

ACTION PLAN FOR THE MINISTRY OF ENERGY OF THE REPUBLIC OF ARMENIA
STIPULATED BY THE PROVISIONS OF THE NATIONAL SECURITY STRATEGIES
OF THE REPUBLIC OF ARMENIA

1. GENERAL PROVISIONS

1. The Action Plan of the Ministry of Energy of the Republic of Armenia (RoA) is closely matched with the provisions of the National Security Strategies of the Republic of Armenia, based on the Energy Sector Development Strategies within the Context of the Economic Development in Armenia, a document that was approved by the Government of Armenia (GoA) on 23 June, 2005, and the ensuing 2006 Least Cost Generation Plan (LCGP) for Armenia.
2. The main objective of the Armenian energy sector development strategies is formulation of the strategic targets for the development of the Armenian energy sector and determining the fundamental directions towards their achievement, based on the sustainable development principles for society in general and the energy sector in particular, adopted by the international community, and guided by provisions of the national security strategies of the Republic of Armenia.
3. The fundamental directions for the operation of the RoA Ministry of Energy ensuing from the principles of the National Security Strategies are as follows:
 - 1) Provision of reliable energy supply at low rates to satisfy the fundamental needs of all customers, enhancing, in the meantime, energy conservation;
 - 2) Avoiding such methods of energy import, in case of which the security and economy of Armenia might be exposed to events and uncalled for political impacts beyond the control of the Republic of Armenia, ensuring maximum utilization of the domestic energy resources and nuclear energy;
 - 3) Ensuring the safe operation of the ANPP through 2016 or until the moment when its energy is possible to replace by other energy resources, and proceed with the decommissioning without any unacceptable economic, ecological and energy security impacts;
 - 4) Ensuring ecologically sustainable energy supply, based on the principles of sustainable development and in compliance with the international environmental commitments of the Republic of Armenia;
 - 5) Construction of a financially sustainable energy system, encouraging the economically efficient operation of all energy suppliers, which would bring forth interest among the investors and private capital;
 - 6) Creation of an electric energy system that is export oriented and generates high added value;

2. ENERGY SECURITY AND INDEPENDENCE

4. “Energy security” is considered as a guarantee of stable and reliable supply of fuel and energy resources, at affordable prices, to completely meet the demand of the country and its citizens, the society and economy by such means of generation, in conditions of normal development as well as in emergency situations, that would have minimum environmental impact.
5. Energy security would be ensured and the dependence from any supplier would be reduced if Armenia diversifies supply sources and plans for fuel storage and emergency preparedness. Such fuel supply diversification – especially important with the ANPP decommissioning - will also improve Armenia’s ability to bargain for better prices and terms of delivery and will reduce the likelihood of price shocks to Armenian customers.
6. Diversification of energy sources certainly requires diversification of supply routes. For Armenia today, the only real way out is the Iran-Armenia gas pipeline and the restoration of the electric energy sector’s parallel operation with other power systems within the region.
7. The current level of economic activity in Armenia can be provided by less energy consumption and less dependence on imported fuel, yet ensuring a higher level of energy security. This means that the Armenian national security and economic sector competition can be enhanced by promoting efficiency of energy consumption.
8. And finally, the level of energy independence in Armenia will be characterized not only by the level of utilization of domestic renewable energy resources and the portion of nuclear generation in the power generation structure (nuclear energy is internationally considered a parity to domestic energy resources), but also by the implementation of activities aimed at the utilization of the energy conservation potential.
9. Thus, the objective of ensuring an adequate level of Armenia’s energy security and independence includes the following critical directions of the energy sector development strategies:
 - Utilization of renewable energy resources and energy conservation;
 - Nuclear energy;
 - Diversification of supplies and regional integration;
 - Ensuring environmental safety;
 - Ensuring social policies, financial stability and economic efficiency.
10. The structure of power generation in Armenia with consideration of the aforementioned principles of ensuring energy security, is as follows:
 - 1) Give priority and with the upcoming 15-20 years completely utilize the domestic portion of renewable energy resources for power generation, which may amount to about 4.7 billion kWh, including:

- Hydro energy	- 3.6 billion kWh, of which around 1.8 billion kWh have already been utilized;
- Wind energy	- 1.1 billion kWh.

