

WP2. Existing and prospected small hydro power plants in the Caucasus and Carpathians

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1. Armenia. SMALL HYDRO SECTOR

1.1. Overall information on SHP sector. State-of-the-art

Armenia has recently succeeded in stabilising the national energy sector. After dramatically energy “cut-offs” and nature disasters in 90th, the energy sector in Armenia has been developing rapidly, partly pushed by the re- incommisioning of the national nuclear power station. Last information on energy production is presented in Table 2.1 and Figure 2.1.

From the number of all small HPPs in Armenia only two are state-owned. All the others are private. From 25 small HPPs constructed in the 80s, 16 are privatised, the others are not privatised because of their technical-economical characteristics and they are –out of operatio. The total capacity of these 16 small HPPs is equal to 32 MW, the total calculated output of electricity is about 100 mln. kWh. From these 16 small HPPs at least 12 need repairs.

Table 1.1 Energy productions in Republic Armenia by sectors (est. 2005), in mlrd. kWh.

No.	Power Plants	Energy production in mlrd. kWh
1.	Nuclear Power Plant	2.7
2.	Thermal Power Plants	1.84
3.	Hydro Power Plants including SHPPs	1.8
	- Small HPPs	0.17
4.	Wind Power Plant (since 15.11.2005)	0.00075
Total		6.31

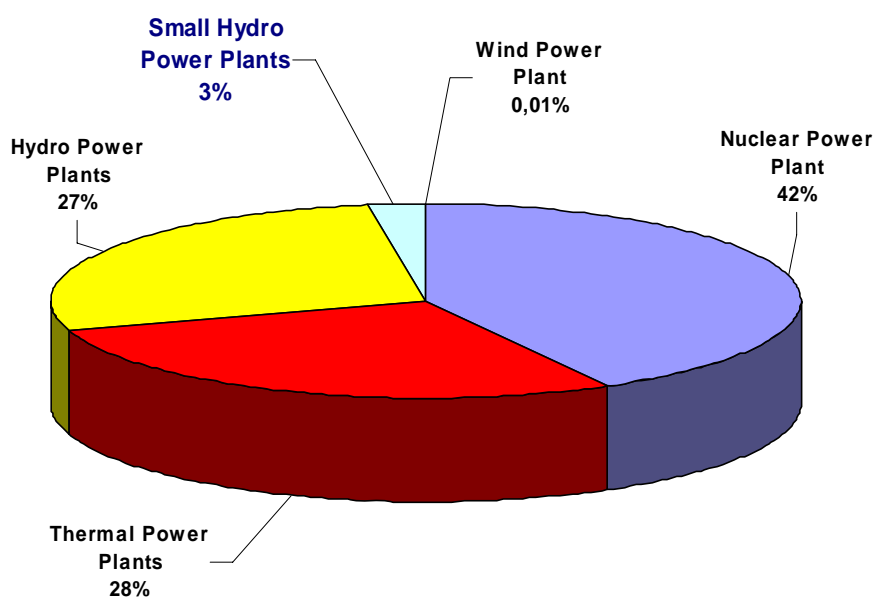


Figure 1.1 Energy productions in Republic Armenia by sectors (est. 2005), in %.

In the result of the conducted state policy for creation and enlarging of the private sector in the sphere of energy for last 5-6 years 18 new HPPs with total capacity of 15 MWs are built and 4-6 are in the stage of construction. According to the plans of hydraulic power engineering development, putting into production of all the feasible hydro potential of Armenia is envisaged, which comprises 3.5 bln. kWhs.

In 1991, the “Scheme of Small HPPs of Armenia” was elaborated. In 1996 with the assistance of the European Community it was improved envisaging the utilization of the feasible energy potential of the small rivers in Armenia. According to this scheme, it is supposed to construct in Armenia 300 small HPPs with total capacity of 270 MW and total output of 700 mln. kWh. On the basis of this scheme, the list of first rate HPPs was prepared, which was submitted to the European Community for investment attraction. The project design financing for these HPPs is supposed by the European financial structures, and in the future the financing of the construction of HPPs is envisaged.

In 2003-2004, in the framework of *TACIS* programme “Substitution of the Nuclear Power through the Development of the Hydropower Capacity of Armenia” the German company Fichtner elaborated the feasibility study of one large and four small HPPs which were included in the Scheme.

