WP2. Existing and prospected small hydro power plants in Georgia

Contents

1 Georgia. SMALL HYDRO SECTOR

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

Small Hydro has a very long history in Georgia, the first HPS with electrical capacity of 220 kilowatt was built in 1898 in Borjomi region. The construction of small HPSs went on and by the begin of the WW2 there where about 55 small HPSs with the overall electrical capacity of around 14000 kilowatt.

In years 1945-1951 about 130 small HPSs were built, it was mostly very small ones. The average Electrical capacity of the HPSs built in these years is about 50 kilowatt.
In the early 60es whole energy system of the Soviet Union was restructured. Small HPSs where declared economically not feasible and strategically unimportant. Most of them where put out of operation. At that time Georgia had About 220 small HPSs with overall capacity of around 50000 kilowatt.

1.1.1 Potential of Small Hydro in Georgia

Georgia has a big amount of small rivers, the technical potential of these rivers is about 8 TWh per year. This rivers are mostly placed in mountain areas of Georgia, which suffer from severe energy shortages. So Georgia has both: Hydro potential and the need to use it. Furthermore, Georgia has good human resources in the field of Small Hydro, school of energetic was always strong and there still are many good specialists in the country.

The survey "Concept of development of Small Hydro" was accomplished according to the order of the council of ministers in year 1991. Following specialists participated in this work: N. Emukhvari (Ltd. Tbilhydroproecti); G. Qoridze (Ltd. Tbilhydroproecti); T. Ashba (Ltd. Tbilhydroproecti); R. Sulaberidze (Ltd. Saqenergo); O. Solomonia (Georgian Research Institute of Power Engineering and Power Structures) and M. Berelashvili (Ltd. Saqtskalproeqti).

As the result of the survey 362 Small HPSs were listed, 278 of them are to be built others are existing HPSs that require refurbishment. Overall electrical capacity of these 362 HPSs is 2.68 million kilowatts, average annual electricity production – 13.4 billion kWh. Only small HPSs (with electrical capacity < 10 MW) from this list have overall electrical capacity of 932.6 thousand kilowatt and average annual electricity production – 5.88 billion kWh.

1.1.2 Present state of Small Hydro

As already mentioned, nearly all Small HPSs where put out of operation in the early 60es, but in the early 90es after the fall of Soviet Union Small Hydro became yet again important for the country. In these years there was severe energy crisis in Georgia and the rehabilitation of Small HPSs could strongly help to overcome it, but money shortage and high corruption rate in the government prevented the full revival of this very important branch.

Today there are about 30 operational Small HPSs in Georgia, others need to be rehabilitated. In different cases a refurbishment of different complicity is required. Some must be practically fully new built; most of the HPSs require fundamental refurbishment.

Table 1.1 *Basic information on existing SHP plants in Georgia*

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	Oper-ational	Owner-ship	Owner
1	Sionhesi	Iori	1964	Tianeti	23	48	9000	33	on-grid	●	private	-
2	Ritseuli hesi	RItseula	1939	Ambrolauri	2,5	280	6100	31	on-grid	●	private	-
3	Chkorotsku hesi	Xobis Tskali	1967	Chkorotsku	36	18	5500	25	on-grid	●	private	-
4	Alazanhesi	Alazani	1942	Gurjaani	19,8	35	4800	18	on-grid	●	private	-
5	Martkopi hesi	Iori	1952	Gardabani	13	34,5	3870	14	on-grid	●	private	-
6	Tiriponi hesi		1951	Gori	6,8	58	3000	14	on-grid	●	state owned	-
7	Misaqcieli hesi	Aragvi	1964	Mtsketa	6,75	52	2780	15	on-grid	●	private	Ento ltd
8	Kakhareti hesi	Potskovi	1957	Adigeni	6,2	42	2080	12	on-grid	●	private	-
9	Igoeti hesi	Tezi-Okami canal	1957	Kaspi	3	80	1775	3	on-grid	●	private	-
10	Abhesi	Abashis Tskali	1928	Martvili	5	44	1700	9,3	on-grid	●	private	-
11	Kabalhesi	Kabali	1953	Lagodekhi	2,6	86	1500	9	on-grid	●	private	-
12	Machakhela hesi	Machakhela	1956	Khelvachauri	8,5	21	1430	9	on-grid	●	state owned	-
13	Dashbashhesi	Khrami	1936	Tsalka	2,4	48	1260	9	on-grid	●	private	-
14	Achihesi	Achis Tskali	1958	Kobuleti	2,8	60	1028	8	on-grid	●	state owned	-
15	Kexvi hesi	Liakhvi	1941	Gori	7,6	16	980	6	on-grid	●	private	-

