

REPUBLIC OF ARMENIA

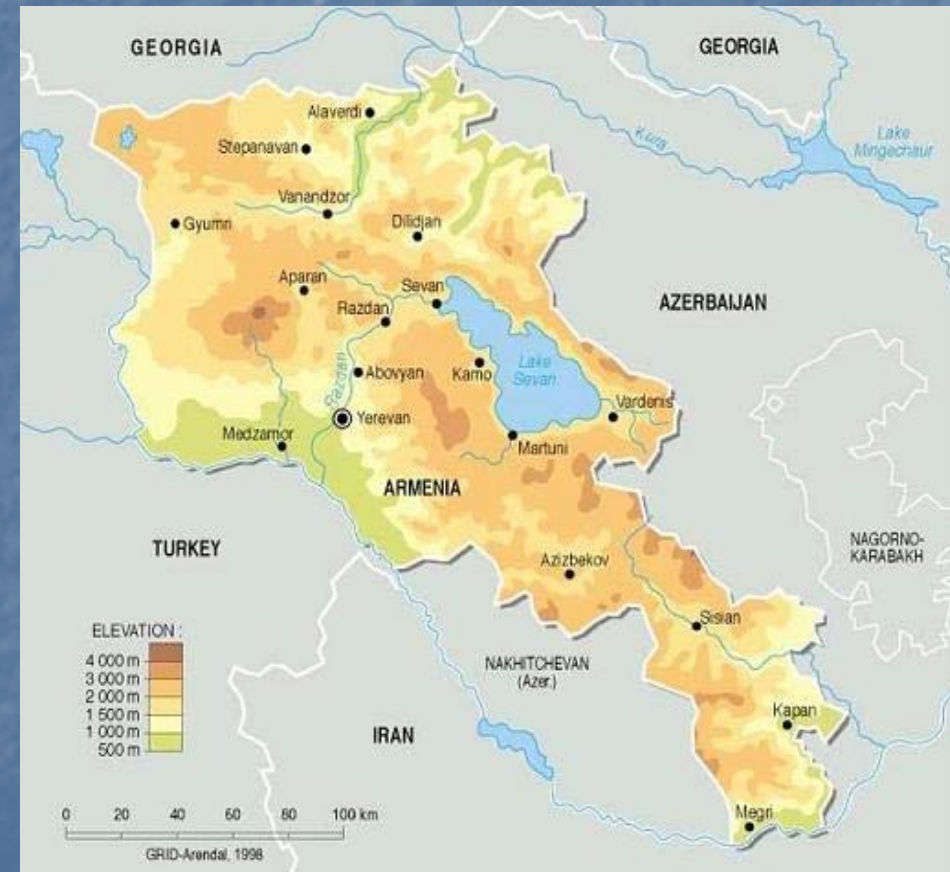


Ministry of Energy and Natural Resources of The Republic of Armenia

**Greets all participants of “Energy Policy 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



Geography

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



1. Armenia in Brief

Country at a Glance:

Official Name:	Republic of Armenia
Capital:	Yerevan
Major Cities:	Gyumri, Vanadzor, Hrazdan,
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 7.2% in average for last 2012 years

GDP - per capita (PPP): \$3269

2. POWER SECTOR OVERVIEW



REVIEW OF THE ENERGY SECTOR

- Energy is the most developed sector in Armenia with qualified specialists
- The Armenian energy sector was and is developing as a regional centre of energy
- We have significant experience in design, construction, operation and maintenance of nuclear, thermal and hydro stations, and of parallel work with integrated energy system

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 of energy

Settling center

Generation

ANPP TPP HPP Renewable

Transmission

High voltages network

Distribution

Electrical network

Import / Export

Consumption

Consumers

Public Services Regulatory Commission

PA

POWER SECTOR OF RA

1. <i>Installed Capacities</i>			
	<i>ANPP</i>		408 MW (2nd unit)
	Thermal Power Plants		2476 MW
	Hydro Power Plants		989 MW
	Small HPPs		218 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 4091 MW, from which the 2520 MW is utilized.

