GEORGIA'S FUEL AND ENERGY COMPLEX AFTER INDEPENDENCE

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This article analyzes the development trends in Georgia's fuel and energy complex (FEC) and its individual branches over the past 15 years. The rates and dimensions of their progress are characterized during this period of time and a brief assessment is given of how the complex operates, both

in the past and during the years of independence. An analysis is carried out of individual types of energy resources. In so doing, particular attention was given to the export-import of energy resources, as well as to the degree the country's demand for them is being satisfied by local resources.

Brief Excursion into History

The fuel and energy complex is a large multi-branch national economic system that plays a leading role in forming society's material and technical base, accelerating scientific and technological

Table 1

Main Development Indices of Power Industry in 1960-1990[1]

Years	Installed Capacity at the End of the Year, thou. kW			Electric Power Generation, million kWh		
	Total	including hydropower plants	%	Total	including hydropower plants	%
1960	974	651	66.84	3,702.0	2,223.0	60.05
1965	1,584	778	49.12	6,042.4	2,792.0	46.21
1970	2,064	788	38.18	8,964.0	2,642.0	29.47
1975	2,708	1,122	41.43	11,603.4	2,564.0	22.10
1980	4,155	2,558	61.56	14,687.4	6,410.0	43.64
1985	4,389	2,688	61.24	14,421.3	6,243.0	43.29
1986	4,385	2,688	61.30	14,570.8	6,056.0	41.56
1987	4,391	2,688	61.22	14,549.7	4,693.0	32.25
1988	4,412	2,733	61.94	14,599.7	7,748.0	53.07
1989	4,412	2,733	61.94	15,824.5	8,787.0	55.53
1990	4,522	2,732	60.42	14,238.0	7,594.0	53.34
1990 in percentage of						
1960	464.3	419.7	–6.4	384.6	341.6	–6.7
1970	219.1	346.7	22.2	158.8	287.4	23.9
1980	108.8	106.8	–1.1	96.9	118.5	9.7

[1] Compiled on the basis of data of the Georgian Statistics Department.

progress, forming the necessary prerequisites for improving operating conditions, and raising the population's standard of living.

The main branch in the complex is **the power industry**, which is the life-supporting and blood-supplying system of the economy's entire complex organism. During the last 30 years of Soviet power (1961-1990), serious quantitative and qualitative shifts occurred in the development of Georgia's power industry: the installed capacity of all types of power plants and electric power generation have grown 4.6- and 3.8-fold, respectively (see Table 1).

The building of power plants was particularly intensive between 1961 and 1980, when the Ortachal hydropower plant (1961), the Tbilisi State Regional Power Plant (TbilGRES), the Khrami-2 hydropower plant (1963), the sixth unit of the thermal power plant of the Rustavi Metallurgical Plant (1962), three stages of the Vartsikhe hydropower plant (1977-1980), new units at the TkvarcheliGRES (1977), and the thermal power plant of the Batumi Oil-Refining Plant (1977-1978) were put into operation. As early as 1970, the total capacity of all of Georgia's power plants amounted to more than 2 million kW, and in 1980 to 4,155,000 kW. In 1980, 14,687.4 million kWh of electric power were produced, which was more than four-fold higher than the corresponding index for 1960.

Whereas before 1960, Georgia's power industry was largely developed by assimilating hydro resources, in subsequent years, the picture changed and thermal power plants came to the fore. This occurred in 1965 when these enterprises accounted for 50.9% of the installed capacity and 53.8% of the electric power generation. In 1970, for the first time in its history, the republic had a positive power balance and even delivered its electric power to other republics. The increase in the latter reached its peak in 1980 (1,743.8 million kWh). By this time, the structure of capacities in Georgia's power industry was as follows: thermal power plants accounted for 38.4% and hydropower plants for 61.6%. Electric power generation at hydropower plants amounted to 43.6% and at thermal power plants to 56.4%.

In subsequent years (1981-1990), electric power generation remained at almost the same level, while consumption quickly rose (by 0.5 million kWh on average per year), with respect to which the power shortage also noticeably increased. In 1988, the power shortage amounted to 3.6 billion kWh in the republic. This figure was a record for Georgia's entire history. In the period under review, the power balance was in the red.