The above capacities are mainly seasonal. This assessment does not include the portion of possible power generation at the account of geothermal resources.

- 2) The rest of the energy generation could be carried out at the new ANPP unit and thermal power plants, including those operating combined generation.

11. ***The aforementioned proportion of energy generation structure is the only one for Armenia. Any power generation capacity development Programs should only respond to the questions associated with the necessary generating capacities and the determination of the timing for their commissioning, taking as a basis the growing demand of economy in electric energy, the level of the country's energy independence and security, the role of the energy system in trans-regional cooperation issues, social issues and so on.***

3. NUCLEAR ENERGY

12. The Government of Armenia has made a commitment to its citizens and to the EC that the ANPP will be decommissioned. This will necessitate the provision of adequate replacement power. Until the time when the facility is shutdown, the Government will support an extensive program of safety improvements at the facility. However, required extensive costs as well as the absence of diversified supply sources now make any near-term shutdown date unrealistic. Indeed, the current least cost power supply plan makes it clear that closing the ANPP will lead to significant increases in the bills of the Armenian customers and further reliance on gas imports.
13. Further operation of the ANPP until 2016 inclusive, would require mitigating of the risks associated with such decision. The nuclear power plant has environmental commitments, though it is not considered an air pollution source. To date, more than 80 million USD have been invested to enhance the level of safety at the ANPP. However, this was not sufficient to meet the international safety standards. In order to complete the safety enhancement operations, new investments are required (around 40 million USD). An additional safety upgrade expenditure of a few million dollars per year will be necessary after the completion of safety enhancement operations. Safety issues arising from the aging of the plant will require particular attention and financing, as will the issues involving training of the plant staff, safety culture, etc.
14. When the ANPP is closed, Armenia will lose an important element of diversity of its current energy supply.
15. The forecasts of nuclear fuel and natural gas price increase tendencies by 2050 also speak in favor of building a new nuclear unit. In conditions of irreversible natural gas price increase, conditional upon the decrease of natural gas resources and reduction of the number of exporters, the price for nuclear fuel may be considered relatively stable.
16. The prices for natural gas bear an impact of the world prices for crude oil that have significantly increased since 2003. Conditions of the regional market and the natural gas prices at the western border of Russia also demonstrate a tendency to rise. The natural gas price is the main determining factor in forecasting the cost of power in Armenia. The 2006 LCGP, developed upon the order of the RoA Ministry of Energy and with technical assistance from USAID, reviews the moderate (average annual price increase of around 4.88 % at the border) and high (average annual price increase of around 5.63 % at the

border) scenarios for natural gas price increase for Armenia, based on the prices envisioned at the western border of Russia. Despite the fact that the Iran-Armenia gas pipeline may ensure competitiveness of the gas supplied to Armenia, it is unlikely that the price of gas from Iran will be significantly lower than that imported from Russia.

17. In the meantime, it is planned that during the upcoming 20 years the cost of nuclear fuel will have an annual 3% increase.
18. The results of the Armenian 2006 LCGP record the following:
 - 1) There are no economic alternatives for the continuous operation of the ANPP through 2016. However, the plant's continuous operation should be justified by the guarantee that the plant will be fully funded to implement all maintenance and safety enhancement operations;
 - 2) By 2016 Armenia will have a demand for around 2000 MW of capacity if the ANPP is decommissioned in 2016 and the existing obsolete thermal capacities (the age of Hrazdan and Yerevan TPP units in 2016 will be more than 40 years by 2016) are taken out.
 - 3) Extension of the ANPP service period is not feasible because the correlation between the briefness of the extension period and the cost of investment is not economically satisfactory.
 - 4) None of the Armenian HPPs (existing or new) has the capacity to operate under base load because of the limited reservoir capacity. The option of base load capacity generation with least costs for the Armenian electric energy system can only be represented by the nuclear or thermal generation alternative.
 - 5) With government funding, it is planned to build a single 208 MW thermal unit, which will be commissioned by the end of this decade.
 - 6) The planned Meghri HPP (with 140 MW of installed capacity) will not be able to serve the Armenian base load during the considered time period (according to the financial scheme of the HPP construction, the entire generated power will be directed to Iran).
 - 7) Commissioning of the new NPP unit is the only least cost option. Apart from being the most reliable alternative in terms of diversification of primary fuel and fuel supply, it ensures energy security and independence and is environmentally adequate.
19. Based on the analysis of the price increase scenarios for gas and nuclear fuel, as well as strategic and economic discussions, the following is recommended:
 - 1) Decommission the ANPP immediately after the construction and commissioning of the new unit;
 - 2) Conduct a comprehensive safety and environmental assessment for the ANPP site to determine compliance with the requirements of decommissioning and new nuclear unit construction;

