ARMENIA'S ENERGY SECTOR: A REGIONAL ACTOR WITH NO ENERGY RESOURCES

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Armenia, a small country without fuel resources of its own and very limited alternative energy sources, is among those CIS countries that can boast of sustainable energy supplies. More than that, its energy export is growing by the year. Its success is partly rooted in the

Soviet past when the republic learned to be thrifty with the available resources; since that time the republic has mastered the latest effective energy-saving technologies.

The Geopolitical Aspect

A predominantly mountainous land-locked country with no access to the largest main pipelines and forced to live in the context of the "frozen conflict" with Azerbaijan, a large regional energy fuel producer, Armenia is seemingly doomed to be in constant need of hydrocarbon fuels. This was how Armenia's future looked in the first half of the 1990s when fighting in Nagorno-Karabakh was still going on, when Georgia was steeped in instability, and when, most importantly, the Abkhazian stretch of the railway was blocked in August 1992 at the beginning of the conflict in this area. Nevertheless, Armenia was the first among the region's countries to restore sustainable energy supplies (in 1996) and start exporting electric energy. This happened because the power consumption of new economy that came to life after the crisis of the 1990s is noticeably lower than that of Soviet economy. The Armenian government has outlined and is carrying out several measures to strengthen the country's energy security:

(1) consistent supply of energy resources;

(2) higher efficiency of electric power generation;

(3) maximum reliance on renewable energy sources; and

(4) thrifty energy consumption.

Available Energy Sources

The information supplied by the Armenian government suggests that in 2005 out of the total amount of 3,462 thousand tons of conventional fuel Armenia uses every year its own (renewable) resources comprised less than 7 percent (about 240 thousand tons, primarily hydro resources); 1,000 thousand tons, or 29 percent, were supplied by the Armenian Nuclear Power Station (ANPS) (Armenia imports nuclear fuel which the IEA classifies within the country's own resources). The rest (63-64 percent) is supplied by energy resources which the country has to import on a permanent scale (gas and oil products). Natural gas holds the largest share—1,600 thousand tons, or 48 percent, of the country's total energy basis (a large part of it is used to produce electric power; for detail, see below).

This means that natural gas production (and the electric power it produces) and non-gas power production are responsible for 83-84 percent of the country's energy balance. They are obviously the key components of Armenia's power production[1] (the rest 16-17 percent belongs to the imported

[1] After 2005, the import of natural gas increased by approximately 10% a year (see Fig. 1 below), so the percentage of the three components in the energy balance mentioned here is now even higher. However, since we do not have more recent official data, we will rely on the situation in 2005; it also clearly shows the importance of these three spheres in Armenia's energy balance.

products) which explains why I have limited myself to analyzing these two spheres. We cannot exclude that in the foreseeable future Armenia will acquire an oil branch of power production: there are plans to build a refinery in the republic which will use Iranian crude oil. Iran and Russia are very interested in the project now at the final stage of the feasibility studies.

Property Relations and Foreign Policy

A considerable part of assets in Armenia's energy sphere belongs to foreign, mainly Russian, investors. The largest of them are Gazprom, RAO EES, and Rosatom (with the liquidation of RAO EES its Armenian assets were transferred to the latter), etc. This could have caused (and sometimes causes) concern over the country's dependence on a foreign state (no matter how friendly). In actual fact, Russia's presence in the Armenian energy market is a positive phenomenon that brings in the necessary investments (which Armenia cannot afford, at least today) and creates some other advantages.

