



Seminar on Small Hydro in Armenia

Armenia, Yerevan, Hotel „BASS”
13 September 2005



Seminar Proceedings

**Within the framework of the project SHYCA-
“Promotion of Small Hydro Power
Retrofittings and implementation in the
Caucasus and Carpathian Region”**

Organisers:

Scientific Institute of Energy
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375025 Yerevan
Armenia

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Germany



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6th Framework Programme, INCO (International Cooperation).*

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SHYCA Consortium

PROJECT COORDINATOR

WIP Renewable Energies - Germany

PROJECT PARTNERS

Azerbaijan Research Institute of Energetic and
Energy Design (AzRIED) – Azerbaijan

AzRos Montage Ltd. – Azerbaijan

Institute of Energy – Armenia

Georgian Research Institute of power engineering
And Power Structures (GRIPEPS) - Georgia

Autoenergo Ltd. – Georgia

Solar Energy Centre (SEC) – Ukraine

European Small Hydropower
Association (ESHA) - Europe

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Summary of the Seminar

1. Introduction

The Seminar on Small Hydro in Armenia was the second of three seminars planned in the framework of SHYCA. The last one was in Tbilisi, Georgia in May 2005, and the next one will take place in Odessa, Ukraine in April 2006.

Main goal of the Seminar was to clarify the situation in the field of small hydro in Armenia; compare it with the situation in Georgia, Azerbaijan and Ukraine; and find out which financing opportunities are there for small hydro in Armenia.

The Participants of the seminar were: representatives from the Ministry of Energy, the Regulatory Commission, SHYCA Partners, energy experts and representatives of other key organizations.

2. Opening

In the opening session L. Aghekyan from the CJSC "SRI of Energy" welcomed the participants and presented his speech about the "Policies of the State in Renewable Energy" after him European partners of SHYCA made their presentations. Maurice Pigaht from WIP – Renewable Energies (SHYCA project manager) presented the project, its objectives and strategies. Many participants expressed the will to cooperate with SHYCA.



3. Small Hydro in Georgia, Armenia and Ukraine

V. Dundua from GRIPEPS Autoenergo, presented the execution of SHYCA Project in Georgia. He resumed the situation in Georgia. He reported that about 30 small HPSs with total capacity of around 50000 kilowatt were operating in the early 60s. He also mentioned the technical potential of small rivers in Georgia which exceeds 8 TWh per year.

S. Artemenko from SEC, presented the execution of SHYCA Project in Ukraine. He reported that 7.9 % of electricity produced in Ukraine is generated by hydropower stations. Overall hydropower capability of small rivers in Ukraine is 3.7 TWh per year, total economical potential of small rivers in Carpathian region is 1901 mln kWh per year. He mentioned that hydropower capability of large rivers in Ukraine is about 17 TWh/a, and major "energy" rivers are Dnieper, Dniester, Yuzhny Bug, Tisa.

A. Kocharyan from Ministry of Energy RA, L. Yeghiazaryan from CJSC "SRI of Energy", L. Aghekyan from CJSC "SRI of Energy" and T. Gnuni from CJSC "SRI of Energy" introduced their presentations about Small Hydro Power in Armenia.

L. Yeghiazaryan spoke about contemporary scientific and technical problems in Energy Sector of the Republic of Armenia.

L. Aghekyan reported about the situation in Armenia. He mentioned that 18 new small HPPs were constructed during the last 5 years and licenses for 19 new ones were issued, mostly due to well coordinated governmental support. His presentation was about Agarak, Meghri and Shaci HPPs. He showed in description the graphs of productivity of above mentioned HPPs for April and July months.



T. Gnuni showed his presentation about socio-economic and legal conditions of Armenia related to small HPP development. He showed the graphs of industrial and agricultural output by marzes (province) in 2004, and other graphs concerned above mentioned theme. A. Grigoryan, R. Kharazyan and R. Tsovyan from Regulatory Commission of Public Services and A. Balabanyan from World Bank Yerevan Office, T. Davtyan and A. Marjanyan from PIU "EnergolInvest" and G. Gevorkyan from "Cascade -Credit" introduced their presentations about legal procedures and financing. A. Marjanyan made a detailed and very

informative presentation, about WB Implemented GEF Grant Project on preparation of renewal resource revolving Fund in Armenia.

B. Arzumanyan from PA Consulting Group, A. Grigoryan from PO "Hydrotechnik" and A. Marjanyan introduced their presentations about Small Hydro project development.

Participants List

AGHEKYAN L.	Deputy Director	CJSC " Scientific research Institute of Energy"
YEGHIAZARYAN L.	General Director	CJSC " Scientific research Institute of Energy"
GNUNI T.	Deputy Director	CJSC " Scientific research Institute of Energy"
SUREN S.	Manager of project "OPET"	CJSC " Scientific research Institute of Energy"
GRIGORYAN A.	Director	"Hydrotechnic" PO
VARDANYAN L.	Chief of Department	Ministry of Energy
KOCHARYAN A.	Chief of Department of Renewable Energy	Ministry of Energy
KHARAZYAN R.	Adviser of Regulatory Commission	Regulatory Commission
TSOVYAN R.	Adviser of Regulatory Commission	Regulatory Commission
ARZUMANYAN A.	Deputy Director	PA Consulting Group
MARJANYAN A.	Specialist	"EnergyInvest"
PAYTYAN G.	Director	"Hydroenergy"
AGHEKYAN V.	Chief of Yerevan and Kotayk HPPs	"Hydroenergy"
PIGAHT M.	Senior Specialist	WIP Germany
KEVIN R.	Manager of "Vekst Foundation	"Vekst Foundation" Norway
ARTEMENKO S.	Manager of "Solar" Organization	SEC Ukraine
DUNDUA V.	Specialist of Project	GRIPEPS Georgia
MIZANDARI I.	Specialist of Project	"Avtoenergo" Georgia
SANAHYAN A.	General Director	"Hayhydroenerganakhagic"

AGENDA
of the Second International Workshop of SHYCA Project
13th September 2005, Yerevan

Hours	Reporter	Topic	Organization
10.00	L. Aghekyan	Key Address	CJSC "Scientific Research Institute of Energy"
10.20	M. Pigaht	"Promotion of Small Hydro Power Retrofitting and Implementation in the Caucasus"-Introducing the SHYCA Project.	WIP -KG
10.35	V. Dundua	Execution of SHYCA Project (Georgia)	GRIPEPS Georgia
11.00	S. Artemenko	Execution of SHYCA Project (Ukraine)	SEC Ukraine
11.20	A. Kocharyan	"The status of Small Hydropower in Armenia"	Ministry of Energy RA
11.40	Break	Coffee Break	
12.00	L.Yeghiazaryan	"Perspectives of Development and Urgent Scientific Technical Problems of Armenian Power System.	CJSC "Scientific Research Institute of Energy"
12.20	L.Aghekyan	"Report for Fulfilling the SHYCA Project"	CJSC "Scientific Research Institute of Energy"
12.40	T. Gnuni	"Social-Economic and Juridical conditions in the Small HPP Sector in Armenia"	CJSC "Scientific Research Institute of Energy"
13.00	Break	lunch	
14.00	A. Grigoryan R. Kharazyan	"The tariffs for Renewable Energy"	Regulatory Commission of Public Service
14.20	R. Tsovyan	"Peculiarities of Licensing Procedure"	Regulatory Commission of Public Service
14.40		Discussion	
15.15	A. Marjanyan	"The Problems of Financing and of Small Hydropower in RA"	PIU "EnergoInvest"
15.45	Break	Coffee Break	
16.05	A. Arzumanyan	"Perspectives of Development of Mycrohydropower in Armenia"	PA Consulting Group"
16.20	A. Grigoryan	"The Small Hydropower Infrastructure in Armenia.	PO "Hydrotechnik"
16.30	A. Marjanyan	"The Accomplishment of WB Renewable Energy project in Armenia	PIU "EnergoInvest"
16.45		Discussions and Summary	
17.00		Workshop Closure	

Abstracts of Presentations

SHPs in Ukraine

Dr. Sergey Artemenko
Solar Energy Center, Ukraine

Basic Information About Ukraine

Population of Ukraine is 47, 425 336,

Total area: 603, 700 sq.km

GDP growth rate: 12%

Industrial production growth: 15.8%

Electricity

- production: 180 billion kWh

- consumption: 132 billion kWh

Of all electricity produced in Ukraine 48.6% is Fossil Fuel, 43.5% is Nuclear and 7.9% is Hydro. Hydropower capability of large rivers in Ukraine is about 17 TWh/a, economic potential of small rivers is 1357 mln kWh/a, and technical potential of small rivers is 2991 mln kWh/a. For Carpathian Regions, there are 7 Hydro Plants, from which 4 are retrofitting, with technical potential 2991 mln kWh and with economic potential 1357 mln kWh in Zakarpats'ka Region, 1 Hydro Plant with technical potential 263 mln kWh and economic potential 128 mln kWh, in Ivano-Frankivska Region, 6 Hydro Plants, which are all retrofitting, with technical potential 1197 mln kWh, and economic potential 544 mln kWh, in Lvivska Region, and 5 Hydro Plants for retrofitting, with technical potential 583 mln kWh, and economic potential 265 mln kWh in Chernivetska Region.

Small Hydro Plants electricity production is about 185 mln kWh, that is a 10% of consumed Electricity .

SHPs in Armenia

Dr. Levon Aghekyan
Deputy General Director
CJSC "Scientific Research Institute of Energy"

Armenia has very rich hydro potential. The main rivers in Armenia is Araks, Hrazdan, Kasakh, Debed and others. There are many HPPs near that rivers. The privatization process in the energy sector in Armenia has begun in 1993. On February 7, 1993, by the initiative of Government of Armenia the list of entities to be privatized during 1993-1994, in the result of which, in 1997 the following 13 small HPPs out of 25 were privatized by International Competitive Building.