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	Oper-ational	Owner-ship	Owner
16	Skuri hesi	Chanis Tskali	1951	Tsalenjikha	2,7	46	920		on-grid		private	-
17	Mashavera hesi	Mashavera	2000	Bolnisi	-	-	900	1,7	on-grid	●	private	-
18	Borjopmi hesi	Borjomula	1898	Borjomi	0,4	146	784	-	on-grid		state	-
19	Kinkisha hesi	Kinkisha	1954	Kobuleti	1,4	67	740	4	on-grid	●	state owned	-

1.2 Portraits of successful implementation of Small Hydro project

Small Hydro projects can be feasible in Georgia and the following example proves it.

In 2003 micro HPS was built in Bolnisi. The construction was ordered by the boarder defence department. Electrical capacity of the HPS is 50 kilowatt; average annual production – 349 500 kWh per year. Total costs of construction equal to: 112456 GEL ~ 47 000 €. Price of electricity produced in a year – 28000 GEL ~ 11 500 € (price of 1 kWh – 0.08 GEL). The HPS will produce the amount of electricity value of which will cover the construction costs in 47 000 : 11 500 ~ 4.1 years

The main reason why this project is so economically feasible is that in this case the department fully consumes whole electricity produced by Bolnisi HPS and there are no intermediaries between the energy production and energy consume.

1.2.1 Bolnisi SHP plants

General information

Name of the HPS	Bolnisi SHP
River	Poladauri
Region (exact location)	Bolnisi region, village Poladauri
Implementer/ers	"Energyprovide" Ltd.
Orderer / ers	Commendatory "Bolnisi" of the Boarder defence department
Actual owner/ers of the HPS	Boarder defence department
Operator	The station is being operated by the employees of the "Bolnisi" commendatory, trained by the "Energyprovide" Ltd. specialists

Technical Information

Max. electrical capacity	42 kW
Annual electricity production	0,35 mln. kWh
Water pressure	19 meters
Construction date and period	February 2003
Used water flow	0.3 m^3 / sec

On grid / of grid	OFF-grid
Specific technology used	Frensis Type turbine, produced by "Tbilaviamsheni" Ltd. Georgia

Financial information

Total investment	State Financing	Commercial loan	Equity	Public Funding
50 000 Euro	*50 000 Euro*	-	-	-

Power station under operation	15 years
Payback Time	4 years

History of the project

The Commendatory "Bolnisi" of the Boarder defence department was using a micro HPS with a capacity of 1.5 kW, which was not enough to satisfy its electricity needs. There was an alternative to by the electricity from the central grid, but the central grid could not guarantee a non-stop supply which is vital for the Commendatory, so the idea of building a bigger HPS on the nearby river came up. The project was developed and implemented by the "Energyprovide" Ltd. with the support of the "Tbilaviamsheni" Ltd. It was financed by the Boarder defence department.

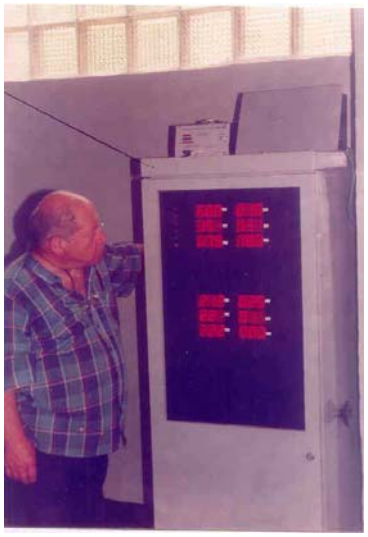
Specific advantages of the project

The main advantage of the project was the ideal situation in financing and electricity selling. There was no need to look for the credits (what is in deed very complicated in Georgia), because the project was financed by the State. But even more important is the fact that the "Bolnisi" commendatory consumes the whole electricity produced by the SHP. If there was no SHP the commendatory would have to by the electricity from the grid and pay 0.084 GEL (0.04 EURO) for the kW\h. If we calculate how big is a payback time of the station evaluating one kWh of electricity for 0.04 EURO, it is less than 4 years. This specific situation makes the project exceptionally advantageous.