For example, in 2003 the ANPS was leased for trust management to Inter RAO EES of Russia on the condition that it would regularly supply the station with nuclear fuel. This is being done: the Russian company finds it easier to deal with a Russian fuel producer. There is an even more graphic example. I have in mind Armenia's close cooperation with Russia in the sphere of natural gas supplies (political factors are in play here as well), which creates obvious advantages for Armenia. Gazprom, which has to choose between the advantages created by its monopoly status on the gas market (which wants to sell at higher prices) and its position as an investor (today it is the largest shareholder of ArmRosgazprom, for details, see below), will have its interests crippled if the gas prices go up too high. Whatever the case, in the past few years Armenia has been paying less for gas than its neighbors: between April 2006 and January 2009 the price of Russian gas for Armenia was frozen at the $110 per 1 thousand cu m (tcm) level while nearly all other countries paid $230 per 1 tcm of Russian gas. According to the unofficial figures, between 1 January, 2009 and 2011 one thousand cu m of Russian gas will cost Armenia $165. In April 2006 Armenia and Gazprom signed an agreement for the next 20 years under which the Russian company assumed responsibility for supplying Armenia with gas and coordinating the prices with the Armenian side (the prices will change along with the prices in Europe; gas prices inside Russia will likewise be adjusted).

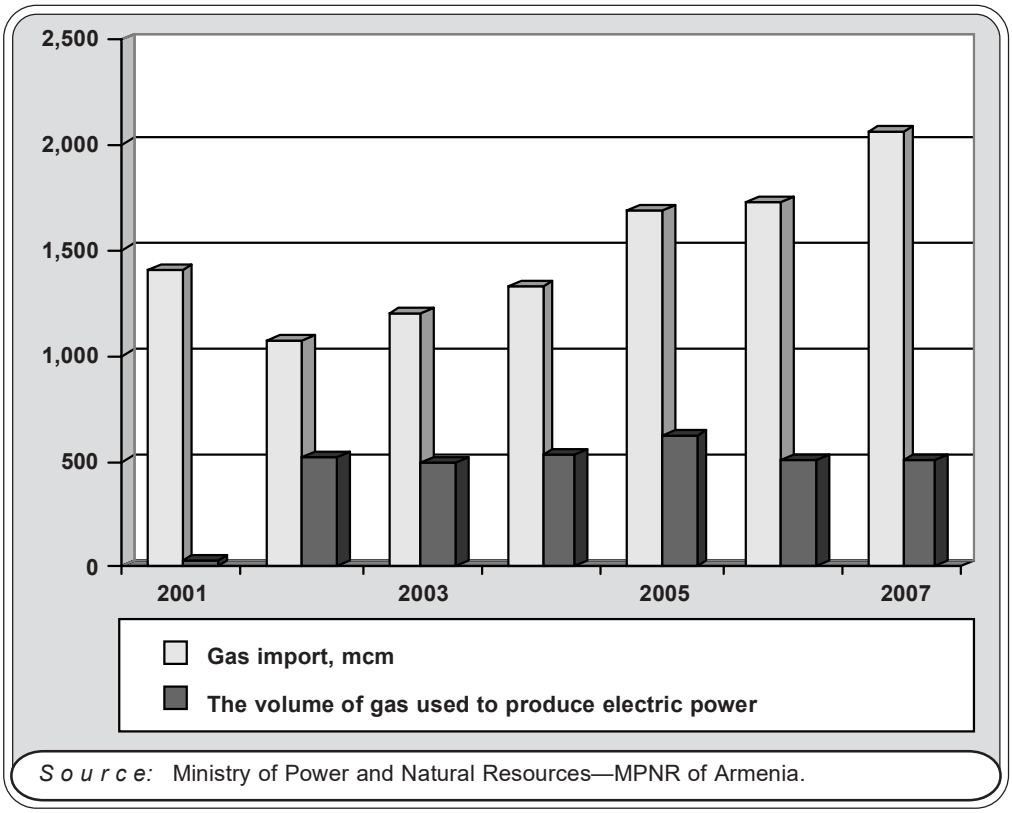
Natural Gas

Since the early 1990s gas has been reaching Armenia through the only 720 mm gas pipeline that crosses Russia and Georgia. The gas pipeline with a greater carrying capacity, which brought gas from Azerbaijan in Soviet times, cannot be used because of the Nagorno-Karabakh conflict. Over the years, Armenia has used gas from different countries, Turkmenistan in particular. In recent years it has been buying gas from Gazprom. Armenia's gas economy is controlled by ArmRosgazprom, a monopolist company in which Gazprom holds 72 percent of shares and the government of Armenia 25 percent. The underground gas storage reservoir, the only one in the Caucasus big enough to supply the country with gas for a month, is Armenia's great strategic advantage.

