

**GREEN FOR GROWTH FUND
SOUTHEAST EUROPE
INVESTING IN ENERGY EFFICIENCY
AND RENEWABLE ENERGY**

**TECHNICAL ASSISTANCE FACILITY
REPRESENTED BY**

OPPENHEIM ASSET MANAGEMENT

REPORT

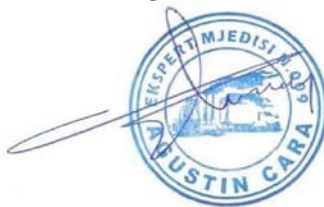
**UPDATING THE SOCIAL
AND ENVIRONMENTAL IMPACT ASSESSMENT
OF
LENGARICA SMALL HYDRO POWER PLANT (SHPP)
AT PREFECTURE GJIROKASTRA, ALBANIA**



Consultants:

(Environmental Assessment, Audition and Expertise)

Agustin CARA



Magdalena CARA

Magdalena MAQELLARI
Ekspert - Mjedisi
Specialist per Raporte
VNM-je, Ekspertiza dhe
Auditim Mjedisor Nr.144



Project: TAF activity Nr.5 2010
Përmet, June 28 2011

Final Report
English

Funded: Green for Growth Fund
Southeast Europe
Technical Assistance Facility

Study Initiator: 1) Oppenheim Asset Management

Address of Study Initiator:

GGF Technical Assistance Facility
c / o Holger CHRIST
Oppenheim Asset Management
4, rue Jean Monnet
L-2180 Luxembourg

Tel. +352 221522-406
+352 221522-9406

2) Lengarica & Energy sh.p.k.

Address of Project Sponsor:

Subject's headquarter and contact details:
"Lengarica & Energy" sh.p.k - a member of enso hydro
Rr. „Eqerem Çabej“- Nd. 6 - H. 2,
Njesia Bashkiake Nr. 5
1022 Tirane
Tel. +43 (3182) 2216-810, Fax DW -380
NUIS: K83026602A

Contractor: 1) Agustin CARA - Environmental Consultant
Address: Lagjia 17, Rruga "Pjetër Hanxhari", Pallati 780,
Durrës, Albania
Tel. +355 52 2 37876, Mob. +355 69 21 79 550,
Email: gusticara@gmail.com

Working Group: A. CARA - Environmental assessment, audition and expertise
Address: Lagjia 17, Rruga "Pjetër Hanxhari", Pallati 780, Durrës, Albania
Tel. +355 52 2 37876, Mob. +355 69 21 79 550,
Email: gusticara@gmail.com

Dr. Magdalena CARA - Environmental assessment, audition and expertise
Address: Agricultural University of Tirana, Faculty of Agriculture and
Environment
Mob. +355 68 60 61 156,
Email: magdacara@gmail.com

Prof.Dr. Spase SHUMKA – Biologist
Address: Agricultural University of Tirana. Faculty of Biotechnology and Food
Albania
Phone: ++355682351130,
E-mail: sprespa@yahoo.co.uk

Object: Updating Social and Environmental Impact Assessment of Lengarica Small Hydro Power Plant (SHPP) at District Përmet, Prefecture Gjirokastra, Albania

Project reference: TAF activity Nr.5 2010 – 01.10.2010

Project Leaders: Oppenheim Asset Management Services S.à.r.l.

Holger CHRIST

Phone: +352 221522-406

Fax: +352 221522-9406

Holger.christ@oppenheim.lu

Technical Assistance: Gülsüm MALCI - Finance in Motion GmbH

Eschersheimer Landstr. 6, 60322 Frankfurt/Main, Germany

Phone: +49 (0) 69 9778 7650-44, Fax: +49 (0) 69 9778 7650-10

g.malci@finance-in-motion.com | <http://www.finance-in-motion.com>

Author of EIA Report: A.Cara, Dr. M.Cara and Prof.Dr. S.Shumka – Environmental Consultants

Table of Contents for ESIA

1. - Executive Summary

2. - Environmental Impact Assessment

- 2.1. - Objectives and scope of the EIA
- 2.2. - Methodology of the EIA implementation

3. - Legal and operational context

- 3.1. - Purpose and objective of the project
- 3.2. - Legislative and regulatory framework in Albania
- 3.3. - Adherence to international standards

