Feasibility Study for Upgrading of SHPP Gjanci (Korca Area)

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1 SUMMARY

Company "SPAHIU – GJANC" sh.p.k. won in 2003 the concession of HPP Gjanc in ROT (rehabilitate, operate, transfer) form. During this time the HPP was rehabilitated and has been in operation throughout the entire time. The company has configured a team that owns wide intellectual capital and experience. Also the company possesses the financial resources needed for this expansion and the management of the entire process of the development of the project.

The general scheme of hydropower plant of Gjançi is designed in combination with the irrigation scheme of Korça lowland, exploiting Gjançi water reservoir in accordance with irrigation schedule and water flow of Osum River in Leshnje.

Gjançi hydropower plant was built during 1979-1981 by the decision of the Ministry of Construction for the irrigation scheme of Korca district and hydropower plant of Gjançi construction with decision Nr. 39 dt. 29.12.1970. Study and construction of this hydropower plant have planed to exploit at maximum the previously existing water works of irrigation system without passing water for irrigation. However the plant strictly respects the irrigation graph schedule and scheme that are made for this purpose.

Major civil works built in 70s-80s period also utilized from the plant are: Intake built on Osum River near the village of Leshnje; water feeding channel from the intake up Gjançi reservoir with a length of 7 km, 5 m3/sec capacity, with two siphons; Gjançi reservoir built with two dams for the collection and processing of Osum river flow in his upper side; feeding tunnel with length of 1600 lm (linear meter).

For the completion of plant's works the following were constructed: intake channel with length around 1200 lm, pressure basin, penstock with 340 lm and 1 m diameter, and powerhouse located at the bottom of the hill of Ujbardhe village on top of irrigation network of Korca lowland. On the following map is given the rehabilitation of the constructed part of the HPP and all cases analyzed.

During design of the irrigation system, project had envisioned that from Osum River, intake and reservoir feeding channel to be taken and processed in the reservoir flows up to 5 m3/sec. According to hydrological studies in the area of Leshnje of Osum River, it has a natural average flow around 1.5 m3/sec. With the accepted and implemented dimensions of works in this constructed project, from Gjanci reservoir would have been exploited a many years average flow up to 1.3 m3/sec.

According to hydrological studies conducted after construction of the works for the agriculture system and plant scheme, it has shown that the amount of water and parameters predicted on exploited water works are not met. Flows in the intake passing through the feeding channel are around 55% -60% of predicted capacity. This has led to the reduction of operating parameters of the plant and irrigation system. The plant is projected to produce on average around 10 million kWh / year, in fact up to this time it has produced around 6-7 million kWh per year. Also water used for irrigation purposes has been processed in lower quantities than initially projected. Rehabilitation of HPP Gjançi and its expansion have these parameters given in Table 1:

Table 1. Current Parameters and Expanded ones

Nr.	The actual parameters of the project	The expanded parameters of the project
1	Gross Fall (Nominal) Hbruto = 131 m	Gross Fall (Nominal) Hbruto = 131 m
2	Net Fall (Nominal), Hneto = 127 m	Net Fall (Nominal), Hneto = 127 m
3	Computing Flow Rate, Qll = 2.8 m3/s	Computing Flow Rate, Qll = 2.8 m3/s
4	Ecological flow Qek = 200 liters / s (based on European Directive: 4% of average flow)	Ecological flow Qek = 200 liters / s (based on European Directive: 4% of average flow)
5	Installed power, kW Nins = 2940	Installed power, kW Nins = 2940
6	Annual energy production, Evj = 6.12 GWh / year	Annual energy production, Evj = 8.15 GWh / year

The following sections will provide a summary of energy and financial analysis referring to the case with expanded parameters of the plant.

1.1 BACKGROUND OF ALBANIAN POWER SECTOR

The new law on concessions provides an important step in the creation of the legal framework which would provide transparency and competition for the investors interested to invest in all sectors of public services and infrastructures, including the sector of electricity generation.

Except the privatization of the distribution which would serve as a good opportunity to attract in our country important investors, a great important is being paid by the Government for the preparation of the suitable legal and institutional framework to attract private investment in the construction of new generation sources, especially in small hydropower plants. Meanwhile a similar PPA for small hydropower plants shall be signed (guaranteed) for all the electricity produced by the power plant for a period that may vary from 10-15 years. Despite this, the PPA for the resources with a big capacity shall be applied taking in consideration even the developments that are expected to occur in the regional electricity market. In the case when there is a big concentration of the local generation in the cascade of Drin River, it is difficult to have a generation competition in the Albanian market in the near future. However, there are possibilities for a limited development related to the low generation of electricity, low co-generation or CHP (plants with combined generation of electricity and thermal energy) and the producers themselves.

Law No. 9072 "On electricity market" (Article 38), which has entered in power in July 2003 has defined the hydropower plants with installed capacity up to 10 MW, CHP generator with installed capacity up to 100 MW and the producers themselves for the additional amount of produced energy when they use renewable energy resources and its installed capacity is not bigger than 10 MW, as privileged energy generators, which have a special treatment by the transmission system operator in the dispatching of the electricity generated by them. The Law provides also that this special treatment is defined in the code of network function.

1.2 TASKS OF DESIGN

The base task of design is the realization of the technical project and of the financial analysis of the upgrading of the SHPP of Gjanci. Based on technical and financial analyses (included in this study), initial investments, produced amount of electricity, price of electricity market, cost and operation and maintenance of Gjanci SHPP, interest rate and loan conditions was possible to realize the Financial Feasibility Analyses.

2. INTRODUCTION AND BACKGROUD OF POWER SECTOR

2.1 Background of the sale and supply of the electricity

Despite the financial barriers of import, the main problem that the Albanian electricity market is facing nowadays is the limited technical ability of the generation, which mainly varies between 14-19Million kWh/day and of the import, which might arrive up to 10–11Million kWh/day providing a total maximum supply of 24-30Million kWh/day. A general overview of the primary energy supply in general and electricity in particular are given in Figures 1-4.

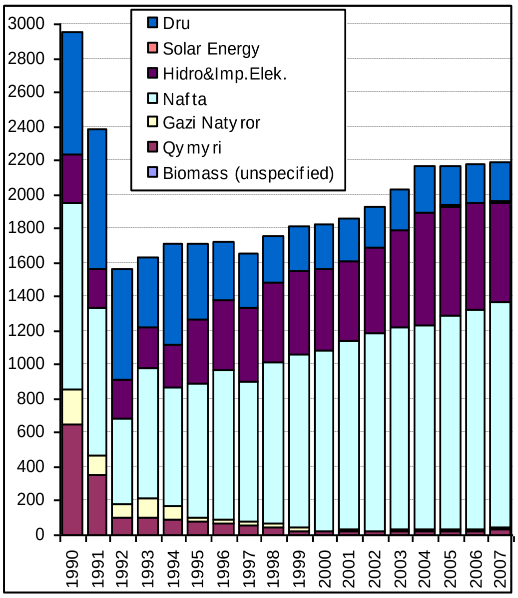


Figura 1.: Supply with primary energy sources in Albania (ktoe)

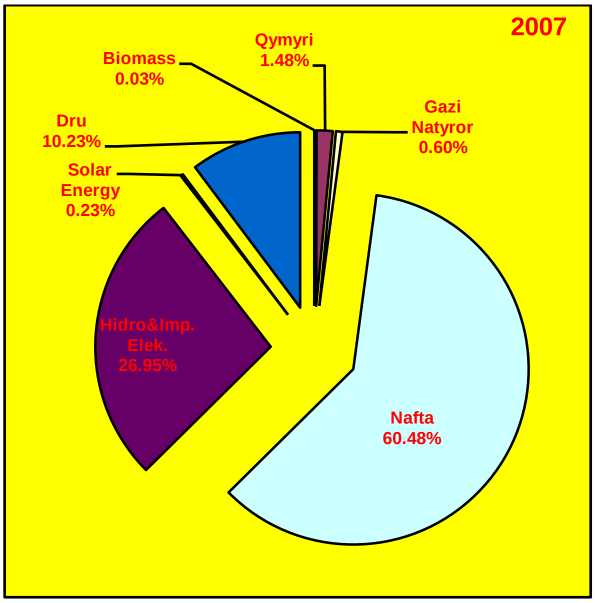
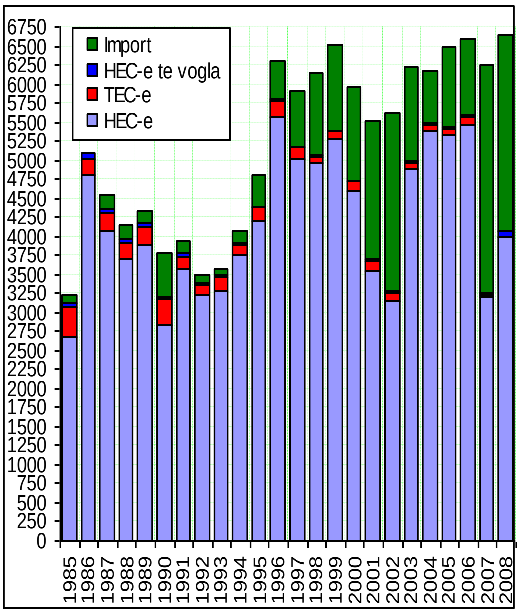


Figura 2.: Contribution of primary energy sources in Albania at the year 2007 (%)



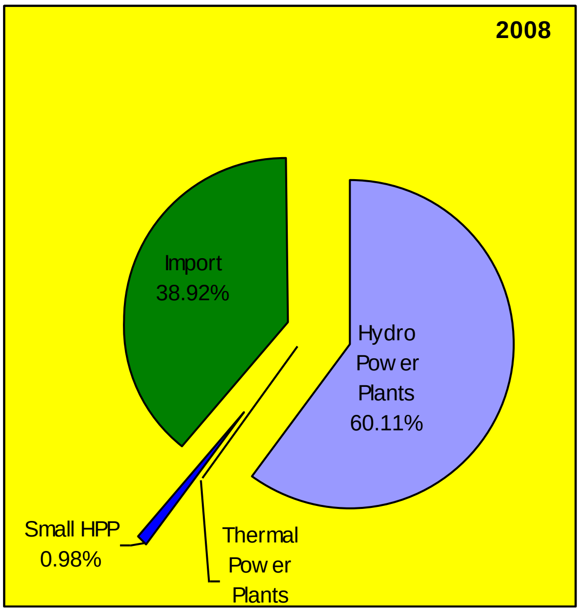


Figura 3.: Supply with electricity for Albania (GWh)

Figura 4.: Contribution of electricity supply for Albania (GWh)

- It must be emphasized also that the consumption needed in a common winter day goes up to 25-27 million kWh. The situation in the country is difficult regarding the coverage of the electricity needs so the energy market for the SHPPs is guaranteed.
- Electric inter-connection with the neighbor countries: The interconnection of the country with the neighbor country is realized through three lines: Elbasan-Kardia (400 kV) with capacity of 1100 MVA, Firza-Prizren (Kosovo) (220 kV-250 MW) and Vau i Dejes-Podgorica (Monte Negro) (220 kV-250 MW). The main load of import is supported by Kardia-Elbasan.
- Technical loses in the transmission-distribution network: Loses in transmission-distribution network in 1999 were very big, 1406 GWh, (720 GWh loses in transmission and 685 GWh in distribution). Based on the planes implemented for the reduction of level of loses has been reduced to the value of 32 % from 41% that it was in 1999. Even though we have a reduction of this loses in the latest years the values are relatively high, 24 % loses in transmission and distribution.

2.2 Daily curves in the function of the winter and summer seasons of the electricity load

Because of the fact that most of the population use electricity for heating purpose the daily electricity curve during the winter day has a peak up to 1280-1390 MW (maximum value without black out), whereas the peak requirement during the summer season varies between 780-897 MW (even this peak is increasing constantly as electricity is being used more and more for air conditioning). One of the main problems of the Albanian electro-energetic system is the need two times higher in winter period than in summer period. This tendency has been reduced starting from 1999 up to 2008 and this is as a result of higher consumption of electricity for heating purposes. In the figures 5-6 there are given the curves of the third Wednesdays in January and in July in 2007 which displays clearly the respective differences between winter and summer seasons for electricity sector.