Gas consumption in Armenia is growing steadily (see Fig. 1): it nearly doubled between 2001 and 2007. Its increase in the last few years is explained by greater gas consumption in the spheres outside energy production. At the beginning of the decade the thermal power stations used approxi-

Figure 1

The Volumes of Imported Natural Gas and its Use by Armenia's Power Stations in 2001-2007



Source: Ministry of Power and Natural Resources—MPNR of Armenia.

mately half of the total amount of gas consumed in the country, whereas in 2007 they consumed merely a quarter of it. The lion's share of imported gas was used in the housing sector: there has been a stunning increase—from 112 thousand in 2002 to over 470 thousand in 2007 (over 90 percent of the users were households). According to ArmRosgazprom the share of gas users in the republic's total population makes Armenia one of the world's leaders. This is a positive phenomenon: the users no longer rely on more expensive and less handy energy sources (previously, electricity was frequently used for home heating).

Transport is another large gas consumer: according to the government's estimates up to 60 percent of the cars run on gas (many of them can use either gas or petrol). Gas is cheaper and much easier to obtain: in August 2008 freight traffic almost stopped because of the war in Georgia (the main link between Armenia and the outside world).

The only gas pipeline that brings imported gas to Armenia makes it vulnerable; it is enough to mention the blast on the pipeline in the Northern Caucasus in the severe winter of 2006 when for some time Armenia was supplied with no gas at all. An energy crisis was prevented due to the supplies in gas storage, but it became clear that the country needed another pipeline, from Iran.

An agreement on it, not so much between Armenia and Iran (the latter was naturally only too eager to enter another market) as between Armenia and Russia, was achieved in 2004. (The Iran-Armenia gas pipeline will deprive Armenia's strategic ally of its monopoly on the market no matter how small.) The details of the Armenian-Russian talks remain secret, however it was absolutely clear that then President of Armenia Kocharian scored an important victory: Russia agreed on the Iran-Armenia gas pipeline. This line, or rather its Armenian part, will belong to ArmRosgazprom (together with the rest of the republic's gas sphere). Coupled with the shares of the 5th block of the Razdan Thermal Power Station (for details, see below), Gazprom's involvement in ArmRosgazprom increased from 45 percent in 2006 to the present 72 percent.

By the time this article was finished (September 2008) the gas pipeline, which stretched from Tabriz in Iran to Erevan, was almost complete; it might be commissioned later in the year. Its annual carrying capacity of 2.5 billion cu m (bcm) of gas is equal to that of the currently functioning gas pipeline that crosses Georgia. This means that the republic has doubled its energy security and added stability to its energy sector.

Armenia's Power Sector

The republic's Soviet legacy included considerable electric power production capacities (complete with the region's only NPS), which, under the new conditions, created enough power to cover domestic requirements and export the rest.

In recent years domestic power consumption has been going up at a moderate rate: from 3.4 billion kWh in 2001 to 4.7 billion in 2007 (see Fig. 2). The increase of 38 percent in six years, or 6.4 percent of the average annual growth, was below the GDP rate, which remained higher than 10 percent throughout the same period. This is probably explained by the much faster growth of gas consumption that partly replaced the need in electric power.

Figure 2 illustrates another fairly recent important fact: between 2001 and 2007 the total volume of electric power produced remained at basically the same level (under 6 billion kWh a year) and in some years even decreased. This was caused by (unexplainable) ups and downs in electric power export. Today Armenia exports electric power to Iran and Georgia in volumes that greatly fluctuate from year to year. According to MPNR, between 2003 and 2007 electric power export to Georgia vacillated between 656 million kWh in 2005 to zero in 2007; and export to Iran[2] fluctuated within the 12 million kWh in 2003 to 95 million kWh in 2007 range.

