

THE REPUBLIC OF ARMENIA



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**Greets all participants of “POWER ENERGY(B)”
training program and wishes fruitful and effective work!**

Structure of the Presentation

- 1. Armenia in Brief
- 2. Armenian Energy Sector Overview
- 3. National Energy Strategy
- 4. National Goals in Renewable
- 5. Conclusion



1. Armenia in Brief

Country at a Glance:

Official Name:	Republic of Armenia
Capital:	Yerevan
Major Cities:	Gyumri, Hrazdan, Abovyan, Edjmiatsin
Head of State:	President Serzh Sargsyan
Head of Government:	Prime Minister Tigran Sargsyan
National Legislative body:	National Assembly
Area:	29,800 sq. kilometers
Population:	3,3 mln
Currency:	Dram



Republic of Armenia

The Republic of Armenia is situated in the southern part of the Caucasus between watersheds of middle streams of the Araks and Kura Rivers. The territory of the Republic is 29.8 thousand sq. kilometers. It occupies the southeastern part of a vast highland area known as the Armenian Upland, which is located within the Alpine-Himalayan mountain system. The Armenian landscape is very picturesque and rich in numerous cultural monuments, such as rock drawings, cave towns, excavations of ancient cities and Paleolithic settlements, remnants of the most ancient observatories and metallurgical centers, creations of old and Medieval Armenian masters (temples, cloisters and fortresses) and modern architectural ensembles. This is all reflected in various guidebooks for the numerous tourists who visit Armenia. Armenia has every reason to be considered a museum in the open air.



The Republic of Armenia

Population: 3.3 mln.

Land: 29 thousand square km

GDP - real growth rate: more than 10% in average for last 7 years

GDP - per capita (PPP): \$5,700



The Armenian Nation was formed on the Armenian Upland, which reached the Caspian, Black and Mediterranean Seas and was situated on the crossroads of trade ways between Asia and Europe. Over centuries the Armenian People had defended their Motherland from the conquerors invading into their territory. But in spite of all ordeals Armenians retained their individuality and national heritage. Against the background of impetuous historical events, in parallel with the national culture, an original, social, intellectual and religious image of the Nation was formed.

Christianity was declared official national religion in 301 A.D. The Church Grigor Lusavorich was built in 2001, devoted to 1700 anniversary of Christianity and is the fifth largest Church in the World.

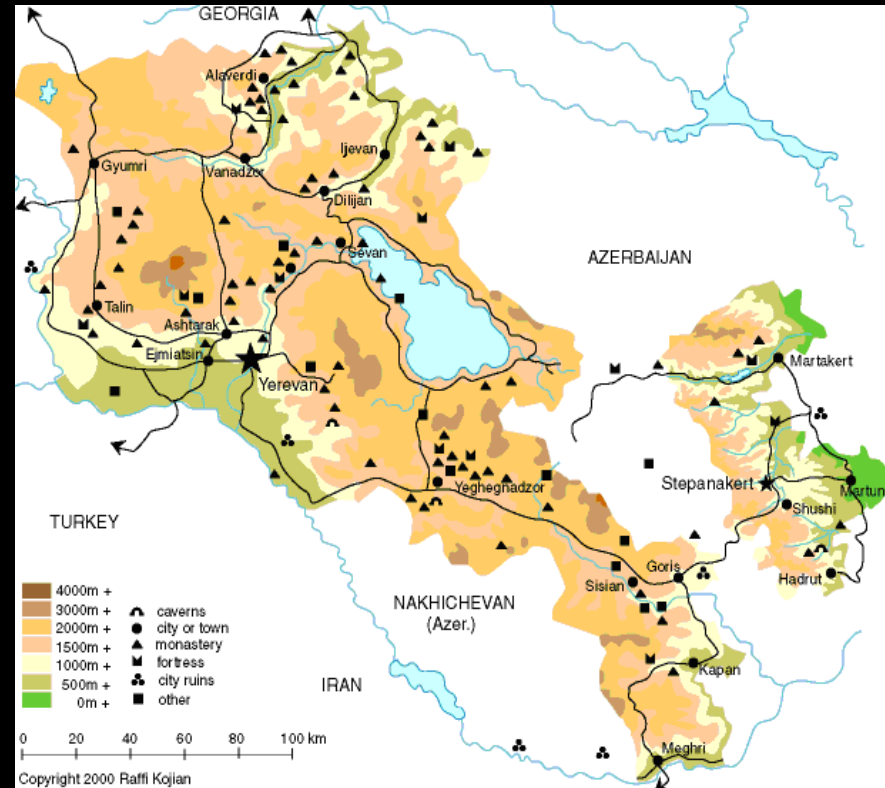
The Armenian alphabet was created by Mesrop Mashtots, the great Armenian scientist, in 405 A.D.