There are many other places in Georgia with similar circumstances. The autonomous energy supply is very convenient especially for the mountain regions, both technically and financially, especially regarding the energy crisis and the central grid instability.

Environmental aspects of the project

Due to the very little used water flow and absence of the dam the ecological situation was practically not affected.



1.3 Prospected Small Hydropower plants

Table 1.2 *Prospected Small Hydropower plants in Georgia*

No.	Name of the HPS	River	Region	Water rate (m^3/s)	Water pres. (m)	Electric capacity (kW)	Annual production (mln.kWh)
1	Jokholhesi	Alazani	Akhmeta	9	70	5000	39
2	Ujarmahesi	Iori	Tianeti	6.5	60	5000	35
3	Omalo 2	Pirikita Alazani	Akhmeta	9	135	9700	53
4	Stori 1	Stori	Akhmeta	16.8	40	5400	28
5	Lopota hesi	Lopota	Telavi	4	230	8000	45
6	Nakhiduri	Khrami	Marneuli	33	34	9800	52
7	Mlethesi	Tetri Aragvi	Dusheti	6	140	6000	45
8	Dzirula hesi	Dzirula	Kharagouli	12.5	55	5200	35
9	Tsiflnarihesi	Bakhvistskali	Ozurgeti	2.3	380	7000	35

10	Chkhikvahesi	Natanebi	Ozurgeti	4.4	190	6100	44
11	Gubazeuli (cascade) SHP 1	Gubazeuli	Guria	6.4	152	7000	30
12	SHP 2	Gubazeuli	Guria	10.5	58	5600	22
13	SHP 3	Gubazeuli	Guria	11	68	5000	22
14	SHP 4	Gubazeuli	Guria	12	65	7000	30
15	SHP 5	Gubazeuli	Guria	14	54	5000	38
16	Suspsa hesi	Supsa	Chokhatauri	11.6	124	9400	54
17	Tao hesi	Faravani	Ninotsminda	9	67	5000	22
18	Tori hesi	Borjomula	Borjomi	3.5	196	5700	23
19	Tekhi 1	Tekhura	Martvili	12	65	6200	27
20	Shoukveti	Nakra	Mestia	5.8	165	7800	46
21	Kmara hesi	Tskhenistskali	Lentekhi	12	66	6500	32,5
22	Kheledula 1	Kheledula	Lentekhi	6	170	8500	47
23	Kheledula 2	Kheledula	Lentekhi	9.5	100	8000	44
24	Machakhela hesi 2	Machakhela	Khelvachauri	11	54	5000	34
25	Khulo	Acharis Tskali	Khulo	7	86	5000	25
26	Kintrishi hesi	Kintrishi	Kobuleti	10	54	5000	34

1.4 Pre-feasibility studies

1.4.1 Kazbegi Hesi

Name of the HPS: Kazbegi Hesi
River: Kistura (right tributary of the river Tergi)
Region: Kazbegi
Year of construction: 1951

The HPS Kazbegi Hesi uses the water-power of the river Kistura (right tributary of the river Tergi) on its lower section. The head constructions are located on the left bank of the river and are designed for water flow of 0, 4 m^3/sec. Canalization is carried out by means of a 550 m long metal pipeline. The station building is located on the right bank of the river Tergi.

The HPS has the following parameters:
Used water flow: 0.4 m^3/sec
Water pressure: 95 m
Electric capacity: 300 kW
Annual production: 1.6 mln. KWh

In the station building 2 Finnish turbines of the type Pelton with a horizontal axis are installed, with the capacity of 152 kW each. Generators are produced by the Russian factory “Electrosila”.

The HPS has been operating since 1951. The constructions and the electric equipment is still in a satisfactory condition.

In 2005 GRIPEPS developed a preliminary project of reconstruction of the HPS. This was done at request of the Ministry of Fuel and Energy of Georgia.