This means that today export rather than domestic consumption determines electric power production in Armenia. It seems (see below) that in the future export will move to the fore in the Armenian energy sector.

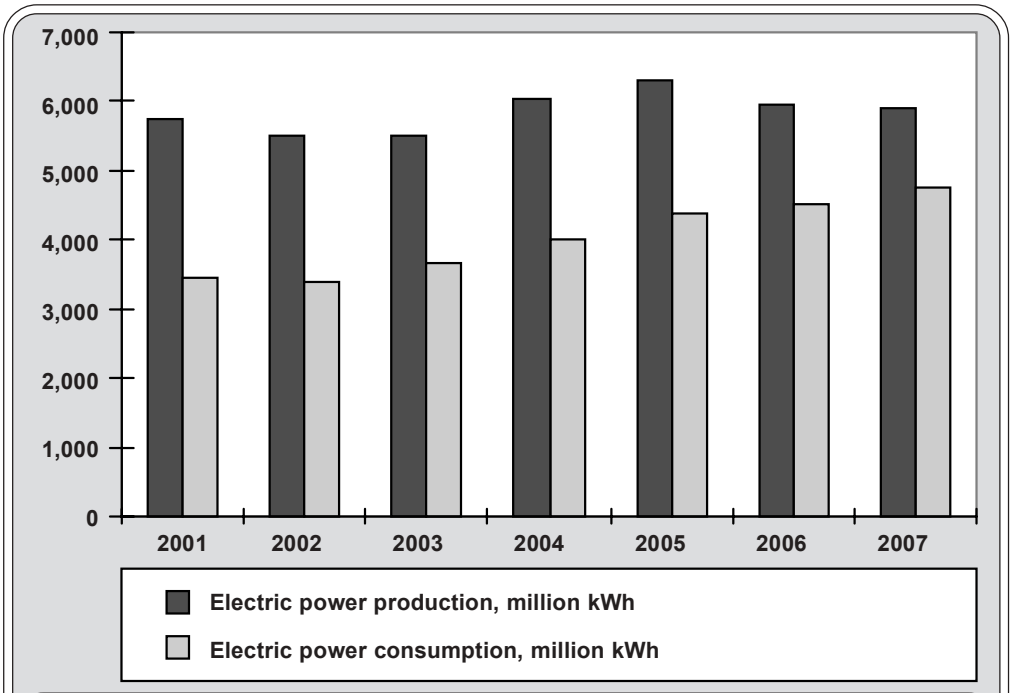
Table 1 illustrates another specific feature of the Armenian electric power sector: the ANSP (accountable for 13 percent of the country's installed power-producing capacities) produces over 40 percent of the energy produced. Thermal power stations, on the other hand, produce less energy than they could if all their capacities were loaded.

This policy looks reasonable: the country is lessening its dependence on imported energy resources. This also shows that Armenia has enough idling energy-producing capacities to be used in case of need. This means that since domestic consumption is fully covered Armenia can potentially export more energy. Part of the power-producing capacities of the Armenian thermal power stations

[2] In the case of Iran, we should talk about net export since in the winter Iran does not buy power from Armenia but sells it to the republic.

Figure 2

Dynamics of Production and Domestic Consumption of Electric Power in Armenia in 2001-2007



Source: MPNR of Armenia.

Table 1

Installed Capacities and Electric Power Production at Different Types of Power Stations in Armenia

	Installed capacity[3] (% of total) by the early 2000s (MW)	Production of electric power, million kWh (% of total)[4]	
		2006	2007
Thermal	1,700 (31)	1.475 (24.8)	1.489 (25.3)
Nuclear	407 (13)	2.640 (44.4)	2.553 (43.3)
Hydro	1,000 (32)	1.825 (30.7)	1.855 (31.4)
Total	3,100 (100)	5.940 (100)	5.897 (100)

[3] The figures are taken from *Puti effectivnoy integratsii energosistem stran Iuzhnogo Kavkaza,* Baku, Erevan, Tbilisi, 2004.

