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Existing Political Conditions and Economic Opportunities for Regional Power Systems Cooperation

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ARMENIA

"AREAT" Center
AZERBAIJAN

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FRIEDRICH EBERT STIFTUNG

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This paper summarizes the main results of a survey carried out by expert groups of the International Center for Human Development /ICHD/ (Armenia), the "AREAT" Center (Azerbaijan) and the Strategic Research Institute /SRI/ (Georgia) – non-governmental organizations.

The paper has been developed on the basis of the three 'country studies'. Each of these is focused on one of the three South Caucasus countries' energy sector situation and was developed by the same countries' expert groups respectively. The views expressed in each topic are those of the authors of the relevant topic and do not necessarily reflect the views of the other expert groups.

The goal of this paper is to analyze the existing political conditions and economic opportunities for regional power systems cooperation, and to work out policy recommendations on the main strategic directions for such cooperation.

FRIEDRICH EBERT STIFTUNG

The Friedrich-Ebert-Stiftung (FES) was founded in 1925 as a political legacy of Germany's first democratically elected president, Friedrich Ebert.

Ebert, a Social Democrat from a humble crafts background who had risen to hold the highest political office in his country, in response to his own painful experience in political confrontation had proposed the establishment of a foundation to serve the following aims: furthering political und social education of individuals from all walks of life in the spirit of democracy and pluralism, facilitating access to university education and research for gifted young people by providing scholarships, contributing to international understanding and cooperation.

The Foundation, which was banned by the Nazis in 1933 and not re-established until 1947, continues today to pursue these aims in all its extensive activities.

As a private cultural non-profit institution, it is committed to the ideas and basic values of social democracy.

International Center for Human Development

The International Center for Human Development is an independent research and public policy institution, a unique think tank, which pays close attention to research as it attempts to develop a unique vision of the main problems facing economic development and social safety. The Center's interests include:

- civil society strengthening;
- regional integration and globalization issues;
- social sector and poverty alleviation;
- governance and public sector reforms;
- free market institutions development;
- assistance to local governance;
- environmental issues;
- cultural promotion, etc.

The Center is aimed to support strengthening the democratic mechanisms and fostering free market values.

"AREAT" Center

The "AREAT" Center was established by the political scientists, sociologists, economists and conflictologists in 1998 year. "AREAT" is an independent non-government organization. The main aim of Center is the promotion of public society and support of the democratic reforms in Azerbaijan. The Center carries out the projects in the different areas of public policy. It successfully co-operates with different international humanitarian organization such as Eurasia, AED, ISAR, UNIFEM, Open Society as well as with national and foreign business structures: BPAMOKO, SOCAR, WB. For 5 years "AREAT" has executed more than 30 projects having got the large resonance in public life of Azerbaijan. The Center is an initiator of scientifically practical conferences on problems of the transit period, publishes analytical and methodical literature. Actively participating in partner's program, the Center promotes the development of integration processes in South Caucasus and the forming of peace culture and tolerance.

The Strategic Research Institute

The Strategic Research Institute (SRI) is the independent think tank for policy analysis and development with mission to support the processes of conceptual and organizational development of new social system and sovereign statehood building in Georgia.

SRI Supports the policy-making processes in all branches of government, political and social organizations to bring about significant policy and institutional changes, covering the issues of:

- Development Policy, Social policy, Economic policy;
- Analysis of conceptual and organizational problems of governance;
- Change management and organizational development in state administration, social and economic institutions;
- Capacity building for policy management;
- Analytical support and facilitation of Business – Government – Civil Society dialogue processes;
- Training programs development on public policy management.

Contents

Preface

After collapse of the Soviet Union a principally new political and economic environment was created in the South Caucasus. The current situation around power supply system in South Caucasus differs substantially from what it was two decades ago. During the years of political conflicts and economic collapse, civil opposition and blockades, the power supply systems came under degradation loosing qualified management and technical skills. Several rehabilitation and reform programs implemented under western support have not yet succeeded to compensate the results of those degradations.

The power supply systems of regional countries were initially built as an integral part of the Soviet power supply system. This system provided for stable functioning of each local sub-system, as well as for their efficiency. Actually, the power systems of three Caucasus countries are operating in full mutual isolations, and without productive links with other neighboring countries. In this circumstance the strongly restricted capacity of these systems are under the huge problems of stable and efficient functioning.

At the same time, the three regional countries have centuries-long traditions and deep historical roots of coexistence. This social potential is still not fully deployed in modern political processes. In the meantime it seems essential that the processes of policy-making in the three countries could be harmonized in such a way that the social interests of the population from each side of the boarder could be balanced and fully reflected in the political decision-making. Especially, regional economic cooperation is an extremely important condition for real economic development of every individual economy. First of all, each local market is too small to provide national producers with adequate market capacity. Also, a single country seems to be a stronger player in the global economy when being integrated in it through regional inter-mediation rather then individually.

Thus, regional economic co-operation is an unavoidable requirement for sustainable development of each nation. Within this context, the regional power supply systems can be considered as a potential leader in the overall process of regional integration. The extraordinary high importance of energy for the modern development makes every country not free to follow in long-term a non-efficient energy policy. The search for efficient energy production/consumption is not a subject of political consideration but a strong economic necessity, which forces the countries to subordinate finally their pure political priorities to the logic of economic rationality.

Thus, the energy integration of the regional power systems is a technological and economical necessity. The substantial political potential of such integration also must be seriously considered, which can contribute strongly for building regional peace and development. The current task is to find out principally new economic and political conditions, as well as the most efficient form of reintegration of regional power supply systems.

The Freidrich-Ebert-Stiftung (FES) made it possible to conduct the project “Policy Recommendations for Power Systems Cooperation of the South Caucasus Countries” in Armenia, Azerbaijan and Georgia simultaneously. The project objective was to analyze the existing political conditions and economic opportunities for regional power systems cooperation, and to work out policy recommendations on the main strategic directions for such cooperation.

A survey carried out by independent experts free from any political interests, played a very important positive role in addressing this issue. Namely, an unprejudiced approach facilitated objective assessment of the actual potential for regional integration, identified conditions holding back integrative processes, as well as gave an objective evaluation of positive outcomes to be achieved through regional cooperation of the three South Caucasus states.

This paper summarizes the main results of a survey carried out by expert groups of the International Center for Human Development /ICHD/ (Armenia), the "AREAT" Center (Azerbaijan) and the Strategic Research Institute/SRI/ (Georgia) – non-governmental organizations.

The power system of the Republic of Armenia

1. Introduction

Prior to the breakup of centralized economic system of the former Soviet Union and sudden emergence of numerous regional ethnic conflicts – the power system of Armenia, Azerbaijan and Georgia operated as a single unit, forming United Power System of Transcaucasia (UPST). At that time the power system of RA played a key role in the named interconnection (shown in Table 1), providing at best (end of 80th) the transmission with about 3.0 – 3.5 bln kWh of energy to neighboring Transcaucasian countries. This was facilitated with the presence of:

- extra visible volumes of energy power in Armenia;
- developed intersystem network in the region (see Figure 1).

Table 1. Electricity export/import operations of Armenia in 1987-1993

Years	1987	1988	1989	1990	1991	1992	1993
Electricity export, million kWh							
Total	3345	3095	1578	778	728	336	3
To Azerbaijan	2167	1997	1260	741	688	332	0
To Georgia	1179	1098	318	37	40	4	3
Electricity import, million kWh							
Total	417	176	1248	1698	2300	670	115
From Azerbaijan	298	130	873	1101	1402	410	0
From Georgia	119	46	318	597	898	260	115
Net export, million kWh	+ 2929	+ 2919	+ 387	- 420	- 1572	- 334	- 112

Unfortunately, today the situation in the region is cardinally changed. Hence the neighboring countries became active players in this sphere: Russia, Iran, Turkey and Turkmenistan. At the same time, the energy system of Armenia is surplus based system, and the existing settled capacities of the general output can reach up to 12 billion kWh per year. Nowadays, internal consumption of the electricity is about 5.2-5.8 billion kWh per year, and the export is only about 0.7 billion kWh per year. Therefore, the Armenia's possibility of the electricity export to the neighbor countries is up to 5 and more billion kWh per year.

The existing situation is not that harsh for Armenia as for Georgia, Turkey and Azerbaijan, which have chronic deficit of energy power. At the same time Armenia's export to Turkey (by intersystem power transmission line "Gyumri - Kars" 220kV) can run up to 2.0 billion kWh per year and export to Georgia (by "Alaverdi" 220kV and "Ninotsminda" and "Lalvar" 110 kV power transmission lines) can be 2,0 billion kWh per year. Such volumes of electricity can be supplied to Azerbaijan, which currently imports from Russia over 1.0 billion kWh power annually.

Obtaining and developing the possibility of power purchase/sale on regional level (no extra expenses on electricity transmission from a distance) presented not a single advantage of creation (reconstruction) of cooperated regional Power System. In general if some countries agree to interconnect their power transmission network they will get:

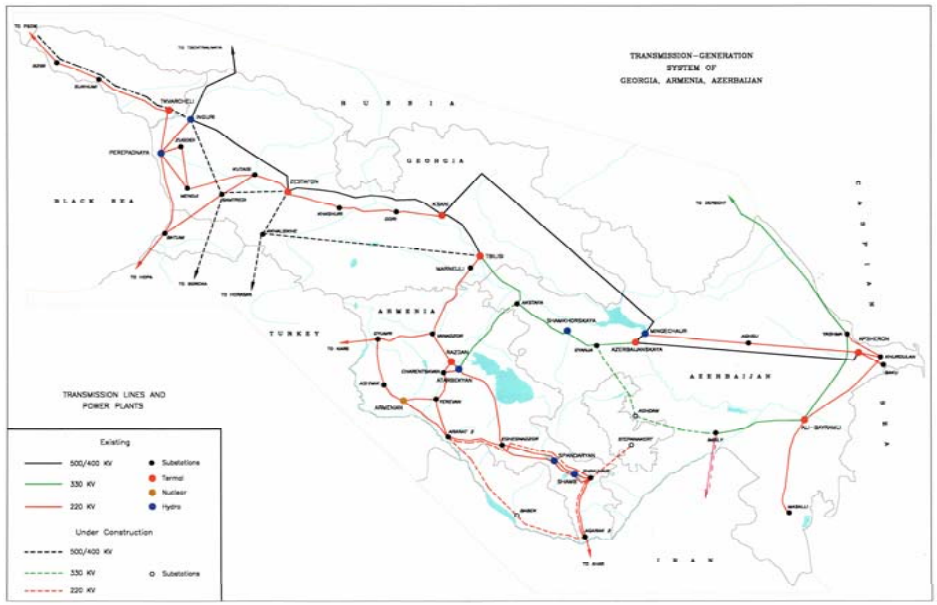
- more reliable system operation,

- complementary nature of generating plants using different primary energy sources or having a different cost structure or technical performance,
- common reserve co-ordination,
- optimization of generation costs.

Certainly, the utilization of those and any other advantages becomes possible only as a result of the all sides work content. Especially the nowadays existing number of unsolved regional ethnic conflicts is another embarrassment.

Nevertheless there are no alternatives for cooperation of regional power systems. It is remaining to raise upper domination of politics and to start appropriate work coming from requirements of the logic of economic rationality.

Figure 1. Armenia's Electricity Transmission Grid

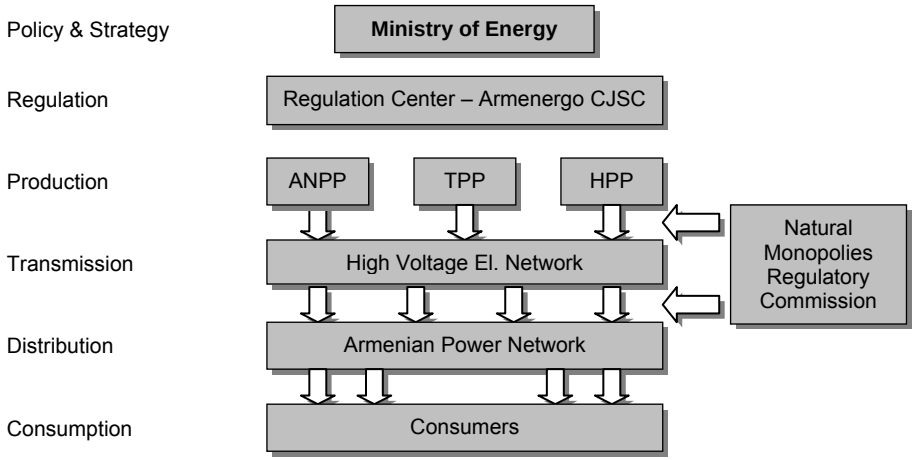


2. Armenian Power System Overview

The Power system of the Republic of Armenia consists of (Figure 2):

1. Generating power plants:
2. High-voltage transmission networks: "High-Voltage Electric Power Lines" CJSC;
3. «Armenian» distribution network;
4. Wholesale purchase and sale and regulation of intersystem communications company "Armenergo" CJSC.

Figure 2. Structure of Armenian Power System



The state policies for the energy sector of the Republic of Armenia are carried out by the Government through the authorized body - Ministry of Energy. The basic principles are as follows [1]:

a) Enhancement of competition and efficient operation in the energy sector and creation of essential conditions for the development of a competitive environment;

b) Regulation of the energy sector operation;

c) Separation of the economic activity, government management, and regulation functions;

d) Protection of the rights of the consumers and economic entities in the energy sector, and the balancing of their interests;

e) Efficient use of domestic energy resources and alternative sources of energy and implementation of economic and legal mechanisms for that purpose;

f) Encouragement of investments in the energy sector;

g) Ensuring transparency of the licensed operations in the energy sector;

h) Ensuring safety in the energy sector;

i) Enhancement of the energy independence of the Republic, including the differentiation of domestic and imported energy resources and ensuring the maximum utilization of generating capacities;

j) Ensuring the protection of the environment;

k) Encouragement of scientific-technical progress and employment of new energy-efficient and energy-saving technologies, as well as encouragement of personal training and re-training;

l) Encouragement of the formation and development of energy markets;

m) Separation of the generation, transmission (transportation), distribution, export, import, System Operator functions of service provision to the power market;

Regulation of the Republic of Armenia's energy sector is carried out by the NMRC - Natural Monopolies Regulatory Commission (hitherto ''Energy Regulatory Commission of the Republic of Armenia'').

Regulation of the energy sector is a part of state policies, aimed at balancing of the Customers and Licensees interests by defining and supervising the market rules, for electricity, thermal energy and natural gas, the regulated tariffs, and the license conditions, as well as creation of equitable conditions for the Licensees and to benefit the formation and development of a competitive market. In this connection the Commission shall [1]:

1) set the regulated tariffs for electrical and thermal energy and natural gas, transmission (transportation), distribution in the energy sector, System operator, services provided in energy market, as well as maximum tariffs for electricity and natural gas import,

2) issue Licenses for operations in the energy sector,

3) oversee compliance with the License conditions and apply penalties provided by Energy Law of the republic of Armenia,

4) approve, reject or set conditions for purchase of Licensees' shares (unless otherwise provided by Laws on privatization of state property), as well as for the sale or other form of transfer of any asset essential to the provision of the services provided by licensed entities,

5) establish rules of supply and use of electrical and thermal energy and natural gas,

6) set quality requirement for services provided to the consumers by the companies,

7) approve the energy market rules in cooperation with the RoA Government authorized body,

8) establish model forms or mandatory provisions for energy and natural gas supply and service contracts to be signed between energy sector Licensees and, pursuant to the procedures established by the Commission, register such contracts as well as contracts for export and import of electric power and natural gas.

9) establish model electricity and natural gas supply contracts, or mandatory provisions thereof, between Licensees and consumers, and ensure their employment, etc.

As a consequence of restructuring a vertically integrated State company "Armenergo" spheres of manufacturing, transportation and deployment of electrical power are shared, and on this basis cooperative associations of producers of electrical power are founded, as well as an electrical transporting company, the common electrical distributive company "Hayastan", National control center.

At this period economic relations between the subjects of economy in power industry of the Republic are built on the basis of applicable concords. The Ministry of Energy and NMRC exploit the rules of power market for the period of transition with the consecutive liberalization of the market.

2.1. Installed Capacity

Prior to 1988, up to 96 % of the total fuel consumption was accounted for imported fuel. At the same time, the Republic of Armenia has respectable reserve of indigenous lie idle energy resources. The hydro-energy potential of Armenia is estimated at 21,8

billion kWh/year. Technically available capacity is estimated at 7-8 billion kWh. The projected electricity generation of the operated 2 Cascade HPP-s and small HPP-s constitutes about 20% of the technically available capacity.

Generating power plants of RA includes (see Table 2)

- Hrazdan Thermal Power Plant;
- Yerevan Thermal Power Station;
- Armenian Nuclear Power Plant;
- Sevan-Hrazdan Hydro Power Cascade;
- Vorotan Hydro Power Cascade;
- Dzora Hydro Power Plant;
- A number of small hydro power plants

(A-1) At present there are only **3 thermal-electric power plants** in Armenia, all of which have exceeded their planned operating life spans and are in need of refurbishment. The largest of these is the 1,100 MW oil-fueled Hrazdan power plants in Kotayk marz. There are currently two power-producing units in operation at Yerevan TPP, which were built in 1965-1967. The total design capacity of the plant amounts to 550 megawatts, with 50 megawatts being used. The 96 MW Vanadzor power plant, in southern Lori marz, had a long inactive period before it was privatized by being sold to "Zakneftegasstroy-Promethey".

Hrazdan TPP is a balancing station that's why its share in the power generation depends on:

a) the change of electricity use in the country and the balance of the overflow,

b) operating capacity on HPP cascades and ANPP,

c) volume of the electricity export deliveries to Georgia.

In mid-July, 2003, Armenia signed a pact to eliminate $93 million of its most expensive debt by turning over five state-owned businesses to Russia, including Hrazdan TPP The deal, known as an "assets-for-debt" swap, has been brewing since Russian President Vladimir Putin and Armenian President Robert Kocharyan called for it in the fall of 2001. The Russian energy officials plan to use the Hrazdan HPP to produce electricity for export to neighboring Turkey.

Only one major thermal-electric power plant is being planned for now, a 225 MW natural gas-fueled gas turbine combined cycle facility that would be a new power block addition to the existing Yerevan TPP. The expected cost would be about $140 million [*Interfax*, 30.09.2003].

Mr. Ovanes Ovakimyan, the General Director of the power plant expressed his high expectation to complete the construction of the mentioned new power-producing unit in 2007. The construction will take two years and another year will be also needed to draft the necessary documentation and hold international tenders to buy coinciding equipment. The new unit is needed due to the wear out of the other units at the plant and also the keen necessity to improve the ecological standards in the country. Compliant with Mr. Ovakimyan, the new power-producing unit would minimize harmful emissions and significantly reduce losses of electricity.

(A-2) Armenia has nuclear power plant - the Armenian (Metsamor) NPP with two VVER-design reactors and a combined capacity of 815 MW. This power plant was shut down

in March 1989 by the Soviet Union because of safety fears following the devastating earthquake that struck Armenia in December 1988.

Table 2. Main characteristics of Generating Power Plants of RA[1]

№	Power plants	Year of commissioning	Capacity per block (MW)	Q-ty of blocks	Total Capacity (MW)
Thermal Power Plants (TPP)					
1	Hrazdan TPP	1966-1974	50/100/200/210	2/2/3/1	1100
2	Yerevan TPP	1963-1968	50/150	5/2	550
3	Vanadzor TPP	1964-1976	12/25/47	2/1/1	96
Total TPPs					1756
Nuclear Power Plant (NPP)					
Armenian NPP		1976-1980	408	2	815
Hydraulic Power Plants (HPP)					
Sevan-Hrazdan Hydro Power Cascade:					
1	Sevan HPP	1949	17	2	34
2	Hrazdan HPP	1959	41	2	82
3	Argel HPP	1953	56	4	224
4	Arzni HPP	1956	23,5	3	70
5	Kanaker HPP	1936	12,5 /26	4/2	102
6	Yerevan HPP	1961	22	2	44
Vorotan Hydro Power Cascade:					
7	Spandaryan HPP	1984	38	2	76
8	Shamb HPP	1977	85,5	2	171
9	Tatev HPP	1977	52,4	3	158
Small HPP, incl. Dzora HPP					61
Total HPPs					1022
T o t a l by Power plants					3593

However, faced with a deepening energy crisis due to the country's lack of fossil fuels and the economic blockade imposed by Azerbaijan and Turkey, on November 5, 1995, Armenia decided to resume operation at the 407.5-MW second unit. The plant, which was built in 1980 with a design life of 30 years, now (in 2002) supplies up to 41 per cent of the country's electricity.

Over the last four years the matter of closing the Armenian nuclear power plant (station) has been at the centre of political speculation in some countries. But how expedient would the closure of the Armenian nuclear power station and its replacement with some other type of power plant be for our country in the economic and overall strategic sense? Minister of Energy Armen Movsisyan answers to this question (by Interfax, 08.09.2003):

> *'' First of all we are not talking about closing the Armenian nuclear power station. If we talk about replacing the plant's capacity with some other relevant capacity, this does not mean that the plant will be demolished and something new built instead of it. The point is that if the plant's resources are exhausted, we shall think about new resources for power generation. They are thermal power plants or solar or wind energy as an alternative resource. As for thermal plants, today we have a security problem. Specifically, Armenia gets its gas from the north, which is quite a dangerous region. We do not know how long the political concern will last and how it will influence gas supply. That is, in order to rely on thermal power plants we should settle the problem of a second gas pipeline to the republic. This is the first condition; the second is that thermal plants always produce more expensive electricity than all the other power stations. That is why we cannot let the thermal plants play such a large part in our power generation that the cost price of electricity immediately rises. That is why we should have an alternative capacity, which will be equivalent to the capacity of the nuclear power station and the electricity generated by it... We need time. So today it is senseless to speak about closing the nuclear power station, as we do not have a plant with an equivalent capacity''.*

[1] Sources: [2-4, 7].

(A-3) The only indigenous source for power generation in Armenia is the hydro energy. The installed capacities make up more than 1000 MW. Power generation on Sevan-Hrazdan HPP Cascade was changed during 1999-2002 because the schedule of generation generally depends on irrigation drawdown from Sevan Lake. While the Tatev plant of the Vorotan Cascade is currently being used as a primary mean of frequency control, none of the hydro plans is considered to be capable to accepting automotive generator capacity (AGC) control without substantial rehabilitation.

Specific engineering work will be needed to establish the hydro generation rehabilitation requirements:

- **The Sevan-Hrazdan Cascade** comprising 6 multi-unit power plants is of 1930s & `40s origin. All plant equipment as well as canals, except Kanaker HPP, are targeted for refurbishment. Rehabilitation priorities established by the management of the Cascade are:
  - Canals and waterways
  - Governors and Generators
  - Turbines and other
- **The Vorotan Cascade** (comprising 3 multi-unit power plants) is of more resent design (1970s) and its equipment is more modern. The Cascade is reported to be in need of maintenance and rehabilitation to render it suitable for remote control. Priorities for rehabilitation are assumed to be consistent with Sevan-Hrazdan Cascade.

Small HPP`s operate on river current the and share of their generation depend on the weather conditions.

> *Last events:*
>
> *(i) Armenia and Russia's Unified Energy Systems (UES) signed a contract in July 2003 to hand over the Sevan-Hrazdan Cascade to the Russian company in exchange for the cancellation of a $25 million debt for Russian nuclear fuel. The International Energy Corporation, which was set up by UES to operate the Cascade - on September 1, 2003 - has been granted a 15-year license enabling it to produce electricity in Armenia told Interfax [08.09.2003] .UES International Energy Corporation has also submitted a second request seeking to raise the price for electricity generated by the cascade from 2 cents to 2.2 cents. Its first request was not considered because the corporation failed to submit a number of documents, including the one confirming its ownership rights to the cascade. Meanwhile, UES said that a higher price "will not lead to an increase in electricity fees for end consumers."*
>
> *(ii) On August 27, 2003, The Delegation of the European Commission for Georgia and Armenia has announced Tender (EuropeAid/116778/C/S/AM) for Rehabilitation HPP`s of Vorotan Cascade.*

2.2. Power Generation and Consumption

Structure of power generation in Armenia (Table 3) very largely depends on the volume of the power generation on the Armenian NPP [2-3, 7], which depends on the deliveries of nuclear fuel. The volume of power generation on ANPP was characterized by non-stability because of the nuclear fuel delivery delays in 1999-2002.

Electricity generation in Armenia had dramatically decreased over the past decade. In 1989-90, about 15 billion kWh was annually generated; by 2000, the amount of electricity generation had been reduced by almost two-thirds. Electricity consumption has also decreased since the late 1980s. During the mid 1990s, a severe electricity shortage resulted in extended blackouts for many of the country's electricity consumers. Armenia's need for electricity is expected to rise during the next decade, as the country continues to develop.

Table 3. Electricity Generation and Consumption in Armenia, 1992-2002[2] *(in billion kWh)*

Years	Net-generation				Net-Consumption
	ANPP	HPP	TPP	Total	
1992	0	3,0	6,0	9,0	9,3
1993	0	4,3	2,0	6.3	6,4
1994	0	3,5	2,1	5,6	5,6
1995	0,3	1,9	3,4	5,6	5,6
1996	2,3	1,6	2,3	6,2	6,0
1997	1,6	1,4	3,0	6,0	6,1
1998	1,6	1,5	3,1	6,2	5,9
1999	2,1	1,2	2,4	5,7	5,6
2000	2,0	1,3	2,7	6,0	5,7
2001	2,0	1,0	2,74	5,7	5,3
2002	2,3	1,7	1,6	5,6	5,2

The high share of electricity generation on Hrazdan TPP in 2001 was stipulated by the following factors:

- decrease of operating capacity of hydropower plants, particularly on Vorotan HPP Cascade (reservoir drawdown during last years and low-water year)
- nuclear fuel delivery delay in third quarter for ANPP

The dynamic of electricity generation in 1999-2002 summed up according to the dynamics of overflow balance and internal use of electricity in Armenia in corresponding periods. Increasing and decreasing of electric power export to Georgia and Iran explains change of generating volumes in mentioned years during stable internal use [3-5].

In correspondence with given data, the dynamics of the electricity consumption in Armenia during 1999-2002 is characterized by the reduction of the electricity use [5,6]. The growth of electricity use and system peak in 2000 took place because of off-system factors. The dynamics of internal use of electricity is not related to the dynamics of GDP by a unique correspondence. The main reasons for the internal use of electricity reduction are as follows:

- Electricity use reduction in water economy (irrigation and water canals), connected with the implementation of a program on optimization of the expenses.
- Change of energy balance structure also because of a decrease in the electricity consumption by population in connection with the rising level of gasification rehabilitation.
- Change of GDP structure (reduction on the power-consuming industries part)

There has been a relatively flat trend in Armenia's electricity generating capacity -- there have been few capacity additions or retirements over the past decade. Nearly 40% of the equipment in use at the power plants in Armenia has been in use for more than

[2] Sources: [2 – 4, 6, 7]

30 years. About 70% of the equipment in use at the country's hydroelectric power plants has been in use for more than 35 years, and about 50% for nearly 50 years.

2.3. Energy Transmission Infrastructure

The electric transmission system of Armenia is operated by the state-owned Company "High Voltage El. Network" and consists of 164 kilometers of 330 kilovolt (kV) lines, 1,320 kilometers of 220 kV lines, and 3,146 kilometers of 110 kV lines. The high voltage transmission network is composed of 220 kilovolt (kV) High Voltage Lines (HVL) network length 1323 km with 14 substations, and 110 kV network length 3169 km with 119 substations.

A map of Armenia's electric transmission grid is shown in Figure 1 (Source: World Bank).

Armenia Power System has interconnections with all the neighboring countries (Table 4), including 63,5 km HVL -220 kV with Georgia, 176,5 km HVL-220 kV with Iran, 80 km HVL-220 with Turkey and 108km HVL -330 kV with Azerbaijan [4,7-8].

Table 4. High Voltage Border Lines of Armenia in 1987-2002

Country	Interconnection HVL	Voltage (kV)	Length (km)	Nominal Power (MVA)
Azerbaijan[1)]	Hrazdan TPP (Atarbekyan) - Agstafa	330	108	400
Azerbaijan[1)] (Nakhichevan)	Ararat 2 - Babek	220	99,6	250
	Ararat 2 - Norashen	110	98	40
	Agarak - Ordubad	110	30	40
Georgia	Alaverdi – Tbilisi TPP	220	63,5	270
	Alaverdi 2/Lalvar- Sadakhlo	110	32,1	40
	Ashotsk- Ninotsminda	110	35,8	40
NKR	Goris- Shushi	110	58	85
Iran	Shinuhair (Tatev HPP) - Ahar	220	176,5	250 (300)
Turkey[3]	Gyumri 2 - Kars	220	80	300

Besides these, there is a 220 kV line connecting Armenia to Georgia that was reactivated in 1997 and also a 220 kV line built to Iran that has been used occasionally.

Since 1998 the Armenian and Iranian energy systems have been performing overflows of electric power, which is the main aspect in supporting the safe operation of the energy system. The overflow of the electric power is performed by the minimal capacity of 200 MW and with the emergency capacity of 250 MW. In December 2001 the Ministers of Energy of IRI and RA signed a Memorandum of Understanding where both sides decided to construct of the part (Agarak – Shinuhair) of 220 kV Syunik-Center main overhead high voltage power line, which was mentioned in the Memorandum of Understanding of 2001, Agreement on the refund of financing of the construction and installation works for the completion of Agarak 220 kV Switching substation.

Construction of the part Agarak – Shinuhair on the line Syunik – Centre will provide not only the high level of safety of the system, but also will let to increase the capacity on the line Megri 120-150MW, which in its turn will let to increase the export component approximately on 1,0 billion kWh/h per year, or will provide inflow of additional financial resources approximately $ 25,0 mln. per year. This makes the question of construction of the line urgent and immediate.

[3] Destroyed or are not used due to the blockades imposed by Azerbaijan and Turkey.

The HV system, formerly operated as a meshed network, is now operated as radial network to control load shedding operations.

The load carrying capacity of the network was more than adequate for the projected loads and the HV grid covers practically the entire country, HV transmission losses are reported to be about 4%.

The system monitoring and control centre is located in Yerevan in the head office of "Armenergo". Direct contact to all HV substations, which are all manned, is generally provided by power line carrier (PLC) via the HV transmission lines. The PLC system is very old and communications cannot always be established. The position of the switches at the various substations is not indicated by the monitoring system.

Last events:

(i) The Republic of Armenia has received a loan from the International Development Association in the amount of USD 21,000,000 equivalent toward the cost of the ''Electricity Transmission & Distribution Project'', and it intends to apply the proceeds of this loan to payments under the contract for Supply and Installation Equipment on 9 Substations 220kV. This project is jointly financed by USAID.

The proposed Project to be complemented by two parallel projects financed by Japan's Overseas Economic Cooperation Fund (about 5,399,000,000 Yen) and Germany's KfW (about US$18 million equivalent). OECF would finance the rehabilitation of 33 active substations 110 kV located through the territory of the Republic of Armenia and working in the common Power System of the Republic of Armenia. (Contract No, J/TR-SS-001).

KfW already financed the rehabilitation of two transmission sub-stations 220 kV at Vanadzor-2 and Kamo (2000-2003).

(ii) South Korea's Daewoo Engineering group is preparing to assume full management of the troubled Armenian energy-distribution network, RFE/RL's Yerevan bureau reported on 17 December, 2002, Initially privatized in August when the British-registered Midland Resources group paid $40 million, the energy network is crippled by annual losses of $50 million due to inefficiency and corruption and by some $100 million in debts to state-owned power plants. The incoming Korean managers have already begun preparing new measures to improve payment collections, curb widespread energy theft, and modernize the network's dilapidated, Soviet-era equipment. The introduction of new management responds to demands by the World Bank and will most likely speed the disbursement of $20 million in new World Bank loans crucial to bridging the state's budget deficit.

2.4. Intersystem overflow and export

Total balance of the intersystem overflow in Armenia in 1999-2002 summed up from two different parts [2-3]:

a) export of electricity in the monetary form (Georgia and Nagorno-Karabakh Republic (NKR);

b) electricity overflows in accordance with the Agreement on Intersystem Change in conditions of parallel work (Armenia-Iran).

Annual dynamics of export supplies of electricity to Georgia in 1999-2002 (Table 5) show that export to Georgia has a trend of growth. Electricity sold to Georgia ("Sakenergo" and "AES Telasi") by the market price fixed on the level of $ 0.025 kWh.

Annual dynamics of the electricity overflow balance in NKR marked as stable in 1999-2001. From the sight of annual dynamics overflow balance do not change practically during the year and stay on the level of 20-30 mln. kWh during the quarter.

As mentioned above the energy system of Armenia is surplus based system, and by the existing settled capacities the general output can reach up to 12 billion kWh per year. The internal consumption of the electric power is about 5.2-5.7 billion kWh per year, and the export is about 0,7 billion kWh per year.