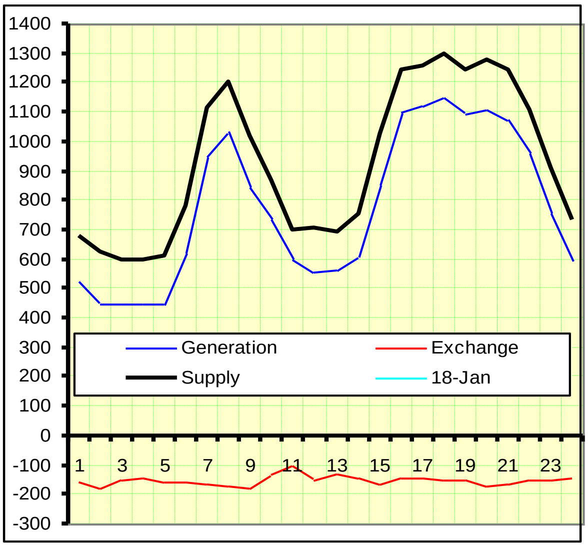


Figure 5.: Daily supply curve with electricity for the third Wednesday of January 2008 (MW)

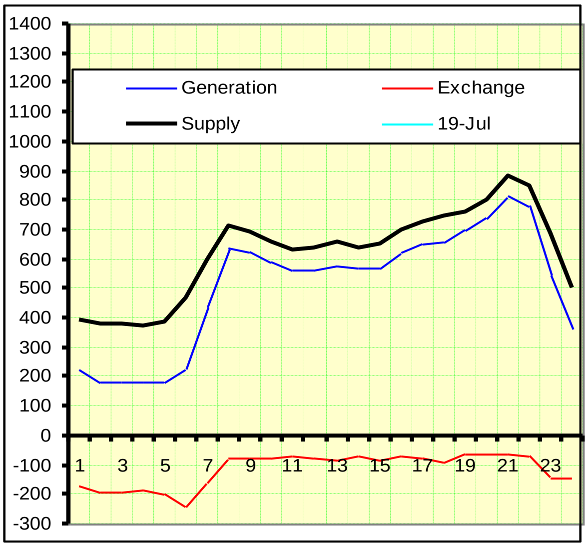


Figure 6.: Daily supply curve with electricity for the third Wednesday of July 2008 (MW)

2.3 Forecast of Electricity Demand

Based on the National Strategy of Energy, in the figures 7 and 8 there are given the needs for electricity and the forecast of loses for the period 1999-2015. As a result, the electro-energetic needs to fulfill the requirements and to reach the level of loses of 10 % are 9535 GWh in 2015.

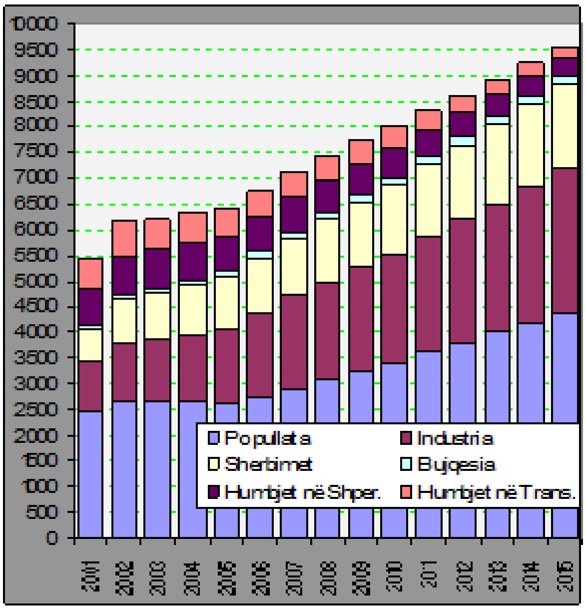


Figure 7.: Forecast of needs for electricity in all sectors (GWh)

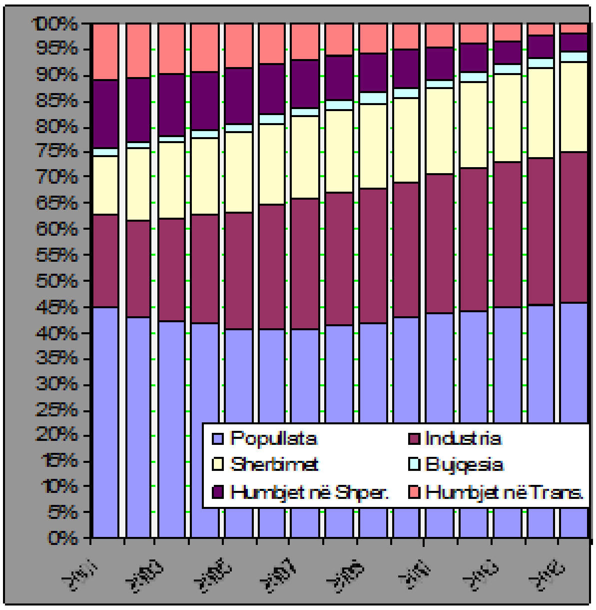


Figure 8.: Forecast of electricity needs and loses in transmission and distribution (GWh)

Privatization of distribution sector which was realized lately (April 2009) and put in efficiency of the local HPPs remains as a possibility to fulfill a part of the needs for electricity of our country.

2.4 Development in electro-energetic sector and technical requirements in generation, transmission and distribution sector

Based on the reconsidered Document of the National Energy Strategy, which is in the approving process, in the following we are giving shortly the generation, transmission and distribution master plan of electricity.

2.4.1 Development of the sector of electricity generation

For the short-term period (up to 2009) and taking also in consideration even the construction of new power plants, new additional needs of Albania will be completed only by increasing the import (as based load) (up to 2.5-3.5 TWh/year). As a result, it is suggested to keep in the plans the import level and it is being worked on the finalization of the installation of CCGT TPP (97 MW), which will start operation at the end of 2009 (figure 9). Based on National Energy Strategy it is calculated that will be installed about 260-300 MW, SHPPs with a mean production about 780 -1200 GWh/year.

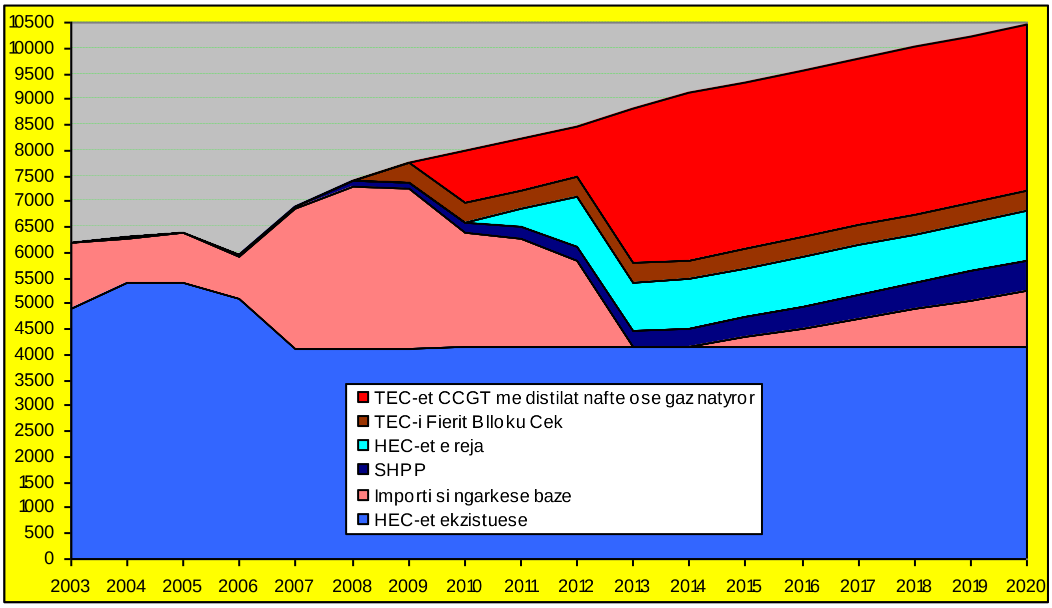


Figure 9.: Masterplan of Development of Generation of Electricity in Albania

2.4.2 Development of transmission sector of electricity

High Voltage Networks of 400 kV and 220 kV together with the respective substations operates near their thermal limits and in the transmission system there are higher loses. The master plan for the development of the transmission network it is prepared in such a way to cover the needs with a minimum cost, with a enough qualitative service and in accordance with the planning criteria. Based on the above level there are taken into consideration all the reinforcement of the network which result in economical benefits and which fulfill the technical requirement, for a safe operation other transmission system integrated in UCTE system. Currently, it is being worked on the realization of the Albanian – Monte Negro interconnection of 400 kV and recently will start the construction of another interconnection project with Albania-Kosovo.

2.4.3 Development in the distribution system of electricity

Based on the strategies for the reduction of the technical loses, the master plan of the distribution system aims at identification and assessment of the best strategies to the enlargement of the network in the way that it will fulfill the increasing demand for all the categories of the consumers. The networks are projected for every region and the distribution master plan in also projected for every region. Rehabilitation and enlargement plan is realized case after case in order to analyze the required intervention to reduce the technical loses and to fulfill the requirements up to 2020. Short-term investment program for the 2009-2011 periods shall realize the expectations as follow:

- Implementation of the project of Rehabilitation of the Distribution, financed by donors group;
- Construction of the distribution lines with a voltage of 20 kV in some of the main cities in the country;
- Installation of the meters within 2009 in all the categories of consumers which aren't installed at the moment;
- Elimination of illegal connection in all areas where this phenomenon is encountered.
- In addition to this, it is emphasized that the reserves factor in the calculation of the investments it is considered to be 15 % as all the assessment are in the pre-feasibility phase. However, it should be mentioned that the detailed action plan must include the maintenance cost, cost of new meters and also the cost of the rehabilitation of the rural network TU with a length of 12156 km with a estimated cost of 111 million Euro, which shall follow the annual plan of OSSH.
- Privatization of the distribution sector is increasing the investments in distributing network which will help considerably the promotion of small hydropower plants in general all over the country and especially of the Gjanci SHPP. The master plan for the rehabilitation and upgrade of the distribution system consist in reduction of technical loses and future upgrade of the distribution system, which focuses on a list of necessary interventions, in order to fulfill the forecasted increase of the demand for electricity in accordance with the foreseen results of this needs for each sector (apartment blocks, services, industries, etc.).
- Organization of the distribution master plan use the area of a district (region) as main module, which correspond to an area, which is supplied by 1-2 substations of 110/20 kV.

In addition to this, for each distribution region it is represented a special master plan, based on the requirements of the district of the distribution regions.

3. SHORT TECHNICAL DESCRIPTION OF GJANCI SHPP

Feasibility project envisages utilization of water of Osumi River in its upper part. In the coming parts are given the work group comments with regards to:

3.1 Hydrology calculation for Gjanci SHPP

Hydrological study and its analysis during the feasibility study phase is used in the stage of project implementation. On the other hand, based on computing flow as defined above it has been checked the rate of exploitation of the annual flow in the selected axis, and is compared with international standards.

For this purpose, the design group is based on daily sustainability curve given in Hydrological Study of the feasibility study. With the construction of new feeding system for the reservoir of Gjançi, the plant is expected to harness water flow in the Osumi River at Leshnje and Zgorolec river flow to a full value of around 49.4 million m3 water per year for the multi-year average year, processing it through Gjançi reservoir, exploited by the HPP and then a part of it around 19 million m3 used for irrigation.

HPP will process the flow of 49.6 million m3 in the reservoir; the irrigation based on following graph provided is given a volume of around 19 million m3 for the time of around 3.5 months.

Water volume for irrigation is given according to a hydrograph with flows from around 1.5 m3/sec, for a short period, up to around 2.8 m3/sec.

The rest of the volume that is left around 30.6 million m3 of water is to be processed outside the irrigation period, mainly before the start of irrigation season. Figure 10 below is given average monthly flows for irrigation (based on the study of plant in 1978):

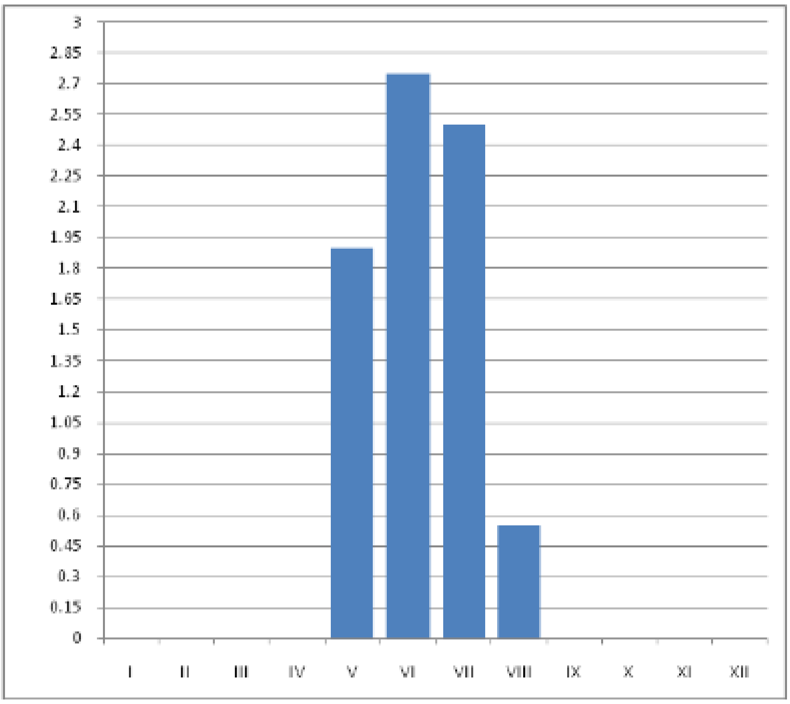


Figure 10: monthly flows for irrigation (based on the study of plant in 1978)