[4] Based on information of MPNR.

is obsolete and does not meet the latest efficiency criteria,[5] however the republic's export potential remains considerable. This is confirmed by the recent statement of Minister of Power and Natural Resources of Armenia Armen Movsisian to the effect that the following year Armenia would be able to sell Turkey 1.5 billion kWh, that is, increase its electric power production by nearly a quarter.

How the Government Intends to Develop the Electric Power Sector

Today, the country has made great achievements in electric power production, at least at the regional level; in fact, the crisis of the 1990s lowered the GDP power consumption below the Soviet level (today, the country uses half of the electric power and a third of the gas it used in Soviet times to produce the same GDP).[6] At the same time the Armenian government knows that the economy and

Table 2

Comparative Per Capita Power Consumption and Energy Efficiency of Armenia and Other Countries

Country	Power consumption tons of oe per capita	Power consumption of GDP kg oe/dollar	Power consumption kWh per capita	Power consumption kWh/dollar	Emission of CO_2 kg/dollar GDP	Emission of CO_2 tons per capita
OSCE	4.67	0.19	8,046	0.32	0.44	10.96
Armenia	0.63	0.83	1,223	1.61	1.2	0.91
Czech Republic	4.10	0.72	5,890	1.03	1.98	11.27
Slovakia	3.44	0.74	5,049	1.08	1.5	7.04
Hungary	2.50	0.44	3,545	0.62	0.95	5.46
Lithuania	2.48	0.84	2,828	0.95	1.18	3.47

oe—oil equivalent (in tons and kilograms).

Source: MPNR of Armenia.

[5] According to MPNR of Armenia, out of 3,100 megawatts of installed capacity only 2,400 megawatts can be used.

[6] For more detail, see: H. Khachatrian, "The Economic Status of South Caucasus Countries in 15 Years of Independence: Comparative Analysis," *Armenian Trends,* Q2, 2006, pp. 23-29.

energy sector do not meet the latest requirements by far. This is testified by the GDP power consumption and various assessments of energy efficiency shown in Table 2.

To prevent the country from falling behind even the less developed countries illustrated by Table 2 the government adopted two basic documents:

(a) **The Development Strategy of Armenia's Energy Sector in the Context of the Country's Economic Development** (dated 23 June, 2005) and

(b) **The National Program of the Republic of Armenia on Energy-Saving Measures and Renewable Energy** (dated 18 January, 2007).

The programs outlined the roads to modernization with special emphasis on the use of renewable resources (smaller rivers, the sun, wind, and geothermal springs) and energy saving measures. Today, modernization of electric power substations has come to the fore: it is expected to cut down losses and upgrade the system's reliability. It is mostly funded from abroad, by the German State Development Bank KfW and the Development Bank of Japan.

New power-producing capacities are also badly needed, therefore the following projects will be implemented on a priority basis:

1. The state-of-the-art block with a combined gas-turbine cycle at the Erevan Thermal Station with a capacity of 240 MW; the project will be implemented using a Japanese $160 million credit with a repayment period of 40 years. In fact, this will be a new block (the old thermal station with an installed capacity of 550 MW built in the 1960s and no longer meeting the current requirements will be probably taken out of operation). The new block will use more than half as much gas (compared to the amount of gas used today) to produce 1 kW of electric power. The initial commissioning date of late 2008 was not observed: the project started in July 2008 is expected to be completed by April 2010.