4. - Project description and environmental and social conditions

- 4.1. - Project area (Geographical position)
- 4.2. - Technical description of the project
- 4.3. - Status of the project area (geological survey analysis, improvement of existing roads, tunnel excavation and construction, etc.)
- 4.4. - Hydrological analysis
- 4.5. - Climate conditions
- 4.6. - Geomorphology
- 4.7. - Ecology and biotic resources (ecosystem)
- 4.8. - Air quality
- 4.9. - Noise
- 4.10. - Human environment
- 4.11. - Occupational health and safety
- 4.12. - Socioeconomic conditions in and around project area
- 4.13. - Community response (e.g. results from public consultations, Community perceptions)
- 4.14. - Cultural heritage (architectural and historic heritage)
- 4.15. - Urban planning of the project area

5. - Description and assessment of the environmental and social

impacts of the proposed project: Significant changes to be identified to environmental and conditions likely to occur as a result of the pre-construction, construction and operation of the proposed project.

- 5.1. - Impacts associated pre-construction and preparatory works (transport of equipment, trucks, personnel, etc.)
- 5.2. - Tunnel construction impacts (to include detailed explanation on disposal of excavated material)
- 5.3. - Impacts associated with construction related to water diversion (intake, weir, etc.), waterways (penstock, channels, etc.) and electromechanical equipment (powerhouse, turbines, etc.)
- 5.4. - Noise

- 5.5. - Impact on surface water
- 5.6. - Impact on underground water
- 5.7. - Impact on flora and fauna (to be explained in detail and to include clarity on fish stock situation in the river)
- 5.8. - Impacts on geology and topography of the project area
- 5.9. - Impact on air and climate
- 5.10. - Impact on irrigation of the project area surroundings
- 5.11. - Impact on the river
- 5.12. - Impact on the forest
- 5.13. - Impacts associated with operations of the plant (residual water flow, irrigation, watercourse damming, flora and fauna, geology and topography, new electric lines, energy production)

6. - Impacts associated with the construction of the transmission power line to the project site (both intake and powerhouse areas, also to address electromagnetic fields)

7. - Description of mitigating measures and measures to enhance environmental and social benefits (social and environmental management plan): Recommended measures to avoid significant adverse project impacts or reduce them to acceptable levels. Social and environmental management plan to address pre-construction, construction and operations activities and to include necessary resources to implement mitigation measures.

- 7.1. - Organizational and capacity measures and responsibilities
- 7.2. - Technical measures
- 7.3. - Environmental and social protection measures

8. - Environmental and social monitoring plan

- 8.1. - Pre-construction phase
- 8.2. - Construction phase
- 8.3. - Operational phase

9. - Conclusions and Recommendations

Appendices:

Annex 1: Matrix of Environmental and Social Impact

1. - Executive Summary

The development of the Albanian energy system is based on the National Energy Strategy. According to the base case scenario, the most important features of Albania's energy system are energy consumption reduction enabling the fulfillment of energy needs, the reduction of energy imports and reduction of relative fossil fuel use and the development of energy transmission network following EU standards.

The development of the energy system in Albania is strongly supported by important financial organisations like the European Investment Bank, KfW Entwicklungsbank, Green for Growth Fund and EU member countries. A high level of importance is dedicated to plans of diversification of the energy system, encouraging the development of assets for generation of renewable energy (i.e. SHP Plants, solar energy, wind energy, biomass and thermal energy).

The SHP Plant of Lengarica (Permet district, Gjirokastrë prefecture) is among the projects of renewable energy to be built by "Lengarica & Energy" sh.p.k. It will be constructed at the lower part of the Lengarica river basin and is situated in a hilly and mountainous terrain, in Benja's Canyon zone at the elevation 410 m a.s.l., about 7 km from Vjosa river. The powerhouse will be located in the mouth of the river valley about 2 km from Vjosa river, close to Petran village at the elevation of 258 m a.s.l.

The project under consideration is awarded by Ministry of Economy, Trade and Energy (Contracting Authority) under BOT concession to "Hasi Energji" sh.p.k., for a concession duration of 35 years. The contract was approved through a Decision of the Council of Ministers (D.C.M.) No. 543 dated May 1, 2008 and was published in the Official Journal No. 73 dated May 26, 2008. The said contract is renovated through D.C.M. No. 476 dated May 6, 2009 and in it are included some important additions and changes.