For commencement of plant's operation it will be needed that immediately after the end of irrigation season to provide the necessary time required for filling the reservoir, this based on a multi-year average, results being from September until January/February. After this time the HPP will begin to harness the excess flow up to early June when irrigation will start so Gjanci reservoir must be full to ensure irrigation.
According to the calculations for the average year it results that for a period of about 4-5 months the HPP will work with an averaged inflow (is not exempted to work with greater inflow up to computed inflow but these being only for time intervals) of around 2.3 m3 / sec.
Even during irrigation the hydropower plant will work with averaged inflow of around 2.3-2.8 m3/sec with variations according to specific irrigation schedule but always fulfilling irrigation needs.
According to the analysis shown above the plant will work according to the chart below Figure 11 (flow coming out of reservoir)

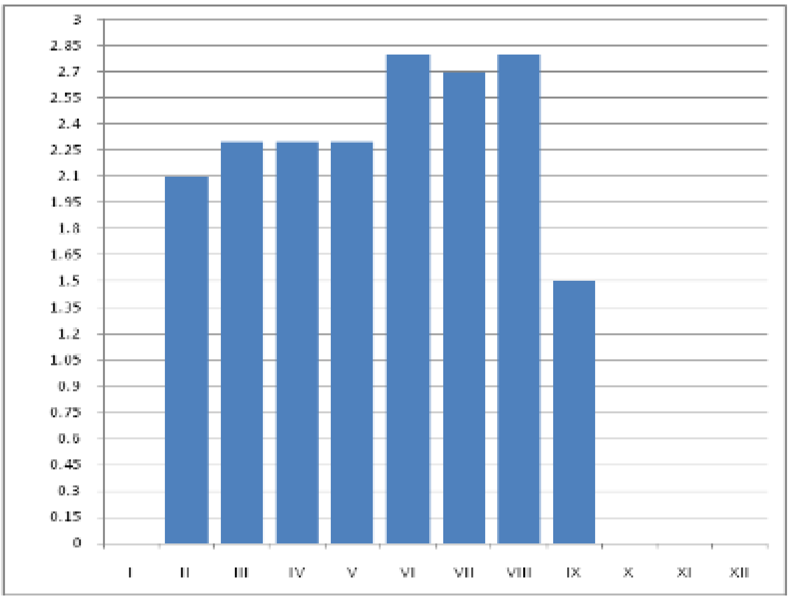


Figure 11.: Monthly average flow (according to the hydrology study)

3.2 Gross and Net Head of HPP GJANC

As from above gross fall of HPP Gjançi turns out to be 131 m. Net fall on the basis of which the power of HPP found, is determined by subtracting pressure system losses. Net fall of HPP Gjançi will be Hneto = 127.00 m.

3.3 Calculation of Installed Capacity and Electricity Generation after upgrading from Gjanci SHPP

Basic parameters for calculating the output capacity of the plant are: incoming flow, nominal fall, efficiency of turbines (for each flow operating level), efficiency of the generator (for each flow operating level) and efficiency of transformers (for each flow operating level).

N =9.81 x η x Qllog x Hneto = 2940 kW

The annual production of electricity is estimated using the curve of sustainability daily flows in the axis of the intake of Gjançi HPP, so:
Qllog = 2.80 m3 / s
Ellog = 14.5 GWh / year

Final analysis of the installed capacity, average annual energy production shows that we have an installed capacity of 2940 kW and electricity production of 14.5 GWh / year for the case of computing flow being 2.8 m3/sec based on the detailed engineering project and the sustainability curve of average multi-year flow taken from hydrological studies.

3.5 Detailed Engineering Design Assessment

The main scheme of the HPP is composed of these basic waterworks: Reservoir; Intakes; Connection point of the intakes; Decanter; Derivation channel without pressure; Pressure Basin; Penstock; Powerhouse and Canal disposal water.

3.5.1 Reservoir

Gjançi reservoir was built in the 70s to exploit Osumi river flow mainly for irrigation purpose. For the exploitation of the flow of Osumi River through Gjançi reservoir, it was built a feeder channel with length around 7 km long with half trapezium section with width of 1.5m and depth of around 1.2m for the maximum estimated flow up to 5 m3/sec. Checks on location and exploitation for over 30 years have led to supply capacity of Gjançi reservoir to be significantly reduced. This is due to damages in feeding channel wearing, maybe even because of not achieving the size of the projected section in some parts of it, water loss in some sectors due to erosion of concrete etc. Hydropower plant of Gjançi processes the natural flow in the Osumi River through reservoir of Gjançi and this flow is further harnessed partly for irrigation of Korca lowland.

This reduced flow capacity of the existing system has brought a low utilization of this flow for energy production as well as for irrigation purposes. The new system (by rehabilitation and upgrading the existing derivation) given in the project ensures the maximum exploitation of this flow and normal supply for irrigation in the area of Korca. Supply system of Gjançi reservoir consists of these works; Intake point at Osumi river in Leshnje; feeding system consisting of pipeline No.1 and no.2, existing upgrading channel between the two pipelines; Intake at Zgorolec; No.3 pipeline for taking water from Zgorolec; tunnel with its elements, etc.

3.5.2 Intake at Osumi-Leshnje

Intake building constructed in the form of a concrete dam with a height 7-8 m, fits for obtaining the new quantity of water that is expected to be harnessed. The existing intake is in the form of a channel in the right side and water entry is done when the discharge gates to the river are closed. In our case intake is done with the same work (construction) but the intake concept is entirely different. Intake is done with a groove gallery with width 1.3 m and length 25 m. Water is forwarded on the left side, where in the vicinity of the intake is a hub designed for decantation of particles of 3-7 mm and the possibility water entering in a pressure pipe so as not to have problems in the operation of the pipeline that will convey the water.

3.5.3 Intake at Zgorolec

For the intake of the water amount of Zgorolec pond an intake with its elements will be built. The intake is placed in the quota threshold of 1088 m and spillway quota at the entrance of derivation of 1087 m. The intake is a groove gallery type with width 1.25 m and length around 5.5 m. Also at this point is projected a decanter for stopping particles of 3-7 mm size, this as not to have problems with the operation of the pipeline downstream.

3.5.3 Supply Channel / Derivation: Pipeline No.1

This pipeline is developed on the left side of the Osumi River, mostly down the road. Begins with the intake and ends over the village Leshnje at the entrance existing channel. It has a length of around 1 km and 2000 mm internal diameter with pressure PN6. Is foreseen to be built with plastic tube reinforced with glass fiber. Tube is inserted into the ground and covered with soil. Pipeline for the parameters that are accepted is dimensioned for flow up to 5 m3/sec. Bends in pipe joints are reinforced with concrete.

3.5.3 Supply Channel / Derivation: Pipeline No.1 and New Pipeline

In the feeding system of Gjançi reservoir, for an economic solution is used a part of the existing channel built previously which is located between the two siphons. The channel is built above the village Leshnje. The channel has a length of about 560 lm, and base width of 1.2m, depth around 1.5-1.6 m in half-trapezoidal shape. For obtaining the projected quantity of water lifting of its shoulders around 30 cm is performed.

3.5.4 Supply Channel / Derivation: Pipeline No.3

This pipeline takes water from the intake of Zgorolec brook and leads to the entrance of the tunnel where connects with the other part coming from Osumi to Leshnje. Pipeline is mostly developed on the left side of the brook, on the side of the stream bed. The pipeline has a length of around 880 lm and 800 mm internal diameter with pressure PN6. Is foreseen to be built with plastic tube reinforced with glass fiber. Tube is inserted into the ground and covered with soil. This tube is placed in trenches and covered with soil.

3.5.5 Existing channel No.2 from tunnel to reservoir

After all works of new feeder system for Gjanci reservoir has been built reservoir, water for a length of around 2000 lm is sent using the existing channel in the hills before the reservoir. The state of this channel is generally good, but needs in some parts cleaning and rehabilitation of embankments and its wearing. Performing these works is done easily because in the area is a construction road which can also be extended.

3.5.6 Pressure Basin

The pressure basin (is in a good condition and will not be invested in it) is built at the end of the derivation channel and serves as a connector of penstock which passes water in the power house. Penstock
Penstock is in good condition and will not interfere in it.

3.5.7 Power House

Powerhouse is in good condition and will not interfere in it.

3.5.8 Water Discharge Channel

This is in good condition and will not interfere in it.

3.5.9 Grid Connection Point

Grid connection at 35 kV is in good condition and there is no need to invest in it.

3.5.10 Turbine and Generator

All electromechanical parts of the plant are rehabilitated in 2004 by the Austrian company KOSSLER and SHCUBERT and their condition is very good.

After the Detailed Engineering Design finalised for all above mentioned works of Intake , Gravel Trap , Desander-Forebay,Penstock, we have been able to have an accurate Bill of Quantites which has been presented in chapter 4.

4. EVALUATION OF TOTAL INVESTMENT FOR GJANCI SHPP

4.1 Total investment needed for construction of Gjanci SHPP

In the following table are presented total investment needed for construction of Gjanci SHPP. A number of studies and procedures have been conducted as a first phase of the project implementation such as: hydrology study, hydro-mechanical and energy study, Geological study, Grid Connection study, permit taken from ministry of agriculture and food, business plan, feasibility study etc

Based on these studies and market indexes on prices a total rehabilitation of the water feeding system for Gjanc HPP has the following initial estimate.

The construction cost of the project consists (given in Table 1) of three main parts: the cost of launching the project, the cost of investment and the cost of putting it into production. To perform the following calculations were analyzed all information provided in Table 1. Costs (unit prices) are based in their quotations and also official bulletin of February 2010 where quotations can’t be found. In Table 2 and Figures 12 & 13 are given the value of investments to be made in each month throughout the construction period.

HIDROCENTRALI GJANÇIT KORÇE

REHABILITIMI I SISTEMIT EKZISTUES TE USHQIMIT TE REZERVUARIT TE GJANÇIT

Nr.	Pershkrimi	Njesia	Sasia	Çmimi	Vlefta-Leke	Vlefta-Euro
	1. ***Nyja e marrjes*** *(Osum) (Q1max=5 m3/s)*					
1	Germime	m3	1100	460	506000	3667
2	Prishje betoni	m3	6	6700	40200	291
3	Betone	m3	360	10200	3672000	26609
4	Hekur betoni	ton	15	110000	1650000	11957
5	Konstruksion metalik	ton	15	105000	1575000	11413
	Shuma 1.	**leke**			**7443200**	53936
S	**2. Sifon *Nr.1&2*** *(V.marrje- kanal)*					
1	Germime	m3	15000	460	6900000	50000
2	Mbushje	m3	8000	250	2000000	14493
3	Tubacion celiku D=2000 mm	ml	360	50000	18000000	130435
4	Betone per ankera	m3	140	9800	1372000	9942
5	Hekur betoni	ton	1	110000	110000	797
	Shuma 2.	**leke**			**28382000**	205667
	4. Kanali ekzistues Nr.1 dhe i Ri *(midis dy tub)*					
1	Germime per zgjerim kanalin dhe kanali i ri	m3	39000	460	17940000	130000
2	Betone per mbilartesim	m3	1820	10000	18200000	131884
3	Beton per veshjen e kanalit te ri	m3	2640	9800	25872000	187478
4	Betone per nyjet hyrj-dalje	m3	1500	10200	15300000	110870
5	Hekur betoni	ton	45	110000	4950000	35870
	Shuma 4.	**leke**			**82262000**	596101
	5. *Vepra e marrjes Zgorolec*					
1	Germime	m3	480	460	220800	1600
2	Betone	m3	216	10200	2203200	15965
3	Hekur betoni	ton	8	110000	880000	6377
4	Konstruksion metalik	ton	2.4	105000	252000	1826
	Shuma 5.	**leke**			**3556000**	25768
	6. *Tubacioni Nr.3*					
1	Germime	m3	9700	460	4462000	32333
2	Mbushje	m3	2500	250	625000	4529
3	Tub plastik D=800mm, PN6	ml	880	10500	9240000	66957
4	Betone per ankera dhe kalime lumi	m3	50	9800	490000	3551
5	Hekur betoni	ton	0.4	110000	44000	319
	Shuma 6.	**leke**			**14861000**	107688
	9. Kanali ekzistues Nr.2					
1	Germime e pastrime	m3	800	380	304000	2203
2	Betone	m3	200	9800	1960000	14203
	Shuma 9.	leke			**2264000**	16406
	Shuma 1-9 .	**leke**			**138768200**	1005567
	Rezerve 5%	**leke**			**6938410**	50278
	Shuma				**145706610**	1055845
	T.V.SH. 20%				**29141322**	211169
	Shuma				**174847932**	1267014
	Me kursin 138 leke =1 € kemi		rreth	€	**1267014**	1267014
	Shpenzimet e pergjithshme					
I	***Ndertim montim***					
	Shuma I	**euro**			**1267014**	**1267014**
II	***Shpenzime te tjera***					
1	Shpronsime	"			0	0
2	Studime hidrologjike				3000	3000
3	Stud-proj.civ	"			27661	27661
4	Punime topografike	"			5800	5800
5	Stud e punim gjeol (gjeofizike)	"			8500	8500
6	Projekte mekanike	"			4000	4000
7	Studimi i plan biznesit	"			3000	3000
8	Studimi i ndikimit ne ambient	euro			3500	3500
9	Drejtim punimesh	"			6915	6915
10	Kolaudim punimesh	euro			2213	2213
	Shuma	"			**64590**	**64590**
	TVSH	***euro***			12918	12918
	Shuma II	***euro***			**77508**	**77508**
	Shuma I+II	***euro***			**1344522**	**1344522**