2. The ANPS needs a new block since the presently functioning block with a capacity of 407 MW must be removed from operation by 2016. For obvious reasons this project is seen as the key in the republic's energy program; the country's leaders repeated time and again that the ANPS could be closed down only if the republic acquired another nuclear power station. The Armenian government declined the demand of the European Union to close down the ANPS by 2004; modernization of the old station continued until the prospect appeared of finding investors for the new station. The feasibility study indicates that the new block may reach a capacity of 1,000 MW. Armenia counts on European and Russian money (as distinct from the present ANPS from which foreign investors were banned). The feasibility study of the new station, which is to be built next to the present one not far from the city of Metsamor 40 km to the west from Erevan, was paid for by the American government and IAEA.

3. The fifth block of the Razdan Thermal Power Station must be completed (construction began in Soviet times and was partly completed in the 1990s). Gazprom bought the block from Armenia in April 2006 for $248.8 million. The Russian company pledged to add a gas turbine to it (at the cost of $180 million) that was expected to lower gas consumption per 1 kW of electric power by more than 30%. The aggregate capacity of the block is expected to reach 450 MW. Today ArmRosgazprom intends to commission the station no later than 2010 (the earlier commissioning date being mid-2008).

4. A new hydropower station with a capacity of 140 MW on the Arax River at the border with Iran. The sides, Armenia and the IRI, have been discussing the joint project for many years now but it has not yet reached the construction stage.

Armenia as an Energy Exporter

In Soviet times Armenia sent electric energy to its all four neighbors (two of them were Soviet republics). Today it can do the same. Much is being done to increase electric power export to Georgia and Iran, which during Soviet power and in the post-Soviet times used and are using Armenian electric power. In recent years two power lines were built (one in each of the two directions); two more lines are planned. Tripartite talks are underway to ensure sustainable power supply along the Georgia-Armenia-Iran axis and to coordinate their power systems. Armenia plays the key role if only because it is the axis' central element.

I have written above that energy supplies to Georgia can hardly be called regular (in recent years Armenia has been mostly sending energy to Samtskhe-Javakhetia, a region of Georgia with a predominantly Armenian population). After the August 2008 war the future of electric power export to Georgia remains vague.

The situation with Iran is different; delivery of energy is seasonal: in the winter Iran sells energy while in the summer it imports its electric power; on top of this, Iran is prepared to buy more electric power in Armenia. Under the treaty on the Iran-Armenia gas pipeline signed on 13 May, 2004 in Erevan, at the initial stage Armenia will receive up to 1.1 bcm of gas every year; later the figure will go to up to 2.3 bcm. Under the agreement Armenia will pay for Iranian gas with electric power at a ratio of 1 kWh per 1 cu m of gas. This means that Iran accepted the possibility that in 2009 it will import over 3 billion kWh of Armenian electric power (half of the present annual production, as is shown in Figure 2). It is not yet clear whether mutual supplies will take place at all and what amounts will be involved since Armenia is falling behind the schedule of commissioning new generating capacities, however the prospects of large-scale electric power export to Iran are still feasible.

Armenia might start selling electric power to Turkey. According to Minister Armen Movsisian, during President of Turkey Abdullah Gül's unofficial visit to Armenia (which can be described as historic),[7] the ministry and Unit, a private Turkish company, agreed on electric power exports to Turkey at an initial annual amount of about 1.5 billion kWh (later the volumes may increase). In anticipation of this the Turkish company has to restore the Gumri-Kars power transmission line. The deal, a potential breakthrough in the two countries' economic relations, confirms Armenia's status of a regional power exporter at the very least.

In the next three or four years (granted that the local situation remains favorable), Armenia might increase its annual electric power export to a level of 2.5-3.5 billion kWh (the equivalent of $170 million), or 15 percent of the country's exports in 2007. If realized the region's economic map will look very different while the region will become more stable politically. These bright prospects depend, to a great extent, on political factors. It remains to be seen whether they will develop in the right direction.

[7] Officially, President Gül came to Armenia, a country with which Turkey has no diplomatic relations, on an invitation from President of Armenia Serzh Sarkisian to watch the match between the national football teams of the two countries.