At the request of "Hasi Energji" sh.p.k. the concession contract was transferred to "Lengarica & Energy" sh.p.k. having partners ENSO hydro GmbH and "Hasi Energji" sh.p.k. The main target of "Lengarica & Energy" sh.p.k. is to build, put into function, and operate SHP Plant following the amended concession agreement.

ENSO hydro GmbH in cooperation with Albanian companies "ELBA" sh.p.k. and "E.F.B." sh.p.k. had carried out geological and hydro geological studies as well as the designing of the hydropower plant works and other engineering details.

The foreseen installed capacity for Lengarica SHP Plant is 8,600 kW and expected annual production amounts to 28,4 GWh. The catchment area of the HP Plant is 270.6 km². The projected water flow to be exploited is calculated at 7.15 m³/sec. Annual operation time is calculated at 3,307 hours (or 137 days). The 35 kV transmission line from SHP Plant to Permet electrical substation is 6 km long.

The construction term is estimated to be 34 months starting from spring 2011.

The SHP Plant is of derivation type with following components: tunnel transmitting structure / siphon / penstock. The start of operations is foreseen in 2014. The investment is calculated to have a cost of 17.2 MEUR. Investment Payback Period is calculated to be 15 years.

The choice of the scope of the ESIA is based on Lengarica SHPP project size as defined in EU Directive No.85/337/EEC, dated June 27, 1985 "On assessment of effects caused on the environment by some public and private projects", Addendum, II, point 3/h and on Albanian Law No. 8990 dated January 23, 2003 "On assessment of Environment Impact", Addendum II, point 3/e.

2. - Environmental Impact Assessment

2.1. - Objectives and scope of the EIA

The target of ESIA study of Lengarica SHP Plant construction project is the re-assessment of potential social and environmental impact under the new project design. The ESIA is a study aiming to identify and foresee all expected positive and negative effects of the project. It will recommend preventive and mitigation measures on negative social and environment impact during the implementation and operation of the project.

The ESIA will orient institutions and decision-making bodies on the development of the present project. Through this report, we aim to assure the respective authorities that the extent of social and environmental impact maintains the requirements for environmental protection.

Specific aims include:

- Long-term targets:
 - + Implementation of SHP Plant construction project following legal framework "On environment".
 - + Implementation of prevention and mitigation measures.
- Short-term targets:
 - + Updating of data from previous ESIA studies in order them to present actual conditions.
 - + Reflection in ESIA of social and environmental consequences after project amendment (from two in only one SHP Plant).
 - + Re-assessment of social and environmental project impact based on updated ESIA.
 - + Planning of preventive and mitigation measures related to negative social and environmental impact.

2.2. - Methodology of environmental impact assessment implementation

Methodology of social and environmental impact assessment generally indicates the way is carried out on the updated ESIA report. In general terms it has been reflected at table of contents of the present report. The time to prepare this study was 4 weeks.

ESIA methodology consists of:

- Studying the documentation already available: previous ESIA reports on Lengarica -1 and Lengarica -2, new studies on geology, hydrogeology, land use, documentation on project implementation, various studies carried out during the last years on the environmental zone of our interest, as well as regards the concordance of Albanian environmental legislation with EU directives.
- Site visits to identify the intervention points of project works in the natural environment, meetings with representatives of local institutions and with the area's inhabitants in order to collect their opinions and concerns relevant to the project.
- Elaboration of technical and social information, preparation of ESIA report.

The assessment of any potential negative social and environmental impact is carried out following the "Methodology of Preliminary Assessment on Environmental Impact of an Activity", stipulated following EU directives and approved through Instruction No. 6, dated December 27, 2006 by the Ministry of Environment, Forest and Water Management (MEFWM) and "Methodology of Assessment of ESIA Report" approved through Instruction No.3 dated November 19 2001, stipulated following EU respective instruction "Guidance on ETA/EIS Review, 2001" Luxembourg: Office for Official Publications of European Communities, 2001/ISBN 92-894-1336-0.

This ESIA report is carried out studying previous versions of two SHP Plants in cascade and also by comparing two project alternatives under consideration. Preliminarily we may state that studying and designing team of hydropower plant, based on the detailed techno-economical studies and considering details of the social and environmental issues, made out the best alternative choice.

Qualitative and quantitative assessment is carried out on the basis of concrete data of the project study, on local statistics and on the most recent studies for the project zone under consideration. Further, negative impact risk assessment is carried out based on comparative risk.

