international markets to increase their profits resulted in an increase in their export supplies to the detriment of domestic supplies at acceptable prices for the population.

2. Less than 10 years have passed since all CIS countries were Union republics of an indivisible state with a common energy balance and a common energy infrastructure. After the collapse of the former USSR this unity of the energy balance and energy infrastructure was disrupted. In connection with this, due to the sluggishness of the development of energy supply systems and the high level of their capital intensity in the context of «investment hunger», many CIS countries did not manage to adapt to new circumstances. All these factors imply special attention in order to use all opportunities and first of all those concerning measures aimed at increasing efficiency of use of fuel and energy and reducing the level of energy intensity of the economy in order to maintain and enhance energy security.

3. Deposits of fuel in the territory of the former USSR were viewed as the property of all the Soviet people despite the fact that more than 80% of all industrial reserves of mineral fuels and productive assets of the Soviet fuel and energy complex were concentrated in the territory of one state, now independent – the Russian Federation. At present the proven oil, including gas condensate, and natural gas reserves in the Russian Federation amount to 84% of all proven reserves. For coal this figure is 68%. The Russian share in the production of each type of mineral fuel and its share in the production potential of its fuel complex is roughly the same (in 1997: oil and condensate – 85%, natural gas – 84% and coal – 62% [2]).

[2] These figures are taken from the Survey of Energy Resources, 1998. According to estimates of the Russian Ministry for Fuel and Energy, the Russian share in proven world reserves of oil (including condensate) amounts to 13%. In this case the Russian share in oil reserves (including condensate) of the CIS would amount to 90%.

4. As of the beginning of 1998 only five CIS countries out of 12 (Azerbaijan, Kazakhstan, Russian Federation, Turkmenistan and Uzbekistan) produced primary fuel and energy resources in quantities exceeding their domestic requirements. As for the other seven countries their domestic energy requirements exceeded their capacities to meet these requirements with the help of their own production of fuel and energy.

5. If we consider the ratio of requirements in individual types of energy resources to their national production, then we will see that 11 out of 12 CIS countries have to import one or several types of energy resources. The only exception is Turkmenistan. Even The Russian Federation, whose domestic requirements in primary energy resources amounted in 1997 to 60% of its total national production, had to import 20 million tons of Ekibastuz coal used to operate the Troitskiy and Reftinskiy thermoelectric power plants with a total output of 6,255 mWt.

6. Taking into account, that forecast estimates for all CIS countries without exception provide for an increase in domestic requirements in terms of virtually all types of energy resources, on the one hand, and limited possibilities of increase in their domestic production on the other, some important changes in energy interdependence of the CIS countries in the near future are hardly to be expected. Some slackening of this interdependence may occur only in the case of individual CIS countries endeavouring at diversification of energy supply sources by seeking exits to energy markets outside the CIS. However, in view of the sluggish development of energy markets it could hardly change in principle the present situation in the next decade. To some extent it may also apply to the increase in production of their own energy resources in those countries where availability of explored reserves of mineral fuels and unexploited economic hydropower potential makes it possible.

Thus, a very important aspect of energy policy for almost all CIS countries consists in determining ways of reducing the rate of energy requirements growth without compromising the economic and social conditions of development. Now, when the development of the economy undergoes a critical stage and when there are heavy investments and a currency deficit for purchases of energy resources abroad, the most important ways of heightening the level of energy security consist in improving efficiency in fuel and energy use and shifting the economy to an energy conservation pattern of development.

A considerable problem for the CIS in terms of ensuring energy security of each of its member states is an uneven repartition of fuel deposits in the territory of the CIS region. The main natural gas reserves are concentrated in the Russian Federation, in the northern territories of West Siberia, which are distant from the consumption centres in the Russian Federation and CIS countries that are the main importers of this resource (mostly Ukraine and Belarus). At present the transportation of natural gas to consumers inside Russia and for export in the CIS countries, as well as in central, eastern and western European countries, costs 10% of the total natural gas output (almost 60 billion cm). The modernisation of gas compression units on the trunk gas pipelines, more efficient use of secondary energy resources at compressor stations, installation of gas pressure turbo regulators allowing the use for energy conservation purposes of gas pressure differential at the entry of gas pipelines into power stations and upgrading of gas consuming equipment of other large consumers of this fuel would make it possible to save 15 billion m^3 of gas that could be supplied to consumers thereby enhancing their energy security.

Considering the level of energy endowment of the CIS as a whole in terms of ensuring in the future sustainable energy supply on the basis of its own proven energy reserves, it should be noted that this level of endowment on the regional scale is much higher than that of the world as a whole. Taking as a basis for calculation the amount of energy resources produced in 1997, the energy

endowment of the CIS region in terms of coal will amount to 590 years as compared with 213 years for the world as a whole. For oil these figures are 55 and 43 years, respectively, and for natural gas – 77 and 57 years.

One of the most important measures aimed at increasing energy efficiency of the economy consists in improving the process of transformation of fuel into electric power. Modern combined – cycle power plants working on natural gas transform it into electric power with an efficiency of close to 60%. It is expected that in the near future this indicator will reach 70% i.e. it will be more than twice as high as the average efficiency indicator in the case of fuel used for electric power generation with the help of traditional steam-electric-turbine plants.

The increase in efficiency of electric power generation through combustion of mineral fuel is particularly important in so far as in the years to come electricity will be used on a continuously larger scale as an energy resource. It is notorious in the world and in the CIS that the electrification ratio of the consumption part of fuel and energy balance of any country, i.e. the share of electric power in the total amount of energy consumption, will in prospect grow continuously, since nowadays electric power is the most flexible, efficient and almost absolutely environmentally clean energy resource.

Energy conservation and decrease in energy intensity of the economy are very important ways of enhancing energy security, but these are not the only ways. The role of energy conservation and energy efficiency in dealing with the issues of energy security, especially in the CIS, will be strengthened if these two processes are used in combination with other methods, for example:

- extension and deepening of economic and technological cooperation in the energy sector and on issues concerning the transition of economies to the energy conservation pattern of development;

- raising the level of independence of national economies and populations from external sources of energy supply by broadening, as much as possible and on an economically justified basis, the use of local energy sources with the participation of national and foreign investors in this field;

- creation of sufficient strategic reserves of oil, gas and coal.

The level of energy security of the CIS and its individual members may be increased through more extensive use of environmentally clean renewable energy sources, including non-traditional ones, first of all biomass, solar, wind and geothermal energy. There is considerable potential for these energy sources in each of CIS countries.

The low level of energy security of the Kamchatka region in the Russian Federation, where almost every year energy crises occur with rather heavy social and economic consequences, is well known. These crises are engendered by delays in supplies to the peninsula of liquid fuel used for the operation of almost all power plants and boiler-houses. However, the Kamchatka region is endowed with rich explored sources of geothermal energy the size of which is enough to ensure a sustainable supply of electric power and thermal energy to all consumers of the peninsula. The same applies to the energy supply system in some Kuril Islands. An example of resolving the problem of energy security through the use of non-traditional renewable energy sources (small waterways and geothermal sources) for meeting the requirements in electric power and thermal energy is Iceland.

The use of wind energy on a large scale would allow a considerable increase in the level of

energy security while solving economic and social issues in various North-European regions of the Russian Federation, in Ukraine and in other CIS countries. The solar energy which could be used for electricity generation and heat supply to consumers located in energy deficient regions may have a great future in terms of ensuring energy efficiency, especially in Central Asian CIS countries and in some other countries of the Commonwealth.

Special attention should be paid to the possibilities of wide use for energy supply of biomass resources available in all CIS countries (wood, waste of agricultural and industrial enterprises, particularly the forest and timber industry, as well as solid organic municipal waste). The use of biomass with the help of modern energy technologies would allow large amounts of fossil fuels to be saved thereby reducing expenditures for their production and import.

General and widespread integration of renewable energy sources in the energy balances of the CIS countries will contribute, along with helping to resolve problems of energy security, to the work aimed at addressing the issues of protection of the natural environment in the CIS countries, in the first instance the air basin.

In order to raise the level of energy security both in the CIS as a whole and in its member states it would be very important to re-establish and develop, on an economically justified basis, inter-state energy links (mainly electric transmission lines and gas pipelines) which were provided for as far back as at the time of the USSR.

It would be very important to institute a body attached to the CIS Executive Committee, similar to the International Energy Agency, which would be entrusted mainly with the task of ensuring energy efficiency through, among other things, energy conservation and reducing energy intensity of the economy.

ROLE AND RESPONSIBILITY OF THE STATE IN ENSURING ENERGY SECURITY

Despite the emergence of market conditions in all CIS countries the role of the state in ensuring energy efficiency at the national level will remain valid and will consist in the following:

- legislative regulation aimed at promoting the increase in efficient use and rational consumption of fuel and energy;

- forecasting strategy of long-term development of the economy and society in order to take timely decisions concerning their sustainable energy supply;

- influencing the development of energy markets at the national and international levels ensuring their transparency and non-discrimination;

- ensuring conditions for maintaining long-term energy security by taking timely decisions, including in the form of preparation and implementation of state programmes financed entirely or partly from the state budget and measures aimed at diversifying energy supply sources and speeding up exploitation of local energy resources, including non-traditional renewable energy sources;

- creating state fuel reserves;

- collecting and disseminating national and international economic as well as scientific and

technological information on energy, methods of increasing energy efficiency of the economy and related scientific and technological progress;

- taking timely decisions with a view to preventing discontinuance in energy supply.

For those CIS countries where the level of energy intensity of the economy is high and where, consequently, the potential of energy conservation is large it would be important to shape economic policy in such a way as to ensure that the planned rate of economic growth is higher than the rate of increase in demand on primary energy resources. For example, according to estimates, if the rate of economic growth in the CIS countries over the first two decades of the 21st century amounts to 3% and the rate of increase in energy consumption amounts to 2%, then the total annual requirements of the CIS countries in primary fuel and energy resources in 2020 will grow by 50% as compared with the present level. On the other hand, if the rates of economic growth and energy saving are the same, then the increase of energy requirements will amount to 80% with all the ensuing consequences for energy and, to a certain extent, environmental security.

The creation of conditions ensuring this correlation between the rates of long-term economic growth and increase in energy consumption, or one close to it, should be one of the main duties of the state.

In the future energy security of the Commonwealth of Independent States will be determined considerably by the development both inside the CIS and between separate CIS countries and third countries of a free energy carriers market. However this aspect is subject to a separate study that will probably be carried out later.

PART I

ENERGY SECURITY IN RELATION TO ENERGY CONSERVATION IN THE COMMONWEALTH OF INDEPENDENT STATES

CHAPTER 1. CURRENT STATUS AND DEVELOPMENT PROSPECTS IN THE FIELD OF ENERGY PRODUCTION AND CONSUMPTION IN THE MEMBER COUNTRIES OF THE COMMONWEALTH OF INDEPENDENT STATES

1.1. MAIN TRENDS SINCE THE CREATION OF THE CIS AND UP TO NOW

In the field of economy

Between 1992 and 1997 almost all CIS countries underwent a sharp decline in industrial production, a general fall of economic output and a decrease in living standards of the major part of population.

Gross domestic product (GDP) in 1997 for the Commonwealth as a whole amounted to 70% as compared with the level of 1992 (Table 1). Over this period only Uzbekistan experienced a positive rate of GDP growth. Economic recovery which began in 1996 and 1997 in some countries has been weak and unstable.

Due to the absence of data on GDP and domestic consumption of primary fuel and energy resources calculated using a unified methodology, the Working group on preparation of the analytical report found it possible to use statistical guides of the United Nations, UNECE, IAE, the World Bank and other organisations to evaluate an average GDP power intensity in these countries.[3] The summary data on the CIS below are calculated with the use of these statistical guides.

In 1997 GDP for all CIS countries in general as per the currency rate amounted to USD 522 billion in prices of 1990 (in 1992 – USD 745 billion, or 30% more), and as per the purchasing power parities – USD 1045.5 billion (in 1992 – USD 1490.8 billion).

GDP power intensity in 1997 in the CIS amounted to approximately 2,4 tce/USD 1000 as per the currency rate and 1.2 tce/USD 1000 as per the purchasing power parities. This is accordingly 6.6 and 3.1 times more than the average in the member countries of the Organisation for Economic Cooperation and Development (OECD). There is also a big difference in GDP power intensity among the CIS countries (Table 1).

According to the preliminary estimates, 60% of the decrease in production may be explained by disruption of cooperation links and only 40% by reforms and internal and external political factors.

Indicative of the considerable decrease in the living standards of the population of the CIS countries is, in particular, the fact that GDP per capita calculated in dollars using purchase power parities fell in 1997 as compared with 1990 in various CIS countries by 35 – 75%. The

3 UN Statistical Yearbook, 1993-1998, Foreign Scouting Service. Commonwealth of Independent States, IMS Energy Group – IEDS Petroconsultants, Geneva, 1999; IEA, Energy Balances of Non-OECD countries, 1996-1997. 1999 edition, materials of the World Bank and the World Energy Council.

consumption by the population of such commodity groups as garments, footwear and furniture underwent the most significant decrease. A lesser but more painful influence on the living standards of the population was exerted by the decrease in the consumption of basic food products and free services. At the same time a sharp increase in purchase of cars (especially imported ones) is observed.

Table 1
GDP energy intensity in the CIS countries, tce/USD 1000

Country	In prices as per the currency rate		As per the purchasing power parities	
	1992	1997	1992	1997
Azerbaijan	3.79	4.62	1.79	2.17
Armenia	3.43	1.37	1.93	0.77
Belarus	3.01	2.68	0.94	0.73
Georgia	1.54	0.84	0.87	0.47
Kazakhstan	3.48	2,27	1.59	1.03
Kyrgyz Stan	3.20	2.36	1.73	1.29
Republic of Moldova	1.47	1.59	0.80	0.86
Russian Federation	2.42	2.42	1.21	1.21
Tajikistan	3.29	2.63	1.90	1.20
Turkmenistan	2.62	3.72	1.07	1.52
Uzbekistan	3.15	2.99	1.52	1.44
Ukraine	2.42	3.29	1.18	1.62

CALCULATIONS AS PER “THE PURCHASING POWER PARITIES”

When comparing indicators of economic development of different states (in particular GDP) these indicators have to be brought to unified units of measurements.

For the CIS countries, as well as for other countries with economies in transition or developing countries, using indexes of an exchange rate of a national currency to USD is considered to be incorrect. The reason is, first, that prices for consumer goods and services in these countries are considerably lower than the world level; second, currency operations between the state, companies and consumers are not always taken into account in the state statistics; and, third, a stock-exchange USD rate in a range of countries is either controlled by the state or influenced by speculations of stockbrokers.

In connection with this problem, since 1993 the United Nations and the World Bank have started to develop an evaluation methodology as per “the purchasing power parities”.

The GDP level of a state, in accordance with the methodology adopted is determined through defining a national currency rate in relation to USD for a certain year, as per purchasing power parities.

The national currency rate as per purchasing power parities is the ratio of national currency (roubles, tenghes, manats, etc.) amount, spent in a country to purchase a certain set of goods and services (“consumer basket”) of the same composition and quality as a USD resident can purchase

for 1 USD.

The United Nations and the World Bank regularly publish data on GDP in the parity of purchasing capacity of the countries of the world. In the USSR, Russian Federation now, similar studies are carried out by the Institute of World Economy and International Relations of the Russian Academy of Science (V. Bolotin). Its evaluations were used for the table.

Over the same period labour productivity in the field of industry in the territory of the member states of the Commonwealth fell by 27%.

The decline in economic output has resulted in «investment hunger» and a decrease in investments in national economies. Moreover, the structure of investments has undergone considerable changes as a consequence of the decrease in the share of agriculture and the building sector and reduced financing of industry.

Mutual economic relations have shrunk drastically; mutual trade in commodities among CIS countries between 1992 and 1998 decreased almost by three times. At present, the specific share of mutual trade accounts for a little more than 30% of the total trade in commodities among the CIS countries, while in 1991 this figure was equal to 60%. The trend towards a decline in volumes of mutual trade, which was halted between 1994 and 1996, is now beginning to gather strength. The trade and economic relations between the CIS countries are taking place almost exclusively on a bilateral basis, the conditions of cooperation between each pair of countries being quite different. The trend towards reorientation of foreign economic relations of most of the CIS member states to third countries is gaining strength. In 1997 alone the share of these countries in the total exports of the Commonwealth increased on average from 72% in 1996 to 73%, and imports from 56% to 61%. In 1997 out of 12 CIS countries only three (Belarus, Kyrgyzstan and Republic of Moldova) carried out most export and import transactions with partners from the Commonwealth.

Actual trends in the development of the CIS are reflected in the increasing fragmentation of the economic (and political) space of the Commonwealth and in the creation of a number of regional groups each of which is composed of the CIS member states. They include in particular:

«Union of Four» (Belarus, Kazakhstan, Kyrgyzstan, Russian Federation) founded in 1996;

Union of Russia and Belarus founded in 1997;

Central Asian Union (Kazakhstan, Kyrgyzstan, Tajikistan and Uzbekistan) founded in 1994;

Treaty on Strategic Partnership between Georgia, Ukraine, Azerbaijan and Republic of Moldova (GUAM), which presents an interest in that it has a pronounced «energy» aspect. One of the goals of this Treaty is to promote diversification of foreign energy supply sources and itineraries for transit of energy resources.

Despite all problems and difficulties in mutual relations between the CIS countries, they continue to be strongly interdependent in the area of economy and energy and it would be erroneous to ignore this fact.

Today the «centre of gravity» in mutual relations between the CIS countries in the area of economy and energy has moved to the level of economic entities (at present almost all Russian foreign trade operations with its partners from the Commonwealth are, in particular, carried out through direct channels). Transformation of entrepreneurial structures into a predominant driving

force of economic rapprochement of CIS countries is an imperative. In this respect it should be noted in particular that transnational structures of the Commonwealth member states – international financial and industrial groups (FIG), economic associations, corporations and joint ventures, especially in the energy sector – have a great role to play in the strengthening of the economic interaction and, in prospect, in the development of integration processes.

In the field of energy

The current status in the field of energy of the Commonwealth member states is characterised by: considerable decline in volumes of production (Table 2) and consumption of fuel and energy resources (FER); increase in excessive energy productive capacities; disruption of links between elements of the single fuel and energy complex which functioned on the territory of the former USSR; ageing of technological equipment used in fuel branches of industry and electric power sectors; lack of investments and crisis of non-payments for the fuel and energy consumed.

Table 2
Production of primary energy resources in CIS countries in 1997 as compared with 1990

Country	Solid fuel, Mt		Oil and condensate, Mt		Gas, Bcm		Nuclear power,TWh		Renewable sources, TWh	
	1990	1997	1990	1997	1990	1997	1990	1997	1990	1997
Azerbaijan	0	0	12.5	9.1	9.9	6.2	0	0	1.7	1.6
Armenia	0	0	0	0	0	0	0	1.62	1.38	1.55
Belarus	0	0	2	1.82	0.28	0.24	0	0	0.02	0.02
Georgia	0.96	0.005	0.186	0.1	0.06	0	0	0	6.5	6.1
Kazakhstan	131.6	72.6	25.8	25.8	7.1	8.1	0	0	6.8	6.7
Kyrgyzstan	3.74	0.5	0.155	0.1	0.09	0.02	0	0	13.4	12,6
Republic of Moldova	0	0	0	0	0	0	0	0	0.3	0.4
Russian Federation	395	244	516.3	306	640.6	571	118	108	167	158
Tajikistan	0.475	0.01	0.144	0,03	0.111	0,04	0	0	15.8	13.7
Turkmenistan	0	0	5.642	4.7	87.8	17.3	0	0	0.01	0.01
Uzbekistan	6.48	3	2.81	7.9	40.8	50.4	0	0	6.2	6.8
Ukraine	164.8	76.3	5.249	4.1	28.08	18.1	76.2	79.4	11.8	15.2
TOTAL	703	396	571	359.7	815	671	194	190	221	223

Energy resource base. The resource base of the energy sector of the Commonwealth as a whole is sufficient to meet to the full the requirements of its members in fuel and energy both at the actual stage and in the foreseeable future (Table 3).

Table 3
Proven reserves of mineral fuels and hydro-energy potential of the CIS countries as of the beginning of 1998 (estimates of the International Energy Council)

Country	Coal, Mt	Oil, Mt	Gas, Bcm	Hydraulic potential, TWh	
				Operating	Economic
Azerbaijan	0	161	900	16	7
Armenia	0	0	0	9	6
Belarus	151	28	3.5	3	0.9
Georgia	400	5	8	68	32
Kazakhstan	34,000	2,890	1,841	63	30
Kyrgyzstan	895	5	6	99	55
Republic of Moldova	0	0	0	1	1
Russian Federation	157,010	6,654	47,700	1,670	850
Tajikistan	390	2	6	527	264
Turkmenistan	0	75	2,860	5	2
Uzbekistan	3,127	81	1,875	27	15
Ukraine	34,356	217	1,121	24	19
TOTAL (rounded)	230,331	10,203	56,330	2,510	1,280

Note:

1. *This table contains data from the Handbook of the World Energy Council (WEC) «Survey of Energy Resources» (1998), as most of national submissions do not contain information on resource base.*

2. *According to the WEC terminology handbook «Energy Dictionary» (1992), the proven reserves of mineral fuels mean the estimated quantities at a specific date, which analysis of geological and engineering data demonstrates with reasonable certainty, to be recoverable in the future from known deposits under the economic and operating conditions at the same date.*

3. *According to the WEC handbook «Survey of Energy Resources» 1998, the technically available hydraulic energy potential means that part of the theoretical hydraulic energy potential, the realisation of which is limited to operating capacities available at present. Hydraulic energy potential, which is economically recoverable, represents that part of the technically available potential, which can be recovered under local economic conditions (without taking into consideration possible limitations due to social and economic conditions).*

4. *The WEC estimates of proven oil reserves (including gas condensate) in the Russian Federation contained in the table do not conform to the calculations by the Russian Ministry for Fuel and Energy as, in its opinion, they amount to 13% of the world reserves or 19 billion tons.*

Oil and oil-refining industry. The decline in production of oil over the past period under review amounted to 37%, mainly as a result of decrease in its production in the Russian Federation. The most satisfactory situation is observed in the oil sector of Uzbekistan where the oil output was successfully raised from 2.8 million tons in 1990 to 8 million tons in 1997. This country has renounced any oil import whatever. Kazakhstan has overcome the decline in oil production and

reached the pre-crisis level. This was possible mainly thanks to the skilful policy aimed at attracting foreign investors in the oil industry. Identical efforts are being made by Azerbaijan.

The oil industry of almost all CIS countries (and, in the first instance, in the Russian Federation where a number of vertically integrated companies are established) has undergone a period of privatisation by creating joint stock and state companies, including ones with the involvement of foreign capital.

Almost all CIS countries are facing the situation where oil producers consider it more profitable to sell crude petroleum, and recently oil products as well, on international markets than on domestic ones. The consequence of this policy has been the motor fuels crisis that was observed in 1998-1999 in the Russian Federation and Ukraine.

The oil-refining industry of the CIS with a potential amounting approximately to 12% of the world capacities is characterised by the low technological level of its equipment. The degree of oil refining at the refineries of the CIS countries does not as yet exceed 63%, although over the last eight years some progress has been achieved in terms of improving this indicator. It can be noted, for comparison, that in western industrial countries this indicator reaches between 85 and 90%.

During the last few years the annual rate of decline in degrees of refining has amounted to approximately 6%. Moreover, the working load of refineries within the territory of the CIS averages at present not more than 60%.

Gas industry. Natural gas output in the CIS countries between 1990 and 1997 fell by 18%, in the Russian Federation this decline amounted to 11%. The most considerable decrease in production is observed in Turkmenistan where its level decreased by a factor of more than 5 because of difficulties with the realisation of Turkmen gas outside the country. This decline in production is the result of a decrease in solvent demand for gas on domestic markets of the Commonwealth member states. Uzbekistan and Kazakhstan succeeded by 1997 in raising the level of natural gas output. Despite the decline in absolute figures of demand for gas, the increase in the share of gas in national energy balances is observed in all CIS countries. In the Russian Federation the share of gas in the total consumption of primary energy resources amounts to more than 50% and in its European part to more than 70%.

The export of natural gas from the CIS countries to third countries between 1991 and 1997 not only did not decline but also even rose by 12%.

Coal industry. In 1997, as compared with 1990, the production of solid fuels (mainly coal) in the CIS declined by 45%. The strongest influence on this decline in coal production was exerted by the crisis in the Russian coal industry (decrease in production by 59 million tons), in Ukraine (by 95 million tons or 2.3 times) and in Kazakhstan (by 59 million tons). The coal output in Georgia, Kyrgyzstan and Tajikistan has been virtually curtailed. The main reason for this crisis in the coal industry resided in the drop of efficiency of production and lack of demand in the context of competition with other types of fuels. Today, measures aimed at reconstructing the coal industries are being taken in the Russian Federation, Ukraine and a number of other CIS countries but for the time being they have failed to produce any result.