Basic Capacity, Generation and Consumption Data			
		2011	2012
Installed capacity of power plants, MW			
	Thermal	2476	2476
	Nuclear	408	408
	Hydro	1146,4	1207
	Total	4030	4091
Yearly generation, billion kWh			
	Thermal	2.3	3.4
	Nuclear	2,4	2,3
	Hydro	2.5	2.4
	Total	7.2	8.1
Annual consumption, billion kWh			
		7.2	8.1
Imports, billion kWh			
			0.99
Exports, billion kWh			
			1.5

Main generators

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.

<i>No.</i>	<i>Electric power plants</i>	<i>Installed capacity (MW)</i>
<i>Thermal power plants</i>		
1	Hrazdan TPP	1590
2	Yerevan TPP	790
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

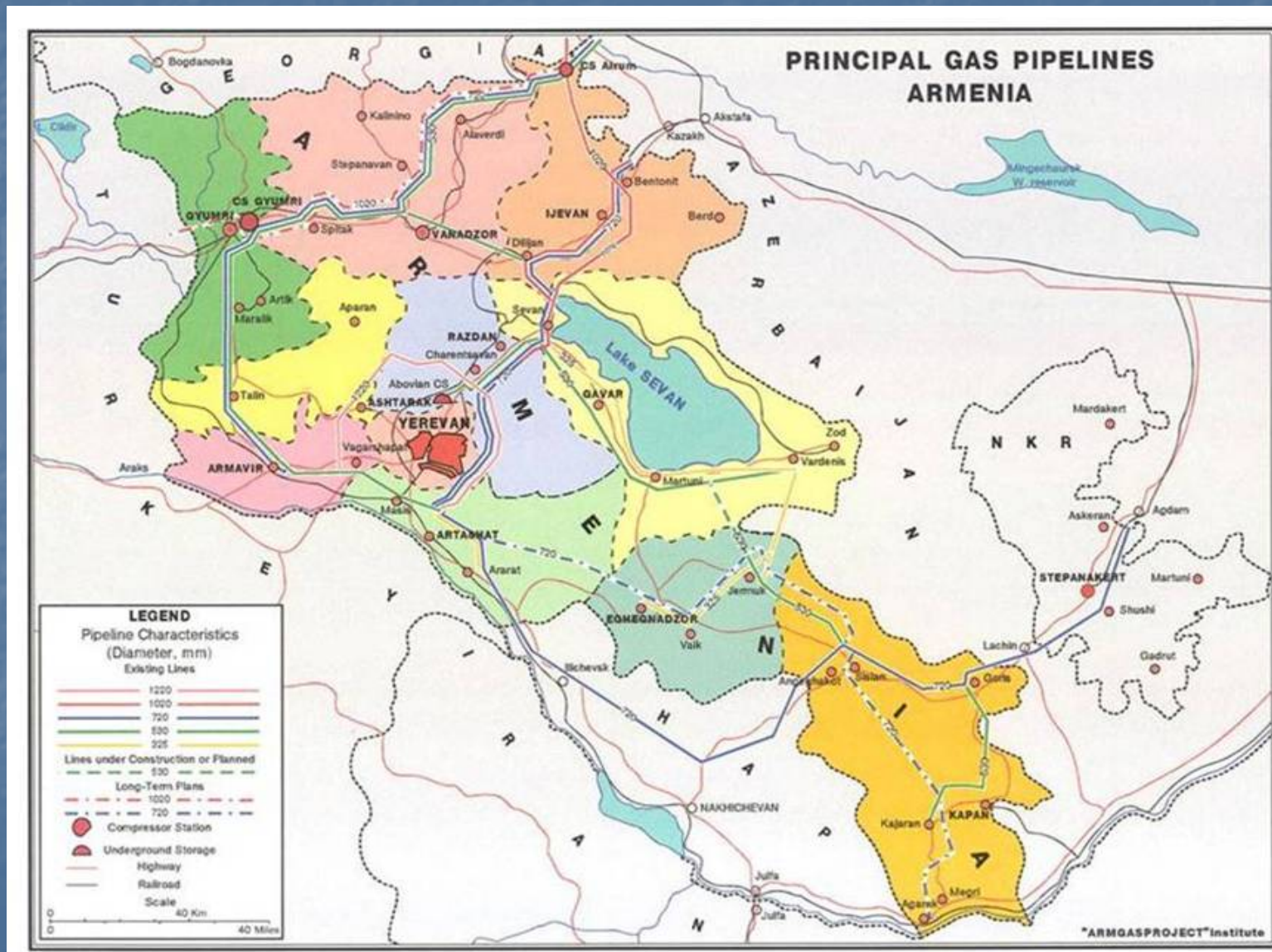
Transmission network and system issues

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

PRINCIPAL GAS PIPELINES IN ARMENIA



3. The Energy Strategy of Armenia aims at the resolution of the following primary problems

- Providing reliable energy supply at low rates to satisfy the fundamental needs of all customers, while enhancing energy conservation, input of energy efficient technologies in all branches of economy;
- Avoiding methods of importing the primary sources that might expose the security and economy of Armenia and which are beyond the control of the Republic of Armenia;
- Ensuring the safe operation of the ANPP in time as its energy can be replaced with new nuclear unit and decommissioning can proceed without unacceptable economic and energy security impacts;
- Ensuring sustainable energy supply, based on the principles of sustainable development and in compliance with the international environmental commitments of the Republic of Armenia;
- Creation of an electric energy system that is export oriented and generates high added value.

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; /was constructed/
- 440 MW Hrazdan-5 unit of Hrazdan TPP – by means of "Gasprom" in 2010; /was constructed/
- 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 2015; /is being constructed/
- 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;
- 1060 MW new unit of nuclear plant with annual production about 7,5 bln kWh till 2020
- Armenia-Georgia 400 kV overhead line 2014, /is being constructed/
- Iran-Armenia 400 kV overhead line in 2014.

Yerevan Combined Cycle Co-Generation Power Plant

SSEO@GSCONST.CO.KR



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 routes
- regional integration and cooperation.