3. - Legal and operational context

3.1. - Purpose and objective of the project

The aim of the project is construction of the 8.6 MW Lengarica SHP Plant in implementation of Action Plans following the base case scenario of Albania's National Energy Strategy. Recent revisions foresee the construction of a sole HP Plant compared with the first project version of two cascade HP Plants.

The original version, under the Concession Contract of 2006 had foreseen the construction of two HP Plants one after the other. Distance between them was 2 km and the remaining issue was to finalize the concept of the intake, tunnel, siphon, and pressure basin. Because of these difficulties, the consultant recommended reconsideration of cascade project. Later on, adapting Albanian legislation to legislation of EU countries, international conventions and especially according to "Kyoto Protocol" it was asked the project implementation to be carried out following "Clean Development Mechanism" (CDM) procedures.

The Ministry of Economy, Trade and Energy (METE) agreed with investors in changing project scheme to a sole HP Plant. The said change was approved through the new amendment of May 6, 2009. The newly established company "Lengarica & Energji" sh.p.k. (having partners Enso Hydro GmbH – 80 per cent of participation and "Hasi Energji" sh.p.k. – 20 per cent of participation) will construct the said SHP Plant and is the holder of concession contract.

Targets of the SHP plant project can be included in the following terms:

- Topographic study of project zone,
- Geological study,
- Hydrological study,
- Stipulation of implementation project of technical works including cost estimation,
- Planning of electro-mechanical equipment,
- Study of legal aspects and partners' relationship,
- Completion of technical and legal documentation to ensure the financing.

"Lengarica & Energji" sh.p.k. has invested in deepening hydrological and geological studies as well as in the detailed engineering projects of special works. Apart two first versions of Lengarica-1 and Lengarica-2, two other alternatives are studied as well: the first having a long tunnel and short siphon and the second one having a short tunnel and a long siphon.

Two implementation project alternatives are taken into consideration. The tunnel and siphon are technical works that differ in their length and geo-physical relief characteristics. Another important aspect of the project is the study of potential impacts on the zone in the vicinity of Benja's Canyons, Benja's Thermal Waters and Pigeon's Cave that are registered as Natural Monuments through D.C.M. No. 676 dated December 20, 2002. The area of Thermal Waters (Benja village, Petran Municipality) together with natural and historical monuments around them is an

important potential of tourism development. Petran Municipality economic development plans foresee the construction of an important recreative and touristic center that shall use the thermal waters and touristic capacity of the area.

The goal and one of the special objectives of the project is the study of the impact and the intervention in the vicinity of these natural complexes with high touristic potential and of economic importance for the inhabitants of the area. The main goal of projecting team has been avoiding of physical intervention in the nearby of Benja Canyons and Thermal Waters and the integration of HP Plant project with the other projects of the plans for the economic development of the area. HP Plant construction shall make possible the use of hydro-energetic capacity of Lengarica river still free and shall support all other projects through the generation of clean energy.

3.2. - Legislative and regulatory framework in Albania

In Albania, water resource exploitation and hydroelectric works construction is based on a legal framework, which is being improved year by year with the aim to approach the legislation of EU countries.

HP Plant construction takes place following DCM of Albania No.27, dated January 19, 2007 "On the approval of rules relevant to estimation and concession awarding" (as amended).

The first "BOT" concession contract for HP Plants on Lengarica river was approved through Decision No. 543 dated May 1, 2008 of Council of Ministers. It was amended through Decision No.476 dated May 6, 2009 of Council of Ministers. The amendment was relevant to the improvement of the contract condition and to the construction of a sole HP Plant having improved technical and economical parameters.

The previous legal basis on the preparation of the legal procedure for private construction of hydropower plants under concession is the following:

- Law No. 8093, dated March 21, 1996 "On water reserves",
- Law No.8527, dated September 23, 1999 "On privatization of local hydropower plants",
- Decision of Council of Ministers No. 289, dated April 15, 2005 "On the definition of requirements and procedures for the approval of permissions, authorizations and concessions on water use",
- Decision of Council of Ministers (DCM) No. 775, dated October 28, 1996 "On the establishment of National Water Council", as amended by DCM No. 125 dated March 2, 2006.