Electric power. Annual electric power generation in the CIS countries over the period 1990-1997 declined by 28%, mainly as a consequence of a decrease in demand. Production of electricity by nuclear power plants remained virtually unchanged, although it diminished somewhat in the Russian Federation and increased in Ukraine. The Armenian nuclear power plant resumed

operation after having been stopped in 1988 for reasons of seismic hazards. Production of electric power by hydropower plants of the CIS countries remains invariable; their specific weight in the structure of electric power output has risen slightly. Nevertheless, the main part of all electric power in the CIS is produced by thermal power plants.

Unstable links between the electric power supply systems of the CIS countries have an adverse impact both on reliability and quality of electric power supply to consumers and operation of the systems themselves. As a consequence, in a number of the CIS countries some accidents of systems have occurred entailing a fan-like switching-off of consumers. Lack of investments is restraining renewal of productive assets.

General development of the situation on the energy markets of the CIS. The total production of primary energy resources as a whole within the framework of the Commonwealth decreased by more than 20%, mainly as a result of a decline in solvent demand inside the CIS. This situation was influenced not only by the increase in prices for energy resources on domestic and international markets but also by a rather difficult situation of consumers being unable to pay increasing prices for the energy resources supplied to them. The drop of energy consumption would have been even more significant if the supplies of energy resources had been affected strictly against their payment. However a «soft» policy on domestic markets of energy resources in the CIS countries aggravated the problem of non-payments for supplied energy resources.

At present, the distinctive feature of the situation is that all main types of energy resources, exports outside the territory of the CIS exceed significantly (for coal by 9 times, for oil by more than 2 times, for electric power by 1.2 times) the volume of inter-state trade in energy products of fuel and energy complexes.

Non-payments are one of the major barriers to the development of cooperation between the CIS countries in the area of energy. They create a somewhat negative background for the evaluation of existing possibilities to implement one or another energy balance scenario and thereby adversely affect the level of collective energy security of the Commonwealth.

Table 4
Foreign trade in primary energy resources between the CIS countries (as at 1997)

Country	Coal, Mt		Oil, Mt		Gas, Bcm		Electricity, TWh	
	Import	Export	Import	Export	Import	Export	Import	Export
Azerbaijan	0	0	0	3	0	0	1.3	0.6
Armenia	0	0	0.433	0	1.445	0	0.008	0.124
Belarus	0	0	10.44	0.4	16.4	0	7.7	0
Georgia	0.006	0.001	0	0	0.93	0	0.5	0.7
Kazakhstan	0	22.6	0	15.5	2.9	3	8.6	1.7
Kyrgyzstan	0.35	0.102	0.115	0	0,982	0	3.8	6
Republic of Moldova	0.45	0	0	0	3.275	0	1.6	0
Russian Federation	0	2	6	126	3	192	10.4	31.7
Tajikistan	0	0	0.39	0	0.7	0	2	3.4
Turkmenistan	0	0	0	0	0	13.6	0	1.5
Uzbekistan	0	1	0	0	0	4.6	6.7	5.7
Ukraine	9.0	2.2	9.0	0	63.8		0	4.4
TOTAL (rounded)	10	25	26	145	90	212	43	51

It is in the energy sector that the bulk of receivables and payables accumulated in accounts between CIS countries are concentrated. Being confronted with the problem of non-payments, many companies of the energy complex and those servicing its branches were on the verge of bankruptcy. Particularly enormous debts of the CIS countries vis-à-vis the Russian Federation concern natural gas deliveries.

The solution to this problem requires the development of other forms and instruments of debt repayment, including accounting systems providing for use in the territory of the Commonwealth member states of securities and bonds, debt - property swaps etc.

As has been noted, many CIS countries (especially Ukraine, Belarus and Republic of Moldova) continue to be dependent to a large extent on imports of energy resources from the Russian Federation, where they purchase a significant part of fuels and energy for their consumption. The possibility of finding new sources of energy for them in the near future seems problematic. The Russian Federation, as well as other energy exporting CIS countries, is interested in sustainability of domestic energy markets within the framework of the CIS.

Deliveries from Turkmenistan are traditionally used to meet the large part of requirements of Ukraine, Georgia and Armenia in natural gas. Deliveries of energy resources from Uzbekistan and Kazakhstan are vital for the economies of Kyrgyzstan and the Republic of Moldova. From the economic and technological point of view the Russian Federation is closely linked to Ukraine, Belarus and Kazakhstan. The coal of the latter is used for major thermal power plants in the Ural region.

With a view to resolving problems accumulated in the energy sector, the CIS countries are seeking new forms of a solution acceptable to all parties concerned. It should be noted that efforts to implement a single «top-down» energy policy through state structures have for the time being failed to produce any tangible results.

By associating companies of fuel and energy complexes of various CIS countries, which are closely linked or «joint» to each other, the transnational structures are strengthening these links through establishing property relations, thereby instituting a single economic interest. Taking into account that integration decisions made on the inter-state level frequently remained on paper simply because they did not coincide with the interests of particular companies, which had to implement them, this fact is of particular importance for the economic rapprochement of the CIS countries in general and for cooperation in the energy area in particular. In the framework of the transnational structures the price regulation and account management may be significantly simplified and homogeneity of economic conditions may be achieved. It certainly would contribute to the general harmonisation of these conditions in partner countries.

Within the framework of the Commonwealth fuel and energy complex more than 30 transnational companies, corporations and joint ventures have been established: These structures are operating in the Russian Federation, Ukraine, Belarus and Kazakhstan. Such companies as the oil company Lukoil, joint-stock association Gazprom and oil company Rossneft (Russian Federation), State oil company Munaigaz (Kazakhstan), joint-stock company Ukrgazprom (Ukraine), State oil company of Azerbaijan and joint-stock company Gruzenergo (Georgia) are taking most active part in the establishment of transnational corporations within the framework of the fuel and energy complex. It is planned to establish two Russian-Belarusian financial and industrial groups with the participation of Russian oil companies and Belarusian refineries.

Several inter-state companies have been established in industrial sectors cooperating with the

fuel and energy complex: manufacture of gas pipes with protective coating (Russian Federation, Ukraine, Kazakhstan), manufacture of oil pipes (Russian Federation, Azerbaijan, Ukraine, Kazakhstan), etc.

Apart from resolving the problems of cooperation in the energy area, the CIS countries are setting themselves as an objective to ensure national energy security and strengthen links with foreign energy markets. Thus, most of the CIS countries have drastically reduced their purchases of energy resources on external markets and some of them have renounced buying any resources whatever (see Table 4). As a rule, this is being done in an effort to reduce the external debt of the state. For example, Azerbaijan has completely renounced, as required by the International Monetary Fund, purchasing natural gas and Uzbekistan importing oil and oil products. Ukraine has considerably increased the level of self-reliance on its own energy resources and, as a result, diminished the purchase of energy. It is important to emphasise that, in contrast to the policy of the IEA member countries, measures aimed at energy conservation, which are being taken by all CIS countries, have failed to exert any influence whatever on these processes.

Those CIS countries, which have a surplus of energy resources, are striving to find an exit to world energy resource markets with a view to earning guaranteed profits in hard currency and carrying out independent foreign trade policy. For the Russian Federation (major exporter of energy resources among the CIS countries) it means in the first place expansion of oil and natural gas deliveries in west European countries. For Kazakhstan, Azerbaijan and Turkmenistan it means the implementation of projects related to oil and gas exports outside the CIS.

The situation with the production of crude hydrocarbons in the basin of the Caspian Sea is the most striking example of efforts deployed by the states of this region with a view to finding external markets for their own energy resources. Although it is unlikely that the Caspian region could become a «new Middle East», most foreign experts believe that there the reserves of hydrocarbon resources are of the same order as in the North Sea region. Thus, the hydrocarbons in the Caspian basin are viewed as a significant factor on the world energy market. It means that this region will draw attention and attract resources of international financial, technological and, finally, political structures determining the development of world energy markets.

In 1997 total consumption of primary fuel and energy resources in the CIS averaged 1,260 million tce. and production of these exceeded 1,700 tce, in other words 440 million tce more than CIS domestic requirements. It can be expected that production of primary fuel and energy resources exceeding domestic requirements inside the CIS will continue.

At present oil deliveries from the CIS countries account for 9% of world trade, and network natural gas accounts for approximately 27%.

1.2. FORECAST ESTIMATES FOR PRODUCTION AND CONSUMPTION OF FUEL AND ENERGY RESOURCES

Forecast of economic development of the CIS countries

Analysis of the trends in development of the main economic, social and resource characteristics with due regard for development of the situation on world energy markets permits several scenarios of economic development of the Commonwealth member states to be worked out.

The main scenario provides for economic development of the CIS towards overcoming

recession and re-establishing an acceptable production level through an extended selective support to companies and more favourable conditions for investments (mainly from national sources) along with reliable inflation control and further development of the legislative, economic and organisational framework of market economy.

According to this scenario, the decline in economic output in most of the CIS countries will continue at least up to 2000; production may be successfully stabilised between 2000 and 2003; after this stabilisation, the economy will undergo a relatively rapid recovery and a consequent increase in economic output with annual rates between 2.5% and 3%. This scenario provides for the re-establishment by 2020 of the pre-crisis average standards of living and, respectively, average level of the gross domestic product.

The national projections of the CIS countries in the energy area are in line with the main provisions of the economic development scenario analysed in Chapter 2 except for several aspects.

The alternative scenarios differ mainly in the extent and the rates of integration of the CIS energy exporting countries in the world energy market, on the one hand, and on the other hand in the evaluation of influence exerted by the European energy market situation on energy exporting and energy importing countries.

The energy exporting CIS countries, i.e. Russian Federation, Kazakhstan, Azerbaijan, Turkmenistan and, to a certain extent, Uzbekistan, are expecting, according to the optimistic projections, a steady increase in demand on the international markets for their energy resources along with, in prospect, high prices for them which would allow these countries to gain additional receipts, mainly from the oil and gas exports and, thereby, ensure a more rapid GDP growth rate compared with the energy importing CIS countries, a considerable increase in living standards of their populations and attraction of foreign investments. As to the energy importing countries they see favourable conditions for their future development in the low level of the world prices for energy resources, expecting in this relation a decline in pressure on their expenditure budgets assigned for imports of energy resources.

For the CIS countries, which set themselves the objective of overcoming the crisis in the next 2 to 4 years, the world economic crisis and the risk of decline in prices for energy resources, as well as measures taken by developed countries aimed at protecting their markets, cause a decrease in demand for their produce, including energy resources. It allows an evident conclusion to be drawn, that in the near future it would be necessary to take radical measures with a view to re-establishing economic links between the CIS countries, ensuring thereby a sustainable merchandise, capital and labour markets and a market of technologies as a means of overcoming the economic crisis and restoring the living standards of the populations. In a strategic prospect, the first and foremost task consists in raising energy efficiency, the main problem being a decrease in the energy component in the production costs and improving the quality of products.

Forecast estimates for energy development in the CIS

According to the scenario of economic development under review and the variants of energy conservation and export and import policies, the projected domestic demand for energy resources up to 2010 permits one to presume that by the end of the period under review it will grow, as compared with 1997, for the CIS as a whole by 17% (Table 5). The most rapid rates of energy consumption growth are expected in Georgia, Armenia, Turkmenistan and Ukraine, while in the Russian Federation and Belarus, according to projections, they will be the lowest. It is supposed that in the Russian Federation, Belarus and Kazakhstan the active increase in energy consumption

will start only after 2000 with the outset of economic recovery. For most of the CIS countries the projections provide for a moderate growth of energy consumption with an annual rate averaging 0.8% to 1.0%. It is important to emphasise that none of the CIS countries is expecting to achieve by 2010 the pre-crisis levels of energy consumption. With a more rapid GDP growth rate in comparison with the rate of energy consumption, it should be possible to expect a decline in the indicators of energy intensity of gross domestic product for the CIS as a whole with the average levels of 1990 being reached by the end of the period under review.

Table 5
Forecast of requirements in primary energy resources for domestic needs of the CIS countries, million tce.

Country	1997 (actual)	2000 (forecast)	2010 (forecast)
Azerbaijan	18.8	22	25
Armenia	3.4	3.77	5.44
Belarus	36.8	34	42.3
Georgia	2	5	8
Kazakhstan	52.2	57.2	73.8
Kyrgyzstan	3.8	4.4	6.9
Republic of Moldova	6	7	10
Russian Federation	890	861	928
Tajikistan	6.4	7	10
Turkmenistan	17.2	20	35
Uzbekistan	71.4	75	83
Ukraine	165.7	180.8	241.4
TOTAL	1,272	1,277	1,469

Oil and oil-refining industry. According to calculations and expert estimates, the aggregate output of oil and gas condensate in the CIS countries in 2010 can amount to some 410 million tons, that is 50 million tons more than in 1997 (Table 6). After a relatively long period of decline in oil production, which will probably continue up to 2005-2010, the Russian Federation nevertheless intends to ensure production of this energy resource in a volume of not less than 255 million tons. Two other main producers - Azerbaijan and Kazakhstan – expect to achieve by 2010 a steep rise in oil production: up to 45 and 75 million tons, respectively, against 9 and 26 million tons, respectively, in 1997. If this to be achieved then the Russian share in the total oil output will fall from 85% in 1997 to 62% in 2010.

Table 6
Forecast of oil production, including gas condensate, million tons

Country	1997 (actual)	2000 (forecast)	2010 (forecast)
Azerbaijan	9.1	14.3	45
Armenia	0	0	0
Belarus	1.8	1.84	1.1
Georgia	0.1	0.3	0.5
Kazakhstan	25.7	33.5	88.6
Kyrgyzstan	0.1	0.1	0.3
Republi of Moldova	0	0	0
Russian Federation	306	299	256
Tajikistan	0.003	0.06	0.12
Turkmenistan	4.7	6	10
Uzbekistan	7.9	9	11
Ukraine	4.1	4.1	5.4
TOTAL (rounded)	360	369	414

The outlook for net oil exports from the CIS countries is for a continuing decline by 2000 to 70-76 million tons, followed by an increase that will restore the Commonwealth's export potential to the pre-crisis level registered in the former USSR. The export of oil products outside the CIS will probably undergo less of a change than crude oil: it may grow from 46 million tons in 1997 to 50-80 million tons by the year 2010.

The increase in the degree of oil refining and in the quality of oil products is a priority for most oil refineries located in the territory of the CIS. If all modernisation programmes are implemented successfully, then the production of untreated gasoline in the CIS by 2010 may reach 65% and the share of produced diesel fuels with sulphur content of 0.2% or less will amount to 85%.

Another direction in which the oil production industry may develop is the construction of small-scale oil refining plants and mini-refineries. The Governments of several CIS countries have supported the projects related to the development of such enterprises.

Gas industry. The Russian Federation and most CIS countries assign a leading role to natural gas in solving future energy and environmental problems. Being the most ecologically clean kind of energy fuel, characterised by a high level of regulation and monitoring of all processes related to its production, transportation and consumption, natural gas has long since played an important part on the CIS energy market as an irreplaceable fuel.

The availability of enormous reserves of natural gas in the Russian Federation and some other CIS countries holds out the hope of a successful development of this industry. During the next 15 years the production of gas in the CIS countries will grow considerably (Table 7), mainly thanks to the increase in gas production in the Russian Federation, Turkmenistan and Kazakhstan. In general, gross production of natural gas in the CIS countries by year 2010 will rise by approximately 37% as compared with 1997.

Table 7
Forecast of natural gas production, Bcm

Country	1997 (actual)	2000 (forecast)	2010 (forecast)
Azerbaijan	6.2	7.4	14.8
Armenia	0	0	0
Belarus	0.24	0.24	0.21
Georgia	0	0	0
Kazakhstan	7.1	7	13
Kyrgyzstan	0.02	0.03	0.05
Republic of Moldova	0	0	0
Russian Federation	571	586	714
Tajikistan	0.4	0.12	0.17
Turkmenistan	17.3	36.7	75.2
Uzbekistan	50.4	51.3	55
Ukraine	18.1	18.5	24.5
TOTAL (rounded)	680	708	900

The possibilities of gas output in the Central Asian region of the CIS exceed the projected domestic requirements of this region. However, the use of the gas surplus for exports in adjacent and more distant countries may face some difficulties. The transportation of the gas from this region to other CIS countries may require the construction of new trunk pipelines, since the existing ones do not possess the required reserve throughput capacities. Furthermore, the trunk gas pipelines now in operation are in need of costly reconstruction and upgrading.

New markets in Pakistan, India and China may offer a separate export opportunity for gas recovered in the Central Asian CIS countries. According to the available expert estimates, the gas output in the CIS as a whole by 2010 will exceed domestic requirements (Table 8) by almost 170 Bcm.

Table 8
Forecast of domestic requirements in gas, Bcm

Country	1997 (actual)	2000 (forecast)	2010 (forecast)
Azerbaijan	8.2	8.6	12
Armenia	1.445	1.656	4.5
Belarus	16.6	18.5	25.0
Georgia	0.8	2	2.5
Kazakhstan	7.1	7.5	10.5
Kyrgyzstan	0.7	0.7	1.0
Republic of Moldova	3.5	3.6	3.9
Russian Federation	382	439	515
Tajikistan	1	1	2
Turkmenistan	3.7	9	12
Uzbekistan	45.8	49	54
Ukraine	81.9	85.0	74.2
TOTAL (rounded)	550	626	717

Coal industry. Despite the difficult situation in the coal industry, in a distant prospect all CIS countries possessing explored coal reserves forecast a sustainable growth in output of this fuel (Table 9). One exception is Kazakhstan, where it is planned to decrease the coal output over the period extending up to 2010 by 12 million tons compared with 1997. The Russian Federation will be able to mine between 245 and 250 million tons of hard and brown coal by the end of the forecast period or more than 51% of the total output in the CIS. The scenarios studied indicate that the CIS countries will, by the end of this period, be able to meet their coal requirements (Table 10) without resorting to imports from outside the Commonwealth. The Russian Federation will continue to play a particularly important role in this regard affording a solid foundation for the entire CIS coal market. At the same time, the Commonwealth countries may restore their coal potential provided that new markets for coal emerge outside the CIS.

Table 9
Forecast of coal production, Mt

Country	1997 (actual)	2000 (forecast)	2010 (forecast)
Azerbaijan	0	0	0
Armenia	0,008	0,009	0,01
Belarus	0	0	0
Georgia	0.005	0.4	0.6
Kazakhstan	72.6	65	87.4
Kyrgyzstan	0.5	0.5	2.0
Republic of Moldova	0	0	0
Russian Federation	244	230	250
Tajikistan	0.01	0.8	1.1
Turkmenistan	0	0	0
Uzbekistan	3	2.5	2.3
Ukraine	76.3	85	100
TOTAL (rounded)	400	387	444

Table 10
Forecast of domestic requirements in coal, Mt

Country	1997 (actual)	2000 (forecast)	2010 (forecast)
Azerbaijan	0	0	0
Armenia	0,008	0,009	0,01
Belarus	0.81	0.6	0.3
Georgia	0.2	0.5	0.7
Kazakhstan	49.2	47	66.4
Kyrgyzstan	0.7	2.3	3.5
Republic of Moldova	2	2	1.3
Russian Federation	242	225	245
Tajikistan	0	0.1	0.5
Turkmenistan	0	0	0
Uzbekistan	2	3	7
Ukraine	72.7	117	130
TOTAL (rounded)	369	397	456

Electric power. Electricity consumption in the CIS countries as a whole will undergo stable growth: by 2010, as compared with 1997, the total electricity consumption will rise by 280 billion kWh (Table 11). The Russian share in the total consumption will fall from 67% in 1997 to 63% in 2010. Ukraine, the second largest consumer of electricity among the CIS countries, will consume 18% in 2010 as against 15% in 1990. The most rapid rate of consumption growth is expected in Armenia, Georgia, Kazakhstan and Turkmenistan, and in terms of absolute growth – in the Russian Federation.

Table 11
Forecast of electricity consumption, billion kWh

Country	1997 (actual)	2000 (forecast)	2010 (forecast)
Azerbaijan	15.5	19	23
Armenia	5.48	6.15	9.1
Belarus	33.7	35	43
Georgia	7.4	9.5	12
Kazakhstan	56.5	51.5	66
Kyrgyzstan	8.6	9.3	12
Republic of Moldova	4.8	6	8
Russian Federation	814	798	930
Tajikistan	14.1	14.4	15
Turkmenistan	7.9	8	14
Uzbekistan	43	45	53
Ukraine	177.8	185	240
TOTAL (rounded)	1192	1179	1426

An increase in electric power generation (Table 12) is expected in all CIS countries. It should be noted that under the likely scenario electricity production in the Commonwealth countries would only slightly exceed the levels attained in 1990.

Table 12
Forecast of electric power generation and installed capacity

Country	1997 (actual)		2000 (forecast)		2010 (forecast)	
	TWh	ths MWh	TWh	ths MWh	TWh	ths MWh
Azerbaijan	17.7	5.1	19.7	5.1	31.4	7.1
Armenia	6.03	3.2	6.2	3.2	9.0	3.7
Belarus	26.1	7.41	27	7.7	41	8.5
Georgia	7.4	4.6	9.2	4.7	11.5	6
Kazakhstan	52	18.24	49	19	71	20.36
Kyrgyzstan	12.5	3.6	13	3.8	15	4.2
Republic of Moldova	4.69	3.01	6.3	3.2	9.5	5
Russian Federation	834	216	818	217	955	230
Tajikistan	14	4.4	14.4	4.4	16.5	5
Turkmenistan	9.4	2.53	8.8	2.5	25.5	7
Uzbekistan	45.5	54.2	48	54.2	58	57
Ukraine	178	55	190	56	250	60
TOTAL (rounded)	1210	379	1267	381	1504	414

Some CIS countries are very seriously considering the possibility of developing nuclear power, but mainly beyond the period under review. Before 2010, the Russian Federation and Ukraine will be the only CIS countries to produce electricity from nuclear fuel. These countries are very cautiously planning a slight growth of electric power output at nuclear power stations after 1999. As a result, nuclear power as a proportion of the primary energy resources produced in the CIS countries will stand at 3.3% as against 2.4% in 1997.

Hydropower plays a modest role in the overall CIS energy balance. At the same time it is an important component in the fuel and energy balances of Kyrgyzstan and Tajikistan. Virtually all CIS countries seriously intend to develop their hydropower potential. More than 70% of total hydro-electricity output comes from the Russian Federation. It is likely that this proportion will not change significantly up to 2010.

Non-traditional energy. Non-traditional energy represents a sub-industry of the fuel and energy complex, producing electricity, thermal energy and fuels through transformation of so-called non-traditional renewable sources of energy (NRSE).

The World Energy Council defines NRSE as follows: «Known and assumed, naturally occurring, continuously renewed energy resources, that are either already of economic value or whose economic value may be assumed to be realised within the foreseeable future».

The NRSE include solar radiation, energy of biomass, wind, geothermal and ocean energy (i.e. tidal energy, wave energy and energy of difference in temperatures between superficial and profound water layers), energy of small waterways, low potential heat dispersed in environment (some countries include in the latter secondary low potential thermal resources).

At present, the CIS countries are exploiting or are considering the possibility of exploiting in the first place energy of small waterways and biomass, as well as solar, wind and geothermal

energy.

A common point, virtually for all Commonwealth countries, is the efforts to integrate NRSE in their energy balances, first of all for energy supply of populations living in the territories remote from centralised supply systems, which do not possess the required quantities of conventional energy resources, and for the economy in expensive and imported organic fuels, as well as the endeavours to reduce ecological pressure or, in other words, to limit the adverse impacts of fuel and energy complex and energy consumers as a whole on the environment.

Unfortunately there is another common point for the CIS, which consists in a serious lag of the Commonwealth in general and all its members in particular, compared with many countries in terms of exploitation of NRSE.

Ukraine is the only country to have a solar power plant of 5 MW built as far back as at the time of the USSR, while in the USA the aggregate power of such plants as of the beginning of 1997 amounted to 330 MW. The CIS has virtually no solar plants operating on photoelectric converters, and, for example, in Japan their aggregate power amounts to 38 MW, in India – to 23 MW and in Germany – 17 MW. There are many plants of this kind in South America, Mexico, Italy, Spain, Switzerland and in another 32 countries of the world. In the Russian Federation, modern technologies used for the manufacture of photoelectric converters of various types are developed and mastered. In the CIS countries, unique technologies and equipment for the practical use of geothermal energy sources and energy of small waterways are being created. Some progress has been achieved in the area of wind energy. However, in the CIS countries none of these NRSE was as widely adopted as in other countries. For example, all requirements of Island in electric power and thermal energy are met from geothermal energy sources and, partly, from exploitation of small waterways.

It seems desirable for the CIS countries to intensify the exchange of experience in the area of NRSE utilisation and work out national programmes related to NRSE development for the period extending up to 2005 and beyond.

Taking into account the importance of NRSE for addressing social, environmental and energy issues, as well as their potential role in strengthening energy security at the national level, all CIS countries are providing in their plans for extensive construction of power plants using NRSE (see Part II of the Analytical report containing a brief review and prospects for the development of non-traditional energy in each CIS country).

1.3. SCIENTIFIC AND TECHNOLOGICAL COOPERATION BETWEEN THE CIS COUNTRIES IN THE ENERGY SPHERE

The general concept of energy security of the CIS countries should provide for every kind of scientific and technological cooperation in the energy sphere.