The main curbing factor of the small hydro energy development in Armenia is the shortage of financial means. The bank system of Armenia do not provide credits in such volumes and in those conditions which are necessary for construction of small HPPs.

The repairs of small HPPs requires investments from several ten thousands up to millions of USA dollars depending on the state of the power plants.

For the repairs of the HPPs in Armenia, the necessary construction basis is existing comprising construction materials, machines and mechanisms, and the industrial basis having corresponding machine-tools and equipment is sufficiently developed. Besides, there are specialised enterprises such as “EnergoRepairs” OJSC and “Energonaladka” CJSC, which can provide the required reconditioning repair and adjustment works. Referring to certain volumes and costs of repair works, the latter depends on certain HPP. The answer to this question demands detailed studies of the HPPs being subject to repairs, information about the conditions of financing and discussion with the owners of these HPPs.

In 2001, in Armenia the new Law on Energy was adopted according to which during 15 years (until 2016) the electricity generated in the small HPPs will be bought by its 100 %. For small HPPs on natural watercourse, the tariff of 4.5 c/kWh (without VAT) is defined and the tariff of 3c/kWh is defined in the case of utilization of already constructed hydraulic engineering objects. This brought to the construction of 18 new small HPPs during last 5 years and licenses for 19 new ones were issued.

Table 1.2 List of existing small hydro stations in Armenia

No.	Name of the HPS	River	Year of constr.	Region	Water rate (m ³ /s)	Water pres. (m)	Electric capacity (kW)	Annual production (mln.kWh)	On/Off grid	Operational	State owned or private	Owner
1	Vokhchi HPP-3	Vokhchi	1954	Syunik		137.2	7500	14	on-grid	●	private	“Kapanenergy” CJSC
2	Elegis	Elegis	2004	Vayots Dzor	3	257	6400	21	on-grid	●	private	“Bazenk” CJSC
3	Giumry HPP	Shirak Channel	1928	Shirak	6.4	114	5280	7.79	on-grid	●	private	“Giumry HPP” LLC named after A,L, Mnjoyan
4	Vokhchi HPP-2	Vokhchi	1913	Syunik		140	4900	9	on-grid	●	private	“Kapanenergy” CJSC
5	Ajrjum HPP	Debed	1957	Lori	18.6	22,15	3028	9.59	on-grid	●	private	“Salenergo” LTD
6	Armavir	Armavir Channel	1952	Aragatzotn	22	11,5	2040	4.48	on-grid	●	private	“Armavir Luis” CJSC
7	Narek	On Hrazdan cement factory channel	2003	Kotayk	2.1	60	1200	4	on-grid	●	private	“EnergatsantsShin” OJSC
8	Kotayk Channel	Kotaik Lake	2000	Kotayk	2.45	62	1190	3.1	on-grid	●	private	“Hydroenergia” LTD
9	Garni	Garni	2000	Kotayk	0.85	160	1076	3.95	on-grid	●	private	“Narenergo” LTD
10	Azatek HPP	Arpa	1952	Vayots Dzor	3.2	39,1	1064	1.04	on-grid	●	private	“Yerenergo” CJSC
11	Amrakits –2 HPP	On Dzoraget-Amrakits pure water channel	2002	Lori	0.5	213	1000	4.65	on-grid	●	private	“Ararat “ CJSC

No.	Name of the HPS	River	Year of constr.	Region	Water rate (m ³ /s)	Water pres. (m)	Electric capacity (kW)	Annual production (mln.kWh)	On/Off grid	Operational	State owned or private	Owner
12	Shaki HPP	Shaki (Vorotan River Branch)	1936	Syunik	2,1	54,5	840	2.76	on-grid	●	private	“Hakobjanyan-Galstyan HPP” CJSC
13	Meghri HPP	Meghri	1936	Syunik	2,2	51	840	1.78	on-grid	●	private	“Q-H” LTD
14	Hermon	On Aisas branch of Elegis river		Vayots Dzor	2,36	44,5	800	3.49	on-grid	●	private	“Elegis HPP” LTD
15	Arjut-2 HPP	On Irrigation Channel	2004	Lori	0,25	336	800	5.85	on-grid	●	private	“Ler ev Jur” LTD
16	Agarak HPP	Lori Channel	1951	Lori	3,18	42	792	1.76	on-grid	●	private	“Agarak HPP”
17	Zovashen	Azat	1952	Ararat	1,75	49	750	1.82	on-grid	●	private	“Zovashen HPP” LTD
18	Yerevan Lake	Fixed to Yerevan Lake Dam	1997	Yerevan	6	13,8	750	2.75	on-grid	●	private	“Hydroenergia” LTD
19	Areni HPP	Arpa	1951	Vayots Dzor	8,5	11,8	684	2.3	on-grid	●	private	“Yerenergo” CJSC
20	Ijevan	Aghstev	1941	Tavush	2,52	40	612	2.01	on-grid	●	private	“Ijevan HPP” LTD
21	Arjut-1 HPP	On Irrigation Channel	2003	Lori	0,25	210	500	2.2	on-grid	●	private	“Ler ev Jur” LTD
22	Aparan-Yerevan HPP-4	On Yerevan pure water channel	2002	Kotayk	0.875	80	500	3.1	on-grid	●	private	CJSC “Energia”
23	Aparan-Yerevan HPP-3	On Yerevan pure water channel	2001	Kotayk	0.875	80	500	3.2	on-grid	●	private	CJSC “Energia”