In 1990, the republic was 3.2 billion kWh of electric power short and could only satisfy 81.6% of the demand. But even this level could not be realist, since thermal power plants supplied with fuel from the outside accounted for 46.7% of the electric power produced in 1990.

Georgia is traditionally supplied with **natural gas** from other countries. Efforts to gasify the republic began in 1956. At the end of 1959, Tbilisi received natural gas from Azerbaijan. The throughput capacity of the main gas pipeline amounted to 1.8 bcm a year, and to 4.6 bcm after reconstruction.

From the very beginning, Georgia's gasification was carried out at a rapid rate, due to which the pipeline capacity and gas resources proved insufficient. New sources of gas supply had to be found. The Vladikavkaz-Tbilisi gas pipeline was built and put into operation in 1963. In 1970-1978, Iranian gas was delivered to the republic. Since November 1978, gas supplies from Iran stopped due to the political events that took place in this country. The Vladikavkaz-Tbilisi gas pipeline was in need of reconstruction, which began in 1985 and was completed in 1991. The annual throughput capacity of the route reached 20 bcm.

Due to this, the Transcaucasian republics (including Georgia) "switched" to gas from Turkmenistan. At this time, Georgia was one of the advanced countries in terms of gasification level. Gas was supplied to 48 cities, 230 villages, 600,000 apartments, some 800 industrial and agricultural enterprises, 1,500 boiler installations, and 2,000 public utility facilities. Ten thousand kilometers of gas

pipeline were laid: 2,000 km of main and 8,000 km of distribution network. In 1989, gas consumption in Georgia topped 6 bcm, which amounted to 60% of the country's fuel balance.[2]

At one point, increasing **coal** production was regarded as a priority for Georgia's industry. At the end of 1990, this branch accounted for 20% of the gross output, 79.6% of the employees, and 53.4% of the cost of the basic production assets of the fuel industry. Coal production has a century-long history in this country. The industry demonstrated its highest index during its entire development in 1958 when 3,014,000 tons of coal were produced, which is three-fold higher than the 1990 level. This was because the post-WWII years saw the most intensive construction of coal enterprises. Pig iron and steel appeared and were developed in Georgia at this time.

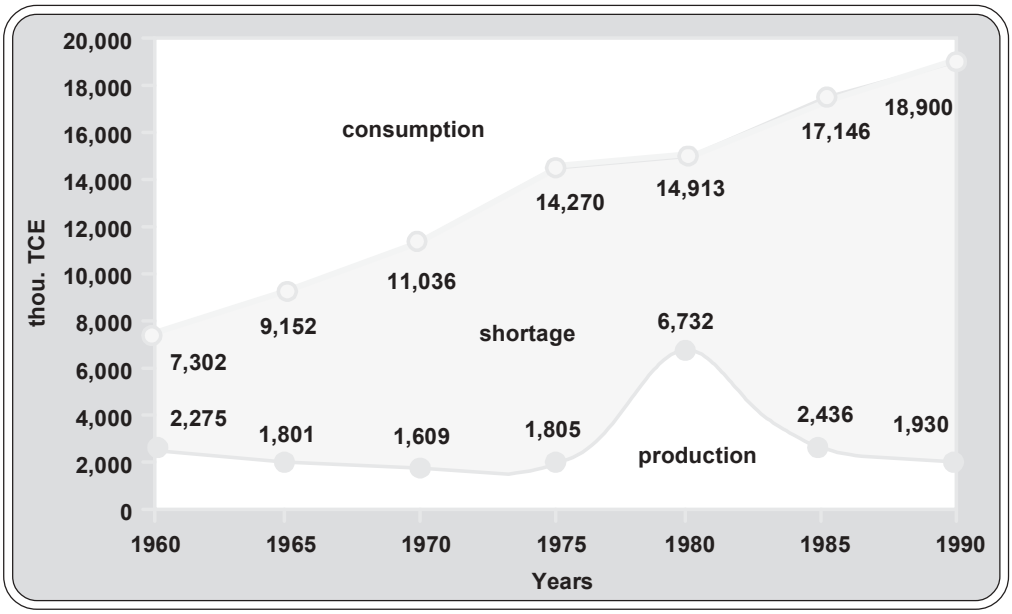
The coal industry was extremely important for the progress of other industries as well. It supplied ferrous metallurgy with process fuel, and the power industry with power-generating coal. Georgia was the only republic in the Transcaucasus that had its own coal industry and met its own needs for this process and power-generating resource to a certain extent.