The goals of this cooperation are as follows:

- radical improvement in the economic and energy efficiency at all stages of extraction (production), transformation, transportation, distribution, storage and final consumption of energy resources;

- development and application of qualitatively new technologies and methods of use of non-traditional and renewable sources of energy;

- security of energy sources in terms of environmental and accident hazards and reliability of energy and fuel supply systems.

In connection with the determining influence of energy on the economic development of the CIS countries and social conditions of life there is a necessity for continuous analysis of the situation and technological achievements applied in the fuel and energy sector, as well as more substantiated state strategies introducing new equipment and high technologies for the development of this sector with a view to carrying out structural adjustment and ensuring accident-free and ecologically acceptable work of the companies and facilities of the fuel and energy complex.

One of the most important actions in this sense may consist in the creation of a single technological space in the energy sphere within the territory of the Commonwealth. Solution of this problem requires:

- formulation and coordination of policy in the field of science and technology, as well as scientific, regulatory, informational, financial, economic and organisational framework of technological cooperation in the area of energy and energy conservation;

- identification and coordination of common priorities in the field of technological cooperation in this sector;

- extension of technological cooperation in carrying out joint projects and programmes related to energy and energy conservation;

- establishment of sustainable technological links among the CIS countries in the area of energy in general and energy conservation in particular, with the involvement of transnational financial and industrial groups, venture companies and venture capital firms with the participation of developers themselves, potential manufacturers and users of new produce, demonstration zones, technological parks and technological policies.

The scientific and technological policy related to structural adjustment and technological renovation of the fuel and energy sector in the next 2–3 years should be targeted to projects and programmes, which could be implemented within a short time frame, require small investments and ensure rapid output. It should basically aim at improving the existing equipment in the fuel and energy complex.

At the next stage it would be necessary to speed up the use of new technologies applicable to different branches of industry, as well as development and use of equipment meeting international standards.

This work requires a new organisational and financing framework of scientific and technological research and fundamental investigations.

Within the framework of existing research institutions and design offices, it would be necessary to establish inter-state advisory centres dealing with energy issues.

Some positive experience has already been acquired. The Programme of Cooperation between the CIS countries related to the use of natural gas as a motor fuel which, according to plans, should be completed by the end of 2000, is sufficiently well advanced. The Programme «Highly Reliable Pipeline Transportation» has received a new powerful backing. The Russian Federation and Ukraine are taking an active part in implementation of these Programmes.

CHAPTER 2

CURRENT STATUS AND IMPLEMENTATION PROSPECTS FOR ENERGY CONSERVATION POLICY IN THE CIS COUNTRIES

2.1. ENERGY INTENSITY OF THE ECONOMY

In 1997, as compared with 1992, energy intensity of gross domestic product of the CIS countries, calculated with the use of purchasing power parities as a ratio of the aggregate domestic consumption of primary energy resources per unit of GDP, remained virtually unchanged (although there are other estimates, according to which in 1997, as against 1992, GDP energy intensity in the CIS increased by around 20%), being several times higher than the average indicator for member countries of OECD. This gap is even more pronounced in comparison with the member States of the European Union.

In 1997 GDP of the Commonwealth as a whole amounted to only 70% as against 1992. Between these years many CIS countries registered until 1995 an increase in the rate of energy consumption per unit of GDP and later on - a decline following a decrease in the rate of GDP growth and relative stabilisation of the economy. The decline in industrial output and performance of goods and public passenger transport, reduction of fuel and energy consumption for defence purposes and structural changes in the field of industry were the main factors that contributed to this process.

Reduction in GDP energy intensity faced by some CIS countries can be explained by high power requirements in the industrial and communal sectors and cannot be connected with improvement of fuel and energy efficiency.

The high level of energy intensity of GDP in the CIS countries is determined by low technical standards of energy consuming processes and equipment and by the predominance of industries producing energy intensive products in the sphere of material production.

While comparing energy intensity levels of GDP in the CIS countries and OECD* it would, however, be essential to take into account differences in climatic conditions and sizes of territories. More severe climate and enormous territories, in the first place that of the Russian Federation, are objective factors contributing to an increase in energy intensity owing to higher fuel and energy consumption for heating and long distances of goods and passenger services. There is another factor acting in the same sense: the CIS as a whole (and in the first place again Russian Federation) is a major supplier of energy intensive products, in particular natural gas (its transportation), ferrous and non-ferrous metals, chemicals etc.

Today, all CIS countries without exception are pursuing policies aimed at energy conservation, including modernisation of production and increase in its technical level, restructuring of this branch of industry, raising the share of non-energy-intensive production, development of services, reduction in raw material intensity of industrial production, restructuring of exports and imports and decrease in relative share of expenses for defence purposes. All these measures should lead to decreased energy intensity of GDP.

* Consisting of 27 member States from Europe, America, Asia and Oceania.

2.2. ENERGY CONSERVATION POTENTIAL

For any state, a major indicator characterising the efficiency of fuel and energy consumption is the size of its energy conservation potential. At present the CIS countries have accumulated considerable energy conservation potential. An accurate evaluation of this potential, particularly in terms of expenses related to its recovery, and its subsequent realisation should promote the transition of the economies to an energy conservation pattern of development, encourage economic growth and ensure progress in addressing acute environmental issues.

Today, non-used energy conservation potential in the CIS countries amounts to 500 – 600 million tce as compared with 1990. It is calculated as a possible decrease in demand for fuel and energy as a result of implementation of all economically appropriate energy conservation measures.

The recovery of such a huge potential, which exceeds the volume of annual consumption of primary energy resources in the following 12 West European economies: Austria, Belgium, Denmark, Finland, Greece, Germany, Luxembourg, Netherlands, Norway, Portugal, Spain and Sweden all combined, can ensure a considerable increase in energy security of the CIS and each of its members.

The recovery of the energy conservation potential in the CIS countries that are net importers of energy resources will allow the following problems to be solved:

- reduce currency expenses of the state for energy carriers purchase;
- ease the country's dependence on external sources of energy supply;
- improve the competitiveness of industrial products on the domestic and international markets;
- relieve adverse impacts of the energy sector on the environment.

For the CIS countries which are net exporters of energy resources the recovery of the energy conservation potential will contribute, first of all, to the enhancement of the export potential of the energy sector and, hence, to the general improvement of the national economy efficiency.

The fuel and energy complex accounts for around one-third of the total potential of the Commonwealth in the area of energy conservation, housing and communal services for 20-25%, and industry, agriculture, building sector and transport for the remaining part.

Two countries, Russian Federation and Ukraine, account for almost nine-tenths of the estimated total potential of the Commonwealth in the area of energy conservation. This potential in Kazakhstan is estimated at the level of 46 million tce and in Belarus 15 million tce. In other countries it is much less: in the Republic of Moldova 3 million tce, in Tajikistan about 2 million tce and in the remaining countries at the level of 1 million tce or somewhat less. The bulk of this potential is concentrated in industry (fuel and energy complex excluded) and in the fuel and energy complexes of the Russian Federation: 30–37% and 31% and Ukraine: 59–55% and 20–22%, respectively.

It goes without saying that the structure of energy conservation potential broken down by economic sectors for the CIS as a whole is determined by the above-mentioned indicators for the

Russian Federation and Ukraine owing to their largest share (around 90%) in the total energy conservation potential of the Commonwealth.

The third largest sector in terms of energy conservation potential in the CIS countries is the housing and communal sector. The fact that most residential and public buildings lack devices for measurement, control and regulation of heat and gas, as well as rather poor choice and exorbitant prices of energy conservation materials (for example double glazed insulating windows), and frequently low level of inspection related to compliance with the energy conservation standards in force, have created in this sector the energy conservation potential of about 100 million tce or 16-18% of the total.

The transport sector accounts for 7–8% of the total energy conservation potential and the share of agriculture amounts to 6–7%.

2.3. ENERGY CONSERVATION AS A FACTOR IN REDUCING THE AMOUNT OF INVESTMENT IN EXTENSION OF THE PRODUCTIVE BASE OF FUEL AND ENERGY COMPLEXES, CURRENCY EXPENSES FOR IMPORT OF ENERGY RESOURCES AND COSTS OF ENVIRONMENTAL MEASURES

The experience gained shows that energy conservation measures help, to a large extent, to save financial resources required for the work of the fuel and energy sector and for extension of its production, generation and network facilities, for purchases of fuel and energy resources abroad, as well as for prevention and/or liquidation of adverse effects related to this sector. The experience gained in the CIS countries confirms this conclusion.

In the Republic of Belarus annual expenses for the purchase of energy resources abroad amount at present to USD 2 billion (in 1997 they amounted to USD 1.65 billion). This is almost one sixth of GDP, which amounts (according to data for 1997) to USD 13 billion. Thus, it is clear that reducing expenses for imports of energy resources from abroad through energy saving and integration of its own energy resources in the energy balance will contribute to the stabilisation, more sustainable development of the economy of this country and improvement of its energy security. Assuming that the potential of energy conservation amounts to around 30% of the total volume of primary energy resources consumed in the country, the annual saving, through reduction of their imports, may amount to USD 600 million.

The energy conservation measures require, of course, investment expenditures, but their implementation, apart from reducing currency expenses for energy imports, diminishes investments in the development of the energy sector of the country. In the case of Belarus, which does not possess sufficient quantities of highly efficient fuel deposits, annual expenses related to the conservation of energy resources per ton of oil equivalent are now much less than the investments in the equivalent increase in their production. It is particularly obvious with respect to electric power conservation, in so far as the increase in its production requires, besides the rise in gas imports, large expenses for the purchase of energy equipment abroad since this country has no production facilities for its manufacturing. When domestic prices for energy, as in Belarus and some other CIS countries, are several times lower than the world prices, the possibilities of payment for delivery of such equipment are rather problematic.

If we proceed from the assumption that the expected annual electricity consumption will amount to 34 billion kWh and the estimated potential of energy conservation to 15% of this figure, then non-increase in installed capacities of power plants by approximately 1,000 MW will decrease requirements in investments by USD 700–800 million.

However, taking into account required investments in electricity saving which are, according to estimates, 2 to 3 times lower than in the development of electricity generating sources, the reduction of investments in the electricity sector could be estimated at USD 400–500 million.

According to the estimates of experts from Kyrgyzstan, the investments required for the recovery of the economic potential in the field of energy conservation available in that country amount to 4 million USD. If realised, the saving in investments for the extension of production facilities of the fuel and energy complex would also amount to around USD 4 million, and the decrease in expenses for energy imports and the implementation of measures aimed at preventing or containing negative effects of the energy sector (including energy consumers) on the environment would amount to USD 12 and 3 million per year, respectively.

Armenia and the Republic of Moldova have to meet their requirements in energy resources virtually to the full through imports, since their domestic reserves of fuel and energy resources are extremely limited.

According to the estimates of Armenian experts, measures aimed at improving the efficiency of the imported natural gas consumed in the housing sector of this country may ensure its annual saving at the level of 600 thousand tce and the loss reduction within the framework of distribution systems – 150 thousand tce. Moreover, the investments already made or planned in energy conservation measures are considerably lower than the expenses for the purchase of 750 thousand tce that could amount to many tens of millions of USD per year.

In the Republic of Moldova, according to the estimates of the national experts, specific expenses for the implementation of energy conservation measures would amount in the near future to between 25 and 40 dollars per ton of oil equivalent, which is much less than the price to be paid for the equivalent quantity of imported fuel.

The estimates of the Russian experts show that if the current energy conservation potential, which has reached the level of around 40% of the annual consumption of primary energy resources, is to be realised, then the required investment expenditures in the fuel and energy complex alone would be decreased by several billion US$.

Furthermore, energy conservation will help to decrease the expenses for exploration work and increase the competitiveness of national economies. In the Russian Federation investments in energy conservation are 3 to 4 times lower than investments in the corresponding increase in their production and the reduction of its GDP energy intensity by 1% would result in its increase by 0.3%.

According to expert estimates, the recovery of energy conservation potential available in Tajikistan requires investments in the amount of USD 43 million, its economic effects being distributed as follows:

- economy in investments in the extension of the production facilities of the fuel and energy complex – USD 85 million;

- economy in expenses for imports of energy resources – USD 40 million;

- decrease in expenses for environmental measures – USD 10 million.

The expenses for the recovery of the energy saving potential in Ukraine by 2000 are

estimated at 9.6 – USD 10,9 billion, by 2005 this amount will increase to USD 15.5–17.7 billion and by 2010 it will reach USD 20.6–24.05 billion.

Proceeding from the assumption that the annual average of energy resource saving over the period up to 2010 could be estimated at 60 million tce the total saving over the same period would amount to 600 million tce. The cost of this quantity of energy resources on the world market amounts to USD 30 billion. Thus, the economy in currency expenditure for the purchase of required energy resources alone exceeds considerably the amount of investments required for the implementation of energy saving measures.

In Ukraine, a considerable economy through energy conservation measures may be achieved in the environmental area as well, particularly by decreasing expenses for prevention and/or containment of adverse effects of atmospheric emissions by energy producing and consuming facilities (Table 13).

Table 13
Reduction of harmful emissions in Ukraine through energy conservation measures, thousand tons

	Reduction of harmful emissions, thousand tons					
Year	CO_2	CO	NO_x	SO_2	CH_4	Ashes
2000	42,895	32.5	121	375	0.88	262
2005	81,967	62.2	234.7	727	1.68	509
2010	130,064	98.7	377.6	1,170	2.67	819

The prevention of economic losses from environmental pollution in Ukraine through the implementation of energy conservation measures may be estimated at roughly USD 4.5 billion in 2000 and USD 14 billion in 2010. These estimates take into account only the direct impact of pollution on the degradation of environmental conditions.

Considerable economy in investment resources through the recovery of energy conservation potential could be attained in other CIS countries as well. Thus, in Georgia the improvement in operational efficiency of the Tbilisi hydropower plant could decrease expenses for fuel imports by USD 15–20 million per year with the reduction of the CO_2 emissions in the atmosphere by 450 thousand tons per year. The activities for modernisation of the hydropower plants in operation in this country will effect a saving of 2 to 2.5 million tce per year. Based on the expected fuel economy the expenses required for the rehabilitation of the Georgian hydropower plants will pay out in less than 5 years, and even earlier with regard to environmental effects.

As to the CIS as a whole, it would be valid to speak about economic effects from the realisation of the energy efficiency potential amounting to tens of billions of dollars per year, taking into consideration economies in the investments required for extension of the production facilities of the fuel and energy complex (including explorations, as well as production, transportation and transformation of the fuel), the expenses related to the purchase of energy resources and energy equipment abroad and the reduction of negative effects on the environment.

2.4. MAIN DIRECTIONS OF INCREASING THE ENERGY EFFICIENCY OF THE ECONOMY

Despite the peculiarities of the economic structure that took many decades to shape within the framework of the USSR and the different occurrences of resources within the fuel and energy

complexes of the CIS countries, the approach to determining the main directions of increasing the energy efficiency of the economy has many common points.

The greatest importance among energy conservation measures in virtually all CIS countries is attached to the measurement and control of fuel and energy consumption through providing consumers of all categories with corresponding devices and systems. It is quite obvious that without due measurement of energy resources consumed, it is out of the question to talk about the implementation of energy conservation policy.

The common problem for all CIS countries consists in a significant proportion of obsolete, and hence low efficiency, equipment that is used in the fuel production, electric power sector and energy transportation systems. Resolving this problem is also a priority for the CIS countries and will contribute to substantially improving the energy intensity of their economies.

For most of the CIS countries the common direction of improving the energy efficiency of their economies is economic restructuring with a view to increasing the proportion of industries of low energy intensity. The following measures could also play a certain part in the diminishing of energy intensity of industries, aimed at:

improving distribution of productive forces in such a way as to bring large industrial enterprises (first of all energy intensive ones) closer to the energy production centres;

decreasing material intensity of industrial production, improving the quality of the raw material to be processed and reducing industrial wastes;

replacing energy resources of low efficiency at the final stage of energy consumption by more efficient ecologically clean ones.

The key factors of industry-wide restructuring which could ensure energy conservation effects can include the following:

- in the fuel and energy complex: introduction of combined cycle for electric power generation, increase in the degree of oil refining, replacement of oil-based fuels by gas;

- in ferrous metallurgy – increase in correlation of ferrous metal rolled stock production with the total scope of melted steel;

- in the chemical industry: development of the production of synthetic resins, chemical fibres and plastics;

- in the building materials industry: replacement of the wet method of cement clinker production by a dry one;

- in mechanical engineering: streamlining of the metal working machinery park, conversion of industry, wider use of stamped and rolled products;

- in railway transport: increase in electrification and rise of proportion of more powerful electric locomotives etc.

In Georgia, great importance in terms of energy saving policy is attached to both technological and structural factors. An example of their combination may be the development of

autonomous energy plants using highly efficient gas-turbine generator units within the main industrial enterprises, which could effect, according to the estimates of Georgian experts, a significant saving in energy resources.

In the Russian Federation, a certain part of the planned savings in energy resources should be attained through the improvement of production structure, and the rest through the introduction of achievements of science and engineering with the help of technological improvements, realisation of targeted investment policy and implementation of a package of organisational measures.

Thus it may be deduced that the CIS countries are not limiting themselves to just one of the directions in which the energy efficiency of the economy may be improved, and are endeavouring (in any event, they are demonstrating their endeavour) to use as many opportunities available to them as possible.

2.5. REGULATORY FRAMEWORK FOR ENSURING IMPLEMENTATION OF ENERGY CONSERVATION POLICY

The efforts made by the CIS countries in the last few years with a view to establishing a regulatory framework bear witness to their activity in the field of shaping and implementation of energy conservation policy.

Legislative acts on energy conservation are already in force in Belarus, Kazakhstan, Kyrgyzstan, Republic of Moldova, Russian Federation and Ukraine.

In Turkmenistan, an identical draft act is under consideration in the Ministry of Justice, whereupon it will be submitted to the Parliament for approval.

A draft act on energy conservation has been worked out in the Republic of Armenia. Legislative acts in this field are at the drafting stage in Azerbaijan and Tajikistan.

For the time being the work on the establishment of a regulatory framework in the area of energy conservation is only at the initial stage in Georgia and Uzbekistan.

In principle, the thrust of the legislative acts on energy conservation in all CIS countries has many common points, including the definitions of:

- institutional structures of energy conservation, their rights and responsibilities;
- financing sources of energy conservation;
- economic mechanisms stimulating development of energy conservation;
- areas in which norms and standards regulating energy consumption should be introduced;
- economic sanctions for exceeding the established energy consumption limits, etc.

Among the common shortcomings of the regulatory framework in the area of energy conservation is first of all the fact that the laws on energy saving represent non self-executing acts requiring a number of subordinate acts for their practical implementation.

For the time being virtually none of the CIS countries has worked out economic mechanisms

facilitating the implementation of the main provisions of these legislative acts. As yet the financial basis of energy conservation is extremely weak.

One of the features of legislative regulation of relations in the field of energy conservation in the Russian Federation consists in the fact that dozens of its entities have enacted regional laws on energy conservation containing self-executing provisions and specifying in certain cases the provisions of the Federal Law on Energy Conservation.

The Model Law on Energy Conservation drafted by the CIS Secretariat played an important role in the preparation and adoption of national legislation in the CIS countries.

In the opinion of Belarusian experts, the Model Law on Energy Conservation has consolidated the approaches of the CIS countries to the energy conservation issues.

The experts from Tajikistan presume that the Model Law has served as a basis for the development of an efficient mechanism of energy conservation management within the framework of the CIS.

A similar law is essential for an organisation such as the CIS. The world's experience shows many striking examples of international cooperation in the area of energy conservation legislation, e.g. the European Union. There is no doubt that the CIS countries have to develop and strengthen such cooperation in every way possible.

2.6. MAIN OBSTACLES TO THE TRANSITION OF THE CIS ECONOMIES TO AN ENERGY CONSERVATION PATTERN OF DEVELOPMENT.

The world's experience shows that the main obstacles to the shift of the economies to an energy conservation pattern of development can be divided into several groups depending on their character:

institutional (organisational);
legislative;
financial;
scientific and technological;
informational.

All these obstacles occur to a variable degree in all CIS countries.

In the institutional area the most important problems, which are common to the CIS countries, consist in the lack of efficient energy conservation policy management at the state level and considerable shortcomings in energy consumption measurement and control at the organisational level. As to the legislation, such problems include in the first place the lack of practical mechanisms encouraging potential participants in the energy conservation process to implement energy conservation measures.

The main financial impediment to the energy conservation development schemes in the CIS countries is the investment deficit and weak financial support extended by the state to the implementation of energy conservation policy.

The most important energy conservation issues in the scientific and technological area include the lack of modern energy saving devices, means and systems, considerable proportion of

obsolete equipment of low energy efficiency used in the CIS countries, insufficient number of qualified staff, extremely lengthy introduction of technological advances with a view to developing production systems and improving efficiency of fuel and energy consumption.

The low level of public awareness about the possibilities and advantages of fuel and energy saving style of "housekeeping" and life should also be noted.

In the CIS countries, where the predominant conditions for most of its members consist in the fact that the transitional period, they are now undergoing, involves a continuous fall in production output, decrease in living standards and lack of financial resources required to restore a true economy, it is rather difficult to persuade people to spend money for energy conservation measures. The financial possibilities of most of the CIS governments are too limited to extend a substantial support to the energy conservation policy. Under these conditions, each CIS country has to elaborate and implement its own appropriate ways of overcoming obstacles to the transition of its economy to the energy conservation pattern of development.

2.7. ROLE OF FUEL AND ENERGY SUPPLYING ORGANISATIONS IN THE IMPLEMENTATION OF ENERGY CONSERVATION POLICY BY END USERS

The energy conservation activities on the side of consumers, carried out by fuel and energy supplying companies of the CIS countries, are extremely limited. The known practical examples of planning and implementation of such activities are some energy companies of Belarus, Kyrgyzstan,Tajikistan and Armenia.

The Decree concerning the Republican Programme of Energy Conservation for the Period up to 2000 adopted by the Belarusian Government in June 1996 provides for financing of the energy conservation activities carried out within the framework of this Programme through the Innovation Fund of the concern Belenergo. The deductions for energy conservation measures amount to not less than 20% of the financial resources of this Fund. These deductions are used to finance the energy conservation activities considered to be of primary importance for the Republic and related both to the production and budget sphere. The amount of financing from the Innovation Fund of the concern Belenergo amounted to USD 26 million or 34% of the total financing of the energy conservation measures in that country.

Energy policy in Belarus on the side of consumers was also implemented in the development of economic mechanisms intended to intensify energy conservation and, in particular, in the establishment at the industrial enterprises of Energy and Resource Conservation Funds within the framework of the Republican Extra-budgetary Energy and Resource Conservation Fund etc. At present an energy demand management programme is being developed by the experts of the Belarusian Polytechnic Academy.

In Kyrgyzstan, according to a governmental decree, the joint-stock company Kyrgyzenergo has since 1993 developed annual activities aimed at improving fuel, electricity and thermal energy efficiency in the processes of production, transmission and consumption for its own and economic needs, as well as on the side of energy consumers. The activities provided for under the Kyrgyzgosenergoholding's programme for 1997 enabled savings in fuel of 3.5 thousand tce, in thermal energy of 40.1 Gc and in electricity of 47 million kWh. This programme also provides for organisational and technical measures. In particular, Kyrgyzenergo undertakes result-oriented work on the improvement of devices for measuring electricity and thermal energy consumption. It replaces the power metering devices used by electricity consumers. In the framework of activities conducted under the project on reconstruction of municipal power plants and heat distribution

systems, it is planned to carry out reconstruction works and provide consumers in Bishkek with heat metering devices. With a view to diminishing the load on electric networks during the hours of maximum load Kyrgyzenergo performs adjustments of the loads by switching off heating electric boilers. At present the total capacity of these boilers amounts to 713 thousand kW.

In Tajikistan, great importance is attached to energy conservation activities on the side of the consumers, carried out by the electric company Barki Tochik. From the year 2000 this company plans to start reducing consumer demand for energy by 2.5% per year through the implementation of corresponding energy conservation measures.

In Armenia, the issue of increasing the level of energy consumption management has been solved through the establishment of measuring units available for energy trading structures implementing individual consumer management.

2.8. ENERGY CONSERVATION TECHNOLOGIES, EQUIPMENT, DEVICES AND MATERIALS

The common problem for the CIS countries, which has a great negative impact on the progress in implementation of energy conservation policy, consists in insufficient and underdeveloped energy conservation technological facilities.

The technological directions followed by the CIS countries engaged in improving the energy efficiency of their economies are characterised by some differences related to different reserves of resources, climatic peculiarities, economic and industrial structure etc. However they have a great number of common points.

Thus, among the typical technological measures in the housing sector may be cited the provision to consumers of devices for measurement and control of energy consumption and improvement of insulation quality, and in the energy sector the replacement or upgrading of obsolete equipment in service within power plants, in particular through the introduction of cogeneration units and combined cycle units.

Among the most important technological directions followed by the CIS countries engaged in improving the energy efficiency of their economies we must single out the modernisation or the use of more efficient modifications of fuel producing equipment instead of less efficient ones, which should permit a considerable increase in the productivity of fuel deposits, both in use and planned to be brought into use, improved quality of energy transportation systems and significant reductions in the energy consumption for its transportation.