No.	Name of the HPS	River	Year of constr.	Region	Water rate (m ³ /s)	Water pres. (m)	Electric capacity (kW)	Annual production (mln.kWh)	On/Off grid	Operational	State owned or private	Owner
24	Aparan-Yerevan HPP-2	On Yerevan pure water channel	2002	Kotayk	0.875	80	500	3.2	on-grid	●	private	CJSC “Energia”
25	Aparan-Yerevan HPP-1	On Yerevan pure water channel	2001	Kotayk	0.875	80	500	3.1	on-grid	●	private	CJSC “Energia”
26	Jermuk HPP	Arpa	1951	Vayots Dzor	0,8	74	440	2.41	on-grid	●	private	“Mushegh HPP” Production Organization
27	Amrakits –1 HPP	On Dzoraget-Amrakits pure water channel	2001	Lori	0,5	125	400	1.27	on-grid	●	private	“Ararat “ CJSC
28	Aigedzor	Ahkinja	1950	Tavush	0,7	60	340	1.5	on-grid	●	private	“Atlas Energo” LTD
29	Energotechnika	On Zuigaghbiur Pure Water Channel	2001	Shirak	0.45	87	320	1.28	on-grid	●	private	“Energotechnika” LTD
30	Avan	On Yerevan pure water channel	2001	Kotayk	0,4	90	200	1.01	on-grid	●	private	CJSC “Energia”
31	Goris	Goris	1950	Syunik	0,8	32	180	0.75	on-grid	●	private	“Elgia” LTD
32	Ani	On Karchaghbiur branch of Sevan Lake	2003	Gegharkunik	0,5	22	50	0.33	on-grid	●	private	“Grigor Tadevosyan Kvarts” LTD

Table 1.3 Hydrologic data on existing SHP plants in Armenia

No	Name of the HPS	Available for 20% of the year	Available for 25% of the year	Available for 55% of the year
1	Vokhchi HPP-3	2.3	6	1.9
2	Elegis	1.5	3	0.5
3	Giumry HPP	1.8	6.4	1.2
4	Vokhchi HPP-2	1.9	4	0.9
5	Ajrum HPP	9.6	18.6	3.7
6	Armavir	15	22	6
7	Narek	1.25	2.1	0.8
8	Kotayk Channel	1.8	2.45	0.7
9	Garni	0.42	0.85	0.42
10	Azatek HPP	3.7	1.8	0.8
11	Amrakits –2 HPP	0.3	0.5	0.3
12	Shaki HPP	1	2.1	0.8
13	Meghri HPP	1	2.2	0.8
14	Hermon	1.6	2.36	0.5
15	Arjut-2 HPP	0.25	0.25	0.25
16	Agarak HPP	1.6	3.18	0.8
17	Zovashen	1	1.75	0.8
18	Yerevan Lake	4.2	6	1
19	Areni HPP	5.4	8.5	1.8
20	Ijevan	1.8	2.52	0.8
21	Arjut-1 HPP	0.25	0.25	0.25
22	Aparan-Yerevan HPP-4	0.875	0.875	0.875
23	Aparan-Yerevan HPP-3	0.875	0.875	0.875
24	Aparan-Yerevan HPP-2	0.875	0.875	0.875
25	Aparan-Yerevan HPP-1	0.875	0.875	0.875
26	Jermuk HPP	0.5	0.8	0.2
27	Amrakits –1 HPP	0.4	0.5	0.2
28	Aigedzor	0.4	0.7	0.4
29	Energotechnika	0.3	0.45	0.2
30	Avan	0.4	0.4	0.4
31	Goris	0.6	0.8	0.6
32	Ani	0.3	0.5	0.3

1.2. Examples of successful implemented projects

As an example of successful implemented projects here presented information on two stations – Yeghegis -1 and Yerevan Lake.