Zerat e punimeve	Vlera ne Euro	2010	2011											
		Dhjetor	Janar	Shkurt	Mars	Prill	Maj	Qershor	Korrik	Gusht	Shtator	Tetor	Nentor	Dhjetor
1. Nyja e marrjes (Osum) (Q1max=5 m3/s)	53936								26968	26968				
2. Sifon Nr.1&2 (V.marrje- kanal)	205667								51417	51417	51417	51417		
4. Kanali ekzistues Nr.1 dhe i Ri (midis dy tub)	596101								119220	119220	119220	119220	119220	
5. Vepra e marrjes Zgorolec	25768								12884	12884				
6. Tubacioni Nr.3	107688								26922	26922	26922	26922		
9. Kanali ekzistues Nr.2	16406									8203	8203			
Rezerve 5%	50278	0	0	0	0	0	0	0	11871	12281	10288	9878	5961	0
T.V.SH. 20% (per zerat e punimeve)	211169	0	0	0	0	0	0	0	49856	51579	43210	41487	25036	0
Shpenzimet e pergjithshme														
Shpronsime	0					0	0	0						
Studime hidrologjike	3000	1500	750											
Stud-proj.civ	27661	9220	9220	9220										
Punime topografike	5800		2900	2900										
Stud e punim gjeol (gjeofizike)	8500				4250	4250								
Projekte mekanike	4000					2000	2000							
Studimi i plan biznesit	3000	1000	1000	1000										
Studimi i ndikimit ne ambient	3500	1167	1167	1167										
Drejtim punimesh	6915								1153	1153	1153	1153	1153	1153
Kolaudim punimesh	2213												1106	1106
T.V.SH. 20% (per shpenzimet e pergjithshme)	12918	2577	3007	2857	850	1250	400	0	231	231	231	231	452	452
Totali Pergjithshem me TVSH	**1344522**	**15465**	**18045**	**17145**	**5100**	**7500**	**2400**	**0**	**300521**	**310857**	**260643**	**250307**	**152928**	**2711**
Totali Pergjithshem pa TVSH	**1120435**	**12887**	**15037**	**14287**	**4250**	**6250**	**2000**	**0**	**250434**	**259047**	**217203**	**208590**	**127440**	**2259**
T.V.SH. 20% (totale)	**224087**	**2577**	**3007**	**2857**	**850**	**1250**	**400**	**0**	**50087**	**51809**	**43441**	**41718**	**25488**	**452**
Kontributi i Investitorit (equity)	**287777**	**15465**	**18045**	**17145**	**5100**	**7500**	**2400**	**0**	**51239**	**52962**	**44593**	**42870**	**27747**	**2711**
Kontributi i Bankes (hua)	**1056745**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**249282**	**257895**	**216050**	**207437**	**125181**	**0**

Table 2.: Estimate of the initial investment for expansion of Gjançi HPP (for each month throughout the period of expansion)

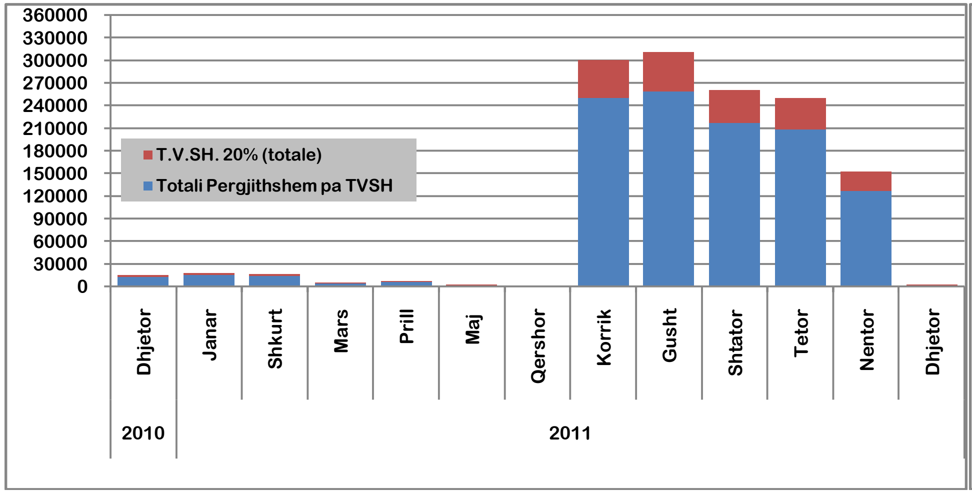


Figure 12.: Investments in monthly timetable (Euro)

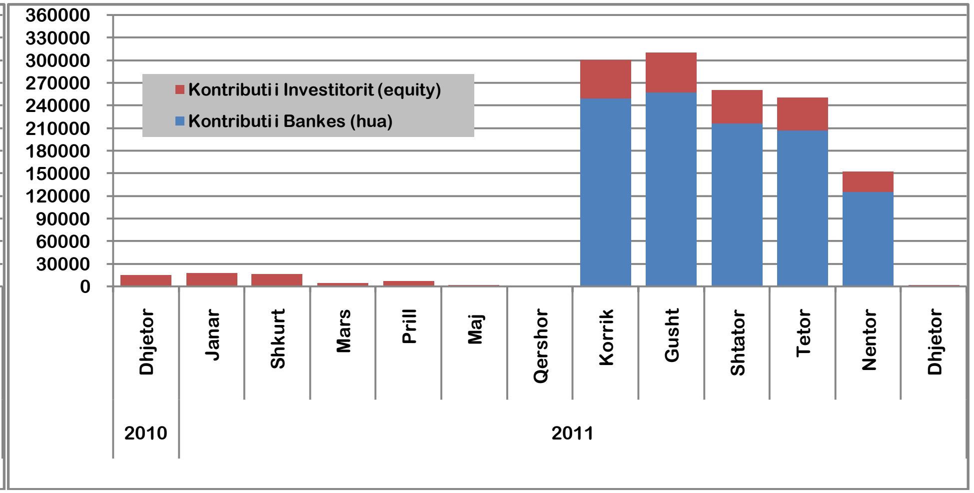


Figure 13.: Own coverage and equity of the bank (Euro)

Full analysis showed that the total investment for expansion of HPP Gjançi is 1.34 Million Euro (with VAT included). Full analysis showed that investment so far made by the Company Spahiu - Gjançi Ltd for this project are only towards the study and project engineering.

RADOVE SHPP		MONTHS																
ITEM'S DESCRIPTION	EUR	Aug 2010	Sep 2010	Oct 2010	Nov 2010	Dec 2010	Jan 2011	Feb 2011	Mar 2011	Apr 2011	May 2011	Jun 2011	Jul 2011	Aug 2011	Sep 2011	Oct 2011	Nov 2011	Dec 2011
EXCAVATIONS-ROADS OPENING and preparation of construction site																		
(REJ Sh.p.k: 224.14% (MT CONSTRUCTION Sh.p.k: 90.000 €). Total: 118.640 €	98667	26000	10000	10000					12667	20000	20000							
TUNNELS																		
(MT CONSTRUCTION Sh.p.k) Total: 120.000 €	188630			30000	30000	30000	30000	30000	38630									
INTAKE STRUCTURE																		
(MT CONSTRUCTION Sh.p.k) Total: 96.000 €	95472			25000								14472	15000	15000	26000			
Desander Structure																		
(MT CONSTRUCTION Sh.p.k) Total: 90060 €	90060			15000	20000							20000	10000	20000	5060			
SUPPLY-EXCAVATIONS-INSTALLATION OF PENSTOCK																		
(MT CONSTRUCTION Sh.p.k) Total: 401,865 €	424942						200000	52000	52000	60000	38000	22942						
POWER HOUSE BUILDING																		
(MT CONSTRUCTION Sh.p.k) Total: 65.000 €	65000										31000	17000	17000					
TRANSMISSION LINES																		
Licences (ELEKTROMEKANIKA Sh.p.k) Total: 10.200 €	100000								10000	10000	20000	10000	10000	20000	20000			
Construction of the line. (ELEKTROMEKANIKA Sh.p.k) Total: 120,000 €	100000				20000	20000	21000	28800	10200									
ELECTROMECHANICAL WORKS																		
Turbines, Generator, Penstock (turbine pipes), Electrical works (Simens).Supply and installation of all cables from Power Station Bulding until the intakes, for power, CCTV system and controling. Total: 1,330,000 €	1330000				296500			296500						450000		228000		59000
OTHERS																		
Planning and construction supervision (acc. HOAI) 155,000 Euro	155000			95000			5000	5000	5000		5000	10000			10000		10000	10000
Contigency. Total 125,229 Euro (5 %)	125229					20000	25000	10000	10000	10000	5600	5000	10000	5000	5000	5000	5000	9629
Grand Total																		
Grand Total Project Cost	2773000																	
Monthly works (in EURO) from the total amount of: 2773000		26000	10000	175000	366500	70000	281000	422300	138497	100000	119600	99414	62000	510000	66060	233000	15000	78629
Cummulative Investment Amount		26000	36000	211000	577500	647500	928500	1350800	1489297	1589297	1708897	1808311	1870311	2380311	2446371	2679371	2694371	2773000
Sources of Financing																		
Bank Debt		15600	6000	105000	219900	42000	168600	253380	83098	60000	71760	59648	37200	306000	39636	139800	9000	47177
Cumulative Disbursement of the Loan during months (in EURO)		39153	45153	150153	370053	412053	580653	834033	917131	977131	1048891	1108540	1145740	1451740	1491376	1631176	1640176	1687353
Equity Participation (in EURO)		10400	4000	70000	146600	28000	112400	168920	55399	40000	47840	39766	24800	204000	26424	93200	6000	31452
Cumulative Equity during months (in EURO)		26102	30102	100102	246702	274702	387102	556022	611421	651421	699261	739026	763826	967826	994250	1087450	1093450	1124902

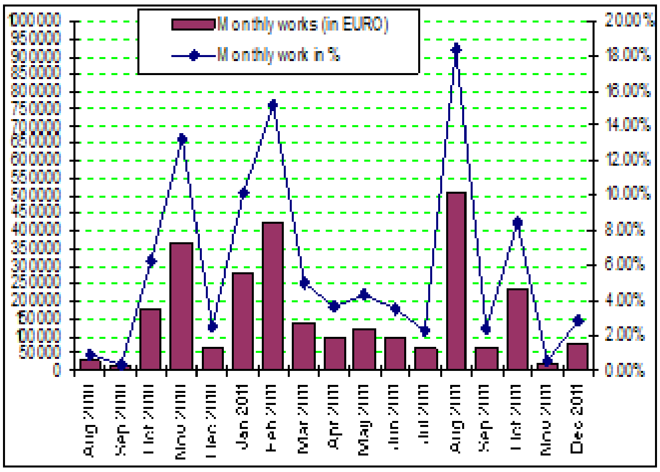


Figure 14.: Monthly investment to be carry out (Euro)

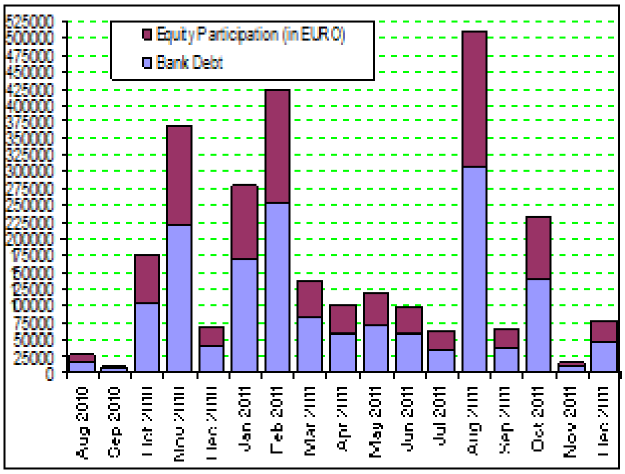


Figure 15.: Monthly investment varry out by loan and by equity to be carry out (Euro)

4.2 Exploitation and maintenance cost

During its activity the company foresees some voice of expenses for the operation and maintenance of Gjanci plant:

The expenses below are for the salaries and social insurances. As it is given in table 4 this voice consists in the main part of the social expenses as far as variable cost is regarded. As the selected staff is 8.5 (as the economist will be employed part-time for the SHPP) persons will operate the SHPP. As it was previously mentioned the staff will consist in 8.5 persons with respective salaries as given in table 3.