Improvement of energy efficiency of industrial processes in the CIS countries is evidently a key aspect of their energy conservation policy. Among the main goals to be attained by the CIS countries in the shortest possible time are the development and introduction of technologies allowing the efficient use of secondary raw materials and wastes for production purposes, modernisation of processes of direct fuel combustion and decrease in non-productive losses of energy resources through the introduction of automated systems for energy consumption control.

The most important problems in the household sector include improvements in quality of external insulation of buildings and reduction of heat losses during delivery to consumers.

The main technological goal in the field of transport consists in increasing the fuel efficiency of motor vehicles and developing fuels of higher quality, improving road coatings and upgrading

the road infrastructure.

2.9. ENERGY EFFICIENCY DEMONSTRATION ZONES IMPLEMENTED WITHIN THE FRAMEWORK OF THE UNECE *ENERGY EFFICIENCY 2000* PROJECT, THEIR ROLE AND IMPORTANCE

Demonstration projects in the area of energy conservation play an extremely important part in the implementation of energy conservation policy and, particularly, in the dissemination of the best practices connected with the realisation of energy conservation projects among large consumers' groups and potential investors.

The cooperation between the CIS countries and the UNECE within the framework of the Energy Efficiency 2000 Project in the development of energy efficiency demonstration zones is aimed at refining, after the example thereof, up-to-date organisational solutions and energy conservation financial schemes and demonstrating the opportunities and advantages brought about by the introduction in the CIS countries of present-day energy saving technologies and equipment.

Among the CIS countries the Russian Federation and Belarus take the most active part in this work within the framework of this Project.

In Russia the projects are being realised on the basis of the agreements on the implementation of demonstration zones signed with the United States, United Kingdom and Norway and closely connected with the international technical assistance programmes carried out in the Russian Federation in the framework of USAID, TACIS, GEE, UNDP, TAGOS, THERMIE etc. A number of demonstration projects are being realised with the help of credits from the World Bank (Institutional residential stock divestment project, Energy efficiency improvement project).

At present, in the Russian Federation there are seven energy efficiency demonstration zones, which have been in successful operation in Moscow (Zelenograd, Lefortovo, Fili), Cheliabinsk, Nizhni Novgorod, Vladimir and Kirovsk. All of them have been awarded prestigious certificates of the UNECE, Russian Ministry for Science and Russian Ministry for Fuel and Energy. The equipment and technologies used in the demonstration zones have been added to and renewed on a permanent basis. On average about 100 different demonstration units per year have been constructed and upgraded. The high quality of represented models is reflected by a higher demand and many offers for their replication at the site.

Identical demonstration zones of high energy efficiency have been in operation or at the stage of development in Belarus and some other CIS countries.

For example, Georgia intends to approach the UNECE with the view of considering implementation of an energy saving demonstration zone, which, in the opinion of Georgian experts, could play a great part in the shift of Georgian economy to an energy saving pattern of development.

In Tajikistan, the project aimed at creating a demonstration zone in Dushanbe has been at the stage of development. Planned investments in energy saving projects within the framework of this demonstration zone are estimated at 10 million US$, and expected economy in fuel and energy resources through their realisation – at 330 thousand tce per year.

2.10. ORGANISATIONAL FORMS OF IMPLEMENTATION OF NATIONAL ENERGY CONSERVATION POLICY

From the economic, social and political point of view the energy sector is a basic industry in many countries of the world. As integration processes in the world economy are developed, the interaction and coordination of energy policy of the countries participating in various international association are strengthening.

For the development of multilateral cooperation in the field of energy, the Energy Charter Treaty is of foremost importance because it establishes legally binding rules of the game within the world energy community.

The world's experience shows that it is necessary and appropriate to strengthen the role of the state in the field of energy efficiency of the economy.

It could be achieved by shaping a regulatory framework, which could be used as a basis for energy saving mechanisms; establishment of a standardisation, certification and metrology system; development of economic sanctions for inefficient consumption of energy resources; conducting of price policy; development of a financial mechanism for energy saving support; ensuring access to national and foreign energy efficient technologies, development of measurement and accountability schemes in the area of energy consumption; reinforcing competence in the field of management; conducting regional energy conservation policy.

The specificity of the regional energy conservation policy consists in the fact that it develops the main provisions of the state energy conservation programme, is based on a clear-cut distinction in the competence on energy conservation issues between the national government and local executive bodies, and is not in conflict with national legislation in force.

The regional energy conservation legislation should basically be a self-executing one. It is this legislation that should ensure economic and environmental effects.

At present some experience has been gained in the field of energy conservation policy that has been conducted by the CIS countries. This experience is reproduced in the country part (II) of this Analytical report.

CHAPTER 3

FINANCING OF ENERGY CONSERVATION POLICY IN THE CIS COUNTRIES

3.1. Economic mechanisms of implementation of energy conservation projects as a basis for the introduction of energy conservation policy in the CIS countries

To improve efficiency of energy resources utilisation in any country of the world it is necessary to create respective legal and normative, institutional, organisation and technical, and financial and investment conditions which in the aggregate define an economic environment favourable for the realisation of national, branch and regional energy saving policies.

A feature of the relevant economic environment is the availability of real possibilities both for direct and indirect financial support of energy saving, as well as the existence of conditions in which excess utilisation of energy resources is economically unprofitable. At the same time, it is financially more attractive for all the companies and enterprises to carry out measures aimed at efficient utilisation of energy resources, rather than other alternatives of possible profitable expenses.

The formation of such an environment in the countries with an energy saving potential considerably misused, moreover with a lack of energy carriers, should be the essence of a long-term state strategy for improvement of energy efficiency of the national economy.

The general principle of the creation of favourable conditions for energy saving is the support of energy efficiency projects with marginal costs which do not exceed the marginal costs for energy resources supply growth.

The priority of energy conservation in the market economy development conditions is defined by a reinforced incentive to decrease industrial expenses. This factor should play a special role in the CIS countries because the value component of energy resources is very high in the cost of industrial products of these countries. In this connection all the measures to transfer to a market economy – structural reconstruction, privatisation, de-monopolisation and competition development – promote energy saving intensification.

In market conditions the price level of energy resources is the main incentive to economise them. There are some prerequisites to use a price factor in the CIS countries as the most important incentive for energy conservation – prices and tariffs for energy carriers are almost at the world level. Therefore all the measures aimed at forming a competitive economic environment positively influence energy saving processes. Active anti-monopoly policy considerably restricts monopolists' capacities to compensate their losses from additional expenses for energy resources by increasing product prices.

The investment attractiveness of energy saving projects in total is potentially more than other investment directions, consequently when the investment climate improves this sphere will be the first to get a development impulse.

Unfortunately, a typical feature of almost all the CIS countries is a weak financial basis for energy saving and lack of effective economic mechanisms for implementing energy saving projects, that prevent transferring the economies of these countries to an energy saving way of development.

Ways and forms of energy saving policy financing

Energy saving financing can be carried out through:

- national investments and subsidies to enterprises and companies manufacturing energy saving equipment;
- national privilege credits for implementation of energy saving projects;
- attracting of foreign credits and investments;
- decreasing taxes for enterprises and companies manufacturing energy and resource saving equipment;
- decreasing taxes for enterprises and companies introducing progressive energy saving technologies and for enterprises and companies doing services in the sphere of improvement of power use efficiency;
- creation of other privilege economic conditions (debt restructuring, netting, progressive schemes of depreciation deductions, etc) for enterprises and companies producing energy and resource saving equipment; enterprises and companies introducing progressive energy saving technologies; enterprises and companies doing services in the sphere of improvement of power use efficiency.

Investments in the sphere of energy conservation can be carried out in the following forms:

- direct financing from the state and/or local budgets;
- financing by attracting funds from the state or regional non-budget energy saving foundations;
- enterprises' and organisations' own investments;
- financing by attracting energy saving associations, companies, concerns, financial and industrial groups, etc.; personal funds; foreign credits and investments;
- transfer of energy saving equipment for a long-term rent (leasing), resources given to be returned from the profit of a project implementation;
- *performance-contract*, in accordance with which the cost of the energy saving equipment transferred and services is to be returned from the cost of energy produced or saved after project introduction, etc.

Using values of financial and economic indications, three key groups of energy saving projects can be identified:

- projects capable of guaranteeing their owners a good income level sufficient to repay financial obligations and make a profit;
- projects whose implementation is of economic importance, but which do not guarantee a good income to direct executors;

- projects whose implementation does not give a financial income, but which are economically t profitable for a country (positive influence on energy market functioning, environmental state, social sphere, etc.).

General characteristics of the ways of energy conservation project financing in the CIS countries

Taking into consideration the existing economic condition in the CIS countries, let us discuss practical possibilities of the ways of financing energy saving projects.

In conditions of evident deficiency of state investment resources in all the CIS countries we can hardly count upon the possibility of getting national investments and subsidies for enterprises manufacturing energy saving equipment, as well as national privilege credits for energy saving projects implementation from the side of the state bodies. For the practical introduction of these ways, first of all it is necessary to conduct activities aimed at improving awareness of the economic and social importance of energy saving for the whole country. This activity should result in the appearance of respective legal and normative documents, the creation of respective state mechanisms and allocation of debit items in the state and local budgets for financing energy saving measures. Investments, subsidies and privilege credits from non-state organisations are possible only when the respective economic incentives are created.

One of the most promising ways to implement energy saving projects is to attract foreign credits and investments from international financing organisations. An encouraging future for this way is defined by an international high-level priority of aspects of energy saving and efficient energy use, as stated in a number of international agreements. Financing of related projects is therefore one of the immediate tasks. Ukraine has positive experience of taking this way. The possibility of attracting international credits and investments from state and non-state organisations is defined by available inter-state agreements in the sphere of economic cooperation development as well as legal guarantees for credit repayment.

The possibility of using tax and other economic privileges to provide the introduction of energy saving policy in a country is defined by the respective legal and normative documents in this country.

Considerable experience in implementation of energy saving policy in the leading industrialised countries and a certain experience in this sphere in the CIS countries at present show that sufficient investment resources (frequently exceeding the volume of the state allocations) can and should be attracted from non-budget sources. As an example of this form of implementation let us consider **a revolving mechanism of regional energy saving programmes financing, using the resources of local budgets.**

To finance energy saving from the budget it is recommended to use a revolving mechanism as follows. The organisation carrying out energy saving measures at budget-financed enterprises is allocated a primary finance amount from a budget and this amount is considerably less than the amount required for financing the activity at all the enterprises, but enough for energy saving measures at a part of the enterprises.

A part of the measures carried out will result in a decrease of energy consumption, consequently the volume of budget subsidies for these enterprises can be reduced. At the same time the bigger part of savings of budget funds will be destined to cover the investments received and part will be accumulated specifically for further financing of energy saving measures at the

remaining number of enterprises.

So, the financing of energy saving programmes can be based upon a primary financing from a budget using the revolving mechanism to pay back resources saved from implementation of energy saving projects. Payback of the resources saved is carried out through budget subsidy reduction caused by reductions of energy resources and water consumption.

For the CIS countries financing by attracting energy saving associations, companies, concerns, financial and industrial groups, etc., seems to be very promising. Let us discuss some financial schemes of realisation of this form.

Undeniably, without strengthening the activity of the competent state bodies of the CIS countries aimed at stabilising the economic situation, improving the fiscal system, addressing non-payment issues, developing an up-to-date regulatory space for energy conservation and ensuring informational support of energy conservation, it would be extremely difficult to persuade the energy consumers to invest large resources in energy conservation projects.

The extent of the energy conservation activities of the energy supplying companies on the side of the CIS energy consumers are limited to Belarus and Kazakhstan, where the local energy producers are undertaking some active measures with a view to improving the energy consumption efficiency at the final stage of consumption. However, even in these countries their investments in the consumer demand management programmes are incomparably less than the resources allocated for these purposes by energy companies of the leading industrial countries of the West.

In this case the main goal of the state is to facilitate the disruption of long-standing rigid interdependence between the rise in sales of energy resources and the increase in profits of the energy companies.

As yet the energy service companies are not widely spread in the CIS countries. At present only a few such companies have been established in the Russian Federation and Ukraine. The main barriers to their establishment consist in difficult access to credits, unstable financial and economic situation and, hence, a high level of risk.

The lack or weak investment component of extra-budgetary funds for energy conservation are important barriers to the development of a solid financial basis for energy conservation policy.

The building-up of investment potential of such funds through deduction of a certain part (as a rule small, in the amount of 0.5–1%) from the receipts for energy resources delivered to consumers is, for the time being, unfortunately, at the stage of declarations and forecasts.

The unfavourable investment climate in the economies of the CIS countries (despite its attractiveness the energy supply sector is no exception) makes it impossible for them to attract funds from domestic and foreign banks, financial corporations and other institutions with a view to investing money in energy conservation. The imperfect investment legislation hinders the application within these countries of financial schemes widespread in many foreign economies, such as leasing, third-party financing etc.

In the context of the CIS transition economies with underdeveloped market relations and pronounced deficit of investment resources, it is difficult to rely on the efficiency of market influence on the investment processes in the energy conservation area. Therefore, the strategy of investment financing, being oriented in the medium- and long-term to the development and use of

the universally accepted market mechanisms for energy conservation management, should be based, in the short run, on the utilitarian schemes and instruments designed to attract investment resources aimed at overcoming the existing barriers of administrative, institutional and behavioural origin. A few such schemes are considered below.

3.2. FINANCING ARRANGEMENT FOR ENERGY CONSERVATION IN SUBORDINATE ORGANISATIONS AND BUDGET ENTERPRISES

In most of the CIS countries the problems of regulatory framework for the financing of energy conservation activities in the organisations and enterprises financed from the budget have still remained unresolved. Some progress in this area is observed in the Russian Federation. It would therefore be appropriate to consider the experience gained there. The case in point is, first and foremost, the adoption by the Russian government of a number of decrees:

establishing annual consumption rates for fuel and energy (limits in volume and value terms) and targets for their saving through the realisation of the energy conservation potential available;

binding the heads of the executive bodies to ensure the financing of energy resources to be consumed and the compliance of their quantities with the established limits and to settle their consumption only in monetary form; arousing incentives for energy conservation for the given consumer group; and creating sources of payback in respect of the investments in energy conservation for the organisations and enterprises within the framework of the energy conservation activities and programmes by maintaining the base level of financial allocations required for the purchase of fuel and energy, established for these organisations and enterprises, over a period exceeding by one year the energy conservation investment payback period.

Since the economic efficiency of this group of investments is high and the period of their payback, quite the reverse, is short, it is safe to argue that the above-mentioned solutions make energy conservation activities very attractive to third-party financing with the help, to a certain extent, of consumer funds, provided that the subordinate organisation which undertakes to reduce he energy consumption in respect of the base level by 20–25% is entitled to financial allocations required for the purchase of energy resources within the established limits over a period exceeding by one year the energy conservation investment payback period.

3.3. FINANCING ARRANGEMENT DESIGNED TO SECURE RESOURCES OF THE POPULATION AND BUDGET ORGANISATIONS THROUGH THE INTRODUCTION OF ENERGY SERVICES

Along with the financial resources of the enterprises and organisations, both own and borrowed ones, resources from energy conservation funds and budgets of various levels, a true financing source for energy conservation measures, in particular within the housing and communal sector, could be the money of consumers of energy, fuel, water and other utilities. Here the main point is how to attract these people’s money for the implementation of energy conservation measures to get them interested in this work.

The idea of attracting the financial resources of the population for energy conservation activities on the side of the consumers could be put into practice by introducing additional services (of energy service companies) for the population and budget organisations. Services of the energy service companies for the population and budget organisations financed from the budgets of various levels are introduced for the purpose of decreasing payments for energy resources and water consumed through saving.

In introducing the services of the energy service companies, the national executive bodies and local governments should be guided by following principles:

- to combine, in the list of payments for utilities by the population and the organisations, the payments for heat, hot and cold water into one item “payments for resources”;

- to charge the energy services subject to the decrease in the total amount of payments in respect to the item “payments for resources” as a result of the work carried out by energy service companies.

3.4. FINANCING SCHEME DESIGNED TO SECURE INVESTMENTS THROUGH THE INTRODUCTION OF FIXED PAYMENTS BY FLAT OWNERS FOR SUPPLIED ENERGY

The introduction of a financial investment instrument on the basis of the services of energy service companies requires the adoption of appropriate regulatory acts. The adoption of any legislative act is rather complicated and lengthy. It would therefore be appropriate to consider another scheme, which could do the same job, being at the same time more simplified in its realisation.

This scheme is based on a contract concluded by a managing entity–direction (association of flat owners, managing direction of housing and communal sector, etc) effecting monthly collection of payments for the energy resources consumed by individual flat (dwelling) owners and providing for the preservation, over an agreed period, of fixed payments for energy resources at the level prevailing before the conclusion of the contract. The level of payments is calculated using the tariffs of the base year and is subject to compulsory indexation to take into account changes in tariffs.

On its part, the direction should guarantee a certain level of decrease in the payments for energy resources consumed by the flat owners, which are calculated on the basis of unchanged tariffs. Moreover, it undertakes to equip at its own expense, by the end of the contract, every flat with individual counters (and possibly with regulating devices) for heat, water and gas consumed.

3.5. FINANCING SCHEME FOR ENERGY CONSERVATION MEASURES WITH THE HELP OF RESOURCES PROVIDED BY A CONTRACTOR WHO CARRIES OUT CERTAIN WORKS FOR THE ENERGY SUPPLYING COMPANY

The legislative and regulatory acts addressing the issues of mutual set-offs between the enterprises and organisations make it possible to obtain extra-budgetary resources required for investments in energy conservation works at the sites of the client using the money intended for the payment for energy resources to be consumed by him.

A necessary condition for this transaction to be realised is the existence of an organisation (“Contractor”), which has performed for the benefit of the energy supplying company some amount of works (services), which have not been paid by this company because of financial constraints and non-payments of energy resources delivered.

For the services rendered by an external organisation, which helped the Contractor to receive money due to him from the energy supplying company, the Contractor should grant this organisation, for some period of time, an advance in an amount of 10–20% of the “ready” money received. If such an intermediate organisation is some energy service company, then the above-

mentioned 10–20% of the total payments may be used by it for investment in energy conservation on the side of the Client. However, in this particular case such Client is that consumer of resources which transfers his money in payment for the energy resources consumed to the Contractor instead of the energy supplying company.

3.6. ISSUE OF ENERGY CONSERVATION BONDS AS A SOURCE OF INVESTMENT FINANCING

This financing scheme provides for the issue of bonds by the regional and local authorities (municipalities), as well as by the enterprises and organisations with a view to raising money to be used for financing energy conservation investment programmes.

In order to strengthen the confidence of potential buyers in the issuer a special energy conservation guarantee fund placed with a reliable bank is established. This fund is designed to ensure, in the first place, a certain level of bond reimbursement in the event of the scheme being unsuccessful.

3.7. INVESTMENT FINANCING OF ENERGY CONSERVATION WITH THE HELP OF EARNINGS FROM THE SALE OF CARBON EMISSIONS QUOTAS

It is common knowledge that the CIS countries have a great economic energy conservation potential, which could ensure, in the case of its realisation, the reduction of greenhouse gas emissions in the amount of many billions of tons. The protocol signed by the participating countries at the Kyoto conference in 1997 defines special mechanisms allowing the countries to acquire economic benefits from carbon emission reductions in the process of international cooperation. The Russian Federation, Ukraine and several other CIS countries have the possibility of selling their greenhouse gas emission quotas through these mechanisms, using part of the receipts for energy conservation purposes.

3.8. REVOLVING MECHANISM FOR FINANCING OF REGIONAL ENERGY CONSERVATION PROGRAMMES THROUGH LOCAL BUDGETS

For the financing of energy conservation activities in the budget sphere it is recommended to use a revolving mechanism, the essence of which is as follows. The energy service company performing some works for budget organisations is entitled to an initial amount of budget assignments far less than the amount required for the performance of all works but sufficient for the performance of a part of these works.

The performance of a part of these works will result in a decrease of energy consumed by the respective facilities, which will make it possible to reduce the amount of budget allocations for these facilities. In this case the most part of the acquired saving in budgetary resources is used to repay the investments, and the remaining part is accumulated expressly for further financing of energy conservation works in respect of the rest of the facilities.

Thus, the financing of energy conservation programmes could be based on the initial financing from the budget through the revolving mechanism allowing a return on the money saved by implementing energy conservation projects. The return of the money saved is ensured through the reduction of budgetary allocations owing to the decrease in fuel, energy and water consumption.

3.9. INVESTMENT FINANCING IN THE FORM OF LEASING

The main advantage of lease financing as compared with financing in monetary form consists in the fact that the equipment let on lease remains the property of the lender (lessor) for the whole period of leasing, which reduces his risks and protects him from the use of the leased equipment for different purpose.

Another important advantage of the financing results from the first one since the equipment leased, as long as it remains the property of the lessor, is not liable for a tax on fixed assets on the part of the leaseholder, which reduces his expenses when implementing energy conservation works.

The leasing means a type of entrepreneurial activity aimed at investing the temporarily free or borrowed financial resources when the lessor undertakes, in conformity with the lease contract (financial leasing), to purchase from the determined seller the items provided for under the contract and let these items on temporarily use by the leaseholder for entrepreneurial purposes against payment.

Where the leasing of the energy conservation equipment is involved, the lessor may perform the energy audit for the consumer and work out proposals in respect of the energy conservation measures and a business plan for the investment project. The equipment may be purchased using both the own money and the money borrowed from a commercial bank. The leasing relations could include warranty-covered and service maintenance of the equipment. The repayment of the leasing credit is effected through leasing payments by the consumer, which could be fixed or determined by the amount of the energy resources saved.

The leasing credits appear to be a very promising form of third party financing of energy conservation activities and they should be developed with further backing at the state level. It would therefore be extremely appropriate to establish specialised state leasing companies dealing with the energy conservation equipment leasing.

3.10. INVESTMENT FINANCING AGAINST SOVEREIGN STATE GUARANTEE AND POSSIBILITIES OF SECURING GUARANTEES BY REGIONAL ADMINISTRATIONS

One of the most serious barriers to attracting of investments (both domestic and foreign) in the energy conservation area consists in the lack of reliable guarantee of their repayments.

One of the possible ways of overcoming this barrier is to afford the guarantee of the investment repayment at the state or regional level.

Sovereign state guarantees. The borrowing of financial resources from development banks and other financial institutes against the guarantee of the sovereign state is an approved and widespread instrument attracting investments in the economy.

Regional administration guarantees. The regional guarantees of the credit repayment in respect of the national and foreign investors are provided for in the regulatory and legislative acts adopted by the national executive and legislative authorities.

The Russian regions show great interest in the inflow of private investments in the economy in general and in the energy conservation area in particular. Many of them have included either in

the specialised laws on energy conservation or in general regulatory acts of economic character separate provisions providing for guarantees afforded to investors by local administrations.

There is no question that the establishment of a legal framework for similar guarantees at the regional level represents a step on the road to the creation of a favourable environment making it possible to attract private investments in the energy conservation area.

CHAPTER 4

ROLE OF COOPERATION OF THE CIS COUNTRIES IN ENERGY CONSERVATION WITH EACH OTHER AND WITH THIRD COUNTRIES

The main driving force of integration in the area of energy conservation is the interdependence of the CIS countries in respect of energy resources. In its turn this force helps to shape the market of fuel and energy resources within the CIS space. Therefore, the energy conservation as a factor in energy security of the Commonwealth members has an inter-state character and the efficiency of its realisation will be improved if the foreign economic relations are set in motion.

4.1. PRINCIPLES OF COOPERATION

The cooperation of the CIS countries is based on the following main principles:

- priority of national interests without prejudicing the interests of other CIS countries;

- ensuring equal possibilities for the national and foreign entities in the development of the national economies along the path of energy conservation and equitable participation in energy conservation projects;

- possibility of using any forms of capital participation in energy conservation development and in any institutional structures;

- coordination of measures and mutual assistance in addressing energy conservation issues at the national level with due regard for the economic interests of all stakeholders.

4.2. DEVELOPMENT OF COOPERATION

The development of cooperation between the Commonwealth countries and with third countries in the area of energy conservation assumes the following directions:

- harmonisation of legislation, including the regulation of requirements for implementation of energy conservation policy - without this regulatory work the architecture of the relationship is lacking and the economic interests are oriented in different directions;

- approximation of the energy consumption and energy conservation requirements to European Union standards and the Energy Charter provisions dealing with energy conservation issues;

- coordination of energy policy in general and energy conservation policy in particular, the greatest importance being attached to the enterprises constituting a coherent system of electric energy, transportation of energy resources and transit; implementation of measures coordinated with industrial and environmental policies and economic restructuring; development of appropriate legal, technological, institutional and commercial principles of interaction and functioning; taking into account the reciprocal basis of national policies aimed at shaping perspective fuel and energy balances; free access to the markets of raw materials and resources;

- creation of a common space with a view to attracting investments in energy conservation projects;

- creation of a common informational space in the area of energy conservation, accessible databases and arrangements for exchange of experience;

- joint development of engineering industries for energy conservation technologies, cooperation aimed at establishing joint ventures for the manufacturing of energy saving equipment, devices, instruments, control and measurement systems;

- harmonisation of price, tariff, fiscal and customs policies with a view to efficient use of energy conservation instrumentality and business development;

- cooperation in the field of science and technology, education and training on energy conservation issues.