In 1990, Georgia produced 956,000 tons of coal, 655,000 tons of which (or 69.6%) came from the Tkibuli, and 290,000 tons (or 30.4%) from the Tkvarcheli mines.

For ten years, the republic's annual **oil** production fluctuated within the range of 20-30,000 tons. The situation drastically changed in 1974-1975. In 1974, 44,000 tons of oil were produced, and a year later, this figure increased almost 6-fold. In 1974, two fields were discovered near Tbilisi—the Samgori-Patardzeuli and Shromisubani-Tskaltsminda. During deep drilling, other deposits were discovered in Georgia. Oil production reached its peak in 1982 at 3,331,000 tons, which was almost 100-fold higher than the 1960 level.

Figure 1

Production and Consumption of Fuel and Energy Resources in 1960-1990, thou. TCE (*ton of coal equivalent*)[3]



[2] See: D. Chomakhidze, *Energeticheskaia bezopasnost Gruzii*, Tbilisi, 2003, p. 122.
[3] See: D. Chomakhidze, *Energeticheskiy balans Gruzii*, Tbilisi, 2007, p. 341.

In Soviet times, the oil-refining industry was represented by the Batumi plant—this enterprise refined 4-5 million tons of oil a year. On the whole, during the Soviet period, the branches of the fuel and energy complex developed with varying success, but the demand for energy resources rose much faster, causing the shortage to increase from year to year. An exception in this respect was 1980 (see Fig. 1).

Fuel and Energy Complex in the Transition Period (1991-2000)

Despite the problems in the power industry that have existed since Soviet times, independent Georgia inherited a power base that was not very efficient, but relatively developed.

In 1990, 2,600 kWh of **electric power** was produced per capita in the republic, and 3,200 kWh were consumed. In this way, as these data show, the country experienced a shortage of electric power. Since then, the generation of the latter has remained at the same level, and later it began to decrease. In 1990-1995, electric power generation decreased by 50.3%, and consumption 2.2-fold. A drop in generation was noted both at hydropower plants (by 16%) and at thermal power plants (9.5-fold). The level of use of the existing capacities also dropped. In 1995, the total capacity of all power plants amounted to 4,800,000 kW, while only 1,800 kW, or 28.7%, were in working order. The number of hours of average annual capacity use also decreased.

Under these conditions, Georgia's power system was forced to operate under non-standard emergency conditions, which had a dilapidating effect on the installment of the system. The republic's power industry has encountered new and extremely difficult problems. Repair work at electric power facilities has essentially ceased due to insufficient funds, and supplying power plants with fuel has become problematic. The power system could not satisfy the demand. Electric power metering and collecting money for its consumption were in an even worse state. Electric power losses escalated out of all proportion. The energy crisis reached its peak. Economic destabilization, the violation of executive discipline in the industry, the plundering of power facilities, the constant turnover of qualified personnel, and other negative phenomena were obvious.[4]

Since 1994, electric power generation has remained at essentially the same level; it reached its peak of 8,119 million kWh in 1999. Subsequently, its generation gradually decreased. It dropped by half at thermal power plants, and increased by 23.3% at hydropower plants, but this increase could not be considered realistic. In particular, in 1994, the lowest level of electric power generation during the past 26 years was noted at hydropower plants: this year, 4,923 million kWh of electric power was produced, which is the lowest index since 1979.