Tabela 3.: Shpenzimet per pagat ne tre vitet e para

Nr	STRUKTURA E PERSONELIT	Nr. i pun	VITI I		VITI II		VITI III	
			Paga mujore	Fondi vjetor	Paga mujore	Fondi vjetor	Paga mujore	Fondi vjetor
1	Drejtor	1	70000	840000	73500	882000	77175	926100
	Inxhinjer Mekanik		61000	0	64050	0	67252.5	0
2	Mirembajtje	1	41,000	492000	43050	516600	45202.5	542430
3	Ekonomist	0.5	43000	258000	45150	270900	47407.5	284445
4	Turbinist	4	38,000	1824000	39900	1,915,200	41895	2,010,960
5	Roje	2	30,000	720000	31500	756,000	33075	793,800
	TOTALI	**8.5**	**283,000**	**4,134,000**	**297,150**	**4,340,700**	**312,008**	**4,557,735**

Maintainace expenses are planned to be 1% of total investment and they remain constant even for the years that will come. The travel expenses/per diem are of such nature to cover all the travel and accommodation cost based on normal standards foreseeing 4 000 lek/day within the country and 12 000 lek/day abroad. The amortization that is considered in the respective table given in the financial calculation is based in some criteria:

- At the same time it should be mentioned that based also on financial accounting Laws it is used the method of linear depreciation of the assets of the future SHPPs.

- The basic criteria are the legislation which has its tolerance for the amortizations (high and low limits of the amortization for the buildings, machineries and various vehicles).

In addition to this, in order to help the environmental programs of the area the company has decided to give every year to the commune a certain amount of grants of 2000 Euro/year for the environmental in general and the forestation of the area specifically. The value of the grant of 3000 Euro/year it is calculated as cost voice in the financial feasibility study and in the business plan accepting in this way the reduction of the income in order to improve the environment for the whole community.

4.3 Upgrading GJANC HPP: investment and production plan

From 2003 when the plant was taken in concession, the development of the concession has been planned with 5 main phases.

Phase 1: Obtaining the Concession of Gjançi HPP (completed in 2003) in the form ROT

Phase 2: Restarting operation of HPP Gjançi (completed, fully operational in 2005)

Phase 3: Operation with average output 6.12 GWh / year for the whole period 2005-2010.

Phase 4: Phase of conduct of engineering study and obtaining all relevant licenses for the start of the expansion of the HPP Gjançi (some of the license exists and the rest will be taken for the expansion of the plant).

Phase 5: Phase of practical implementation of all civil works for expanding the plant.

Phase 6: Phase of testing and commissioning of all works.

Phase 7: Phase of operation of HPP with enhanced parameters, expected to commence in January 2012.

Operation of HPP will not halt during expansion phase; this means that during this time the plant will generate income as previously. Attention has to be paid on water exploitation to avoid negative impacts on irrigation period and on Environment as described on Environment Impact Study. Plant staff has been trained according to western standards.

4.4 Upgrading GJANC HPP: *SWOT ANALISYS*

4.4.1 Strengths of HPP Gjanc Expansion/Upgrading

A number of pros can be mentioned backing the expansion of water feeding system of HPP Gjanci:

a) A flexible privatization scheme made by the Albanian Government in ROT form since 2003 for 30 years.
b) The energy sale price which for small HPPs for the period 2004 – 2008 has increased from 3.7 to 9.2 ALL/kWh. This being very attractive for investments in such objects under normal operation.
c) Potential field of investment; being that Albania has large capabilities in construction and energy production from small HPPs.
d) Improving conditions on transmission and distribution has decreased losses. Also being that small HPPs such as Gjanc are locater in rural areas they help improve voltage level regulation, which in our case before the construction of Zemblak substation was of primary importance.
e) Employment and development of renewable energy sources in Albania with state of the art technology, as a national development strategy.
f) Collaboration with KESH (Albanian Power Corporation); interviews with directors at KESH has shown good collaboration with energy producers from small HPPs.

4.4.2 Weaknesses of HPP Gjanc Expansion

Some of the Weaknesses are:

a) Dependence of energy production on water irrigation scheme
b) The context being based on contractor and regulator terms
c) Relatively high APR's (interest) from Albanian banks, especially in the time of global economic crisis.
d) 30% of total energy production serves is dependent on the irrigation schedule

4.4.3 Opportunities of HPP Gjanc Expansion

a) Some of the Opportunities are:
b) Improving irrigation of the villages
c) Improving electricity supply in the villages
d) Opportunities for investment from medium level Albanian companies
e) Development of good experience and technology, since design and implementation will be done with Albanian companies, some works from the company itself and the tunnel with specialized construction companies
f) Diversification of energy sources like renewable sources with low production cost.

4.4.4 Threats of HPP Gjanc Expansion

A number of risks exist summed up as:

a) The continuing process of reforms in Power Sector creates a form of insecurity in the investment sector.
b) Privatization of Distribution System
c) Lack of professionalism for remote control with operators

5. INITIAL ANALYSES FOR THE ENVIRONMENTAL IMPACT AS A RESULT OF SELCA 1 SHPP CONSTRUCTION

The components and the environmental factors are:

a. Basement and formations; given in the geological, geomorphologic and pedagogical profile, in the environmental framework, even as non-renewable sources.
b. Atmosphere, the quality of the construction area and the climatic characteristics.
c. Vegetations, flora, fauna; vegetal formation and the animal community, significant emergences, species that shall be protected and natural equilibrium.
d. Hydro environmental, underground and aboveground waters considered as components, as environment and as resource.
e. Public health; the epidemiologic situation of the community.
f. Ecosystem; include the behavior of the physical, chemical and biological factors, their connection and independence among them which form a unitary and identifiable system (so a lake, a forest, a river, sea) for the special structure, for the function and evolution in time.
g. Noises and vibration; consideration in relation with the natural and human environment.
h. Ionizing and non ionizing radiation, consideration in relation with natural and human environment.
i. Landscape; morphological and cultural aspects of the landscape, identity of the interested human community and the cultural goods.

Residual flow is the amount of water which should remain in the river bed, but which is not used for electricity generation and which in the case of Gjanci SHPP it is accepted to be 2 liter/ (sec*km^2) which is equal to the value given in the European Directive for Water, i.e. in this case in the river bed will be allowed a flow equal to 31 l/sec. This amount of water, which is relatively low) is very important for the protection of the river and of the area surrounding it. If no water is left in the riverbed the communication between the aboveground water and the underground water will be affected considerably resulting in the lowering of the lever of the underground water. For this reason, the micro-climatic conditions will change toward a drier micro-climate, causing changes in the plants from the intake of the water up to the powerhouse.

For this problem shall be taken in consideration not only the environmental conditions but even those economical, as in this are the land might be used for advanced livestock. The worst scenario would be periodical landslide in this are during heavy rainfall periods in summer due to the lack of plants. The fish economy contributes in a certain rate to increase the income of this region. So, “No water in the river beds” option would affect also the local economy and the social standard. In the pollution problems shall be taken in consideration the distortion of the water quality during the construction and operation period of SHPP. A more detailed analysis is given in the Environmental Impact Assessment Study, but it should be emphasized that in the analyses of the electricity generation this residual flow is taken in consideration.

5.1 Social-economical conditions

The areas where this SHPP will be constructed is located in the villages of Korça region. In these villages lives about 2 000 inhabitants and their main activities are mineral mining, agriculture and livestock. There are considerable incomes from the emigration. Another activity is also the collection of medical herbs. The construction of this SHPP will enable the employment of more than 150 people especially for civil works. This employment period will last 2 years consisting in employment, material goods and in addition to direct employment there will be even indirect employment. As a result of the construction of this power plant will be employed a great number of experts which will consumes considerable amount of fresh products of these villages.

5.2 Cultural sources

In the area where the Gjanci SHPP will be constructed there are no archeological sources. This area has the same traditions and rituals as the region it is situated in.

5.3 Potential environmental impact and suggested measures for its reduction

Potential environmental impacts of the SHPP occur during both the construction and operation phase. Since the beginning we should emphasize that based on their working principle as electricity generation plant from the renewable energy resources (as is the case of hydro-energy) and the transformation of the electricity from one level of voltage to another causes minimal pollution in the environment.

5.4 Environmental impact during the construction phase

The improvement of the roads that leads to the SHPP construction site is a very short distance as the main road passed just by. As a result, during the improvement of the road there will be small amount of dust emission in the atmosphere as a result of different civil works that will be carried out in it. The Company has already finished all the connecting roads and the dust emission was minimal as the company has transported the soil with covered vehicles. The preparation of the construction sites for the electric plants of

SHPPs has, also, a certain impact in the environment. As a result during the opening of two sites (25X20 m) and during the improvement of this short-distance road there will be a low amount of dust emission in the atmosphere due to different civil works that shall be carried out in the construction site.

6. FINANCIAL ANALYSES OF GJANCI SHPP

In this chapter it a will be conducted a financial analysis of HPP with the increase in production from a last 5 years average of 6.12 GWh/year to 14.5 GWh/year (figure 16). In the chart below is given the annual energy production for the period 2005 – 2010 from HPP Gjanc.

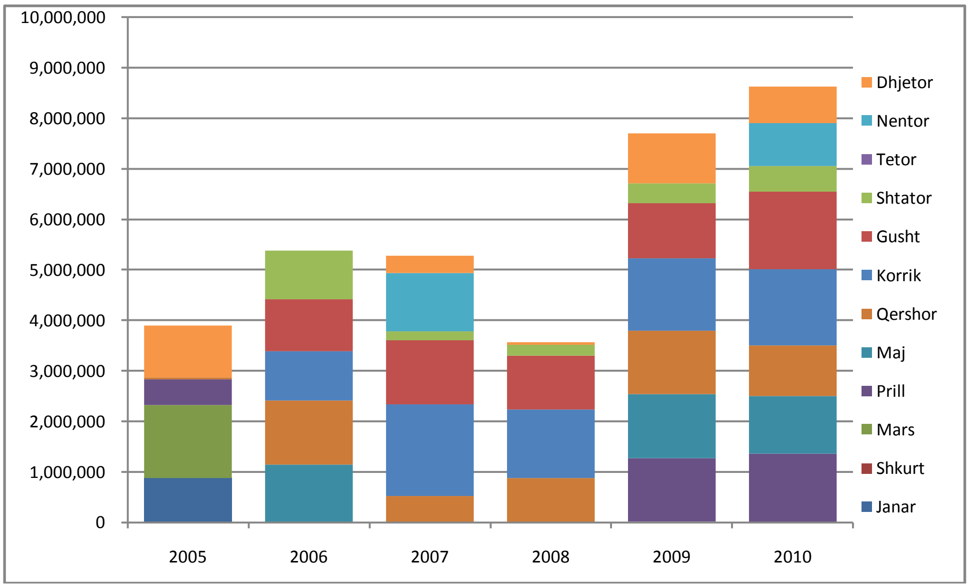


Figure 16: Production of electricity in years for the period 2005-2010 (monthly columns)

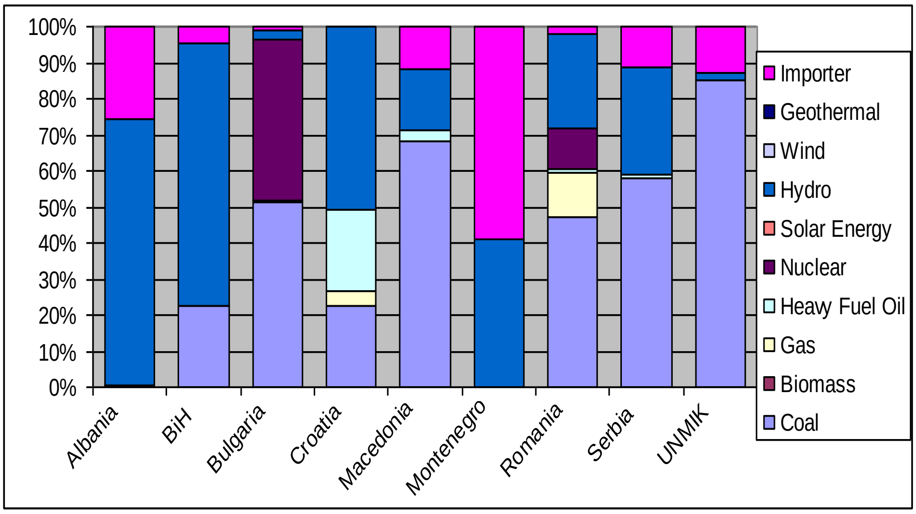
"SPAHIU-GJANC" sh.p.k. has very good relations with several banks in Albania and has had offers from Albanian banks for the implementation of this project. "Spahiu-Gjanc" is the only shareholder of the plant, owning 100% of its shares.

The determination of the above parameters provided all the necessary technical parameters, preventives and financial for Gjanci SHPP and that will be constructed by the Company. In the following section, in all the section of chapter 5 will be described in details the financial analyses of gain-cost of Gjanci SHPP.

6.1 The trend of the South-East European electro-energetic market

As it is shown in figure 17, the main fuel burned for the generation of electricity in the region is coal providing almost half of the generated electricity in the region. Albania and

Monte Negro are totally depended on hydro resources and the import of electricity, whereas nuclear energy contributes only in Bulgaria and Rumania.