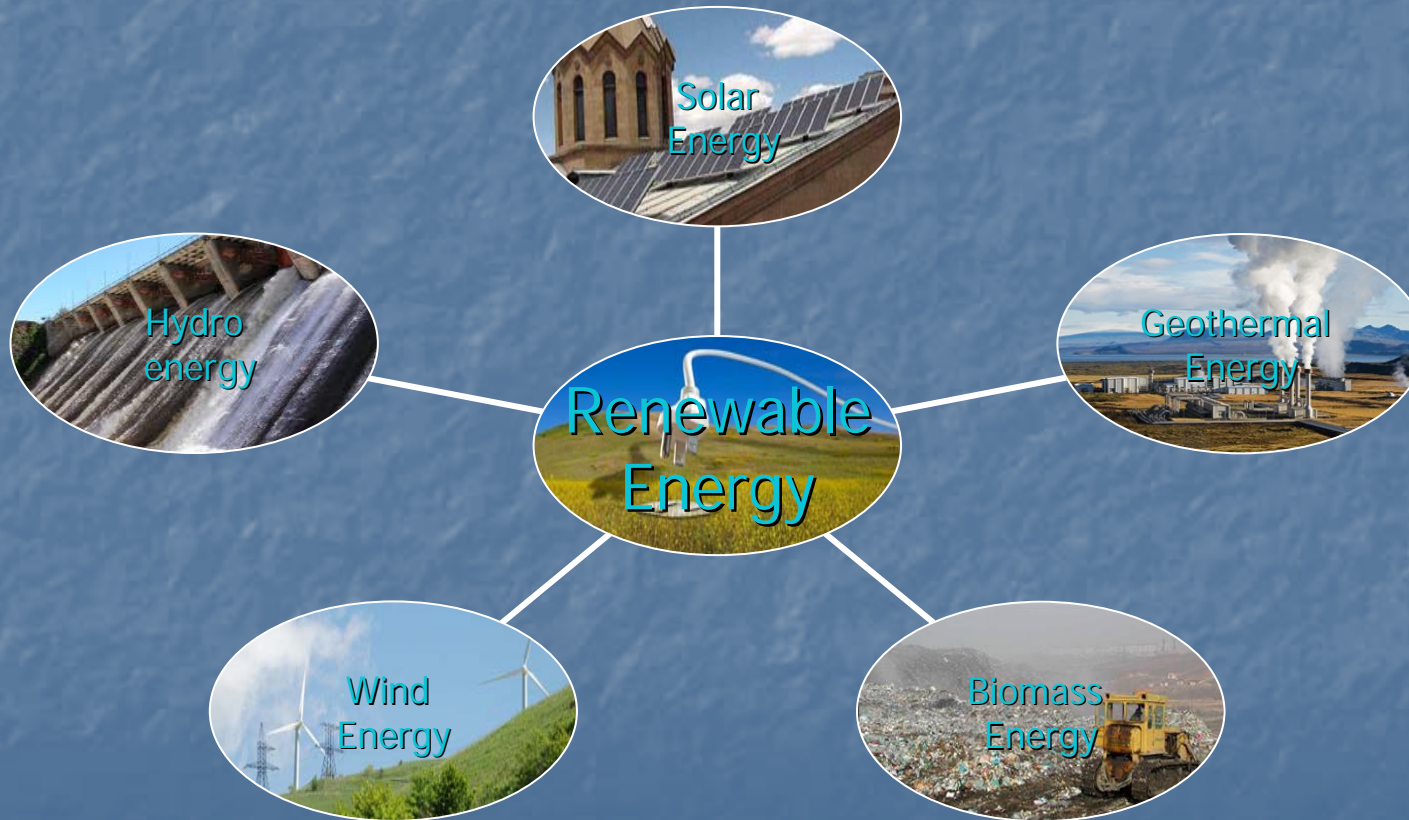
Renewable Energy

Armenia has significant renewable energy resources, utilization of which will make available to cover 30% 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>

Renewable energy resources in Armenia under the current developments





Hydro energy

Existing HPPs in Armenia

- Sevan-Hrazdan HPPs Cascade:
559MW / 2320 million kWh
- Vorotan HPPs Cascade:
404MW / 1157 million kWh
- Dzora HPP:
26MW / 90 million kWh



Small HPPs in Armenia

There are:

- 137 Existing SHPPs
218 MW / 650 million kWh
- 77 SHPPs under the construction
164 MW / 585 million kWh



Wind Energy

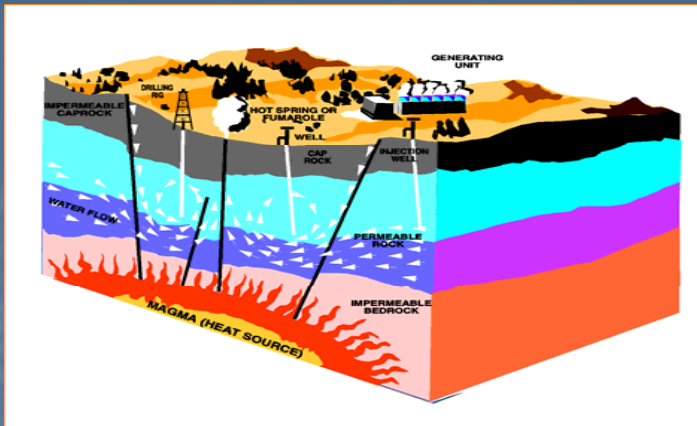
*The first wind power plant in
Armenia and in Caucasus*

- 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 250oC/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.



**Thanks for attention
and
Welcome to ARMENIA**