The decrease in generation had an impact on the country's electrification indices: this primarily concerns per capita electric power generation (see Table 2)—over a span of ten years (1990-2000), it dropped by 39.3%. In terms of this index, Georgia lags noticeably behind other states, including the CIS countries.

The development rates of the republic's power industry traditionally lag behind those of the economy as a whole, including in the production sector. This trend was also manifested in the period under review.

[4] See: G. Tavadze, D. Chomakhidze, *Prirodnye monopolii i ikh regulirovanie*, Tbilisi, 2005, p. 46.

Table 2

Per Capita Electric Power Generation[5]

Years	In kWh	In percentage of 1990
1990	2,626.3	100.0
1991	2,452.8	93.4
1992	2,107	80.2
1993	1,898.7	72.3
1994	1,352.5	51.5
1995	1,399.1	53.3
1996	1,466.2	55.8
1997	1,491.4	56.8
1998	1,702.9	64.8
1999	1,723.6	65.6
2000	1,593.7	60.7

After 1990, gas consumption in Georgia gradually dropped, and in 2000 amounted to 1,094 mcm, that is, it dropped 5.5-fold compared with 1990.

The well-known phenomena of the past years had an impact on the gas industry. Gas supplies to the country ceased for a long time. During the first half of 1995 and 1996, Tbilisi, like almost the whole of Georgia (apart from Rustavi and the Kazbegi District) found themselves without gas.

The halt in gas supplies aggravated the technical state of the gas plants, since gas pipelines were subjected to external corrosion, which began in earnest due to the instable supply of electric power; while internal corrosion became an additional problem. During the instable period between 1991 and 1993, the corrosion protection installations were plundered, copper and other materials being removed from them. The training of engineers and middle-rank technical personnel, as well as of blue-collar workers, was undermined. The emergency and accident prevention service left much to be desired. The repair work done showed that 40-50% of the gas pipeline inspected needed to be restored. The sections of the gas network damaged by corrosion were "repaired" in the traditional way, by means of their complete replacement. This is much more expensive than using the new technologies advanced countries (Germany, France) make use of, for example, inserting a section of polyethylene pipe in the damaged steel network or attaching special film to the inside of the pipe.

As a result of all the above, gas consumption decreased from 6.1 bcm in 1989 to 0.9 bcm (or 6.7-fold) by 1998, and if we do not take into account the large consignors (the power industry, the chemical industry, the metallurgical industry), use dropped 15-fold. Of the 587,000 gasified apartments, only 13.6% were supplied with natural gas.

Against the background of the economic crisis, the demand for coal dramatically dropped in the period under review. The **coal** industry almost ground to a complete standstill. Coal production has

[5] Compiled on the basis of data of the Georgian Statistics Department.

been decreasing with each passing year, and by 2000 dropped to 7,300 tons. During the period under review, it decreased by 40.9%.

During the first years of independence, the Georgian oil industry was in a piteous state. It was poorly financed and did not have material and technical support. The need arose for forming joint ventures with foreign companies. At this time, oil production was being carried out by Iorisveli joint venture, Frontera Intern-Georgia, the Georgian-British Company, and so on.

Development of the Fuel and Energy Complex in 2001-2006

Electric power generation in 2001-2006 not only did not increase, but, on the contrary, decreased by 4.6%.

It stands to reason that its generation also decreased at certain power plants, including at large ones, such as the Inguri hydropower plant, the Vardnili hydropower plant, the Lajanuri hydropower plant, the Khrami-2 hydropower plant, and others. Between 2000 and 2005, generation dropped by 6%, 12.8%, 35.6%, and 44.5%, respectively (see Table 3). A record drop in electric power generation was noted in 2001, when it decreased to 6,942 million kWh, which approximately amounted to the 1967 level, that is, in this respect, the country lagged by 38 years.

In 2000-2005, the drop in generation at hydropower plants was largely caused by breakdown of the hydroturbine units. In particular, the Khrami-2 hydropower plant was out of operation for 17 months during 2000-2005, due to which the republic was unable to produce approximately 350 million kWh.