1.2.1. Small Hydropower plant on Yerevan Lake

General information

Name of the HPS	SHPP on Yerevan Lake
River	Hrazdan
Region (exact location)	c. Yerevan
Implementer/ers	LLC “HydroEnergy”
Actual owner/ers of the HPS	Locals
Operator	LLC “HydroEnergy”

Technical Information

Max. electrical capacity	750 kW
Annual electricity production	2,95 mln. kWh
Water pressure	18 meters
Construction date and period	1995 - 1997
Used water flow	6 m ³ / sec
On grid / of grid	On-grid
Specific technology used	Hydropower Blocks (3) MEG 250 Propeller Turbine (LLC “ALTEN”, Russia) and Synchronous Generator (Safonov EMZ, Russia)

Financial information

Total investment	Private Funding	Commercial loan	Equity	Public Funding
400 000 Euro	400 000 Euro	200 000 Euro	200 000 Euro	0 Euro

Power station under operation	8 years
Payback Time	7 years
Information about functioning	
Who buys the electricity from the HPS	“Electric Network of Armenia” CJSC
Is all of produced electricity being sold	The total amount is sold
For what price is electricity sold	0.283 Euro / kWh
How high are the annual maintenance costs	62 000 Euro
Who does the maintenance works	High qualified personnel of the LLC “Hydroenergy”.
Did any brake downs take place.	No break-downs occurred

History of the project

- Idea of the owners of LLC “HydroEnergy”
- Positive experience: promotion of state organizations
- Negative experience: too high credit rates

Specific advantages of the project

- Use of existing hydroconstructions (water reservoir, outlet irrigation water line)
- The Project is attractive for its placement, suitability of maintenance and communications

Environmental aspects of the project

- No impact on fish
- No impact on forests

Benefits of the project

- stable electricity supply
- environmental advantages (CO₂, mitigation of deforestation)
- social advantages (additional employment, better health supply, capacity building in the region.
- Creation of new jobs, construction of buildings, repairs of roads

1.2.2. Small Hydropower plant “Yeghegis – 1”

General information

Name of the HPS	SHPP „Yeghegis – 1“
River	Yeghegis
Region (exact location)	Vardahovit, Vayots Dzor, RA
Implementer/ers	LLC “HydroEnergy”
Actual owner/ers of the HPS	Shareholders of “Bazenk” LLC
Operator	LLC “HydroEnergy”

Technical Information

Max. electrical capacity	6 200 kW
Annual electricity production	21,7 mln. kWh
Water pressure	272 meters
Construction date	03.02.2004
Used water flow	3 m ³ / sec
On grid / of grid	on-grid
Specific technology used	<i>Pelton Type Czech turbine. Provided by VUJE Trnava a.s. and three - phase generator NIR11274 A-10Q of ALCONZA-BERANGO, S.h. production.</i>

Financial information

Total investment	Private Funding	Commercial loan	Equity	Public Funding
4,6 mln. Euro	4,6 mln. Euro	1,1 mln. Euro	3,5 mln Euro	0 Euro
Power station under operation	2 years			
Payback Time	10 years			

Information about functioning

Who buys the electricity from the HPS	The Central grid
Is all of produced electricity being sold	According to the Contract EN-04-008 with “Electric Network of Armenia” CJSC dated 01.10.04, the total amount of generated electricity is bought
For what price is electricity sold	0.435 Euro / kWh
How high are the annual maintenance costs	70 000 Euro
Who does the maintenance works	The maintenance is carried out by ourselves or by VUJE specialists.
Did any brake downs take place.	No break-downs occurred

History of the project

At 01.02.2001, the Regulatory Commission RA has given construction license to “Bazenk” CJSC for “Yeghegis-1” HPP. The construction work was carried out by “Arpa-Sevan” OJSC. Currently, the “Bazenk” CJSC has received construction work license for 2 hydrounit installation from the Regulatory Commission RA.