Within the framework of the project it is planned to increase the electric capacity up to 1000 kW. To achieve this goal, the implementation of the following measures is planned:

- Reconstruction of the head constructions, in order assure receipt of an increased water flow of 1, 9 m^3/sec. A second metal pipeline (700 mm in diameter, 550 m long) will be added;
- The station building will be enlarged to make installation of a 3rd unit possible. The electric capacity of the new unit will be 1000 kW. Two alternatives are available: a Russian turbine of the type "Fransis" - PO 115/697 and a Chinese turbine of the type "Fransis" - HL 160-WJ-50

The average annual power production will be 7 mln. KWh.

The approximate cost of the rehabilitation is **800 000** EURO. The recipients of the electric energy could be: Inhabitants of the Kazebgi valley and some small local enterprises.

The HPS is connected to a substation located in the Kazebgi valley with a 10 kV transmission line.

The HPS is in the property of the Georgian State.

1.4.2 Kala Hesi

Name of the HPS: Kala Hesi
River: Khalde (right tributary of the river Enguri)
Region: Mestia
Year of construction: ----

The HPS was located on the river Khalde, 800 m above its estuary in the river Enguri. The receiver of water received the water flow of 0.7 m^3/sec; Canalization was made possible through a 1 km long ground canal on the left bank of the river, at the end of which, a concrete pool was located. A 250 m long metal pipeline ensured a water pressure of 15 m. The station building is located on the right bank of the river Enguri.

The hydro unit had the electric capacity of **84** kW.

At present the head junction is destroyed, the canal is filled with soil. The frame of the pool still exists; the pipeline is misshapen and can't be used. The station building is damaged and the hydro unit is inoperable. The electric equipment was stolen. The HPS was conserved in 1965-70.

It is reasonable to reconstruct the HPS, increasing its capacity, in order to ensure power supply of the inhabitants of the villages Kala, Ipari, 4 villages of the Ushguli region. The annual electricity demand of these villages was estimated at **350-400** guaranteed kW. If we take into attention the future development of agriculture, the electricity demand can rise by approx. 400-600 kW and thus constitute **800-1000** kW annually.

According to the rehabilitation project the head junction will be built on the river Enguri. It will be of Alpine type, the canalization will be made possible through metal pipeline (1200 mm in diameter, 2.6 km long).

This pipeline will supply 2 turbines of the type ”Frensis” with water flow of 1.6 m3/sec. The electric capacity of the HPS will be 800 kW and the annual production about **5.5 mln.** kWh.

The estimated cost of the rehabilitation is **950 000** EURO.

1.4.3 Katskhi Hesi

Name of the HPS: Katskhi Hesi
River: Katskhura
Region: Chiatura
Year of construction: ---

Katskhi Hesi was in operation till the 60ies of the 20th century. The HPS had the following parameters:

Used water flow: 0.2 m^3/h
Water pressure: 20 m
Electric capacity: 25 kW

As a result of the electrification of Georgia the operation of the station was suspended.
Today from all station constructions only a part of head junction is left.

The parameters of the river flow and relief support the reconstruction of the HPS with an increased capacity. According to the project, used water flow will be 0.4 m^3/sec, water pressure - 45 m and electric capacity - 140 kW. Annual production will come to 0.55 mln. KWh.

It’s intended to supply with electricity the village Katskhi and other villages located nearby. In 1994 “Hydromshenebeli” Ltd., by request of the administration of the region Chiatura drew up the initial variant of the rehabilitation project.

The estimated cost of the rehabilitation is **170 000** EURO.

1.4.4 Goresha Hesi

Name of the HPS: Goresha Hesi
River: Kvadeura (left tributary of the river Dzirula)
Region: Kharagauli
Year of construction: 1941

The HPS uses water from the rivers Kvadeura and its tributary Tchomati Khevi. The head construction consists of a dam, 1.5 m in height and 12m long. On the right bank of the river a water receiver of a simple construction is located. A 20 m long pipeline (0.4 m in diameter) connects the water receiver to the pool. The pool is also supplied with water from the river Tchomatis Khevi, where we have water receiver of the same type. The metal pipeline is 100 m long and 0.35 m in diameter. From the pool a 1970 m metal pipeline, the diameter of which is getting smaller and smaller (on its last sections) and is 0.6 m, 0.4 m and 0.35 m respectively, creates a maximum pressure of 60 m.

In the station building a turbine with a horizontal axis (capacity 125 kW) is installed, produced by the Georgian "RemMashMsheni". The generator (ХЭМЗ МО-317-4/6) was produced by the electromechanical factory in Kharkov, Ukraine.