Due to the instable operation of the Lajanuri hydropower plant, the power system was short approximately 200 million kWh of power. Due to the emergency shutdown of the hydroturbine units (Vardnili hydropower plant No. 1, No. 2, and No. 3, Vartsikhe hydropower plant No. 2 and No. 5, the four Shaori hydropower plants, and Gumati hydropower plant No. 3) and the breakdown of the hydraulic structures (the sluices of the Inguri dam, and so on), more than 1 billion kWh of electric power were not produced.

The increase in generation at thermal power plants was due to the relatively stable operation of the 9th power generation unit of the Mtkvari-Energy Company and the 3rd unit put into operation. In 2005, the import of electric power rose by 16.7% (it was imported both from the Russian and the Armenian power systems, amounting to 732.9 and 475.4 million kWh, respectively).

The irrational use of water by hydropower plants had a negative effect on the results of the industry's operation. For example, on 1 January, 2005, there were plans to accumulate water reserves equivalent to 502 million kWh in the reservoirs connected to the hydropower plants. However, in actual fact, only 277.7 million kWh of equivalent water were accumulated for the hydropower plants, that is, 55% of the plan.

The technical state of the power system's plants can be evaluated by the following indices: by the end of 2005, the total working capacity (of the 4,600 MW of all the installed capacities) amounted to 1,766 MW, that is, only 38.4%. The data presented show that the technical state of the power-generating facilities is extremely alarming, and this is aggravating the shortage, increasing the weighted average tariff rates, reducing revenue into the budget, and negatively influencing the economy and finances.

It is a well-known fact that the percentage of the Inguri hydropower plant is significant in the entire structure of all the electric power produced. In 2005, its generation amounted to 2,578.9 million kWh,

Table 3

Electric Power Generation in 2000-2005
(*million kWh*)[6]

Indices	Years						2005 in % of 2000
	2000	2001	2002	2003	2004	2005	
Electric power generation	7,446.0	6,942.0	7,045.6	7,163.0	6,706.0	7,100.6	95.4
Including by: Thermal power plants	1,540.4	1,370.5	513.5	635.1	813.2	1,030.6	66.9
of them: TbilGRES	1,520.1	139.8	245.8	18.7	21.5	318.2	227.6
Mtkvari		1,226.4	267.7	616.4	791.7	712.4	58.1
TbilTPP	20.3	4.3	—	—	—	—	—
Hydropower plants	5,905.6	5,571.5	6,532.1	6,527.9	5,892.8	6,070.0	102.8
of them: Inguri	2,742.6	2,344.2	2,989.0	3,066.1	2,728.1	2,578.9	94.0
Vardnili	487.5	457.3	509.9	356.0	384.2	425.0	87.2
Lajanuri	194.6	186.7	134.0	216.0	86.3	125.3	64.4
Vartsikhe	665.7	657.1	840.7	738.0	606.6	674.0	101.2
Shaori	81.9	90.4	146.1	138.0	96.9	109.4	133.6
Dzevrula	109.7	70.9	171.5	139.0	84.3	128.0	116.7
Gumati	176.6	184.4	181.9	181.2	204.3	203.0	114.9
Rioni	267.5	259.2	226.6	290.0	288.8	296.0	110.7
Khrami-1	149.1	158.8	151.7	313.0	238.8	197.0	132.1
Khrami-2	228.3	239.8	210.4	104.0	3.0	126.6	55.5
Zhinvali	292.9	362.2	476.1	353.0	437.9	402.0	137.2
Others	509.2	560.5	704.6	633.6	733.6	804.8	158.1

four (capacity of 920 MW) of the five units at the plant (installed capacity of 1,300 MW) are in working condition, but only one is in use, 110 MW of the 210 MW of installed capacity of which are in operating order. The Vardnili-2, 3, and 4 hydropower plants have come to a complete standstill.

[6] Compiled on the basis of data of the Georgian Statistics Department.

In 2005, with the support of the Georgian government and Ministry of Energy, an entire series of hydropower plants, thermal power plants, and the electric power network were restored (thanks to the amount allotted from the state budget). All of this made it possible to raise the reliability of the power system and ensure stable supply of consumers with electric power.