On September 21, 1991 Armenian Nation voted for its Independence. In December 1991 after the Collapse of USSR, International Community was accepted Armenian Independence.



Geography

Armenia is the smallest of the Caucasus countries, which is bordered by Georgia in north, Azerbaijan in west and southwest, Turkey and Iran in east and south consequently.



2. POWER SECTOR OVERVIEW



Functional Structure of Armenian Energy system

Policy and Strategy

GOVERNMENT OF RA
Ministry of Energy

Licensing and tariffs

Dispatching

Operator of the system

Registration of commercial flows

Settling center

Generation

ANPP TPP HPP Renewable

Public Services Regulatory Commission

Transmission

High voltages network

PA

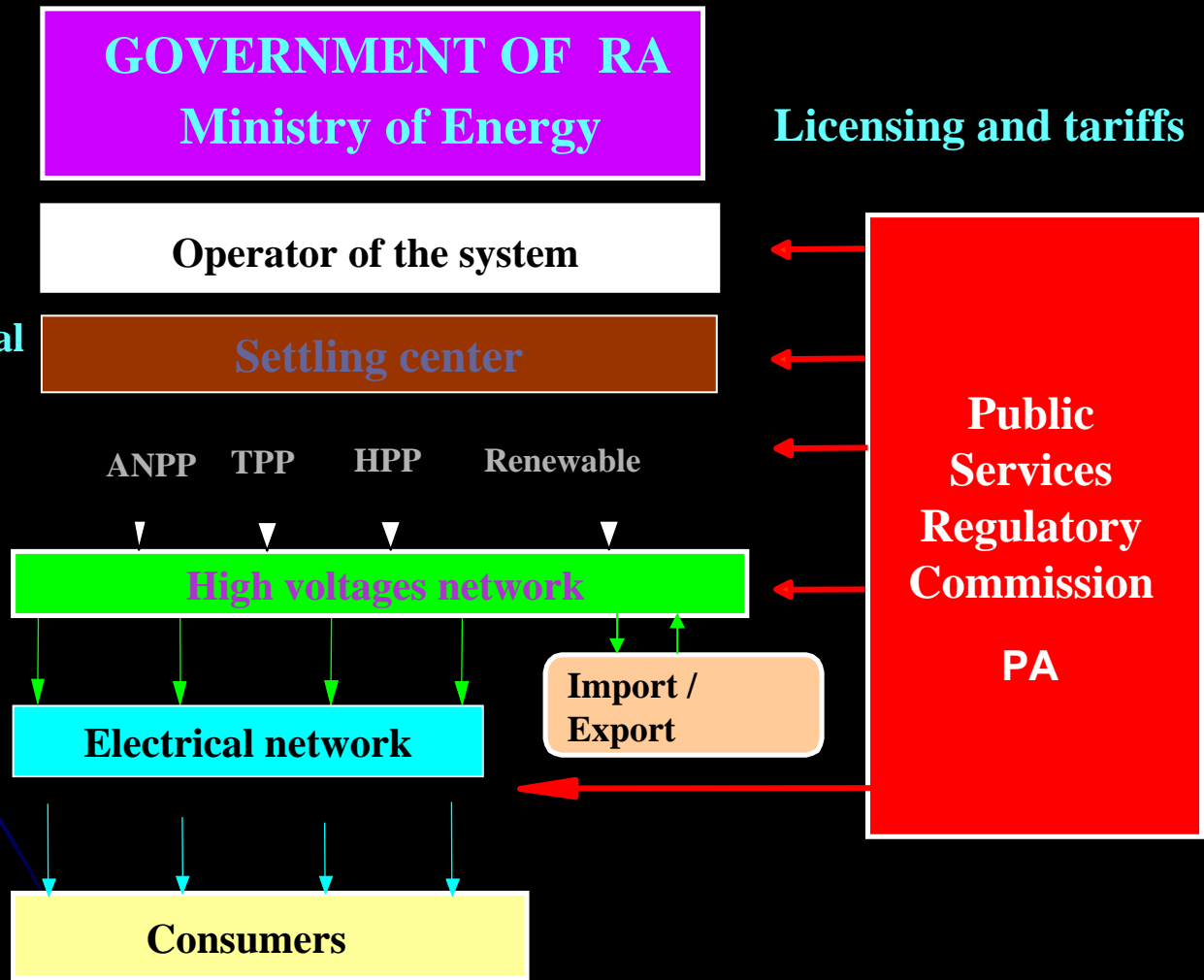
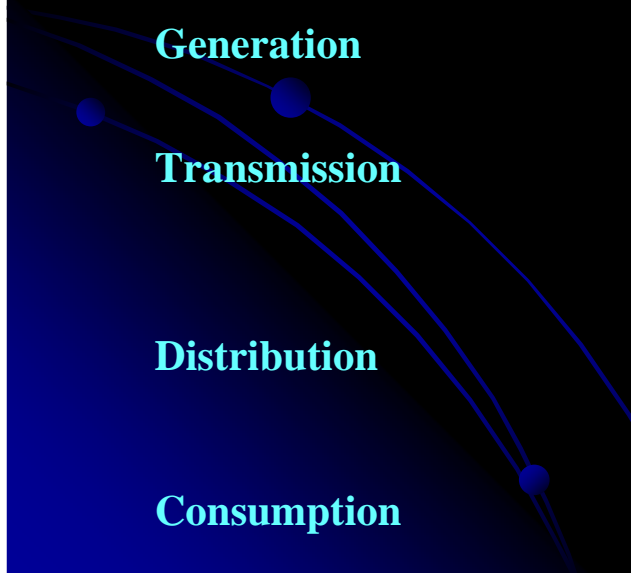
Distribution

Electrical network

Import / Export

Consumption

Consumers



POWER SECTOR OF RA

1.	<i>Installed Capacities</i>		
	<i>ANPP</i>		408 MW (2nd unit)
	Thermal Power Plants		1756 MW
	Hydro Power Plants		956 MW
	Small HPPs		102 MW
	Wind Farm		2,6 MW
2.	<i>Transmission system</i>		
	220 kV	1323 km	14 substations
	110 kV	3169 km	119 substations
3.	<i>Distribution system</i>		
	35 kV	2675 km	278 substations
	6(10) kV	9740 km overhead and 4955 km cable lines	
	0.4 kV	13570 km overhead and 2160 km cable lines	

Currently the energy sector of Armenia is one of the full operational and cost-effective branches of the country's economy. Armenia fully covers energy demand in the internal market and exports electricity to Georgia, as well as successfully performs an electricity exchange with Iran on mutually beneficial basis. The installed capacity of the power system of Armenia is with surplus and is equal to 3107,6 MW, from which the 2420 MW is utilized. During the recent years the maximal load of power system crossed the frontier of 1200MW