The HPS was built in 1941 and was reconstructed in 1947.

The technical parameters of the HPS are:
Used water flow: 0.3 m^3/sec
Water pressure: 52 m on average, 60 m maximum
Electric capacity: 125 kW
Planned annual production: 0.9 mln. KWh
Actual annual production (during last years): 0.26 mln. KWh

All constructions and mechanic as well as electro technical equipment is depreciated and paid-off.

But based on the inspection conducted by GRIPEPS in 2003, it can be said, that the overall state of the HPS is satisfactory. Rehabilitation of the HPS would allow increasing the amount of produced energy. To speak in concrete terms: It is necessary to replace the current pipeline with pipelines 0,6 m in diameter. This way the water pressure of the station will be increased. The same result may be achieved by the transfer of the station building downstream along the river, by increasing the section of energy use or by installing a new turbine with a higher coefficient of efficiency. After these actions the electrical parameters of the station will be:

Electric capacity: 200 kW
Annual electricity production: 1.2 mln. KWh
With a 16 km long 6 kV transmission line the station transfers produced electricity to the administrative center Kharagauli.
The station is in private ownership of "Goresha Ltd."
The estimated cost of the rehabilitation is **215 000** EURO.

1.4.5 Sno (Djuta) Hesi

Name of the HPS: Sno (Djuta) Hesi
River: Shino (tributary of the river Sno)
Region: Kazbegi
Year of construction:

The HPS had the following electrical parameters:
Used water flow: 0.25 m^3/sec
Water pressure: 140 m
Electric capacity: 220 kW

One impulse of type "Pelton" turbine was installed. At present only head constructions and the station building are left, both of them damaged.

Metal pipeline, which supplied the hydro unit with water, 400 mm in diameter and 560 meters long, today supplies village Sno with water.

In 2005 by request of the Ministry of Fuel and Energy of Georgia GRIPEPS developed a preliminary project of reconstruction of the HPS was developed.

The main features of the project are: Rise of electric capacity up to 800 kW, rise of used water flow up to 0.8 m^3/sec. The existing pipeline will be refurbished and the increased water flow will flow through the new pipeline, 500 mm in diameter. The existing impulse turbine will be reconstructed and an additional turbine with the capacity of 550 kW installed. The station building will be enlarged to make the installation of a new unit possible and old constructions will be repaired.

There will be two hydro units with the capacity of 250 and 550 kW. The first one will operate within the periods with decreased water flow. After the reconstruction the annual electricity production will be about 3.65 mln. kWh.

The approximate cost of the rehabilitation is **780 000** EURO.

For the transmission of the electricity to the substation "Sno" a 400 kW/a transformer must be installed. The HPS will be connected to the substation with a 10 kV, 1.5 km long transmission line, which is again connected to the substation "Kazbegi" with a 6 km long transmission line.
The main consumer of the electricity will be population of the Kazbegi region.
The HPS is in the property of the State.

1.4.6 Avranlo Hesi

Name of the HPS: Avranlo Hesi
River: Ktsia-Khrami
Region: Tsalka
Year of construction: 1947

The HPS was put into operation in 1947 with the following energetic parameters:
Used water flow: 1.0 m^3/sec
Water pressure: 13 m
Electric capacity: 88 kW
Annual production: 0, 6 mln. kWh

The exploitation of the station was abandoned in the 60ies years of the 20th century. Today the HPS is completely destroyed.

The reconstruction of the HPS within its old parameters would be unjustified taking into account the increase of the electricity demand in the region as well as favourable river and relief conditions. The rehabilitation project was developed in 1996 by the "Hydromshenebeli Ltd" functioning at the GRIPEPS.

It is planned to build the head construction above the village Avranlo. The head construction will be of mountain type. A metal pipeline (2700 meters long, 1400 mm in diameter) will be placed in a trench and buried into the soil. The station building will be built near the village Avranlo.

The parameters of the HPS will be:
Used water flow: 3.0 m^3/sec
Water pressure: 50 m
Electric capacity: 1200 kW
Annual production: 6.5 mln. kWh.

The estimated cost of the rehabilitation is **900 000** EURO.

1.4.7 Borjomi Hesi

Name of the HPS: Borjomi Hesi
River: Borjomula
Region: Borjomi
Year(s) of construction: 1898-1902

The HPS was built to supply with electricity the summer house of the Russian grand duke Michael Vorontsov.