On the whole, due to the lack of financing for hydropower plants undergoing repairs, the utilization rate of the installed capacity is very low, which is causing large water losses during flooding and also the loss of cheap electric power. As for privately owned installations, it should be noted that twenty hydropower plants were privatized in Georgia with a total installed capacity of 105.7 MW. Their total installed capacity amounted to 37.7 MW at the end of 2005, that is, essentially one third of the installed capacity was used—35.7%. In 2006, another six hydropower plants were privatized (the Rioni hydropower plant, the Ats hydropower plant, the Shaori hydropower plant, the Lajanuri hydropower plant, the Gumati hydropower plant, and the Dzevrula hydropower plant), as well as the Kakhetian, Ajarian, and joint distribution companies.[7]

During the years of independence, new power installations were put into operation in the republic: first the Khadori hydropower plant with a capacity of 24 MW, and then a gas-turbine installation with a capacity of 55 MW (with the prospect of doubling it).

Georgia's **gas supply** (as of 1 January, 2005) provided 32 enterprises with fuel, 3 of which (or 9.4%) are large, 14 (43.7%) are medium, and 15 (46%) are small. As for the service structure, the large enterprises accounted for 72.2% of all the production, the medium for 23.2%, and the small for 4.6%. In 2005, the industry disposed of gas totaling 35.5 million lari, and it employed 3,200 people. Compared with 2000, the production volume increased 3.8-fold, and the number of employees by 33.3%.

The largest gas distribution company is the Tbilisi Company (created in 1958); street gas networks of 2,040 km in length and costing approximately 4.8 million lari are kept in its account. The company services 205,000 gasified apartments and 3,350 enterprises. Part of the gas pipeline (1.6%) is high pressure, 26.7% is medium pressure, and 71.7% is low pressure. A joint-stock company was formed on the basis of the indicated structure. In 2006, the KazTransGaz Company purchased Tbilgaz.

The **oil-producing** industry currently operates on the basis of the existing fields, whereby some of them have been in operation since 1930. According to experts, the current oil and gas wells are on the brink of exhaustion. This shows that these fields have very few possibilities for increasing production, although growth can still be achieved by using new technologies and methods. There are prospects of finding new deposits.

The data on oil production for 2001—2005 are as follows (in thou. t): 2001—98.8, 2002—73.9; 2003—139.7; 2004—97.6, and 2005—66.6, which is naturally not enough for resolving the existing energy problems.

The **coal** industry could not reinforce its foothold on the energy resource market in 2001-2005 (with respect to sale of its production). The industry is essentially running idle. Coal production in these years amounted to the following (in thou. t): 2001—5, 2002—6.1; 2003—8, 2004—8.1, and 2005—5.1.

Georgia is rich in **non-traditional** sources of energy (thermal waters, solar and wind energy), but their use, as in previous years, remains at a very low level (see Fig. 2).