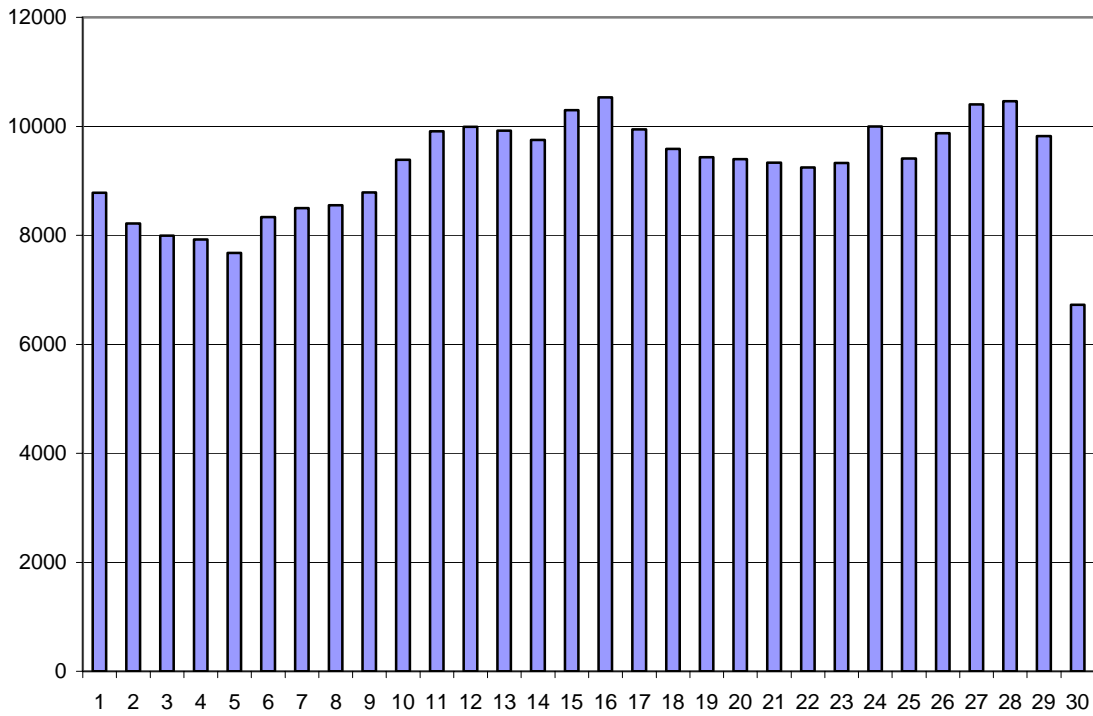
- | | | |
|----------------|-----------------|-----------------|
| 1. Areni HPP | 6. Meghri HPP | 11. Armavir HPP |
| 2. Azatek HPP | 7. Gyumri HPP | 12. Agarak HPP |
| 3. Ijevan HPP | 8. Sisian HPP | 13. Jermuk HPP |
| 4. Airum HPP | 9. Vokhji2 HPP | |
| 5. Martuni HPP | 10. Vokhji3 HPP | |

During the last months it was prepared and the corresponding Resolutions of the GOA were established on the privatization of several companies of the energy sector and their privatization is in process. Some of that companies are:

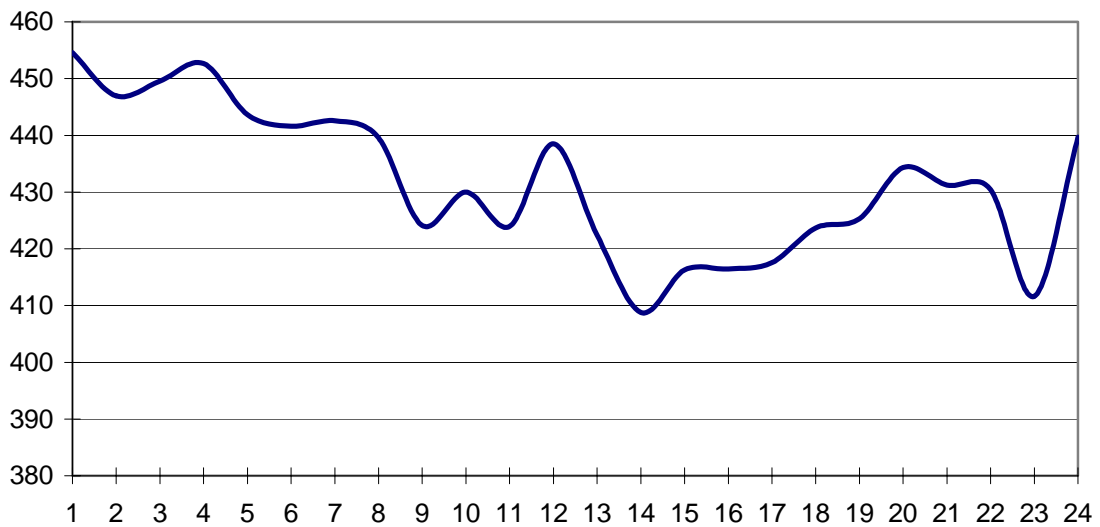
- | | | | |
|----------------|-----|-------------|-----|
| 1. Talin | HPP | 3. Zovashen | HPP |
| 2. Eghegnadzor | HPP | 4. Dzora | HPP |

Here is the graphs of productivity of Agarak small HPP for April and July months in description. April, as top productive month in the year, and July as most unproductive month in the year.

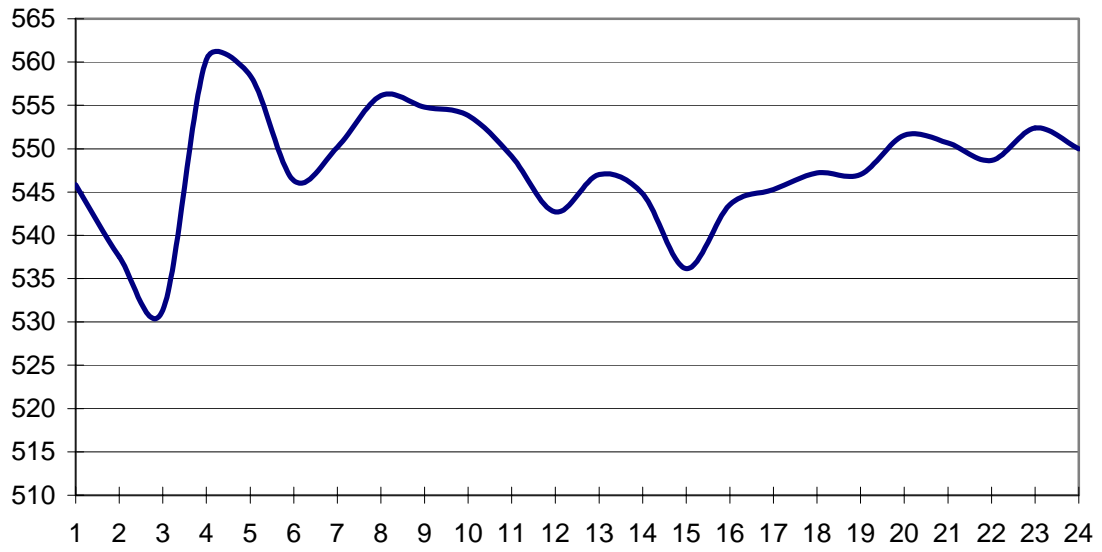
AGARAK HPP (April 2005)