4.3. ORGANISATION OF COOPERATION

Bilateral and multilateral agreements establishing the legal framework of inter-state relations should play a fundamental role in cooperation between the CIS countries in the field of energy conservation.

The main instrument of integration and interaction of energy conservation policies of different states should be national energy conservation programmes (Table 14).

Table 14
National energy saving programmes

Country	Programme availability
Azerbaijan	At the development stage
Armenia	At the development stage
Belarus	Yes
Georgia	No
Kazakhstan	Yes
Kyrgyzstan	At the development stage
Republic of Moldova	Yes
Russian Federation	Yes
Tajikistan	Yes
Turkmenistan	No
Uzbekistan	Yes
Ukraine	Yes

The inter-state projects and national programmes to be implemented, the multi-level system of state backing, public institutions and market infrastructure should be set in motion.

Support and cooperation in the area of energy conservation within the framework of the CIS take place at three different levels:

- international level, where the main areas of activities include the establishment of a general regulatory framework, creation of required institutional structures in the form of international organisations, centres and transnational companies, development of major programmes and projects, removal of barriers to financial inflows in the area of energy conservation. The

coordination of activities at this level should be the responsibility of the CIS Executive Committee or one of its bodies.

- national level, where the work is aimed at developing a legislative framework, preparing specific programmes and projects, encouraging energy conservation, creating economic conditions for the development of specialised enterprises and business in the area of efficient energy use. Special managing bodies including, among others, energy conservation funds, large joint ventures and economic entities, extend national support. The coordination of these activities is entrusted to an authorised state body.

- local level, where specific standards and norms are being adopted and where energy conservation projects are being implemented by the economic entities.

The level of cooperation in the area of energy conservation in the CIS countries may be characterised as obviously insufficient. Inter-state agreements in this sphere of economic relations are still lacking. The work on harmonisation of standard setting activities in the CIS countries, in particular energy conservation laws is more advanced. These acts are based on the Model Law on Energy Conservation adopted by the CIS Inter-Parliamentary Assembly in 1998 and made available to all states for practical use.

Table 15
Data allowing assessment of the status of cooperation

Country	Number of joint energy conservation projects with the CIS countries	Number of joint energy conservation projects of the CIS countries with third countries	Number of institutional structures in the CIS countries dealing mainly with energy conservation
Azerbaijan	-	5	-
Armenia	-	12	-
Belarus	3	3	6
Georgia	1	4	1
Kazakhstan	2	6	2
Kyrgyzstan	-	3	-
Republic of Moldova	-	2	1
Russian Federation	6	19	21
Tajikistan	2	9	1
Turkmenistan	-	1	-
Uzbekistan	2	7	4
Ukraine	2	11	6

As yet, the results obtained by the cooperating CIS countries have no significant impact on the decrease in the energy intensity of their economies. They have not succeeded in developing stable links oriented to a joint solution of energy efficiency issues.

The economic integration policy of the CIS countries urges the objective necessity and creates the necessary pre-requisites for the development of cooperation in energy conservation.

After the stage of the legislative basis shaping at the national level is completed, cooperation in the economic sector in respect of energy conservation occurs. The direct consequence of this development at the macroeconomic level is the elaboration of a coordinated long-term (10 years) programme of action of the CIS countries aimed at shifting the economies to an energy saving pattern of development, without which the energy security of many CIS countries will be imperilled. At the microeconomic level it is proposed to formulate local self-executing laws on energy conservation ensuring efficient implementation of this programme.

CONCLUSIONS AND RECOMMENDATIONS

1. The Commonwealth of Independent States has all the possibilities, both in terms of resource endowment and productive capacities of its fuel and energy sectors, to achieve a required level of energy security of the Commonwealth as a whole and of each of its member states provided they develop mutually advantageous economic and technological cooperation and use the expertise of West European countries in the field of energy and energy conservation.

2. The proven organic fuel resources, hydropower potential, splitting material deposits, potential of non-traditional and renewable power sources as well as the available energy infrastructure in the CIS countries form the necessary conditions for the self-provision of sustainable supply of economy and population with fuel and energy in the foreseeable future. Due to this the region remains one of the leaders in energy carrier supply to world markets.

3. For the CIS member states with a high level of economy's energy intensity and, therefore, a huge potential of energy conservation, it is very important to base their economic policy upon the economic growth rates forestalling an increase in demand for primary energy resources. According to experts, if the economic growth rates of the CIS countries in the first two decades of the 21st century amount to 3% on average, and the rates of energy consumption growth – 2%, the general annual demand for primary fuel and energy resources will increase by no more than 50% in 2020 as related to the current level. In the event that the economic and energy growth rates are at the same level the demand for energy resources will increase by 80% with all the ensuing consequences for energy and, to some extent, environmental security.

4. Within the last 2–3 years national laws in the sphere of energy conservation have been adopted in the majority of the CIS member states. Many of their articles are harmonising and identical thanks to the Model law of energy conservation developed by the CIS Executive Committee.

5. The implementation of an active state energy conservation policy is one of the most important issues to ensure energy security of all CIS countries and in the first place those which have to meet part of their energy requirements through imports of energy carriers. The energy exporting countries may also benefit from the reduction of energy intensity, as it will considerably foster their security in terms of energy and national interests as a whole.

6. Transparency of data on current status and development prospects of the energy sector and methods of implementation of energy conservation policy, cooperation and exchange of experience in the field of energy and energy conservation in the CIS countries can considerably enhance energy security and the process of economy transition to an energy-saving pattern of development.

7. The CIS member states and the Commonwealth bodies should make efforts to establish conditions for economies' transition to the energy saving pattern of development and use of this factor for improving their energy security.

It implies first of all the need to:

- shape effective market-oriented energy conservation management structures;

- develop and coordinate priority areas of economic cooperation with regard to energy conservation;

- work out agreements on political backing and development of inter-state economic entities implementing energy efficiency projects and strengthening interaction between the state and the private sectors in this area;

- work out coordinated approaches to the improvement of energy supply sustainability in general and to the implementation of energy conservation policy in particular;

- ensure information support to systems in terms of access to advanced energy conservation technologies;

- set in motion practical market mechanisms designed to develop commercial projects and put them on the investment market.

8. Cooperation between the CIS countries in the area of energy conservation is at the initial stage of development. The positive factors and advantages of joint economic development within the framework of the former single state (language, education, technical systems, information network, etc.) are used inefficiently. The energy efficiency issues have neither gained required acceptance within the national economies, nor become the starting point for the shaping of a new lifestyle and new attitudes towards energy resources.

9. Development of economic as well as scientific and technological cooperation both within the framework of the Commonwealth and with other international organisations, in the first place with the European Union and International Energy Agency. It is necessary to consider the possibility of instituting, after the example of the International Energy Agency, a workable CIS Interstate Energy Agency attached to the CIS Executive Committee, with terms of reference providing for, among others, promotion of more active energy conservation policy with a view to encouraging an increase in the level of national and collective energy security of the CIS countries, implementation of activities aimed at integrating non-traditional renewable sources into energy in energy balances of the CIS countries and execution of actions in order to create a more «transparent» information support for the development of energy complexes and energy conservation programmes in the CIS member states, including the issue on a regular basis of information directories and dissemination of statistical and forecast information, analytical reviews and other materials.

10. At present in almost all the CIS countries the unsolved matters of financing are one of the main barriers to implementation of energy conservation policy. At the same time specific experience in attracting investments in energy saving projects has been accumulated. It can take the following forms:

- direct financing from the state and/or local budgets;

- financing by attracting funds from the state or regional non-budget energy saving foundations;

- enterprises' and organisations' own investments;

- financing by attracting energy saving associations, companies, concerns, financial and industrial groups, etc.; personal funds; foreign credits and investments;

- transfer of energy saving equipment for a long-term rent (leasing), resources given to be returned from the profit of a project implementation;

- *performance-contract*, in accordance with which the cost of the energy saving equipment transferred and services is to be returned from the cost of energy produced or saved after project introduction, etc.

11. It seems reasonable for the CIS countries to consider the creation of the CIS Energy Efficiency Centre with the following responsibilities:

- strengthen coordination of national energy conservation programmes;

- complete establishment of a legislative basis for effective implementation of energy conservation policy and to promote it at the municipal and local levels with due regard to the development of specific standards and norms;

- develop economic mechanisms, financing schemes and management arrangements for the implementation of energy conservation projects;

- encourage creation of joint ventures, including energy service companies, designed for implementation of new energy conservation technologies and management of energy conservation projects;

- exchange scientific, technological and economic information on energy and energy conservation through the use of modern telecommunication means;

- expand trade in energy efficient technologies and systems, strengthen links with international financial institutes with a view to developing schemes securing financial backing of projects and attracting investments in energy efficiency projects;

- work out inter-state agreements on:

    - development of a joint cooperation programme (on the basis of national programmes) in the context of strategies and goals provided for by energy conservation policies of the CIS member states;
    - creation of a database on energy conservation technologies and investment projects on the basis of the Internet computer network;
    - approximation of legal, regulatory, institutional, economic, as well as scientific and technological conditions decreasing energy intensity of the economy in order to improve the competitiveness of industrial production;
    - development of international cooperation mechanisms designed to secure financial backing of energy efficiency projects;
    - preparation and organisation in 2000 of an inter-state conference on energy efficiency and, in particular, on the project *Energy Conservation as a Factor in Increasing the Energy Security of the Member States of the Commonwealth of Independent States*.

12. The Republic of Moldova finds it reasonable to recommend in addition the following to the governments of the CIS countries:

- promote implementation of joint energy conservation and environmental programmes with the involvement of international organisations;

- jointly develop and introduce energy efficiency European level standards in their countries;

- develop and carry out joint production of advanced and affordable installations ensuring involvement of non-traditional renewable energy sources in the energy balance;

- envisage in the sphere of information support to energy conservation the following measures:
    - creation of a common energy conservation journal for the CIS countries;
    - systematic publication of various bulletins on energy conservation;
    - creation of an automated databank containing data on energy efficient technologies available, installations, devices in the CIS countries and the world;
    - creation of a databank containing legal and regulatory information;
    - arrangement of international seminars and conferences on the most pressing issues of energy conservation;
    - exchange of energy saving training programmes;
    - arranging demonstration objects and zones of high energy efficiency, exchange of experience in this sphere.

PART II

BRIEF REVIEWS OF THE SITUATION IN THE MEMBER COUNTRIES OF THE COMMONWEALTH OF INDEPENDENT STATES

The Republic of Azerbaijan

General Information

Territory – 86.6 thousand km^2, including the autonomous republic of Nakhichevan with an area of 5.5 thousand m^2, fully isolated from the main territory of the country by the Armenian region of Zangezur, and the enclave Nagorny Karabakh with an area of 4.4 thousand m^2.

Population – 7.7 million (as of 1997).

Azerbaijan is an industrial-agrarian country. The GDP scope in 1997 totaled 15.4 trillion manat (USD 3.85). The fuel and energy sector provided 58% of GDP.

Mineral resources include oil, gas, ore, iron pyrite, barites, cobalt, molybdenum, arsenic, marble and tuff.

Currently Azerbaijan is undergoing a difficult transition to a market economy complicated by domestic and external political problems.

In 1997 foreign investments amounted to USD 1.3 billion (77% of all investments). Energy carriers comprise 85% of the entire export, foodstuffs – 65% of the whole import.

Fuel and Energy Sector

Fuel and Energy Sector Resource Base. Azerbaijan has considerable oil and natural gas resources sufficient both to meet domestic demand for them and for export needs. There is no official data on the explored reserves and total oil and gas resources. The possible reason for this lies in the fact that, at present, intensive research and exploration works on oil and gas, leading to permanent changes in the assessments, are underway. According to the World Energy Council (Survey of Energy Resources, 1998) the confirmed produced reserves of oil and gas condensate in Azerbaijan amount to 161 million tons, and natural gas 90 billion m^3.

As of 1 May 1998, 67 deposits of oil and natural gas have been discovered in Azerbaijan, of which 55 are under exploitation, including 25 deposits on the sea shelf (18 under exploitation). Approximately 1.4 billion tons of oil, including gas condensate, and a little over 440 billion m^3 of natural gas, including 435 million tons and 320 billion m^3 respectively from the sea deposits, have been produced over the whole period of oil and gas industry operation in the country.

Production and Consumption of Fuel and Energy Resources

Azerbaijan is one of the world oldest oil and gas producing regions. The oil and gas industry has predetermined the formation of the country's economy structure and played a decisive part in its three stages of development. The peak of oil and gas production as well as that of electric power in Azerbaijan goes back to 1980–1991 on the eve of the collapse of the USSR. At present, these indicators have tangibly reduced (Table 16).

Table 16
Review of Data on Situation in the Power Sector of Azerbaijan over the Recent Years

Indicators	Measuring units	Years			
		1990	1995	1997	1998
Total production of primary fuel and energy resources, including:	Million tce	32.21	22.80	23.0	25.02
Oil production	million tn	12.5	9.1	9.1	10.5
Natural gas production	billion m^3	9.9	6.6	6.2	6.2
Electric power production	TWh	23.1	17.3	16.2***	19.0
Specific fuel and energy resources production	tce/man	4.47	2.98	2.98	3.25
Total domestic fuel and energy consumption, including:	Million tce	33.53**	15.77	18.81**	20.81
Fuel oil	Million tn	6.70	3.60	4.20	4.20
Natural gas		17.16	7.10	6.1	6.2
Electric power	TWh	23.15	17.30	17.57	18.30
GDP power intensity	tce/USD	13.0*)	no data	6.5	no data
Specific fuel and energy resources consumption	tce/man	3.72*)	no data	2.06	no data
GDP electric power intensity	kWh/ USD	2.45*)	no data	2.3	no data
Specific electric power consumption	MWh/ USD	2.7*)	no data	2.5	no data

*) data as at 1992;
**) 7.5 million tce were imported in 1992, no fuel and energy resources were imported in 1997;
***) including 1.8 TWh at hydro-power plants.

Forecast evaluations of fuel and energy resources production and consumption in the country up to the year 2010 are given in Table 17.

* data as at 1992;

Table 17
Forecast of Fuel and Energy Resources Production and Consumption in 2010 as related to 1997

Indicators	Years		
	1997	2010	2010 as related to 1997, %
Total fuel and energy resources production, million tce	22.8	no data	no data
Level of supply with own fuel and energy resources, %	100.0	no data	no data
Oil production, million t	9.1	15.8	174
Gas production, billion m^3	6.1	15.0	24,0
Electric power production, TWh	17.57	24.0	136
Domestic demand for fuel and energy resources	18.81	25.0	133
Total planned capacity of power plants, GW	5.0	5.0	-

Studies undertaken in the country have shown that it would be more effective to invest in reconstruction of electric power and gas industry production funds rather than in the establishment of new ones over the period till 2010.

Development of the Azerbaijan fuel and energy sector is basically connected with the exploration and development of new oil and gas deposits at the Caspian Sea shelf. Attracting foreign capital is considered to be most important in this process. Nine international agreements on hydrocarbon raw material exploration and production at the continental shelf were concluded between September 1994 and November 1997. Oil and gas companies of the United States, Russian Federation, United Kingdom, Norway, Japan, Turkey, Saudi Arabia, Italy, France, Islamic Republic of Iran, Germany and Belgium participate in them.

Azerbaijan has a big potential of non-traditional renewable power sources, which, however, has not as yet been fully estimated. It is believed that by 2010 small hydropower plants with total capacity of up to 100 MW can be constructed at small water flows alone. The wide-scale use of solar radiation for heating in agricultural production is considered to be economically feasible. It is supposed that the construction of wind power units with total electric capacity of 15 to 20 MW in the Apsheron Peninsula will be justified by 2010.

So far there is no legislative regulation in the field of fuel and energy production and consumption in Azerbaijan. There exist only the national laws *On Foreign Investment Security, On Enterprise, On Joint-Stock Companies, On Commodity Exchanges, On Pawn, On Bankruptcy*, that provide to various extents some kind of regulation in the power sector. The national laws *On Currency Regulation, On Fundamentals for Power Resources Use, On Electric Power, On Bowels of Earth, On Energy Conservation*, currently being elaborated in the country, will produce a specific positive effect, including on foreign investment attraction to the Azerbaijan fuel and energy sector. Other legal and regulatory acts in the power sector are also under development.

Energy Conservation

The power intensity of the Azerbaijan economy over 1990-1992 has somewhat reduced, however, in 1993 it started rapidly increasing and in 1995 it grew by 52% as related to the indicator

of 1992. There is no definite understanding of the reasons for the power intensity growth and no evaluation of energy conservation potential in the country as yet. This testifies to the fact that the state activity aimed at improving energy efficiency in the country's economy is in its initial phase.

Meanwhile improvement of fuel and energy efficiency in the country's housing and communal sector has lately become one of the priorities in the Azerbaijan Government's activity, special attention being drawn to solving the challenge of improving quite an inefficient use of electric power in heating.

The principal problems of energy conservation policy in Azerbaijan are considered to be as follows: poorly arranged activity on concluding contracts for implementing energy conservation measures; instability in use of allocated finance; unsolved issues in the system of price formation; lack of energy carriers metering and control facility.

Main Conclusions and Recommendations

At present, the fuel and energy sector of Azerbaijan meets the domestic demand for fuel and energy resources. At the same time the expected growth of economic activity in the country will be accompanied by an increase in domestic needs for fuel and energy. It is supposed that the growth of oil and gas production up to 15 million tons and 15 billion m^3 respectively by 2010 can be swallowed up to a considerable extent by the domestic market, which will not allow the crisis phenomena in the power sector currently existing in the country to be completely removed.

Utilization of the existing energy conservation potential can have a positive impact on increasing the country's energy security, will encourage the release of energy resources for export needs, increase the currency flow to the country, necessary for the development of the economy, and ensure economy transition to an the energy conservation pattern of development.

To reach these goals we consider it possible to effect the following measures:

- elaboration of a set of legal and regulatory documents controlling relations in the power sector and energy conservation as well as creation of facilities for implementation of their major provisions;

- elaboration of state energy strategy for the coming 15 to 20 years taking into account integration with the CIS and European states;

- establishment of a self-sustained state body (agency) in the sphere of energy conservation;

- elaboration of a target programme for effecting priority arrangements for energy efficiency improvement in connection with phases and scope of investments taking into account expertise of European countries;

- development of scientific-technical and economic cooperation with the CIS countries and international organizations in the sphere of energy conservation;

- elaboration of a programme for non-traditional renewable power source involvement in the fuel and energy balance of the country;

- elaboration of a programme for modernization of power plants and power network, envisaging restoration and development of power links with the adjacent states, primarily the CIS member states.

The Republic of Armenia

General Information

Territory – 29.8 thousand km^2.

Population – 3.8 million (as of 1997).

Armenia is an industrial-agrarian country.

Armenia is rich in many types of non-ferrous metals like molybdenum, copper, lead, zinc, etc., and also in building stone. All of them at present are developed on an industrial scale.

The leading industrial branches are as follows: engineering industry, metal working, light and food industry, non-ferrous metallurgy, precious stone and metal working, building material industry.

The energy supply of the country depends mostly (93%) on import of energy carriers. In 1997 the GDP scope in the country totalled 799 billion drum (USD 1.6 billion), in 1998 – 952 billion drum (USD 1.9 billion). The GDP growth amounted to 5.8% in 1996, 3.1% in 1997 and 7.2% in 1998. Average annual GDP growth over 1993–1998 totalled 5.3%. In 1998, however, the country faced a decline in industrial production by 2.5%. The bigger part of GDP (34% in 1998) is held by the power sector, while in 1990 this indicator made up only 3.4% and in 1997, 27%. In 1997 the total consumption of electric power amounted to 5.48 TWh/year, supply with own fuel and energy resources – 6.7%, power intensity – 2 t.c.e./1000 USD, electric power intensity – 1.84 kWh/USD.

Fuel and Energy Sector

Fuel and energy sector resource base. There are signs of coal, oil shale, peat, bitumen, bituminous sand, oil and natural gas on the territory of Armenia. Hydrocarbon exploration works are underway. At some sites preliminary estimated deposits of coal and oil shale amount to 23–24 million tons, perspective reserves of coal are estimated at approximately 100 million tons. Perspective resources of oil shale total some 130 million tons. As of late, experimental coal mining has been conducted along with prospecting at some sites (Idjevan, Demadjur). Perspective oil and gas structures have been discovered in two regions of the country where exploration works were restarted with the attraction of foreign capital on a production-sharing basis. Reserves of some coal and oil shale deposits belong to the category of industrial.

Currently an advertising campaign aimed at attracting foreign companies to free licensed plots of land is underway.

Theoretical hydropower potential of Armenia is estimated at 21.8 TWh/year, including potential of large and medium-sized rivers – 18.6 TWh/year and small rivers – 3.2 TWh/year. The hydropower potential technically feasible for development is estimated at 7-8 TWh/year, and the one economically feasible for development in modern conditions – 6 TWh/year, 1.5 TWh/year of which are already in use.

The territory of Armenia has a considerable potential of non-traditional renewable power sources, primarily solar and wind power and the mentioned power potential of small rivers.

The average value of the solar power per square metre of the horizontal earth surface totals 1,720 kWh/year, this indicator is equal to 1,850 kWh/year at the quarter territory of the country. The use of this potential is considered to be economically reasonable in the conditions of Armenia for the production of electric power on the basis of photoelectric converters and hot water and heat supply through flat collectors.

Theoretical wind power potential is estimated at 10.7 TWh/year, the one technically feasible for development is provisionally estimated at 1.6 TWh/year.

Geothermal deposits available in Armenia can be used only for heat supply.

Production and Consumption of Fuel and Energy Resources

The major power resources traditionally used in Armenia are natural gas, oil products, nuclear power, hydropower and coal. Total annual consumption of all types of power resources prior to the USSR collapse amounted to 12–13 million tce per year, after decay (in 1992) it reduced to 3 million tce.

National production of primary fuel and energy resources is rather limited and makes up less than 200 thousand tce per year. This is mostly the power generated at hydropower and nuclear power plants.

The total planned capacity of power plants in Armenia amounts to some 3,200 MW, including 1,754 MW generated at cogeneration plants, 400 MW at nuclear power plants and the remaining 108 MW at hydropower plants. In 1997 electric power generation in the country as a whole amounted to 6,030 GWh, of which 3,032 GWh at cogeneration plants, 1,620 GWh at nuclear power plants and 1,380 GWh at hydropower plants. The united electric power system of Armenia is connected with the power systems of Azerbaijan, Georgia, Turkey and Iran through 330 kV and 220 kV power lines. However, the lines connecting Armenia with Azerbaijan and Turkey do not operate at present. In 1997 the total capacity peak in the power system of Armenia made up 1,260 MW. It is planned to reach 2,1000 MW by 2010.

By now (mid-1999) the electric power crisis in Armenia, that has had an absolutely negative effect on the economic situation of the country and the living conditions of the population within the last several years, has been completely overcome.

The principal demand for organic fuel is covered through imports.

The gas supply system includes 2 thousand km of transmission and 9.3 thousand km of distribution gas pipelines, as well as one underground gas reservoir with a capacity of 180 million m^3. The level of gas supply in the cities and rural inhabited locations reached 73%. The largest scope of gas in the country was used in 1989 and totalled a bit less than 6 billion m^3.

Energy Conservation

The provisional research undertaken shows the possibility of saving up to 600 thousand tce per year in the system of residential sector gas supply and up to 47 thousand tce (125 million kWh) in the system of power supply at the expense of reducing electric power losses in the process of transmission and distribution. Practical work on the improvement of building insulation and heat network modernization has started, which should provide a tangible conservation of power resources.

In 2000 the specified losses in electric lines of Armenia are planned to drop to 13% as related to 18.7% in1997.

Table 18
Energy Conservation Potential, as of 1997

Trends of Electric Power Utilization	Consumption, GWh	Energy Conservation Potential, GWh
Industry	724	280
Agriculture	243	47
Transport	150	50
Housing and communal sector	2500	480
Other sectors	953	140
Total	4570	1007
Requirements of electric power plants	406	28
Losses in lines	1054	125
Total	6030	1160

The main principles of state power policy carried out by the Energy Ministry of the Republic of Armenia include: provision of reliable, continuous and efficient production, transmission (transportation) and distribution of electric and thermal power, as well as transportation and distribution of natural gas; provision of the permanent improvement of energy security; creation of the necessary conditions for the development of a competitive environment; stimulation of fuel and energy sector enterprise liberalization, privatisation and divestiture.

Government-regulated issues include stimulation of local power resources development, energy conservation, environmental protection, scientific-technological progress, staff training and re-training, etc.

As of July 1997, the Law *On the Power Sector*, the major legal document regulating relations in this sphere, came into force, as well as the Law *On the Peaceful Use of Nuclear Power*. The law secures the consumers' right to be supplied with electric power, heat and gas on a contract basis meeting their production and household requirements.