Specific advantages of the project

The first phase of the Project is financed partially by shareholders, due to credits financial aid, and the second phase became possible due to credit agreement with the European Bank of Development and Reconstruction.

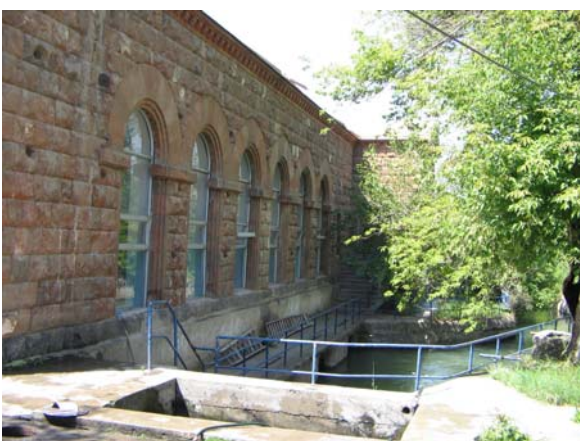
Environmental aspects of the project

The SHPP “Yeghegis-1” is situated in non – dwelling district. There is no fish or forest in the section of Yeghegis river HPP.

Benefits of the project

- stable electricity supply
- environmental advantages (CO₂, mitigation of deforestation)
- social advantages (additional employment, better health supply, capacity building in the region.
- Creation of new jobs, construction of buildings, repairs of roads

Photographs from the site – visiting “Yeghegis – 1”





Yeghegis – 1

1.3. Prospected SHPs

1.3.1. Hydropower potential of small rivers

"The Scheme of Small HPPs of Armenia" has been developed in accordance with the program INCO and Protocol between "The Center of Economic Researches on the Energy, Transportation and Environment" (CEEETA), Lisbon, and Institute ARMHYDROENERGYPROJECT, Yerevan. In accordance with this program the Institute ARMHYDROENERGYPROJECT has revised in 2006 the available "Scheme of Development of Small Hydropower in Armenia" and had refined the basic parameters of HPPs. On the basis of this work, the questionnaires and drawing materials on the 317 HPPs have been prepared and sent to CEEETA. Part of this work represented in [Annex III](#) contains information on hydrological parameters planned SHPPs at basins of following rivers:

- Debed River
- Aghstev River
- Akhuryan River
- Kasakh River
- Hrazdan River
- Lake Sevan
- Rivers Azat and Vedi
- Arpa River
- Meghsetsiget and Vokhchi
- Vorotan River

Presented information includes next parameters:

- Names of Rivers and prospected SHPPs
- Capacity, kW
- Annual Average Electricity Generation, mil. kWh
- Elevation Marks, m
 - Water Head
 - After Bay
- Diversion
 - Length, m
 - Diameter, m
- Designed Head, m
- Designed Discharge, m³/sec.
- Run-off through HPP, mil. m³
- N of the Drawing (available via IoE)

1.3.2. Prospected Small hydropower stations

Table 1.4 List of prospected small hydro stations in Armenia

No.	Name of the HPS	River	Region	Water rate (m ³ /s)	Water pres. (m)	Electric capacity (kW)	Annual production (mln.kWh)	On/Off grid	Project developer	Planning status	Site property
1	Pambak	Pambak	Lori	15	169	21000	79.2	on-grid	CJSC “ArmHydroEnergoProject”	Construction status	CJSC “Griar”
2	Argishti	Argishti	Gegharkunik	4	247.8	8600	29.1	on-grid	CJSC “ArmHydroEnergoProject”	Construction Status	“Hydrocorporatsia” LTD
3	Meghri	Meghri	Syunik	3,2	254.7	6500	16.8	on-grid	CJSC “ArmHydroEnergoProject”	Construction status	CJSC “Griar”
4	Getik-1	Getik	Tavush	4	178	6000	19.6	on-grid	CJSC “ArmHydroEnergoProject”	Construction status	CJSC “Griar”
5	Kurtan-2	Gargar	Lori	3	218.2	5230	17.01	on-grid	CJSC “ArmHydroEnergoProject”	Construction Status	LTD “Tirakal”
6	Martsiget-2	On Martsiget Branch of Pambak River	Lori	3	199.6	4800	20	on-grid	CJSC “ArmHydroEnergoProject”	Construction Status	“Argishti-1” LTD
7	Jradzor	On Akhuryan Right-Side Channel	Shirak	4	146	4800	16.7	on-grid	CJSC “ArmHydroEnergoProject”	Construction Status	OJSC “Ani”
8	Talin	On Talin Channel	Armavir	4	110	4000	20.5	on-grid	CJSC “ArmHydroEnergoProject”	Construction Status	LTD “Bur Group”