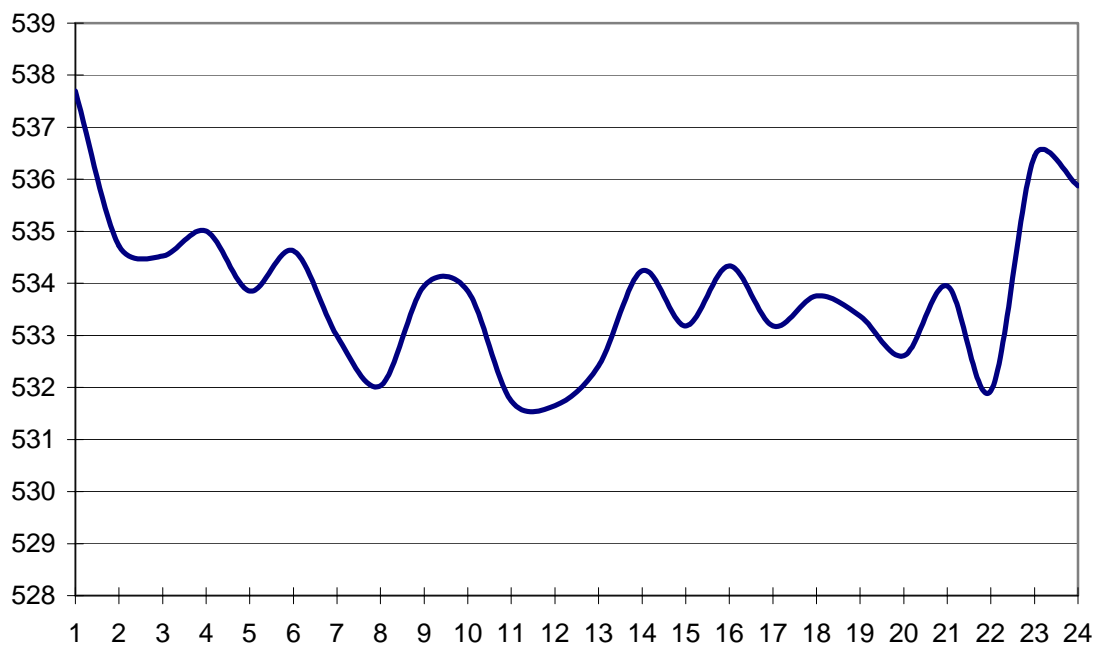
AGARAK HPP 05.04.05



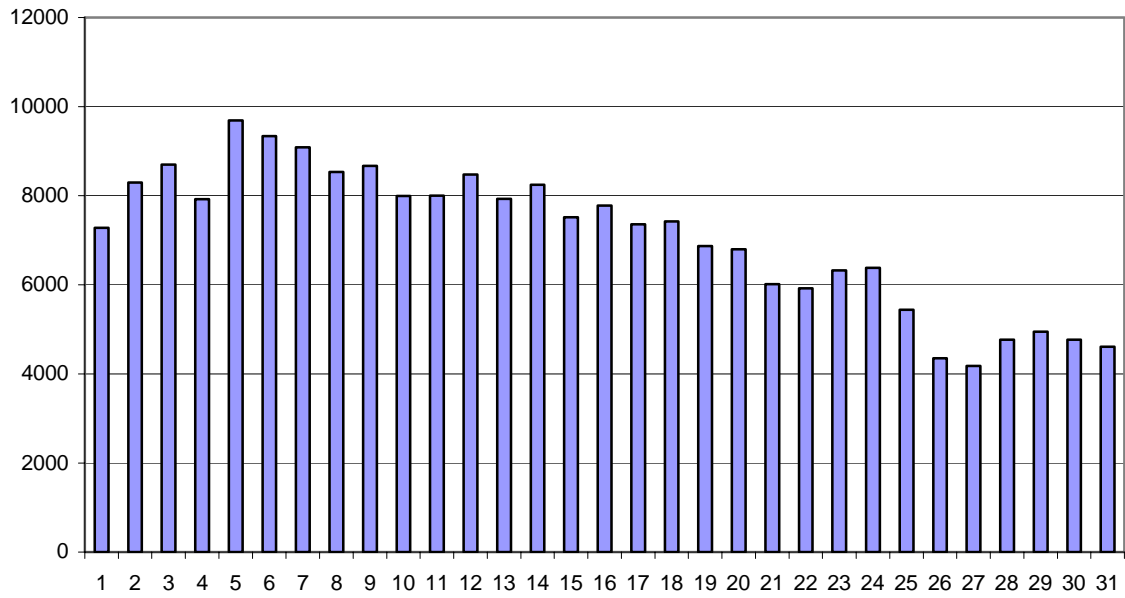
AGARAK HPP 16.04.05



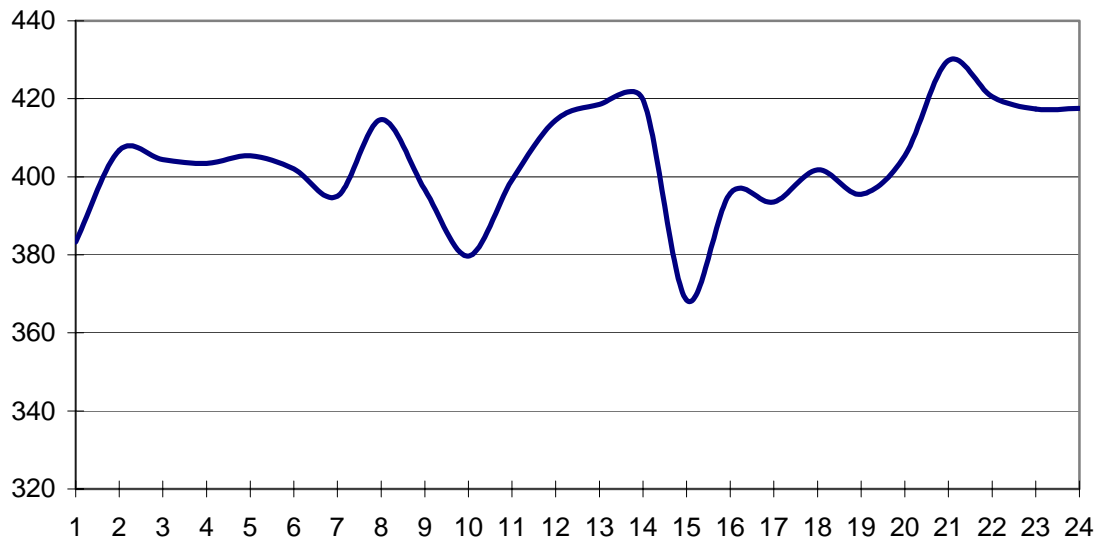
AGARAK HPP 30.04.05



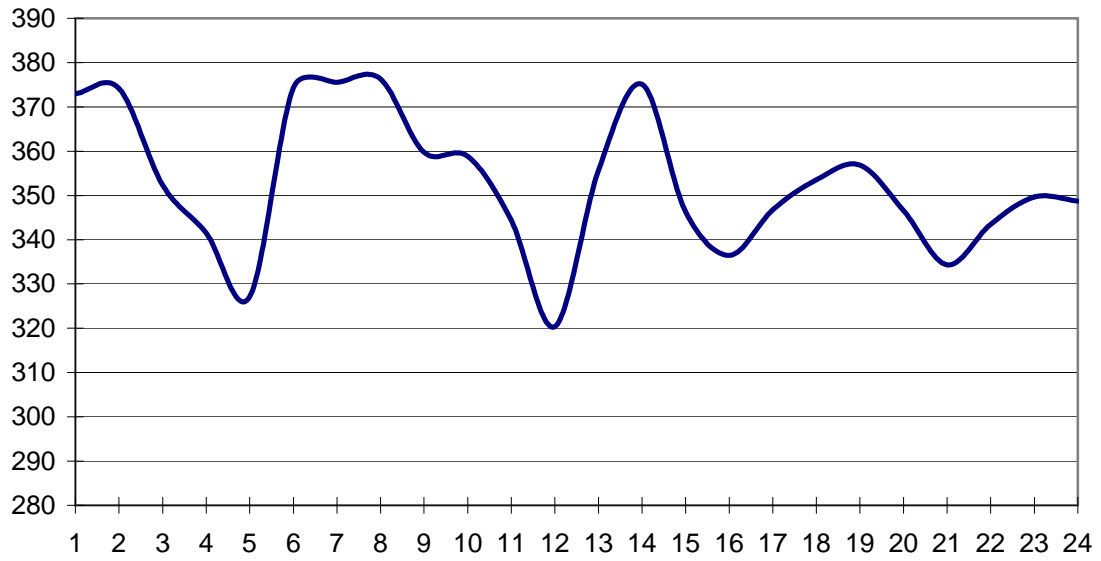
AGARAK HPP (July 2005)



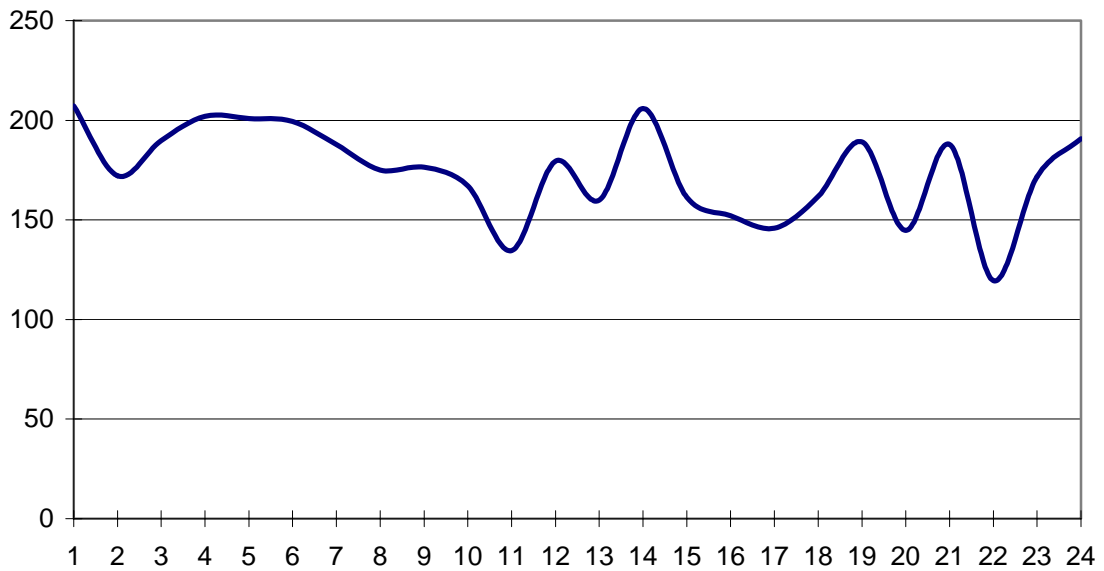
AGARAK HPP 05.07.05



AGARAK HPP 12.07.05



AGARAK HPP 27.07.05



PRESENT SITUATION IN SMALL HYDRO SECTOR IN GEORGIA

Victor Dundua
GRIPEPS

Hydropower always was a very important source of energy for Georgia. Its development started at the end of the 19th century and ever since hydropower generated a big part of whole energy generation of our country. Last fifteen years were very difficult for the country and for hydropower generation, but nowadays situation is slowly getting better. Let us briefly discuss the main problems and main positive factors for the Small Hydro. Main barriers for the development of Small Hydro in Georgia are the economical ones. Selling tariffs for generated electricity are low – not more than 0.027 USD for the kWh, these tariffs are monopolistically set by the electricity wholesale market. The additional problem is a bad payment from the consumers, only 40 to 60% of the consumer their fees, sometimes even lower. There is no financial assistance from the State; moreover, the thermal power plants have a higher electricity selling tariff than the hydropower plants – up to 0.040 USD for the kWh. At the moment there is no possibility of getting a credit with the payback period and the interest rate which would be suitable for the Small Hydro project.

All these problems seriously slow down the development of Small Hydro, but there are some new initiatives which give us hopes of better days in the future. One of the important projects which are being implemented is: “Georgia – Promoting the Use of Renewable Energy Resources for Local Energy Supply”. This project was started in cooperation of Georgian government, United Nation Development Program and Global Environmental Facility, its main objective is to remove the key barriers to the increased utilization of renewable energy. A revolving fund is being established in the framework of this project, which will give out credits to the Small Hydro developers. The payback period for these credits will be up to 8 years with the interest rate of about 8% per year. There are some discussions about wholesale market giving Small Hydropower plants possibility to directly contract the distributors and set the electricity selling tariff themselves. This would give the hydropower plant owners and developers the possibility to be more flexible and realize truly economically feasible projects in Small Hydro. Also other possibilities of creating better conditions for Small Hydro are in the discussion, we hope that these initiatives will be implemented quickly.

At the end it can be sad that Small Hydro is still in the crisis in Georgia, but there are some changes to be seen. The government is clearly showing that energy supply is one of the priorities of the country at the moment. Positive changes are less intensive than we would like them to be, but anyway, after fifteen years of stagnation and degradation it is pleasant to see that Small Hydro is reviving, even if it is a slow revival. In these conditions it is quite possible to make some good pilot projects in the framework of SHYCA. The situation is changing and this opens new possibilities that should be explored.

Presentation of SHYCA

Maurice Pigaht
 WIP Renewable Energies

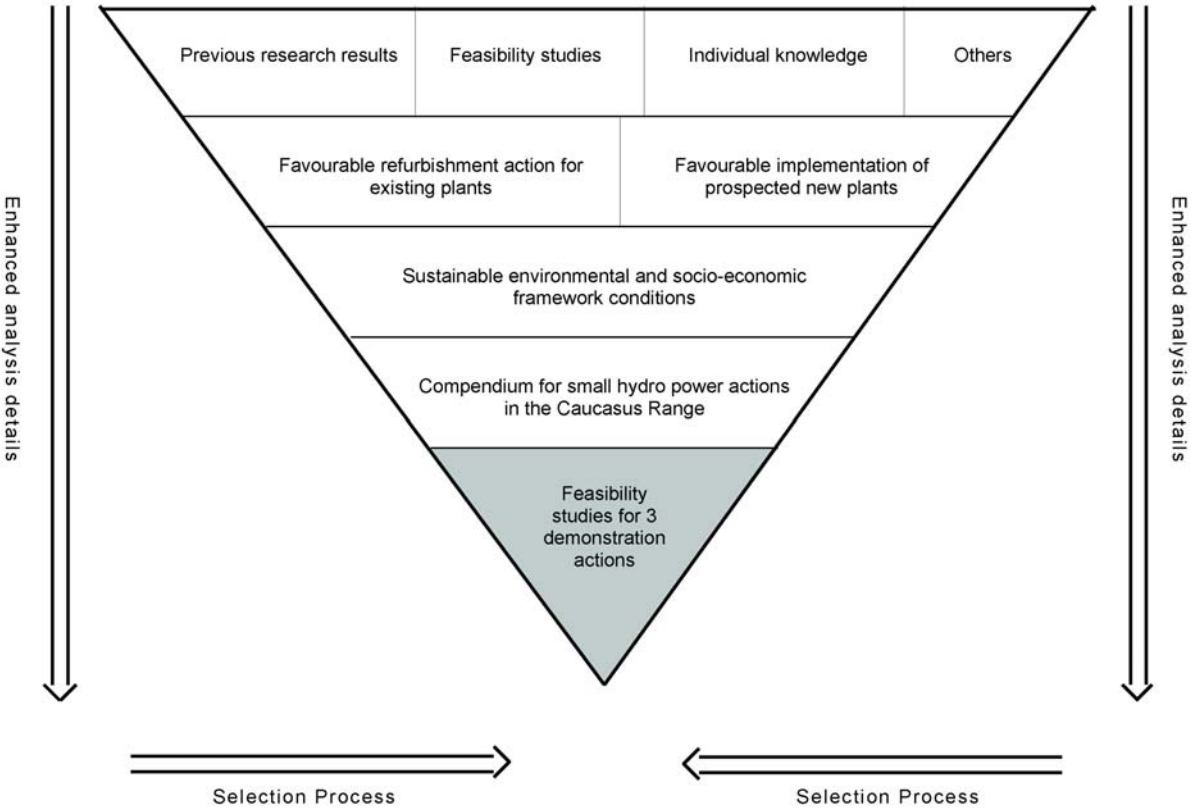
Structure of presentation includes 3 points :

- . SHYCA Background
- . The SHYCA Project
- . Small Hydro situation in Europe

The SHYCA Project

The exploitation of the vast small hydro potential in the NIS offers enormous economic, social and environmental benefits. Consequently, small hydropower generation has a long tradition in these countries. Due to neglect in favour of a more centralised energy supply during the Soviet period, one third of existing small hydro plants are now out of operation. The project, “SHYCA”, aims to revive the existing infrastructure and know-how for small-hydro energy generation in NIS. The Caucasus and Carpathian region are ideal starting locations, with a high potential for small hydro and severe electricity shortages. The revival of the small hydro sector has already begun and urgently requires external support.