The possibility of the electricity export to the neighbor countries is up to 5 and more billion kWh per year. Export to Turkey by intersystem power transmission line "Gyumri-Kars" 220kV can run up to 2.0 billion kWh per year. Export to Georgia by "Alaverdi" 220kV and "Ninotsminda and Lalvar" 110 kV power transmission lines can be 2,0 billion kWh per year. However because of political situation in the region power transmission line "Gyumri-Kars" 220kV doesn't operate and the export to Georgia is limited by the reason of their inability to pay.

Table 5. Electricity export/import operations of Armenia in 1996-2002

Years	1996	1997	1998	1999	2000	2001	2002
Export, total, bln kWh	0	0,01	0,3	0,6	0,8	0,7	0,7
Import, total, bln kWh	0	0,1	0,03	0,5	0,3	0,3	0,3
Average cost of the exported electricity to Georgia and Iran, dram/ kWh (VAT included)				15,7	13,6	13,8	

2.5. Tariffs

The basic principles of setting (by NMRC) tariffs for electric and thermal energy and natural gas, as well as sizes of payments for rendered services are as follows [1]:

a) Providing for compensation of justified operation and maintenance costs, as well as the depreciation allocations of the fixed assets and non-material assets essential for the conduct of the Licensed Operation in compliance with the License provisions;

b) Providing the opportunity for reasonable profit;

c) Inclusion of justified loan service costs;

d) Establishment of differentiated tariffs for customers dependent on the consumption volume, requested capacity, season, time of use, connection terms, type of service;

e) Inclusion of justified and essential insurance costs;

f) Inclusion of justified costs related to compliance with environmental norms;

Inclusion of mothballing and preservation costs of the installations subject to mothballing in conformance with the RoA Government Energy Development Program;

g) Inclusion of necessary burnt nuclear fuel maintenance costs and ensuring allocations to Nuclear Plant Decommissioning Fund;

h) Inclusion of justified technical and commercial losses;

i) Inclusion of other justified and necessary costs as provided by the Legislation.

In accordance with enumerated the Commission has set in 2002 the following tariffs for electricity generation and transmission [7]:

Table 6. Average Tariff in 2002 (with VAT)

Energy Sector	Cent/kWh
Generation	2,4
Transmission	0,4
Bulk-supply	2,8

The dynamic of increasing of electricity consumption tariff in Armenia in last decade is shown in Table 7 [2, 5].

Table 7. Electricity Consumption Tariff in Armenia, 1993-2002 (Cents per 1 kWh)

Years	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Average	1,35	2,46	2,36	3,05	3,56	4,01	4,08	4,00	3,87	3,76
Industry	1,88	2,46	2,56	3,25	3,68	3,83	3,45	3,15	3,16	3,10
Domestic	0,86	2,46	1,74	2,64	3,36	3,80	4,67	4,83	4,47	4,35

3. Undertaken Measures for Raising the Efficiency of Power System

For the past few years of independence the power system of Armenia has had a hard way of reforms and reformations. And on this way considerable volume of foreign donor's support played a major role (made up for 1993-2003 in the energy-sector of the country in the order of $245 million-from $390 million asked in those years [10]).

One of the sums of the continuing international aid and of the stored experience of the ruling of Armenia's energy sphere in conditions of market economy became the formation of the country's power system development program, the basis of which is the conception of the guarantee of the necessary level of energy security [1]. The given Program takes into consideration the strategic priorities of the Government of the RA [5,9], under the strict provision of the Republic's energy system diversification hierarchy and exactly:

- according to the channel of building-HPP, TPP, NPP;
- according to the fuel supply-nature gas, petroleum residue, nucleate fuel;
- according to the ways of provision of energy resources- electro and gas-transportation trunks, transportation means and ways of conveyance of oil, installation of their own energy resources.

It mainly forecasts:

- **in the sphere of hydro-electrical power:** reconstruction and modernization of the existing HPP-s, installation of economically expedient hydro potential;
- **in the sphere of heat-power engineering:** exploitation of the existing power units and aggregations to the full depletion of technical resource, technical re-equipment of the heat-power station by modern steam-gas-turbine directives;
- **in the sphere of nuclear power system:** realization of all forecasted measures, directed to the ceaseless rising of the exploitation security level of the acting power unit of Armenian NPP, in the program of development for the period 2010-2030 there is the consideration as an alternative to the building of warm power units the development of atomic power system on the basis of modern reactors with increased quotients of security and dependability;
- **installation of alternative sources** of power and integrated realization of energy-conserving policy.

In the practical frame the realization of each of these tendencies is ganged with the necessity of laying considerable financial resources. And here donor support of developed foreign countries and of international financial organizations can be considered one of the necessary conditions.

In Table 8 in a generalized form all the projects are presented which are presently realized or are shaped to the realization in Armenia under a huge foreign financial support [10]. In addition to the enumerated in Table 9 the details of some of these projects are presented, which are of interest from the position of opportunities of Armenian electrical power export.

Table 8.

Donor/Project	Status	Committed	Disbursed
ARMENIA			
Construction of the fifth power unit of Hrazdan TPP	Underway	$22,291,80	$9,300,000
First aid to power engineering (rehabilitation of Kanaker HPP)	Underway	$252,000	$152,100
Total		$22,543,80	$9,452,100
GERMANY			
First aid to power engineering (rehabilitation of Kanaker HPP)	Underway	$12,600,000	$3,405,668
Rehabilitation programme in power transmission sector	Underway	$13,860,000	$139,107
Total		$26,460,000	$3,544,775
EBRD (European Bank for Reconstruction and Development			
Hrazdan Unit #5 Technical Assessment	Completed	$161,333	$152,971
Construction of the fifth power unit of Hrazdan TPP	Underway	$57,400,00	$52,722,560
Total		$57,561,33	$52,875,53
Donor/Project	Status	Committed	Disbursed
EU (European Union)			
Gas Industry Development	Completed	$2,246,102	$2,359,780
Restructuring of the Gas Sector	Completed	$1,182,159	$1,252,454
Construction of a HPP at Debed	Completed	$123,533	$130,293
Strengthening of the National Energy Saving Strategy Centre	Completed	$3,133,333	$2,798,803
Establishment of an Energy Sector Implementation Unit	Completed	$1,237,785	$1,206,400
Energy Conservation Programme	Completed	$1,880,141	$1,775,795
Emergency Repairs of Hydro-Electric Power Plants	Completed	$482,085	$482,085
Extension and Strengthening of Energy Sector in Armenia	Completed	$1,660,785	$1,625,293
Pricing and Financing Gas Supply	Completed	$174,593	$174,051
Promotion of Investment to International Oil Companies.	Completed	$390,879	$383,138
On-site Assistance to the Metsamor NPP.	Completed	$4,525,917	$4,451,222
Licensing of Related Activities of the Metsamor NPP.	Completed	$130,293	$127,777
Multifunctional Stimulator for the Metsamor NPP	Completed	$30,341	$30,341
Nuclear Safety Facilities	Completed	$390,879	$370,689
Transfer of Western methodology for nuclear regulations to Armenian Nuclear Regulatory Body	Completed	$390,000	$390,000
Total		$17,978,82	$17,558,120
FRANCE			
Radioactive Fuel Storage	Completed	$15,649,129	$2,942,762
Activities of the Fonds Armenien de France in the Energy Sector	Completed	$44,059	$44,059
Activities of the Fonds Armenien de France in Energy Transmission	Completed	$1,459,925	$1,425,603
Total		$17,153,11	$4,412,425
UNITED KINGDOM			
Assistance to SNC of Armenia in founding	Underway	$4,979	$4,979

Emergency center			
INTERNATIONAL ATOMIC ENERGY AGENCY			
Seismic Safety Re-evaluation of Metzamor NPP	Completed	$634,470	$633,838
Restructuring Nuclear Safety Regulatory Body	Completed	$464,466	$416,225
Establishing a Radioactive Waste Management System	Completed	$103,375	$91,135
Strengthening Nuclear Regulatory Authority	Completed	$445,253	$444,986
Emergency Response Programme	Completed	$173,921	$173,707
Total		$1,821,485	$1,759,891
JAPAN			
Energy and gas systems restructuring	Underway	$600,000	
THE NETHERLANDS			
ARMWIND: A wind power IPP at Pushkin pass	Underway	$485,405	
ARMNEDSUN	Underway	$600,299	$300,251
ARMNEDWIND	Underway	$450,376	$300,251
Total		$1,536,080	$600,501
Other Donors			
Construction of the fifth power unit of Hrazdan TPP	Underway	$3,258,200	$3,258,200
Rehabilitation programmed in power transmission sector	Underway	$453,600	
Electricity transmission and distribution systems	Underway	$2,677,025	$27,225
Total		$6,388,825	$3,285,425
UNEP (United Nations Environment Programme)			
National program for anti-desert operations in Armenia	Completed	$70,000	$70,000
Donor/Project	Status	Committed	Disbursed
UNITED STATES OF AMERICA			
Restructuring Nuclear Safety Regulatory Body	Completed	$150,000	$124,800
Training of staff. Office and technical modernization	Completed		
Scientific and technological assistance for analysis of security of NPP	Underway	$172,736	$172,736
Purchase and Delivery of Gas	Completed	$60,000,000	$45,000,00
Energy Sector Restructuring	Completed	$52,250,000	$51,955,00
Nuclear Safety	Completed	$21,900,000	$21,900,00
Supply of computer equipment	Completed	$37,591	$37,591
Economically and Environmentally Sound Energy Sector	Underway	$32,428,000	$25,393,00
Total		$166,938,327	$144,583,127
The World Bank Group			
Electricity transmission and distribution systems	Underway	$66,328,200	$1,493,147
Preparatory works for Yerevan geothermal pilot project	Underway	$350,000	$237,353
Total		$66,678,200	$1,730,500

Over the 1993-2003s, the Government aimed to deepen the power sector reforms already underway by building on the interrelated achievements of greatly improved supply reliability, improvements in payment discipline, and the completed unbundling of Armenergo into separate power generation, transmission and distribution enterprises. Specific objectives to be achieved by end 2003 were [9]:

a) to place all power sector enterprises on an efficient, commercial footing;

b) to ensure that the country's electricity requirements are met in a reliable, secure and cost effective manner;

c) to attract private capital at reasonable terms to meet the bulk of the investment needs of the sector;

d) to eliminate quasi-fiscal subsidies provided in the form of non-payments for electricity, theft and other non-technical losses of electricity, and below full cost tariffs, and

e) to privatize all electricity distribution, thermal generation, and non-regulating hydropower companies, with preference being given to strategic private investors.

In correspondence with the Conception of the development of the power industry market of Armenia, worked out by NMRC of the country, at the first stage of the reformation the realization of the compulsory Pul - model is accepted as rational. The regulation will be preserved in those sub sectors of the power industry, which are natural monopolies.

In Armenia a special significance is given to the realization of measures as to the utilization of investors. In the electrical power system sector of the country certain success is reached in the part of the realization of the privatization program, including:

- beginning from 1997 almost all the small HPP-s of Armenia has gone private and also building organizations and enterprises of subsidiary meaning,
- in the membership of a unique industrial-manufacturing complex Vanadzor TPP has gone private,
- at the end of August 2002 the distributive company «Electrical nets of Armenia» has gone private, the owner of which on the basis of tender procedure became the British Consortium «Midland Resources Holding LTD» .

In correspondence with the Low on privatization in the list of energy objects, belonging to the privatized till 2003 category, also almost all the big electrical power stations of Armenia entered, including Hrazdan and Yerevan TPP, Sevan-Hrazdan and Vorotan cascade of HPP. The exception was Armenian NPP, the preservation of which as a governmental property is fixed, as it is known, in the RA «Low on electrical power». Though, in September 2003 many of these entities were given to the Russian, and particularly: Armenian NPP- to the financial disposition of RAO "UES of Russia, and Hrazdan HPP and Sevan-Hrazdan Cascade HPP- to the full property ownership of this powerful Russian Holding.

In the program of a long-term development of the power system sector of Armenia an important significance is given to the utilization of investments (especially –private) to the building of new energy objects. More important Projects for the country are as follows: the building of the gas main Iran-Armenia, Meghry HPP on the River Araks, a new steam-gas power unit with power of 170Mw on Yerevan TPP, the completion of Unit 5 of Hrazdan TPP.

The RA Low on the power system opens opportunities for the development of the power system on the renewed energy resources. During the last few years dozens of license were given for building of small HPP-s. Wide-ranging investigations are realized as to the mark of the wind energetic potential of the Republic and as to the revealing of perspective grounds for building of network wind energetic stations.

In the power sphere of Armenia on the whole there is a good atmosphere for maintaining and development of international cooperation. In this direction for today:

- the joint Armenian-Russian enterprise «ArmRosgasprom» has been founded and functions rather successfully;
- at the nearest perspective the cooperation with RAO «UES of Russia» will enter the practical phase in the sphere of production and export of electrical power;

- the correlations with Islam Republic of Iran are developing highly as to the profitable exchange of electrical power, and also as to the realization of long-term investment programs (the construction of the gas main Iran-Armenia and the HPP on the bordering river Araks, other projects).

Armenia makes serious efforts as to the organization of cooperation in all the spheres of power engineering on the basis of signing both multilateral and bilateral treaties with all the near and far foreign countries.

The new governmental energy politics determined the participation of Armenia as a reliable and equitable partner in the Commonwealth of Independent States Electric Power Council (CIS EPC), in the Council concerning oil and gas of CIS and also in such authoritative international organizations as the UCTE - Union for the Co-ordination of Transmission of Electricity, EURELECTRIC, ETSO – European Transmission System Operators, etc.

The further development and deepening of the Government's initiatives is closely connected with the integration of the electric-power system of Armenia to huge power-unification and first of all in the frames of CIS. Armenian power supply system has for it all the necessary prerequisites:

- realization of reformations and technical development;
- participation in international organizations and programs;
- availability of intersystem connections with the power systems of all contiguous countries;
- potential of export;
- work experience of the operative personnel of Armenian power system consisting of huge power-unification.

In this connection the search for the ways as to the reestablishment and development of regional intersystem connections continues, since the availability of redundant power in the power system of Armenia doesn't exclude the cheap electrical power import opportunity. The concluded Treaty about the parallel work of the power systems of CIS countries, other agreements may become a basis for the organization of Regional market of electrical power and power in the format of new market correlations. As it is expected, this can be mutually beneficial from different positions, also from the viewpoint of getting opportunities of a joint settling of foreign markets in the future.

The retractable tendencies of the intersystem electrical connections and fuel trunks development with the participation of Armenia, from the economic viewpoint, will make the further projects of electrical power export possible and the transit of the nature gas more fetching.

Table 9. Main Technical Assistance Projects (TAP-s)[4]

Construction of the fifth power unit of Hrazdan thermoelectric power plant	
Donors	ARMENIA EBRD (European Bank for Reconstruction and Development) Other Donors
Start Date	1/1/93
End Date	12/31/02
Status	Underway
Description	Hrazdan TPP Unit #5 is a condensation type unit using natural gas as basic fuel and envisaged to fire heavy oil as well. Specific consumption of conventional fuel - 316 g/kW.hr. Unit #5 consists of the following main equipment: BOILER - gas-tight, once-through, for supercritical parameters, capacity- 1000t/hr, steam pressure - 240 kg/sq.cm, steam temperature-545 grad., content of harmful impurities in exhaust gas - 200mg/kg, manufactured by "Krasni Kotelshchik", Russia. TURBINE - steam turbine, capacity - 300MW,with cooling of last stages, capacity regulation range from 30 to 100%, motor mode possibility, manufactured by LMZ(Leningrad Hardware Factory), Russia. COOLING TOWER - Heller-Forgo type, manufactured in Hungary. GENERATOR - capacity 320 MW, manufactured by "Electrosila" factory, Leningrad, Russia. Currently, Unit #5 Project is 75% complete.
Beneficiary	State Authority Structures
Source of Financing	Administrative Budget

Donor Contribution By Year	Donor	G L	Year	Committed	Disbursed	Currency
	Total			82,950,000.00	65,280,760.00	USD
	ARMENIA	Grant		22,291,800.00	9,300,000.00	USD
			1993	22,291,800.00	0.00	USD
			1999	0.00	9,238,400.00	USD
			2000	0.00	61,600.00	USD
	EBRD	Loan		57,400,000.00	52,722,560.00	USD
				4,677,440.00	0.00	USD
			2000	51,267,200.00	51,267,200.00	USD
			2001	1,455,360.00	1,455,360.00	USD
	Other Donors	Grant	1999	3,258,200.00	3,258,200.00	USD

Hrazdan Unit #5 Technical Assessment	
Donors	EBRD (European Bank for Reconstruction and Development)
Start Date	1/1/93
End Date	1/1/97
Status	Completed
Nature of TA	Advisory Services
Policy Objectives	Infrastructure Development
Description	Technical assessment component of the EBRD loan for the construction of a 300 MW gas-fire power plant and a transmission line to Yerevan.
Beneficiary	Public-Owned Companies

Donor Contribution By Year	Donor	GL	Year	Committed	Disbursed	Currency
	EBRD	Grant	1997	121,000.00	121,000.00	EUR

Energy Sector Restructuring	
Donors	UNITED STATES OF AMERICA
Start Date	10/1/94
End Date	1/1/01
Status	Completed
Nature of TA	Supplies and Equipment Partnership Advisory Services
Policy Objectives	Infrastructure Development
Description	Restructuring, consolidation and regulatory reform of the Energy sector.
Beneficiary	State Authority Structures

Donor Contribution By Year	Donor	G L	Year	Committed	Disbursed	Currency
	USA	Grant		52,250,000.00	51,955,000.00	USD

[4] Data not available [10].

			1994	26,250,000.00	0.00	USD
			1995	26,000,000.00	7,400,000.00	USD
			1996	0.00	6,700,000.00	USD
			1997	0.00	6,400,000.00	USD
			1998	0.00	20,755,000.00	USD
			1999	0.00	5,700,000.00	USD
			2000	0.00	5,000,000.00	USD

Extension and Strengthening of Energy Sector in Armenia

Donors	EU (European Union)
Start Date	7/1/96
End Date	1/1/98
Status	Completed
Nature of TA	Advisory Services
Policy Objectives	Infrastructure Development
Description	Strengthening of Energy Center. (TACIS)
Beneficiary	Public-Owned Companies

Donor Contribution By Year

Donor	G L	Year	Committed	Disbursed	Currency
Total			1,660,784.75	1,625,293.03	USD
EU	Grant		1,280,000.00	1,280,000.00	EUR
		1996	1,100,000.00	360,000.00	EUR
		1997	180,000.00	865,000.00	EUR
		1998	0.00	55,000.00	EUR

First aid to power engineering (rehabilitation of Kanaker hydro power plant)

Donors	ARMENIA, GERMANY
Start Date	2/16/98
End Date	7/16/01
Status	Underway
Description	The main parts of Phase 1 of "Rehabilitation Program of Kanaker HPP" are followings: I. Civil part 1. Rehabilitation of canals (about 8,5 km). 2. Cleaning of tunnels (about 4 km). 3. Civil works connecting with replacement equipment. 4. Rehabilitation of auxiliary equipments structures. 5. Rehabilitation of head basin. 6. Rehabilitation of powerhouse and control room building. II. Mechanical equipment 1. Overhaul repair of the turbines5 and 6. 2. Replacement of governor system of units 5 and 6. 3. Repair/replacement of gates hoists, level measurement devices of the weir, daily pond and head basin. 4. Repair/replacement of auxiliary equipments of units 5 and 6. 5. Installment of hydro technical control panel. III. Electrical equipment 1. Replacement of generators 5 and 6. 2. Replacement of unit transformers 5 and 6. 3. Repair/replacement of the bays of unit transformers 5 and 6. 4. Replacement of auxiliary transformers 1 and 2. 5. Replacement of battery chargers 1 and 2. 6. Upgrading of central control and monitoring system. 7. Repair/replacement of cables. 8. Rehabilitation of earthling system. 9. Rehabilitation of telecommunication system.
Beneficiary	State Authority Structures
Source of Financing	Administrative Budget

Donor Contribution By Year

Donor	G L	Year	Committed	Disbursed	Currency
Total			12,852,000.00	3,557,768.00	USD
ARMENIA	Grant	1998	252,000.00	0.00	USD
		1999	0.00	152,100.00	USD
GERMANY	Loan		12,600,000.00	3,405,668.00	USD
		1998	9,194,332.00	0.00	USD
		2000	2,775,100.00	2,775,100.00	USD
		2001	630,568.00	630,568.00	USD

Economically and Environmentally Sound Energy Sector

Donors	UNITED STATES OF AMERICA, USAID

Start Date	4/1/99
End Date	4/1/01
Status	Underway
Nature of TA	Supplies and Equipment, Feasibility Study, Advisory Services
Policy Objectives	Structural Adjustment & Institutional Strengthening Infrastructure Development Assistance in Policy Development
Description	-
Beneficiary	State Authority Structures
Source of Financing	Fiscal Year Budget

Donor Contribution By Year

Donor	G L	Year	Committed	Disbursed	Currency
US OF AMERICA	Grant		32,428,000.00	25,393,000.00	
		1999	28,827,000.00	9,438,000.00	USD
		2000	3,601,000.00	15,955,000.00	USD

Rehabilitation programme in power transmission sector

Donors	GERMANY, Other Donors
Start Date	1/1/98
End Date	12/31/01
Status	Completed (in 2002/2003)
Description	Rehabilitation of node substations Vanadzor -2 (220/110/35/10 kW) and Kamo (220/35/10 kW): 1. Operative control centers construction; 2. Cable channels construction; 3. Replacement of equipment for 220/110/10 kW (circuit breakers, disconnections, current and voltage transformers, storage batteries, relay protection system equipment).
Beneficiary	State Authority Structures
Source of Financing	Administrative Budget

Donor Contribution By Year

Donor	G L	Year	Committed	Disbursed	Currency
Total			14,313,600.00	14,313,600.00	USD
GERMANY	Loan	2000	104,850.00	104,850.00	USD
		2001	34,257.00	34,257.00	USD
		2002	13,720,893.00	13,720,893.00	USD
Other Donors	Grant	2002	453,600.00	453,600.00	USD

Electricity transmission and distribution systems

Donors	Other Donors The World Bank Group
Start Date	1/11/99
End Date	12/31/03
Status	Underway
Description	Sources of financing: World Bank credit and Japanese Bank of International Cooperation Loan. In accordance with the categories of the Project, implementation of the following measures/tenders is foreseen from the funds of the credit/loan (according to the clarified Project scope): A. In the part of WB Credit 1. International audit of four companies of the Energy Sector for 1998 and 1999 fiscal years (completed). 2. Procurement and implementation Consultant (completed). 3. Replacement of the equipment at nine 220kv s/s and construction of new 110kv s/s. 4. Computers and software for the Financial Settlement Unit. B. In the part of JBIC Loan 1. Procurement and implementation and new SCADA/ Communication Design Consultant for the Energy Sector. 2. Replacement of equipment at 33 110kv s/s. 3. Implementation of the first stage of SCADA/Communication System. 4. Procurement of multi-tariff meters for the sociably population.
Beneficiary	State Authority Structures
Source of Financing	Administrative Budget

Donor Contribution By Year

Donor	G L	Year	Committed	Disbursed	Currency
Total			69,005,225.00		USD

	Other Donors	Grant		2,677,025.00		
	The World Bank Group	Loan		66,328,200.00		

4. Regional Power Treatments: Current Condition and Tendencies of Extension

The disintegration of the Soviet power grid brought considerable changes for the electricity system of the Trans-Caucasian Republic (South Caucasus). In former time, energy was not correctly valued at market prices and the cost of primary energy such as oil, gas or coal as well as the cost of peak power and base load power was not accounted with real international market prices. In addition, the power plants of the Trans-Caucasian Republic served to optimize the Soviet power grid: the hydro power plants were used as peak power plants and as power/frequency control units for the Southern and Western part of the USSR. This allowed the operating of the nuclear power plants at constant load which is both technically and economically of greatest importance.

Now the South Caucasus countries have to buy fossil fuel at international market prices and the operation of their power plants is judged as well on economic terms. These conditions represent not only a burden for the utilities but offer also the opportunity to play a role on the market and to sell the energy at maximum price. The Caucasus countries have to orient their energy price by the own generation cost and the market price of electricity in the region, and all neighbors are potential trade partners with variable prices. Any scope of power trade can be activated by the South Caucasus countries with the aim of optimization of benefits.

Meanwhile it's fair in fact to consider that according to the geographical location and to the existing possibilities of export and import of the electrical power of the republics of the South Caucasus have all the presuppositions both for the joint profitable work and for occupying a worthy place in the existing plans of the unification of the power grids of front Asia and Europe. Moreover, the required high voltage lines exist and continue to be constructed on the two-sided or many-sided basis.

Briefly about the aforementioned is presented below.

4.1. The Plans of the Creation of the Regional Wholesale Power Market

It was considered that the reconstruction of the power links between the national power systems of South Caucasus doesn't require the solution of complicated technical problems and huge investments for the organization of the joint power system "Russian Federation - South Caucasus – Iran -Turkey", the presence of which is a prior condition for the realization of the free export, import and transit of electrical power. As a conductive circumstance the presence in the region of the power links presented in Table 5 and Table 9 was viewed.

In fact the problem of the regional collaboration of the power grids was discussed earlier yet in 1994. Exactly to that time the beginning of the elaboration of the project TACIS-EREG 9401 "The Unification of the Caucasian countries with Turkey" refers [11]. But this project remained in a "rudimentary" state.

Here we should add that in the same context the aims and tasks of the holding of the international conference organized by the company Consulting Group (USA) in the summer of 2002 in Georgia under the financial support of the American agency of the

international development USAID should be viewed. Meanwhile, the ideas expressed at this conference about the creation of the regional wholesale market of the electric power called comments in the radiant administrations of the South Caucasus republics, especially in Azerbaijan.

As against such declarations of the Azerbaijan side, Georgia, according to the information of the agency " Mediamax" from 14.11.2002, considered (as to the words of the former Minister of Energy of Georgia D. Mirtskhulava), that the creation of such a power system is profitable not only economically but also from the viewpoint of the regulation of political conflicts. "At this stage it's important that Armenia and Azerbaijan understand that the question has matured and demands a solution", - underlined Mirtskhulava. And, doubtless, from the solution of this problem all the countries of the region will win, including Azerbaijan. And this is natural, since the whole world knows the advantages of the parallel work of the power grids which provides the getting of profits of free sale and the exchange of energy.

The parallel work of the power grids of various countries implies first of all the development and the creation of the technical possibilities of the energy transfer (the so-called "overflows") from one country into another. And such a practice already gives a tremendous economy of the energy, for instance, in Europe.

a) The condition of the energy-connection "Armenia-Azerbaijan"

As has already been mentioned, in the near past a number of high voltage lines (HVL) of power transfer existed, which linked the power systems of Armenia and Azerbaijan (Table 4).

Unfortunately, now these links are lost and the restoration will require corresponding expenses.

b) The condition of interconnection "Armenia-Georgia"

The export of the Armenian energy to Georgia is carried out in the latest years according to the scheme of the separated "island" in the radial regime.

In the period from the beginning 1997 to the autumn 2002 in Georgia overall approximately 1,2 Billion kWh of energy was sold with the realization of its supply as to the acting HVL 220kV "Alaverdi", HVL110kV "Lalvar" and HVL 110kV " Ninotsminda".

c) The condition of interconnection "Armenia-Iran"

In accordance with the Agreement on Intersystem Change in conditions of parallel work between Armenia and Iran, Armenia has an opportunity to import electricity from Iran during the period of maximal load (winter months), compensating the overflow from Iran in summer months. Such scheme allows increasing usage factor of the Armenian NPP in summer months, thus decreasing fuel expenses for natural gas on Hrazdan TPP in winter months. Intersystem overflow dynamics between Armenia and Iran are characterized by the accumulation by Armenia of negative overflow balance to the end of the calendar year during 1999-2000. The situation was changed in 2001 when Armenia-Iran overflow balance became positive.

Table 10. Other Acting Regional Border HVL-s

From Substation	To Substation	Voltage, [kV], (number of circuit)
Links from the stuff of the Unified Energy System of the Trans-Caucasus		

AZER-TPP (Azerbaijan) AGSTAFA (Azerbaijan) YASHMA ((Azerbaijan) YALAMA (Azerbaijan) ENGURI- HPP (Georgia) BZYBI (Georgia)	KSANI (Georgia) TBIL-TPP (Georgia) DERBENT (Russia) DERBENT (Russia) CENTRALNAYA (Russia) PSOU (Russia)	500 (1) 330 (1) 330 (1) 110 (1) 500 (1) 220 (1)
Exits to Turkey		
BABEK (Nakhichevan) SADARAK (Nakhichevan) BATUMI (Georgia) BAZARGAN (Iran)	IGDIR (Turkey) ARALIK (Turkey) HOPA (Turkey) DOGUBEYAZIT (Turkey)	220 (2) 34,5 (1) 220 (1) 154 (1)
Exits to Iran		
IMISHLY (Azerbaijan) ASTARA (Azerbaijan) ARAZ (Nakhichevan)	PARSABAD (Iran) ASTARA (Iran) ARAS (Iran)	220/230 (1) 110/220 (1) 110/132 (1)
Turkmen direction		
BALKANABAT (Turkmenistan)	GONBAD-E-KAVUS (Iran)	220 (1)
European direction		
BABAESKI (Turkey)	MARITSA-3(Bulgaria)	400 (1)

As mentioned above, on December 2001 the Ministers of Energy of IRI and RA signed a Memorandum of Understanding where both sides decided to construct:

- hydro power plant on the river Araks,
- the part (Agarak – Shinuhair) of 220 kV Syunik-Center main overhead high voltage power line (HVL)

Construction of the named part on the line Syunik – Centre will provide not only the high level of safety of the system, but also will let to increase the capacity on the line Megri 120-150 MW, which in its turn will let to increase the export component approximately on 1.0 billion kWh per year, or will provide inflow of additional financial resources approximately $ 25,0 mln USD per year. This makes the question of construction of the line urgent and immediate.

By the preliminary accounts concerning the construction of line Syunik–Center Armenian side 12 mln US dollars are needed, that will be transferred by the Iranian company Sunir, which is the General Contractor for the construction and the supplier of the necessary equipment, goods and materials.

d) Regional Plans of RAO "UES of Russia"

The Joint Stock Company Unified Energy System of Russia (RAO "UES of Russia") is a unique system which creates significant economic benefits for both the Russian people and Russia's industry.

Electricity exports are viewed as a priority of RAO "UES of Russia" and one of sources of funds for the Company's operations and implementation of investment projects.

In 2002, total electricity exports made RUB 16.7 billion decreasing by 1.2 TWh, or 6%, compared to 2001. Notwithstanding the mentioned, export revenues grew to USD 292 million in 2002 from USD 254.1 million in 2001, which suggests that the efficiency of export operations of RAO "UES of Russia" has improved. In 2002, RAO "UES of Russia" exports to the former Soviet Union countries somewhat decreased compared to 2001, whereas exports to other foreign countries rose.

Pursuant to the decision of the Management Board of RAO "UES of Russia", beginning in Q4 2002, part of export sales to the CIS countries were handled under contracts by Closed Joint Stock Company "Inter RAO UES", a wholly-owned subsidiary of RAO "UES of Russia". The volumes of electricity exported by "Inter RAO UES" in 2002 totaled

848.3 Billion kWh, including about 1, 43 Billion kWh to the South Caucasus region and to the Turkey (see **Error! Reference source not found.**).

Table 11. Export of Russian Electricity in region 2000-2002, *million kWh*

Regional Countries	2000	2001	2002
Azerbaijan	-	9,64	1 087,30
Georgia	269,30	415,22	249,92[5]
Turkey (through Georgia)	-	180,49	92,76
Total	269,30	605,35	1429,98

UES's New Export Plan of action for increasing export capabilities in sales to the "near abroad" countries includes:

- Intergovernmental coordination of long-term programs for the development of the electricity industry in CIS countries, creating conditions that will attract investment funds for these purposes;
- Development of an intergovernmental market of electrical energy and capacity to the CIS countries, facilitate efforts for streamlining customs procedures for transmitting electric power across national borders;
- Assigning property in the CIS countries to UES of Russia in exchange for country debt to the Holding Company.

RAO "UES of Russia" is preparing to launch several energy projects in the ex-Soviet Union countries. These projects involve expansion of electricity exports and operation of local energy entities. Particularly, at present the RAO "UES of Russia" has acquired equity stakes of Armenia and obtained rights for managing some power facilities in the Republic, specifically, Hrazdan TPP, Armenian NPP, and hydraulic power plants of Sevan-Hrazdan HPP Chain (Cascade) .