No.	Name of the HPS	River	Region	Water rate (m ³ /s)	Water pres. (m)	Electric capacity (kW)	Annual production (mln.kWh)	On/Off grid	Project developer	Planning status	Site property
9	Tatev	Vorotan	Syunik	30	11.8	2850	16.9	on-grid	CJSC “ArmHydroEnergoproject”	Construction Status	“Tigran and Trdat Brothers” LTD
10	Aghstev	Aghstev	Tavush	6	41.5	2000	11.5	on-grid	CJSC “ArmHydroEnergoproject”	Construction status	CJSC “Griar”
11	Martsiget-1	On Martsiget Branch of Pambak River	Lori	3	77.1	1850	7.7	on-grid	CJSC “ArmHydroEnergoproject”	Construction Status	“Argishti-1” LTD
12	Vardan	On Talin Channel (Second Phase)	Armavir	5	42.6	1710	8.17	on-grid	CJSC “ArmHydroEnergoproject”	Construction Status	“GGV” LTD
13	Chanakhchi-2	Chanakhchi	Lori	1.9	95	1440	5.72	on-grid	CJSC “ArmHydroEnergoproject”	Construction Status	LTD “Mavr”
14	Apres	On Vorotan River	Syunik	2.8	57	1260	10.7	on-grid	CJSC “ArmHydroEnergoproject”	Construction Status	“Syunik” LTD
15	Ayri	On Ayri Branch of Sisian River	Syunik	1.2	107	1100	4.57	on-grid	CJSC “ArmHydroEnergoproject”	Construction Status	Manufacturing Cooperative “Zorakar”
16	Yeghvard	On Arzni-Shamiram Channel	Aragatzotn	2	56	900	4	on-grid	CJSC “ArmHydroEnergoproject”	Construction Status	LTD “Bur Group”

No.	Name of the HPS	River	Region	Water rate (m ³ /s)	Water pres. (m)	Electric capacity (kW)	Annual production (mln.kWh)	On/Off grid	Project developer	Planning status	Site property
17	Getik-2	Getik	Tavush	3	34	900	4.3	on-grid	CJSC “ArmHydroEnergoProject”	Construction status	CJSC “Griar”
18	Kurtan-1	On Martsiget Branch of Pambak River	Lori	2.14	38.9	670	2.93	on-grid	CJSC “ArmHydroEnergoProject”	Construction Status	LTD “Tirakal”
19	Chichkhan	On Chichkhan Branch of Pambak River	Lori	0.8	95	600	3.5	on-grid	CJSC “ArmHydroEnergoProject”	Construction Status	“Ler and Jur” LTD

Table 1.5 Hydrological data on prospected SHP plants in Armenia

No.	Name of the HPS	Available for 20 % of the year	Available for 25 % of the year	Available for 55 % of the year
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1	Pambak	10	15	5
2	Argishti	1	4	0.5
3	Meghri	1.6	3.2	1.2
4	Getik-1	2.5	4	1.1
5	Kurtan-2	1.2	1.9	0.2
6	Martsiget-2	1.6	3	1.2
7	Jradzor	3	4	4
8	Talin	1.5	2	1
9	Tatev	20	30	8
10	Aghstev	3	6	2.4

No.	Name of the HPS	Available for 20 % of the year	Available for 25 % of the year	Available for 55 % of the year
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11	Martsiget-1	1.6	3	1.2
12	Vardan	3.6	5	1.2
13	Chanakhchi-2	3	4	3
14	Apres	1.8	2.8	0.8
15	Ayri	0.6	1.2	0.2
16	Yeghvard	3	4	4
17	Getik-2	2	3	1.4
18	Kurtan-1	1.2	2.14	0.8
19	Chichkhan	0.4	0.8	0.4