The head of the HPS is located at the mark of 1120 m. From there the river water flows into the pool, which is located at the mark of 976 m. To get there, it must pass a 6,5 km long open canal. From the pool the water flows to the station building, located in the Kura - Borjomi Park, at the mark of 820 m. On this route a **metal** pipeline creates water pressure at hydro units of 147 m. At first the capacity of the station was 150 horse-powers (112 kW), in the following years the capacity was increased and was 225 kW, later 784 kW. Correspondingly, the used water flow rose from 0, 4 to 0, 8 m^3/sec.
Within the framework of SHYCA the HPS was examined and as a result the following observations were made: the hydro- technical constructions are in catastrophic state. Metal constructions, units are plundered, the electric equipment is stolen. Body of one generator and the pipeline catch are left. The HPS hasn't been in operation for many years now.
Nadarbazevi Ltd. was authorized to reconstruct the HPS. It plans to build on river Borjomula a cascade of 3 HPSs. Besides the Borjomi Hesi it is planned to build two more HPSs of a small capacity - between 1256 and 1120 m.

1. Tba Hesi - Electric capacity 500 kW. The station will have a metal pipeline (1000 mm in diameter, 1100 m long. The used water flow will be 1.0 m^3/sec.
2. Plato Hesi - water pressure: 40 m, capacity: 350 kW, canalization: 6.8 km.
3. The electric capacity of Borjomi Hesi will rise up to 1100 kW and the used water flow will be 1.0 m^3/sec. The energetic scheme will stay unchanged; the reconstruction will touch the pipeline, the pool and the station building. New hydro - mechanic and electro - mechanic equipment will be installed.

It is the end of 2005 now and the reconstruction process hasn't started yet.

The estimated cost of the rehabilitation of the Borjomi Hesi is **660 000** EURO.

1.4.8 Kinkisha Hesi

Name of the HPS: Kinkisha Hesi
River: Kinkisha
Region: Kobuleti
Year(s) of construction: 1954

The HPS is located near village Kvirike (10 km from the seaside resort Kobuleti). The head construction of Alpine type, built on the river Kinkisha, satisfies the general engineering standards.

The water receiver is built on the left bank of the river and is equipped with a riverbed washer. Canalization is provided with a 1, 6 km long open canal, which is laid on mountainsides. Its walls and bed (made of concrete) are seriously damaged. On its whole length the canal is partly filled with soil and stones created as a result of erosion of mountainsides. On a 350 m segment derivation is conducted through a metal pipeline (1 m in diameter), that is damaged. Because of the above

mentioned reasons the station doesn't have the planned water flow. The pool at the end of the canal is in a satisfactory state. The pressure metal pipeline is 240 m long and 800 mm in diameter. The station building is also in a satisfactory condition. Here two hydro units Φ 13 -ГН -70 are installed, 370 kW capacity each. As already mentioned, the current state of hydro technical constructions makes passing of the water flow of 1.2 m^3/sec impossible. So in spite of planned 740 kW capacity and 4 mln. KWh annually, the HPS only produces 2 mln. kWh annually.

The planned technical electric parameters of the HPS are the following:
Used water flow: 1.4 m^3/sec
Water pressure: 67 m
Electric capacity: 740 kW
Annual production: 4 mln. kWh

The HPS was built in 1954. The hydro technical constructions are amortized and some of them are damaged a lot. For the reconstruction of the HPS the following measures must be taken:

- The water receiver and river bed before the water receiver (section at the Zeda Biepi) must be cleaned and all inert particles removed;
- The canalization (derivation) canal must be repaired capitally on its whole length and a roof built in order to prevent filling with soil and stones.
- The pipeline on the damaged section of the canal must be changed;
- All metal regulation panels must be changed;
- The pressure pipeline must be changed;
- New units must be installed.

Kinkisha Hesi is in state ownership, the produced electricity is part of the state power system of Georgia.

The estimated cost of the rehabilitation is **300 000** EURO.

1.4.9 Andeziti Hesi

Name of the HPS: Andeziti Hesi
River: Borjomula
Region: Borjomi
Year(s) of construction:

The Tsikhisjvari Hesi was located at the mark of 1540 m on the river Borjomula (near to the tributary Shavi Tskali). The water receiver, which used the water flow of 0.5 m^3/sec supplied the 174 kW station with water. The HPS had water pressure of 37 m. It had been in operation since 1949 and mainly provided power supply of a mining plant, extracting the rock-mineral Andezit. It also supplied inhabitants of the village nearby. The HPS stopped operating in the 70ies. Today all station constructions are totally destroyed.