According to the Mass Media Department of RAO "UES of Russia", the Republic of Armenia remains the sole owner of Armenian NPP. After "Inter RAO UES" obtains the rights of shareholder in Armenian NPP, it will control the plant's financial and business operations. The functions of the operating entity, as before, will be performed by AO "Armenian NPP". "Inter RAO UES" will work to improve the operations at AO "Armenian NPP", introduce advanced business-processes, budgeting, and enhance the Company's transparency.

Under the Agreement, "Inter RAO UES" undertakes to facilitate regular supplies of nuclear fuel and repayment of the debts owed by the plant to Russian fuel suppliers. The debts will be repaid with the proceeds from the sale of electricity generated by the NPP.

Besides, RAO "UES of Russia" is looking into the possibility of taking a long-term lease of the cross-border power transmission lines linking Armenia with Georgia, Iran and Turkey (all of them are HVL 220 kV). These transmission lines will make it possible to sell excess electricity from Armenia's energy system to other countries.

Meanwhile a mentioned plan has put a Russian company in position to dominate potential Caucasus power exports. Some observers now worry that the business moves can enhance the Kremlin's ability to project its political power in the region.

Table 12. Turkey: Prognosis of the Power deficit for the period to 2020 (by [2, 4, 16-18])

Years	*2000*	*2010*	*2020*
Power demand value (Billion kWh)	134,0 *125,0*[6]	289,8	547,1

[5] Without 556,0 KWh electricity exported in Georgia since December 2002 prior to March 2003

Import (Billion kWh)	7,0 *3,8*[6]	57,5	76,7

Underpinning the recent burst of activity is a clearly stated desire by Russian concerns to boost regional power and energy exports. Anatoly Chubais - the UES Chief - has stated that his company aims to make inroads into the underserved markets of eastern Turkey. Experts generally agree that Armenia has sufficient generation capacity to export electricity. However, Armenia is unable to export power to Turkey directly given the lack of full diplomatic relations. Any Armenian power exports would thus have to flow through Georgia.

Despite the relatively high tariffs, the use of the electrical power in Turkey has risen quickly, calling forth from year to year a notable rise in its deficit (see Table 10). It's quite natural that the countries of the region deployed for the Turkish and further for the Balkan power markets both the economic and the political struggle into which Armenia was also drawn. Having surplus of electrical energy power, the country is able to export about 500 MW. The maximum closeness of the country to Turkey in contrast to other countries, during the export of electricity is able to bring the losses during the transportation to the minimum.

From the position of the demand for the electrical power of some interest for our region is a range of countries of South Europe - Balkan countries and particularly, Italy, disposed in turn with Turkey. And the data of Table 13 is a sufficient proof of that.

Most of all Turkey entices with the high cost of electricity in the inner retail market and with the constant raise of its consumption volume. The average price of 1 kWh for retail Turkish users is about 8 cents, while Armenia is ready to supply electrical power to the neighboring country for 2.5 cents for 1 kWh (for comparison, the cost price of 1 kWh electrical energy produced in Russia in average makes more than 1 cent, in Azerbaijan and Georgia about 2 cents, in Turkmenistan-more than half a cent).

About the signs of the real existence in Turkey of the crisis in the possibilities of electro import we can judge with the example of RAO «UES of Russia"- this company planned to export 110 million kWh a month to Turkey but its current yearly size (see Table 10) doesn't confirm such iridescent expectations.

With the registration of that incident in previous years the exporters and the buyer discussed the selling of kWh for 3 cents at a retail price for 8 and more cents, the Turkish "electricians" can earn on the resale with the registration of sales more than 250%, And the exporters appear to be in a difficult situation.

Till the latest times in the existing plans of enlarging the export of Russian electrical energy to Turkey more attention was paid to three projects:

- Convey as transit goods through Georgia;
- By express " Russia-Azerbaijan-Georgia-Turkey"
- By express "Russia-Azerbaijan-Iran-Turkey"

Table 13. Power sector of the Balkan and of the adjoining countries: The dimensions of the Power deficit in 1999-2000[7]

Countries	Import value (Year)
Bulgaria	1.5 billion kWh (2000)
Greece	1.729 billion kWh (2000)
Romania	775 million kWh (2000)
Turkey	3.791 billion kWh (2000)
Slovakia	4.5 billion kWh (2000)
Slovenia	700 million kWh (2000)
Italy	44.831 billion kWh (2000)
Macedonia,	75 million kWh (1999)

[6] Factual data

[7] According to the data of OECD- Organization of Economic Collaboration and Development

However, at this period - in connection with a harsh energization of the activities of Russia in the regional Power sector, opportunities for studying and using also other schemes of realization of the denoted plans have appeared.

As to the reports of the Russian and Turkmen Media, on 24 October, 2002 during the negotiations of the prime-minister of the RF Mikhail Kasyanov with the Minister of Energy and Natural Resources of Turkey Djumchur Ersyumer, which took place in Istanbul, again an arrangement was reached about direct deliveries of the electrical power from Russia to Turkey through Georgia. As to the words of A. Chubais, who accompanied Kasyanov, the protocol about the electrical energy supply which Georgia has already signed, was initialed also by the Turkish part. If previously Georgia in fact resold Russian electricity to Turkey, now there will be no resells-every month Russia can deliver to Turkey 100-110 million kWh powers and the general sum of supplies is estimated up to $50 million a year. Besides in future Russia will possibly take part in the construction in Turkey of the lines of electro-transmissions and the volumes of the electrical power supply will be enlarged.

As in October 2002 the former Minister of Fuel and Energy of Georgia D. Mirtskhulava declared (at the meeting of the Ministers of Energy of the NIS countries) now with Russia the possibility of the electrical power export is examined within the limits of the project on the erection of intersystem lines of electro transmission, connecting Russia, Georgia, Azerbaijan and Turkey (the second from the mentioned above expresses). The given project envisages the erection of HVL-500 kV, passing through the south regions of Georgia (see Figure 1) with the exit to Turkey. The minister mentioned that the building of the line began yet in the Soviet period. Now they are built for 30%. As to the computation of Georgia, the completion will cover more than 2 years and will demand means of about $250-290 million. He also underlined that Russia and Azerbaijan, on the whole, support this initiative.

The realization of the given project will allow, as to the words of the Minister, to export yearly from 2.5 billion kWh of electrical power with the annual increase of 500 million kWh to 6 billion kWh The share of Georgia in the deliveries of electrical power can make up to 1 billion kWh And the preliminary arrangement with Turkey on this account was reached. However, after the reformation of the Turkish electrical power a lot of competing companies arose and now it's necessary to restart the negotiations about electrical power export possibilities.

Adherence to this aim was confirmed once again by Turkey in February 2003-during the meeting of the Minister of Fuel and Energy of Georgia D. Mirtskhulava with the Minister of Energy and Natural Resources of Turkey Guler which took place in the same month in Istanbul. Meanwhile, as it was reported, agreements were reached about the export and transit of electrical power from Georgia and on the elaboration of a joint project of building HVL-500KV, connecting the power grids of Azerbaijan, Russia, Georgia and Turkey.

The idea of creation and usage of the third express (”Russia- Azerbaijan- Iran-Turkey”) belong in a considerable amount to Russia and was first promulgated at the end of August 2000-in the visit to Baku of the delegation RAO “UES of Russia” (during which the representatives of this department met with the leaders of “Azerenergy”). Exactly at that period the parts discussed the details of the project of the transit of Russian electrical power in Georgia through the territory of Azerbaijan, including the question of creating a joint work group according to its exploitation.

As to our viewpoint, we can confidently expect that the energization of RAO «UES of Russia» activity in the region and especially in Armenia can and will soon bring to the creation of a common power grid in South Caucasus. At this point it's important that the same idea was supported by the Prime-Minister of Armenia Andranik Margaryan, which, as to the statement of the agency ARKA (10/23/2003) informed that the creation of a common power grid in South Caucasus shouldn't be connected with political issues. As to his words, the Armenian Government announced for several times and again it confirms its readiness in arranging normal economic relations with Azerbaijan and Turkey. And we’ll be grateful if the activity of RAO “UES of Russia” in the person of Anatoly Chubais will cooperate on this question with us”,- said A. Margaryan.

One of the decisive steps in this direction can become the commenced formation under the aegis of Russia, Common Power Market of the Republics of CIS (CPM-CIS), mentioned above, which has the aim of building of a common market space on the basis of parallel working power system for [18]:

- Increased efficiency of the CPM-CIS subject functioning;
- Optimization of the fuel and energy resource usage of the States-participants of CPM-CIS;
- Approach of the power field reformation process in the States-participants of CIS;
- Creation of technical, legal and economic basis for the unification of the power markets of states-participants of CIS and of other countries of Europe and Asia.

In the conceptual plan such unification will present a sphere of free buying-selling of electrical power and of appropriate services between the participants of the market. The participants of CPM-CIS –these are the subjects of the electrical power of the States-participants of CIS, which have access to CPM-CIS and realizing activity on production, delivery, commerce and distribution of electrical power; on the operative-technological management, on the qualified and effective rendering of system and other types of services, etc.. At this point it is important that among topping principals of the organization of CPM-CIS the most basic are as follows:

- Rights of equal access to the technological (nets, dispatcherization) and commercial (specialized trade grounds) market infrastructures for all the participants of CPM-CIS;
- Non-discriminating transit of the electrical power delivery and the power through the territory seized by CPM-CIS taking into account of technological limitations.

While under equal conditions the provision of the right to transport electrical power through the power nets of the CPM-CIS participants according to the Rules of CPM-CIS and signed treaties for the delivery or/and transit of the electrical power. For this in its turn the states-participants of CIS must take measures, contributing to the following:

- The opening of home markets of the electrical power took place with a gradual decrease of the sociability threshold;

- The electrical power sellers located on the territory of one State had the right of the access to the delivery system and the signing of treaties for the electrical power supply on the territory of another State in accordance with the legislation of these countries;
- The buyers of electrical power located on the territory of one State had the right of the choice of the electrical power seller on the territory of another State.
- As to the version of the Executive Committee of the Power System Council of CIS the corresponding basic document on the general power market of the CIS countries will be ready for signing in April-May 2004. It’s natural that the existence of such a document will facilitate the solving of the problems of South Caucasus power system unification. Nowadays active role of Iran in the power system of the region can contribute to it.

e) Power Export Plans of Iran

Iran enjoys an outstanding geographical location in the Middle East due to its land and water borders with its neighboring countries. One of the most important roles Iran can play in the region is to establish trade relationship among neighboring states. Transport and transit of goods, existing of oil and gas pipelines and communication routs connecting the country with neighboring states can uplift our country's status as the main center of economic activities in the region. This also includes exchange of energy with neighboring states. The managing director of the Power Generation and Distribution Company (Tavanir), referring to managerial structure of the company and export of electricity to other countries, said that given the special geographical conditions of the region we can exchange energy with northern neighboring states and can swap electricity with eastern and western neighbors due to their difference of horizons with Iran. This can be beneficial to both sides.

Already active trade of the electricity is carrying on by Iranian electric networks, joint with matching networks of Armenia, Azerbaijan, Turkey and Turkmenistan. Despite of an own deficit of energy, Iran will utilize any possibility to gain currency at the expense of energy export, transit and other bargains. At present time Iran exports power to Turkey and Azerbaijan (40 MW to each country).

Tavanir and "Azerenergy" JSC (Azerbaijan) signed an agreement, which stipulates increasing of power exchange between two countries, comprising the escalation of power deliveries from Iran to Nakhichevan. The reached arrangement on construction of the 132kV transmission line will enable rising power deliveries by 30 MW. Foreseen building of new "Julfa" 63 MVA substation on the territory of Nakhichevan and construction of a transmission line to connect it to the same line like substation on the territory of Iran, will allow this year to reduce deliveries of power from Iran to Nakhichevan up to 140 MW. That will practically amount 100 % of own consumption in this region (130-150 MW), which is now covered with deliveries from Turkey and Iran. While the delivery of power from Azerbaijan to certain provinces of Iran is carried out.

Construction of the second transmission line Imishli-Parsabad will allow reducing cross flows of electricity from Azerbaijan to Iran from 200 MW up to 350 MW. Then the second design stage - construction of the transmission line deep into of both countries will be realized, that will allow by July, 2005 to increase a possibility of power exchange up to 1000 MW. Georgia also searches for any possibility to receive a cheap energy and to confine deliveries of energy from Russia. This year (according to the information of the Iranian trade representation) the Ministry of Energy of Georgia applied to Iran with the request to sell electricity through Azerbaijan. Turkmenistan, at the same time with increasing of power generation also is constructing transmission

line for transit it to Iran, allowing also outlook of deliveries of electricity to Turkey and Armenia.

By adding that within the framework of trilateral cooperation Armenia – Iran - Greece is solved the problem, on building the Armenian thermal power station on territory of Iran.

At the same time Yerevan attaches great significance to the project to transfer Iran's gas to Armenia, and called for expediting the implementation of the project as soon as possible, said Armenia's Energy Minister Armen Movsisyan on October 22, 2003, in a meeting with the visiting governor general of Iran's East Azerbaijan province *(Iran.ru, 10/23/2003).* Movsisyan pronounced that Armenia is determined to cooperate with Iran on the project, stressing those Iranian officials have also pledged to provide all necessary assistance to make the project operational. He further stressed that Iran and Armenia have agreed to construct two units of a hydroelectric plant with a production capacity of 80 megawatts on the banks of the Araks River. Movsisyan added that Armenia would use Iran's experience in constructing the plant. Elsewhere in his remarks, the Armenian energy minister said that Tehran and Yerevan are also considering starting a new project to transfer Iran's electricity to Armenia. He said the project will come on stream in mid-2004, stressing that it will double Iran's exports of electricity to Armenia (more details see above).

5. The Existing Political Constraints for Regional Cooperation

It is true to consider that regional integration in South Caucasus is inevitable due to conformity to globalization and objective tendency of modern world development.

Future regional integration is conditioned not only by the global conformity and world tendency but also with presence of definite requisites among which are marked out the followings:

- Geographical closeness of members countries;
- The presence of general problems (social-economic development, ecology, migration and so on) the decision of which will be more effective in unified integration system;
- Potentially available regional division of labor;
- Experience of regional cooperation within USSR and presence of definite regional system of transportation, communication and power infrastructure (which are under reconstruction and (or) modernization);
- Approximately equal level of socio-economic development;
- Support an idea of creation regional integrated group by Europe and US which are ready to finance major projects of regional scale and etc.

If follow the overstate model of integration offered by Europe, it is obvious that regional integration of South Caucasus countries must pass several stages before getting the valuable institutional form and effectively functioning over national institutes and structure:

Stage I - suppose the development of socio-cultural and economic interrelations mainly transnational character (so realized without government participation). The main participants of that stage are separate individuals, enterprises, different organizations and so on.

Stage II – the strengthening of economic and social interdependency of South Caucasus countries inevitably will bring to creation of unified economic alliance. This alliance will provide free moving of products, power, services, manpower capital and information.

At the same time, the three regional countries have centuries-long traditions and deep historical roots of coexistence. This social potential is still not fully deployed in modern political processes. In the meantime it seems essential that the processes of policy-making in the three countries could be harmonized in such a way that the social interests of the population from each side of the boarder could be balanced and fully reflected in the political decision-making. Especially, regional economic cooperation is an extremely important condition for real economic development of every individual economy. First of all, each local market is too small to provide national producers with adequate market capacity. Also, a single country seems to be a stronger player in the global economy when being integrated in it through regional inter-mediation rather then individually.

Thus, regional economic co-operation is an unavoidable requirement for sustainable development of each nation. Within this context, the regional power supply systems can be considered as a potential leader in the overall process of regional integration. The extraordinary high importance of energy for the modern development makes every country not free to follow in long-term a non-efficient energy policy. The search for efficient energy-production/consumption is not a subject of political consideration but a strong economic necessity, which forces the countries to subordinate finally their pure political priorities to the logic of economic rationality.

The realistic vision of the future benefits - especially in relation to regional power systems cooperation - can play a role of strong political argument to intensify activities to overcome the immediate obstacles on the way toward common development. The integration in South Caucasus is real and Europe serves as excellent example for as earlier the hostile countries could create economic and political alliance which answer to their long-term interests.

Bellow the basic restrained and, vice versa, favor circumstances of integration of Armenia to the regional economic system are shortly presented.

5.1. Contributory circumstances

a) Growth of Russian Influence in the Region

As mentioned above now under Russian corporate control in Armenia are considered to be 1100-megawatt Hrazdan TPP and six hydropower stations, totaling 556 megawatts, on the so-called Sevan-Hrazdan Cascade. In addition, the Armenian government formally approved a deal on September 17, 2003, that will allow UESR`so act as the "financial manager" of the Armenian nuclear power plant. The five-year agreement stipulates that Armenia remains the titular owner of the nuclear facility, responsible for maintaining a safe operating environment at the plant.

Observers believe the next step for Russian companies could be into the Armenian energy market. Gazprom and ITERA, another Russian company, hold key stakes in Armenia's gas distribution company. Russia's new weight in Armenian power generation could lead to broader control in the Armenian gas sector.

Nowadays Russian concerns have also made a high-profile push into Georgia. UES obtained a controlling interest in the operation of Georgia's power grid in August, while also purchasing a majority share in the power-generating joint venture AES Silk Road. Those deals give the Russian electric giant virtual control over Georgia's domestic

power market. Last May, Gazprom, the Russian gas conglomerate, established a dominant position in Georgia's energy distribution infrastructure by concluding a partnership agreement with the Georgian government.

As to our viewpoint, despite the existing apprehensions concerning the possible geopolitical impact of such steps (see, for example, Russian Moves in Caucasus Energy and Power Sectors Could Have Geopolitical Impact. EurasiaNet, 9/25/2003), they are able to have a positive impact both on the economics of the countries of South Caucasus and on the whole region on the whole. Moreover, we can expect that exactly the growing existence of Russian power companies in the region is able and will soon bring to the solution of the problem which is of interest- to the mutually beneficial unification of South Caucasus power systems. In this connection the following reports of A. Chubais, which he made in Yerevan during the press-conference from 21.10.2003 are notable. Answering the question about the possibility of Armenian electrical power export to Azerbaijan, Anatoly Chubais again underlined the importance of creation of a joint parallel both with Azerbaijan and with Georgia (RusEnergy, 10/22/2003). "And even having zero soldo-overflow this will be profitable for both States", - mentioned the head of RAO UES of Russia… Now new arguments appear for the negotiations with Azerbaijan. Nowadays electrical power is exported from Russia to Azerbaijan. There exists a potential possibility for the supply of electrical power from Armenia to Azerbaijan; however at this stage we don't have such a problem. There is an aim to synchronize Armenia and Azerbaijan. At the following stage new project concerning the outlet to the third countries may appear. Particularly, RAO "UES of Russia" aims to participate in the privatization of the power objects in Turkey", - said Chubais.

b) The Regional Interests and Steps of Iran

At present Armenia and Iran are seeking to boost bilateral relations. Both countries clearly hope that closer cooperation can be used as leverage to influence broader political and economic issues in the Caucasus. However, relations are developing slowly, due in large part to the fact that close Armenian-Iranian ties run counter to the interests of other countries in the region. Armenia and Iran, at first glance, appear to be unlikely partners. Iran is a large autocratic and theocratic Muslim nation, while Armenia is a small, Christian country struggling to implement market-democratic reforms. Nevertheless, Iran's ties with Armenia are stronger than the links that bind Tehran to many of its Islamic neighbors[8].

Ultimately, Armenian-Iranian relations will be shaped by the success or failure of bilateral projects now under consideration. Armenian President Robert Kocharyan's last visit to Iran (December 2001) helped create a favorable bilateral atmosphere, paving the way for substantive cooperation. In addition to the thermal power station possibility, Yerevan and Tehran have agreed to speed up construction of the Kajaran tunnel in southern Armenia, which will greatly enhance cargo turnover. Another project envisages linking the optical fiber cable networks of the two countries. When the 40-kilometer gap in northern Iran is filled, Iran will be connected to the Russian optical lines to which Armenia is already linked.

In early February 2002, during ceremonies observing the 23rd anniversary of the Iranian revolution, Tehran's ambassador to Yerevan, Mohammad Farhad Koleyni, described Armenia and Iran as the "best" of neighbors. The two countries are paying particular attention to expanding trade. At a tri-partite gathering of Armenian, Greek and Iranian officials held February 13, 2002, in Yerevan, Armenia and Iran announced that they would explore the feasibility of constructing a thermal electric power station

[8] Source: IRAN-ARMENIA TIES LOOK PROMISING, THOUGH OBSTACLES REMAIN STEEP. *Eurasianet, 02/20/2002*

in Iran to provide power to Armenia, according to the Arminfo agency. Armenia is reportedly intensifying efforts to attract Iranian investment.

Necessity is driving the two countries together. Iran needs a friendly Armenia to provide an alternate transportation route to Russia and Europe. Armenia, meanwhile, faces continuous trade-route blockades from Azerbaijan and Turkey. Yerevan is thus interested in securing a reliable outlet for trade.

Armenians are more excited about collaboration with Iran's energy sector. Armenia lacks meaningful fuel reserves and plans to close its nuclear power station within 10 years. The thermal power station and other energy links to Iranian production centers would significantly enhance Armenia's economic security.

Among the more intriguing possibilities is the construction of a 140-kilometer gas pipeline that would connect the two countries. A pipeline has long been a topic of bilateral discussion. Realization of the project has been hampered by the high cost of exporting Iranian gas, hampering its ability to compete on world markets. New hopes arose after the Korpedzhe-Kurt-Kyi pipeline began construction in 1997, linking Turkmenistan and Iran. This line should enable Turkmenistan to export its cheap gas though Iran to third countries, of which Armenia could be one.

On July 13, 2002, Iranian Energy Minister Habibollah Bitaraf wrapped up a three-day official visit to Armenia with upbeat statements about the future of his country's already warm relations with its sole Christian neighbor. He said the Islamic Republic is strongly interested in the success of joint energy projects with Armenia, viewing them as a key element of its policy toward the entire South Caucasus[9].

Speaking at a joint news conference in Yerevan, Bitaraf and his Armenian counterpart, Armen Movsisian, announced an agreement to increase the volume of mutual power supplies and reaffirmed plans to construct a multimillion-dollar power plant on the Araks River, which marks the border between the two countries. "The scope and areas of our cooperation are very broad. We are step-by-step deepening that cooperation and thus moving forward."

Movsisian agreed, saying, "Mr. Bitaraf's visit marked the beginning of very fruitful work, and I believe that this cooperation is beneficial for both the Islamic Republic of Iran and the Republic of Armenia."

The seasonal exchange of electricity between the two energy sectors was launched in 1998 and, according to official figures, has since totaled 1.3 billion kilowatt hours, or approximately $40 million. Armenia imports electricity from Iran in the winter when its hydroelectric power plants operate at a fraction of their capacity. Iran, by contrast, needs additional energy during its hot summer months and receives much of it from Armenia.

The scheme will be substantially expanded after the opening next month of a new power exchange facility in an Armenian town near the Iranian border. A new high-voltage transmission line that is currently under construction in southeastern Armenia will serve the same purpose.

In addition, Iranian and Armenian energy officials have been conducting feasibility studies on the Araks hydroelectric plant. Bitaraf and Movsisian said they have already agreed in principle to go ahead with the project, which is estimated to cost some $35 million.

President Robert Kocharyan told Bitaraf on 17 July that energy cooperation should become an "engine" of Armenian-Iranian economic ties. Prime Minister Andranik

[9] Source: ARMENIA: ENERGY COOPERATION WITH IRAN TO INCREASE. RFE/RL, 07/14/2002

Markaryan likewise noted at a meeting with the Iranian minister that Yerevan and Tehran are motivated by "common regional interests" in their drive to strengthen bilateral relations.

The United States, which accuses Iran of being part of a global "axis of evil," recently signaled its unease over the growing Armenian-Iranian links. Armenian officials have pledged to address the U.S. concerns and claim to have already tightened export controls at the country's main border crossings. But they have stressed that the U.S. sanctions were imposed on private Armenian entities and will not affect the interstate relationship with Iran.

Armenian-Iranian relations are now developing within the context of building competition between Russia and the United States for regional influence. This geopolitical jockeying will exert considerable influence on Yerevan's relationship with Tehran for the foreseeable future. Likewise, Turkey and Azerbaijan are wary of the Armenian-Iranian partnership. Armenia's relations with both countries remains strained. Also, Azerbaijan and Turkey's energy interests also put it at odds with Iran.

Providing at least some counter balance to potential US and Russian opposition, the Yerevan-Tehran partnership has received support from the European Union. The EU is an especially keen supporter of power projects that promote the elimination of Soviet-era nuclear plants, including the Armenian NPP plant in Armenia. In addition, better Armenian-Iranian trade connections could facilitate commerce between the Gulf region and Europe. Among EU members, Greece is the most inclined to cooperate with Armenia and Iran, driven in part by Athens' rivalry with Turkey.

Last event:

Iran's Minister of Oil Bijan Namdar Zanganeh here on October 06, 2003, called for expansion of cooperation between Tehran and Yerevan in the field of energy.

Zanganeh made the plea in a meeting with Armenian Energy Minister Armen Movsisyan, who termed transfer of Iranian gas to his country as "significant". Movsisyan said his country is ready for any sort of cooperation with Iran in transfer of electricity. The two sides also exchanged views on ways and means of energy transfer from Iran to Armenia, reaching agreement on dispatch of a group of energy experts from Armenian energy ministry to Iran in near future for related studies. Tehran and Yerevan would decide on implementation of an energy transfer project upon completion of expert studies in line with mutual national and economic interests[10].

c) Expressive Curiosity of EU

The international community and Europe in particular, has an interest in maintaining stability in South Caucasus states. The following is a part of the exclusive interview of EU foreign policy chief Javier Solana to Armenian News Agency "Mediamax"[11]:

«The South Caucasus region is a priority for the EU. As you know we have invested a lot of efforts on issues such as institutional, legal and administrative reform, private sector and economic development, infrastructure reform and environmental protection. In the past ten years, the EU has given more than 1bn euros in grants alone to the region. The South Caucasus region will stay on top of our agenda... . The security, stability and welfare of the region depend in part on the actions and attitudes of the countries of the region and in part on the actions and attitudes of actors outside the region. I can think of no better way of reducing to the minimum the risks of negative outside influence and bring to the maximum real autonomy than through a genuine and sustained effort among the countries of the region to settle the disputes between them that give others the opportunity for influence...»[12] .

[10] Source: MINISTER URGES ENERGY COOPERATION BETWEEN TEHRAN, YEREVAN. IRNA, 10/07/2003

[11] Source: AN EXCLUSIVE INTERVIEW OF EU HIGH REPRESENTATIVE FOR COMMON FORIGN AND SECURITY JAVIER SOLANA. *Mediamax News Agency, 06/24/2003*

Corrupt practices, which date back to the Soviet era, have long been as a serious hindrance to Armenia's economic development. Meantime Transparency International, an international non-governmental organization, has ranked Yerevan among the least corrupt former Soviet republics: today Armenia came in 78th place in it's 2003 survey of 133 countries, and ranked far ahead of Azerbaijan and Georgia, which shared 124th place together with three other states[13].

6. Advantages of Joint Utilization of the Potential of Regional Power Systems

At present Armenian Power System is capable to generate up to 12.0 GWh (billion kWh) per year including TPP – 8.2 GWh, NPP – 2.5 GWh and HPP – 1.3 GWh by now. But actual generation just a little exceed 5.5 GWh. The internal consumption of the electric power is about 5,2 GWh per year and the export is about 0,7 GWh per year.

Therefore, the possibility of extension of the electricity export to the neighbor countries is up to 5 and more billion kWh per year. Export to Turkey by intersystem power transmission line "Gyumri-Kars" 220kV can run up to 2,0 GWh per year. Export to Georgia by "Alaverdi" 220kV and "Ninotsminda" and "Lalvar" 110 kV power transmission lines can be 2,0 GWh per year. Export to Azerbaijan by intersystem HVL 330kV "Atarbekyan-Agstafa" 330kV (and number other power transmission lines 110 kV) can run up to 2,5-3,0 GWh per year. But because of political situation in the region power transmission lines to Turkey and Azerbaijan doesn't operate and the export to Georgia is limited by the reason of their inability to pay. As a result of this now the most of the perspective is interconnection with Islamic Republic of Iran.

Meanwhile, the thereby geographical location of Armenia, the presence of the most generation reserves and present good conditions of country's high voltage Sub-stations and Lines (internal and external) create the necessary prerequisites for enlargement of power export and also for power transit from the outside.

This is the important underexploited potential. At the same time with the providing of definite of commercial profits (both Armenia and other countries of region) it's able to become one of the decisive investments of inevitable regional integration within South Caucasus countries.

It has been told earlier about inevitability, contributed circumstances and available steps to the regional integration. As to economic, technical and other practical profits of united work of regional energy systems, so short they can be presented by the following

In general, if some countries agree to interconnect their power transmission network they will get

1) more reliable system operation
   - bigger spinning reserve in the system
   - power injection from several sides

[12] Source: Gain of corruption level in Armenia

[13] Source: GLOBAL CORRUPTION SURVEY CLAIMS IMPROVED GOVERNANCE IN ARMENIA,. EurasiaNet,10/20/2003

- exchange possibilities

2) the complementary nature of generating plants using different primary energy sources or having a different cost structure or technical performance

- thermal plants operate at base load - hydro plants are in charge of peak load and frequency control
- seasonal exchange of hydro generated power in summer and thermal generated power in winter
- equalization of power surpluses due to steps in the expansion planning program

3) common reserve co-ordination in the case of

- outage of thermal plants
- unexpected raising load
- co-ordination of plant maintenance

4) optimization of generation costs

- power exchange to avoid uneconomic plant operation
- use hydro generated surpluses
- power exchange because of cheap primary energy
- differences in the load profiles of the networks of interconnected power companies
- the possibility of making use of complementary characteristics and differences through short-term emergency supplies or energy exchange programmes
- the reduction of investment in new generation plants through the two types of exchanges mentioned below.

For the Caucasus interconnection the assessment of the different cost elements can be estimated with sufficient accuracy if for each country will be recognized

- Government's Plans (Long- and Short-term) of economic development and following power demand both of domestic consumers and industry;
- rehabilitation programs and related costs;
- extension program for the construction of power plants;
- production costs per kWh.

While the benefits must be evaluated with a simulation program that calculates the benefits as difference between generation costs with autonomous production and interconnected operation.

Big technical and economic advantages also arise for the power production, as the interconnection of large areas allows for co-operation and complementation of power stations of different characteristics which results in a more economic operation. The joint construction and operation of large units allows as well the utilization of cost digression through scales.

Further tasks of a superimposed interconnected network consist in mutual help in case of extraordinary energy situations, in the transmission of the power generated in the joint power stations as well as in the exchange of quickly controllable energy from the reservoirs against base load energy.

In order to fully utilize the above advantages of interconnected operation, the superimposed high voltage grid has to be sufficiently strong. This means that the supra-regional interconnection lines have possessed a sufficient transmission capacity.

Such an interconnected operation requires, on one hand, the existence of certain technical equipment and, on the other hand, the proper organization of the energy traffic between the individual networks.

The question of real presence of such possibilities also and for South Caucasus countries is enough difficult and it requires special many-sided study. In general outline one can talk about the following profits:

1) Long term benefits, due to the mix of hydro and thermal power plants;

2) Short term benefits, using differences of daily, weekly and monthly load curves;

3) Mutual provision of hot and cold reserve;

Possibility for power trade since:

- the utilities of the South Caucasus countries have to operate their power system according to international market conditions which allows them to play an active role at the energy market.
- the South Caucasus countries shall play again their role as crossing point between Russia, Iran, the Middle East and Turkey.

4) Long Term Benefits

Table 14 and Table 15 monitor the generation shares of power plants (hydro, thermal and nuclear) and their percentage on the total production for the years 2002 and 1997 for the concerned countries if we assume an average inflow for all hydro power plants.

Table 14. Expected Power Generation Capacity

Year 2000	Armenia		Azerbaijan		Georgia		Total South	
	GWh	%	GWh	%	GWh	%	GWh	%
Hydro	1,3	21,7	1,5	8,1	5,9	79,7	8,7	27,2
Thermal	2,7	45	17,1	91,9	1.5	20,3	21,3	66,6
Nuclear	2.0	33,3	-	-	-	-	2,0	6,2
Total	6,0	100	18,6	100	7,4	100	32,0	100

Table 15.

Year 1997	Armenia		Azerbaijan		Georgia		Total South Caucasus	
	GWh	%	GWh	%	GWh	%	GWh	%
Hydro	1.4	23,3	1.7	10,7	6,0	84,5	9,1	30,5
Thermal	3.0	50,0	15.0	89,3	1.1	16,5	19,1	64,1
Nuclear	1,6	27,7	-	-	-	-	1,6	5,4
Total	6,0	100	16.7	100	7,1	100	29,8	100

Both this tables show that the Caucasus countries have an important hydro generation share that can be used more advantageously in combination with thermal power plants. In addition, thermal power plants are not fully utilized.