- 3) Develop a comprehensive decommissioning plan to be ready 5 years prior to the commencement of the ANPP decommissioning;
- 4) With own resources and with the help from donor organizations, fund the safety improvement activities and provide the required investments for the safe operation of the ANPP until 2015 inclusive;
- 5) Develop an action plan to provide for the funding scheme of the new nuclear units with up to 1000 MW and resolution of construction related issues, including the dimensions of the unit and its decommissioning in future, with consideration of the possible prospects of operating the uranium mine in Armenia and its impact in selection of the nuclear reactor type.

4. DIVERSIFICATION OF SUPPLIES AND REGIONAL INTEGRATION

20. Analysis and assessment of the opportunities for diversification of supplies, regional integration and electricity export are a critical element of the operation of Armenia's Ministry of Energy.
21. The analysis of materials on Iran, Turkey and South Caucasus countries demonstrate that these countries have chosen the principle of self-satisfied Power Sector development. This will inevitably bring to undesirable changes in the available energy balance. Moreover, the energy resources of the Caspian Sea basin will be exported through the East-West fuel transportation highways, bypassing the territory of Armenia, which will decrease the role of Armenia from the perspective of electricity export.
22. A strong competition for servicing the energy markets of the region will appear in the future. It is clear that the country with the most rapid speed of implementation of its development programs, especially in areas oriented at export and creating high added value, will obtain the political and economic privileges. In other words, the policy of these countries should be based on the development of such political and economic atmosphere that will attract foreign investors. This becomes particularly important for the development of such capital-intensive industries as the energy sector.
23. The Iran-Armenia gas main is a stable alternative for the only gas pipeline across the territories of Russia and Georgia. Construction of this gas main is justified and has a prospective strategic significance. The Government must put every effort to successfully complete the already commenced construction of this alternative gas main.
24. Given the fact that part of the generated electricity necessary for satisfying the winter peak load in Armenia is received from the fossil fuel, and full-scale use of natural gas both by residential sector and by industrial sector is highly preferable, Armenia must have storages with enough capacity to overcome unexpected interruptions of import. Storages, as well as equipment for fuel transportation in and out of the storage should be reliable.
25. Here is another consideration with regards to the issue of regional cooperation: in future the country, which will have the opportunity to generate inexpensive basic type of electricity at the nuclear plant and reduce the size of obligatory environmental payments associated with the emission of hazardous materials from TPPs, will take the primary place in the competition for regional power market services.

26. In November 2004, the Conference of Ministers in Baku convened upon the EC initiative, founded and is currently developing cooperation between the EU states, the countries of the Caspian Sea basin and their neighboring states in the energy sector. The primary objective of that is the unhindered transit of fuel and energy resources (basically oil and natural gas) to EU from the aforementioned territories, with the employment of beneficial mechanisms for the involved states.
27. Within the framework of the aforementioned Cooperation, Armenia is not considered a country that exports fuel and energy resources. However, we should certainly make use of our favorable geographic position for the transit of such resources, the availability of our existing and expandable underground gas storages and ensure the legislative, political and institutional compliance prescribed by the Collaboration and Cooperation Agreement that serves a warrantee for the transits. This will provide for the maximum use of the Armenian energy system potential in terms of the transit of the Caspian (including Iranian) fuel and energy resources to Europe and will create an opportunity for the attraction of the EC investments intended for that purpose.
28. In order to acquire political and economic privileges in the region, Armenia should obviously speed up its development programs, especially in branches like electric energy, oriented at export and creating high added value.
29. These last provisions come to prove once again the necessity of creating base load power generation capacities, ensuring in the meantime the involvement of the Armenian energy sector not only in the Caspian but also in the Black Sea united energy systems.