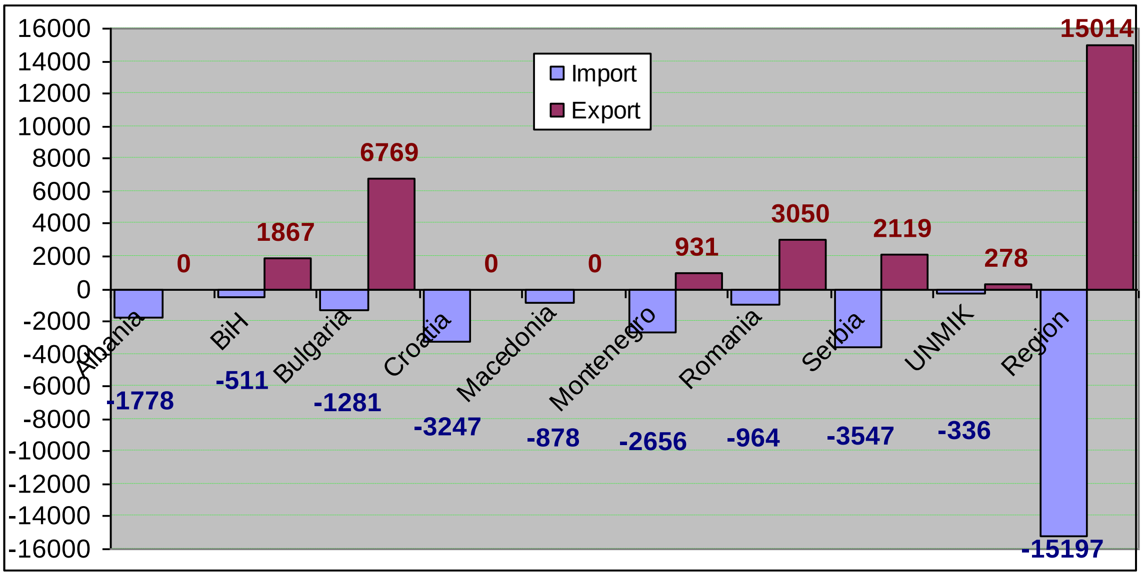


Figura 17.: Importi dhe eksporti i cdo vendi per vitin 2008 (GWh)

The closure of the Nuclear TPP in Kozmodull in Bulgaria, which generated about 7 TWh/year means that the entire region is in total import since 1 January 2007. This is already evident as the supply for 2007 has been reduced and which has been accompanied with an import price of 80-150 EURO/MWh. This tendency (even though it is decreasing for the first three-month period of 2009 due to the very good hydrologic conditions in the region and due to the economic decrease caused by the financial crisis which has been reflected in the decrease of the demand) together with the price increase of the fuels such as oil, natural gas and coil result in a financial environment and high feasibility for the construction of the SHPPs in places where they are designed with high efficiency and minimum environmental impact

6.2 The trend of electro-energetic market in Albania

The Aim of the Electricity Market Model is the first logic step toward a general development of the market. Due to the difficulties to develop national electricity market, this focus is justified for the following reasons:

1. The general electric system is very small. So, the potential for multiple competing native Purchasers (DDC) is limited.
2. The consumption greatly overpasses the supply; the load shading occurs all over the year. "Demand", as this term is used mainly in t the foreseen of the load in enterprises, foresees a energy level that the consumer want to pay.
3. Industrial clients are a decreasing percentage in the total mix of generation. So, the number of potential Qualified Clients is limited.
4. Import capacity of Albania is limited by unsuitable infrastructure of the transmission and interconnection.
5. Hydro occupies 98% of the inland generation of the system or of the mix of the generation installed capacity, almost all of it by three plants located in the same cascade which requires dependant operation of the plants.

The development of these plants requires a more promoting policy from the government, especially for the new plants. The investors ask for the signing of a long-term Power Purchase Agreement (PPA) in order to be safe for the investment that they are going to do. The term of this PPA-s might be limited in years as long as, on one hand it is stimulating (or it is worth) for the construction of new plants, and on the other hand it is acceptable by the purchaser. Different European countries Germany, Greece or Portugal has ratified laws which oblige system operators to all the electricity generated by these plants for 20-year period.

The purchase of the electricity generated by HPPs is another effecting element to invest in these plants. The methodologies for the determination of the electricity price generated by the small hydropower plants shall be in such way that it encourage the development of this plants to bring certain incomes for the consumers. This development is a powerful tool to promote the competition among sellers in the national market and it shall encourage their number and even the increase of their experience in the market.

For small HPP-s it is important even their connection with the system. As these plants due to their low installed capacity are connected with the distribution network, the distribution code shall be amended in such a way that it shall oblige the distribution to connect these plants in the nearest point with the distribution network.

6.3 Analyses of electricity selling price

The Banks won't finance an HPP project if it is not profitable. The profits depend from the volume of the investment, from the cost of financing and the expected profits to be generated by the investment. The profits are a function of the generated electricity (GWh) and to the price with which this electricity is sold. In addition to this, the Banks would give a loan only to the HPPs if the loan taker would take all his/her financial obligations as far as the loan conditions are regarded, i.e. cash flows received from the project shall be coordinated with the time and the requirement of the loan. Electricity selling tariffs in the network from the HPPs has approximately been 34.4 Euro/MWh in 2004 (taken from a long-term purchasing agreement with KESH as a distribution sector). Whereas in 2005, 2006 and 2007 the price was 38.2, 40 Euro/MWh and 52 Euro/MWh applied by ERE. In 2008 the calculated tariff was 9.2 lek/kWh. The electricity tariffs are expected to be calculated based on long-term marginal cost of G/T/SH of electricity.

In the analyses done in the National Strategy of Energy, in the section of the Master plans of Generation, Transmission and Distribution, there are evaluated the necessary investments to implement these master plans. Based on these investments of G/T/D, their respective interests fix costs of operation and maintenance, variable costs of operation and maintenance, cost of the fuels and the cost of imports, it is calculated the long-term unit marginal cost. The analyses give in table 7 the level of long-term marginal cost of G/T/D is 8.63 cent/kWh.

Table 7.: Partial marginal cost and those accumulated according to the divisions of the electric sector

Total [EURO/MWh]	**Marginal cost of Generation**	Development cost of Transmission System	Development cost of Distribution System
Level of Generation (47.2 or 53.53%)	47.2		
Level of Transmission (59.8 or 15.75%)	50.8	9.0	
Level of Distribution (86.3 or 30.70%)	56.8	10.0	19.5

For the financial analyses of the profit-cost selling price of the electricity from Selca 1 SHPP in the Distribution Company was taken in 1 January 2009 to be 9.2 Lek/kWh. In the following section we will give the methods use to determine the tariffs for SHPPs. The commissioning board of ERE has approved with a Decision Nr. 5, dated 26.01.2007 the Methodology use to calculate the selling price of electricity from the SHPPs with capacity up to 10 MW;
The Albanian Government, proposed by METE has prepared the respective formulae to determine the unified selling price of the electricity by the small HPPs on annual base, based on the following formula:

$$P_{feed\text{-}in}(t) = P_{imp}(t-1) * 1.1 * \text{Exchange rate of Euro/Lek}$$

Where:
$P_{feed\text{-}in}(t)$: Electricity selling tariff in year (t)
$P_{imp}(t-1)$: Mean pondered price of import of electricity in the previous years
1.1 Coefficient that takes in consideration the reductions due to the technical loses in transmission and distribution with a value of 10%.

Applying this formula for the unified selling price of electricity is applied for 2008 the selling price would be 9.2 lek/kWh. The above analyses showed that the price of electricity sold from the small HPPs is 9.2 lek/kWh and based on the regional market the import price is expected to be increased with 6-10 % year after year for the following 7-10 years. What is important to emphasize here is that this price is feasible for the construction of small hydropower plants

6.4 Cash flow analyses for Gjanci SHPP

The initial investment for different plants (including those energetic) include the following voices: the payment done to all the suppliers, transporters (including even the Customs if there are any); the payment done to all the study and project offices; payment done to all industrial offices; a certain amount of expense done to cover the danger during the construction of the plant; all the expenses for the different processes of implementation construction, issuing (up to the time when the HPP will work in full load); of the infrastructure outside the plant (but which are necessary for its normal operation) (roads, water, etc.); other additional expenses for the environmental protection plant etc. During the construction of the projects it is most probably that the value of the initial investment will be increased with a value which varies from one scheme to another and according to the concrete terrain conditions where the HPPs will be constructed. As it has been emphasized in the above section the value of initial investment for Selca 1 SHPP is 2.87 milion Euro. All the evaluation technical of the investments require the basic parameters in order to calculate the exploitation cost, initial investment and profits that will be gained from this investment.

For the evaluation of Gjanci SHPP cost to divide them in fix costs, independent from the exploitation (the amount of the production) of the plant and in proportional ones (variable)from the exploitation (the amount of the production) of the plant. The exploitation costs independent from the exploitation of the SHPPs evaluated on annual bases are included in the fix cost, independent from the plant load. This include staff cost, primary materials stuff and the cost of the help independent from the exploitation, maintenance and other services cost, loans and payment to third parties. Cash flow is the difference between the profits in a year determined by the sell of electricity with the operation cost and the VAT over the gross profit. So the cash flow for Selca 1 SHPP will be calculated with the following formulae:

$$X_t = B_t - C_t \quad (gross\ profit)$$

$$VAT \min = 0.10 \cdot X_t \qquad (1 \& 2)$$

$$X_{t\ (neto)} = (B_t - C_t) - 0.10 \cdot (B_t - C_t) = 0.90 \cdot (B_t - C_t)$$

6.5 Financial Methods for the realization of financial feasibility analyses

Different methods are used and are being used to take the financial decision including that of Net Present Value-NP, Internal Rate of Return-IRR; Wealth-Maximizing Rate-WMR and Pay Back Period- PBP. The most used financial methods are those of NPV and IRR and their respective calculating formulae are given in 3 and 4.

$$NPV = \sum_{t=0}^{30} \frac{B_t}{(1+r_t)^t} - \sum_{t=0}^{30} \frac{C_t}{(1+r_t)^t} \qquad (3)$$

$$NPV = \sum_{t=0}^{30} \frac{B_t}{(1+IRR)^t} - \sum_{t=0}^{30} \frac{C_t}{(1+IRR)^t} = 0$$

Where:

$t \rightarrow$ time of cash flow: it varies from 0 (installation year) to n (the last year equal to the lifetime).
$r_t \rightarrow$ minimum rate of discount (in this financial assessment, in the base case it is considered for Selca 1 SHPP: 8% (also it should be emphasized that even the sensitivity analyses has been carried out) based on the bank market analyses. In the sensitivity analyses, when we analyze the variation of NPV toward r_t, it was taken the range (7%-12%).
$B_t \rightarrow$ the profits of the project that come from the multiplication of the generated of electricity in Selca 1 SHPP with the electricity price for every year.
$C_t \rightarrow$ initial investment (only C0) and the cost of project operation that comes from the multiplication of the annual energy generated from Gjanci SHPP with addition unit cost given in section 3.7.

Another well known method, especially in electricity generation sector (as it is the case of Selca 1 SHPP) is also the long-term Liveliest Discount Cost-LDC of the unit generation of electricity. The long-term Liveliest Discount Cost-LDC of the unit generation of electricity is based on the following formula:

$$LDC = \frac{\sum_{i=0}^{30} \frac{C_i}{(1+r_i)^i}}{\sum_{i=0}^{30} \frac{E_i}{(1+r_i)^i}} \quad \text{[Lek/kWh]} \qquad (5)$$

In the above formula there are given these parameters:

C_i - sum of initial investment cost of xxx SHPP, maintenance cost, staff cost, sell/purchase of electricity cost and amortization cost.
E_i - Generated electricity;
r_i - discount rate is considered 8% for the base case (it will be finally determined based on the negotiations with Bank).

Another method used to take the financial decision is based on the concept of the payback period of the investments. Pay Back Period-PBP is determined as the shortest time needed by the Selca 1 SHPP that the profit overpasses the costs for this period. Let's consider Xt every cash flow in year t; Xt is negative if it is cost and it is positive if it is profit (gain). Let's sign with"PBP" the pay back period, than the simplest formulae to calculate the PBP is taken from:

$$\sum_{t=0}^{PBP} X_t \geq 0$$

Where as it was stress $X_t = B_t - C_t$ (6)

By not discounting the cash flow, PBP has considerable errors as it does not take in consideration the value of time in money and for this reason it shouldn't be used any more. As the discontenting is included than the equation for the calculation of the PBP will be:

$$\sum_{t=0}^{PBP} \frac{X_t}{(1+r_t)^t} \geq 0 \qquad (7)$$

In the case, discounted cash flows are added up to the point where their sum is positive. In order to realize a complete financial analysis of the Selca 1 SHPP feasibility will be used all the financial technical described above: NPV, IRR, LDC and PBP.