The hydro systems of the Caucasus, including the necessary spare capacities were dimensioned according to the recorded dry years. For covering of the peak demand this required an elevated surplus of spare capacity which is only needed in the case of rainfalls below the average amount. If a large interconnected system is available the hydro power plants can be used as seasonal reservoirs or as peak power plants and

power can be drawn from the thermal power plants of the interconnected system in dry years.

On the other hand, thermal dominated systems are not limited by the amount of available primary energy but by the installed capacity. Thermal power systems must provide important installed capacity for only short periods during the peak load. Consequently, it is advantageous if the short peak demand can be supplied from hydro power stations that were over dimensioned due to irregular water flows.

The combination of hydro and thermal systems offers advantages for both sides. Through the interconnection with the thermal plants, the hydro system can be secured against scarcity of water inflow and unused spill water can be used for power export. In the thermal system the interconnection allows to reduce the need for spare capacity and in the hydro system the requirements for storage capacity can be reduced.

The interconnection among the South Caucasus countries - Armenia, Azerbaijan and Georgia – are able to bring substantial benefits in operation for each country but the grid operation of a larger system including Russia and Turkey fully exploit these benefits.

a) Short Term Benefits

Apart of the long term balance of generation the short term power exchange is also advantageous. Turkey could receive power from the thermal power plants of the Caucasus during the daily maximum peak period and compensate the use of water through supplies of thermal generation during the minimum load periods. The difference of price between peak and off-peak power is taken into account by an adjustment factor.

Additional power exchanges can be performed due to the time differences among the South Caucasus countries and Turkey which amount up to three hours. The daily exchanges allow to smoothen the daily load curves and to operate the power plants with a more stable load.

b) Mutual Provision of Hot and Cold Reserve

One of the major advantages of interconnected networks for each partner is the possibility of receiving power from the neighboring network in case of disturbances of the own generation facilities. This allows operating each system with a smaller spinning reserve than in autonomous operation as the partners share the primary regulation capacities.

In case of the South Caucasus countries and Turkey the total installed generation capacity of approximately 12,000 MW of the Caucasus is complemented by the Turkish installed capacity of about 12,000 MW. In case of faults, power can be drawn for a short time from the neighboring country and returned immediately as soon as the system is re-established.

In addition, the South Caucasus countries and Turkey can share spare capacity. These are generally thermal blocs that can be activated and warmed up within few hours in case of failure of other plants or to provide power according to the planned operation schedule of plants. Each country has to keep in stock sufficient spare capacity which can economically be shared between the partners of the interconnected system.

c) Transit Supplies from Russia to Turkey

The Caucasus countries always formed the link between Russia and Turkey since all exchange of goods passed through this region except for sea trade. Now the region offers the possibility of power transfers if the Caucasus grid is connected both to the Russian and the Turkish power systems. Good prospects exist for such transfers of

electric power from Russia to Turkey since Russia is rich in energy resources, especially primary energy such as coal, natural gas and oil and electric energy produced from nuclear power plants at low generation costs. The interconnection Russia - Caucasus - Turkey would provide an access for the south western part of Russia to the hard currency energy market of Turkey.

Note: A high-voltage network can operate in various forms:

Radial Operation

A prerequisite for radial operation is a line connection between the two regions. Such an operation is an improvement compared to isolated operation as the supra-regional line can transfer power station capacities from one region to the other. Radial operation can only be deliberately performed, in case of disturbances (for example loss of generating capacity) the operational conditions completely correspond to totally separated operation.

Isolated Operation

Is a further development of radial operation? In this case not only generating capacities but also loads are assigned to other networks via supra-regional lines. Within certain limits radial and isolated operation allow for energy exchanges (import and export) between separated network parts ("pocket operation").

Parallel Operation

Parallel operation of two networks takes place when both systems are connected by a supra-regional line whose terminal points represent meshed system nodes. Dependent on the production and load conditions in the two systems, a flow arises in the supra-regional line, i.e. an energy exchange takes place. This preliminary stage of a real interconnected operation has the advantage that the reserve capacity of the power stations can be lower than in the case of separate operation as disturbances can be balanced via the supra-regional line.

Synchronously Interconnected Operation

If the 3 (or more) networks are connected by supra-regional lines in order that a trilateral energy exchange can be performed. Consequently, the reserve capacity of the power stations can be lower. In case of disturbances the interconnected operation allows for mutual help. Through the connection of large areas, the number of generating units is increased, and thus reserve management and security of supply is improved. In case of disturbances in the system or in the power stations, bottlenecks in the now strengthened part of the system can be overcome more easily. The consumption is equalized by connecting areas with different load curves.

Due to different operation philosophies, it is technically not possible to operate a synchronously interconnected system extending from Turkey to Moscow and to Cairo and since regional interconnections and power exchange is wanted for the Caucasus region the theoretical options are reduced to two feasible options, namely:

- *Option 1*: Synchronous operation of the Caucasus countries with Russia and DC-bridge to Turkey;
- *Option 2*: Synchronous operation of the Caucasus countries with Turkey and DC-bridge to Russia.
- *Option 3*: Synchronous operation of the Caucasus countries with Russia and Turkey (as a possible participant of UCTE in future) .

In view of the strong political, economic and technical connections between Russia and the Caucasus countries, only option 1 or 3 is feasible which foresees the parallel operation of the Russian grid with that of the Caucasus countries.

The technical-economic evaluation and the choice of the better of these two variants is a subject of another investigation.

Scope of Power Exchange of Armenia

The simulation of operation of power stations showed that some hydro power plants which have a certain reservoir operate as base load power plant. The reservoirs would allow providing ramp power during the peak period. Such operation during peak period produces kilowatt hours with a higher value compared to a kWh of base load. The power trade with neighboring countries permits to sell the high valued peak energy and to buy cheap base load in return. The identified power stations for such trade were identified as Tatev HPP (157MW available capacity), Spandarian HPP (76 MW available existing. Using the present unit size of thermal blocs of 300 MW and the availability of thermal units of 80 % of the year one bloc could produce 2,102 GWh per year.

Finally it is to mention that the regional interconnection would ease the operation of the Azerbaijan grid in case of disturbances. Both spare capacity and spinning reserve can be reduced in a big regional grid which provides assistance in case of outages, however, the advantages are smaller than recorded for Armenia.

It is to mention as well that the regional interconnection would ease the operation of the Georgian grid in case of disturbances. Both spare capacity and spinning reserve can be reduced in a big regional grid which provides assistance in case of outages, however, the advantages are smaller than recorded for Armenia.

Scope of Power Exchange of Turkey

Load flow calculations of autonomous grids and of the interconnected system of the Caucasus countries and Turkey did not show any restrictions or technical constraints both for the year 1997 and 2010. This applies in particular for the transit flows from Russia to Turkey, from South Caucasus to Turkey and from Iran (Turkmenistan) to Turkey.

Scope of Transit Power Exchange

Russia has large resources of primary energy and the 500 kV line across the Caucasus provides access to the Russian power system. This transmission line has a transport capacity exceeding 1,000 MW and could supply cheap energy generated in the nuclear power stations in Russia. The scope of such supplies cannot be predicted with certainty and lies outside the scope of this study, but both nuclear generated base load as well as peak load could be provided.

7. Conclusions and Recommendations

The disintegration of the Soviet power system brought considerable changes for the electricity system of the Caucasus. In former time, energy was not correctly valued at market prices and the cost of primary energy such as oil, gas or coals as well as the cost of peak power and base load power were not accounted with real international market prices. In addition, the power plants of the Caucasus served to optimize the Soviet power system: the hydro power plants were used as peak power plants and as power/frequency control units for the Southern and Western part of the Soviet Republic. This allowed operating the nuclear power stations at constant load which is both technically and economically of greatest importance.

Now the Caucasus countries have to buy fossil fuel at international market prices and the operation of their power stations is judged as well on economic terms. These conditions represent not only a burden for the utilities but offer also the opportunity to play a role on the market and to sell the energy at maximum price. The Caucasus countries have to orient their energy price by the own generation cost and the market price of electricity in the region, and all neighbors are potential trade partners with

variable prices. Any scope of power trade can be activated by the Caucasus countries with the aim of optimization of benefits.

Under the old Soviet central planning system, Armenia had developed a modern industrial sector, supplying machine tools, textiles, and other manufactured goods to sister republics in exchange for raw materials and energy.

Armenia is now a net energy exporter. Parallel works with Iranian power system have started in September 1998 with the aim of mutually beneficial seasonal power exchange, as in Armenia maximal consumption period is winter and in Iran – summer. The agreement was signed considering ratio of two power systems, so regulation of frequency was placed on Iranian power system and regulation of power flow on Armenian.

Since mentioned time wide joint actions on increasing of safety and cost-effectiveness of parallel operation have been performed with Iranian party, which shows how technical questions affect on enlargement of trade possibilities. Nowadays parallel operation with Iranian power system is carrying out with zero balance (annual profile) with seasonal exchange approximately 250 mln kWh electricity and maximal capacity 220 MW in both directions. During September 1998 October 2002 from Iran to Armenian has been delivered approximately 1.3 GWh and from Armenian to Iran 1.52 GWh including 110 mln kWh for construction of Agarak switching station.

Electricity export from Armenian power system to Georgia took place in radial regime by the scheme named “isolated island”.

It is profitable to continue and develop positive experience already achieved during parallel works with Iranian power system and commercial deliveries to Georgia.

Therefore, the Armenia’s possibility of the electricity export to the neighbor countries is up to 5 and more billion kWh per year. Obviously it is unutilized (lost) potential. Moreover not so much for Armenia as for Georgia, Turkey and Azerbaijan, which has chronic deficit of energy power. At the same time, while o reaching suitable agreements, export to Turkey can run up to 2.0 billion kWh per year and export to Georgia can be 2.0 billion kWh per year. Such volume of electricity can be supplying in Azerbaijan, which buying at present from Russia more than 1.0 billion kWh power annually.

Enlargement of Armenian power export both in parallel and radial regimes, except commercial profits will also increase safety and reliability of Armenian power system, because emergency switching of single nuclear reactor of ANPP and permanently operating system interconnection with Iran can cause emergency shortage of power up to 72 % because of the possible failure of relay protection.

7.1. Main phases and directions of increasing of the Armenian electricity export and enlargement of the possibilities of the technical cooperation

It’s necessary to study possibilities of frequency and power regulation by the connections during examination of the question on enlargement of the area of parallel operation of neighbor countries. Experience of parallel operation between two countries confirms above mentioned. What about power flow regulation, we need to consider, that from the technical and economical point of view in the case of connection of another power system to the existing integration this new system have to participate in the regulation of Armenia-Iran power flow. This necessity comes from the analysis of the actually formed frequency in the integration, power systems capacities and regulation possibilities. Also it will be required to revision and design of relay protection system for new integration.

a) Phase 1

Armenian power system has all technical possibilities (generation and network) to organize radial operation with Azerbaijan and Turkish power system in the case if it will be profitable for them too. For organization of the above mentioned operation it's necessary to carry out:

- Step-by-step reconstruction of all 110, 220 and 330 KV connections with Azerbaijan. Preliminary estimation of the required financial resources for the necessary works it Armenia.
- Putting into operation (with possible necessity of the fulfillment of some reconstruction works on the neighbor territory) of the interstate Armenia-Turkey 220 KV transmission line.
- First of all for the development and extension of the technical cooperation between power systems of the region it's necessary to:
- Organize exchange of experience in the fields of domestic regulations of energy market and particularly criteria of power system reliability.
- Create recommendations on the procedures of the forming and operation of the regional energy market.
- Create recommendations on the normative requirements of the interstate transmission lines.
- Organize mutual assistance between power systems of the region on contract basis or possible donor financing.

For example in Armenia accumulated considerable experience on the prevention of the full redemption of power system during appearance of emergency shortage of power up to 70 %. This can be useful for Georgian power system.

b) Phase 2

As the basic aims of the phase can be viewed following points:

- Increasing of the safety and reliability of Armenian power system, which includes nuclear power plant and also taking into consideration limitation of the fuel supply.
- Loading of the free generating capacities of the TPP and additional export of electricity.
- Enlargement of the achieved mutually beneficial seasonal power exchange with neighbor countries. Above mentioned exchange can be mutually beneficial for Armenia and Georgia considering differences in the structure of generation and seasonal capacity of generation and consumption.
- Realization of the power transit to the third countries by the possible loading of the networks.

For example following can be mutually profitable:

1) Energy transit through Armenian power system to Nakhichevan power system from Azerbaijan power system, as it was before.

2) Energy transit through Armenian and Georgian power systems to the Turkish power system from Russian power system.

Possible technical decisions (the rather small investments):

- Economically expedient for Armenia is putting into operation transmission line 330 KV between Armenia and Azerbaijan, certainly under condition of reaching mutual agreement. The technical possibility of parallel operation of the Armenian power system with the Russian power system through electrical networks of Azerbaijan and Georgia with preservation of parallel operation of the Armenian power system with Iranian is appeared.
- Alternate is the connection through the Georgian power system, passing to territory of Azerbaijan - certainly, with the consent of the Georgian side. The transmission line 330 kV Armenia - Georgia is possible by constructing of an additional part of the line 330 kV with length ≈ 125 kms (in Armenia ≈ 75 kms, in Georgia ≈ 50 kms), or construction of the same part of the line in overall dimensions 500 (400) kV and realization conversion of an existing line 330 kV on a level 500 (400) kV, because the organization of parallel operation of join power systems of Armenia and Iran with Russian on single line 220 KW Armenia - Georgia of is technically impossible.
- Organization of parallel operation of the Armenian power system and Turkish on available 220 kV line after reaching the agreement and putting it into operation, and also after putting into operation constructed 400 kV line between Iran and Turkey. It is technically possible after competitions of parallel operation project.
- Recovery of Transcaucasia power systems transmission lines and the designing of regime facilities and relay protection will create necessary technical preconditions for the beginning of organization of mutually beneficial parallel operation of power systems of large region taking into account additional lines and gas pipelines which are under construction and planned to be constructed. The correctness or inaccuracy of this opinion for each power system can be affirmed by stage by stage study at technological reports levels and then feasibility report on the region as a whole. The found facilities for such common action will considerably accelerate the process of decision making at a competent level. The delay in time for each power system also for Armenian power system will bring to losses and additional expenses.

c) Phase 3 - Outlook

The operations of mentioned phase are connected with large investments and guess construction of Armenia - Georgia - Russia 400 (500) kV, Armenia -Turkey and Armenia - Iran Overhead Transmission lines with the purpose to organize mutually beneficial power transit corridor for large power flows and integration of regional power systems in an European power grid.

7.2. Any primary recommendations

In view of the potential of power trade between the Russia, South Caucasus countries, Iran and Turkey and the calculated of necessary cost is technically and economic feasible. Therefore, the project of interconnection of the Caucasus countries with Russia, Iran and Turkey can and has to be implemented. But this is faced with the difficulty that the future development of the South Caucasus power sector is characterized by a high degree of uncertainty concerning:

1) Detailed technical clarification of the interconnection.

The design study of the interconnection shall include among others, detailed design of the interconnection, final identification of the voltage (400 kV or 500 kV) of the trans-border line and of the terminal points, determination of needs of data exchange,

measurement and control requirements, line route study, environmental study, economic analysis.

2) Continuation of the improvement of the power systems in each of the South Caucasus countries.

It is essential that each of the South Caucasus countries continues to improve its power system as to be able to cover the local power demand (including long term supply contracts with neighboring countries). Without stable power systems the re-synchronization of the electricity grids of the Caucasus is not feasible.

3) Rehabilitation for parallel operation of the electricity grids of the South Caucasus countries.

The power systems of the Caucasus countries would benefit most if the three electricity grids are rehabilitated for parallel operation. The principal steps for the structure for parallel operation would be:

- study on the institutional and organizational structure to operate the grids in parallel;
- study on the structure for the pricing of power exchanges between the partners of parallel operation;
- approval of performed studies by the participating countries;
- creation of the necessary bodies and structures;
- definition of procedures for power exchange and wheeling between the participating countries;
- implementation of the missing technical installations needed for the parallel operation of the grids;
- operation of the unified grids.

Possible alternatives of operations organization

Alternative 1. Preparation of the multivariate project for the leaders, relevant authorities and decision making offices of the region`s countries. The process of designing is carried on principles of technical cooperation without political interference to prepare reasonable for all interested parties decision. Negotiations on signing and official registration of the relevant multilateral agreement will took place after consideration and the acceptances of the project.

Alternative 2. The project starts by the results of bilateral and multilateral negotiations on signing the relevant agreements. The negotiating on reaching the agreement then starts process of designing.

In each of mentioned alternatives the right of decision making remains for competent authorities of all interested countries. Thus, proceeding from the essence of the problem and specificity of political economical relations between countries of Southern Caucasus, from our point of view most defensible, is Alternative 1.

8. Endnotes:

1. THE LAW OF ENERGY OF RA. Signed by the President April 11, 2001.
2. H. Baghdasaryan. Anticipation of requirements of the electrical power in the RA (its deficit/abundance in South Caucasus and the adjoining regions). Review at the Round table “Export potential of Armenia”, Central Bank of the RA, Yerevan, May 2003.
3. Bulletin “The main quotients of the power system work of the countries of CIS for 2002”. Commonwealth of Independent States Electric Power Council (CIS EPC), Moscow, 2003
4. Review on “Reforming Electric Energy in CIS Countries”, CIS EPC, Moscow, 2000.
5. Monthly published bulletins of energetic news of Armenia and of other countries of the region. Under the drafting of H. Baghdasaryan, JSC “Armenergo”, 2002-2003.
6. Bulletin of the Intergovernmental Dispatching Center “PontoEl”. Tbilisi, 2001.
7. Lost Potential in the South Caucasus: Aspects of Interstate Trade. ICHD, Yerevan-Baku-Tbilisi, 2003
8. Armenia: Electricity Transmission and Distribution Project (AM-PE-8276, vol.1). Project Appraisle Document, Annex 11 - Power Sector Restructuring and Development Program. The World Bank Document, February 8, 1999.
9. IADA – International Assistance Database for Armenia. http://www.gov.am/en
10. TACIS EREG 9401 – Final Report. TACIS Information Center, Euro Commission, Brussels, 1997.
11. RAO "UES of Russia" - Annual Report 2002. Moscow, 2003
12. Concept of RAO UES's Strategy for 2003 – 2008. The "5+5". Moscow, 2003.
13. 2002 CIA World Fact book – Turkey, February, 2003.
14. Energy Prices & Taxes - Quarterly Statistics (Third Quarter 2000, Part II, Sections B and D. Paris: International Energy Agency, 2001.
15. US Department of Energy (DOE)/ Energy Information Administration. Annual Energy Outlook 2002. Washington, DC, February 2003.
16. US Department of Energy (DOE)/ Energy Information Administration. Country Analysis Briefs: South-East Europe. Washington, DC, May 2003.
17. 2002 CIA World Fact book – Turkey, February, 2003.
18. The project “Conceptions of formation of a general power industry market of CIS”. CIS EPC, Moscow, 2003
19. Materials of the local and of foreign press for 2001-2003 (returns are given in the texts of partition).

The Power System of the Azerbaijan Republic

1. Introduction

The break-up of Soviet Union and acquisition of sovereignty by new republics brought the young independent states not only "easy" freedom at first sight but also lots of economic problems that were regarded as of paramount importance. There appeared the questions connected with the development of economy main branches unaided. The power engineering and in particular oil industry undoubtedly had to become a priority of Azerbaijan economy, especially as it had almost 130 years of its development history. There's it that was considered as a certain engine would be good at setting the country economy out of crisis.

The basis of fuel energy complex consists of: State Oil Company of Azerbaijan Republic (SOCAR) whose enterprises extract oil and gas and also produce finished oil products; state-owned Joint-Stock Company "Azerenergy" whose thermal and hydro-electric power plants in fact produce all the electric power of republic and state-owned Joint-Stock Company "Azerygas" that keeps and distribute natural gas all over Azerbaijan territory.

The main Azerbaijan's natural resource is hydrocarbon raw materials. Now oil stocks on the land and Caspian shelf are estimated within the limits of 3-5 billion tons; all the acknowledged stocks of oil are done 1 billion tons. There is an analogous picture of natural gas stocks. The stocks proposed are 4,6 trillion m^3, all the acknowledged ones are 700 billion m^3. As a whole, all the proved stocks of hydrocarbon raw materials in Azerbaijan are equivalent to 1,7 billion tons of comparison fuel.

SOCAR enterprises have been getting annually 9 million tons oil (maximum of soviet period was 23.5 mil. tons) and 5,5 bln m^3 natural gas (maximum of soviet period was 14,9 billion m^3.) for some last years. Azerbaijan oil-refining works processes almost 6.5 million tons oil. All the natural gas extracted is burnt up by the enterprises, thermal power plants and population of republic.

Azerbaijan problems of extracting hydrocarbon raw material come as a matter of fact to deciding two main tasks. The first one is to keep the existing level of extraction at SOCAR deposits exploited for the following 5-10 and more years. The second task is to increase producing the volume of raw materials at the new land deposits at the expense of inland-invested reserves.

As regards the opening up of the promising sea hydrocarbon structures the country's strategy is quite straightforward. The risk of work on the Caspian shelf must be shared between some participants of appropriate projects. So the country plans signing and realizing the new international agreements analogous that had been concluded by Azerbaijan in 1994-2001.

Azerbaijan International Operational Company (AIOC) having set to work at the deposits Azery, Chirag, and deep-sea part of Gunashli with stocks of 630 million tons extracted 20 million tons oil and more 4,2 billion m^3 escorting oil gas from November 1997 to June 2002. Azerbaijan with only efforts of SOCAR and AIOC plans reaching the levels of oil and gas extraction within the volumes are equivalent to 60 million ton of comparison fuel. It must ensure the fuel and energy security of Azerbaijan for 25-30 years at least.

The main sources of revenue return into the Azerbaijan fuel and energy complex is a profit of oil and oil produce export. By 2001 year the country intend to extract and export more 50 million tons oil and 6,6 billion m^3 gas annually. Such a potential of Azerbaijan export will be ensured by two large projects (besides the rest) are deposits exploitation Azery-Chirag-Gunashli and Shach-Deniz. Two export oil and gas pipelines Baku-Tbilisi-Jeyhan and Baku-Tbilisi-Erzerum also promise the large profit.

In 2001 Azerbaijan besides "early oil" sent 1.1 million tons diesel fuel, 550 thousand tons fuel oil, 280 thousand tons jet fuel, 185 thousand tons petroleum, that is more 2,1million tons oil produce in sum to European market. But the position of power-bearers selling at inland market is much worse. In the first place, it touches fuel oil and gas.

Consumers of fuel oil produced by Azerbaijan oil refineries are eight thermal power plants on the whole. Natural gas extracted by SOCAR goes into the thermal power plants of "Azerenergy" enterprises. It is consumed by population of republic. There are two underground gas-storehouses in Galmaz and Garadag with capacity of 3 billion m^3, 150 gas-regulating stations and system of gas-main with the length of 40 thousand km that are at "Azerenergy" disposal. There also consider the opportunity of building the modern gas-refining works.

There are 14 power electric plants in the structure of Azerbaijan energy system with the common capacity of 5000 MW. 6 hydro power plants (15%) and two types of 8 thermal power plants (85%) of condensating cycle - thermal condensating power plants (TPP) and of combined heat and power cogeneration cycle - combined heat and power cogenerating plants (CHPP) are functioning in Azerbaijan power system. The most important component of energy system is electric nets consisting of electrical network-substations and transmission lines (0,4 -500 kV).

Azerbaijan power system covers all territory of the republic and has the close connections with neighboring systems of Russia Federation, Iran, Turkey and Georgia by means of electricity transmission lines with voltage of 500, 330 and 230 kV. This is a favorable factor for the parallel work of energy systems and transit of electric power. In the connection of Karabakh conflict the communication with Armenia energy system was interrupted.

Beginning since 1999 there reached the turning point in the electric power production and the manufacture started increasing. It became a result of government large efforts. First of all, the capacity of energy system again began increasing in that year. Secondly, the projects of radical modernization for electric enterprises were realized at the expense of financial foreign organizations and Azerbaijan government. It was concern of CHPP-1, state district power plant (SDPP) "Shimal" in Baku, CHPP-1 and CHPP-2 in Sumgayit.

None the less, the modern Azerbaijan energy system is in very heavy condition. The main branch problem is a lack of investments. In most cases the equipment of electric power plants is worn aged long ago and requires no partial and the large-scale renovation. Moreover, the generating installations of enterprises became obsolete. The steam-gas units having big efficiency are already put into practice the world over. At the same time in Azerbaijan almost all the pool of power engineering is steam-generator units. The complete reconstruction of country's energy system annually demands about 25 million dollars in accordance with the different calculation. 5 million dollars have been annually investigated into this branch every year since 1995. This problem can be solved with the aid of privatizing the generating enterprises to involve strategic investors in the branch. It is necessary to work out the conception of electric power engineering reforming for achieving the goal.

The main problem of developing Azerbaijan energy complex is non-payments for gas and electric power. The enterprises and population of republic owe "Azerenergy" and "Azerygas" the astronomic sum of 2,6 billion dollars that is equivalent to three annual budgets of republic! Getting debts from the enterprises and population is very difficult. As a matter of fact, the only key factor of putting pressure on debtors is a disconnection of light and gas. However, it is impossible to stop supplying electric power, for example, to the Baku Underground because its subways would be flooded by subsoil waters for some hours. One can't leave people's homes, schools, hospitals and so on without light and warm. According to trade unions data there is almost one million unemployed in Azerbaijan now and it would be inhumanly to deprive of electric power and warm the people lost their work and livelihood. Moreover, it is fraught with the social outburst. As to state grants they are not limitless and almost all the subsidies must be spent for maintaining one million refugees (12,5% population).

To master the situation on non-payments in the Azerbaijan fuel and energy complex on the 25-th of March 2002 President of Azerbaijan Republic issued a special edict "On Strengthening the Financial Discipline in the Power Supply Sector". According to this document the program was worked out for 2002-2003. Its realization must at last bring the electric power and natural gas to turning into the goods of value in Azerbaijan that is they are paid by consumers. As far as successfully this task is carried out there will depend on future of some important fuel and energy project in Azerbaijan.

Thus, problem of non-payments is a stumbling-block both for developing Joint Stock Company "Azerenergy" and Joint Stock Company "Azerygas" and also SOCAR producing fuel oil and extracting natural gas and for introducing alternative technologies in Azerbaijan to get thermal and electric powers. Today all the repayments to Azerbaijan fuel and energy complex is a key task for Ministry of Fuel and Energy Development.

2. Azerbaijan Power System Overview

2.1. General view

Azerbaijan's power sector has an installed generating capacity of approximately 5.1 gigawatts (GW), consisting of eight thermal power plants (accounting for roughly 85% of generating capacity) and six hydro power plants, all of which are owned by the state. Both electric generation and consumption have been relatively flat since independence, with generation totaling 18.6 billion kilowatt/hours (BkWh) in 2002, and consumption of 20 BkWh. Because of the country's inefficient distribution network, much of the country's generation is lost in transmission, making Azerbaijan a net electricity importer. In order to supply electricity to all parts of the country (including the Nakhichevan), Azerbaijan imports power from Russia, Turkey, Iran, and Georgia.

Built during the Soviet era, Azerbaijan's power infrastructure is in generally poor condition, with minimal public investment and maintenance since independence. The country's economic contraction during the mid-1990s, along with systemic problems - such as prices capped below market rates and frequent non-payment by customers - have left Azerbaijan's power sector without sufficient capital to upgrade aging power-generation facilities.

The international donor community has undertaken several projects to restore and add new capacity to Azerbaijan's power sector, including a $53 million loan by the World Bank to complete the construction of the 4,000-MW Yenikand hydroelectric plant

(completed in May 2000), and the European Bank for Reconstruction and Development's roughly $21 million loan (in conjunction with the Islamic Development Bank and the European Union) for the reconstruction of the 360-MW Mingechaur hydroelectric plant on the Kur river (completed 2001). In early 2003, Azerbaijan's newly completed "Shimal" power plant began operation with the help of Japanese companies Mitsui and Mitsubishi. The 400-MW steam-gas unit will provide power mainly to the Absheron peninsula, and is expected to help rise Azeri electricity generation in 2003 by 6% over 2002 levels. State-owned JSC "Azerenergy" is considering numerous plans to develop the country's distribution network and increase its generation capacity.

While "Azerenergy" has a monopoly on power generation, the country's national electricity network is divided into five regional grids: Baku; Nakhchivan; North (Sumqayit); South (Ali Bayramli); and West (Ganja). Azerbaijan has transferred the management of these four regional distributors via long-term concession agreements to private investors, with the Baku and Sumgayit distribution networks now operated by "Barmek Holding", a Turkish firm, and the Ganja and Ali Bayramli distribution networks now operated by Factory Electric Facilities Production, an Azeri firm.

2.2. Production and Consumption

In the beginning of 50-th years the rapid development of oil-refining and chemical industries led to necessity of dramatic increase of thermal energy production (steam, hot water) for these branches requirements. So in 1951-1955 the new thermal powers were put into operation at Baku CHPP-1 and Sumgayit CHPP-2. This fact allowed establishing the foundation of thermalfication in the republic. During this period the heat supply increased from 134 thousand to 1178 thousand GCal. In connection with putting into operation the new powers at Baku CHPP-1, Baku CHPP-2, Sumgayit CHPP-1, Sumgayit CHPP-2 and Ganja CHPP the heat supply increased very much. In 1977 it made 14000 thousand GCal and in 1980 – 15081 thousand GCal. In 80-th years in connection with the permanent economic growth in oil-refining and chemical industries there was continuing the production increasing of thermal energy.

The volume of industrial production in Azerbaijan was continually growing in 70-th and 80-th years. In 1980 and 1990 there produced the electric and heat energy accordingly: electric energy was more by 139% and 193%; heat energy – by 177% and 180% than in 1970. There real confirmation of electrification scales is that the consumption of electric energy per one person made 2171 kWh in 1970, 2966 kWh – 1980, 3310 kWh –1990.

After the break-up of the Soviet Union and the severance of economic relations among former republic of USSR, Azerbaijan and its oil-refining and chemical industries has been experiencing the serious crisis in connection with the loss of production seller's market and shortage of raw materials. As a result of this recession the thermal energy production at electric power plants fell from 15309 thousand GCal in 1990 to 2871 thousand GCal in 1999. The crisis in the energy system took its toll on all the Azerbaijan economy very ruinously.

However, beginning since 1999 the situation had been gradually improving thanks to the large efforts of government. Soon the turning point was reached and the production of different sorts of energy began increasing.

Figure 3. Production and consumption electricity energy (million kilowatthours (MkWh))

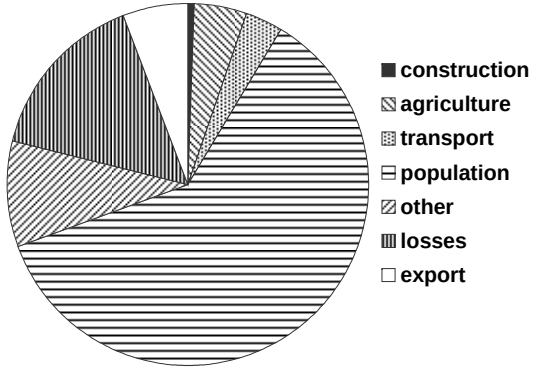


Table 16. Structure of electricity consumption in 2001 (MkWh)

	2002	2001	2000	1999	1998
Production	18578,38	18821,87	18602,86	18063,9	17895,3
TPPs	16558,37	17520,55	17069,28	16558,1	15944
HPPs	2020,01	1301,328	1533,579	1505,8	1951,3
Consumption	20029,1	19497,9	19097,1	18817,2	18145,1

In 1990 93% electric energy was produced at the thermal power plants. In spite of falling the electric energy production per 22% in 1999-2001, the structure of this production with the high part of thermal power plants was not changed.