5. ENSURING SOCIAL POLICIES, FINANCIAL STABILITY AND ECONOMIC EFFICIENCY

30. Armenia's economy is now in the middle of a phase when its energy system ceased to be an instrument for the country's social policies and became a system where the companies belonging to private owners strive to elevate their efficiency to gain profit and attract investments for development.
31. In order to mitigate the social consequences associated with consumption tariff increase due to the installation of new capacities and implementation of major projects of strategic importance for Armenia, the Government must strive to attract so-called "soft" loans and as many grants as possible. In the case with Armenia, the construction of new capacities and implementation of major projects with the attraction of private capital cannot be justified.
32. Expansion of gas distribution network in a stable and economically acceptable method by "ArmRosGasProm" CJSC and provision of gas supply for all consumers, who need it, will indisputably contribute to the solution of the problem of heat supply recovery, including promotion of heat and cogeneration units, as well as assistance to autonomous and distributed (decentralized) generators.
33. The primary measures to ensure financial stability and economical efficiency should include the following:
 - 1) Continuous development of the energy market;

- 2) Completion of the privatization process by involving foreign firms and encouraging competition among the private companies, and prohibiting concentration of all energy capacities with one owner;
- 3) Creation of favorable legal and economic environment for investments and compliance with the EU legislation;
- 4) Conducting balanced tariff policies for investors and consumers;
- 5) Gradual transition from a regulated towards a competitive market.

34. The Government should render all possible financial assistance to the latest global developments in energy research that can be applied in Armenia:

- In the energy conservation area;
- In the development of the energy market;
- In the development of alternative small energy generating capacities;
- In the development of oil and gas, fossil fuel explorations and industry development;
- In the development of new technologies for nuclear unit decommissioning.

6. CONCLUSIONS

35. Thus, in order to maintain the existing level of energy independence and safety, it is planned to accomplish the activities specified in the Table below, by 2025.

36. Among the energy capacities listed in the Table below, there are no digital indications for the potential of geothermal, biogas, solar (thermal and photovoltaic) and other possible sources of renewable energy, as well as for the activities towards the receiving of bio-ethanol and the possible results of the continuous explorations for oil and natural gas. However, the issue of the efficient utilization of the aforementioned potential is within the focus of the policies conducted by the Ministry of Energy.

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Table

No	Activity	Objective and Anticipated Results	Performance Dates	Financial Sources for Implementation
1	2	3	4	5
1.	Construction of Small HPPs /up to 260MW capacity/.	Utilization of hydro energy potential of the Republic, generation of additional 600 million kWh electric energy, in addition to the current ~200 million kWh electric energy.	Before 2025, by certain allocation per years. In accordance with the licenses issued by the RoA PSRC, 58 Small HPPs of 143.6MW capacity and of about 525 million kWh generation are already under construction.	Private investments.
2.	Construction of LoriBerd HPP /60MW capacity/.	Utilization of hydro energy potential of the Republic, generation of about 200 million kWh electric energy.	Commissioning is in 2015.	By the state support using “soft” loans. In accordance with the Feasibility Study of German “Fichtner” Company, about 80 million Euro.
3.	Construction of Shnogh HPP /75-100MW capacity/.	Utilization of hydro energy potential of the Republic, generation of about 300-400 million kWh electric energy.	Commissioning is before 2015.	Private investments. 2 options of estimations: “Harza” Company-100 million USD (300 million kWh) and “General Electric Hydro” Company- ~160 million USD (440million kWh).
4.	Construction of Meghri HPP /140MW capacity/.	Utilization of hydro energy potential of the Republic,	Commissioning is before 2014. This amount of	Loan provided by Islamic Republic of Iran in the