The laws *On Energy Conservation, On Oil and Gas* are under discussion in the National Assembly of the country; the list of privatised energy enterprises has been approved and became valid in law; activities on review and renewal of current energy norms and standards to get them world-levelled are underway; a number of changes in and additions to the Administrative and Criminal Codes have been introduced taking into account increasing responsibility for violations in the power sector; the new version of the *Rules for the utilization of electric and thermal power and natural gas* has been approved; the transfer to international accounting principles has started; the regulation on technical inspection in the power sector and the appropriate authoritative bodies has come into force.

Thanks to implementation of the policy of the Republic's Energy Ministry, Armenia managed to participate as a reliable and equal partner in the Energy Charter and in such authoritative international organizations as the Black Sea Economic Cooperation and the CIS Energy Council.

The Energy Commission, a self-sustained body of five members appointed by the President of the Republic of Armenia, received authority for anti-monopolist regulation. The main levers of anti-monopolist regulation are tariff regulation and licensing.

In the course of overcoming the energy crisis in Armenia the issue of increasing the level of energy consumption management has been solved through the establishment of measuring units available for energy trading structures implementing individual consumer management. Meanwhile effective energy consumption regimes were obtained which led to the restoration of continuous electricity supply with full withdrawal of the so-called fan deviations in the energy system

Main Conclusions and Recommendations

In the Republic of Armenia whose power supply depends on imported power supplies, the creation of economic, finance and legislative conditions in support of economy transition to the energy conservation pattern of development should become of high priority in the power policy.

To achieve these goals it seems reasonable to effect the following at the national level:

- elaboration of the national energy conservation programme in connection with phases and scope of investments taking into account expertise of European countries;

- elaboration of a set of necessary regulatory documents in the power sector and energy conservation;

- establishment of a self-sustained state body (agency) in the sphere of energy conservation;

- elaboration of state energy strategy for the coming 15 to 20 years taking into account integration with the CIS and European states;

- elaboration of programmes for possible utilization of local fuel and energy resources, including non-traditional renewable power sources;

- development of scientific-technological and economic cooperation with the CIS countries and international organisations in the sphere of energy conservation;

- attraction of local and foreign investors for participation in energy conservation project implementation and creation of power units allowing local fuel and energy resources to be used.

The Republic of Belarus

General Information

Territory – 207.6 thousand km^2.

Population – 10.2 million (as of 1997).

The republic has well developed manufacturing industries such as chemical, automotive, machine building, electronic, defence, dairy and meat. By early 1998 the non-governmental sector share amounted to 34%.

Belarus has relatively small reserves of coal, lignite and oil. These reserves are insufficient for the power supply of the country. Its economy depends to a great extent on oil, coal and natural gas imports (from Russian Federation).

Unlike some other CIS member states, where a continuous economic recession has been observed for many years of late, the Republic of Belarus faces a growth of economy and industrial production: in 1996 GDP increased by 2.8 and in 1997 by 10%, and the industrial production increased by 3.5 and 17.6% correspondingly.

Fuel and Energy Sector

Fuel and Energy Sector Resource Base. The proven oil reserves in Belarus total 27 million tons, which can provide oil supply over 15.5 years with the latest production methods. The confirmed natural gas reserves are estimated at 3.5 billion m^3, which is enough for 14.5 years with the latest production methods.

Belarus has a big potential of non-traditional renewable power sources. The potential of solar power utilization in intensification of agricultural product drying and hot water supply alone is equal to replacement of 150 thousand tce per year.

Technical potential of wind power utilization is estimated at 1.9 million tce, – 0.2 million year./year economically feasible by the year 2015. Possible electric power production at small hydropower plants is estimated at some 95 million kWh. Much attention in the country is drawn to the issue of wood utilization and bio-energetic unit application. Potential possibilities for biogas production make up some 160,000 tce. Potential power generation from household garbage processing is estimated at 470,000 tce. The use of special agricultural plantations for power goals is planned in the Republic. This will help replace up to 1 million tce annually. Complete utilization of plant growing refuse for power goals will additionally release 1.5 million tce per year.

Production and Consumption of Fuel and Energy Resources

In 1997, 14% of the entire domestic requirements of Belarus were met from local fuel and energy resources, while the major part (86%) was covered by their imports from Russian Federation. The high level of Belarus economy dependence on imported power resources will be maintained in the future (Table 19).

Table 19
Review of Data on the Situation and Perspectives of Economy as a Whole and the Power Sector of the Republic of Belarus

Indicators	Measuring Units	1997 (Actual)	2000	Forecast 2010	2015
National production of fuel and energy resources,	Million tce	5.1			
Including:					
Oil production	Million t	1.8	18	1.1	1.1
Natural gas production	Billion m^3	0.24	0.24	0.21	0.18
Electric power production	TWh	26.1	27.3	36.8	41.0
Total requirements for fuel and energy resources	Million tce	36.8	34.0	42.3	45.0
Including:					
Oil and gas condensate	Million t	12.3	13.4	16.8	18.7
Natural gas	Billion m^3	16.4	18.5	25	28.0
Coal	Million tce	0.7	0.6	0.3	0.3
Electric power	Billion kWh	33.7	34.2	41.8	44.0
Thermal power	Million Gcal	79.8	76.0	83.0	89.0
Total requirements	Million tce	27.9	27	32.3	35.7
For boiler-furnace fuel					
Import of fuel and energy:					
Oil (from Russian Federation)	Million t	10.4	12.0	15.7	17.6
Natural gas (from Russian Federation)	Billion m^3	16.4	18.3	24.8	27.8
Liquefied gas	Billion m^3	0.2	0.1	0.1	0.1
Electric power	TWh	7.6	6.9	5.0	2.5–3.5
GDP power intensity	tce/ billion Bel. rub. *	104	79	68	56

* USD = 26.2 thou. Belarus rubles

Energy Conservation

As of late, the Republic of Belarus has achieved a considerable success in implementation of energy conservation policy and economy transition to the energy saving pattern of development. This is confirmed, in particular, by the fact that over the last several years the rate of power consumption growth in the country has substantially lagged behind the rate of economic growth: in 1997 total consumption of primary fuel and energy resources in the country increased only by 2.9% while GDP grew by 10% and industrial production by 17.6%. The GDP power intensity drop over this year is estimated at 7%. Over the first 10 months of 1998 total absolute value of power consumption in the Republic of Belarus decreased by 3.8% in relation to the similar period of 1997. Meanwhile the GDP production during these months increased by 10 per cent.

The given data on a rather favourable tendency in the implementation of state energy conservation policy prove to be the result of effecting a wide range of energy conservation measures, structural reform of the economy aimed at increasing its share of low power intensive manufactures. The state has rendered great support to the positive tendency by adopting regulatory documents and, thus, providing:

- organization of energy conservation management in the country and its support, including financing, to local implementation of energy saving projects;

- carrying out serious arrangements for structural economy transformation expressed in decrease of power intensive production share and provision of conditions for outstripping development of low power intensive and science intensive productions;

- improvement of the fuel and energy balance structure in the country reflected in an increase in its share of the most effective and environmentally clean energy carrier – natural gas;

- optimisation of the price formation system in fuel and energy supply of the country;

- creation and introduction of a facility providing implementation of legislative measures and observance of state norms in energy consumption and conservation;

- support rendered to cooperation of organizations and enterprises of the Republic of Belarus with the partners from the CIS countries.

Implementation of energy conservation policy in the country was especially successful thanks to the timely creation of a legislative and regulatory framework aimed at:

- provision of financing support to energy conservation, including implementation of the state energy conservation programme;

- economic stimulation of enterprises and organizations in carrying out energy conservation measures and procurement of energy saving equipment;

- introduction of metering and control over the consumption of power resources and water, as well as over their efficient utilization;

- conducting power monitoring of enterprises and organizations to identify reserves and ways of saving fuel and energy;

- development of the small and non-traditional power sector in the Republic;

- improvement of energy consumption and conservation management in all spheres of material production and the non-production sphere at the republic and regional levels;

- organization of the common regional structure of state control over the efficiency of fuel and energy resources utilization;

- establishment of an energy conservation foundation.

Legalization of the energy conservation process started with the adoption of the Law *On Energy Conservation* of the Republic of Belarus in 1998. This is a framework law, however it gives a solid legislative base for the solution of energy conservation issues. Under the law, the energy conservation policy in the Republic is effected on the basis of implementing specific programmes, major provisions related to energy saving activities and their financing facility are legally supported.

The programme of energy conservation at the republic level has an inter-branch character. It pursues the aim of identifying potential possibilities for reducing consumption of power resources, basic trends of activity of the Government, local authorities, science, different spheres of economy, enterprises and residents orientated towards solution of the problem of rapid increase in power resources efficiency, as well as coordination of efforts and assets of all participants in the process.

The strategic objective of efficient energy policy presented in the Programme lies in expansion of the Republic to the level of the European Union states regarding GDP power intensity by 2010.

In accordance with the Programme, for effective energy conservation management a hierarchic institutional structure is in the process of being established in the Republic. It covers all levels: republic, district, city, branch, enterprise; developing and adaptive system of economic, financing and legal support to energy conservation management; system of information support to energy conservation management; system of staff training and re-training.

Positive expertise exchange in energy conservation and its information support played a distinctive part in the fulfilment of positive tendencies in power intensity.

At present measures for subsequent development of positive tendencies in economy transition to an energy saving pattern of development and implementation of the available tangible energy conservation potential are being undertaken in the country (Table 20).

Table 20
Energy Conservation Potential in the Republic of Belarus, as of early 1999

Branch	Energy Conservation Potential Million tce
Power	2.6
Chemistry and petroleum chemistry	4.2
Machine-building and metal working	0.6
Fuel	0.55
Building materials	0.35
Food	0.4
Other industries	0.25
Communal and housing	4.8
Agriculture	0.85
Other consumers	0.3
Total	14.9

Currently international economic and scientific-technical cooperation of the Republic of Belarus in energy conservation is effected in the following directions:

1. Cooperation with the UNECE within the framework of the international project *Energy Efficiency 2000* under the following programmes*: Establishment of Demonstration Zones of High Efficiency of Fuel and Energy Resources Use, Development of Energy Efficiency Standards for Home Power Consuming Appliances*.

2. Cooperation with the World Bank in preparing the project on carrying out energy conservation arrangements in the social sphere (schools and hospitals).

3. Participation in implementation of an international project on rational wood utilization and reduction of harmful emissions through their use in thermal power generation, which is financed by UNDP with the participation of UNECE. The purpose of the project lies in the development of a programme for large-scale utilization of wood refuse as fuel with the following presentation of this programme in international financing institutions to get financial support for its implementation. Participation in implementation of the UNDP *Development of Energy Carrier Generation from Hydraulic Lignite Production Refuse* Project.

4. Cooperation with the concerned organizations of the United States and Denmark within the framework of the World programme for solar power utilization and implementation of the regional Russian Federation -Belarus project on utilization of radionuclide contaminated wood.

5. Cooperation with Karl Bro (Denmark) in implementation of the *Electric and Environmental Programme 95* Project aimed at reconstruction of the Minsk heat network.

6. Cooperation with foreign companies Term (Germany), Pipe (Sweden), and with the US National Okridzh Laboratory in the sphere of energy conservation propaganda and introduction of energy saving technologies at Belarus enterprises.

7. In 1997, the Agreement on cooperation in the sphere of energy efficiency and renewable power sources was concluded between the Ministry of Fuel and Energy of the Russian Federation and the State Energy Conservation Committee of the Republic of Belarus. The first meeting of the joint Coordination Committee for supervision over the process of cooperation in the sphere of energy efficiency and renewable power sources was held on 8-9 July 1998.

Along with the above-mentioned state measures for economy transition to an energy saving pattern of development whose importance in the future will grow, it is envisaged that further deepening of cooperation between power systems of Belarus and the Russian Federation will be of additional importance which in the process of their parallel work should provide efficiency improvement in using boiler-furnace fuel and present generating capacities. The principal agreements on deepening that type of Russian Federation and Belarus power system integration have been already achieved. It can be supposed that the efficiency of the whole system of electric power and heat supply of the country will be considerably improved as a result of the following planned arrangements in the electric power system:

- enterprise privatisation;
- establishment of a competitive electric power market;
- free consumer access to electric power networks.

One the major future goals in the sphere of reducing power intensity lies in reconstruction and modernization of physically and morally obsolete key production funds, primarily in the power sector itself and also in chemistry, petroleum chemistry, machine-building, metal working and building material industry.

In conditions of the Republic of Belarus, where the country’s dependence on imported energy carriers is to continue growing, success of the further increase in energy efficiency of the economy will seriously tell on the level of energy, economic and environmental security of the country. Here we should bear in mind the expected inevitable transfer from procurement of energy carriers at reduced prices in the Russian Federation to their import at world prices, which could lead to a considerable increase in state currency expenditures. It should also be remembered that a decrease in the level of energy security and the following possible short delivery of 1 tce alone could bring significant damage to the country’s economy. Short delivery

damage per 1 tce exceeds the fuel cost by approximately 9 times.

The importance of energy conservation policy can also be illustrated by the fact that a decrease in demand for primary energy resources by the quantity equivalent to the above given energy conservation potential will be equivalent to a reduction of currency expenditures in an amount of some USD 1.2-1.5 billion in 2015.

Main Conclusions and Recommendations

The Republic of Belarus has gained considerable success in economy transition to an energy conservation pattern of development considering this trend the most important factor of its energy security. Experience in the organization and implementation of the energy conservation policy could be quite useful for other Commonwealth countries. Nevertheless, to further activate economy transition to an energy conservation pattern of development and, correspondingly, to increase energy security, we consider it reasonable to prepare proposals for:

- creation of the national programme for extended utilization of local fuel and energy resources, including non-traditional power sources, through the use of an updated scientific-technical base;
- development of the legislative framework in the power sector, envisaging mechanisms for attracting fuel and energy supplying organizations in implementation of energy conservation measures with power consumers;
- creation of an information system in the sphere of energy conservation to be used by power consumers of different levels;
- improvement of a policy of equity accumulation by power consumers to carry out energy conservation arrangements;
- strengthening control and increasing responsibility, primarily of big power consumers, for inefficient utilization of fuel and energy;
- increasing the production of energy conservation equipment, devices and materials;
- development of scientific-technical and economic cooperation in the sphere of energy conservation with the CIS and European states;
- attracting domestic and foreign investors to participate in implementation of energy saving projects;
- working out of measures for integrating the power systems of Belarus and the Russian Federation, primarily to bring together regulatory documents and tariff policy;
- gradual removal of current energy tariffs with their ‘cross subsidizing’ of beneficiary categories of power consumers and a transition to the introduction of energy prices the reflect the costs of production or world market levels.

Georgia

General Information

Territory – 70 thousand km^2

Population – about 5 million

The country is facing structural reorganization of the entire economy. The existing infrastructure of the Georgian economy is characterized by high power intensity and a great degree of dependence on imported carriers, despite the rich hydropower resources available in Georgia. In addition, Georgia also has deposits of coal and non-traditional renewable power sources.

After declaration of independence in 1991, disruption of the traditional economic links, increase in prices for energy resources, lack of currency for their purchase, obsolete power equipment with no possibility of replacing it, the high power intensity of the economy, and non-payment for utilized power aggravated the situation in the power sector of Georgia.

The gravity of the energy crisis can be illustrated by the dynamics of electric power production, which in 1997 was 2.4 times less than in 1990. Electric power consumption over this period dropped 10 times in industry and almost 100 times in agriculture. The review of data on the power sector of Georgia for 1997 is given in Table 21.

Table 21
Review of Data on the Power Sector of Georgia for 1997 and forecast estimates up to 2010

Indicators	Measuring Units	1997 (actual)	Forecast 2000	2005	2010
National production of fuel and energy resources	Million tce.	1.2			
Net import of fuel and energy resources	Million tce.	2.2			
All primary fuel and energy resources	Million tce.	3.4			
Energy carrier end use including:	Million tce.	2.3			
Industry	Million tce.	0.5			
Housing and communal services	Million tce.	1.0			
Transportation	Million tce.	0.4			
Agriculture	Million tce.	0.1			
Total electric power production	TWh	7.4	9.5		11.9
Planned capacity	Million GWh	1.8	2.8		3.8
Total number of power plants, including:					
Hydropower plants	Million GWh	1.3	1.7		2.55
Cogeneration plants	Million GWh	0.52	1.0		1.3
Total electric power consumption, including:	Million GWh	7.8	9.50		11.9 1
Industry	Million GWh	1.0	2.1	2.6	3.8
Communal sector	Million GWh	2.9	2.6	3.8	3.6
Other consumers	Million GWh	2.3	2.4	1.6	2.1
Electric power plants' needs and losses in the power networks	Million GWh	1.6	2.4	2.0	2.3

Supply of Georgia with its own resources is estimated at approximately 50%, which is mostly at the expense of hydropower resources.

Hydropower potential economically feasible for development is estimated at 40–45 TWh/year. At present, 12-15% of this potential has been developed.

Coal deposits make up about 400 million tons. They are practically not used while throughout the world coal is a key source of electric power production.

Industrial deposits of oil in Georgia amount to some 12 million tons. Exploration works are underway, the forecasts on the big potential of oil deposits in this region were made. An oil refinery with a capacity of 0.1 million tons per year has recently been built in association with the United States.

Explored natural gas reserves in Georgia are small – 10 billion m^3.

Georgia has a considerable potential of non-traditional renewable power sources, such as geothermal, solar, wind and power potential of small rivers.

Debit of geothermal water with a temperature of 80-100^0 C can reach 220–250 million m^3 per year. At present, 0.5% of the existing potential of this power source is used in the household sector.

Wind power potential in Georgia is estimated at 2.1 TWh/year.

The existing capacity of electric power generating units of Georgia amounts to 4,550 MW. There are approximately 60 hydropower plants in Georgia, six out of them are supplied by the regulated reservoir, Inguri hydropower plant (West Georgia) being the most powerful with the capacity of 1,300 MW. The impossibility of conducting capital renovations and restoration works at hydropower plants and hydro-constructions due to financial problems led to the situation where out of 2,700 MW of the planned capacity only about 1,200 MW were in operation.

There is a similar situation at the main station of Georgian heat and power sector TBILGRES where 10 power units have been installed: eight units of 150 MW of the old generation and 2 new units of 300 MW each. All plants work fully on imported fuel – natural gas and fuel oil with very low efficiency. At present, actual working capacity of TBILGRES does not exceed 700 MW.

The planned thermal capacity of the boiler plants of Georgia's housing and communal sector makes up about 4,200 MW., 99% of them working on imported fuel. Due to lack of fuel the district heating system ceased functioning in 1999, and a considerable part of the population and public buildings turned to rather ineffective electric power heating and partially to heating devices operating on kerosene, liquefied gas, firewood and local coal. This is a big burden for the power, economic and environmental sectors of the country.

The power system of Georgia is connected with the power systems of adjacent countries by high voltage power lines:

- with Russian Federation: 2 power lines, one line Kavkasioni of 500 kV with carrying capacity of 700 MW; the second one of 220 kV with carrying capacity of 250 MW;

- with Azerbaijan: one line of 50 kV with carrying capacity of 700 MW; another one – 330 kV with carrying capacity of 400 MW;

- with Armenia: one line of 220 kV with carrying capacity of 250 MW;

- with Turkey: one line of 220 kV with carrying capacity of 250 MW.

Currently a new line of 400 kV with carrying capacity of 600 MW is under construction in the southern direction to Turkey.

These constructions should encourage an increase in import-export (in the summer period) potential of the power system of Georgia.

Georgia has quite a developed system of transmission and distribution networks of gas pipelines with carrying capacity of 8-10 billion m^3 of natural gas, which tangibly exceeds the demand of the country (in 1990, Georgia consumed about 6 billion m^3 of natural gas annually).

Transmission gas pipelines have a big reserve of carrying capacity for gas transit (currently gas is transmitted from Russian Federation to Armenia via Georgia).

Taking into account the specific role of the power sector, the Government of Georgia declared the power sector to be a priority and developed a programme of taking the power sector out of crisis through reforms, restructuring and economy transition to the market pattern of development.

International financing institutions and donating countries render great assistance to Georgia.

The new state policy in all spheres of the economy has already produced a positive effect, which is reflected in stabilization of the macroeconomic situation and a tendency towards a decrease in the budget deficit. Signs of production growth have appeared. The creation of a legislative framework assists in implementation of the new policy. The rate of the national currency, lari, has stabilized. USD 1 is equal to 1.9–2 lari. In 1997, the GDP of Georgia exceeded the indicator of 1996 by 11.3%.

The country started to use the advantages of its geographical location as a transit corridor between Europe and Asia.

Routing the oil pipeline for Caspian oil transportation to Europe via Georgia offers good perspectives. A new contract on construction of a big oil pipeline Baku–Tbilisi–Djeikhan (Turkey) has recently been signed.

There is a project for a transit gas pipeline running from Middle Asia and the Russian Federation to southern countries and Europe.

There are still big problems left in the economy and the power sector of Georgia connected, primarily, with the fact that, as already noted, almost all the infrastructure of the country's economy is orientated towards imported energy resources and it so far remains high power intensive.

In connection with this increase in energy conservation, reliability and energy efficiency of the country's economy is an urgent goal faced by Georgia.

Developments accomplished in the country as of late are evidence of the availability of a big energy conservation potential which, if introduced in the power balance, could help substantially increase the level of energy security in Georgia, decrease state currency expenditures for energy carrier imports, and improve Georgian product competitiveness in the domestic and foreign markets.

To implement the energy conservation programme in Georgia, institutional facilities are being set up in Georgia, including the establishment of a special unit within the framework of the Fuel and Energy Ministry involved in the solution of energy efficiency issues. This will encourage a more effective distribution of national resources to implement feasible energy conservation projects, and getting international technical assistance under European Union programmes, from international financing institutions and commercial companies.

To overcome the energy crisis, programmes for increasing energy efficiency of production generation, transportation and power consumption systems have been developed. Special attention is drawn to carrying out works on modernization of the existing generating capacities at the thermal and hydropower plants of the country.

It is universally acknowledged that modernization of the existing power facilities requires considerably less financial expenditure than the construction of the new ones, and the necessary investments in energy conservation – 2–3 times less than provision of the equivalent growth of energy resources production.

On the initiative of the Fuel and Energy Ministry of Georgia, in 1998 UNIDO in association with the Georgian experts developed a project of increasing energy efficiency and improving environmental characteristics of the old generation power units (150 MW each) installed at TBILGRES. It is estimated that the increase in energy efficiency of the TBILGRES operation can save annually some USD 15–20 million worth of expenses for imported fuel with a reduction of CO_2 emissions by 450 thousand t/year.

Representatives of the Russian Federation and Ukraine plants manufacturing old units participated in the development of this project-proposal. It should be noted that implementation of the given proposals as a prototype project is of special regional importance because the experience of improving energy efficiency gained at TBILGRES can be disseminated at similar power units that continue functioning (almost 120 units) at thermal power plants of all former Soviet republics and are big sources of environmental pollution.

Restoration works effected at the hydropower plants of Georgia can provide the country with additional electric power production of 5 TWh per year, which is equivalent to a saving of 2–2.5 million tce per year. Expenses for restoration works at the hydropower plants of Georgia will be paid back in less than 5 years, and taking into account their environmental effect in a still shorter period of time.

It should also be pointed out that a number of big West European countries and Japan are considering projects of electric power production facilities construction in Georgia, the most important of them being the Khudoni hydropower plant of 700 MW and the thermal power plant in Tkibuli operating on local coal.

A large potential of increasing energy efficiency in Georgia regarding power consumption lies in the restoration and development of heat and gas supply systems.

Development of the heat supply system, especially cogeneration, can save some 2.5 million tce worth of fuel and energy resources in the power balance of the country for 2005–2010.

To implement the energy conservation policy in Georgia, the legal and regulatory framework is being created. The *Law on the Power Sector* was adopted in 1994, the *Law on Electric Power and Natural Gas* in 1999. The draft Law *On Energy Conservation*, to be considered by the Parliament of the country in the near future, has been elaborated in the Ministry of Fuel and Energy of Georgia. However, the indicated Law cannot be effectively used in the absence of economic conditions, favourable for energy conservation, in particular in the absence of the appropriate policy for energy carrier price formation.

Energy pricing policies and tariff structures are vital components of the energy conservation policy, which need to be introduced. Subsidies to the population and social facilities in Georgia

are gradually being reduced along with the simultaneous introduction of target support to needy layers of society.

As of 1 July 1999, the price of 1 kWh of electricity in Georgia went up to 9 tetri (about 4.5 cents). The rate should increase in parallel with strengthening control over payments for the electricity consumed.

Positive results were reached with getting electric power meters installed in apartments. Such arrangements undertaken in the cities of Kutaisi, Batumi and Rustavi caused electric power consumption to be halved.

Imports of power consumption meters to Georgia are exempt from customs taxation. Reduction of energy resources consumption as a result of implementing energy conservation technologies will cause a reduction of the GDP power intensity and improvement of the economic and environmental situation in the country.

The Parliament of Georgia has adopted a number of Laws encouraging the creation of an environment favourable for attracting investment and developing market relations in the power sector.

A very important element in the transition of the Georgian power sector to a market pattern of development is the creation of a wholesale electric power market. Experience of power utilization in the housing sector of the United Kingdom and United States was used for the development of these principles.

According to the programme of restructuring of the power sector of Georgia, joint-stock companies for electric power production, dispatching and transmission were established on the basis of the monopolist state energy company Gruzenergo.