Figure 4. Electric Power Production (M kwh)

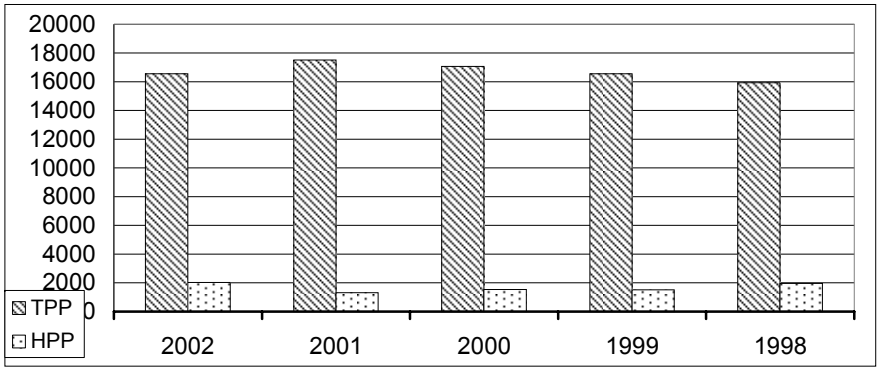
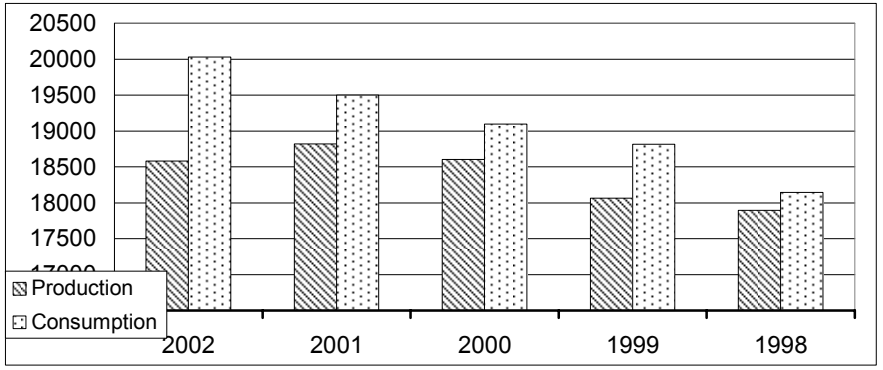


Figure 5. Dynamics of Electric Power Prouction and Consumption 1998-2002 (Mkwh)



Thus, since 40-th years of XX century in Azerbaijan the production of electric energy had been increasing very stable. In 1999 its production reached the record –23,2 BkWh. Since 1991 to 1998 it began decreasing. In 1999 the growth restored again and in 2001 there produced 18,9 BkWh. It made 80% from the best achievements of soviet period.

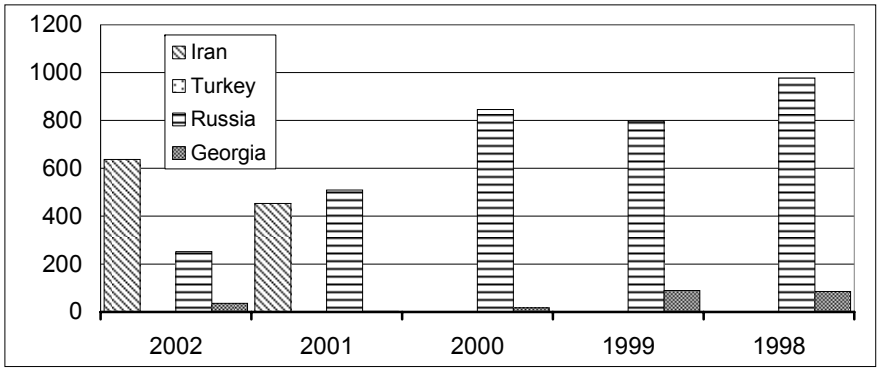
2.3. Export and Import

For the first time export of electric energy was realized in 1954 from Azerbaijan to Georgia on the lines of electricity transmission Ganja-Akstfa-Rustavi with the voltage 110 kW. With bringing in the new lines of electricity transmission having higher voltage there appeared the opportunity to ensure the parallel work of energy systems of three Caucasian republics in 1958-1959. Since December, 1969, United energy system of Caucasus republics became working parallel with United energy system of European part of USSR. When the line of electricity transmission Ali Bayramli-Jashma-Derbent with voltage 330 kW the reliability and stability of energy systems of three Caucasian republics. The energy system of Azerbaijan possessed the plentiful power and exported the electric energy in Armenia and Georgia before 1975. As a result of accelerated development of industry and agriculture the lack of generating powers disappeared since the second half of 70-th years. Since this moment the republic was forced importing the electric energy for the satisfaction of its growing necessities. This situation existed before 1988. However, after putting Shamkir HPP and three energy blocks of Azerbaijan SDPP into operation the energy system could not only satisfied the necessity of its consumers but also became exporting electric energy. Thus, Azerbaijan began exporting the electric energy since the middle of 50-th years (5,1 % from the volume of production) but after 1993 this index did not exceed three percentages. There exported electric energy with the volume 924,57 MkWh in 2002. The trade partners of Azerbaijan were Iran, Russia, and Georgia –69%, 27% and 4% accordingly.

Table 17. Electric power export from Azerbaijan (MkWh)

	2002	2001	2000	1999	1998
Total	924,57	966,09	863,1	886,4	1063,3
Iran	636,67	453,89	-----	-----	-----
Turkey	-----	-----	-----	-----	-----
Russia	252,4	508,933	845,3	796,9	977,3
Georgia	35,5	3,27	17,8	89,5	86

Figure 6. Dynamics of Electric Power Export 1998-2002 (Mkwh)



There exists the import of electric energy now. It has been beginning since 60-th years: 0,4 % to the volume of production, 5% by 1998, 10,7% by 2000. Azerbaijan annual buys up some quantity of electric energy: in 1999 there bought up 1639,7 MkWh with sum of 44925,6 thousand dollars, where 61% was for counties of CIS; in 2000 there imported 1357,3 MkWh from abroad for the sum of 35584,7 thousand dollars on the price 0,03 dollars for 1kWh. The part of electric energy that is imported means for Nakhichevan AR. This region of Azerbaijan is in the blockade because of Karabakh war. In 2002 the volume of import made 2375.3 MkWh, the share of Russia is 54%, Iran-23%, Turkey-18%, Georgia –5%.

Table 18. Electric power import to Azerbaijan (MkWh)

	2002	2001	2000	1999	1998
Total	2375,3	1642,19	1357,32	1639,7	1313,1
Iran	554,3	482,65	290,02	345,4	299,2
Turkey	435,1	432,83	412,70	286,4	298,2
Russia	1278,7	726,74	653,7	864,8	622,2
Georgia	107,2	-----	0,9	143,1	93,5

Figure 7. Dynamics of Electric Power Import 1998-2002 (Mkwh)

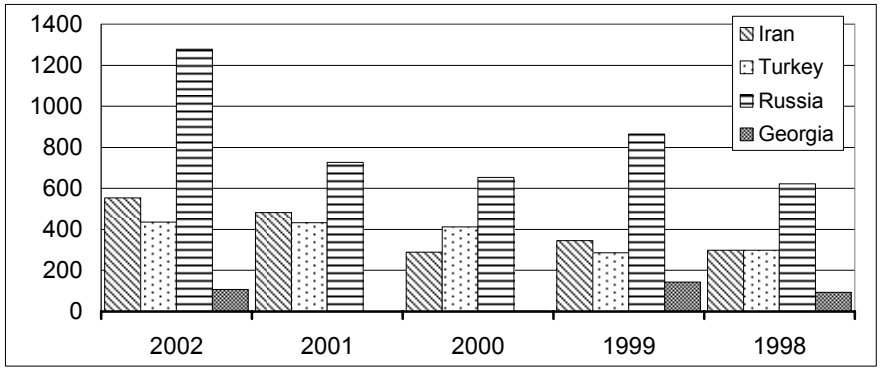


Table 19. Electric power export and import (MkWh)

	2002	2001	2000	1999	1998
Export	924,57	966,09	863,1	886,4	1063,3
Import	2375,3	1642,19	1357,32	1639,7	1313,1
Balance	-1450,73	-676,1	-494,22	-753,3	-249,8

There supplied 1,884 billion electric energy from Russia, Iran, Turkey, and Georgia to Azerbaijan for 10 months of 2003. 435,5 MkWh were got from Iran, 322,9 MkWh – from Turkey, 32,7 MkWh – from Georgia at the expense of mutual calculation, the rest 1,093 billion kWh were got from Russia. The foreign supplies of electric energy were reduced on 4,3% by comparison with the same period of 2002. It is explained by the growth of energy production at the Azerbaijan electric power plants. So, if for 10 months of 2002 year "Azerenergy" produced 14,776 billion kWh, at the same period of 2003 there produced 16,988 billion kWh. It's more by 15 %.

2.4. Power Generation System

There are 14 electric power plants with the general capacity more 5000 MW in the Azerbaijan energy system. There are 8 thermal power plants (85% established capacity) and 6 hydro power plants (15%). The state-owned "Azerenergy" has a monopoly on power generation. The main part of electric energy is produced at thermal power plants (90%). The main sorts of fuel at the thermal electric power plants are gas and fuel oil.

a) Thermal Power Plants

8 thermal electric power plants are functioning in the Azerbaijan energy system:

- Azerbaijan SDPP (state district power plant)
- Ali-Bairamli SDPP
- "Shimal" SDPP
- Baku-1 CHPP (combined heat and power cogenerating plant)
- Baku-2 CHPP
- Sumgayit-1 CHPP
- Sumgayit-2 CHPP

- Nakhichevan TPP

Two types of thermal power plants of condensating cycle and of combined heat and power cogeneration cycle are functioning in Azerbaijan power system.

The condensating cycle power plants are: Azerbaijan SDPP, Ali-Bayramli SDPP, Nakhichevan TPP and "Shimal" SDPP, . In the beginning of 2003 the stream-gas unit put into operation at “Shimal” SDPP. Its capacity made 400 mw.

The combined heat and power cogenerating power plants are: Baku-1, Baku-2, Sumgayit-1 and Sumgayit-2 CHPPs.

№	Name of Power Plant	01.01.2002 Design capacity MW
1. Azerbaijan SDPP (Mingechavir town)		
	Block №1 Block №2 Block №3 Block №4 Block №5 Block №6 Block №7 Block №8 Total:	300 300 300 300 300 300 300 300 2400
2. Ali-Bayramli SDPP (Ali-Bayramki town)		
	Block №1 Block №2 Block №3 Block №4 Block №5 Block №6 Block №7 Total:	150 150 150 150 150 150 150 1050
3. “Shimal” SDPP (Baku)		
	Block №7 Total:	150 150
4. Sumgayit CHPP-1 (Sumgayit town)		
	TU №8 TU №9 TU №10 TU №11 Total:	50 50 50 50 200
5. Sumgayit CHPP-2 (Sumgayit town)		
	TU №1 TU №2 TU №3 TU №4	60 50 60 50

	Total:	220
6. Baku CHPP-1		
	TU №1 TU №2 TU №1 TU №2 Total:	55.0 55.0 50 50 110
7. Baku CHPP-2		
	TU №1 TU №2 TU №4 TU №5 Total:	6 6 6 6 24
8. Nakhichevan TPP		
	TU №1 TU №2 TU №3 TU №4 Total:	16 16 16 16 64
	Total for TPPs:	**4218,0**

b) Hydro Power Plants

The water resources of Azerbaijan are mainly presented by the lower flow of Kur river with its numerous tributaries that flow from slopes of Big and Small Caucasus down, Araz river running into Kur beside its estuary and the group of small mountain river that directly run into Caspian Sea.

At present some hydro power plants with sum capacity 847,7 MW are exploited in Azerbaijan Republic, including:

- Mingechavir HPP
- Varvara HPP
- Shamkir HPP
- Ter-Ter HPP
- “Araz” HPP
- Yenikend HPP

and some other hydro power plants with small capacity.

Table 20. Existing Hydro power Plants in Azerbaijan (10 MWe and larger)

Generating Facility	Location		Rated Capacity (MW)
	River	Region	
Mingechavir	Kur	Mingechavir	402
Shamkir	Kur	Shamkir	380

Yenikend	Kur	Shamkir	113
Araz[14]	Araz	Babek	44
Vavara	Kur	Mingechavir	17
Tartar (Serseng)	Tartar	Tartar	50

Table 21

№	Name of Power Plant	01.01.2001 Design capacity MW
1. Mingechavir HPP (Mingechavir town)		
	HA №1 HA №2 HA №3 HA №4 HA №5 HA №6 Total:	60 70.4 60 70.4 70.4 70.4 401.6
2. Shamkir HPP (Shamkir region)		
	HA №1 HA №2 Total:	190 190 380
3. Yenikend HPP (Shamkir region)		
	HA №1 HA №2 HA №3 Total:	37,5 37,5 37,5 112,5
4. Varvara HPP (Mingechevir town)		
	HA №1	5,5
	HA №2 HA №3 Total:	5.5 5.5 16.5
5. Tar-Tar HPP (Tar-Tar region)		
	HA №1 HA №2 Total:	25 25 50
6. Small HPPs		
	HA 1-6	19,4
7. Araz (Nakhchevan AR)		
	HA №1 HA №2 Total:	11 11 22
	Total for HPPs	**1002,0**

[14] power plant capacity is equally shared between Azerbaijan and Iran

2.5. Power Transition System

Azerbaijan electrical network has complicated scheme consisting of several hundred substations interconnected by the various voltage level transmission lines, that are connected among them and operating jointly. The state-owned JSC “Azerenergy” owns all of the high voltage transmission lines in Azerbaijan and also controls dispatch of the high voltage grid.

The system forming network includes the substations and transmission lines with voltage 110, 220, 330 and 500 kV; living nets on with 110 and 220 kV and distributing nets with 0,4, 6, 10, 35 and 110 kV.

On the Absheron peninsula the main substations has been functioning for more than 60 years.

System forming network of Azerbaijan power system includes the following substations:

- 500 kV - "Absheron"
- 330 kV - "Ganja", "Jashma", "Imishli", "Agdam", "Agstafa"
- 220 kV - "Masalli", "Agsu", "Nizami", "Sangachal", "Mushvig", "Khirdalan", "Gabble", "Babek", "Govsan"
- 43 substations with high voltage level 110 kV

Moreover it includes also the following most important transmission lines:

- 500 kV - "1st Absheron" and "2nd Absheron";
- 330 kV - "Agdam", "3rd Agstafa", "4th Agstafa", "3rd Ali-Bayramli", "3rd Mingechevir", " 4th Mingechevir", "5th Mingechevir", "3rd Imishli", "3rd Shamkir";
- 220 kV - "1st Ali-Bayramli", "2nd Ali-Bayramli", "3rd Absheron", "4th Absheron", "5th Absheron", "7th Absheron", "Agsu", "1st Govsan", "2nd Govsan", "Gabala", "3rd Masalli", "1st Mingechevir", "2nd Mingechevir", "Sangachal", "Jashma", "Mushvig";
- 170 transmission lines with 110 kV voltage level.

Total capacity of transmission system's transformers is about 8462,6 MVA, including:

- 1200 MVA of 500 kV transformers,
- 1630 MVA of 330 kV ones,
- 2677 MVA of 220 kV ones,
- about 2955,6 MVA of 110 kV ones.

Electric power system of Azerbaijan Republic has got the connections with the neighboring energy systems of Russian Federation, Iran and Georgia by lines transmission with voltage 500, 330 and 230 kV that is the favorable condition for the parallel work of energy systems and electric energy transit. Because of Kharabach

conflict the connection with Armenia is interrupted. For the partial providing the necessity of electric energy with Nakhichevan Autonomous Republic "Azerenergy" are cooperating with Turkey and Islamic Republic of Iran.

The connection with power system of Georgia is realized on the lines transmission 500 kV "Azerbaijani Electric Station – Muhrani" with length 197 km. And 330 kV "Akstafa – Gardabani" with length 43,6 km.

The connection with Iran is realized on the lines transmission Astara (Azerbaijan) – Astara (Iran) with capacity 220 kV put into operation in summer of 2003. This project was realized by the means of credit that had been given by Iran partners without the government guarantees from "Azerenergy". Clearing off credit will be realized at the expense of equivalent electric energy supplies. The line electric transmission Astara-Astara is the second one connecting power systems of two countries. The analogous stream of energy is realized on the line electric transmission Imishli – Parsabad. There propose to extend its potential at the expense of constructing the new parallel line transmission in prospect at present. Azerbaijan power engineering specialists suppose to go on the building of line electric transmission towards Azerbaijan cities Salyan and Ali-Bairamli. It is their nearest plans. The joint use HPP "Araz" is an example of successful international cooperation between Azerbaijan and Iran.

The energy change between Azerbaijan and Russia is realized on the line electric transmission Derbent-Jashma with voltage 330 kV by the length 166,4 km. and also on line electric transmission (110kV) towards Chechnya but it is used very seldom. In the prospect Azerbaijan and Russia power engineering specialists plan the construction of the second line: Derbent – Yashma that will make 182 km on the Azerbaijan territory with voltage 330 kV.

With energy system of Turkey the connection is realized on the line electric transmission 154 kV "Babek – Igdir" with the length 94 km (in Nakhichevan Autonomic Republic).

Azerbaijan Republic has the following system forming transmission lines:

- 110 kV-transmission line (TL)-128-2449 km
- 220 kV-TL-18-1195km
- 230 kV-TL-1-31 km
- 330 kV-TL-12-1284 km
- 500 kV-TL-2-451 km

Total length of transmission lines is 5410 km.

Energy system of Azerbaijan has the following high voltage substations:

- 110 kV-22
- 220 kV-9
- 230 kV-1
- 330 kV-4
- 500 kV-1
- Total -37

3. Power Distribution System

Power distribution within Azerbaijan is handled by four regional joint stock companies, Bakuelectricshebeke SC, Ali-Bayramlyelectricshebeke SC, Gandjaelectricshebeke SC, and Sumgayitelectricshebeke SC, each of which purchases electricity wholesale from "Azerenergy" for resale. Each of these four regional companies has a distribution monopoly in its territory (the autonomous region of Nakhichevan also has its own separate electricity distribution network). Azerbaijan has transferred the management of these four regional distributors via long-term concession agreements to private investors, with the Baku and Sumgayit distribution networks now operated by "Barmek Holding", a Turkish firm, and the Ganja and Ali Bayramli distribution networks now operated by Factory Electric Facilities Production, an Azeri firm.

In October,2001, Ministry of Economic Development signed the agreement with the Turkish company "Barmek Holding" about the transfer to it in the long-term management joint-stock company "Bakielectricshebekeh" ("Bakelectricnet"). Volumes of investments offered by Turkish company constitute more 300 million dollars.

Earlier the German company Siemens was admitted as a winner of tender for transfer joint-stock company "Bakelectricnet" for foreign management. But it lost this right in connection that Azerbaijan government counted up the efforts advanced by company are unacceptable. In particular Siemens insisted on disconnecting electric energy for defaulters (the gathering of payments for electric energy made 33%). The leadership of German company also demanded increasing the tariffs for electric energy supplied. It explained this decision that company would not cover its outlay for modernization of electric nets. The Azerbaijan government made an offer to the company to increase the tariffs for getting electric energy since 2004 year. But the leadership of Siemens for more guarantee required confirming these tariffs and put them in action since 1 January of 2004.

In August of 2002 the President signed the order on confirming the agreement about the assignation for the long-term management of electric power nets of three Azerbaijan large industry centers – Ganja, Sumgayit and Ali-Bairamli.

Electric power nets of Ganja and Ali-Bairamli changed hands to joint-stock company "Baku Factory Electric Facilities Production", and Sumgayit nets to Turkish company "Barmek".

In accordance with the agreements signed joint-stock company "Baku Factory Electric Facilities Production", will transfer 1,5 million dollars to the state budget on 750 thousand dollars for every net. During the first eight year the joint-stock company will pay for "Azerenergy" from 30 to 80 % electric energy supplied. On the expiry of this period the management company obliges to pay for 100% all the electric energy supplied.

For the development of Ganja electric nets there will be invested 33,7 million dollars during the first fife years. For Ali-Bairamli this sum will constitute 28,8 million dollars.

Company "Barmek" will be also obliged to transfer into the state budget 330 thousand dollars and during the first fife years to invest 23,695 million dollars for development of Sumgayit electric power nets.

Tariffs since 01.10. 2001 for electric energy:

- For population – for 1kWh – 96 manats (with the Value Added Tax (VAT))
- For budget and industry plants – for 1kWh – 153 manats (with VAT)
- For commercial structures – for 1kWh – 295 manats (with VAT)

- For wholesale dealers – for 1kWh – 71 manats (without VAT)

4. Efficiency of Power System

4.1. Characteristics

The times when electric power was called as "bread of industry" seemed to be sinking into oblivion. But the point of problem only just changed because the question is about economy as a whole, for the must important indicator of its potential is counted of high efficiency of electric power using.

In spite of transition to market economy Azerbaijan energy industry remained in fact completely the state sector. 7 thermal power plants with sum capacity 4200 MW and 4 hydro power plants with common capacity 780 MW were in Azerbaijan power system structure on the eve of breaking-up of USSR. The Yenykend HPP was built in the period of independence.

In 1990 93% electric power were produced at TPPs. Despite the production of electric power fell by 22%, the structure of this industry with the high part of thermal power plants did not alter.

However, significant alternations were in the structure of energy consumers. The share of industry that made 41% fell. Now the main consumer is population. This share increased from 5% to 51,8%. The volume of electric power import increased from 1,8 billion kWh in 1990 to 2,4 billion kWh in 2002 and the export much decreased, in that period it grew shorter more than 3,5 times: from 3,4 billion kWh in 1990 to 0,9 billion kWh in 2002. But if in 1990 Azerbaijan as a whole transferred electric power for Georgia and Armenia, that Russia and Iran became the main consumers in 2002 year.

During 1990-2001 the proportion expense of conditional fuel was growing for one released kWh. In 1990 for production of 1 kWh there consumed 366 grams of conditional fuel, and in 2001 – 409,9 grams or 12% more. It was connected basically with the worn aged equipment.

Now 40% electric power nets are needy for the capital repair. Till 1994 this figure was equaled 17 %. There is a reason: the mean from the budget is not assigned and the brunch can neither repair nor build because of non-payments.

Since 40-th years of XX century the production of electric power stable increased in Azerbaijan. In 1990 its production reached the record that was 23,2 billion kWh. From 1991to 1997 it began decreasing. Since 1998 the grow of energy renewed and in 2000 there produced 18,7 billion kWh – 80,1% of 1990 level.

One can designate two main causes of electric power production fall:

- There stopped putting the new energy capacities into operation. From 1960 to 1995 they were put into operation permanently. But 1990 new capacities were not put into operation before 1999 year.
- The technical re-armament of brunch got slower. The analysis shows even when the lead-in of new capacities came to a halt in 90-th, the capital investments in electric power sector increased. On the whole the investments were intended for capital repair of equipment because the supplies of new equipment from Russia were made difficult. As a result the grow of expenses did not accompany with the adequate grow of production volume. That is an index of fund output was decreasing in electric power engineering for 90-th years.

Beginning since 1999 thanks to the large effort of the government there reached the turning point in the electric power production and it began increasing. First, the capacity of country's energy systems started growing since 1999 year. Secondly, since 1999 there began realizing the projects of main modernization of power plants (Baku CHPP-1, SDPP "Shimal", Sumgayit CHPP-1 and CHPP-2) on the means of foreign financial organizations and government.

Nevertheless, the modern domestic electric power industry is in a very difficult condition. The head reason of strained situation is a low efficiency of production and consumption of electric power.

At present in fact maximum capacity of energy system makes (in the period of peal load) from 3 to 3,5 MW according to different sources. But the real necessity is above approximately on 800 MW. So to overcome the deficit of generating capacities and compensate this difference Azerbaijan must buy up electric power of its neighbors that is Russia and Iran. However, the power engineering specialists suppose that the deficit even taking into account the import will make no less 450 MW, especially in winter period. As a whole, only for 9 months of 2003 the total amount of electric power import to Azerbaijan has exceeded its export on 49,4 %, having made more than 1 billion 205 million kWh.

The specialists are sure that the situation won't be able to change the broadly caused a sensation company of SDPP "Shimal" reconstruction because there need new sturdy lines transmissions calculated, as a minimum, for 220 kV and good equipping substations for the new capacities. Also it is necessary to take into account losses at transportation of the electric power (failure of networks, transformer substations).

The brunch is need of investments. The main funds of basic thermal power plants Azerbaijan SDPP and Ali-Bairamli SDPP are worn out very much (they are accordingly above 20 and about 40 years) and require wide-scale but no partial renovation. So it is no surprising that in spite of annual repairs these large thermal plants can not till now work on the optimum capacities. Moreover, the generating plants grew old. There require annually some 25 million dollars (according to different calculations) for the full reconstruction of country's energy system. Near 5 million dollars were annually invested in the brunch since 1995 year. The way of this problem solution is in the privatization of generating capacities to attract the foreign investors.

The most critical situation with electric power is for consumers of Nakhichevan Autonomous Republic. The problem is explained by that Azerbaijan has not got the generating capacities in Nakhichevan yet without taking into account Araz HPP that is working with the load 15-20 MW. So electric power supply for Nakhichevan is a difficult problem. Now power engineering specialists try to solve it at the expense of preventive maintenance and repair of the capital equipment and network. In result real capacity of a power supply system should be considerably increased. Today the NAR necessity of electric power is evaluated as 180-190 MW, but in fact its consumption makes some 130-150 MW. It is realized by the imported electric power from Turkey and energy change with Iran. In the last case Azerbaijan transfer the equivalent volume of energy into Iran power system.

In the last years there is a paradoxical situation in Azerbaijan: absolutely non-connected with each other the growing volumes of electric power production and its prolonged shortage. This situation may be explained by growing demand for the consumption for that "Azerenergy" can not be in time anyway. But it happened on the background of stoppage of almost all the industrial plants that were the main consumers of electric power. According to logic the present volume of electric power production on the level of 18,5 billion kWh (it is 80% peak period of Soviet time, in 1990 this indicator reached 23,2 billion kWh) must full satisfy all the necessities of

economy. However, the analysis of electric consumption structure shows its absolute non-efficiency.

The decreasing of electric power production didn't conduct to the reduction of its consumption in the first half of 90-th. Though it is a paradox but the power engineering got the damage less than the extracting and manufacturing industries in the period of reorganization. As compared with 1990 the index of electric power production did not fall lower 60%, at the same time the production of extracting industry sometimes made only half in fact and the manufacturing sector reduced to one quarter of 1990 level. By that since a moment of restoration of economic stability and renewal of development the electric power engineering among the different sectors of industries enters the number of slowly developing brunches. The extracting industry demonstrates the most dynamic growth.

The weakness of connections among dynamic of electric power engineering development and other brunches of economy shows itself and in the comparison gross domestic product and production of power engineering. The recession in the economy of country was closely connected with electric power production before 1992. Further the continuation of economic recession was not accompanied by the same slump in the power engineering. Analogous situation also was observed in the growth of GDP.

The analysis of electric power production and consumption in Azerbaijan in 90-th years shows interesting situation that is not characteristic for any normal developing economy. On the background of general economic situation worsening in the country, the production and consumption decreased by insignificant rates! For example, in 1997 industry and agriculture was in the biggest recession for all 90-th years and production of these brunches made accordingly 28% and 50.3% of 1990 level, the electric power production reduced to 72,3% of the same level. Taking into account that in 1990 these brunches consumed near 50% from all the electric power produced one can admit that such data not at all adequately reflected the events. It is obvious, that decrease in production of the electric power corresponding to adequate reduction of rates of growth in the industry and agriculture should be observed. Otherwise it is necessary to find other explanation to the new phenomena. The matter is that for this period there were qualitative changes not only in structure of economy, but also in the consumption of electric power.

In the general view there are three factors that led to the appearance such an absurdity:

a) Radical change of electric power consumption structure

b) Growth of resource capacious of economy

c) Growth of shady economy scales

a) Radical change of electric power consumption structure

In the years of Soviet period the spheres of material production were the main consumers of electric power. In 1990 their share on the whole made 51,2% all the electric power consumed including in industry and agriculture – 48,6%. After finding the independence, in the connection with the economic crisis that befell the republic, the consumption of electric power in the brunches of material production abruptly reduced and in 2001 they used 8,6% of all consumed electric power. On the other hand because of the breach of fuel resources supply of population (especially with natural gas) the consumption of electric power by population significantly increased. If in 1990 the population used 4,94% of all electric power consumed in the country, in 2001 this index made 51,6%. At the same time with the transition on the electric heating the population began using electric power extremely irrationally. This situation was

promoted the privileges for communal payments to the broad sections of the population. It conducted to the groundless growth of consumption.

However, after abolishing almost all the privileges electric power consumption didn't become more rational. The low gathering of payments for using electric power (50% -in Baku, 25% - in regions) partially explains this moment. The overwhelming majority of population still suppose using electric power almost as a God's gift. Using electric power by the population in the heating purposes results in growth of consumption during the winter period almost in one and a half time. If in summer electric power consumption in country makes 2900 MW in the very peak period, in winter this figure reaches 4200 MW. Taking into account that the additional demand is brought by indigent part of population, its payment even in 96 manats for 1kWh becomes problematic and non-payment is almost guaranteed. Any economy in the world won't hold such wastefulness.

b) Growth of resource capacious of economy

The slump of production volume both in industry and in agriculture at the same time accompanied with the growth of power-consuming indexes of these brunches. It would conduct to the same consumption of electric power volume even by significantly smaller volume production. The analysis shows that for 1990-2000 power-consuming indexes of industrial production on the whole increased for 7,5 %. For that period power-consuming indexes of gross domestic product also increased for 5,6%. From position of market logic and saving the principal of competition advantage power-consuming indexes on the whole must reduce. However, in Azerbaijan judging by the brunch structure of economy and prevailing the extracting sector in it, that doesn't work according to market principal, this situation is easy explained. In either event, while SOCAR will not start to work as typically market structure and will not count up its expenses the constant growth of power consumption will be observed in the country.

c) Growth of shady economy scales

For 90th years in Azerbaijan the tendency of growth of scales of shadow economy was observed. According to the very modest calculations now the shady sector makes about 25% of country's economy. The growth of shady economy sector is accompanied with the growth of necessities in resources including in electric power. On the other hand, the resources used in that sector do not reflect in any documents as well as and all the other operations. There apply the useful way of estimation of shady sector volume by electric power consumption in the world practice. So electric power consumption of shadow sector is not only the consequence but also the method of exact estimation of its volume. It is not difficult to calculate that 25% shady sector is according to the very modest evaluates 5 billion kWh electric power. In either event electric power engineering became the "black hole" of economy where million dollars disappear without leaving a trace.

Azerbaijan government realizes the special program of power engineering sector reformation. The main directions are selected as the development of payment for public utilities mechanism, re-structurization of joint-stock companies "Azerenergy" and "Azerygas", also the largest consumers of electric power. And, certainly, increasing of tariffs for energy resources. By the way, the leadership of "Azerygas" already appeal to Ministry of Fuel and Energy Development at least with three versions of proposals for revision (on the hand of increasing) the existing tariffs for gas for all consumers without exception. However, it can leave only as the half-measures if they don't define the global task that is a transition for production of economical and cheap electric power, energy saving technologies, but mainly high effective energy using. It is everything that power engineering is sharply in need of.

Azerbaijan energy policy seems mostly centered on facilitating the development and export of its huge hydrocarbon reserves. In April 2001, Azerbaijan established its Fuel and Energy Ministry; this entity's main function is to boost foreign investment in Azerbaijan energy sector. This Ministry also supervises the state-owned oil and gas companies and sets import tariffs in those sectors.

During the last half of the 1990s and the beginning of this decade, several laws were enacted in a so far mostly unsuccessful attempt to bring the energy sector into market-based operation. These included a law on usage of energy resources (enacted in 1996), a law on electric power generation (enacted in 1998), and a law specifically covering thermal-electric power plants (enacted in 2000). There have also been several Decrees, by both the President of Azerbaijan and the Cabinet of Ministers, concerning regulation of the energy sector, including one in December 2001 that listed nine very small hydroelectric power plants that were available for privatization.

On March 25, 2002, the President of Azerbaijan issued Decree #893, "On Strengthening of Financial Discipline in the Energy Sector." The decree was issued because. “Azerenergy” (the state-owned joint-stock electric company) and “Azerigas” (the state-owned joint-stock gas company) have only paid for a small percentage of their fuel deliveries and have continued to increase their debts to the State Oil Company of the Azerbaijani Republic (SOCAR). In 2001, “Azerenergy” paid SOCAR for only 0.5% of the value of its fuel while “Azerigas” paid for just 1.3% of the value of its gas. The decree lays out a two-stage approach to the problem. Stage 1 implements measures to prevent creating new debts. Payments to SOCAR are planned at 20% in 2002, 30% in 2003, 45% in 2004, 65% in 2005, and 80% to 100% in 2006. During Stage 1, the unpaid amounts will be regulated through securities to provide record-keeping and transparency. In Stage 2, the debt will be restructured when the accrual of new debts has been stopped. By the end of 2006, Azerbaijan plans to increase collection from distribution networks to 100%.

Decree #893 also sets a goal of eventually switching all thermal power plants to natural gas fuel and announces plans to restructure “Azerenergy” and “Azerigas” and speed up the process of privatization or concession of electricity and gas distribution networks. The decree states that a Tariff Board has been established that will do a comprehensive analysis of utility tariffs, set optimum levels, and promptly regulate them. In addition, Decree #893 announces the government's intention to restructure SOCAR. This would include improving the settlement operations of SOCAR with its industrial customers and increasing collections from domestic fuel users. Azerbaijan intends to reduce costs by privatizing SOCAR's servicing and social facilities or transferring them to other institutions. It is planned that the differential between domestic and export prices will be reduced for oil, oil products, and natural gas.