SHYCA will perform a complete technical and socio-economic assessment of small hydro retrofitting and construction using extensive existing but dispersed data. The consortium includes strong and competent players in Georgia, Armenia, Azerbaijan and Ukraine. These countries have a potential for new hydro projects and retrofitting of over,



who have detailed knowledge on the existing and planned small hydro capacity in these countries. SHYCA will systemise and update this existing data. Cost effective plans for retrofitting and for constructing new plants will be formulated. In parallel a comprehensive analysis of socio-economic and political framework conditions will be performed as well as an extensive stakeholder analysis with emphasis on experienced NIS manufacturers and

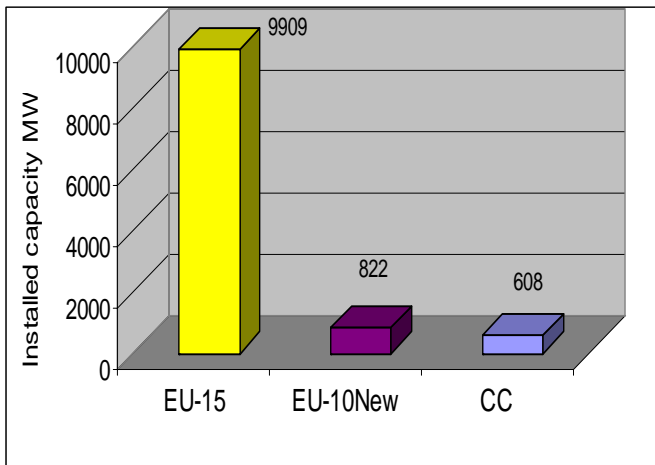
key European actors.

A Compendium for Small Hydro Power Action including all relevant technical and socio-economic data and including 3 feasibility studies will be compiled, and used as a tool for involving EU actors in small hydro actions in the region. This compendium will also be an important basis document to support political and economic decision-makers. A broad dissemination and exploitation of project results throughout NIS will be ensured with a broad PR campaign in Russian and English.

Through this carefully planned action, the Caucasus and Carpathian regions will serve as a platform to re-launch the small hydro sector in the entire NIS.

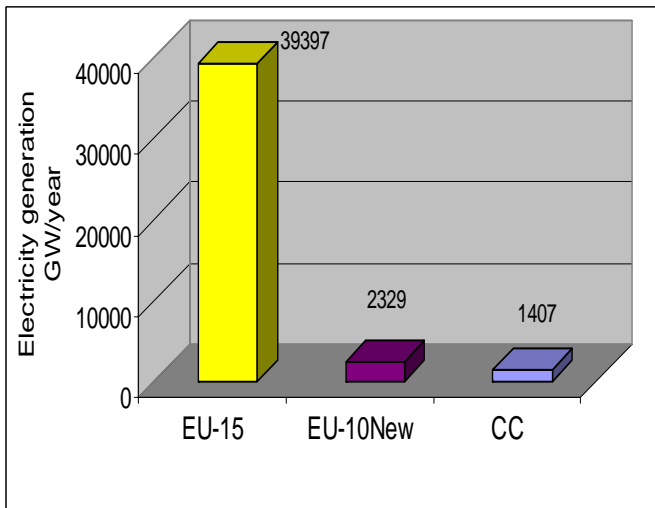
Small Hydro in Europe

Installed Capacity (MW)



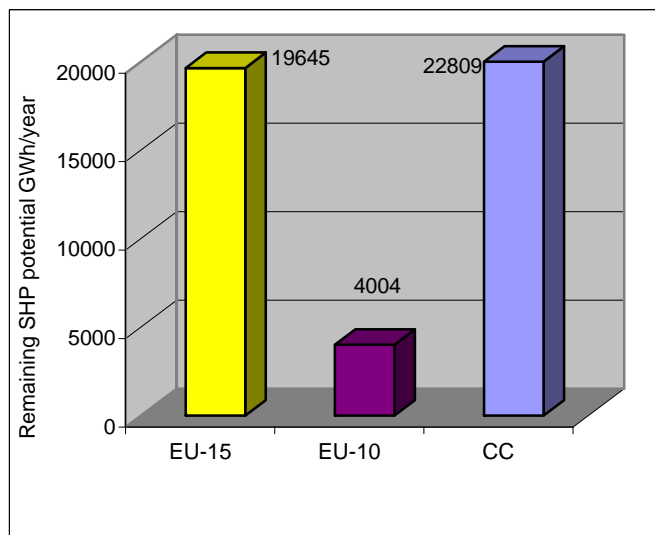
The total installed capacity of SHP plants in New Member States and CC is at least 10 times smaller than in the former EU-15

Electricity Generation (GWh)



- . Production is nearly 15 times smaller in the EU 10 and 30 times smaller in the CC
- . The exploitation of each MW installed capacity is significantly larger in the EU-15-this impact on plant profitability

Remaining SHP Potential



- . EU -15 SHP expansion by 50% is feasible
- . EU -10 and CC potential is 26 TWh/year
- . The majority of this potential (roughly 19300 GWh/year) is located in Turkey

Full Presentations

World Bank Project on Renewal Resource Revolving Fund in Armenia

Tigran Davtyan

ENERGYINVEST PIO State Institution, Director
27-28 June 2005, Yerevan, Armenia

T. Davtyan

1

1. Project development

objective & components

- The project objective is to increase the privately owned and operated power generation utilizing renewable energy (mainly hydro and wind power plants).
- Project components
 - A. Technical assistance to remove barriers and support project implementation (US \$3million from the GEF)
 - B. Financing of investments (indicative amount: US \$21million)

T. Davtyan

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2. Project development

preparation phase

- Preparation phase has already commenced with support from GEF (\$250,000 PDF-B grant) and USAID.
- Key activities include
 - support to the establishment and initial capacity building of the Fund;
 - Technical and financial feasibility assessment of an initial portfolio of bankable projects
 - Identification and removing barriers for REN development.

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3. Some Barriers Identified

- Relatively high capital outlay and project preparation costs
- Lack of interest by international investors for small projects
- Limited access to long-term finance due to underdeveloped capital market
- Management capacity and small size of banking sector
- Unfamiliar risk profile of borrowers and perception of high risk
- Lack of experience of project sponsors, local financial intermediaries with renewable projects and weak engineering and consulting industry that can assist in developing small renewable energy projects
- Legal and regulatory barriers

T. Davtyan

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4. PROJECT DESCRIPTION:

Lending instrument

- The IDA credit in the amount of US \$5 million is designed as a specific investment loan that will be on-lent from the Ministry of Energy through the Fund to project developers.
- GEF will provide a grant of US\$ 3 million in co-financing to cover TA components of the project.
- In addition, EBRD will provide funds to co-finance the on-lending activities.

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5. Technical assistance to remove barriers and support project implementation

- Improvement of legal and regulatory framework and capacity building for state agencies
- Support in facilitating investments in renewable sub-projects
- Mechanisms to leverage additional financing
- Project implementation and monitoring

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6. Financing of investments

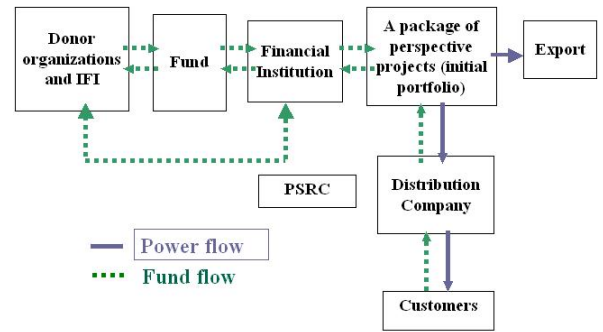
indicative amount: US \$21million

- US \$5million from the IDA loan,
- US \$7million from the EBRD,
- US \$3million from FI
- US \$6million from project

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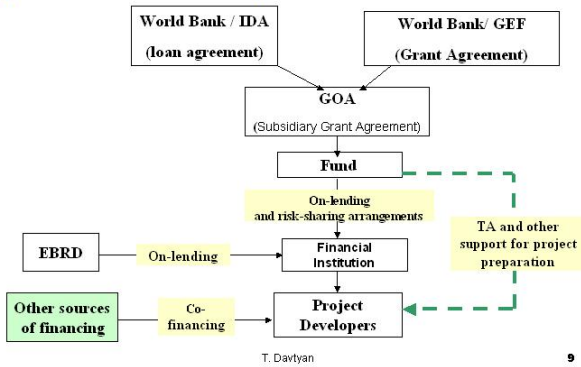
7. Relationship Between Fund and Other Entities



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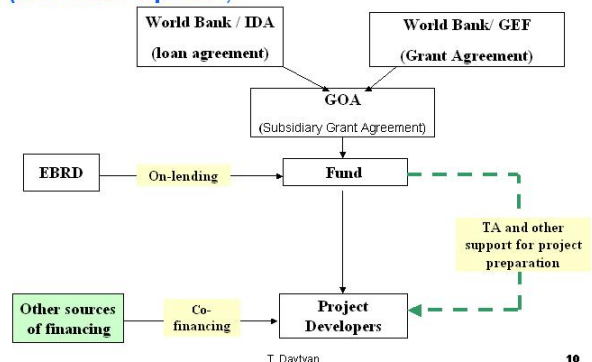
8. Project Implementation (Base Case Scenario)



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9

9. Project Implementation (Fall Back Option)



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SHPs in the Ukraine

Yerevan, 13 September 2005

SHYCA Seminar on Small Hydro Project Development

Solar Energy Centre, Odessa (Ukraine)
Dr. Sergey Artemenko

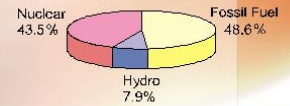


Basic Socio – Economic Factors (est. 2005)

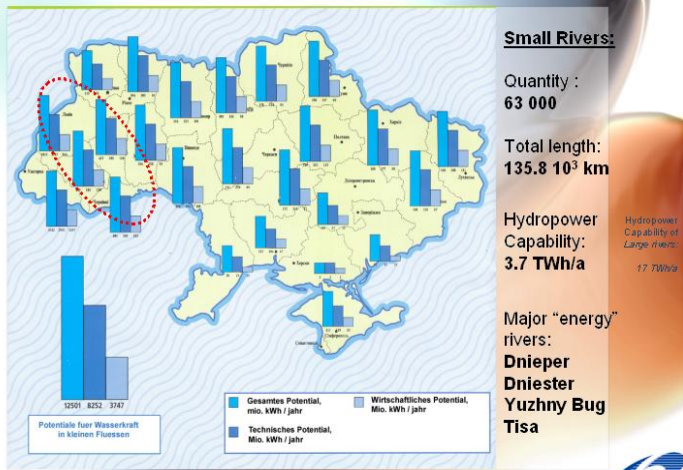
- Population 47 425 336
– Median age: 38.22 years
- Total area: 603 700 sq. km
- GDP growth rate: 8 %



- Electricity
 - production: 180 billion kWh
 - consumption: 132 billion kWh
- Electricity production by source



Small Hydro potential in the Ukraine (est. 2001)



Ref. Incl. Renewable energy 2001-2004. Mkhitarian 2001

Small Hydro potential in Carpathian regions

Zakarpattia



Potential SH resources – 4532 mln kWh/a

- Small rivers:
- Chorna Tisa (22.84 MW)
 - Kosivska (16 MW)
 - Bila Tisa (15.54 MW)
 - Brusturianska (slightly more 10 MW)
 - Liuta (slightly more 10 MW)
 - Mokrianka (slightly more 10 MW)
 - Mala Moshurka (slightly more 10 MW)
 - Vicha (slightly more 10 MW)
 - Serednia (slightly more 10 MW)