1.4. Pre-feasibility studies for SHP plants in Armenia

Table 1.6 Pre-feasibility studies

Name	Her-Her	Vararakn	Vedi	Bldan	Dali	Jermuk-1	Jermuk-2
Place	River Her-Her	River Vararakn	River Vedi	River Bldan	River Dali	River Arpa	River Arpa
Capacity and produced electricity per year	1400 kW 9.12 x 10 ⁶ kWh	620 kW 2.72 x 10 ⁶ kWh	900 kW 4.13 x 10 ⁶ kWh	680 kW 2.7 x 10 ⁶ kWh	3600 kW 15.1 x 10 ⁶ kWh	2850 kW 11 x 10 ⁶ kWh	1850 kW 10.8 x 10 ⁶ kWh
Used water flow and river flow rate	0.7 m ³ /s 16.3 x 10 ⁶ m ³	0.8 m ³ /s 12 x 10 ⁶ m ³	2.2 m ³ /s 33.2 x 10 ⁶ m ³	1.0 m ³ /s 14.5 x 10 ⁶ m ³	2.0 m ³ /s 29.5 x 10 ⁶ m ³	3.0 m ³ /s 41 x 10 ⁶ m ³	3.0 m ³ /s 65 x 10 ⁶ m ³
Water pressure (Static pressure), m	250	105	65	105	275	137	81
Turbine (type, manufacturer, country)	Pelton Russia or Europe	Frensis Russia or Europe	Frensis Russia or Europe	Frensis Russia or Europe	Pelton Russia or Europe	Frensis Russia or Europe	Frensis Russia or Europe
Generator (type, manufacturer, country)	Synchronous Russia or Europe	Synchronous Russia or Europe	Synchronous Russia or Europe	Synchronous Russia or Europe	Synchronous Russia or Europe	Synchronous Russia or Europe	Synchronous Russia or Europe
Civil works (who can perform them)? What materials can be used (local, imported)	Local organizations with local materials	Local organizations with local materials	Local organizations with local materials	Local organizations with local materials	Local organizations with local materials	Local organizations with local materials	Local organizations with local materials

Name	Her-Her	Vararakn	Vedi	Bldan	Dali	Jermuk-1	Jermuk-2
Cost for feasibility work and project preparation Thousands USD	70.0	40.0	70.0	50.0	150.0	140.0	80.0
Civil work costs Thousands USD	300.0	170.0	280.0	220.0	1090.0	1220.0	570.0
Electrical equipment costs (turbine, generator) Thousands USD	410.0	190.0	270.0	210.0	1260.0	990.0	650.0
Total costs Without VAT Thousands USD	780.0	400.0	620.0	480.0	2500.0	2350.0	1300.0
Equity	Own Actives	Own Actives	Own Actives	Own Actives	Own Actives	Own Actives	Own Actives
Development loan (interest rate, needed securities and pay back time)	-	-	-	-	-	-	-
Commercial loan (interest rate, needed securities and pay back time)	-	-	-	-	-	-	-
Project grants	-	-	-	-	-	-	-
Pay-back Time (for the economic calculation) Years	2	1.5	2	1.9	2.5	2	2
Electricity tariff US Cents	4.5	4.5	4.5	4.5	4.5	4.5	4.5

Name	Her-Her	Vararakn	Vedi	Bldan	Dali	Jermuk-1	Jermuk-2
Custom fees to be paid for imported equipment and/or materials Thousands USD	40.0	20.0	30.0	20.0	120.0	100.0	60.0
Maintenance and Operation Cost Thousands USD	100.0	60.0	90.0	70.0	400.0	350.0	200.0
Financial expenses and tax Thousand USD	984.0	576.0	888.0	684.0	3624.0	3360.0	1872.0
Is the electricity sold to a energy board or directly to the customers	Sale to single buyer	Sale to single buyer	Sale to single buyer	Sale to single buyer	Sale to single buyer	Sale to single buyer	Sale to single buyer
If it is sold directly to the customers, how strong is the payment ability of the customers. How is the payment ensured?	-	-	-	-	-	-	-
What would be the conditions of a Power Purchase Agreement?	Standard Contract of Selling the Electricity to single buyer	Standard Contract of Selling the Electricity to single buyer	Standard Contract of Selling the Electricity to single buyer	Standard Contract of Selling the Electricity to single buyer	Standard Contract of Selling the Electricity to single buyer	Standard Contract of Selling the Electricity to single buyer	Standard Contract of Selling the Electricity to single buyer
Accuracy of the used data	1 and 2	2 and 4	1 and 2	2 and 4	2 and 4	1 and 2	1 and 2