The Azeri government recognizes that to create free competitiveness in the power generation subsector, several measures must be fully implemented: fair tariffs and non-discriminatory access to the high voltage power grid, creation of true independent power generation companies, implementation of a power trading and resale system, and re-thinking the taxation system for power generation in order to discourage monopolistic control of the power market and encourage alternate forms of power generation. Future laws and decrees toward this end can therefore be expected.

Development of power system and heat supply in Azerbaijan envisages increase of energetic efficiency through phasing out and reconstruction of outdated technologies, increase in the share of combined power and heat generation, decrease of condensed power generation during less intensive periods of energy consumption. The strategy of power and heat supply system development in the country will target the following problems:

- shift from construction of large thermal power plants to construction of middle and small power units on the basis of steam-gas and gas-turbine units;
- gradual dismantling of the worn out equipment at thermal power plants (up to 30% of total capacity);
- replacement of the worn-out facilities at the Mingechevir HPP, upgrading its design capacity;
- increase in the share of hydro power resources in the energy balance to 25% with priority given to small and micro HPPs for collective and individual use;
- construction of wind power plants at the Absheron peninsula and Nakhchivan with capacity of 15-20 MW;
- maximum possible provision of TPPs with natural gas and improvement of technical, economic and environmental characteristics of gas-oil plants due to use of gas-turbine units;
- technical modernization of the distribution net and reorganization of management structure of power system in accordance with transition to market relations;
- technical modernization of heat-electric plants and boilers and their provision with natural gas;
- rehabilitation of heat supply lines and reorganization of management structure in the heat supply system;
- use of solar energy and energy of geothermal waters for heating, hot water supply, and air conditioning.

Forecasts on growth in design capacities and in electric power generation for the period up to 2025 are presented in the following tables.

Table 22. Forecast on power generating capacities up to 2025, MW

Technology	Years				
	2005	2010	2015	2020	2025
TPP	4135	4175	4175	4175	4175
CHPP	345	415	415	415	415
HPP	976	976	1147	1557	1857
Non-traditional	30	60	80	100	120
Total	5486	5626	5817	6247	6577

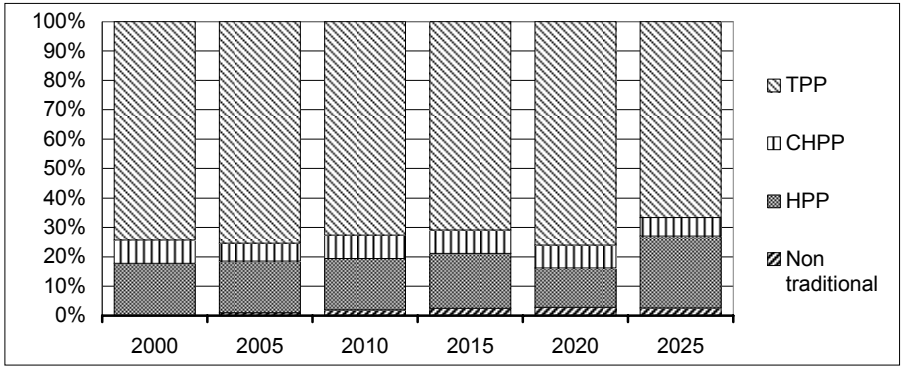
Table 23. Forecast on power generation and consumption up to 2025

Years	Design capacity, MW				Output,	Local consumption,	Export,
	Overall	TPP	HPP	non-traditional	billion kWh	billion kWh	billion kWh
2005	5486	4480	976	30	26.50	24.00	2.50
2010	5626	4590	976	60	27.00	24.09	2.91
2015	5817	4590	1146	80	27.64	24.64	3.00
2020	6247	4590	1556	100	28.56	25.56	3.00

2025	6577	4590	1856	120	29.52	26.52	3.00

Next diagram illustrates forecast on generating capacities of electric power system up to 2025.

Figure 8



Forecast on development of generating capacities is projected that local heat demand would be met through further expansion of district heating as well as use of small boilers and individual heat supply. Natural gas is projected to be used as a basic fuel for these purposes.

Table 24. Forecast on heat generation up to 2025, million Gcal/year

Technology	Years								
	1990	1995	1998	2000	2005	2010	2015	2020	2025
CHPP	14,80	6,32	2.93	5.1	14.8	24.0	25.1	26.0	26.8
District boilers	6,60	3,44	3.15	2.4	7.5	7.7	8.1	8.5	8.9
Total	21,40	9,76	6.08	7.5	22.3	31.7	33.2	34.5	35.7

Based on the forecasts of natural gas and furnace fuel oil outputs, growth in generating capacities and generation of electric power and heat, an estimation of fuel consumption at TPPs and CHPPs has been made for the period up to 2025 and presented in the following table.

d) Fuel consumption structure in the power generation industry up to 2025

Fuel consumption	Years					
	2000	2005	2010	2015	2020	2025
Fuel oil, PJ	118.50	128.71	108.5	77.89	53.25	-
% of overall	66.9	48.3	36.3	25.3	17.1	-
Natural gas, PJ	58.71	137.84	190.27	229.57	257.79	291.12
% of overall	33.1	51.7	63.7	74.7	82.9	100
Total, PJ	177.21	266.55	298.77	307.46	311.04	291.12

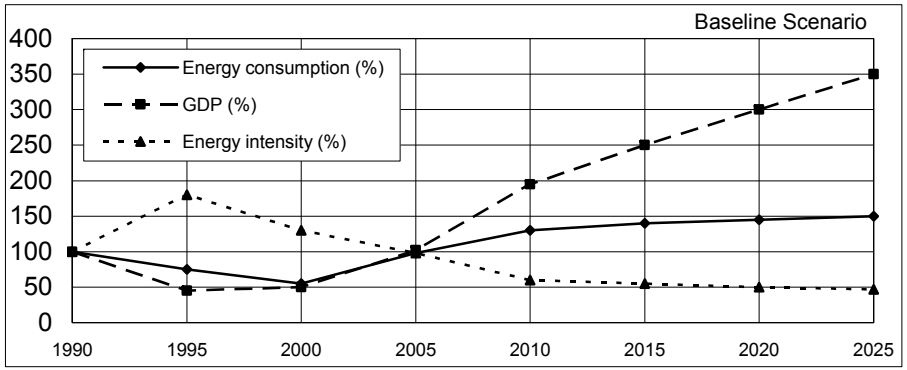
e) Energy demand projection by the economy sectors, PJ

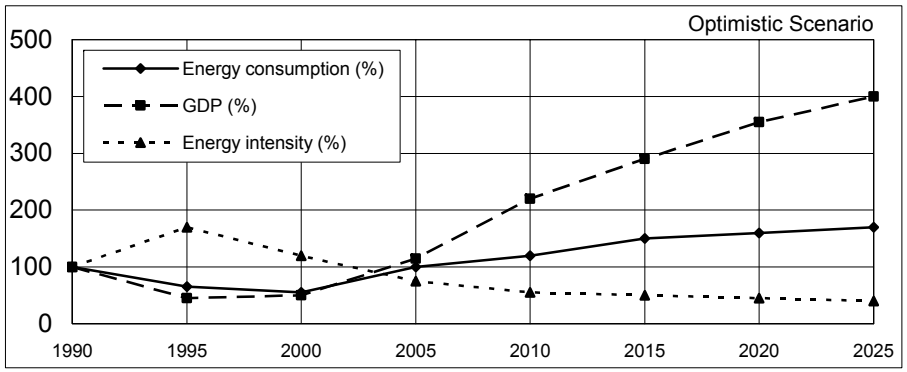
Sectors	Years							
	1990	1995	2000	2005	2010	2015	2020	2025
Baseline scenario								
Power generation	266	184	150	252	312	360	394	410
Industry	123	85	68	114	142	163	179	186
Transport	64	44	36	61	75	86	95	98

Commercial	109	76	60	101	125	144	158	164
Households	88	61	48	81	100	115	126	131
Agriculture	41	28	24	40	50	58	63	66
Others	17	14	15	24	30	33	35	39
Total	708	492	401	673	834	959	1050	1094
Optimistic scenario								
Power generation	266	184	150	258	326	398	424	446
Industry	123	85	68	117	148	180	192	202
Transport	64	44	36	62	78	95	102	107
Commercial	109	76	60	103	130	159	170	178
Households	88	61	48	82	104	127	136	143
Agriculture	41	28	24	41	52	64	68	71
Others	17	14	15	24	30	35	39	42
Total	708	492	401	687	868	1058	1131	1189

Depending on the scenario of economy development, energy consumption levels considerably change, however tendency of decrease in the GDP energy intensity after the year 2000 is characteristic of both cases. With the increase of GDP and energy consumption due to the energy saving measures and new technologies energy intensity will be in contrary decreased. By 2025 this indicator will make up 42 to 44% of the year 1990.

Figure 9. Forecast on dynamics of energy intensity for different scenarios of economic development





5. Regional Cooperation

5.1. Perspectives and constraints

During Soviet rule all three South Caucasian states developed within the framework of the USSR's internal division (a main planning economic unit in Soviet central planning). The economy of the Soviet Union was sectorally managed, but the principle of regional planning was also maintained. Regional cooperation and integration during Soviet period, despite many declarations, was not achieved. New political and economic conditions give new stimuli for regional cooperation in the South Caucasus. There are new possibilities for development for each of the region's new independent states. At the same time, the investment potential of the Caucasus and its attractiveness for the foreign investor would undoubtedly grow if Azerbaijan, Armenia and Georgia closely cooperated and optimally formed a single economic space.

For the last ten years economic relation among three South Caucasus states were significantly reduced or interrupted because of regional conflicts, civil confrontation and blockades. One must point such a fact in past economic mutual relations of three republic with their neighbors were more conditioned by ideological interests and political pressure than the interests of common profits. These situations extremely limited the opportunities of choice of economic partners and thus brought to naught the geopolitical potentials of region.

The South Caucasian states have no alternative but to develop economic co-operation within the region and to learn solving their problems of security on their own interests. Any large-scale regional economic project will serve not only as a generator of their economic development but will also strengthen regional co-operation and security. South Caucasus states have to balance global interests of the USA, EU and regional powers for the sake of stability and sustainable development in the region. The role of the regional powers (Russia, Turkey and Iran) is of particular importance. It is truly in the interests of these regional powers to play a more constructive role in establishing an attractive economic and security environment in the South Caucasus.

The idea of the South Caucasus as a integral economic unit is a difficult task enough. Not only wars but also the economic differences prevent from this process. However, the economic integration of three republics would have a very big effect and allow them to become the elements of corridors “East-West” and “North-South”. If such unity would exist the South Caucasus can partly dictate the economic play rules. Population of the South Caucasus makes just 15 million persons and region can be of interest for Europe only as the complete, economically integrated space that is free from any conflicts.

In its turn the regional cooperation may and must help the regulation of conflicts. However, this process can get the real benefit only in the case of clear understanding of common advantages without wishing to get the winning and prejudice to somebody by all the sides.

The firs action for economic cooperation and regional integration in the South Caucasus has to be the establishment of general super-regional structure that would be occupied with exploring tactic and strategy of integration processes and defining the prospect directions of cooperation.

All the world practice shows that unity on the integration grounds has as much more opportunities as the steps of its development are more gradual. In that aspect there are acceptable forms that is the beginning of regional cooperation with comparatively the high level of cooperation but in the narrow field (for example, the rebirth of common

energetic system). This way was defined by European community that established the European Coal and Steel Association. It was based on the common market, common goals and common management. There exist and over option that is to comprehend more broad area but having the small integration of subjects. It is, for example, North American Agreement on Free Trade signed by USA, Canada and Mexico.

On the first stage the cooperation in the South Caucasus must be realized in these areas of economic activity that are of interests for all state of region, where are evident the interrelationship of economies and what would be able to stimulate the development of region. Of cause, this area is power engineering. It is unquestionably that the sides are of interest in the cooperation of value in power engineering. Speaking about the potential cooperation in the field of electric power engineering one must take into account the Azerbaijan-Georgia experience of large power engineering project that is being realized. One of such projects is a building of oil pipe-line Baku-Tbilisi-Jeykhan and also the project Baku-Tbilisi-Erzerum on transporting Azerbaijan gas. The realization of these projects will become the important stimuli that help a sharp rise in economies of two countries.

The first stage of regional cooperation may be the zone of free trade that can be established by the states easy enough. Within its frameworks one will reduce and gradually abolish the taxes, duties and customs, licenses and quotas, remove the quantity limits in mutual trade and prohibit the non-sanction re-export. It must become a link on the way of the South Caucasus market establishment that providing for forming common custom policy, creating the custom union with unification of custom legislation and custom procedures, full abolishment of tariff and non-tariff regulation, coordination of foreign trade policy towards the other states and the free transference of goods, services and factor of production. The last point of this chain must become economic union that would propose:

- establishment among the states of free transference of goods, services, capitals and labor force;
- conducting coordinated financial and credit, budget, price, tax, custom and currency policy;
- promotion for business and investments, encourage for the development of economy cooperation and direct connection of plants and brunches;
- harmonization of economy legislation.

The beginning of broad regional cooperation in the South Caucasus will mean, in point of fact, starting up the mechanism of broad-scale processes of globalization that will take away a lot of today’s problems including territorial problems. Majority of power engineering, transport and communication projects have not only super-regional characteristics but directly join in the new world political and economic order whose one of force line lies through the South Caucasus region. In the case of their realization the political confrontation will give up its place to more pragmatic economic attraction towards the cooperation.

The strengthening of economy and base of stability, establishment of infra-structure, building of oil pipe-lines, rebirth of common energy system and, consequently, prosperity of all region is an attractive goal enough for all three countries so as to refuse from the ambitions and enter into the active process of regional cooperation.

The regional economic integration of Azerbaijan, Georgia, Armenia may be the strong encourage for the development of national economy for every country and establishment of common investments space. At the first place, the national market is too small to provide a lot of national producers with the adequate market space and only the market of regional scale can guarantee the real potentials. In the second place,

integrating in the world economy through the region, the country will be, apparently, stronger player. Countries of the South Caucasus have very good preconditions for such a decision. These states are close to each other not only territorially but only historically and cultural connections (they are very strong to this day) and the common economic development in the Soviet period. From this prospect one can regard the regional integration as socially and economically profit and necessary.

Today the urgency of strengthening of inter-regional integration processes on Southern Caucasus is available, as well as their weak real embodiment the roots of this situation are, first of all, in the political non-stability and also in general difficult economic problems.

In the period after "Cold War" the South Caucasus became an object of rivalry among the large states. And now the disposition of region and its economic potential is conditioning this rivalry.

From the geographical point of view the South Caucasus is situated on the ancient trade communicational roads connected Europe and Asia. Moreover, there cross the Slavic, Turkic, Persian and local Caucasus culture. The Caucasus is a meeting-point for Christian and Islamic civilizations. From political point of view it was situated on the historical intersection of Russian, Persian, Turkey empires. Now Caucasus lies between the regional states: Russia, Iran, Turkey. As a result all the states logically and naturally regard the South Caucasus as the area of their influence in region. USA also regards the South Caucasus as a zone of their national interests.

The natural stores of oil and gas in the Caspian Sea, in particular in Azerbaijan, attracted both private and government interests in region. The questions of property rights of energy resources and mainly their transporting on the world market became characteristic of geopolitical rivalry in the South Caucasus. The states that are members of EU: France, German, Great Britain and Italy also realize their broad activity in the South Caucasus. However, no one of this state can individually disseminate its significant influence. EU would be able to become approximately one of the most influential figure or even the most influential one. But the inability or unwillingness to create the common policy with regard to the South Caucasus did not allow Europe to realize its potential.

The regional policy in the South Caucasus must not be considered separately. This region is under the strong influence of events that take place in Central Asia and Middle East. It brings much more non-prognostication and uncertainty in the regional situation. Israel activity takes part both in the private sector in Azerbaijan and Georgia and in policy because of Iran nearness. Pakistan plays the role of Azerbaijan ally in its conflict with Armenia. In summer, 2002, there signed the agreement of defenses between Azerbaijan and Pakistan. The Chain interests in the South Caucasus are mainly connected with oil and gas industry.

The appearance of new independent region attracted attention of many countries to the South Caucasus. Some countries' attempting to isolate themselves from somebody's influence did not reach the desired result. And today their dependence on the geopolitical interests of the large states became the factor that could not play the positive role in integration processes.

Besides the social and national problems accumulated since the Soviet period and absence of independence experience conducted to such a situation what a lot people did not believe in the integration processes.

However, the relations between Azerbaijan and Georgia significantly improved after finding the independence, especially for the last years. Both the states realize that their security are mutual connected with each other. Azerbaijan cannot export its oil without

help of Georgia that connects it with Turkey and West. Georgia partly relies on the Azerbaijan export as on the guarantee of its economic and political security. Both the countries became the main force in GUUAM organization (Georgia-Ukraine-Uzbekistan-Azerbaijan-Moldova) that began developing since 1997 as a counterbalance to Russia hegemony in CIS.

The development of regional cooperation is necessary for establishing the peace and prosperity in the region but all initiatives to this direction are blocked by political conflicts. So it is necessary to find measures that can promote the cessation of "information war", create the different forms dialogue and come into contact with political elite and the population of both countries. In that direction the work with mass-media, NGOs, youth may be the best way to serve as a powerful spur to the understanding for all society. The best way of restoration of trust is cooperation.

Speaking about the mutual integration and cooperation one must remind once again that the conversation is turning to process, which already really exists. Even having the barriers established by politicians business may overcome them. There are ocular demonstrations of these words. There function the trade fairs on the Red Bridge, Sadchalo, Ergneti in Georgia where Azerbaijanis and Armenians deal in during the escalation of war operations. These processes are natural and they emphasize the necessity of taking into account this reality.

Thus, the important condition for developing the South Caucasus on the whole and the regional cooperation in particular is settlement of conflicts in the region, namely conflict because of Nagorny Karabakh between Azerbaijan and Armenia. Today opportunities of regional economic cooperation are blocked with this problem. It is difficult to introduce long-term programs of development and investment in the presence of non-stability factor that is this conflict. Azerbaijan and Armenia are in the meanwhile much inferior to the peace, political settlement of conflict, not only beginning of integration processes but also economic cooperation. However, for establishing the preconditions of broad regional cooperation one should not expect the settlement of conflict. On the contrary, the elements of new regional order must be built-in into the political models of conflicts settlement.

After the break-up of the Soviet Union they understood that Azerbaijan, Armenia, Georgia were poor integrated. And it was, in its turn, one of factor that promoted the worsening of political situation in the region. And today regional integration processes in the South Caucasus are realized with very weak pace.

The most main task of region is to find its place and function in the international division of labor and international trade. The economic heritage remained after former USSR does not give opportunities for countries region to produce and sell the competitive production on the international market (but Azerbaijan oil and gas) and so states of the South Caucasus can expect the improvement of their economic situation from projects regional cooperation using the advantageous geographic localization of region. However, economic cooperation in strategic sectors of economy is practically frozen in fact because of existing conflicts. Moreover, the regional economic cooperation is significantly limited by corruption existing in the region and also of the lag in the area of laws and rules harmonization directly or indirectly connected with economic activity.

Without economic cooperation each of three states of regions has not any serious prospects for development. The disconnected region does not represent interest for investors. Large joint regional projects can promote not only reducing the level of difference of opinion among the country but also can the base of positive tendencies for overcoming the political non-stability and settlement of regional conflicts. The strategic sectors for regional cooperation one may count the power engineering and transport.

Serious prospects of regional cooperation are available also in telecommunication sector and in the field of environment.

6. Regional Power Systems Cooperation and Integration

6.1. Perspectives

Geopolitical interrelationship of region dictates the necessity of joint actions in the area of power engineering without that it is impossible to solve any problem of region and every country. So the question of power systems cooperation is a necessary factor for development of integration process on the whole.

Some models of cooperation of power engineering area, unfortunately, remained in past. For example, one of them existed within the frame of Tasis program brought to initiating the model of new common power system - Azerbaijan, Georgia, Armenia, Turkey. The work on research of potential of the South Caucasus republics unification with the Turkey energy system was realized very actively at first. A country that had surplus of electric power would be able to export it to any country of these states. Though now all four countries have a deficit of electric power in a different degree, this project could have the large significance for future after the peace establishment.

Azerbaijan attaches great importance to such a fact if the price on the gas increase it will become an electric power exporter once. As it is known Azerbaijan is going to export its gas from deposit "Shach-Deniz" in 2006. With the furthest exploit deposits on the Azerbaijan shelf of Caspian Sea this country can soon provide its necessary in natural gas. In some expert opinion, Azerbaijan perspective structures especially in the north part are more gas-condensation than oil ones. So in perspective, Azerbaijan possessing the modern plants for producing electric power that work on natural gas will be able to realize electric power to the other country successfully enough during the current transfers.

Azerbaijan power system has supporting operating conditions and quite good stocks of capacities. By 2005 when power system solves its problem modernization Azerbaijan will be able to export its surpluses of electric power. By this time Azerbaijan considers to export near 4 billion kWh electric power. For its export a certain potential is in some directions of project on the privatization in this area. It means the privatization of small objects of electric power engineering, set steam-gas units to the large plants and building by foreigners their own power plants. This project can be realized and promise the surplus export reserves of energy system if Azerbaijan economy develops without serious shocks. Thus, project of trade change with free energy capacities and also regulating such a common energy system would be able to become reality. Judging by Armenian power engineering projects the processes of full uniting energy systems can be begun at any moment but evidently only accomplishment of Karabakh conflict. Then the next stage can be become the realization of joint energy projects and on alternative sources of energy.

However, and negative situations can urge to the integration processes. The failure at Armenian atomic power station would be accident not only for all Southern Caucasus, but also much more far regions. By 2004 atomic station will exhaust its resources and some international institutes suppose that it be closed by this time. But Armenia renewed the exploitation of atomic power station because of difficult situations and closing it this country will demand the guarantees of its energy security from the interested parties. Azerbaijan would be able to become such a guarantor as the most

provided with energy resources country in the South Caucasus. But this concept of providing energy is very conditional because of permanent crisis.

In the periods of reducing electric power consumption the production at the plants forcedly decreased. At least it conducts to increasing the production cost price. There is a current transfer outside the internal system to run about this situation. And the cooperation in this direction will promote increasing effective work of local electric power plants.

As reported, the main obstacles for developing integration process are dissolved conflicts and political non-stability. However, there exist the examples when in spite of political differences the countries successfully realize joint projects in the area of power systems integration. For instance, one must admit that there exist difficulties in the interrelation between Azerbaijan and Iran. One should only remember the incident in the Caspian Sea when Iran Navy in the ultimatum form demanded that two Azerbaijan research ships, belonging to BP and explored the perspective structure "Alov", accomplished the work and left the place location. They stated that this territory belonged to Iran. But in spite of these problems there establish system of mutual profit economic cooperation between two countries at last time.

Thanks to joint efforts Azerbaijan and Iran power engineering specialists there became the reality the accomplishment of building the part of high voltage transmission lines Astara (Azerbaijan) - Astara (Iran). They propose the building of the second turn of high voltage electric transmission lines Imishli - Parsabad. On the whole, for the last years energy change between Azerbaijan and Iran reached 600-700 million kWh in year.

Azerbaijan power engineering specialists successfully cooperate not only with the Iranian but also Russian colleagues. There were conducted the fruitful negotiations about the necessary of building of the second chain of high voltage transmission lines 330 kW Derbent - Yashma. According to the protocol signed on total of negotiations they decided to prepare technical and economic project ground within four months term. Putting into operation of new electric transmission lines will allow to Azerbaijan quality to decide the problems of electric power nets loads and also increasing efficiency of power plants work.

In the result of negotiations between Russia Federation and Islamic Republic of Iran they signed the agreement on the change of electric power volume 300 MW. Thus, Azerbaijan became the transit country for electric power transfer between Russia and Iran.

Synchronization of power systems of region is necessary for successful development of integration processes in the field of power systems. The synchronic work is an alternative, moreover cheap, to the building of units of direct current that cost near 40-50 million dollars. In the case of transition on the synchronic work transfer of electric power can realize through the existing lines but not to built units of direct current.

The economic effect of synchronization include in significant increasing the safety of function of electric power complexes (more clearly it is shown in period of maximum loads in winter and fall and in the case of accident situations liquidation). It will allow using the energy resources more rationally because of mutual electric power change.

The technological aspect is included in reserving capacities that will let increasing safety of energy systems. After system accidents in some countries of Europe and America this aspect became a most actual. From the political point of view, the synchronization will conduct to larger transparency and opening of economy.

Moreover, it is very important circumstance that Russia is interested of synchronization for synchronization of energy systems of the South Caucasus will allow increasing the safety of regional electric power engineering work. It will open the

opportunities of Russia electric power export on the "fantastic attractive" (A. Chubays) Turkey market where the price of one kWh more in 2 times is higher than in Russia.

Taking into account the base of economy development is power engineering and the improvement of technical characteristics of electric power plants is a condition of increasing the energy production, in perspective, one must give the advantage for renewing existing systems and building new power plants and establishing the regional energy system. Today all over the world the situation that was brightly marked in past, when some countries aimed to reach the self-providing of electric power was over. It happened because of difficulties with using the most rational sorts of resources that would take place if power engineering specialists went on encouraging the concept of autonomous power system. In that aspect unification of power systems of the South Caucasus countries has the special significance.

In the base of one must lay the mechanism of inter-states coordination, ensuring the interaction of states energy systems, for example, by exploring and perfecting legislation bases of these countries. Unification of power systems is also possible in the form of establishing the transnational corporations on coordination of electric power production and its transporting.

The cooperation and integration of power systems are necessary; they are inevitable because they are dictated not only geographic and historical condition but mainly economic ones. However, in that process one must keep the balance of interests of counties that can integrate in common power system.

6.2. Objectives and requirements

Period of development of the post-soviet states economy on the South Caucasus and the formation of market mechanisms causes search of ways and conditions of power systems cooperation as in a part of a making new a pattern of ownership and structure of management in the national power systems and in search of ways of organization of their cooperation and joint integration. Decision of these tasks will define in long-term prospect:

- Technological development of power branch with the establishment of South Caucus power system
- Common market of the electric power and services
- Conditions for the investment activity
- Maintenance of reliable, qualitative and effective operation of power interconnection by coordinated principles and standards under mutually advantageous conditions for all energy partners

The organization of regional power systems cooperation suppose the following objective circumstances:

- Removal of political and basic economic barriers to develop of cooperation in the South Caucasus in the field of electric power industry
- Further liberalization of the power market
- Absence of political obstacles
- Integration ideas and tendencies
- Process of profound economic reforms

The primary objective of regional electricity cooperation and integration is that the target and transfer regulation and structure of the regional electric power industry will

facilitate its contribution to sustainable development objectives and, particularly, to make the best use of the regional energy resources.

This implies:

- Planning the outputting of resources for the national power systems, in a sustainable development prospect, as part of the development of resources for the regional electric power system, taking into account the regional energy system and regional energy policy;
- Setting up legal frameworks, rules, protocols, coordination and regional mechanisms and bodies responsible for:
  - the reliable, secure and cost-effective operation of the regional interconnected network,
  - the introduction of a regional electricity power market (bulk power market, free access to the transmission network);
- Implementing mechanisms and structure for the development and the carrying out of regional electric power projects;
- Setting up a regional organization that will be responsible for the implementation of these actions, and for the operation of the regional interconnected power system.

Generally speaking, regional power systems cooperation and integration enhances the contribution of the electricity sector to sustainable development.

Regional power systems cooperation and integration ranges from sharing experience and expertise on the operation and planning of the electric power system, to pooling activities such as training electric power engineers, research and development, integrating parts of or the entire structure for operating and developing the electric power systems. The electric interconnection of national power systems is considered as a very important step towards regional electricity integration, and decisive step towards the implementation of a regional competitive power market. There is a clear case for pooling resources in every sector of the economy, particularly sectors of mass production. This is all the more true in the electricity supply industry: as electricity is not storable, there is a strong incentive for pooling supply and consumption through the interconnection of electricity networks.

Certainly accepting the necessity of energy equation of national systems and observance of qualitative maintenance of parameters of an electrical mode, the major requirement of joint operation of South Caucasus power interconnection is organization of:

20. regulation of frequency and power allowing to ensure reliable parallel operation of power interconnections of South Caucasus countries,

21. maintenance of reliable operation of interstate transmission lines.

All the other questions, including, choice of regulating stations and accommodation of a reserve, structure of system of a secondary control, structure of emergency automatics and the others must be rational and acceptable for every country.

However, these two marked above requirements are rather serious as it is necessary to solve the following questions:

- Introduction of automatic control of frequencies and power with installation of central regulators in national electric power systems and power interconnection as a whole

- Connection conducting power plants to systems of a primary control with maintenance of a required maneuverability
- Installation on the interstate levels automatics of restriction of a power flow, network separations, facilities of power compensation and regulation of voltage and others

The cooperation of the power systems of the countries, in its final stage, may be defined by two objectives. First of all, the national electricity networks should be interconnected to enable substantial energy and capacity exchanges between countries. Then, having agreed on a certain level of quality of supply, the operators and the developers of the regional power systems have to coordinate themselves in order to minimize the regional cost of electric power, while contributing to environmental and social objectives.

Finally, regional integration will consist of:

- the creation, under the governance of the governments of the region, of a regional organization responsible, partly or entirely, for the coordination of the actors of the electric power industry, the harmonization of the planning and operating rules, and for the minimization of the overall cost of supply;
- the management of power generation and transmission projects that are justified from the prospect of sustainable regional development.

Considering electrical ties and existing infrastructure of electric power industry of South Caucasus states and examining prospect of development of power systems integration, definition of strategic directions of regional power systems cooperation is necessary:

- Development of power systems and power interconnections
- Effective utilization of a powerful infrastructure of interstate transmission lines by joint efforts
- Coordination of actions on management of development and functioning of national power systems of the states with the purpose of increase of reliability, efficiency and quality of an electricity supply of the consumers, including powerful interstate gas and oil main communications
- Complex realization of an export energy potential

Regional integration is a long process, it may develop over years. The structure of the regional electricity market may evolve according to the development needs and the financial capability of the regional countries. Regional power systems cooperation promotes the development of economic cooperation, raises reliability and quality of an electricity supply of the consumers, carries significant political and social advantages of power systems, gives essential economic benefit caused by economy of reserves, fuel, mutual aid, trade in the electric power and others.

6.3. Recommendations

Lower are presented some recommendations for appropriate actions in the field of the organization and development of regional power systems cooperation and integration. The guiding principles for these actions will, generally, have to be agreed upon at political levels. These actions must be implemented and developed at technical and financial levels. The joint actions are necessary to accent on the following questions:

- Coordination of the uniform technical requirements on regulation of frequency and power in super interconnection
- To present a new requirements on the adjusting characteristics of the equipment and systems of automatic control to all upgrading and constructing power plants
- To lead auditing a number of main power plants for the subsequent choice from them of plants with an opportunity of modernization and inclusion in a contour of primary and secondary control systems
- To develop and to carry out a complex of measures on maintenance of reliable power exchanges on interstate cut sets with installation of automatic of restriction of power flows.
- Estimation of the investments in updating systems of regulation and reservation, modernization bordering substations and means of telecommunication for maintenance of synchronous parallel operation of regional power interconnections
- Development of necessary technical and organizational measures
- Training the personnel

6.4. Recommendations:

a) Agreements between countries:

These agreements should specify:

- the basic principles of regional cooperation;
- the basic operating and planning criteria and the basic rules for the regional electric power market;
- the organization of permanent regional and national coordinator centers and their functions.

b) Political, legislative, and institutional areas

Regional Integration: in the energy policy of each country, regional cooperation should appear as one of the major factors for the development of the power system. This should be acknowledged and enforced by each country.

Laws and Regulations: to reach the necessary level of compatibility between national legislation in accordance with requirements or regional power systems cooperation and integration.

A credible and clear regulatory framework, in compliance with a future competitive market should be set up in each country

c) Transmission

Ownership: National policies relative to the ownership and operation of national transmission facilities as well as to the bulk regional interconnection links should be clearly defined and harmonized.

Electricity wheeling: Each country commits itself to allow the wheeling of capacity and/or energy through its system, provided it is technically and economically feasible.

A distinction between different priority levels as well as different wheeling charges will be established.

Open access: Policies of open access to the transmission network for use by all generators on a nondiscriminatory basis should be established, taking into account the requirements relative to the electricity market.

d) Environmental impact

A regional approach addressing environmental issues should be set up:

- To create and update a set of rules, criteria, guidelines and regulations to be applied by each country
- To strengthen national environmental institutions
- To incorporate environmental issues in national and regional planning

e) Technical area

Planning

- A simplified master plan.
- A flexible regional generation and transmission master plan (to be updated every 2-3 years) determining the least-cost scenario.

Operating

- definition of data to be gathered at a regional level;
- definition of operating criteria;
- procedures for routine and emergency operation;
- reliability standards;
- implementation and use of ancillary services
- lines protection coordination;
- procedures for outages analysis.