Small rivers

Economic potential : 1357 mln kWh/a
Technical potential: 2991 mln kWh/a

Small Hydro plants (Zakarpattiaoblenergo):
Tereble-Ritscka (27 MW)
Onokivs'ka (2.65 MW) ~ 50 %
Ughgorodska (1.94 MW) ~ 50 %

Total SHP Electricity production:
185 mln. kWh
10 % of consumed electricity

Need: 270 – 290 MW

Zelena energetyka, 2003

Small Hydro "state-of-the-art". Regional overview

Region	SH in use			SH for Retrofitting			Technical potential, Min kWh	Economic potential, Min kWh
	Qty, incl. microSH	Installed capacity, MW	Electricity production, Min. kWh	Qty, incl. microSH	Planned Capacity, MW	Electricity production, Min. kWh		
CARPATHIAN Regions								
Zakarpats'ka	3	31.55	110.0 – 143.0	4	0.56	2.0	2991	1357
Ivano-Frankivska	1	2.5	2.2 – 2.5	-	-	-	263	128
Lvivska	-	-	-	6	1.44	4.9	1197	544
Chernivetska	-	-	-	5	1.25	4.4	583	265

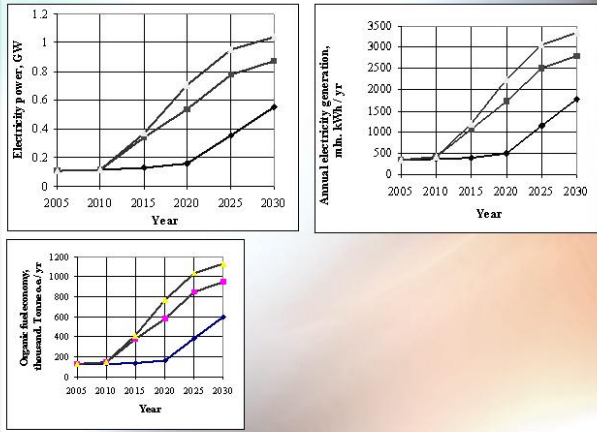


Small Hydro Plants. "The state-of-the-art"

	Operational	For possible retrofitting	Technical Potential, Min kWh	Economic Potential, Min kWh
SH plants :	70 (7)	97		
Installed capacity, MW:	105.24 / 98.39	19.92	8252	3747
Electricity production, Mln kWh:	273.5 – 391.8	95.6		



Scenarios of small hydro development in the Ukraine (2005 - 2030)



SHP strategy of the Ukraine

№	Item	Units	Scenario	Years						Total
				2005	2006-2010	2011-2015	2016-2020	2021-2025	2026-2030	
1	Specific capital investment for reconstruction and refurbishment of dormant SHP	kEuro / kW	-	1.6 - 2	1.6 - 2	1.6 - 2	1.6 - 2	1.6 - 2	1.6 - 2	
2	Specific capital investment for establishment of new SHPs	kEuro / kW	-	1 - 2	1 - 2	1 - 2	1 - 2	1 - 2	1 - 2	
3	Specific capital investment for establishment of new SHPs (> 4000 kW)	kEuro / kW	-	0.9 - 1.1	0.9 - 1.1	0.9 - 1.1	0.9 - 1.1	0.9 - 1.1	0.9 - 1.1	
4	Amount of financing	M€	<i>Pessimistic</i> <i>Base</i> <i>Optimistic</i>	3.3 3.3 3.3	36.6 56.3 56.3	71.4 163.5 309	97.9 278.6 416.2	221.7 195.1 274.4	187 103.3 103.3	618.3 879.5 1162.6

Economical prerequisites / facts

- Prime cost of SHPs energy generation (without credits):**
 - 0.8 - 1 cents/kWh (< 4000 kW)
 - 0.6 - 0.7 cents/kWh (> 4000 kW)
 - Water use price (0.17 - 0.2 Euro / 100 m³)
- Credits:**
 - crediting rate - 20%
 - 10% - profits tax
 - 10 year - return time
 - **Prime cost of SHPs energy generation: 2 cents / kWh**
 - **Profitability: 10 - 15%**
- Capital costs: < 1700 Euro/kW** (reconstruction)
800 Euro/kW (establishment of new SHPs > 3000 kW)
High CO for reconstruction can be explained by bad (dangerous) state of hydraulic works as well as high custom taxes
- Transport costs for private sector: ~ 1 cents / kWh**

Electricity tariffs in the Ukraine and some CIS countries

Electricity Tariffs	Ukraine	Russia	Belarus	Moldova	Poland	Latvia	Lithuania	Estonia
Public Tariff (US Cents / kWh)	2,3 (17,96)	3,5 (4,6*)	3,3	5,8	8,1	6,9	8,1	6,8
Industry Tariff (US Cents / kWh)	3,06 (17,96)	4,2 (4,17*)	6,0	5,6	6,38	6,02	6,65	6,04

* Prices in national currency

Typical SHP projects

- Technical:**
 - Run-of river stations,
 - Supply head 5-10 m,
 - Water flow 5-20 m³/sec,
 - Capacity 250-500 kW
- Economic:**
 - Investment volumes 0.3-2.0 M€,
 - Power supplied to private (industrial) consumers via the power distribution grid
 - payback 6-11 years

It is also their general practice to deliberate upon affairs of weight when they are drunk;

and then on the morrow, when they are sober, the decision to which they came the night before is put before them by the master of the house in which it was made;

and if it is then approved of, they act on it; if not, they set it aside.

Sometimes, however, they are sober at their first deliberation, but in this case they always reconsider the matter under the influence of wine.

Persian Wars by Herodotus. Book I. Clio

За вином они обычно обсуждают самые важные дела.

Решение, принятое на таком совещании, еще раз предлагается на утверждение, но уже в трезвом виде.

Если они и трезвыми одобряют эти решения, то их выполняют.

И наоборот, решение, принятое трезвыми, они еще раз обсуждают во хмелю.

Геродот о персах

Contemporary Scientific and Technical Problems in Energy Sector of the Republic of Armenia

Levon YEGHIAZARYAN

General Director

“Scientific Research

Institute of Energy” CJSC

<i>NN</i>	<i>The Title of Problem</i>	<i>The Field of Implementation, Designation and Contemporaneity</i>
1	Elaboration of Normative Technical Documents in the Field of Energy	<ul style="list-style-type: none"> ✓ Elaboration of Common Rules of energy installation and equipment maintenance in energy companies of Armenia, ✓ Elaboration of the draft of damage definition order concerning the electric energy (capacity) wholesale market subject interests caused by power system emergency and disorders, ✓ Elaboration of electric energy (capacity/power) market rules (Grid Code) conforming to the market subjects and presenting to the Ministry of Energy RA and Public Services Regulatory Commission for confirmation, ✓ Elaboration of technical rules and national standards in this field, ✓ Elaboration of service quality indices, ✓ Elaboration of the list of electric equipment subject to certification.

<i>NN</i>	<i>The Title of Problem</i>	<i>The Field of Implementation, Designation and Contemporaneity</i>
2	Elaboration of Development Programs in RA Energy	<ul style="list-style-type: none"> ✓ Execution of calculations and forecast researches of electric energy production and consumption volumes and structure, ✓ Carrying out of researches and elaborations of energy sector development programs, ✓ Elaboration of power system (as a unified system) development scheme in once in 5 years period, taking into account the developments in regional energy flows, ✓ Elaboration of the regional energy link development feasibility study, ✓ Elaboration of programs and plans of RA energy system annual recruitment.

<i>NN</i>	<i>The Title of Problem</i>	<i>The Field of Implementation, Designation and Contemporaneity</i>
3	Elaboration of Pricing and Tariff Policy Problems in Electric Energy (Capacity) Market	<ul style="list-style-type: none"> ✓ Analysis of electric energy market activities, ✓ Elaboration of market efficiency raising measures through elaboration and implementation of new normative documents for superior principles of pricing and market participants' interests equilibrating, ✓ Elaboration of consumer and their group electric energy sales tariffs multitariff and multizone differentiated types for smoothening the daily load curve of the system and promoting the efficient consumption increase, ✓ Elaboration of tariffs for regulating consumers.

<i>NN</i>	<i>The Name of Problem</i>
4	Elaboration of Development Problems of the Fuel Supply Complex of the Country in order to Increase the RA Energy Independence and Degree of Security

<i>NN</i>	<i>The Title of Problem</i>	<i>The Field of Implementation, Designation and Contemporaneity</i>
5	Elaboration of Investment Programs in Energy	<ul style="list-style-type: none"> ✓ Research and evaluation of operation residue resource the electric equipment of power plants and grids: elaboration of their renovation modes, ✓ Elaboration of business plan options for energy companies' development, ✓ Elaboration of Primary Projects of modern energy saving and efficient equipment and technologies in energy companies together with financial analysis and basing, ✓ Scientific and technical accompanying of new equipment and technology implementation in energy, ✓ Expertise of market subject investment programs with energy system operation reliability and security raising part for tariff calculations.

<i>NN</i>	<i>The Title of Problem.</i>	<i>The Field of Implementation, Designation and Contemporaneity</i>
6	Elaboration of Reliability Problems for Energy Sector Systems	<ul style="list-style-type: none"> ✓Elaboration of calculation techniques for electric system actual and planned (prognosis) operation reliability normative indices, ✓Calculation of electric system steady mode, ✓Calculation of short circuit electric current in electric systems, ✓Calculation of preliminary settings of relay protection and elaboration of new protection equipment implementation proposal, ✓Calculation and analysis of energy system transitional modes and elaboration of their reliability improvement measures.

<i>NN</i>	<i>The Title of Problem.</i>	<i>The Field of Implementation, Designation and Contemporaneity</i>
7	Elaboration of Management Tasks of Energy System Modes	<ul style="list-style-type: none"> ✓ Calculation of energy system steady-state regime, ✓ Calculation and analysis of losses in electric grids, ✓ Automation of energy system and HPP cascade energy modes' calculation and analysis of their efficiency modes, ✓ Investigation of electric system reactive power problems, ✓ Calculation and analysis of 0.38/0.22 kV up to 220 kV electric grids electricity reporting, prognosis and expert losses, ✓ Selection of 6(10)-35 kV grids by optimum schemes of minimal losses and elaboration of operative conduct calculation program and implementation in dispatch and technical services of grids, ✓ Calculation and analysis of electricity loss portions in the grids caused by current interflow between node load of electric grid and(or) two arbitrary grid nodes, ✓ Elaboration of the technical and economic problems of small power plants' grid connection and electricity exchange taking into account the energy characteristics of connection node.

<i>NN</i>	<i>The Name of Problem</i>
8	Investigation of the Seismic Security and Elaboration of Measures for the Armenian Nuclear Power Plant and Energy Complexes

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"Scientific Research Institute of Energy" CJSC

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MICRO HYDRO DEVELOPMENT OVERVIEW

SEMINAR ON SMALL HYDRO PROJECT DEVELOPMENT

September 13, 2005

Presented By: Armen Arzumanyan, PA Consulting Group

The author's views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development or the United States Government.