In 1992 "Hydromshenebeli" Ltd., by request of the "Samtokimia" trust worked out a reconstruction project. The HPS was renamed and is now called Andeziti Hesi. It is planned to build the head construction on the river Borjomula (at the mark of 1520m). The water receiver will be of a mountain type. With the help of open soil canal, water from the tributary Shavi Tskali will be connected to the water from Borjomula, thus increasing water flow to 1 m^3/sec. Canalization will be conducted through a pipeline (800 mm in diameter, 5 km long, made of metal or plastic). 2 hydro units will receive water.

The station building will be built at the bank of the river Borjomula, at the mark of 1270 m. At the end of the pipeline a discharging pipeline will be installed, which will play the role of a balancing tank. The water pressure will constitute 230 m. The installed capacity will be 1800 kW, the annual electricity production 9 mln. kWh. The average capacity in winter season will be 700 kW. The main user of the electricity could be the growing skiing resort "Bakuriani".
The estimated cost of the rehabilitation is **1 260 000** EURO.

1.4.10 Khertvisi Hesi

Name of the HPS: Khertvisi Hesi
River: Paravani
Region: Aspindza
Year(s) of construction:

The head junction of the HPS was built on the river Paravani, in the course of 2.5 km from its confluence into the river Kura. It is located at the right bank of the river; at the mark of 1198 m. Canalization is conducted through a quadrangular open canal. The canal is 900 m long. At the end of the canal there is a concrete pool, which has an 80 m long canal at its right side. Water flows through it into the river Paravani. The pool and station building are interconnected with a 21 m long and 900 mm in diameter 2 thread pipeline. The pipeline is buried into the soil.

In the station building two turbines of the type "Frensis" are installed. The turbines were produced in Finland. The generators are also from Finland. (Enterprise Strömberg, year 1948). The unit has a capacity regulator lever gearing. The nominal capacity of every hydro unit is 145 kW. There are also a control pane and an electro technical construction in the station building. The step-up transformers are located outside the building. The electricity transmission is being conducted through a 10 kV transmission line.

The users of the electricity are some working regional plants and the inhabitants of the nearby villages. The station works in an autonomous regime. An energy distribution company receives payments from the users and pays the owner 0.014 $ for 1 kWh. The HPS is privately owned by Nodar Lekishvili.

The technical parameters of the Khertvisi Hesi are:
Used water flow: 3 m^3/sec
Water pressure: 13 m
Electric capacity: 294 kW
Annual production: 2 mln. kWh

During the last years the station works with interruptions and break downs. The station has been in operation for more than 55 years by now, so hydro technical constructions and electro mechanical equipment is amortised. One part of the constructions is damaged and urges reconstruction works to be carried out. In its present state the HPS is unable to produce more than 0.8-1 mln. kWh electricity annually.

The most important damages and damaged constructions are listed below:

- The wall of the head junction was completely destroyed in course of the water floods in summer 2005. The wall regulated water flow in periods with little amount of water in the river.

- The left (river side) side of the derivation canal is strongly damaged at some places. Due to this fact, a filtration is occurring - results waterlogged areas around and decreased amount of water needed for the operation of hydro units.
- The metal closing panes (shields) have to be changed. At present their regulation is possible only in the manual mode.
- The whole mechanical and electro technical equipment has to be changed (turbines, generators, control pane system)

Besides implementation of the rehabilitation works it would be reasonable to raise the capacity of the station to 1000 kW. To achieve this, the water receiver has to be reconstructed. This will increase the water flow up to 5.5 m^3/sec. The height of the canal boards has to be raised by 0.5-0.6 m to ensure passing of increased water flow. The height of pool walls has to be increased by the same value and the threshold of the side canal must also be raised. It is important to change the old pipeline and increase its conductivity. The annual production of electricity will be 6.8 mln. kWh.

In case the decision to increase the HPS capacity is made, the station building could be relocated 0.5- 0.7 km downstream - this will result in an increased water pressure.

The estimated cost of the rehabilitation is **600 000** EURO.