To set up a regional coordination center implementing the following responsibilities and functions:

- to establish a central data base including information about outages;
- to analyze outages affecting regional operation;
- to perform operational planning studies at the regional level to identify possible constraints in normal and deteriorated situations, transfer limits on interconnection lines, wheeling limits through countries, reliability or stability problems;
- to continuously monitor and coordinate the routine, degraded, emergency operation of the regional interconnected power system, implementation and use of ancillary services, lines protection system performance, compliance of the national control centers operation with the regional requirements and reliability standards;
- to coordinate, monitor and disseminate the generation and transmission maintenance schedules.

f) Commercial and financial

Transmission pricing: to introduce in each country a mechanism for calculation of transmission prices which will reflect the fixed and variable costs of transmission. The prices should be compatible among the countries, transparent and nondiscriminatory

in order to provide a firm basis for investors interested in the development of transmission and generation facilities, and for operation of the regional interconnected network.

Transmission prices and priority to wheel should be determined to make open access fully effective.

Generation tariff: to introduce in the each country a mechanism of calculation of generation tariffs, based on two parts: one part relative to the capacity available and the corresponding fixed costs, and another part relative to the actual energy supplied and the variable energy costs.

Taxes and royalties: each country should review and ensure the compatibility of taxes and royalties policy.

Ancillary services: to develop procedures for payment of ancillary services that should be compatible among countries.

Valuation of capacity and energy settlement of payments: to establish procedures compatible with regional requirements for valuation of capacity and energy, metering, billing and settlements.

Existing contacts: to assess how existing contracts could be accommodated within the new institutional and commercial framework.

Investments: actions should be taken by the countries and coordinated at the regional level to facilitate and promote private investments, particularly by mitigating risks supported by investors:

- to outcome market entry barriers;
- to establish clear policy relative to regulatory framework, pricing mechanism, taxes and royalties, convertibility of currency and open access to regional transmission network;
- to develop a clear process for construction;
- to address environmental issues;
- to allocate risks allocation.

To establish guidelines, procedures, models for project definition, business plan, risk analysis, financial and operation structure definition, commitments, contractual agreements.

Financial support: contacts should be made with multilateral and bilateral financing institutions with the objective of assessing their co-financing and their guarantee capabilities in order to catalyze private investment.

g) Other actions

Training: a training program should be established for the staff working in the different areas of power system cooperation. The operators of the regional power system should be the first to benefit from training.

The Power System of Georgia

1. Introduction

Economic development of Georgia is considered as a necessary precondition of the building of the new Georgian statehood and its modern development. In this process great importance is attached to strength of the energy of the country as one of the most important sectors of the economical infrastructure and its sustainable development: it should provide for not only the stabile economic growth, but also serves as a strong basis for the state security.

Georgia has a considerable energy potential, and in case of rational usage and corresponding efficient management of the state policy it would be possible to provide for sustainable existence for the country and to satisfy the energy requirements necessary for development. During the existence of the Soviet Union the energy resources of Georgia have been studies in depth and widely utilized. These resources represented an integral part of the Soviet Union energy potential, which created reliable conditions of energy supplies for Georgia. The energy sector of Georgia, having been completely integrated into the unified energy space of one of the larges country of the world, was provide for stabile energy supplies notwithstanding great number of weaknesses of the energy complex of the Soviet Union; in particular, those weaknesses were as follows: overall low efficiency of the productiveness of the energy sector, extremely irrational and spending regime of energy usage, imperfection of organization of the production processes and the centralized system of management, low labor culture weakness of economic incentives, and many others.

After collapse of the Soviet Union the political-economic conditions created in the region of the Southern Caucasus is drastically different from the situation twenty years ago. On one hand, we have clear weakening of the economic relations between the newly created states in this space. On the other one, the three regional countries have centuries-long traditions and deep historical roots of coexistence. This social potential is still not fully deployed in modern political processes. In the meantime it seems essential that the processes of policy-making in the three countries could be harmonized in such a way that the social interests of the population from each side of the boarder could be balanced and fully reflected in the political decision-making. Especially, regional economic cooperation is an extremely important condition for real economic development of every individual economy. First of all, each local market is too small to provide national producers with adequate market capacity. Also, each country seems to be a stronger player in the global economy when being integrated in it through regional inter-mediation rather then individually.

Thus, regional economic co-operation is an unavoidable requirement for sustainable development of each nation. Within this context, the regional power supply systems can be considered as a potential leader in the overall process of regional integration. The extraordinary high importance of energy for the modern development doesn't allow any country to follow in long-term a non-efficient energy policy. The search for efficient energy-production / consumption is not a subject of political consideration but a strong economic necessity, which forces the countries to subordinate finally their pure political priorities to the logic of economic rationality.

Unfortunately, today agreed parallel functioning of the energy systems of the three states of the region of the South Caucasus – Georgia, Azerbaijan and Armenia – does

not practically exist. As a direct result of economic collapse, civil unrest, acute political conflicts and economic blockade of the period after the dissolution of the Soviet Union, the energy systems of the region suffered from important technical, financial and personnel degradation. The results of those destructive processes notwithstanding the already conducted reforms, and implementation of important rehabilitation projects, are not yet compensated for.

The collapse of the Soviet Union facilitated creation of an essentially new situation in the region. Under the new geopolitical settings completely new conditions of overcoming political obstacles have been created for the economic relations between the countries of the region. This circumstance for the first time in the modern history creates the capacities of full utilization of the geopolitical potential of the countries of the Southern Caucasus. Among them, specific importance is attributed to the economic cooperation between the countries of the Southern Caucasus because this is a non-alternative condition for their development with the modern form.

Within the frameworks of the process of development of the regional economic cooperation from the point of view of economic efficiency and political importance, one of the priorities is the issue of integration of the energy systems of the countries of the region. In particular, among them for Georgia has one of the highest priorities the integration of the electric sectors of the region. Such integration is connected with steady increase of reliability of the electric energy sectors of the countries, important decrease of the reserve capacities necessary for functioning of this systems, and increase of economic efficiency of different types of generating capacities (hydro-power plants, heat-power stations, nuclear stations). At the same time, integration of the energy systems can become the best condition for the increase of economic security of the countries of the region and stabilization of political relations among those countries. Together with this, integration of this form in the development of wide-scale economic cooperation among the countries of the region can perform the role of a leader because with low spending it becomes possible to assure people in efficiency of regional cooperation.

2. Perspective of regional economic cooperation in the Southern Caucasus

Southern Caucasus, which used to be one of the best developed regions on the territory of the former Soviet Union, today represents the zone of economic calamity. The process of economic degradation in the countries of this region – Armenia, Azerbaijan and Georgia – which lasted for about ten years, led to the situation when the countries rich in their natural and human resources are not able any more to provide their population with even minimum conditions for existence. It is no doubt that one of the main catalyst of this process became inter-ethnic wars in the countries of these region, which followed the dissolution of the former Soviet Union, and, as a result of this we have breaks of mutually beneficial economic links and economic isolation of the countries of the Southern Caucasus.

It is clear enough that without solution of the problem of political resolution of the existing inter-ethnic conflicts it is also impossible to talk about complete economic rehabilitation of this region. Nevertheless, there are a lot of aspects of economic relations, which can and have to be solved until reaching political consensus. Moreover that economic benefits from cooperation between the countries of the region can serve as a reliable basis for the further process of political settlement of the existing problems.

The process of economic integration according to the international experience, has an evolutional nature. Economic relationships between the countries, as a rule, start from demolition of trade barriers and can gradually grow into an economic alliance with a common currency (for example, the European Union) or even a political union.

While studying the possibility of economic integration on the Southern Caucasus we can mention that the path that the countries of this region have to go is much more difficult and long than in other regions. It is stipulated by the fact that currently due to political and military conflicts some economic, trade or communication links still exist between separate Caucasian countries. Such situation in the relations between the neighboring countries, which for a long time were enjoying the benefits of joint cooperation in the sphere of economics, transport and other sectors, could not but have serious negative influence over their economic wealth including their export capacities. This is also confirmed by huge deficit of balance of payments, which is characteristic for each of those countries. Therefore the first step of economic integration on the Southern Caucasus should be not removal of trade barriers but opening the borders, liquidation of blockade and regulation of normal trade relations.

It is quite evident that these measures can essentially increase economic wealth of the countries of the region. According to the evaluation of the specialists of the World Bank, short-term effect from removing blockade may facilitate essential increase of export volumes, energy trade and decrease of transport expenses. (Polyakov E. Changing Trade Patterns after Conflict Resolution in South Caucasus. The World Bank, Washington, DC, 2000; Trade Facilitation in the Caucasus. Final Report, The World Bank, Washington, DC, October, 2000). In particular, according to those studies, the Republic of Armenia will possible benefit from peaceful settlement, which more than other countries of the region suffers from blockade. Thus, according to the experts of the World Bank, in Armenia as a result of removing blockade the economy of transport expenses will amount to 6-8 mil. USD, expert volume will increase more than two times and will total to 300 mil. USD per year, and the balance of payments of the country will be considerable improved. Azerbaijan will be able to decrease its trade deficit at the expense of increase of export for more than 25%, and increase of GDP can reach 5%. Georgia will presumably face slight decrease of transit through its territory and, correspondingly will loose some revenues to the balance of payments from transport services but at the same time can benefit more from cooperation, in particular, in the sphere of energy sector. Functioning in the unified system in this sector will enable all the countries of the Southern Caucasus to economize considerable investments and to solve their energy problems.

Development of normal relations in the region is obviously an important precondition for increasing of the wealth in all the countries of the Southern Caucasian region because that would enable to put a basement for further development of integration processes in the region. Currently it is difficult to give qualitative evaluation of the influence processes on the economic wealth of the countries of the region. However, on the whole we can make general conclusions in relation to possible consequences of regional integration for the Southern Caucasus.

First of all, one of the possible positive results of regional integration is economic development in the member-countries, which can be reached under the influence of the following:

- Positive influence from the scale
- Regional specialization
- Attraction of foreign investments
- Extension of trade and export capacities

- Increase of efficiency of local enterprises as a result of their inclusion in the process of globalization (effect of perception on the basis of practice –"learning by doing")

Secondly, another important issue of economic integration is provision of regional control over fulfillment of reforms in each of the member-countries. Investment attraction of the region as a whole depends on how incorporated the activities of those countries will be in the matter of implementation of necessary economic reform, market liberalization, fight against corruption and development of infrastructure. In this context the regional integration can be viewed as a reliable mechanism of control over realization of the necessary changes in economy.

Thirdly, creation of regional block will give the member-countries considerable priority during conducting negotiations about getting benefits from liberalization of trade. International experience witnesses that making trade relationships takes place much easier between large alliances than separate countries. Drafting or concluding trade agreements with the European Union, for example, can happen for all the three countries of the Southern Caucasus region much easier within the frames of the union than separately. If regional union acquires the rules, which are not confronting the multilateral agreements, then this union represents the shortest way for reaching the free trade.

Economic integration in the Southern Caucasus represents real perspective for each of the countries of this region to have economic growth, accelerate the process of integration in the European Union and to improve economic wealth of its population. However, for successful implementation of this process certain preconditions are necessary. Here we are first of all talking about elimination of political, economic and institutional barriers, which are characteristic for the relationships between those countries. Solution of these problems will give the possibility to liquidate current disagreements and to create real basis for the beginning of the development of integration processes in the region.

1. The first step in elimination of political barriers of economic integration is development of normal relations between the conflicting parties, removal of barriers and opening of borders. Other, not least important step in this direction should be unification of trade regimes in the region. Implementation of those measures will enable to make the process of formation of normal trade relationships between countries of the Southern Caucasus essentially easy, which, itself, can facilitate increasing their export capacities, attraction of foreign investments and foster their economic activity.

2. An important precondition for development of integration processes is provision of macro-economic stability. On the given stage notwithstanding already reached results main task of all the three countries of the region is further betterment of macro-economic situation. With the purpose of creation of normal conditions in which the integration processes can fruitfully develop, it is necessary to keep further decrease of inflation, state debt, foreign balance deficit and stability of the national currency. For this those countries need to stick to rigid regime in the financial and fiscal policy in order not to destroy the existing stability.

3. Primary importance for successful implementation of the regional integration is existence of development infrastructure: reliable energy sources, telecommunication means, developed rail and motor roads, ports and other transport means. Main task of the countries of the Southern Caucasus in relation to infrastructure development is encouragement of the privatization processes and utilization of market mechanisms in the given sectors of economy. This will enable to increase the efficiency of their functioning, to attract new investments and

financial means needed for the support and rehabilitation of the mentioned above systems. In particular, implementation of the following measures is considered to be feasible:

- Institutional strengthening of the system of road construction and road maintenance, provision of constant control over its management from the part of the private and public sectors.
- Institutional strengthening of the system of railroad transportations, perfection of the systems of market planning and economic analysis of the activities in the given sphere.
- Creation of the regional center for exchange in the Internet, which would enhance more efficient usage of international lines and at this expense to decrease the tariffs. In some of the countries it is necessary to start the process of privatization in this sector.
- Creation of the unified system in the energy sector with the purpose of economizing investments and productive capacities, increasing economic efficiency and effectiveness. This will enable to solve the problem with the malfunctioning of the electric energy supplies.

4. An important obstacle in the matter of development of integration processes is unnecessary bureaucracy and corruption, which is connected with it. Therefore main emphasis in all the three countries of the Transcaucasian region should be made on taking measures in connection with reforming the bureaucratic institutions, revision of their enhanced flexibility in the matter of decision-making, prevention of corruption and kickbacks by the state officials.

5. Currently the countries of the Southern Caucasus have adopted most laws, which are necessary for legal regulation of business. Main problem, however, still stays inefficient implementation of existing laws due to underdeveloped and corrupt courts. Such condition in the legal sphere has a negative influence over the development of businesses. Therefore, the main task on the given stage is creation of efficient judicial-administrative system capable of implementation of the existing laws on a desired level.

6. With the purpose of efficient realization of the integration processes on the Southern Caucasus it is necessary to harmonize of internal legislation and regulatory acts. We are talking here about harmonizing norms and rules, tax legislation, usage of the unified samples of trade licenses and the licensing principles and so on. This will enable the countries of the region to move more efficiently in the direction of creation of common uni-regional market, to attract considerable investments, to increase export capacities of local manufacturers, and also to provide for the economic growth.

3. Short characteristics of the electric energy system of Georgia

Actual potential of the electric energy sector of Georgia, its everyday problems and main directions of the development of the sector need to be clearly defined with the purpose for inclusion of Georgia in the process of integration of the electric energy systems of the three countries of the Southern Caucasus region, working out specific policy and its efficient implementation. From this point of view we have provided below short characteristics of the electric energy sector of Georgia.

During the recent decade different aspects of the condition of the electric energy sector of Georgia have been several times studies and described by both the international organizations as well as the corresponding Georgian state agencies and scientific organizations. Our characteristics is mostly based on the information contained in the materials of those studies. This information used mainly the following materials:

1) EBRD Project (1998) _ Enguri Dam and Hydroelectric Power Station, Feasibility Study of Rehabilitation"

2) TACIS Project (1998) _ "Assessment of Present Institutional Set-up of the Ministry of Fuel and Energy" – report;

3) Report of the research "Optimum Development Plan of the Electric Energy Sector of Georgia", produced in 2000 with the supported of the United States Agency of International Development (USAID)

4) Report on the Regional Energy Needs Assessment of the United States Agency of International Development (USAID) (2000);

5) Analytical researches and critical letters of the electric energy of the country produced by the Committee of sectoral economics of the Parliament of Georgia;

6) The analytical data of the Ministry of Fuel and Energy of Georgia, which have been processed by the Georgian state organizations: the Institute of Energy, "Energokselproekti" ("Electric Network Project"); "Sakenego" ("Georgian Energy") and "Hydroproject";

7) The reports of the study of the Georgian Strategic Research Center of the potential and perspectives of economic cooperation between the countries of the Southern Caucasus;

8) Energy Policy of Georgia; 2002; project, developed by the Georgian Strategic Research Center, commissioned by the Ministry of Fuel and Energy of Georgia;

9) 9. The Energy Security Concept of Georgia; 2003; worked out by the Georgian Strategic Research Center commissioned by the National Security Council of Georgia.

3.1. Short overview of the electric energy of Georgia

Strategic location of Georgia makes it possible for the country to participate in many large-scale projects connected with the energy sector of the country, the implementation of which is planned in the Caucasus region. There is an idea that as a result of unification and connection with the energy systems of the countries neighboring Georgia – Russia, Azerbaijan, Armenia and Turkey – more sustainable and unified energy system will be created, which will bring much benefit for all the systems included there. The international experience shows that there are important economical and technical benefits that all the sides, which are joined by the common energy system, have to receive from each other. For this strengthening and modernization of the systems of electric energy management, communication and dispatching will be necessary for obtaining economic efficiency

The electric energy system of Georgia, first of all, is using the energy produced by the hydro-power plants, which makes up to 60% of the total generation; and the heat power plants working on gas and mazut are used with the purpose of making balance. The generation for the energy system of Georgia is mainly concentrated in two regions of Georgia – North-West and South-East.

From the perspective of functioning of the macro-system the electric energy system of Georgia can be easily divided in two parts, in particular, the Western and Eastern energy systems of Georgia. Such division becomes natural when the Western and Eastern Georgia is divided by the mountain gorge. Apart from this location of the sources generating electric energy, the centers of the load and the infrastructure of distribution of energy systems, in general, also corresponds to the division into the Western and Eastern energy systems of Georgia. There are many hydro-power plants with huge capacities – including the Enrugri HPP (1 300 megawatt); Vardna (340 megawatt), Lajanuri (111 megawatt), Vartsikhe (184 megawatt), Tkibuli (80 megawatt), Shaori (80 megawatt), Rioni (40 megawatt) and Gumati (47 megawatt). Main load centers are Kutaisi and Batumi.

There is the Gardabani heat power plant in the Eastern Georgia (current nominal capacity is ~ 780 megawatt); a number of small hydro-electric power plants, such as Khrami (110 megawatt) and Jinvali (130 megawatt), are also in the Eastern Georgia. The highest load center is Tbilisi, which is located in the length of 40 km between the mountainous gorges. Other important load centers are – the Rustavi Metallurgical Factory and the Rustavi Chemical Factory.

3.2. Hydro-energy Units

Total install capacity of the Georgian HPP is 2 838.1 megawatt. This potential is nearly completely distributed among 103 HPPs, which are mainly the stations with the installed capacity of more than 10 megawatt. It is considered that the stations with the capacity of less than 2 megawatt do not make much input in the energy balance of Georgia, and their consideration is not necessary. At the same time, main share of the installed capacities is distributed among 18 Georgian hydro-electric power plants, the main indicators of which are as follows:

Table 25

Station	Installed capacity megawatt	Throughput (GWatt·h/year)		Total Cost	
		Existing	Real	Mil. USD	USD/kilowatt
Enguri	1,300	2600	4070	101	83
Vardnili I	220	470	470	8.1	37
Jinvali	130	350	500	22.9	136
Khrami I	113	230	317	14.45	128
Lajanuri	112	330	425	25.3	226
Khrami II	110	254	370	16.18	147
Tkibuli	80	125	165	21.2	265
Rioni	49	248	325	16.7	486
Vartsikhe I-IV	184	700	1000	54.3	295
Gumati I	44	155	255	21.4	486
Shaori	38	145	148	16.8	437
Vardnili II	40	0	90	36	900
Vardnili III	40	0	90	36	900
Zahesi	44	150	210	16.1	366
Gumsti II	23	95	138	17.4	486
Ortachala	18	40	90	12.0	670
Atshesi	16	62	97	9.2	670
TOTAL	2557	5954	8852	481	

Nearly one half of the hydro-electric power plants mentioned here is more than 40 years old and the majority of the rest is more than 20 years old. Distribution of the stations according to their age (except for Vardnili II-IV):

Table 26

Age	Number of stations
10-20 years old	5
21-30 years old	2
31-40 years old	3
> 40 years old	9

Apart from capacities difficult operational conditions influence the stations, which was caused by the lack of the financial means necessary for technical maintenance for the last 10 years. Because of that comparatively new stations are also in very bad conditions. Mainly all the equipments are either obsolete or soon will become obsolete. For the reliable and efficient operation it might be necessary to change all the technical equipment.

According to preliminary evaluation, there are hundreds of possibilities of operation of perspective electric power stations, putting in operation of which will cause considerable increase of the energy potential of the country. Among them the main ones are as follows:

Table 27

Station	Installed Capacity (megawatt)	Generation (GWatt·h/year)	Expenses	
			Mil. USD	USD/kilowatt·hour
Khudoni	638	1450	338	530
Cheri	107	347	120	1401
Jorkvali	160	496	168	1260
Tvishi	100	404	141	1410
Namakhvani	250	928	259.4	1036
Joneti	100	346	1333.5	1335
Tsageri	140	488	174	1240
Paravani	120	443	168	1400
Minadze	41	108	70	1700
Dzevra	24.7	55	54	2200
Ponichala	20.1	120	39	1940
Rustavi	14	55	33	2350
Abuli	8.5	37	18	2080
Mutso	2.4	15	5	2100
Gubazeuli cascade	80	327	81	2350
Zestaponi cascade	118	610	136	1900
Tskhenistskalis cascade	125	624	114.5	2300
Stori 1	8.5	50	20	2300
Stori 2	2.7	14.9	7	2600
Stori cascadi	11.2	65	29	2600
Total	2071	6983	2111	

3.3. Heat generation of electric energy

Total installed capacity of the units of the heat electric energy of Georgia reaches approximately 2 200 megawatt. Main heat power station is the Gardabani station (1 850 megawatt, 10 units), Tkvarcheli station (200 megawatt, 2 units), Tetsi (18 megawatt, 3 units) and the heat power station of the Rustavi Metallurgic Factory (149 megawatt 6 units). There are a number of small industrial co-generational units. Majority of the heat generation of electric energy in Georgia is obsolete due to lack of maintenance and incorrect operational condition, and some have been damaged during the civil war. Operation of the considerable part of the capacities is still possible or their rehabilitation is feasible. Rehabilitation of existing generation units is generally economically more feasible for short-term than making investments in new units.

All the heat power stations are planned in such a way as to work on natural gas as the main fuel and mazut as the reserve fuel. General description of existing heat electric energy stations is given in the table below:

Table 28

Existing heat electric stations				
Power generating units	Nominal capacities	Fuel	Phasing-in, year	Condition
Gardabani 1	150	Gas, Mazut	1963	Out of operation
Gardabani 2	150	Gas, Mazut	1964	Out of operation
Gardabani 3	150	Gas, Mazut	1965	Operational
Gardabani 4	160	Gas, Mazut	1967	Damaged
Gardabani 5	160	Gas, Mazut	1968	Damaged
Gardabani 6	160	Gas, Mazut	1971	Damaged
Gardabani 7	160	Gas, Mazut	1968	Damaged
Gardabani 8	160	Gas, Mazut	1972	Operational
Gardabani 9	300	Gas, Mazut	1990	Operational
Gardabani 10	300	Gas, Mazut	1994	Under repair
Gardabani 10	300	Gas, Mazut		Unfinished
Heat Power Station 1	6	Gas, Mazut	19	Operational
Heat Power Station 2	6	Gas, Mazut	19	Damaged
Heat Power Station 3	6	Gas, Mazut	19	Operational
		Gas, Mazut		
Rustavi 1	12	Gas, Mazut	19	Operational
Rustavi 2	25	Gas, Mazut	19	Operational
Rustavi 3	25	Gas, Mazut	19	Damaged
Rustavi 4	12	Gas, Mazut	19	Operational
Rustavi 5	25	Gas, Mazut	19	Operational
Rustavi 6	50	Gas, Mazut	19	Damaged
Tkvarcheli 1	100	Gas, Mazut	19	Damaged
Tkvarcheli 2	100	Gas, Mazut	19	Damaged

Many of the heat electric energy stations existing in Georgia are among the oldest in the former Soviet Union; half of the units – is more than 30 years old. During the last several years heat electric energy stations in Georgia experienced wear and tear due to age of the equipments and also absence of the funds for maintenance and repair works. The units often worked under the conditions of overloading and at such times when their turning-off for maintenance was necessary. All these put the installations under additional pressure. Besides, lack of electric energy caused fluctuations of frequency in Georgia, frequency was falling up to 44 Hz, which damaged electric equipment of the stations. Out of 2 000 megawatt of the installed generating capacity of heat energy only 650 megawatt are currently operational.

The table below gives the situation with the heat units existing in the country.

Table 29

Existing heat electric power stations			
Unit	Declared capacity megawatt	Coefficient of operational availability (readiness) 1997-1998	Need for rehabilitation
Gardabani 3	131	89	Serious repairs
Gardabani 4	133	0	New construction
Gardabani 5	133	0	New construction
Gardabani 6	135	0	New construction
Gardabani 7	133	0	New construction
Gardabani 8	135	89	Serious repairs
Gardabani 9	300	87	Minor repairs
Gardabani 10	300	0	Serious repairs
Heat Power Station 1	6	90	Minor repairs
Heat Power Station 2	6	0	Serious repairs
Heat Power Station 3	0	90	Minor repairs
Rustavi 1	0	0	Serious repairs
Rustavi 2	0	0	Serious repairs
Rustavi 3	0	0	Serious repairs
Rustavi 4	12	85	Serious repairs
Rustavi 5	0	0	Minor repairs
Rustavi 6	0	0	Serious repairs
Tkvarcheli 1	0	0	Unknown
Tkvarcheli 2	0	0	Unknown

3.4. Electric Power Supply System

Internal supply system of electric energy consists mainly of 500 kilowatt and 220 kilowatt distribution lines. The systems of Western and Eastern Georgia are connected with 500 kw transmission line (Enguri-Zestaphoni-Ksani-Gardabani) and a number of 220 kw transmission lines. Electric energy from the Eastern to the Western Georgia and vice versa the possibility for transfer of electric energy is currently unreliable and limited.

From the point of view of perspectives of the linkages between the regions, the western part of the energy systems of Georgia in the Northern direction is connected with Russia, in the Southern direction – with Turkey. Eastern part of the energy system of Georgia is connected with Azerbaijan, and the Southern part – with Armenia. The Table 30 brings high-voltage lines connecting Georgia with its neighbors.

Table 30

Region	Line	Capacity - kw	Status
North-west - east-west	Vardnili-Batumi	220	Existing
	Zugdidi-Menji	220	Existing
	Enguri-Menji	220	Perspective
North-west – west	Enguri-Zestaponi #1	500	Existing
	Enguri-Zestaponi #2	500	Perspective
East-west – west	Menji-Kutaisi	220	Existing
	Menji-Tskaltubo	220	Rehabilitation
West-central	Zestafoni-Ksani	500	Existing
	Zestaponi – place in 15 km from Akhaltsikhe	500	Rehabilitated and perspective
	Zestaponi-Khashuri	220	Rehabilitation
	Zestaponi-Chiatura-Khashuri	220	Perspective
Central east	Ksani-Gardabani	500	Existing
	Gardabani-–place in 15 km from Akhaltsikhe	500	Rehabilitated and perspective
	Ksani Gldani	220	Existing
	Ksani-Lisi	220	Existing
	Jinvali-Telavi	220	Perspective
North-west – Russia	Enguri-Russia	500	Existing
	Enguri-Sukhumi-Russia	500	Perspective
	Bzipi – Russia	220	Existing
East-west	Batumi – Turkey	220	Existing

– turkey			
Central turkey	Akhaltsikhe – Turkey	400	Perspective
Central Azerbaijan	Ksani – Azerbaijan	500	Rehabilitation
East - Azerbaijan	Gardabani – Azerbaijan	330	Rehabilitation
East – Armenia	Gardabani – Armenia	220	Existing

3.5. Energy renewable sources

During a number of years the Georgian scientists and experts have studied technological capacities and processing of the sources of renewable energy. However, due to predisposition to the large capacities stations working on natural gas and nuclear energy during the Soviet Union the sources of renewable energy is considered as a novelty, which used to be considered as a subject of interest of scientists and academicians only. During the last period the Government of Georgia has reconsidered the importance of the sources of renewable energy and the need for its usage with the purpose of decreasing the dependency of the imported energy. According to the optimum plan of the energy system of Georgia, the research of non-traditional, or else, renewable energy sources is envisaged with the purpose of possible production of electric energy.

There are importance resources of geo-thermal, solar and wind energy, which can be used efficiently. Out of those three sources the wind energy has the biggest potential from the point of view of direct production of electric energy. This also represents a well-developed technology, with the means of which it would be possible to produce importance electric energy with competitive cost value. The geo-thermal and solar energy provide for the possibility of considerable decrease in prices for electric energy for a final user, however, only the wind energy is able to play an important role in total throughput of the electric energy of the country.

The amount of the produced electric energy with the help of the wind energy is evaluated at approximately in 1.3 bil. kilowatt per year, based on the data, the collection of which takes 50 years in 145 meteorological stations of Georgia. Based on this data it is possible to build the generating stations with the capacity of up to 730 megawatts, which will work out up to 2 bil. kilowatts of electric energy per year. In Georgia the cost of construction of energy stations based on wind energy, or else wind electric stations is less than 1 100 USD per 1 kilowatt, and the cost of the produced electric energy can possibly reach 0.04 USD per 1 kilowatt, in accordance with the financial capacities and the power of stations.

3.6. The situations with the energy efficiency in Georgia

Traditionally in the former Soviet Union the energy efficiency was the issue of general discussion and not actions. From this point of view the situation in Georgia has not changed. With the purpose of correct implementation of the activities directed on improvement of electric efficiency the corresponding programs and legislation. We need strong sectoral and regional programs. The purposes of the energy efficiency should be connected with industrial, social, financial and other policies, which are influencing the usage of electric energy. The work for planning of optimum planning needs common approach in relation to improvement of electric energy. The technology be correctly chosen and put into compliance with the existing policy and practices.

Georgia in the process of working out the approach to the energy policy should attach primary importance to the improvement of energy efficiency. Experience of the foreign countries shows that existence of well-developed policy of improvement of the energy

efficiency is needed in order to solve currently existing energy problems. With the purpose of elaboration and implementation of such policy regional organizations need to exist in the country, which conduct administrative work in the above-mentioned direction. Without institutional efforts it would be very difficult to pup the Georgian economy on the path of energy efficiency. The potential for economizing of energy will remain potential if the institutions are not created, which implement such events in practice.

With the purpose of acceleration of implementation of activities in connection with the energy efficiency the corresponding economic environment is needed: economic incentives and motivation so that the market participants decrease production costs through making investments in the energy efficiency sector. Such motivation is the reform of the energy costs and the process of privatization. Through improvement of energy efficiency production costs are decreasing and, accordingly, the basis for economic growth is created. Evaluation of some technologies should be implemented in the industrial processes on the basis of structural analysis of the usage of electric energy.

4. The perspectives for integration of the energy systems of the countries of the region

Prior to the Soviet Union's breakup, the generation and transmission facilities serving the Caucasus were planned and operated as an integrated system. The generation and transmitting sating were done without regard to state boundaries, and generation and interchange were scheduled from a central location for the entire region, with the individual dispatch centers of Georgia, Armenia and Azerbaijan executing the schedules. This centralized approach provided a reasonable distribution of the types of generation serving the region. Now when the three systems are operating independently, Georgia is short on base load capacity, Azerbaijan is short on peaking power, and Armenia is the only one of the three systems with a reasonable distribution between base and peak load generation (although Armenia is presently suffering from a nighttime minimum load problem during the non-winter seasons).

Of the three Caucasus country power systems, Armenia's is the only one currently able to meet electric demand most of the time, and the only one able to maintain frequency. Armenia was only able to provide power to Georgia by transmitting to an isolated portion of the Georgian system.

There are three key technical issues that will need to be addressed before greater regional power system integration can occur:

1) there must be sufficient transmission capability to transfer energy from the major sources of generation to the load centers for the wide variation of operating conditions that will occur;

2) the three systems must all be able to maintain frequency on the portions of the systems that interconnect;

3) there must be a system in place to coordinate dispatch and power transfers.

The key non-technical issues to be addressed include:

1) contractual arrangements that clearly delineate each entity's responsibilities; and

2) how payments will be handled.

Each country has demonstrated a relatively poor payment history of providing cash payment for power received. In Azerbaijan and Armenia, most of the power imported and exported tends to be transacted as an energy "swap"; that is, the power received is offset later through power delivered. Given the extent of financial difficulties among the regional power systems, similar types of energy "swaps" may be the only practical way to achieve some greater coordination.

The following benefits can be anticipated, should closer regional coordination develop:

1) Operation of the thermal plants at a more efficient level (i.e., as units are dispatched more optimally in line with their equipment configuration, the actual efficiency of the units should increase. For example, one of the reasons for the relatively poor efficiency of the thermal units is that they are cycled frequently with minimal uptimes and cannot meet their desired output for maximum unit efficiency.