Conducting arrangements for privatising power facilities of Georgia is very significant for the achievement of macroeconomic stabilization.

In July 1998, Presidential Decree No. 403 *On the Strategy of Privatising Power Companies in the Power System of Georgia* was issued. A large American company AES has purchased the electric power distribution system of Georgian capital *Telasi*. Many small hydropower plants and the Tbilisi cogeneration plant have already been privatised. In the near future several big hydropower plants and new power units No. 9 and 10 of TBILGRES will be privatised. The end of 2000 must complete the privatisation of the power sector of Georgia.

The key strategic objectives of the energy policy of Georgia for 2005–2010 can be characterized as follows:

- reasonable modernization and re-equipment of the power sector;

- coordinated development of all branches of the fuel and energy sector;

- increase in energy efficiency and development of energy conservation in all power system sectors under power generation, transportation and consumption;

- priority development of the hydropower sector, primarily through the growth of the peak electric power export possibility;

- rational use of its geographical location. Development of the power corridor part in the power resources transit region;

- development of own resources (coal, non-traditional renewable power sources); introduction of environmentally clean technologies in the systems of power generation and consumption;

- improvement of managing and restructuring systems of the power sector, creation of the appropriate legal and regulatory framework;

- preparation of conditions for large-scale privatisation and attracting investors to the power sector of the country.

To implement the enumerated strategic goals faced by the fuel and energy sector of Georgia and provide energy security of the country, of decisive importance will be the development of scientific-technical and economic cooperation in energy conservation with the CIS states, countries of the Black Sea Economic Commonwealth, other foreign countries and international organizations.

Main Conclusions and Recommendations

In the conditions of Georgia whose sustainable power supply depends to a great extent on he external power supplies, implementation of energy conservation potential and the maximum feasible, from the economic viewpoint, development of local energy resources, primarily non-traditional renewable power sources should be of prior importance in effecting the economic and power policy in the country, as they can tangibly increase the level of energy security in the state.

To create the conditions for implementation of energy conservation policy we consider it reasonable:

- to develop a package of legislative acts in the sphere of energy conservation;

- to develop the national programme of energy conservation in connection with phases and scope of investments taking into account the expertise of European countries;

- to create an independent state body (agency) in the sphere of energy conservation;

- to develop scientific-technical and economic cooperation with the CIS and European states in the sphere of energy conservation.

The Republic of Kazakhstan

General Information

Territory – 2,717.3 thousand km^2.

Population – 16.7 million (as of 1998).

Kazakhstan's share in the entire production of all the CIS countries makes up 40% of uranium, 97% of chromium, 70% of lead, 50% of zinc, and the output of other raw materials, including precious metals, is considerable. Kazakhstan holds the first place among the CIS countries in explored reserves of lead, zinc, bismuth, and the second place – in those of copper, molybdenum, bauxite, phosphate and cadmium.

The leading industries are mining, ferrous and non-ferrous metallurgy, machine building, oil refining and chemistry, production of building materials.

In 1997 GDP totalled USD 22.25 billion. In 1998 production recession continued in a number of branches.

In conditions of the continuous economic crisis the process of transferring large enterprises, particularly of the raw material and fuel and energy sectors, to foreign companies is underway in Kazakhstan.

The key types of export products are ferrous and non-ferrous metals, ore, coal, oil and oil products, of import products – equipment and transportation means.

Fuel and Energy Sector

Fuel and Energy Sector Resource Base. Kazakhstan has considerable explored reserves of organic fuel and a large hydropower potential. The explored oil reserves (including gas condensate) amount to 2.9 billion tons, natural gas 2.3 trillion m^3, and coal 36 billion tons. Its share makes up about a quarter of the confirmed world uranium reserves.

Gross hydropower potential is estimated at 170 TWh, of which 23.5 TWh are technically feasible for development.

Production and Consumption of Fuel and Energy Resources

In 1997 production of primary fuel and energy resources in the country was almost double the demand (Table 22). Excessive national production of fuel and energy resources over the demand for them will also remain in the future.

Table 22
Review of Economic and Power Indicators in Kazakhstan for 1997 (actual) and forecast up to 2010

Indicators	Measuring Units	1997 (actual)	Forecast 2000	Forecast 2010
Production of power resources, Including:	Million tce.	103.7		
Coal	Million tce.	72.6	65.0	87.4
Oil and condensate	Million tce.	25.8		
Gas	Billion m^3	7.1	7.0	13.0
Import of energy resources	Million tce.	2.0		
GDP power intensity	tce/thousand USD	3.08		
GDP electric power intensity	KWh/USD	2.51		
Specific consumption of fuel and energy resources	tce/man	4.37		
Specific consumption of electric power	kWh/man	3562		
Coal export	Million t	23.5		
Oil export	Million t	16.1		
Gas import	Billion m^3	2.3		
Gas export	Billion m^3	2.3		
Electric power production	Billion kWh	52.2	49.0	71.0
Electric power import	Billion kWh	7.2		
Electric power export	Billion kWh	4.9		
Total demand for primary fuel and energy resources	Million tce	52.2	57.2	73.8
Oil balance forecast	Million t	25.7	30.2	57.9
Domestic demand for gas	Billion m^3	7.1	7.5	10.5
External demand for gas	Million t	49.2	47.0	66.4
Domestic demand for electric power	Billion kWh	56.5	54.0	66.0

Energy Conservation

Kazakhstan is a net exporter of energy resources, however the problem of energy security provision through energy conservation factor use is also current. Implementation of the energy conservation potential available in the country to strengthen both energy and economic security will allow the country to:

- raise the level of the Republic's self-supply by electric power, gas, oil and oil products;
- increase reliability of electric and thermal power supply in some regions, cities and enterprises;
- decrease technological effects on the environment;
- release a certain share of investments aimed at the development of and support to electric power resources production and direct them to the social sphere;

- increase export potential of industries producing power resources;

- improve technological level of production and reduce products' cost;

- improve the economic situation of enterprises and the population at the expense of reducing expenses for power production and consumption, increasing the scope of industrial production and improving the living conditions of the population.

Kazakhstan experts have identified energy conservation potential in the country by comparing the weighted average indicator of the country's economy (1/03 tce/thousand USD GDP) with the similar indicator of OECD member countries (0.39 thousand./thousand USD). Taking into account this comparison, absolute energy conservation potential of Kazakhstan is estimated at 61.5 million tce, including 13.4 million tce actually implemented as at 2000 (Table 23).

Table 23
Energy Conservation Potential of the Republic of Kazakhstan, million tce

Indicators	1995 (actual)	Forecast 2000	2005	2010
Potential economically feasible for development	22.0	17.3	10.0	-
Potential actually feasible for development	19.3	13.4	7.1	-
Technological potential, including by types of energy carrier:	45.6	38.5	33.3	22.26
Electric power	17.8	14.5	12.7	8.8
Thermal power	3.2	2.5	2.0	1.2
Coal	5.9	4.9	4.6	3.0
Gas	1.8	1.4	1.2	0.7
Oil and oil products	13.0	11.6	9.8	17.1
Including by economic sphere:				
Electric power	0.9	6.6	5.8	3.9
Machine-building and metal working	0.1	1.8	1.5	1.0
Oil and gas industry	0.4	1.2	1.0	0.7
Oil refining	0,4	1.2	1.0	0.7
Automobile transport of general use	0.5	0.4	0.4	0.3
Ferrous metallurgy	0.3	3.6	3.1	2.1
Non-ferrous metallurgy	0.9	5.0	4.3	2.9
Coal industry	0.2	3.5	3.2	2.0
Agriculture	0.8	4.0	3.5	2.3
Other spheres of energy consumption	3.1	11.2	9.5	6.4
Replacement of organic fuel by non-traditional renewable power sources	3.9	3.6	2.8	1.4

Kazakhstan has a big potential of non-traditional renewable power sources, which are planned to be developed in four directions: introduction of solar water heaters, construction of new and restoration of the formerly deserted small and micro hydropower plants, construction of wind electric power plants for work both within the electric power system and autonomously.

The most prepared for practical implementation are the projects of small and micro

hydropower plants with total planned capacity of 480 MW and annual electric power generation of 8.5 TWh.

Construction sites have been selected for a number of wind power units with total capacity of 520 MW and annual electric power generation of up to 2 TWh.

Up to 5 million tce annually could be released for other needs as a result of these two directions in non-traditional renewable power sources utilization alone. Taking into account that the major part of electric power in the country is generated at electric power plants working on coal, release of this quantity of fuel can be estimated at USD 10 million per year.

In conditions of Kazakhstan, like in some other CIS countries, small deposits of natural gas amounting to 2.4 billion m^3, and a little less than 700 million m^3 of associate oil gas, annually burnt in torches at oil deposits, could also be referred to non-traditional (though non-renewable) power sources.

The basic trends of energy conservation policy of the Republic of Kazakhstan are united in three blocks:

1. Economic levers of influencing energy carrier producers, distributors and consumers, including facility development for the formation of prices and establishment of tariffs for energy carriers stimulating energy conservation in all phases from primary energy carrier production to distribution and consumer systems, preparation of recommendations in taxation policy, orientated towards stimulating investments in energy conservation technologies and arrangements.

2. Institutional and legal arrangements implying: creation of a facility for managing implementation of state and regional energy conservation policy; making standard norms and rules meet the requirements of decrease in power intensity of material production and public services sector; legislative support to energy consumption and conservation valid in economy transition to market relations; establishment of a unified centre for implementing energy conservation policy charging it with the functions of control, preparation of recommendations for introducing technologies and energy conservation arrangements along with the associated establishment of a non-budget inter-branch energy conservation fund.

3. Technical arrangements concerning energy conservation issues, developed by the ministries and companies and attracting branch institutes, implementation of which will give tangible economic and environmental results. These measures are the basis for departmental energy conservation programmes effective under the state programme.

According to the Law *On Energy Conservation* of the Republic of Kazakhstan, the highest body for effecting state energy conservation policy shall be an authorized one. The Government of the Republic of Kazakhstan has determined the Ministry of Energy, Industry and Trade as an authorized body. The Government of the Republic of Kazakhstan elaborates three trends of the unified state policy, strategic and tactical measures for its implementation, principal state programmes and submits them to the President of the Republic of Kazakhstan for approval; develops regulatory-methodical, legal and economic facilities of energy conservation and stimulation of renewable power source utilization; determines the structure of the state energy conservation system and the authorized body; determines a policy in the sphere of standardization, certification and provision of common measurements in the production and consumption of fuel and energy resources; determines a procedure of information distribution,

propagation of knowledge, population and expert training; maintains international cooperation; accomplishes other functions in accordance with the legislation of the Republic of Kazakhstan.

The authorized energy conservation body carries out general state policy in the sphere of energy conservation; effects control and coordination of the appropriate ministry, department and organization services to provide implementation of state energy conservation programmes; develops the Provision on energy conservation examination; arranges state supervision over the efficiency of utilising fuel and energy resources; participates in international cooperation; accomplishes other functions in accordance with the legislation of the Republic of Kazakhstan.

Acceleration of activities for the development of the available energy conservation potential in Kazakhstan and involvement of non-traditional renewable power sources in the country's power balance would encourage a considerable increase in energy efficiency of the economy and in the level of energy security.

Main Conclusions and Recommendations

In the Republic of Kazakhstan, due to the high share of power intensive productions in the total scope of GDP, energy conservation policy implementation is of special importance for the economy of the country as a whole and for increasing the level of energy security.

To speed up the rates of economy transition to the energy conservation pattern of development it is considered expedient:

- to develop a long-term national programme for economy transition to the energy conservation pattern of development, including via improvement of industries' structures by increasing the share of low energy intensive productions and providing control over the efficient and rational use of fuel and energy resources, as well as using modernization and reconstruction of industrial production technological base in connection with phases and scope of investments taking into account the expertise of European countries;

- to develop a programme for involving non-traditional renewable power sources, primarily small water flow power, in the energy balance of the country by using the existing hydrostatic head pressure at the first stage;

- to draw attention to the development of small gas deposits and increase in the level of using associate oil gas, improvement of power transportation systems to reduce the level of expenses in them and increase in the level of utilizing secondary power resources in industry.

The Republic of Kyrgyzstan

General Information

Territory – 198.5 thousand km^2, about 90% of it located at an altitude of 1,500 m and more above sea level.

Population – 4.8 million (as of 1998).

Kyrgyzstan is an industrial and agrarian country. Key industries (15.5% of GDP) are non-ferrous metallurgy, power, machine-building, light and food production. Priority is given to agriculture (43.4% of GDP). The scope of GDP in 1997 increased by 6.5% as related to 1996 and amounted to some USD 1.7 billion.

Kyrgyzstan is rich in gold, mercury, antimony, tin, tungsten, zinc, lead, etc.
Industry of Kyrgyzstan depends on import of machines, materials, metal and oil by 70% and more. Export commodities include gold, mercury, timber, electric power, agricultural products, machine building and electronics.

Fuel and Energy Sector

Fuel and Energy Sector Resource Base of Kyrgyzstan consists of coal deposits estimated at 2 billion tons and hydropower resources with a theoretical potential totalling 142 TWh and economically feasible for development – 55 TWh. There are relatively small reserves of oil and gas.

Potential resources of non-traditional renewable power sources are estimated in Kyrgyzstan at 840 million tce, including wind power 246 million tce, geothermal power 21 million tce, biomass 1.8 million tce. and small water flows 0.7 million tce.

Production and Consumption of Fuel and Energy Resources

Production of primary fuel and energy resources in the country has continuously fallen within recent years. In 1997 it became half that of 1991, the reduction affecting all types of energy carriers. Domestic demand for fuel and energy resources fell at higher rates, resulting in the self-supply growth from 67% in 1991 to 80% in 1997.

According to forecast estimates, national production of primary fuel and energy resources will grow 1.4 times in 2010 as compared to 1997, and their domestic consumption 1.9 times, which will result in a level of self-supply with primary fuel and energy resources estimated at 65% by the end of the period under review (Table 24).

Table 24
Review of Data on the Situation and Development Perspectives in the Fuel and Energy Sector of the Republic of Kyrgyzstan

Indicators	Measuring Units	1997	1998	2000	Forecast 2005	2010
Total production of primary fuel and energy resources	Million tce	2.36	2.23	2.62	3.6	4.5
Including:						
Oil	Thousand ton	85	78	125	190	215
Gas	Million m^3	24	18	30	30	55
Coal	Thousand ton	522	432	475	1635	2000
Electric power	TWh	12.6	11.57	13.1	14	15
Out of them						
at hydropower plants		11	9.94	11.9	12	12.5
at cogeneration plants		1.6	1.63	1.2	2.0	2.5
Total energy resources imports	Million tce	1.9	2.3	2.3	3.0	3.6
including:						
Natural gas	Million m^3	982	999	700	800	800
Coal	Thousand t	290	806	1250	1650	2000
Oil products	Thousand t	415	608	600	620	820
Domestic consumption of fuel and energy resources	Million tce	3.8	4.1	4.4	5.5	6.9
Energy carriers export	Million tce	0.3	0.1	0.3	0.3	0.8

Practical utilization of non-traditional renewable power sources in the country is inconsiderable and in 1997 about 6,000 tce were replaced on their basis, the majority of this replacement (over 95%) provided through the use of solar water heaters.

Energy Conservation

At present end-use power losses in the housing and communal sector of Kyrgyzstan amount to 55%, in transport 83%, in industry 45% and in agriculture 50%.

Total potential of energy conservation in the country is estimated at 33-55% of the total power consumption, or in absolute value 0.9– 1.5 million tce.

Currently no legislative and institutional frameworks have been created with the exception of the Law of the Republic of Kyrgyzstan *On Energy Conservation* insufficiently utilized for a wide-scale implementation of the energy conservation policy. Meanwhile, in conditions of the high level of dependence of the country's power supply on the import of power resources, the growth of energy efficiency of the economy could tell positively on increasing state energy security, improving national products' competitiveness and solving environmental problems.

Main Conclusions and Recommendations

At present no legislative and institutional frameworks have yet been created to implement the energy conservation policy in the Republic of Kyrgyzstan. Meanwhile, in conditions of high

level of dependence of the country's power supply on the power resources' import, the growth of energy efficiency of economy could tell positively on increasing state energy security, improving national products' competitiveness and solving environmental problems.

To reach these goals it is considered reasonable:

- to develop the national energy conservation programme taking into account expanded utilization of non-traditional renewable power sources;

- to accelerate implementation of the Law of the Republic of Kyrgyzstan *On Energy Conservation* specifying the management system, benefits and incentives for enterprises conducting energy conservation arrangements;

- to attract local and foreign investors to participate in energy conservation project implementation and power unit establishment;

- to effect control and increase responsibility for inefficient utilization of fuel and energy;

- to adopt a set of legal and regulatory acts and documents for practical implementation of the Law *On Energy Conservation* of the Republic of Kyrgyzstan;

- to develop an intergovernmental agreement on mutual fuel and energy deliveries aimed at establishing a common power market providing reduction of the CIS states' expenses for the development of their own fuel and energy sectors and utilization of efficient energy carriers.

The Republic of Moldova

General Information

Territory – 33.7 thousand km^2.

Population – 4.4 million.

The Republic of Moldova is an industrial and agrarian country. The food industry is the leading one. Machine-building, electronic, chemical, metallurgical and light industries are also developing.

Fuel and Energy Sector

Fuel and Energy Sector Resource Base. The Republic of Moldova does not have organic fuel deposits. The power sector of the country is based on imported fuel and hydropower resources. The country has considerable non-traditional renewable power sources used so far on a small scale.

Biomass resources in the form of wood and agricultural refuse are one of the principal national sources of fuel supply in the country.

Production and Consumption of Fuel and Energy Resources

In 1997, consumption of energy resources in the Republic of Moldova was half that in 1990.

The major type of boiler-furnace fuel in the country is coal. The Republic of Moldova meets all demands for organic fuel at the expense of imports, which is why indicators of fuel demand given below in Table 25 reviewing data on the situation and perspectives of power sector development are at the same time also import indicators.

Table 25
Review of Data on the Situation and Development Perspectives in the Fuel and Energy Sector of the Republic of Moldova

Indicators	Measuring Units	1997 (actually)	Forecast 2000	2005	2010
Total consumption of primary fuel and energy resources including:	Million tce	7.93	8.5	8.9	9.1
Coal	Million tn	0.45	0.386	0.32	0.285
Natural gas	Billion m^3	3.27	3.51	4.0	4.5
Fuel oil	Million tn	0.21	0.35	0.39	0.42
Petrol	Million tn	0.31	0.36	0.42	0.5
Diesel fuel	Million tn	0.35	0.48	0.58	0.7
Electric power	TWh	8.7	9.2	9.5	9.6
Other sources	Million tce	0.92	0.73	0.48	0.26
GDP power intensity	tce/1000 USD	4.6	4.18	3.76	3.40
GDP electric power intensity	MWh/1000 USD	5.03	4.55	4.01	3.59
Specific fuel and energy resources consumption	tce/man	1.83	1.97	2.05	2.11
Specific electric power consumption	MWh/man	2.0	2.14	2.19	2.23

Production potential of the leading power branch of the Republic of Moldova – electric power – was formed mostly before 1980 and currently maintains its structure.

The Moldova hydropower plant with a total capacity of 2,520 MW is the largest power plant of the country. Three cogeneration plants, two of which service Kishinev, have total capacity a little over 320 MW. Total capacity of small cogeneration plants servicing sugar refineries amounts to 100 MW. Two hydropower plants of the country have total planned capacity of 64 MW. A considerable part of the equipment at power plants is obsolete and needs replacement or reconstruction.

According to the power strategy elaborated in the country, it is envisaged to accomplish reconstruction of functioning power plants and construction of a number of middle-sized and small cogeneration plants by 2010.

Energy Conservation

The problem of increasing efficiency of fuel and energy resources utilization is one of the most urgent on the list of problems connected with energy security improvement in the country. This proceeds from the *Energy Strategy of the Republic of Moldova up to 2010* adopted by the Government on 11 April 2000.

Key goals and most important trends of state power policy implementation are as follows: reduction of power intensity of economy by 13.5 times and electric power intensity by 1.4 times by 2010 as a result of effecting progressive structural changes the in economy, introduction of energy saving technologies, metering and control over fuel and energy use,

conducting arrangements for decrease of non-production losses of electric power and heat, introduction of norms and standards, development of economically advantageous renewable energy sources.

The national energy conservation programme dwelling on energy conservation potential and the necessary means for its development are underway in the Republic of Moldova.

Energy conservation potential as a whole is estimated at 30% of the total primary resources consumption, or 2.4 million tce as at 1997.

At present some USD 210 million, which makes up 43% of the country's budgetary expenditures, are spent on energy resources imports annually. Implementation of the available energy conservation potential would allow expenses for energy carrier imports to be reduced to USD 63 million.

In the period before 2005, the following arrangements for energy conservation policy implementation in the country are envisaged:

- development of activities of the National Agency for Energy Conservation (ANCE) established in 1994 and claimed to coordinate and conduct arrangements regarding power resources conservation in all spheres of the national economy;

- establishment and launching of the state power inspection to provide control over the observance of technical security norms and regulations in the process of power unit operation, as well as regulations in the sphere of power resources utilization;

- establishment of energy efficiency demonstration zones.

In addition to ANCE, the Ministry of Economy and Reforms, the Ministry of Industry and Energy, structural power divisions of sector ministries and departments, corporations and enterprises, as well as local authorities are involved in solving energy conservation problems.

The Department of Industry and Infrastructure with the Government State Office is in charge of energy conservation problems at the governmental level.

The key legislative acts in the power sector and energy conservation are the Law on energy conservation, energy, electric power and gas. Draft laws on thermal power and oil products are in the process of elaboration.

International cooperation of the Republic of Moldova is executed within the framework of the TACIS programme and the UNECE Committee on Sustainable Energy. It should be noted that currently there is no worthy energy conservation project in the Republic of Moldova implemented with the assistance of some foreign firm or international organization.

Main Conclusions and Recommendations

The problem of increasing energy efficiency of the economy in conditions of almost complete dependence of the country's energy supply on imported energy resources is of high priority for the Republic of Moldova in gaining the necessary level of energy security.

Energy conservation potential is quite big in the country and its development is much

more effective as per 1 tce compared to import of any energy carrier.

To implement energy conservation policy it is considered reasonable to undertake a number of institutional, legislative and financial measures at the national and international levels, including:

- creation of a legal and regulatory framework in energy conservation;
- attracting local and foreign funding, local and foreign investors for participation in energy conservation project implementation;
- development of stimulating methods for energy conservation projects;
- creation of an effective system for energy conservation programme management taking into account development expertise of other countries.

The Russian Federation

General Information

Territory – 17,075.4 thousand km^2.

Population – 143.6 million (as of 1 January 1999).

The Russian Federation is an industrial and agrarian country. It has all types of organic fuel resources, metallurgical raw materials, and other mineral resources. All industries are well-developed: heavy, general, middle-sized and transport machine-building, instrument engineering, electronic, chemical and oil-chemical, wood and wood-working, military, light and building, food and medical industries. In September 1998 GDP of the Russian Federation made up 257 billion roubles (by 9.9% less than in September 1997). The share of services in GDP amounts to approximately 50%.

The fuel and energy sector gives about 70% of the federal budget revenues and meets about 50% of export demands.

Fuel and Energy Sector

Resource Base. The Russian Federation has almost all types of fuel and energy resources sufficient to completely meet domestic demands for power both currently and in perspective, as well as for maintenance of export potential of the Russian fuel and energy sector.

According to the World Energy Council (World Energy Council, 1998, Survey of Energy Resources, 18th Edition), the proven output of the Russian Federation's coal reserves makes up 16% (157 billion tons) of the world reserves, oil and gas condensate 4.5% (6.6 billion tons)* and natural gas 32.4% (47.7 trillion m^3).

Production and Consumption of Fuel and Energy Resources

Like in other CIS countries, fuel and energy production and consumption has considerably reduced as of late, which is a result of the economic crisis continuing up till now. The review of data on the Russian Federation's fuel and energy sector operation in 1997 and 1998 as compared to 1990 is given in Table 26.

* According to the Ministry of Fuel and Energy of the Russian Federation, the explored oil and condensate reserves in Russia total 13% of world reserves, that is some 19 billion tons. The Russian Federation has a tangible potential for the development of almost all key trends in the non-traditional power sector: solar, wind, thermal power, biomass and small water flows power application.

Table 26
Review of Data on the Fuel and Energy Sector of the Russian Federation

Indicators	Measuring Units	1990	1997	1998
Production of primary fuel and energy resources	Million tce	1848	1362	1372
Including:				
Oil and condensate production	Million tn	516	306	303
Gas production	Billion m^3	640	571	591
Coal production	Million tn	396	245	232
Electric power production	TWh	1082	834	828
Fuel and energy sector share in industrial products	%	23	29	28
Investments in fuel and energy sector (1990 = 100%)	%	-	38	27
Fuel and energy sector share in exports of Russian Federation	%	52	47	43
Consumption of primary fuel and energy resources in Russian Federation	Million tce	1275	908	904
Power intensity of economy (in % as related to 1990)	%	100	117	122
Specific consumption of fuel and energy resources	tce/man	8.46	6.18	16.16

Total planned capacity of the Russian Federation's power plants as at early 1990 amounted to 215.6 GW, including cogeneration plants 30.8%, steam power plants 29.5%, hydropower plants 20.3%, nuclear power plants 9.9%, power unit 4.5%, decentralized electric power plants 4.4% and gas turbine units 0.7%.