		generation of about 800 million kWh electric energy.	electricity will be exported to Islamic Republic of Iran before return of Iranian investments.	amount of 240 million USD. Currently, negotiations with Iran are coming to the end on coordination of financial scheme.
1	2	3	4	5
5.	Construction of wind plants /200 MW capacity/.	Utilization of potential of wind energy of the Republic, generation of about 525 million kWh electricity.	Before 2025, by certain allocation per years. In 2008, by "GIRRIET" Company 25 MW capacity from 90MW will be installed in the first phase.	Private investments.
6.	Construction of cogeneration gas-turbine energy unit of 208 MW capacity in Yerevan TPP.	Generation of about 1.4 billion kWh electricity.	Commissioning in 2011.	Loan provided by the Japan Government and own resources in the amount of ~208 million USD.
7.	Completion of construction of the 5-th energy unit of up to 440 MW capacity of Hrazdan TPP.	Generation of about 2.8 billion kWh electricity.	Commissioning in 2009.	Funding by the Russian "GasProm" Company in the amount of ~180 million USD.
8.	Construction of new energy unit of up to 1000 MW capacity of Armenian NPP.	Generation of about 7.5 billion kWh electricity.	Commissioning in 2016. Development of Feasibility Study for construction of nuclear energy unit by the USAID experts will be completed in September 2008.	Funding in the amount of about 2 billion USD from other countries and private companies is in the phase of discussion.
9.	Completion of already started upgrading process of electricity transmission network.	Construction of new 400kV two-circuit lines to Iran, 400 kV new intersystem lines to Georgia, reconstruction of Gyumri- 2 substations. Provision of possibility for regional integration.	Implementation of works in 2008-211. The project for 400kV overhead line to Georgia has already been developed and the project for 400 kV two-circuit OL to Iran is in the development phase.	Loans from German KfW Bank in the amount of 14,6 million Euro (Gyumri-2) and 20,4 million Euro (Georgia 400 kV overhead line) and loan in the amount of about 90 million USD provided by Islamic

				Republic of Iran.
10.	Upgrading of electricity distribution network and increase of service quality.	Reduction of commercial and technical losses up to the internationally accepted criteria.	Implementation of works in 2008-2025, ongoing.	By "Armenian Electric Networks" CJSC.
1	2	3	4	5
11.	Construction of the second phase of Iran-Armenian gas main.	Diversification of natural gas import routes to the Republic.	Completion of works in 2009.	Funding will be made by the Russian "GasProm" Company in the amount of about 62.4 billion AMD.
12.	Investments in transportation and distribution systems of gas supply.	Completion of the total gas supply process of population.	Completion of works before 2010.	By "ArmRosGasProm" Company.
13.	Restoration of available amount of 150 million cubic meter of natural gas underground storage.	Increase of reliability level of gas supply.	Completion of works in 2009, will be implemented by "Gas de France" Company.	By "ArmRosGasProm" Company of about 5 billion AMD.
14.	Expansion of capacity of natural gas underground storage.	Harmonization with the regional energy market development tendencies.	Implementation of works before 2025. At present, preliminary researches on estimation of possible and necessary expansion of volumes are made.	By the state support through the "soft" loans.
15.	Restoration of heat supply by maximum use of geothermal, biomass, solar and other renewable resources.	Provision of heat supply needs of the population.	Implementation of works before 2015, ongoing.	State subsidies, other economic privileges, by the state support "soft" loans. Private investments.
16.	Organization of implementation of wide-range ongoing activities that will ensure energy efficiency.	Stimulation of energy efficiency technologies. Implementation of energy efficiency national program approved by the RoA Government.	Implementation of works is ongoing, in accordance with the activities to be developed based on recommendations of the state government bodies.	State subsidies, other economic privileges, by the state support "soft" loans. Private investments.