MICRO HYDRO DEVELOPMENT: Purpose

The purpose of this presentation is to provide:

- Overview of MH development under USAID/PA pilot projects program
- Overview of MH Regulatory issues

MICRO HYDRO DEVELOPMENT: Technical Aspects

- Two MH prototypes of Benki-Mitchell turbine design are being manufactured under the PA's contract; first installation is planned for November, 2005, in v. Lermontov, Lory region and v. Hatsavan, Syunik region of Armenia.
- Ten more of these prototypes will be installed during this and the next year in the framework of PA's pilot projects program.
- Advantages:
 - Benki-Mitchell type turbine is simple to build, does not require castings and can be welded together.
 - Can be mounted in one compact package.
 - Head and flow are more flexible than Francis or propeller turbines.
 - Have worked well in other parts of the world.

MICRO HYDRO DEVELOPMENT: Technical Aspects

Development of local micro hydro industry by producing two 30 kW and 60 kW prototypes for potential mass production.



MICRO HYDRO DEVELOPMENT: Cost Analysis

- A typical MH project cost may include the following:
 - Total cost
 - Using existing infrastructure (canal, pipe, etc) \$ 400-600 /kW
 - A run-of-river project \$1000 / kW
 - Parts
 - Penstock \$ 350/ton
 - Equipment (Using any turbine) \$ 200 - 350 /kW
 - Equipment (Using pump as a turbine) \$ 160 /kW
 - Overhead power transmission lines \$ 3000/km

MICRO HYDRO DEVELOPMENT

Regulatory Issues

- Clear distinction between small (less than 10 MW) and micro-hydro (less than 100 kW) generators aiming at mitigation of existing procedures and requirements.
- MH Definition: Definition of microhydro resulting in simplified procedures for getting rights and permits including water rights and environmental assessment expertise.
- Fixed stimulating tariff for all microhydro projects connected to the grid including run-of-river projects and built-on-existing infrastructures.
- Simple one page licensing procedure for MH: Authorize local or regional government bodies to cooperate closely with PSRC and administer on behalf of developers.
- Implementation through regional communities.
- PSRC net-metering procedure for a microhydro generators connected to the grid. No commercial activity.

MICRO HYDRO DEVELOPMENT: Advantages

- Alternative and diversified source of energy for rural communities;
- An essential supplement for consumers to fight the poverty and improve living standards;
- The lowest environmental impact;
- The lowest cost compared to other renewable resources especially if existing infrastructures are used.

MICRO HYDRO DEVELOPMENT: Potential MH sites in Armenia



MICRO HYDRO DEVELOPMENT: Potential MH sites in Armenia



MICRO HYDRO DEVELOPMENT: Potential MH sites in Armenia



MICRO HYDRO DEVELOPMENT: Potential MH sites in Armenia



WB Implemented GEF Grant Project on Preparation of Renewable Resource Revolving Fund in Armenia

Ara H. Marjanyan,
WB/GEF grant project coordinator
Energyinvest PIO State Institution
13 September 2005, Yerevan Armenia

"Energyinvest PIO" SI

1

1. Purpose of the WB/GEF Grant Project

The purposes of the WB/GEF Grant TF053910 are to assist Armenia in the preparation of the Renewable Resource Revolving Fund Project which aims to increase the share of renewable energy production by the Recipient through development of a self-sustaining, market-based financial mechanism - Renewable Resource Revolving Fund (RRRF)=R²E² Fund.

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2. Main Activities of the WB/GEF Grant Project

- ✓ development of operational modalities of the RRRF, including organizational structure and operational modus and manual
- ✓ development of recommendations to remove the barriers for development of renewable energy
- ✓ preparation of an initial portfolio of the renewable energy projects for RRRF

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3. List of the WB/GEF Grant Supported Projects in Armenia

- Project 1. Development of Renewable Energy Data Base of Armenia, its Management and Parallel Work with GIS
- Project 2. Development of Geographical Information System of Lori marz (Armenia) for Renewable Energy Projects

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4. List of the WB/GEF Grant Supported Projects in Armenia

- Project 3. Data Collection for Preparation of Feasibility Studies for Renewable Energy Projects and Armenian Renewable Energy Data Base (including field surveys in Lori Marz)
- Project 4. Development of RRRF operation Modus, Financial schemes and back-ups

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5

5. List of the WB/GEF Grant Supported Projects in Armenia

- Project 5. Renewable Energy Projects Initial Portfolio Building for RRRF
- Project 6. Development of Recommendations to Remove the Barriers for Development of Renewable Energy in Armenia
- Project 7. Development of "One-stop-Shop" Concept of Renewable Energy Projects Implementation in Armenia

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6. List of the WB/GEF Grant Supported Projects in Armenia

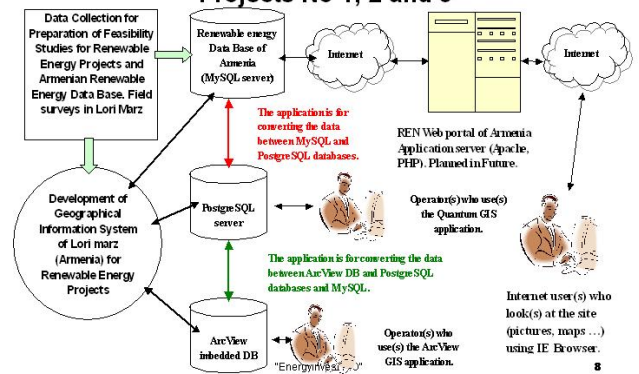
➤Project 8. Assessment of Technology Transfer and the potential of local producers in Renewable Energy in Armenia

Currently 7 of the 8 projects are in progress. More than 8 scientific research institutes and private companies and more than 60 local experts and professionals are involved.

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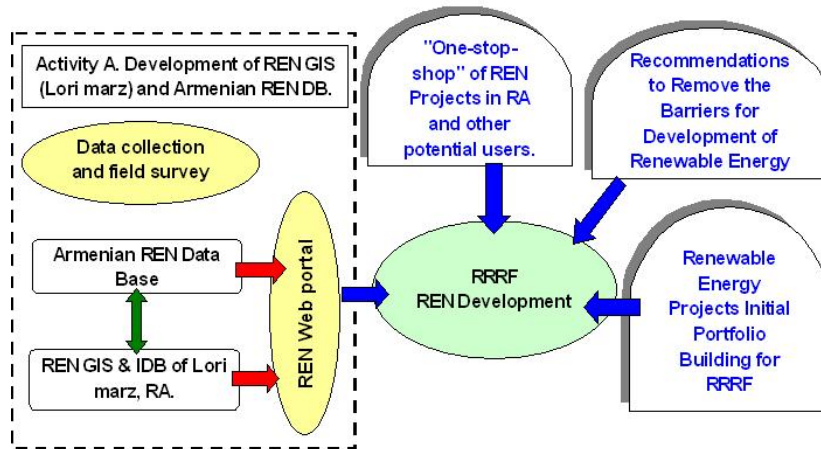
7

7. Links Between WB/GEF Grant Supported Projects No 1, 2 and 3



8

8. Links Between All WB/GEF Grant Supported Projects



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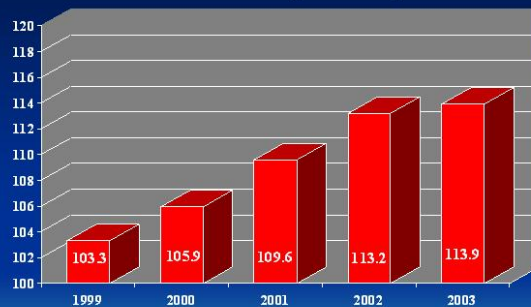
9

Socio-economic and legal conditions of Armenia related to small HPP development

Dr. Tigran Gnuni
Energy Research Institute

Socio-economic condition

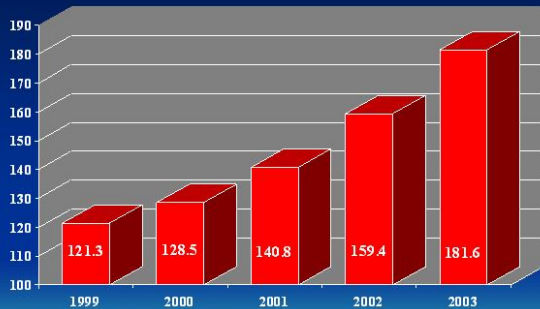
■ GDP, % to previous year



Source: Statistical Yearbook of Armenia.

Socio-economic condition

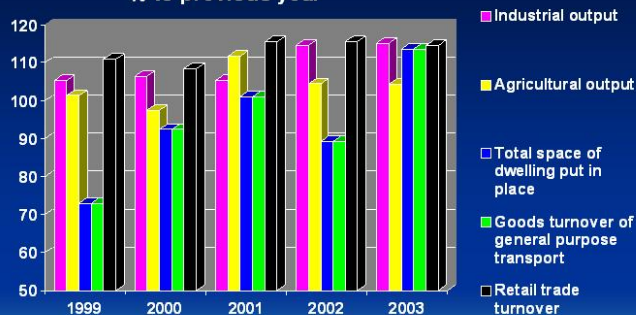
■ GDP, % to 1995



Source: Statistical Yearbook of Armenia.

Socio-economic condition

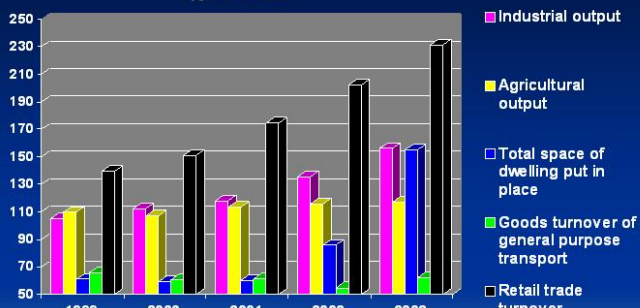
% to previous year



Source: Statistical Yearbook of Armenia.

Socio-economic condition

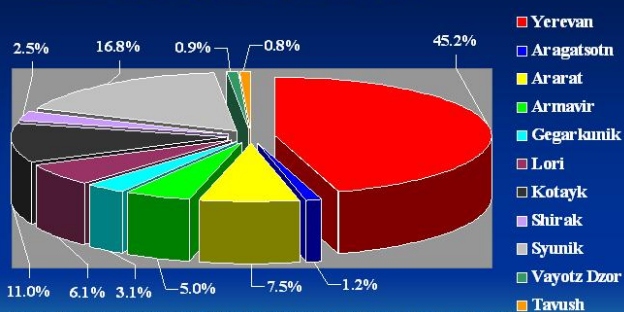
% to 1995



Source: Statistical Yearbook of Armenia.

Socio-economic condition

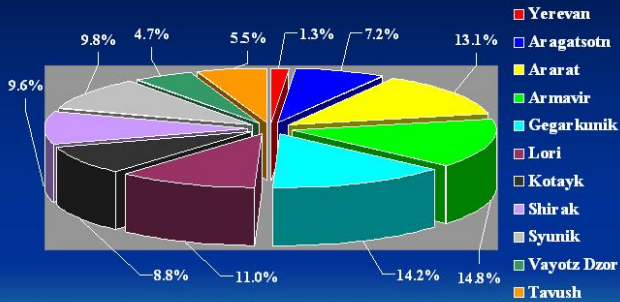
Industrial output by marzes (province), 2004



Source: Socio-economic condition of Republic of Armenia. The National Statistical Service of RA.