6.6 Financial Figures for the Best Alternative of Gjanci SHPP

Up to now we have calculated initial investment, exploitation cost, electricity prices and interest rate to be accepted as 8% for the basic case.

All financial indicators will be calculated for both cases as follows:

First Case: calculation performed only for the extension of energy after expansion (extension 8.387 GWh/vit).

Second Case: for the case with total production after expansion (14.5 GWh/year).

Increased generation will be 8.387 GWh/year and is very important to be mentioned that all above calculation have been done for this increment, which is the most conservative case.

As above we have all the necessary data to calculate the financial indicators, based on the formulas and programmed built in excel, calculation are provided in Table 5 below:

Table 5.: Financial Parameters of both cases under consideration

Nr	Parameter	First Case	Second Case
1	Net Actual Value (NPV - Million Euro)	4.52	10.69

2	Internal Return Rate (IRR - %)	20.53%	37.26%
3	Pay Back Period (PBP – years)	5.44	2.95
4	Long-Term Unit Marginal Cost of Generation(LDC - Euro cent/kWh)	0.039	0.024

6.6.1 Sensitivity Analyses versus Main Parameters for Gjanci SHPP

The most important base parameters that are expected to change in the case of Gjanci SHPP investment are: interest rate of the loan, the amount of generated electricity in a year, electricity price, initial necessary investment to construct this SHPP and its working life. In order to have a more stable financial feasibility analyses it is necessary to carry out the sensitivity analyses. In the sensitivity analyses will be calculated the variation of NPV, IRR, LDC and PBP versus the above mentioned parameters.

6.6.2 NPV, IRR, LDC and PBP versus the interest rate

A basic very important parameter expected to change for the case of this investment is the APR. To perform a full sensitivity analysis of all financial parameters against this one, variation in APR is set between 7-12%.

In figures 18-21 is given the analysis against APR for HPP Gjanc. Main conclusions of this analysis are:

0. NPV decreases with APR increase and remains positive for all APRs in the interval 7-12% for both cases analysed;
1. IRR remains constant (20.33% and 37.26% for first and second case respectively) with APR increase, because is not related to the APR at all;
2. LDC increase with APR increase and for the worst case (when APR is 12%) it reaches the value of 4.9 cent/ kWh (first case) which is smaller than the sale price of energy;
3. PBP increase with APR increase and for the worst case (when APR is 12%) it reaches 6.12 years and 3.46 years for first and second case respectively;

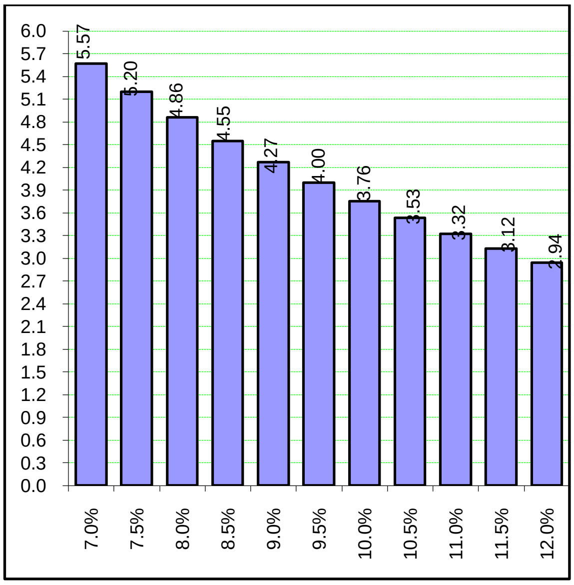


Figure 18.: Sensitivity analysis of NPV against APR for first case.

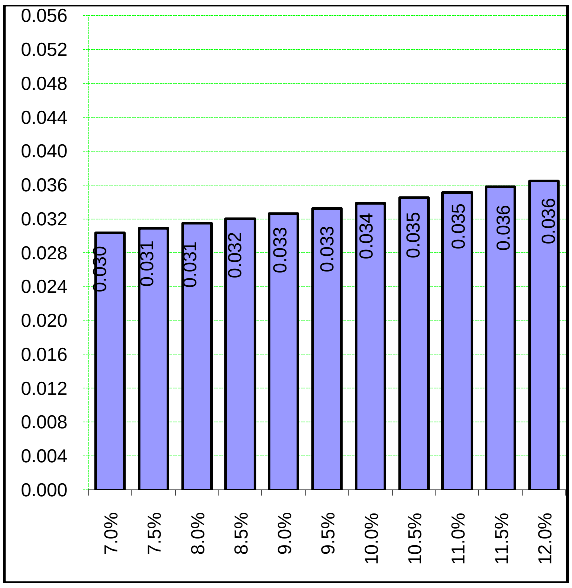


Figure 19.: Sensitivity analysis of LDC against APR for first case.

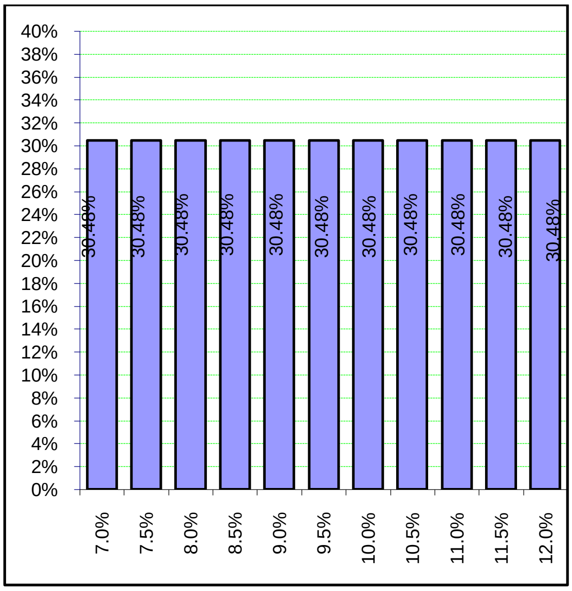


Figure 20.: Sensitivity analysis of IRR against APR for first case.

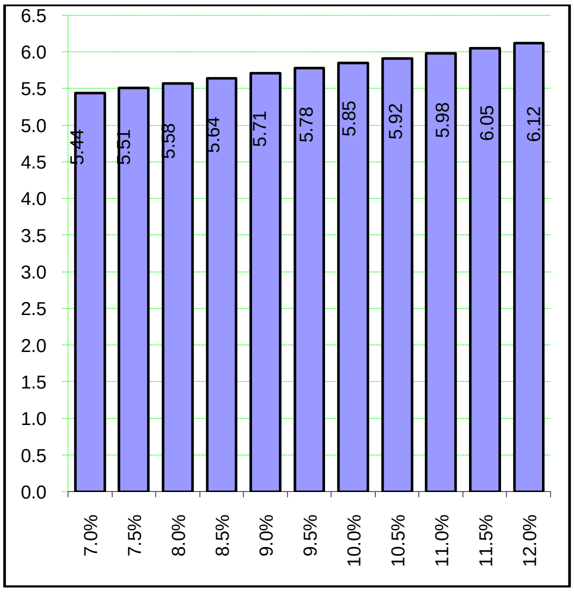


Figure 21.: Sensitivity analysis of PBP against APR for first case.

The general conclusion of this analysis is that the entire investment is of value since financial indicators are very profitable for both cases.

6.6.3 NPV, IRR, LDC and PBB versus the value of generated electricity

Another important variable parameter expected to change in the future is the sale price of produced electricity from plant.

In figures 22-25 is given the analysis against this parameter.

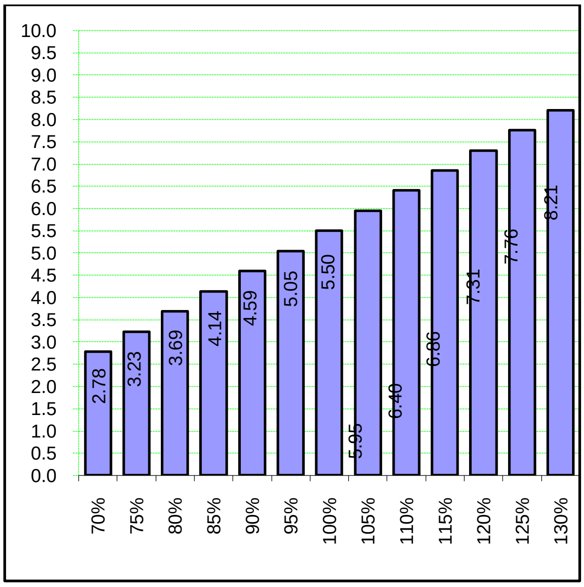


Figure 22: Sensitivity analysis of NPV against produced energy for first case

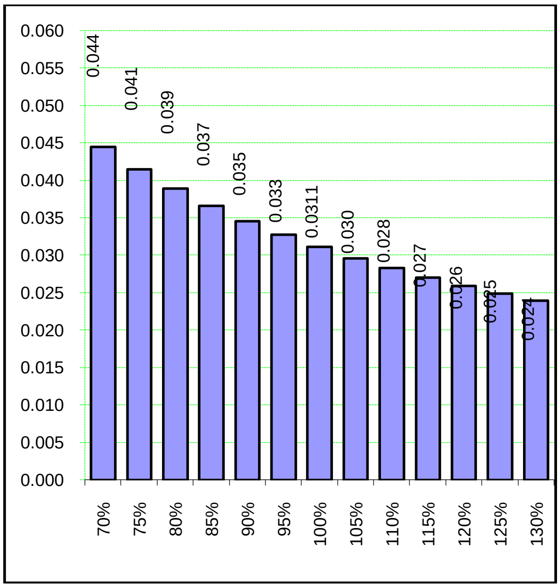


Figure 23: Sensitivity analysis of LDC against produced energy for first case

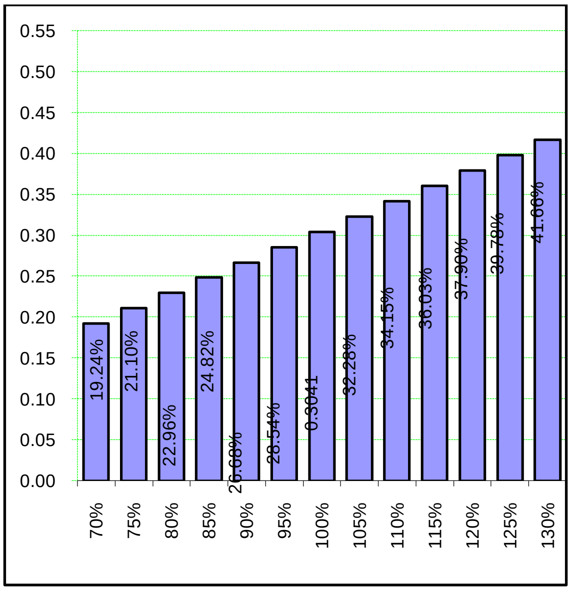


Figure 24: Sensitivity analysis of IRR against produced energy for first case

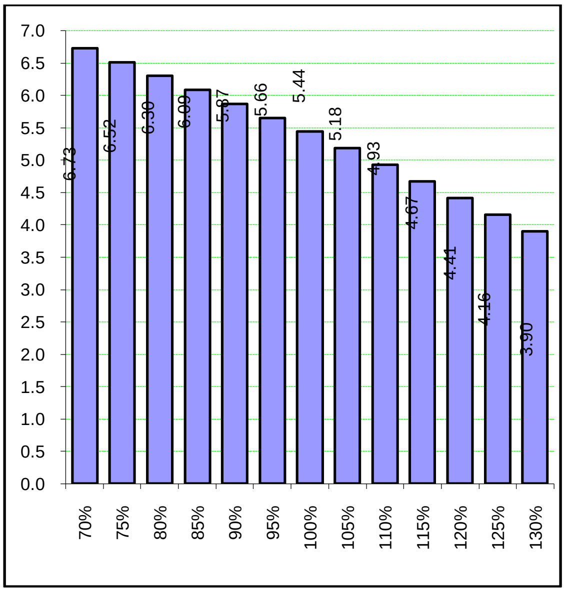


Figure 25: Sensitivity analysis of PBP against produced energy for first case

Main conclusions of this sensitivity analysis are:

1. NPV decreases with the reduction in energy production and for 70% of normal value (14.5 Gwh/year), NPV stills remains positive.
2. IRR zvogelohet me zvogelimin e prodhimit dhe per 70% te vleres normale, IRR eshte 12.58% (rasti i pare) me e madhe se norma e interesit (8%). Ndersa me rritjen energjise elektrike te prodhuar IRR rritet. IRR decreases with reduction in production and for 70% of its normal value; IRR is 12.58% (first case) higher than rate (8%).

3. LDC increases with reduction in production and for 70% of its normal value; LDC is 5.5 cent/kWh (first case. While for increase in production LDC is reduced.
4. PBP increases with reduction in production and for 70%; PBP is 3.9 years (lifetime of plant is over 35 years technically). While with energy production increase PBP is reduced reaching 6.73 years for production level 130% to normal.