Electric power consumption in the Russian Federation is supposed to increase from 810 TWh in 1998 to 820–846 TWh in 2005.

Gas production in the country in 2002 is planned in the amount of 548–568 billion m^3, gas exports are planned to increase from 198 billion m^3 in 1998 to 235–267 billion m^3 in 2005.

The maximum level of oil and condensate production (569 billion tons) was reached in 1987. Production has now decreased by 1.9 times. By 2002 production is planned to reach 307–315 billion tons. By 2002 this indicator is to reach 239–250 million tons.

Development indicators of fuel and energy resources in the Russian Federation for 2010–2020 are currently being estimated in million tons within the framework of the preparation of a new amended and supplemented edition of Russia's Energy Strategy, approved by the Government of the Russian Federation in 1995.

Energy Conservation

Development and implementation of energy conservation policy are assigned to the Ministry of Fuel and Energy of the Russian Federation. The Ministry of Economy, Ministry of

Science and Academy of Sciences also participate in this work at the federal level.

GDP power intensity in the Russian Federation is 3 times higher than in West European countries and 1.8 times higher than in the United States. The higher level of power intensity is explained by the high share of energy intensive branches in the structure of industrial production, technological deficiency of production funds in industry and fuel and energy sector. Severe climate on the larger territory and the enormous size of the country have a certain negative effect on the economy's power intensity indicator.

In the conditions of the Russian Federation, low efficiency of fuel and energy utilization and, therefore, the high level of economy power intensity are also connected to some extent with deficiency of valid legal, financial and price facilities poorly stimulating fuel and energy producers and consumers to reduce their expenses for fuel and energy purchase.

Legal, economic and institutional fundamentals of state policy in energy conservation are fixed in the Federal Law *On Energy Conservation* adopted in 1996. At present regional laws on energy conservation have been passed in dozens of the Russian Federation entities. Unlike the Federal Law, they contain a number of direct action provisions allowing many factors with regard to their region to be determined, influencing the implementation of energy conservation arrangements, in particular the scope and source of funding (financial support) activities on energy conservation projects.

Conservation potential of primary fuel and energy resources in 2010 as related to the level of 1995 is estimated at 350 to 460 million tce (Table 27).

Table 27
Potential of Fuel and Energy Resources Conservation in 2010
(as related to the level of 1995)

Indicators	Natural Gas Billion m^3	Oil Products million tons	Coal, coke, Million tce	Electric Power TWh	Thermal Power million Gcal	Total million tce
Fuel and Energy Sector, total	33–48	11–14	25–31	28–37	115–145	110–145
including:						
in oil production	3.7–8	-	-	-	-	4.5–10
in coal production				6–8		1.5–3
in energy carrier transportation	6–7	-	5–6	22–29	110–135	38–47
in electric and thermal power	28–33	7–9.5	20–25	-	-	58–77
in oil refinery		3.5–4	-	-	6–8	6–7
Housing and communal services	8	0.4–0.6	18–21	80–90	105–120	65–75
Agriculture	1.4–1.5	14–15	1.5–1.7	8–10	4	27–30
Transport	-	23–28	-	-	-	27–30
Industry, total	23–24	4–6	8–12	170–235	120–160	115–170
including:						
General industrial measures	6–8	0.5–1	-	105–145	55–70	52–75
Metallurgy	8–10	1.5–2	6.5–9	15–23	4–6	25–35
Machine-building	2–3	1.2–1.8	-	41–53	-	11–16
Building materials	6–8	-	1.5–3	6–9	28–40	15–22
Chemistry and oil chemistry	3–4.5	-	-	3–5	8–12	6–11
Wood and paper industry	0.2–0.5	0.7–1	-	-	25–32	6–11
Total	68–92	52–64	52–64	285–370	340–425	350-460

At present the Special Purpose Federal Energy Conservation Programme approved by the Government of the Russian Federation in 1998 is underway.

The key goals and objectives of this programme are as follows:

- to provide conservation of 365–435 million tce in 1998–2005;
- to reduce on this basis the GDP power intensity by 13.4% in 2005;
- to reduce budgetary subsidies for fuel and energy supply in regions;
- to complete the formation of a legal and regulatory framework and adjust financing and economic facility of energy conservation at the federal and regional levels;

- to implement the investment programme for expanding utilization of energy conservation technologies, manufacture of energy efficient equipment, constructions and materials.

Regional energy conservation programmes financed from regional budgets and special regional energy conservation funds are developed and implemented in the majority of the entities of the Russian Federation.

In the difficult economic conditions that the Russian Federation has lived through over the recent several years, as shown from experience, energy conservation programmes can be accomplished only with state financing support at the federal and regional levels.

The work on improvement of regulatory acts in the sphere of energy consumption is conducted under the guidance of the Ministry of Fuel and Energy of the Russian Federation. Rules of enterprise energy audit, rules of power resources control, rules of limiting budget energy consumers and norms of heat losses in buildings have been approved. Rules of thermal and electric power supply are under consideration.

Presidential Decrees and Resolutions of the Government of the Russian Federation have solved many legal problems in the sphere of energy conservation.

Within the framework of the UNECE Project, demonstration zones set up and developed on the territory of the Russian Federation make a certain contribution to the implementation of energy conservation policy. The UNECE, the Ministry of Science and Technologies and the Ministry of Fuel and Energy of the Russian Federation have certified seven zones of that type. Several zones are getting ready for certification.

The work on replacement of expensive low-grade types of organic fuel by non-traditional renewable power sources is underway in the Russian Federation. The concept of non-traditional power development, the draft law on state policy in the sphere of non-traditional power sector, now under discussion in the Federal Assembly of the Russian Federation, have been elaborated.

Thanks to the application of non-traditional renewable power sources, it is envisaged, in particular, to reduce by 50% liquid fuel delivery to territories difficult of access and the North, as well as to reduce harmful emissions to the atmosphere by 2005.

Implementation of the whole *Energy Conservation of Russia* Programme is to result in decrease of harmful emissions to the atmosphere by some 3.1 million tons per year, and the total scope of environmental damage avoided through energy conservation is to make up 10–13% of the entire damage related to activities of the fuel and energy sector of the Russian Federation by 2005.

Main Conclusions and Recommendations

Institutional, legal and regulatory fundamentals in the sphere of energy conservation have been created of late in the Russian Federation, and key directions in implementation of economy transition to the energy conservation pattern of development have been identified.

To accelerate transition of the Russian Federation's economy to the energy conservation pattern of development it is reasonable:

- to complete elaboration of the appropriate legislative acts, envisaging in them: institutional

structures of energy conservation, financing sources of energy conservation arrangements; financial benefits received by participants in the energy conservation projects, standards and regulations of specific power consumption in various economic sectors and sanctions imposed for energy resources overuse;

- to develop a facility capable of changing power consumers' attitude towards its use in the process of effecting energy conservation arrangements in all economic sectors;

- to provide incentives for investment activity in the sphere of energy conservation at enterprises and institutions with different types of ownership with the help of tariff and taxation policy in the sphere of power production and consumption;

- proceed with restructuring of the country's economy pursuing the aim of reducing its share of power intensive production;

- expand the production base of the branch involved in manufacture of energy conservation equipment, instruments and materials;

- assist in attracting of local and foreign investors to participate in implementation of energy conservation projects, identification of a mechanism for attracting non-budgetary financing sources at the federal level;

- establish a self-sustained state body (agency) in the field of energy conservation;

- continue rendering assistance to regions in the development of regional energy conservation programmes containing objectives and goals of energy policy on the territory of the region, as well as the facility for its implementation and funding, exact arrangements and projects have been envisaged and the creation of the necessary management structure is underway;

- assist in establishment of complex companies for the development of technical documentation, complete delivery, assembly and adjustment of energy conservation sites along with their servicing and information system in the sphere of energy conservation to be used by all types of power consumers.

The Republic of Tajikistan

General Information

Territory – 143.1 thousand km^2, over 90% covered with mountains.

Population – 5.7 million (1995).

Tajikistan is an industrial and agrarian country.

Oil, gas, coal, antimony, arsenic, polymetal occur in the bowels of the earth, however their deposits are relevantly small.

Leading industries are light, food, chemical, non-ferrous metallurgy, machine-building and building materials.

Fuel and Energy Sector

Resource Base. Forecast coal resources are estimated at 5.5 billion tons, including some 800 million tons of explored ones. Industrial reserves of natural gas amount to 30 billion m^3 and of oil 20 million tons. Geological oil resources are estimated at 118 million tons. Tajikistan experts believe that the scale of potential solar power development in the country could be estimated at 132 million tce, and wind power potential at 2 million tce. Other types of non-traditional renewable power sources are of no interest from the viewpoint of their economically feasible development. Hydropower potential is estimated at 330 TWh, including 220 TWh technically feasible for development, 15 TWh of which have already been developed.

Production and Consumption of Fuel and Energy Resources

The Republic of Tajikistan has the least productive capacities of the fuel and energy sector among the CIS countries. In 1997 oil production totalled 30 thousand tons, natural gas 40 million m^3, coal 20 thousand tons. In 1997 total production of electric power amounted to 13.9 TWh and was almost a quarter less than in 1990. The major part of electric power was generated at electric power plants.

The main Tajikistan demand for oil and natural gas is covered by imports.

Perspectives of the Tajikistan fuel and energy sector development are linked to the development of oil and gas deposits currently under exploration, completion of constructing Rogun hydropower plant with a capacity of 3.6 GW, implementation of the programme for construction of small hydropower plants.

Energy Conservation

In the present conditions of Tajikistan one of the main facts determining the possibility of an increase in the economy's energy efficiency is considered to be normalization and control over fuel and energy use, reduction of heat losses during transportation, distribution and consumption.

Extension of non-traditional renewable power sources has wide perspectives in respect of fuel oil replacement.

Before early 1998 relations in the sphere of energy conservation were regulated by the Resolution of the Government of Tajikistan *On Measures for Rational Use of Fuel and Energy Resources in the National Economy of the Republic of Tajikistan for 1995 through 1997*. In connection with the expiration of the resolution's term of validity and pursuing the aim of providing a reasonable use of thermal and electric power, the new Resolution of the Government of Tajikistan *On Normalization of Fuel and Energy Use in the National Economy of the Republic of Tajikistan*, the key goal of which lies in providing utilization of technically and economically feasible and progressive norms of using electric and thermal power in the process of planning, of conservation regime, rational distribution and their most efficient use. At the time of completing the manuscript of this report the draft Law of the Republic of Tajikistan *On Energy Conservation* was under development.

Tough limiting of energy consumption and planned disconnection of industrial and residential buildings from electric power and natural gas supply are taking place in conditions of dire need in the power resources in the country.

However, reduction of power consumption through this type of arrangement is not analogous to fuel and energy conservation. Analysis of enterprises' activity in the autumn-winter period showed that short delivery of energy carriers leads to considerable economic damage.

Price policy for energy carriers in the domestic market also became a new factor in energy conservation.

Liberalization of energy carrier prices led to considerable increase in prices in the domestic market due to energy carrier procurement at world prices and additional transportation expenses. In the housing and communal services sector prices of energy carriers are formed taking into consideration the low paying capacity of the Republic's population and do not cover expenditures for their delivery.

Tajikistan, whose electric power is based on utilization of hydropower resources, can export excess electric power generated at hydropower plants in the summer time. However, this requires settlement of electric power transit via third countries and creation of the common market for this energy carrier.

Main Conclusions and Recommendations

Currently the elements of market mechanism in the economy of Tajikistan are only at the initial stage of formation.

To solve the problems in the sphere of energy conservation it is considered expedient:

- to develop the Law of the Republic of Tajikistan on energy conservation and the mechanism for implementing its basic provisions;

- to identify investment policy in energy conservation (beneficial financing of the most efficient energy conservation projects, advantageous crediting, search for investors in their implementation);

- create a system of discounts and surcharges for energy carriers utilization by enterprises in the domestic market following from energy conservation results.

Turkmenistan

General Information

Territory – 488 thousand km^2.

Population – 4.7 million (1995).

Turkmenistan is rich in mineral resources: sulphur, salt, non-ferrous and rare earth metals, building materials, etc.

The country has a big fuel and energy sector, chemical and oil-chemical industries. Light and food industries are considered to be the key ones.

Fuel and Energy Sector Resource Base.

Resource Base. According to the World Energy Council, confirmed oil and natural gas deposits in Turkmenistan, as of early 1997, amounted correspondingly to 75 million tons and 2.9 trillion m^3. Supply with the confirmed deposits of oil considering its output level in 1997 (4.6 million tons) made up 16 years and natural gas (17.3 billion m^3) almost 170 years. The given indicator of supply with the confirmed natural gas deposits is rather provisional, as it relates to the year when the natural gas output in the country decreased to the minimum level over recent years as a result of economic crisis and problems with its export. Only in 1997 was gas output in the country cut in half. Supply of production with reserves, considering production level for 1996, is sufficient for 77 years.

The proven reserves and potential resources of oil, taken together, are estimated at 12 billion tons and of natural gas 22.8 trillion m^3.

The theoretical hydropower potential of Turkmenistan is estimated at 24 TWh/year, including 19 TWh/year technical feasibility for development and 18TWh/year economically feasible for utilization in modern conditions – a total of 5 GWh being already developed out of them.

Evaluation of non-traditional renewable power sources potential is lacking, nevertheless its clear that the country has possibilities for using solar and wind power, as well as that of small and middle-sized water flows.

Production and Consumption of Fuel and Energy Resources

While, as mentioned, natural gas production in 1997 reduced to half the output in 1996, oil production was reduced by 7.5%. The maximum level of gas production was reached in 1990 – 88 billion m^3. The fall in the gas output was explained by decreased possibilities of its export (mostly to Ukraine) deliveries due to non-payment.

In view of an increase in oil and gas production, the construction of new pipelines and reconstruction of existing gas pipelines are envisaged in Turkmenistan. It should provide, primarily, complete gas supply to the inhabited locations of the country and stable gas exports. By 2005 domestic demand for gas is supposed to grow to 15 billion m^3 against 11.2 billion m^3 in 1998.

In 2010, gas output is planned to reach 120-130 billion m^3, and its export – 100 billion m^3.

Electric power, like oil and gas sector, is the key branch of economy. The power system of Turkmenistan is linked to power transmission lines with other countries of Central Asia.

Five cogeneration plants form the basis of the power system generating capacity with a total capacity of 2.65 million kW (Table 28).

Table 28
Electric Power System of Turkmenistan

Indicators	1991	1995	1997	1998
Planned capacity of electric power plants, million kW	2.53	2.53	2.53	2.65
Electric power generation, TWh	14.9	9.8	9.4	9.3
Domestic consumption, TWh	9.6	8.4	7.9	8.0
Electric power export, TWh	4.3	1.7	1.5	1.2
Maximum load, million kWh	1.5	1.5	1.4	1.5

Energy Conservation

Practically no activity on fuel and energy efficiency improvement has started in the country. The reason for this is definitely connected to some extent with excessive production of power resources, etc.

There is almost no legal framework for energy conservation in Turkmenistan in the sphere of power generation and consumption. It is quite obvious that increasing fuel and energy efficiency is not currently considered by the Government as a key direction of its activity in the power sector.

Gas, electric and thermal power metering is close to nil at the customers' level. Electric power generated in the country and gas produced are distributed free of charge to the population.

Energonadzor (Power Inspection) functioning in the country is to tackle the following problems: examination of power intensive enterprises to identify opportunities for electric and thermal power conservation; arrangement of raids and inspections for exposure of theft or irrational use of electric and thermal power by enterprises and organizations; technical examination of electric and thermal power metering systems at industrial enterprises.

The national programme of legislative activity is oriented towards development of the following laws and regulatory acts: on energy conservation, on state regulation of electric power tariffs, on licensing of activity for generation, transmission and distribution of electric and thermal power, on increasing responsibility for the damage of electric power networks. There is also a necessity to elaborate the concept of developing the country's power system under new economic conditions.

Main Conclusions and Recommendations

Turkmenistan, having excessive productive capacities in the fuel and energy sector,

which are several times higher than the demand of the country, does not consider energy conservation as one of the priority trends of its activity. Nevertheless, increase in fuel and energy efficiency can play an important part in the national economy, in the solution of environmental problems and growth of the export potential of the country. In order to increase efficiency and rational use of fuel and energy produced in the country it seems reasonable:

- to evaluate energy conservation potential;
- to elaborate the strategy of developing the power sector of the country, introducing ways of transition of the economy to the energy conservation pattern of development as a counterpart;
- to develop the national energy conservation programme in connection with phases and scope of investments taking into account the expertise of European countries;
- create a legal and regulatory framework in the sphere of energy conservation.

Ukraine

General Information

Territory – 603.7 thousand km^2.

Population – 50.5 million (1998).

Ukraine is an industrial and agrarian country. It has multi-branch agriculture, heavy, light, food and building industries. The share of industries in the national revenue amounts to 50.5%, of agriculture 21.4%, of the building industry 9.9%. The non-governmental sector manufactures 56% of all industrial products.

Iron and manganese ores, non-ferrous and rare metal ores, sulphur, potassium salt, etc. are produced in the country.

Fuel and Energy Sector

Resource Base. Ukraine has considerable explored reserves of organic fuel and big hydropower potential. Their scale and efficiency, however, are insufficient for energy carrier production in a scope able to meet fully the country's needs in power.

According to the World Energy Council (World Energy Council. 1998. Survey of Energy Resources, 18th Edition) the proven reserves of coal in Ukraine make up 36.4 billion tons, including 16.4 billion tons referred to the category of bituminous coal by the World Energy Council classification, 16.0 billion tons to sub-bituminous coal and some 2 billion tons to lignite. Supply of the Ukrainian coal industry with resources considering the scope of coal production in the record year of 1976 (218 million tons) is enough for almost 170 years.

According to the same estimates, the confirmed produced oil reserves, including gas condensate, amount to 217 million tons and considering the level of their output in 1997 their supply to the Ukrainian petroleum industry is sufficient for some 50 years. According to forecasts, it is envisaged to provide the growth of the explored oil reserves by 95 million tons in the period up to 2010. By its confirmed oil reserves Ukraine holds the fifth place in Europe following the Russian Federation, Norway, United Kingdom and Romania. By its confirmed reserves of natural gas (1 trillion m^3) Ukraine also holds the fifth place in Europe following the Russian Federation, United Kingdom, Netherlands and Norway.

Theoretical gross hydropower potential of Ukraine is estimated at 45TWh, of which 24 and 19 TWh/year are respectively technically and economically feasible for development. A considerable part of it belongs to small water flows.

A big potential of non-traditional renewable power sources is available in Ukraine.

The wind power potential technically feasible for development is estimated as equal to the scope of replaced organic fuel in the amount of some 20 million tce/year, resulting from its complete development. Potential of solar radiation reaching the surface of the Ukrainian territory is estimated at 400 billion tce.

There is also a large potential in the country regarding the use of geothermal sources and biomass in the form of agricultural refuse and refuse of industrial production and city

communal sectors.

Fuel and Energy Sector

Ukraine has a big fuel and energy sector producing almost all types of energy resources. The review of data on the situation and perspectives of development of the fuel and energy sector are given in Table 29.

Table 29
Review of Data on the Situation and Development Perspectives in the Power Sector of the Republic of Ukraine (rounded)

	Measuring Units	1997	2000	2005	2010
Demand for primary fuel and energy resources for domestic use	Million tce.	165.7	180.8	213.9	241.4
Including coal	Million tce.	48.3	57.9	71.8	76.9
Oil	Million tce.	16.1	17.7	42.9	62.9
Natural gas	Million ? 3	81.9	85	74	74.2
Nuclear power	Million tce.	27.6	24.4	25.0	29.8
Hydropower	Million tce.	3.6	4.25	4.4	4.9
Non-traditional renewable power sources	Million tce.		0.05	3.0	7.1
Production of own primary fuel and energy resources	Million tce.	78.79	84.45	100.2	111.69
Including Coal	Million tn	76.3	87	93	100
Oil	Million tn	4.1	4.1	4.4	5.4
Natural gas	Billion m^3	18.1	18.5	21.3	24.5
Total electric power generation	Billion kWh	178	190	232	250
Including at					
Thermal power plants	Billion kWh	82.8	98.5	129.8	124
Hydropower plants	Billion kWh	10	12	14.4	15.1
Nuclear power plants	Billion kWh	79.4	72.5	77.5	95.4
Non-traditional renewable power sources	Billion kWh		0.5	1.2	2.3

Proceeding from an analysis of the data given in Table 29 we can make the following conclusions:

- at present Ukraine is a net importer of fuel and energy resources and will stay as such within the first decade of the 21st century;

- reduction of dependence of the country's energy conservation on imported energy carriers is envisaged through the development of the fuel and energy sector in perspective. The share of the national power resources in the entire scope of primary fuel and energy resources will grow from 43% in 1997 to approximately 50%.

Electric power generation based on non-traditional renewable power sources will develop at increasing rates (by 3.4 times over 1998–2010) along with gas output (by 1.9 times). Increase in production of all other types of primary power resources is also planned.

By 2010 it is planned to install 3.3 million m^2 of solar collectors, whose thermal power productivity will be equivalent to replacement of 430 thousand tce per year and 96.5 MW of photoelectric units that will replace about 60 thousand tce per year. It is also planned to build wind power units with a total capacity of 2 GW whose electric power generation will be equivalent to replacement of 1.8 million tce per year, and small hydropower plants with a total capacity of 590 MW, whose electric power generation will be equivalent to replacement of over 1 million tce per year. It is planned to receive appropriately 4.4 and 1.5 million tce in the country in 2010 through the use of biomass and geothermal power.

Thus, as a result of developing non-traditional renewable power sources, a total of 9.2. million tce are to be replaced in 2010.

Energy Conservation

Energy conservation potential of Ukraine estimated in relation to 1990 is determined as ranging from 42% to 48% of the entire scope of primary power resources consumption (Table 30).

Table 30
Evaluation of Energy Conservation Potential in Ukraine as at the Basic 1990

Fuel and Energy Consumers	Fuel, million tce	Electric Power, billion kWh	Thermal Power, million Gcal	Total, Million tce
Fuel and energy sector, total Including:	14-20	17-22	48-64	28-38
Fuel industries	3-4	2-3	3-4	4.2-5.7
Electric power	8-11	11-14	-	11-16
Transportation of power resources	3.5	4-5	45-60	12-17
Industry, including	39-43	88-96	99-113	85.8-94
Interbranch measures	12-13	68-70	47-50	42.1-44.4
Metallurgical sector	9.5-10	6-7	5-6	12.3-13.3
Machine-building	6.5-7	4-5	4-4,5	8.5-9.4
Chemistry and oil chemistry	2.5-3	2.5-3.5	8-9	4.7-5.6
Building material industry	3.9-4.0	1.6-2	5-6	5.2-5.7
Food industry	3.5-4.0	1.9-2.0	17-18.5	7-7.8
Other industries	1.4-2.3	3.9-6.9	13.4-19.5	5-7.9
Communal sector	6.5-7	12-13	40-45	17.3-19
Agriculture	4-5	2-3	-	4.7-6
Transport	9.3-9.8	1.8-5	0.5-0.9	10-11.6
Construction	0.5-0.8	0.2-0.4	0.7-1.0	0.7-1.1
Total	73-86	12-14	189.6-224	145-170

Ukraine was one of the first among the CIS countries to adopt (on 1 July 1994) the Law of Ukraine *On Energy Conservation*. This Law identifies legal, economic, social and environmental aspects of energy conservation policy, implemented within recent years in the country.

A Presidential Decree established the State Energy Conservation Committee of Ukraine in 1995. Its objective was to provide implementation of the common state policy in the sphere of energy conservation in the country. In 1996 Resolutions of the Government of Ukraine *On Energy Conservation Management*, envisaging the creation of divisions especially involved in energy conservation in branch ministries and departments, and *The Issue of the State Energy Conservation Inspection* were adopted. A number of special decisions in the sphere of energy conservation were passed at the governmental level in 1997-2000. Among them are, first of all, *On the Establishment of the Ukrainian Energy Saving Company* and *On the Complex State Energy Conservation Programme in Ukraine*, etc.

Main Conclusions and Recommendations

The work on the solution of institutional, legal and financial problems in economy transition to an energy conservation pattern of development is conducted in Ukraine. For the subsequent implementation of energy conservation policy it is considered reasonable:

- to complete the formation of a legislative and regulatory framework in the sphere of energy conservation and consumption and a system of energy conservation management at all levels;

- to proceed with the restructuring of the economy so as to reduce its share of power intensive manufactures with a simultaneous increase in low power intensive and primarily science intensive production;

- to develop a mechanism of stimulating introduction of energy conservation events, primarily in the housing, communal and household sectors;

- to determine a mechanism of non-budgetary financing source attraction;

- to activate information support to energy conservation policy implementation, primarily at the level of small manufacturing companies and population;

- to continue activities of state, regional and local authorities, as well as of fuel and energy saving companies for implementation of energy conservation arrangements at the consumer level.

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