Socio-economic condition

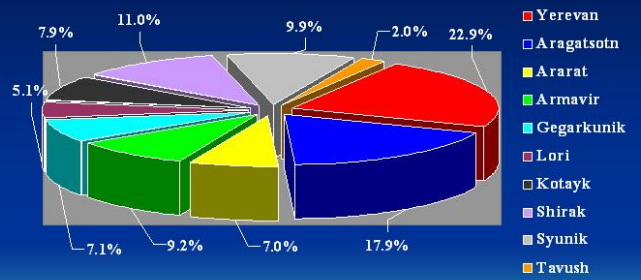
Agricultural output by marzes (province), 2004



Source: Socio-economic condition of Republic of Armenia. The National Statistical Service of RA

Socio-economic condition

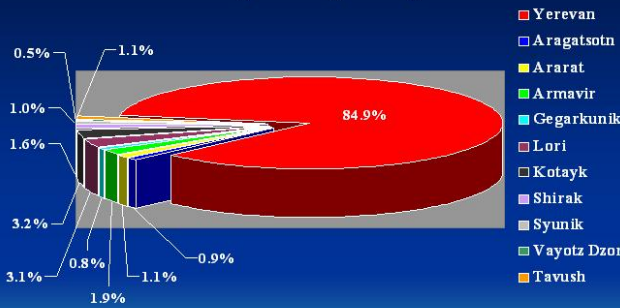
Total space of dwellings put in place by marzes (province), 2004



Source: Socio-economic condition of Republic of Armenia. The National Statistical Service of RA

Socio-economic condition

Retail trade turnover by marzes (province), 2004



Source: Socio-economic condition of Republic of Armenia. The National Statistical Service of RA

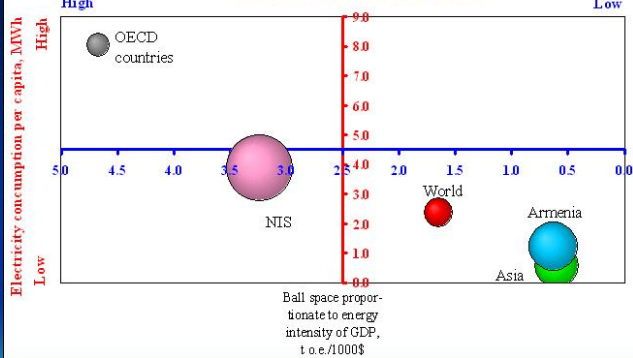
Socio-economic condition

Indicators	2005 Jan.-May as compared with 2004 Jan.-May, %	2005 May as compared with Apr., %
Gross Domestic Product	108.5	127.7
Industrial output	104.5	103.2
Agricultural output	102.8	146.1
Total space of dwellings put in place	131.1	178.1
Goods turnover of general purpose transport	116.2	77.1
Retail trade turnover	104.4	105.4
Services rendered to households	113.4	93.0

Source: The National Statistical Service of RA

Socio-economic condition

Energy consumption per capita, t.o.e.

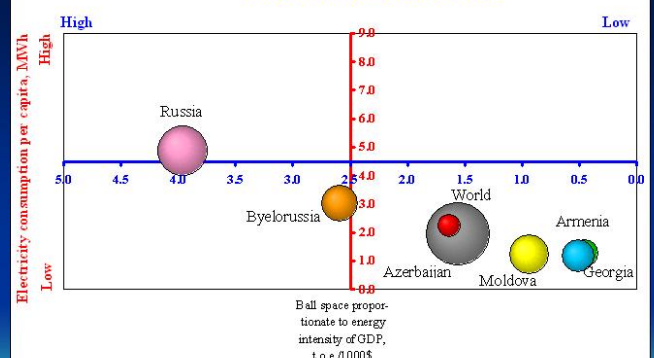


2002

Source: IEA Key World Energy Statistics 2004

Socio-economic condition

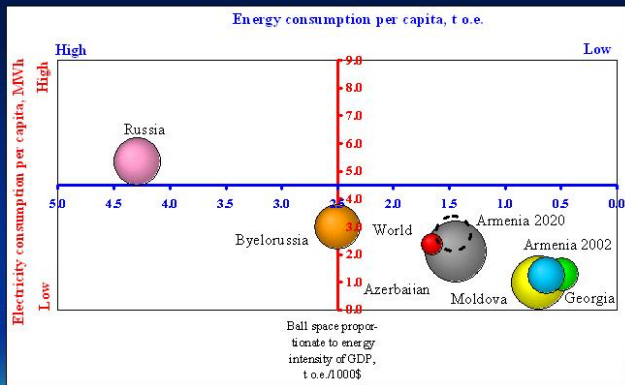
Energy consumption per capita, t.o.e.



1995

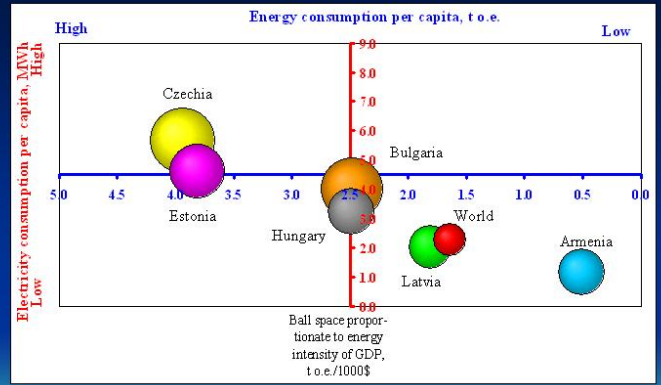
Source: IEA Key World Energy Statistics 2004

Socio-economic condition



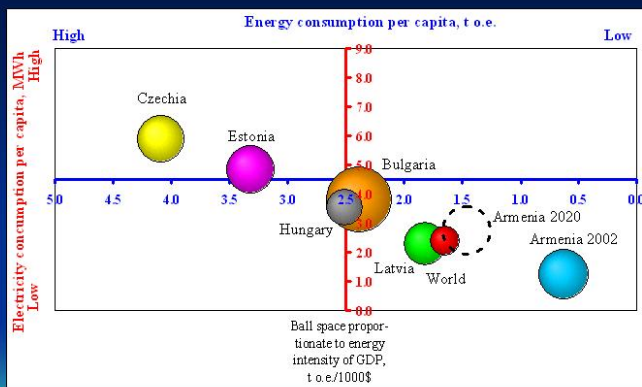
Source: IEA Key World Energy Statistics 2004

Socio-economic condition



Source: IEA Key World Energy Statistics 2004

Socio-economic condition



Source: IEA Key World Energy Statistics 2004

Legal conditions

- **The Energy Law of the Republic of Armenia. April, 2001**
- **The Law of the Republic of Armenia on Energy Saving and Renewable Energy. November, 2004**
- **Energy Sector Development Strategies in the Context of Economic Development in Armenia. Adopted by the Government of Armenia at June, 2005.**

Legal conditions

■ The Energy Law of the Republic of Armenia.

Article 5. 1. e) Efficient use of domestic energy resources and alternative sources of energy and implementation of economic and legal mechanisms for that purpose.

Article 5. 1. i) Enhancement of the energy independence of the Republic.

Article 5. 1. j) Ensuring the protection of the environment.

Article 7. 1. The provision of state-owned land for construction of new generating facilities ... shall be based on a priority right and in accordance with the defined procedures under the law.

Article 59. 1.

- b) the Distribution Licensee is granted an exclusive right to sell electricity (capacity) for 5 years to customers within the Service Area defined in the License.
- c) All electricity (capacity) generated at small hydro power plants, as well as from renewable sources of energy within the next 15 years shall be purchased pursuant to the Market Rules.

Legal conditions

■ The Energy Law of the Republic of Armenia.

Article 10. The primary methods of regulation are as follows:

- a) Licensing, establishment of license conditions and their supervision;
- c) Setting regulated tariffs;
- d) Development of model contracts or mandatory terms for energy supply (service provision) between Licensees, as well as energy supply (sale/purchase) to consumers;
- f) Development of legal acts and oversight of their implementation by the regulatory body, within the framework of its authorities;
- g) Development of service quality requirements;
- h) Study of the investment programs presented by the Licensees with the purpose of their (full or partial) inclusion in the tariff or rejection.

Legal conditions

■ The Energy Law of the Republic of Armenia.

Article 34. Licenses for Construction or Reconstruction of Generation Capacities

- 1. Entities holding a license for construction or reconstruction of generation capacities shall have the right to construct electric energy plants in compliance with the License provisions.

Article 35. Generation Licenses

- 1. The Electricity (Capacity) Generation Licensees are granted the right to generate electricity (capacity) and to sell it in accordance with the market rules.
- 3. The relationships between the Electricity (capacity) Generation Licensees, the Electricity System Operator and other market members shall be regulated by market rules and contracts.

Legal conditions

■ The Law of the Republic of Armenia on Energy Saving and Renewable Energy.

Article 3. e) ... renewable energy resources, including electric energy generation from water resources, where the present law applies to hydro-power stations with installed capacity of up to 10,000 kW inclusive.

Article 5. 2. The principles of state policy are:

- a) Increasing level of supply of indigenous renewable energy;
- b) development and enforcement of legal and economic mechanisms for the promotion of renewable energy;
- c) Ensuring increase of renewable energy resources usage;
- d) Ensuring competitiveness of renewable energy resources;
- e) Promotion of integrated activities between the autonomous energy producers, using renewable energy resources, and the energy system aimed at the exchange of electric energy;
- f) Implementation of energy saving and renewable energy state (national) targeted programs.

Legal conditions

■ The Law of the Republic of Armenia on Energy Saving and Renewable Energy.

Article 20.

1. Within one year after the present law enters into force:
 - a) The Regulatory Commission of the RA shall define the conditions for integrated operation between the auto-producers using renewable energy resources and the electric energy network with the pre-condition of electric energy exchange;
 - c) The government shall approve the small hydro power plant development scheme and adopt relevant decisions aimed simplification of procedures for land allocations and other required permission granting;
2. Within six months after the present law enters into force, the Regulatory Commission of the RA shall adopt the decisions on the application of long-term tariff policy for the promotion of accelerated renewable energy development.

Legal conditions

■ Energy Sector Development Strategies.

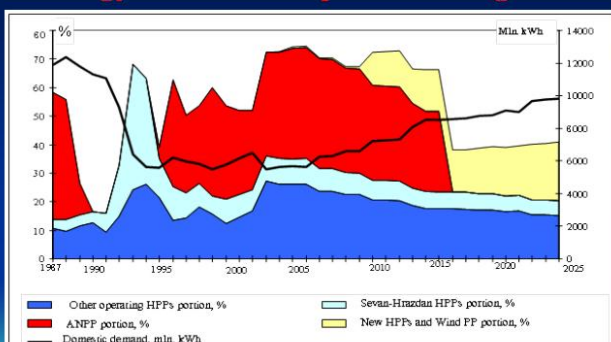
Article 2.3.

These Strategies are aimed towards the following goals:

- Achieving sustainable economic development in Armenia;
- Ensuring safety in the energy sector;
- Enhancing the energy independence of the country, including diversification of imported and domestic energy resources and ensuring maximum utilization of generating capacity;
- Ensuring efficient use of domestic energy resources and alternative sources of energy and implementation of economic and legal mechanisms for that purpose.

Legal conditions

■ Energy Sector Development Strategies.



Legal conditions

■ Energy Sector Development Strategies.

Article 2.7.1

During the next 15-20 years maximize use of domestic renewable energy resources for power generation, which may amount to about 5.1 GWh, including:

- Hydro energy - 3.6 GWh;
- Wind energy - 1.5 GWh.

Article 3.2. The economically justified potential from small HPPs amounts to 800-850 million kWh/yr, of which 200-220 million kWh is generated at existing units.

Legal conditions

■ Energy Sector Development Strategies.