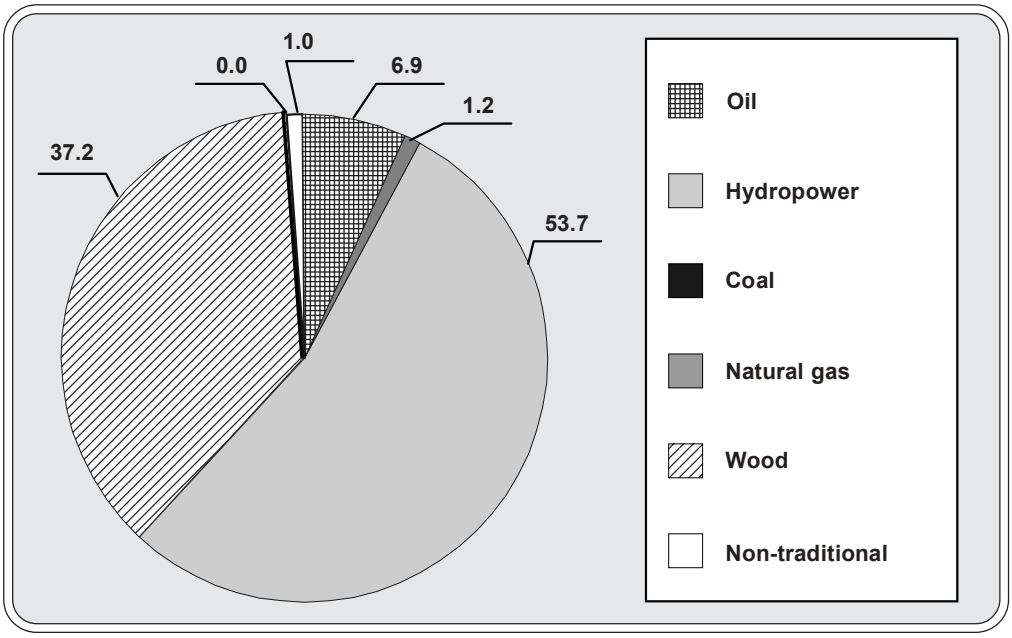
In 2006, 7,425 million kWh of electric power were produced in the republic, which is 4.5% more than the same index for 2005, and consumption amounted to 7,964 million kWh. There is no doubt that the country has a deficit power system. As for oil production, it dropped by 4.7% and amounted to 63,500 tons (compared with 66,700 in 2005).

The increase in electric power generation in 2006 was promoted by the increase in its generation at thermal power plants (by two-fold and more). In the indicated year, the gas-turbine installation

[7] See: G. Tavadze, Ir. Kavtaradze, *et. al*., *Regulirovanie energetiki. Teoriia i praktika*, Tbilisi, 2006, p. 192.

Figure 2

Structure of Self-Produced Energy Resources (%)
[2005—972,000 TCE]



produced its first electric power (in a volume of 290,500 kWh). What is more, the generation of the TbilGRES and the Mtkvari-Energy Company increased (2.1-fold and 61.3%, respectively).

In 2006, Georgia's hydropower plants produced 5,321.6 million kWh of electric power, or 71.6% of its total generation. Compared with 2005, it decreased by 12.3%; in particular, at the Inguri hydropower plant by 36%, at the Vardnili hydropower plant by 14.5%, at the Shaori hydropower plant by 38.8%, at the Khrami-2 hydropower plant by 6.4%, and at the Zhinvali hydropower plant by 3%.

The main reason for the generation drop at the Inguri hydropower plant and Zhinvali hydropower plant was that scheduled maintenance work was being carried out, which meant that these plants were out of service for three months. In addition to this, the Khrami-2 hydropower plant stood idle for four months, and the Shaori hydropower plant and Dzevrula hydropower plant have not been operating for three months.

In 2006, the republic's power system was characterized by a decrease in imports and a loss of electric power in the networks. The indicated "losses" fell to 1,404 million kWh (1.7% of consumption), and imports decreased to 764.5 million kWh (or 1.83-fold). Despite the positive shifts, in 2006, an electric power shortage was nevertheless noted, which amounted to 682.1 million kWh, but the trend toward its decrease was obvious. Compared with the previous year, the deficit decreased almost two-fold.

Conclusion

During the years of independence, the development of the country's fuel and energy complex has been unsatisfactory. There has been an obvious decrease in energy resource production (the situation in this sphere has only begun to improve in recent years).

The research carried out showed that in the transition period (1991-1995), the production, as well as the consumption of fuel and energy were characterized by a slowing trend. At the current stage (1996-2005), they are undoubtedly increasing; whereas in 1991-1995, the production of fuel and energy resources decreased 2.3-fold, and their consumption 8.5-fold, in 1996-2005, there was an increase by 67.9% and 56.7%, respectively. In this way, a trend has recently been designated toward a gradual decrease in the deficit.

Georgia is not rich in fuel and energy resources, but the country does have reserves of these resources to one extent or another: it has bituminous and brown coal, peat, oil, associated gas, thermal waters, hydropower resources, and favorable conditions for using solar and wind energy.

This analysis has shown that despite its energy shortage, Georgia should make fuller use of its local reserves in order to better satisfy its energy demands.