Final analysis of sensitivity against production for both cases even when we have 30% reduction in production of the plant's lifetime from its normal value, shows a very positive performance and a profit norm of 19.24%.
This analysis is of great importance because guarantees the bank that even for the worst case the loan will be paid back (it is not possible to have 35 years of dry weather).

6.6.4 NPV, IRR, LDC AND PBP versus the electricity price

Another important parameter expected to change in this project is the sale price of electricity. As mentioned above the base value of this price will be around 8 ALL/kWh, but this can significantly increase in the future when given the status of qualified clients of electricity and liberalization of the market.
Also this can increase due to increases in oil prices globally. To perform a full analysis of the financial indicators against this parameter, a variation of electricity price is taken to be between 8-10.25 ALL/kWh.

From figures 26-29 this analysis is detailed. Main conclusions of this analysis are:

- NPV reduces with sale price decrease and for sale price 8 ALL/kWh, NPV still remains positive.
- IRR reduces with sale price decrease and for sale price 8 ALL/kWh, IRR is 26.07% (first case).
- LDC remains constant and is not dependant of the sale price, because it only depends on costs and not from income.
- PBP increases with sale price decrease and for sale price 8 ALL/kWh, PBP = 6.2 years (first case). While with price increase it reduces.

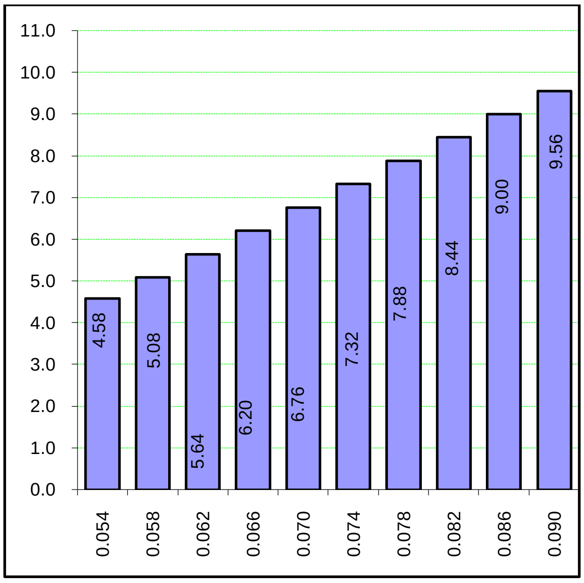


Figure 26.: Sensitivity Analysis of NPV against sale price for first case

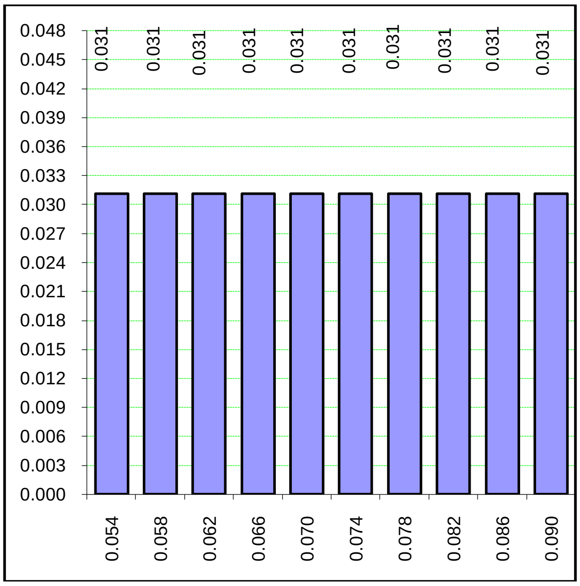


Figure 27.: Sensitivity Analysis of LDC against sale price for first case

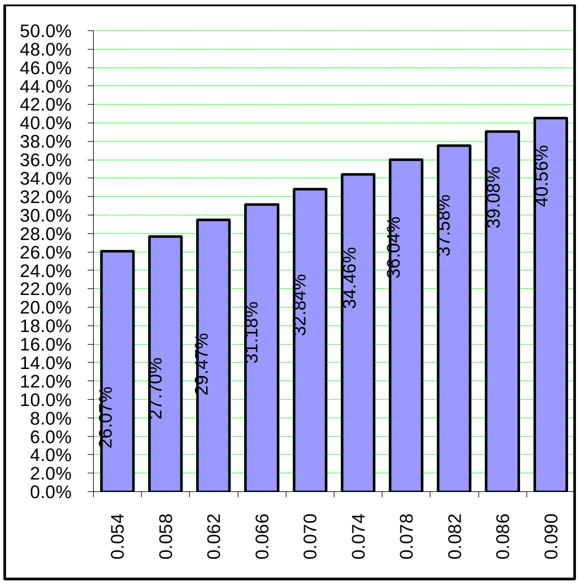


Figure 28.: Sensitivity Analysis of IRR against sale price for first case

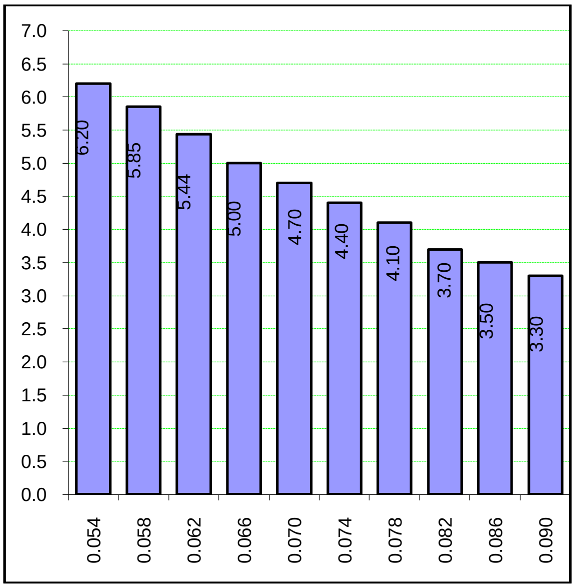


Figure 29.: Sensitivity Analysis of PBP against sale price for first case

6.6.5 *NPV, IRR, LDC AND PBP versus the initial investment*

Another important parameter expected to change in this project is the initial investment. While based on the engineering study made it is accepted a variation in initial investment 10% (for Gjanc HPP 1.95 mil Euro VAT incl.) to obtain a full analysis of this sensitivity, the interval variation of this parameter is taken between 70-130% since at the moment we are at the stage of idea-projection.

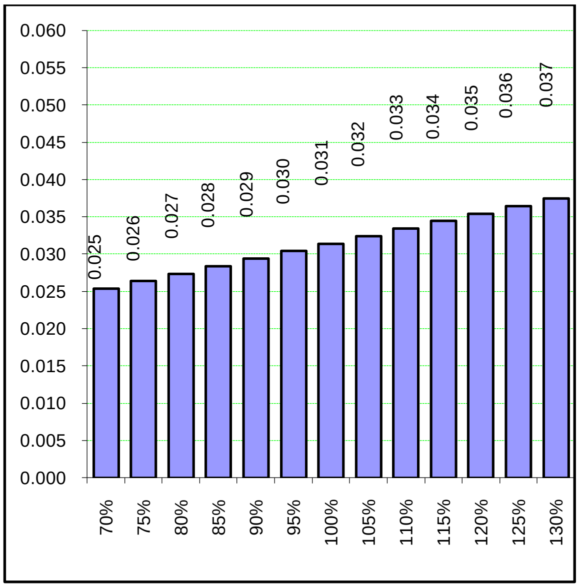


Figure 30.: Sensitivity analysis of NPV against initial investment, first case

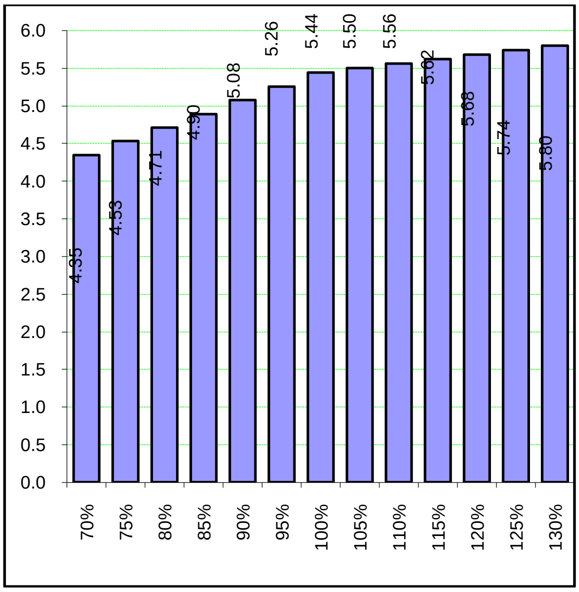


Figure 31.: Sensitivity analysis of LDC against initial investment, first case

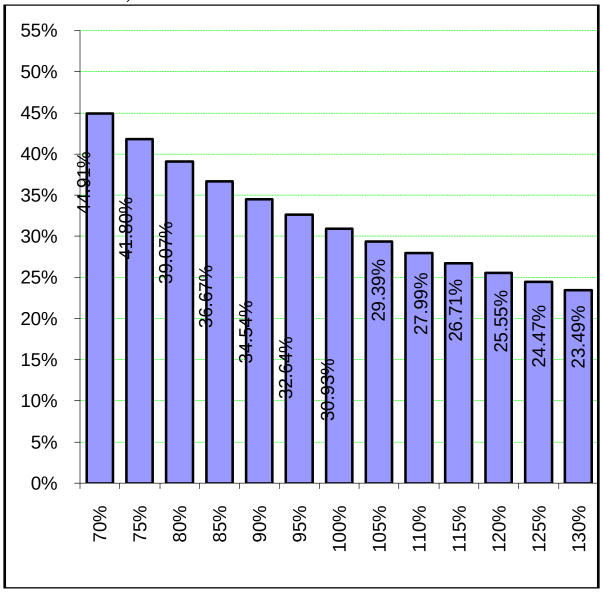


Figure 32.: Sensitivity analysis of IRR against initial investment, first case

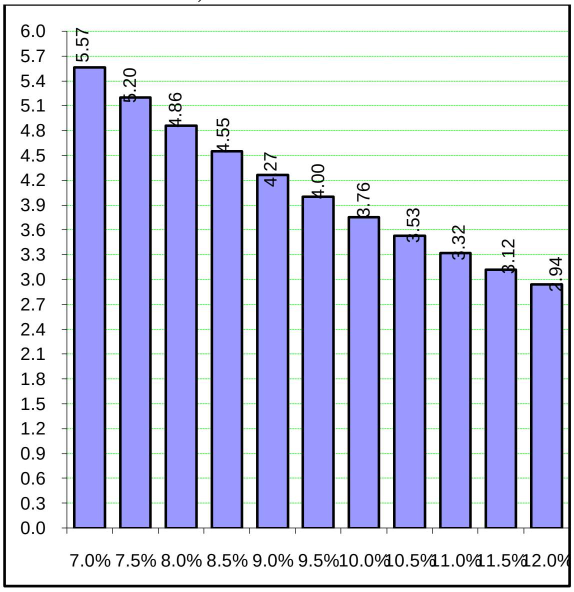


Figure 33.: Sensitivity analysis of PBP against initial investment, first case

In figures 30-33 is given the analysis against initial investment. The main conclusions are:

1. NPV decreases with increase in initial investment value, but for entire interval; it remains positive with a very large value even for the worst case.
2. IRR decreases with increase in initial investment value but for entire interval; it remains higher than APR even for the worst case when the initial investment is 130% of normal value IRR is 23.49% (first case).
3. LDC increases with increase in initial investment value and for worst case (130% of nominal value) it reaches 4.9 cent/kWh, which is still smaller than sale price.

4. PBP increases with increase in initial investment value and for worst case (130% of nominal value) it reaches 5.9 years (first case).

7. CONCLUSIONS OF THE FINANCIAL ANALYSES

Most important conclusions for the expansion of Gjanç HPP are:

1. Installed capacity of Gjanci is HPP is 2940 kW.

2. **Electricity produced from the expansion of HPP Gjançi will be 14.5 GWh / year. Increased generation will be 8.387 GWh/year and is very important to be mentioned that all above calculation have been done for this increment, which is the most conservative case.**

3. **The initial investment estimate for expansion of HPP of Gjançi is 1.34 Million Euro including VAT.**

4. Configuration of Gjançi HPP is with one turbine which together with other electromechanical parts does not need rehabilitation. The need for rehabilitation / expansion is only by means of waterworks, especially with the increase of feeding channel capacity to Gjançi reservoir to obtain optimum utilization of plant capacity.

5. Electric line connection to the HPP is in very good working order and does not require rehabilitation.

6. The project presents very low risk and great value to the financing party.

7. **IRR (Internal Rate of Return) as calculated from Business Plan for total production of 14.5GWh/year is 37%. IRR (Internal Rate of Return) as calculated from Business Plan for only part of increased of production of 8.347 GWh/year is 30.48%.**

8. As observed from the profit and loss predicted statement above the financial performance is very positive, which means we are dealing a great value investment and there shouldn't be any risk in financing it.

9. Detailed Business Plan has shown that in the worst case energy production the debt coverage ratio is between 1.61– 2.13 and for the normal production case is between 2.1-2.34. This again shows that this investment is of great value.