Article 9

Period: 2005-2010

- Construction of 140 MW Meghri HPP, costing 120 million USD. *State Support: Commercial loans and/or special funding schemes.*
- Construction of 70 MW of small HPPs, costing 75 million USD. *Funds from private investors, KfW project, revolving fund (EBRD, WB, USAID).*

Period: 2011-2016

- Construction of the 60 MV Loriberd HPP, costing around 100 million USD. *State Support: Commercial loans and/or special funding schemes.*
- Construction 65 MW of small HPPs costing 75 million USD. *Financial resources from private investors, revolving fund (KfW/ EBRD, WB, USAID).*

Legal conditions

■ Energy Sector Development Strategies.

Article 9

Period: 2017-2025

- Construction of the 75 MW Shnogh HPP, costing around 100 million USD. *Financial resources from private investors.*
- Construction of small HPPs with 130 MW installed capacity, costing 170 million USD. *Financial resources from private investors.*

Thank you



A. Kocharyan



Power Sector

Installed capacity

Armenian NPP	815 (440) MW
Hrazdan TPP	1100 MW
Yerevan TPP	550 MW
Sevan-Hrazdan cascade of HPPs	550 MW
Vorotan cascade of HPPs	400 MW
Small HPPs	73 MW

Transmission system

220 kV 1323 km 14 substations

110 kV 3169 km 119 substations

Interconnections with all neighboring countries

Distribution system

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

	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Total electricity (GWh)	1206	6204.8	5698.1	5517	6220.2	6026	6140	5716	5957	5743.9	5523.7	5406.6	6029.7
Total HPP (GWh)	1050.8	4292.1	3515.4	3910.3	1565.5	1360.4	1536.2	1199.5	1260.3	967.0	1662.6	1011.0	2013.6
Share of HPP	8.8%	68.2%	62.1%	34.4%	25.2%	22.7%	25.0%	21.0%	21.2%	16.8%	30.1%	36.1%	33.4%
Share of Sevan-Hrazdan Cascade	3.7%	45.1%	37.0%	14.0%	9.5%	8.06%	7.74%	6.06%	6.3%	5.4%	6.8%	9.2%	8.8%
Share of Vorotan Cascade	4.9%	21.1%	20.1%	10.8%	14.4%	12.3%	15.5%	12.7%	13.1%	9.2%	20.2%	23.7%	21.0%
Share of Small HPPs	0.2%	2%	2%	1.8%	1.3%	1.94%	1.96%	2.24%	1.8%	2.2%	3.1%	3.2%	3.6%



Total electricity production in Armenia



<i>in 2004 - 6029 GWh</i>	<i>(100 %)</i>
NPP - 2403 GWh	39.86 %
TPP - 1613 GWh	26.75 %
HPP - 2013 GWh	33.39 %
(including small HPP's – 214 GWh,	3.55 %)

in 2020 (forecast) - 11000.0 GWh (100 %)

Renewable sources:

HPP - 3200.0 GWh	29.1 %
(including small HPP's - 750 GWh,	6.8%)
Wind Farms - 1000.0 GWh	9.1 %

Thermal Solar Energy – 300.0 GWh



Hydro Potential



- The economically exploitable
- Hydro potential is about - 3500 GWh
- Developed - 1600 GWh
- New HPP's:
 - Big HPP's (3) - 1300.0 GWh
 - Small HPP's (310) - 600.0 GWh



ENERGY LAW OF ARMENIA

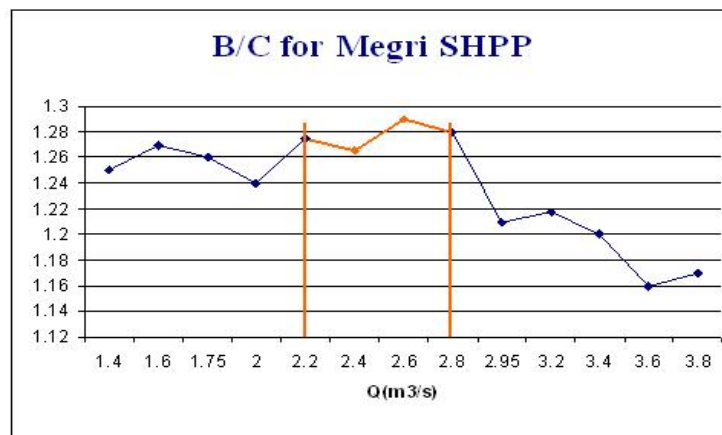
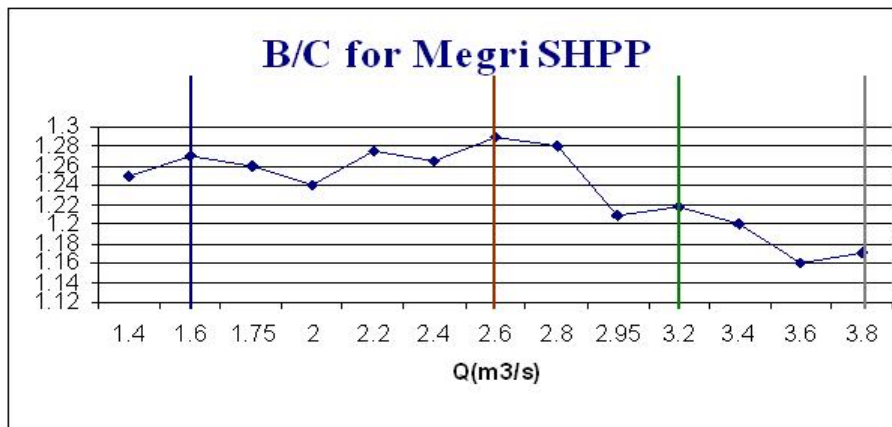
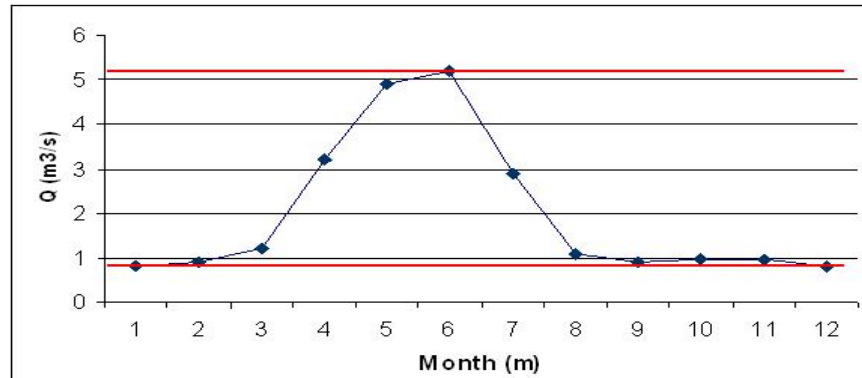


- Efficient use of domestic energy resources and alternative sources of energy and implementation of economic and legal mechanisms for that purpose; (Article 5 Basic Principles of the State Policies in the Energy Sector}
- All electricity (capacity) generated at small hydro power plants, as well as from renewable sources of energy within the next 15 years shall be purchased pursuant to the Market Rules (Article 59. Transitional Provisions)

- From the moment of the enactment of this Law, the Government of the Republic of Armenia shall: issue respective Decrees within 6 months, which shall set procedures for providing guarantees for long-term supply of the estimated amount of water essential for power generation at hydro power plants (Article 59. Transitional Provisions)
- **Law on Energy Efficiency and Renewable Energy** adopted in the end of 2004. This law creates additional favorable conditions for the development of renewable energy.



Flow of Megri SHPP





Infrastructure of Small Hydropower in Armenia



The procedure of small HPP (SHPP) design and construction in Armenia is the following.

Several design organizations in Armenia having the corresponding license for design are engaged in the design of SHPPs.

The preliminary design and or basing with investments for SHPP construction(so called scheme) is carried out without detailed survey. The scheme is drawn up on the basis of topographic maps of 1:25000 scale. The geological basins and playing out of derivation path is worked out on the basis of recognizing work and fund materials. The hydrology of SHPP water resources is done on the basis of the data of the HydroMetCenter of Armenia or on the basis of existing yearbooks, which were published before 1988. Besides the abovementioned, the scheme has the following parts:

- Water-and-energy calculations
- Substantiation of the calculated consumption and the diameter of the had derivation pipeline
- Basing of the SHPP capacity
- Calculation of SHPP construction costs with extended indices of construction-and- mounting work volumes and their costs
- Concise ecological summary (report)
- Financial analyses and feasibility study of SHPP construction.

Having passed the corresponding procedure, the investor receives the SHPP construction license from the **Regulatory Commission** on the basis of the scheme.

The investor announces the tender of SHPP construction between the construction companies, or else the investor, having the license for hydraulic engineering object construction, carries out the construction.

The investor announces tender between the design organizations, or select himself the design organization for draft documentation (detailed design) compilation.

The draft documentation undergoes technical and ecological expertise. Any design organization having the corresponding license can fulfill the technical expertise of the project, and the ecological expertise can be carried only by the state ecological expert organization.

The change in all design solutions during SHPP construction are agreed upon with the author of the design. The author supervision during the construction is carried out by the author of the draft documentation.

On the basis of the technical task for equipment delivery drawn up by the design organization, the investor selects the factory-producer by questioning or by tender, concluding a contract with him about the production, delivery and contract supervision. After finishing the construction, the investor is getting a permission on a long-term-water use from **Committee of Water Resources**. In order to connect SHPP to the power system, the investor firstly receives the technical conditions from the company **CJSC "Electric Network of Armenia"**, afterward he concludes a contracts for electricity delivery. After the SHPP construction, completion the investor (owner) obtains electricity production and sales license from the **Public Services Regulatory Commission** through corresponding procedure.

There is a developed functioning infrastructure for the SHPP design, construction and operation in Armenia.

Design

The detailed design includes the following parts:

1.Natural conditions, involving:

- Engineering hydrology,
- Engineering topography,
- Engineering geology.

2.Design work

- Main constructions,
- Calculation of coasts,
- Passport of constructions,
- Volume of operation,
- Detailed drawings.

The design and survey works for the overall complex of work in Armenia is fulfilled by the **CJSC "Armhydroenergoprojekt"**, company **"Hydrotechnic, "Arpa SevanNakhagits"**, and **"Era"**. The construction of all types of hydraulic engineering construction and mounting of had diversion pipeline in Armenia is accomplished by such organizations as **OJSC "Arpa Sevan"**, **OJSC "Hydroenergostroy"**, **OJSC "Hydrospetsstroy"** and others. The production, delivery, contract supervision, start and adjustment and alignment work for the set of hydroequipment (turbine, generator, system of automatic control) is carried out mainly by Russian or foreign companies. However, currently there are several organizations, which function, producing sets of hydroequipment in Armenia. The **OJSC "Vorotan-Turbo"**, **OJSC "Izodrom"** are examples of such organizations. It is already several years, their products are functioning on the existing small HPPs. The Armenian companies produce mainly hydrounits of capacity up to 1000kWts.

The investors mostly purchase electric engineering equipment produced by such factories, as **"Armelectrozavod"**, **"Electromash"**, **"Electrodvigatel"**, **"Cable Factory"** and others. **"Armenergoremont"**, **"Armnaladka"**, **"Repairs-and-Mechanical Factory"** and other organizations are engaged in the repairs of mechanical electric engineering and hydroequipment in Armenia. From the abovementioned, we can state that there is a developed infrastructure for small HPP design, construction and services in Armenia for the development of small hydropower.

The infrastructure of small hydro power in Armenia can be use not only for Armenia, but also for the other countries of the region.