Basic Capacity, Generation and Consumption Data		
	2007	2008
Installed capacity of power plants, MW		
Thermal	1756	1756
Nuclear	408	408
Hydro	1058	1074
Total	3222	3238
Yearly generation, billion kWh		
Thermal	1,5	1,8
Nuclear	2,5	2,5
Hydro	1,8	1,8
Total	5,8	6,1
Annual consumption, billion kWh		
	5,5	5,73
Imports, billion kWh		
		0.34
Exports, billion kWh		
		0.48

Main actors :

Transmission system operator
“The Electric Power System Operator” CJSC plays the role of a transmission system operator.

Other actors:

CSC “Armenian electric networks” CJSC – distribution company, generating entities including “Armenian NPP” CJSC, “Hrazdan TPP” CJSC, “Yerevan TPP” CJSC, “Vorotan Cascade of HPPs” CJSC, “International energy corporation” CJSC, “HV electric network” CJSC – transmission company, “The Settlement Center” CJSC.

Main generators

<i>No.</i>	<i>Electric power plants</i>	<i>Installed capacity (MW)</i>
<i>Thermal power plants</i>		
1	Hrazdan TPP	1110
2	Yerevan TPP	550
3	Vanadzor TPP	96
<i>Nuclear power plants</i>		
1	Armenian NPP	408
<i>Hydro power plants</i>		
1	Spandarian HPP	76
2	Shamb HPP	171
3	Tatev HPP	158
4	Sevan HPP	34
5	Hrazdan HPP	82
6	Argel HPP	224
7	Arzni HPP	70
8	Kanaker HPP	102
9	Yerevan HPP	44
10	Dzora HPP	26.4

Transmission network and system issues

Status of international interconnections

Existing international transmission lines

Country	Name of substation	Voltage (kV)	Length (km)	Transmission capacity (MVA)
Azerbaijan	Hrazdan HPP – Akstafa	330	108	400
Azerbaijan (Nakhichevan)	Ararat-2 – Babek	220	99.6	250
	Ararat-2 – Norashen	110	98	85
	Agarak – Ordubad	110	30	85
Georgia	Alaverdi – Tbilisi TPP	220	63.4	245
	Alaverdi 2/Lalvar – Sadakhlo	110	26.88	80
	Ashotsk – Ninotsminda	110	35,8	80
	NKR Goris – Shushi	110	58	85
Iran I	Shinuair – Agarak	220	189.2	250
Iran II	Shinuair – Agarak	220	166,92	250
Turkey	Gumri – Kars	220	9.5	340

The following four Pillars are identified in National Energy Strategy:

- development of nuclear energy
- full and sound utilization of renewable energy sources, improving of energy efficiency
- diversification of primary energy resources and import/export routs
- regional integration and cooperation.

The strategic issues for development of nuclear energy in Armenia have been clearly formulated since that moment of adoption of National Security Strategy of RA and in this way on November 2007 the GoA approved the Decommissioning Strategy of ANPP. Presentation of Feasibility Study for the construction of new nuclear unit and Study on assessment of environmental impact conducted by the assistance of USAID was made on 24 September 2008. Within the framework of the mentioned works the study is carrying out by IAEA assistance on the required training for personnel that will be involved in construction and operation of new unit. TOR for seismic exploration of the site was elaborated and submitted to IAEA's approval and international tender for implementation of the mentioned works will be announced soon.

According to “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” it’s foreseen to construct:

- 271 MW combined cycle energy unit of Yerevan TPP – by loan of JBIC in 2011;
- 440 MW Hrazdan-5 unit of Hrazdan TPP – by means of “Gasprom” in 2010;
- small HPPs with nominal total capacity of 260 MW and with total annual production - 600 mln kWh till 2025;
- 140 MW Meghri HPP with annual production about 800 mln kWh till 2014;
- 60 MW Loriberd HPP with annual production about 200 mln kWh till 2015;
- 75 MW Shnogh HPP with annual production about 300 mln kWh till 2015;
- 1200 MW new unit of nuclear plant with annual production about 7,5 bln kWh till 2016
- Armenia-Georgia 400 kV overhead line - by loan of KfW in 2009,
- Iran-Armenia 400 kV overhead line in 2011.