2) Capturing seasonal differences between the generation systems. For instance, Georgia's seasonal peaking hydropower could be used to back down the use of thermal plants in both Azerbaijan and Armenia during the spring and summer periods. This could also assist with scheduling maintenance.

3) Capturing the differences between the Caucasus countries load shapes and those of nearby countries such as Turkey. While all of the Caucasus power systems and the Turkish power system are winter peaking, there are nonetheless differences in the load shapes that should permit for more effective utilization of the regional generating capacity to meet regional needs, thus helping to lower production costs. The time zone difference between Turkey and the Caucasus (up to three hours) may offer some advantages for economic power exchange.

4) Operating the Caucasus power systems in parallel offers the potential to reduce the reserves needed in the region. There is a limit to the power transfer capability between each nation but in the event of a power system emergency (e.g., sudden loss of capacity in one country) some amelioration could result by sharing of reserves for the region. If a power facility went off-line in Georgia, Armenia and Azerbaijan could respond by providing power immediately from their so-called "hot" spinning reserves.

5) Improved power system development plans, while this area is potentially difficult to achieve it also offers the greatest potential benefits. Each of the three Caucasus nations has developed its own power system development plan. No consideration has been given to the possible benefits that could be achieved through import of power from other nations and development/promotion of projects designed to meet regional needs. Each nation, for understandable reasons, is interested in maintaining a generating capacity fully sufficient to meet its own needs. It is unlikely that any of the countries would agree to place the reliability of its power supply on projects located outside of its territory. However, the perception difficulty may be lessened if the project was operated by a private company and not subject to the shortcomings associated with government ownership. One option would include each of the participating utilities to take ownership shares in the facility based on the percentage of output from the facility they receive.

6) Perhaps most importantly, improved power transfers would serve to reduce the level of outages witnessed in both Georgia and Azerbaijan. The region has a supply and transmission inertia capability that could permit restoration of supply in present areas suffering from deficits.

7) Based on the present supply/demand balance within each of the Caucasus nations, Azerbaijan has the potential to become a large exporter of electricity by 2003, of up to 4,000 GWh. Azerbaijan is constructing substantial new capacity, which when complete will represent the most efficient thermal units in the region. If Azerbaijan can both increase its domestic gas supply from the current level of 4 BCN annually to the government target of 12-14 BCN, and implement commercial reforms in the areas of metering and billing and collection (combined with tariff reform), the country can be expected to have significant electricity export potential. To meet that potential, Azerbaijan will need to place these figures in perspective, assuming government targets are met. The Azeri power system could easily replace the amount of energy generated from the Armenian nuclear power station following the nuclear plant's planned retirement in 2004.

8) Improved power quality through system synchronization and restoration of system frequency to 50Hz. If the nations of the Caucasus could be synchronized and system frequency restored to 50 Hz, there would clearly be reduced "wear and tear" on the power system equipment, motors, etc. It is likely that there would also be substantial improvement in stabilizing voltage thus resulting in an improvement in overall power quality throughout the region.

5. Some aspects of the state policy of development of the Georgian electric energy

Integration of the electric energy systems of the countries of the Southern Caucasus will undoubtedly have positive influence on functioning of energy systems of each separate countries and will create stabile possibilities for efficient satisfaction of variable demand for own energy resources by those systems. At the same time, specific forms of the above-mentioned integration and the conditions of management of common regional energy system will be much based on the priorities of the energy policy of each country and specific aspects of this policy. Therefore, creation of the regional energy system should be preceded by the own energy strategy, which is well prepared and worked out by each country.

Georgia has already worked out the project of the state energy policy. Unfortunately, this process is still not officially discussed and adopted by the government of Georgia. Thus we are still not in position to declare about specific principles of the development of the energy system of the country. Currently the perspective model of development of the energy sector is used as an aim of the development of the state electric energy policy, which, based on the materials presented by different state bodies of Georgia has been worked out within the frames of the corresponding project of the United States Agency for International Development.

Within the scope of the mentioned above research large-scale work has been performed, first of all, with the purpose of creation of the vision for the period of perspective economic development of Georgia – up to 2020. Based on this prognosis of the needs of Georgia in energy have been performed, as a result of which the perspective program for development of the energy sector of the country has been worked out. However, in the mentioned above model did not envisage the issues of regional integration; and, correspondingly, from the point of view of regional energy integration, this program needs further additional elaboration.

However, there is one more extremely important aspect, which requires special additional efforts for elaboration of the issue of the development of the regional energy system. The thing is that the mentioned above model in thinking about the

development of the Georgian energy system has been prepared with consideration of only technical and technological aspects; it does not include those sides defining the functioning of the energy sector of the country, which, according to the general organization of the energy sector and the existing condition of its system of management, is created by the problems existing in this system. And those problems under the Georgian circumstances have great importance in the matter of solving of those political issues, which are dealing with integration of countries in the sphere of energy.

Wide research implemented in 1998 by the Center for Strategic Research within the frameworks of the TACIS project, which dealt with organization of public administration of the energy sector of Georgia, has revealed that management of the energy of the country is facing deep conceptual and organizational problems. Without radical solving of those problems it would be extremely difficult to talk about efficient functioning of the energy sector of the country. Majority of the energy problems of Georgia, which are still very important nowadays, represent the results of inadequate organization of the whole system and inefficient management. Among them technical and technological difficulties existing in the system have been essentially caused by such types of problems. Thus, main task of the electric energy policy of the country – first of all – is not technical and technological improvement of this system but organization of its management and efficient formation of the management policy. Without solving of such types of problems it would be difficult to satisfy all the objective and political principles of the unified regional energy system.

5.1. Several critical aspects of the approach in relation to the perspective development of the system of electric energy of Georgia

Orientation definition of expected levels of the needs for electric energy in Georgia has been produced for the perspective period until 2020. This work was completed on the basis of cooperation between the Ministry of Fuels and Energy of Georgia and foreign experts in 1998-2000. The resulting assessment is based on the works performed during the last years by the Georgian and foreign experts. At the same time, based on the critical analysis of the existing materials that we have produced and real data of the last years we have incompliance of methodological approaches with specificities of the economy of Georgia which was revealed at the current stage (which is supported by the above-made researches). Accordingly, we have produced a conclusion in relation to making prognosis about the necessity of consideration of non-linear processes currently going on in the economy of Georgia, which should take place, in particular, through usage of export capacities of possible parameters of those processes.

a) Current condition of prognosis of the needs for electric energy in Georgia

During the period until 2020 one of the most complete prognosis of the demand for electric energy in Georgia is given in the study completed in 1998 and performed by the Center of Energy Efficiency – CENEF (the Russian Federation), which was commissioned by the company Burns & Roe Enterprises – USAID sub-contractor.

The methodology, on which the mentioned above study was based, was from the very beginning extremely criticized by a certain part of the experts during the special seminar, which was organized in the fall of 1998 by Burns & Roe Enterprises and which was dedicated to specifically this problem. Unfortunately, the criticism made was rejected without serious argumentation.

First of all the criticism was dealing with the fact that the CENEF took the data on consumption in 1997 as a baseline for prognosis of the demand for electric energy. According to official sources, under the circumstances of the average payment level of

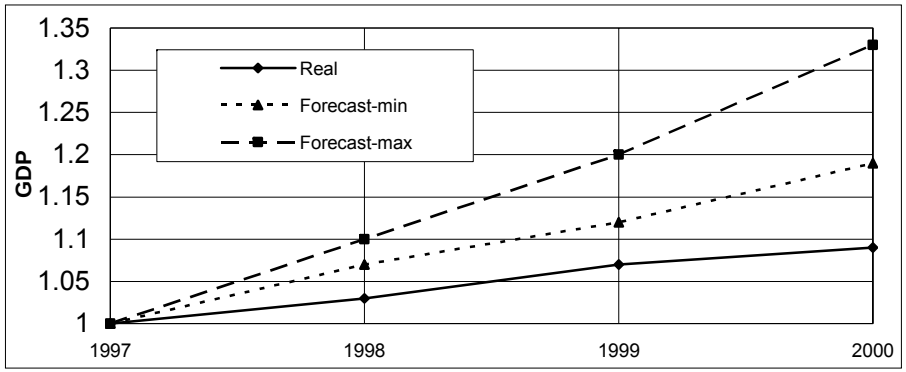
20-30% for the cost of electric energy in the country, massive losses and stealing, large-scale of corruption facts, and wide shortages of supply, equalization with the level of consumption of the electric energy does not stand criticism. Here we, apparently, have to recall the economic reality that the term "demand" only under the circumstances of 100% payments equals uninterrupted supply.

Secondly, we have to touch upon the issue of the methodology of prognosis itself, which led us to the condition of gradual and constant increase of the demand for electric energy. Such situation is a result of basing prognosis on the linear models of prognosis, which is in principal common for economic prognosis of the countries, like Georgia, which are in the stage of the process of transformation of crisis structures. Here, of course, we are dealing with the current linear processes of in the economy and energy of Georgia.

These are the processes of improvement of collection of payments, stage-by-stage increase of the tariff for electric energy and complete rehabilitation and enlargement of the system of natural gas supplies, the completion of which can be expected maximum in 2-5 years time. As a result we would have qualitative improvement of the structure of consumption of energy, which will be completed by substitution of the electric energy by natural gas in a number of spheres (first of all, at the expense of drastic decrease of massive usage of the electric energy with the purposes of heating, and in the longer term – substitution of electric energy for gas during water heating) and switching to the regimes of maximum economy of electric energy from the part of the consumer himself.

Apart from this, it is now possible to use real statistic data of the last years for the purposes of evaluation of the mentioned above approaches.

Figure 10. Predicted and real increase of the gross domestic product during 1997-2000

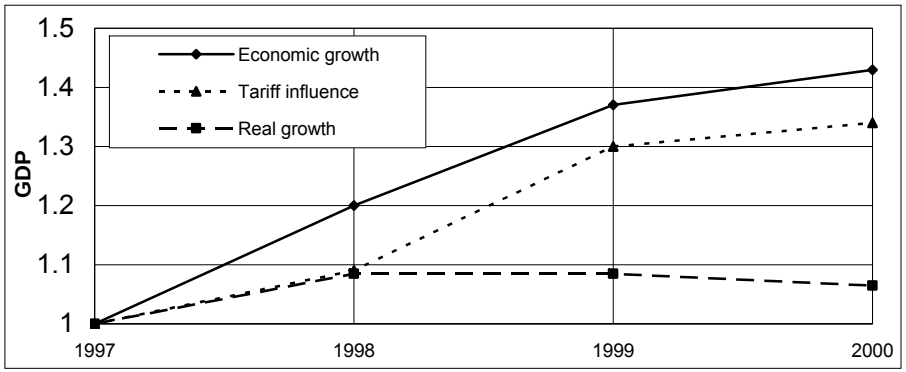


Unreality of the produced prognosis, first of all, is revealed in comparison of the scope of possible change of the pace of economic growth and real pace of increase of the gross domestic product (GDP) of the country (Figure 10). Thus, for example, for 1998-2001 the pace of growth of GDP in the mentioned above prognosis is defined at a rate from 6% up to 10%, however, in reality this increase in 1998 amounted to 2,9%, in 1999 it was 3.0%, and in 2000 it totaled to 1,9%. Thus, real pace of growth does not even reached the final scope (quite large) of the prognosis, but even more, it was two and three times less than the minimum level mentioned in the prognosis.

This was the fact where the methodological incompliance, which was used during the prognosis, with the type of economy that is currently in place in Georgia.

Based on the real data of the previous years of the growth of GDP (11,2% in 1996; 10,7% in 1997) and in accordance with the methodology used, smooth follow-up was predicted. In reality, however, the year 1998 became the "record-holder" of non-linear changes (the rate of increase has drastically fallen in nearly 4 times).

Figure 11. Predicted and real increase of consumption of electric energy in the country during 1997-2000



The same situation is in the part of predicted consumption of the electric energy (Figure 11). Thus, for example, according to the prognosis option of minimal increase of the CENEF, increase in consumption in 1999 in comparison with 1998 had to be 16,7% (according to other options, it would have been clearly higher), however, real increase reached the level of only 2%. As for 2000, here instead of the predicted considerable increase, the decrease of consumption is already evident.

Thus, it is clear that the problem of making prognosis on the demand for the electric energy in Georgia has to be solved from the very beginning; at the same time, more or less positive results in this direction is possible only on the basis of current and predicted massive non-linear events. We can also assume that the most optimum way for solution of this problem together with the existing evaluations is connected with the utilization of the experts' analysis of non-linear processes.

b) Some important tendencies occurring in the economy of Georgiaand their influence on the character of functioning of the system of electric energy

The degradation processes currently going on in the economy of Georgia is completely depicted in fluctuation of the structure of usage of the electric energy (the following table).

Table 31. For illustration purposes, structure of usage of the electric energy in 1990 and 2000

Sectors	1990 (TWh)	2000 (TWh)	Change (%)
Industry	8.054	0.56	-93
Agriculture	1.46	0.007	-99
Transport & communication	1.04	0.35	-66
Construction	0.31	0.20	-35
Municipal Utilities & Services	1.20	0.445	-63
Household	2.32	2.949	+13
Other	0.003	2.507	+ ∝
Total Consumption	**14.39**	**6.32 (7.02)**	**-51**
Supply	**17.45**	**7.85**	**-55**

The data presented above are clearly showing that the economy of Georgia in 2000 is still far from the renewed structural stability and in practice, is currently on the stage of broken old structure. Unfortunately, in accordance with the statistics of the recent years the economy of Georgia has not made any real important steps in the direction of developing of the economic structure of the modern times.

The most vivid indicator of this circumstance is anomalously high level and the share of usage of electric energy by the households and, which, on one hand, is caused by deep degradation in other spheres of consumption, and, on the other one, is connected with substitution of the natural gas – the primary energy source for the last decades – by the electric energy. Also, further transformation of the consumption of the electric energy will be mainly connected with the development of new structures of the economy and restitution by natural gas of the status of primary energy source (the share of more than 60% of overall primary usage).

Out of the two values presented in the column of consumption for the year 2000 the highest one (7.02) represents the figure of the annual balance of the State Regulatory Commission, which envisages the technical losses (10,5%) in relation to only high voltage part of the energy system (electric distribution). The lesser value (6.32) has been defined as the energy consumed by the users (for example, the energy, which they had received) with consideration of the fact that the losses of the distribution lines currently consist of 10%.

6. Some acute problems of the organization and management of the electric energy system of Georgia

The present part of our research dealt with the problems, which have been created in the electric energy sector of Georgia as a result of mistakes having been made during the process of privatization of the units of distribution. We have presented the analysis of the current situation in this sphere. Also, main problems have been revealed, which are facing the sector during the process of its restructuring, including the following ones: bad administration, dependency of regulatory institutions and absence of corresponding "interests" from the political authorities, which is needed for supporting this sphere.

The discussion presented below does not have an aim of making complete analysis of the problems existing in the sphere of public administration of the electric energy sector. It has more an illustration character, in which the problems of public administration of the sector are very well revealed, and the need for political efforts necessary for making immediate solutions of those problems is presented. Complete characteristics of the overall situation with the problems in organization and public administration of the system will need a special research, one of the most inspiring argumentation, as we hope, is given by the discussion presented below.

Development of the modern society and increasing of the life level of the population is impossible to consider without availability of the efficient and reliable system of the electric supply. Functioning of this system touches upon many different aspects of the public life of the country and itself depends from the events and decisions being made in the political, economic, social and other spheres of activities. This correlation is most clearly evident in Georgia under the conditions of transfer to the market economy. During the period succeeding the proclamation of independence of the country in 1991, economic crisis and political instability, disintegration of traditional linkages and liberalization of the prices for the energy resources led to serious

worsening of the system of electric supply. Catastrophic situation, which was evident in the energy sector of Georgia in the mid-90th, itself became the cause of decreasing the life level, increasing of social tensions, further strengthening of political instability and development of obstacles to the economic development of the country.

6.1. Several problems of the electric energy of Georgia and the mistakes made during the process of privatization of the sectoral units

We have to mention that serious problems in the electric energy were implanted even in the period of the management during the Soviet Union when the deformed economic system had been created in the country. Excessive power consumption of the industry had been compensated by import of cheap energy sources from outside of the republic. With the dissolution of the former USSR and disintegration of the unified energy system, supplies of cheap energy resources in Georgia was stopped, thus causing stagnation processes in the whole economy of the country. The crisis situation in the sector was furthermore aggravated under the influence of other negative factors, among which we can separate the following ones:

- Deficit of generating capacities during the Fall-Winter periods;
- Incorrect operation and stealing of the available equipment;
- Corruption and plundering of grants, credits and other means, which have been allocated for conducting rehabilitation and development of the electric energy;
- Breaking down of the system of heat supply, causing considerable increase of consumption of electric energy;
- Low indicator of payments collections, and, in many cases, existence of total non-payments for the electric energy.

Not belittling the importance of other factors, we have to mention that it is the inefficiency of the system of payment collections for the electric energy, which is much responsible for disastrous condition of the electric energy at the current stage. This is evident, because taken into consideration the absence of monetary revenues at a quantity adequate to the sum of the consumed services, it is impossible to talk about the rehabilitation and repair of the energy units, which are needed for increase or even pertaining the existing industrial capacities, preserving qualified service personnel capable of guaranteeing of the reliable work of the system; import of the electric energy needed for covering of existing deficit and so on. Bad indicator of payment collections for the electric energy can be explained not only and not by the low level of solvency of the population (at the end of the days, this problem can and should be solved with the assistance of special social programs); but by absence of efficient system of distribution of the electric energy, which is responsible for provision of payment collections for the consumed electric energy.

The measures undertaken by the state at the primary stage, which have been aimed at reconstruction of the distribution system and during which the independent energy company has been created, did not and could not bring the desired results. Under the conditions of the deficit of the electric energy and low level of payment collections, the newly created institution, transformation of which did not go beyond the frames of simple structural changes and did not essentially touch upon the mentality and behavior of its employees, became the source of corruption and plundering thus discrediting the process of reformation in the opinion of the population and rendering damage to the development of the sector. Decisive factor of successful reconstruction is creation of the new organizational culture - combination of views, beliefs, prevailing in the organization and making it easy for each of the employees to understand the aims,

means and methods of reaching those goals[15]. It is under the influence of organization culture that corresponding organizational climate is being formed – the system of behavior, policy, routine, on the whole, providing for efficient functioning of the organization. Based on the mentioned above, the cause of the failure of new institutions called upon to promote development of the market processes, should be sought in the mentality of those people, who are implementing those reforms, and which did not undergo essential transformation from the times of command economy. Those cultural values at their time encouraged development of the business methods or formation of routine enabling to "successfully" plunder the economy of the country. Under the conditions of transformation prevalence of psychology of "money-makers" and transformation of old routines of the command system into the new environment leads to formation of necro-economy – "dead" economy – which is unable to exist[16]. Therefore, effective process of reconstruction of the electric energy should not only ensure reorganization of the old structure into the new market institution, but also seriously dealing with the existing organizational culture and its corresponding routines.

Perhaps, the only true solution in this situation is attraction of the strategic investor – an organization, which has enough financial means and technical know-how for implementation of further reconstruction of the sector and increase of the efficiency of its functioning. Privatization of the Tbilisi Company "TELASI", 75% of the shares of which have been bought by the foreign strategic investor – large American company "AES" was supposed to have the solution of this problem. However, the hopes that were pinned to the entry of the strategic investor in this importance sphere of the economy have never been realized.

To be fair we have to mention that there has been in reality certain progress in relation to payment collections for the electric energy after appearance of the company "AES-TELASI". At the preliminary stage this company has implemented a number of serious investments in the main funds, training of qualified personnel and improvement of management, as a result of which collection of payments for the electric energy have fundamentally increased (approximately up to the level of 60-70%. For instance, in the energy companies remaining within the management of the state the level of technique and training of the personnel was so low, and the level of corruption was so high, that the collection of payments for the electric energy in 2002 was not higher than 10-15%. However, the mistakes made by the state and the regulatory bodies in relation to the strategic investor, created certain problems in the sphere price formation and services to the population.

First of all, main mistake was made already at the stage of signing the contract with the big investor, during which the strategic interests of the country in relation to development of the sector have not been taken into account. This happened due to incompetence or carelessness of the "authorities", which did not care for or did not want to analyze long-term consequences of realization of the contract for the whole sector of the electric energy. In any case, this witnesses about absence of strategic vision of development of this importance sphere of the national economy. We can state that the objects of attention of the management system are not fundamental problems of the system, but the tasks of rehabilitation of separate energy units. Under the circumstances of non-regulated system problems, solving those issues also looses their importance. Actually, there has not been any separation of responsibilities in the sphere for completing administrative and political functions, the example of which is the activities of the Ministry of the Fuel and Energy. Instead of working out strategic

[15] Smircich, Linda, "Concepts of culture and organizational analysis," *Administrative Science Quarterly*, 28 (September1983), pp.339-58.
[16] V. Papava. Necro-economy and post-communist transformation of economy. Tbilisi. 2001

directions of development of the sphere, this body is dealing with solution of separate administrative problems. This Ministry has not made any steps in direction of protection of interests of the country in the matter of signature of the contract with the important investor or operating of the mechanisms of regulation of natural monopolies, although these aspects are one of the priorities of the energy policy.

Furthermore, it is well known, that the problems in the energy sector appear when the state is facing difficulties in the matter of regulation of this sphere. The role of the regulation by the state is huge, especially when it comes down to the issues of distribution of benefits from involvement of private sector and development of competitiveness so that those benefits be fairly distributed between the investors and consumers and not be given exclusively to investors. Non-observation of this fundamental principle of regulation in the process of formation of the electric energy system in Georgia was brought to light by problems and weaknesses of existing regulatory institutions, which decreased essentially the efficiency of the process of restructuring of the sector.

Typical example of inaptitude of the regulatory institutions to solve the problems created by the new realities is "predatory" policy having been carried out by the company "AES-TELASI". Being a natural monopoly-holder in the system of distribution in the city of Tbilisi (the capital of the country inhabited by about one third of the total population of the country) and enjoying absence of fundamentality in the positions of the regulating bodies, the company "AES-TELASI" managed to fix an "exorbitant" tariff for the electric energy thus putting the burden of responsibility for its inaptitude to fulfill the terms of the contract (to provide 100% of the rate of collection of payments for the electricity) to the population. The new tariff for the electricity fixed under the pressure from the monopolist, the share of the "AES-TELASI" exceeded 60%, which is an unprecedented fact taking into account the circumstance that this company is just the distributor of the electric energy. Although by the decision of the court this tariff was slightly decreased, such reduction was introduced at the expense of interests of the generating sector, in particular, the Inguri Hydro Electric Station. Under the condition when only half of the industrial capacities of this leader of the electric energy of Georgia are being used, due to the lack of financial means for their rehabilitation, further decrease of the tariff for its produced electric energy puts under question the possibility of using the Inguri Hydro Electric Station as the base station.

Thus, we can state that monopolistic behavior of the «AES-TELASI" and inability of the regulatory bodies to counteract this behavior not only encourage "pillaging" of the users of electricity, but also render serious damage to the program of rehabilitation of generating capacities and development of the sector as a whole. However, protection of the market and the society from the "predatory" behavior of natural monopolies is the direct responsibility of the regulatory institutions. Here we have quite an appropriate question – why this system did not work thus offering the right with impunity to infringe the interests of the consumers to the monopoly-holder.

We believe that for understanding of this problem it is necessary to consider its political and economic aspects. In his studies dedicated to the economic problems of regulation of natural monopolies, D. Stigler noted that political authorities and regulatory institutions represent in their essence the "sellers" distributing the rights for the benefits between the suppliers and buyers on the regulatory market[17]. As a "currency" at such market can be used not only the monetary means, but also the votes of the population, fees to the election campaigns, offers of good job places in the private sector after leaving politics and other benefits. Stigler determined that small number of organized suppliers on the regulatory market, as a rule, have advantage in

[17] Stigler, George J. "The theory of economic regulation." Bell Journal of Economics. 2 (Spring 1971), pp.3-21

promotion of their interests and they receive rent at the expense of the interests of the majority of badly organized buyers. An important factor ensuring such advantage is availability of key information about the peculiarities of the regulated sphere and the level of organization, which provides for lower expenditures in promotion of their interests. In other words, with the purpose of protection of their interests, the consumers should not only show the necessary organization of the activities in connection with protection of their own rights, but also to gain access to the key information in this respect. This, itself, can be achieved at the expense of ensuring transparency in the activities of the regulatory bodies.

The current situation in the sector of electric energy of Georgia, in our opinion, coincides much with the conclusions of the model of economic regulation, which has been described by Stigler. Political authorities of the country through abusing the ignorance and non-organization of the population, have actually "sold" the interests of the consumers, having drafted such type of a contract with the company "AES-TELASI", which allows it to take the rent at the expense of the well-being of its clients (and to the loss of the development of other sectors of the sphere). Inertia of the regulatory bodies vis-à-vis the "predatory" policy of the monopolist witnesses about strong political influence on it from the part of the authorities, which threatens the declared independence of this institution.

The analysis of the situation having been created in the sphere of electric energy in Georgia gives us the possibility to singe out the following problems, without solution of which it would be impossible to guarantee stabile development of this sphere. These are, correspondingly, as follows: absence of the strategic vision of the development of the sector, weak administration, absence of independent regulatory institution and political will from the authorities, which would be directed to the development of the energy sector. Presence of such problems having been envisaged by ineptitude of the existing institutions to solve facing them problems, represents serious threat for the stability of not only the energy sector, but also the whole economy of the country. This, itself, infringes upon the normal functioning of the public production, undermines the obtained level of life of the population and, thus, causes increased political and social tensions in the society and also the threat to the existence of the statehood itself.

7. Recommendations

First step in elaboration of any program is the choice of the right direction – the direction of realization, which could lead to the desired result. It is the absence of clear vision within the "authorities" of Georgia in relation to the strategy of development of the electric energy that led to the existing situation in the sector. Majority of the mistakes but in relation to privatization of the "TELASI", as well as concerning other energy units have been made as a result of failure to understand the strategic priorities of the reformation of this sphere. In order to avoid making those mistakes in future, first of all, we need to clearly define the strategic aims, which should serve as a starting point during making important decisions: choice of strategic investor, definition of a set of requirements to be given to the investor, assessment of alternative directions of restructuring and investments priorities and so on.

However, the correct choice of the strategy of development of the electric energy does not guarantee reaching the intended results. In order to have success in implementation of the development program it is necessary not only to do "the right things", but also to "do things in the right way"[18]. In other words, the strategic choice

[18] Drucker, P. F. (1973). Management, Harper, New York.

should be supplemented with the corresponding tactical steps, needed for successful realization of the program of development of the sector. We have been talking earlier that many "things" in the energy sector of Georgia are done "in the wrong way". In particular, we have defined three problems hindering the successful implementation of the strategy of restructuring of the sector: bad administration, dependency of the regulatory institutions and absence of corresponding "interest" from the part of the political authorities in real development of the sector.

Weak administration, first of all, in the sphere of distribution and dispatching of the electric energy means absence of the efficient mechanism of distribution of the electric energy and financial flows needed for stabile development of the whole sector. For successful reformation of those sectors, one needs, first of all, to change the organizational culture and form such organization routines that would allow those sectors to successfully implement their own functions. One of the directions of the solving of the problems of weak administration is, in our opinion, attraction of foreign experts and consultants, who could bring on-board new organizational values and technologies in the management of public enterprises. In particular, the recently concluded agreement envisaging transfer of the management rights of the "United Distribution Company"[19] to the foreign consulting company with the term of a year and half, is an important step in formation of the organizational culture and implementation of the routine necessary for successful realization of the strategy of reconstruction of the sector. In the sphere of distribution, for example, the company "AES-TELASI" managed to achieve considerable success. Thanks to the improved management, the level of payment collection in the city of Tbilisi much higher than in other regions, where the sphere of distribution remained non-privatized. The problems connected with the company "AES-TELASI", first of all, are caused by the "bad" contract and inefficient regulation of this sphere, enabling the natural monopoly-holder not to undertake additional efforts directed to further improvement of organization of services of the population and payment collections. In other words, formation of the organizational culture and routine, which are adequate to the new conditions through attraction of the foreign management, is an important direction of increasing of efficiency of administration of the sector. But in the sectors with the signs of natural monopoly, only this is not necessary. It is necessary to also ensure such regulation of the sector, in which the monopolist would be forced to strafe for maximum increase of efficiency of his activities.

International experience shows that formation of an efficient institutions of regulation should be based on the following three principles:

- Absolute independence of this institution in the matter of decision-making process;
- Complete transparency of its activities;
- Possibility of appealing to its decisions through the legal process

However, we should also take into account that under the conditions of underdeveloped democracy it is very difficult to ensure complete independence of the regulatory body from the will of political authorities, which is evident on the experience of Georgia. Therefore, the third necessary condition for development of the electric energy is presence of strong and unilateral interest of the political authorities in the issue of development of the sector. In the matter of solution of this problem it would be naïve to rely on coming of a "kind uncle", who himself will make all the necessary decisions. In order to crease such interest within the authorities, active public support

[19] The company was created on the basis of merger of the companies "Elektrogadatsema" ("Electric distribution") and "Electrodispecherizatsiya – 2000" ("Electric Dispatch – 2000")

is needed top the programs of development of the sectors. Using the political terminology, for the politicians, taking responsible decisions in relation to the electric energy, the cost offered by the society should be much higher than he one offered by the monopoly-holder on the regulated market.

In conclusion, we have to mention that the solution of each of the problems we had presented creates the necessary conditions for successful realization of the strategy of restructuring of the electric energy sphere. However, none of these conditions, if taken separately, is not sufficient enough for reaching the goals. Only joint implementation of the mentioned above conditions will create both the necessary as well as sufficient preconditions for successful implementation of the restructuring, operational-technical measures and attraction of investments in the sphere of electric energy need for its rehabilitation, development and transformation in the leading sphere of economy of Georgia.

The following years should become the crucial point in relation to the change in the mentality of the population of the country and the state institutions and a move from total corruption in priorities to the real interests of the country, and also from the point of view of turning to the creation of staring conditions for development of effective businesses in the country. The essential transformation of the economy of Georgia should be linked with the real process of development, which should b developed under the stabile international and domestic conditions. Such main factor of the transformation is change in the region (and not only region) in the competitive relationship to cooperation between the United States of America and the Russian Federation during the stage after the events of the September 11, start of the process of creation of vital energy strategies in our region by the West and the preliminary shifts happening for the recent years in the Georgian society towards revival of real thinking. The main basis of the same process, of course, represent the natural, geo-strategic and intellectual potential of Georgia.

In the same period the policy depicting state interests and economic feasibility should be implanted in the management of the energy of the country; the process of rehabilitation, modernization and development of new directions of the remains of the energy of the country should start on the basis of the unified and balanced energy policy; the barriers on the path of rapid development of efficient usage of the natural gas should be completely removed.

During 2003-2005 the complex of the events of recovery of the commercial relations should be implemented in the natural monopolies of energy (electric energy, the system of natural gas) including the privatization of the distribution lines, bringing the tariff into full compliance with the feasible losses of the energy enterprises and investments (with possible increase); and ensuring difficult collection of payment for the consumed energy.

In the recent period the process of complete rehabilitation of the functioning of the existing system of natural gas supply should be finished.

In 2003-2004 the process of supplying natural gas through the network existing in the regions for the heating purposes, and in 2003-2006 – hot water based on natural gas, including provision of the necessary capacities for modernization of networks and individual heating and supply of hot water.

- By the end of 2006 main stage of rehabilitation and modernization of electric energy and optimization of the structure of usage of the electric energy should be finished (in the sphere of natural gas usage with the purpose of heating and boiling water including minimization of the share of the electric energy), which is preceded by finalization of the stage of solving the problem with revitalization of commercial relations on the market of electric energy and complete collection of

payments in 2005. From 2007 the electric energy sector of Georgia should transfer into the normal, commercially feasible and balanced functioning.

Conclusion

The key driving factors behind the desire for more trade in electricity are: security of supply and economic efficiency. In many cases, it is more costly to satisfy requirement on power supply through installation of additional capacity than through interconnections. Another potential benefit of supply security brought by trade is that imported power can diversify the energy portfolio geographically and by fuel type.

Moreover, interconnected systems can reduce total required generation capacity when the daily or seasonal load curves among neighboring countries are complementary. In such cases, interconnections facilitate peak load saving, thereby reducing or eliminating the need for capacity expansion. Last but not least, large integrated power systems stimulate competition.[20]

The rational need for cooperation in power systems is very strong. It is necessary to carry out several technical arrangements (interconnection, parallel operation etc). Also it is necessary to create appropriate sustainable institutional framework. These problems easily could be solved, however without political goodwill all attempts may come to nothing. Should we wait for political decisions? Probably we shouldn't. The worked out technical and organizational arrangements together with expediency may become strong pushing factor for political decisions.

[20] Regional Electricity Markets in the ECT Area. // Energy Charter Secretariat. 2003