Renewable energy resources in Armenia under the current developments



- Hydro energy
- Wind Energy
- Solar Energy
- Geothermal Energy
- Biomass Energy

4. Renewable Energy

Armenia has significant renewable energy resources, utilization of which will make available to cover 35% of electricity demand in 2025 (not including the potential of geothermal energy, solar energy direct transformations and production of electricity from biogas).

It is foreseen the construction of the following HPPs:

HPP	Information about course of affairs
<p>On Araks River Meghri HPP /about 140 MW capacity and around 800 million kWh annual electricity generation/</p>	<p>The project on construction of hydro power plant is being realized together with Islamic Republic of Iran /IRI/. The Feasibility Study for Meghri HPP is completed. Negotiations are carrying out for clarification of financial schemes for construction of Meghri HPP.</p>
<p>On Debet River Shnogh HPP /about 75 MW capacity and 300 million kWh annual electricity generation/</p>	<p>Technical design, which was done by Armhydroenergyproject Institute in 1966, was updated in 1993. The Ministry of Energy and Natural Resources of the RA is conducted negotiations to arrange elaboration of the Feasibility Study for construction of Shnogh HPP by the assistance of World Bank.</p>
<p>On Dzoraget River Loriberd HPP / about 66 MW capacity – and around 200 million kWh annual electricity generation /</p>	<p>The Feasibility Study was elaborated by Fichtner company within the framework of European Union /TACIS/ 2003-2004 programme. In February 2007 Fichtner company updated the FS. In the result of implemented cost estimation the increase of prices on 15% was registered compared with 2004. In general increase of prices resulted from increase of prices on equipment. The Ministry of Energy and Natural Resources of the RA is conducted negotiations for construction of Loriberd HPP by the assistance of World Bank..</p>

Hydro energy

Existing HPPs in Armenia

- Sevan-Hrazdan HPPs Cascade:
556MW / 2320 million kWh
- Vorotan HPPs Cascade:
404MW / 1157 million kWh
- Dzora HPP:
25MW / 90 million kWh

Small HPPs in Armenia

There are:

- 70 Existing SHPPs
81 MW / 278 million kWh
- 64 SHPPs under the construction
152 MW / 548 million kWh
- 115 foreseen SHPPs
147 MW / 540 million kWh

Wind Energy

The first wind power plant in Armenia and in Caucasus

- **Lori-1 Wind Power Plant**

**2,6 MW /
5 million kWh**



Solar Energy

- The average annual amount of solar energy flow per square meter of horizontal surface is about 1720 kWh/m²
(the average European is 1000 kWh/m²)
- One fourth of the country's territory is endowed with solar energy resources of 1850 kWh/m².

Geothermal Energy

Geothermal energy sources

- Projects under the development:
 - **Jermaghbyur:** 20-25 atmosphere pressure
250°C/2500-3000 meter in depth/25 MW
 - **Gridzor and Qarqar:** geological and geophysical explorations
- Investigation of other perspective sites

Biomass Energy

- Biogas

Solid Waste Landfill Gas Capture and Power Generation CDM Project in Yerevan- 56000 t CO₂ emissions/1,4 MW

- Bioethanol

Project development at the national level:
Bioethanol Production, Potential Utilization and Perspectives in Armenia-7000-14000 t/annually



5. Conclusion

Utilization of some of the above mentioned measures will allow to maintain 30% of renewable electricity production in Armenia, from the total, before 2025. Even more ambitious goal than famous EU 20% before 2020!





Thanks for attention
and
Welcome to ARMENIA