The legal basis for the environmental protection and estimation of social and environmental impact of development projects and private economic activities is the following:

- Law No. 8652, dated June 31, 2000 "On the organization and functioning of local authorities/governments",

- Law No. 9734, dated May 14, 2005 "On tourism" (as amended through Law No. 9930, dated June 9, 2008,
- Law No. 8934, dated September 05, 2002 "On environment protection", as amended through Law No. 9890 dated March 20, 2008, Law No. 9983 dated September 08, 2008.
- Law No. 8990, dated 23.01.2003 "On estimation on environmental impact", as amended through Law No. 10050 dated December 24, 2008,
- Law No. 8906, dated June 06, 2002 "On protected areas" as amended through Law No. 9868 dated February 04, 2008,
- Law No. 9587, dated July 20, 2006 "On biodiversity protection",
- Law No. 7875, dated November 23, 1994 "On protection of wild fauna and hunting", as amended through Law No. 9219 dated April 08, 2004,
- Law No. 9385, dated May 04, 2005 "On forests and forestry service", as amended through Law No. 9791 dated July 23, 2007,
- Law No. 8897, dated May 16, 2002 "On the protection of air from pollution", as amended through Law No. 10266 dated April 15, 2010,
- Law No. 9010, dated February 13, 2003 "On environmental management of solid wastes"
- Law No. 9115, dated July 24, 2003 "On environmental treatment of used waters",
- Law No. 9537, dated May 18, 2006 "On environmental management of dangerous wastes",
- Law No. 9774, dated July 12, 2007 "On sounds/noise management",
- D.C.M. No. 676, dated December 20, 2002 "On proclamation of protected natural zones",
- D.C.M. No. 805, dated December 04, 2003 "On approval of list of activities having environmental impact for which ones is required to have environmental permission",
- D.C.M. No. 249, dated April 23, 2003 "On approval of documentation for environmental permission and on elements of environmental permission",
- D.C.M. No.177, dated March 31, 2005 "On allowed normative of liquid discharges and zoning criteria of hospitable ambient receiving environment",
- D.C.M. No. 435 dated September 12, 2002 "On the adaption of standards for emissions on the air in Republic of Albania",
- D.C.M. No. 99, dated February 18, 2005 "On approval of Albanian catalogue of waste classification",
- D.C.M. No. 803, dated December 04, 2003 "On standards of air quality",
- D.C.M. No. 994, dated July 02, 2008 "On drawing of public opinion on environmental decision-making"
- Instruction No. 6, dated May 17, 2006 "On rehabilitation plans of surfaces damaged by stone-quarries",
- Instruction No. 3, dated September 3, 2009 "On the methodology of the estimation report of environmental impact",
- Instruction No. 6, dated November 27, 2007 "On approval of rules, contents and deadlines for the preparation management plans relevant to solid wastes",
- Regulation No.1, dated March 30, 2007 "On the treatment of construction wastes since the creation, transport up to their annihilation / liquidation",

- Instruction No. 3, dated March 25, 2009 "On estimation and approving procedures of clean development mechanism projects".

3.3. - Adherence to international standards

Studies on SHP Plant project are carried out in full accordance with international standards.

Albania has a National Plan on aligning its legislation with that of EU directives and on the Implementation of the Stabilization-Association Agreement. The said plan has been approved by Albanian government since 2005. The measures to approach the Albanian legislation on environmental protection are related to approval of laws and other legal acts on air, waters, wastes, discharge and transfer of pollutants (PRTR), education on sustainable development, ESIA-EIA environmental estimations and ratification of international convents.

Apart from the legal acts presented at 3.2 (above) there are others approved, as well:

- Law No. 8672, dated 26.10.2000 "On ratification of Aarhus Convent" "On the right of public to have information, to participate in decision-making and to be address to Court on environmental issues";
- Law No. 9334, dated 16.12.2004 "On adherence of Republic of Albania at Kyoto Protocol" of Frame Convent on Climate Changes (UNFCCC).
- Law No. 9424, dated 06.10.2005 "On ratification of strategic environmental assessment protocol".
- Law No. 9486, dated 06.03.2006 "On adherence of Republic of Albania at Beijing Amendment of Montreal Protocol "On substances thinning ozone layer".
- Law No. 9548, dated 01.06.2006 "On adherence of Republic of Albania at Protocol for registering discharges and pollutants transfer".

Actually are used for consultancy and for assistance the following EU directives:

- European Parliament Directive on Air and Particle Levels:
 - + Council Directive 96/62/EC, dated September 27, 1996 on assessment and management of environmental air quality.
 - + Directive 2002/3/EC of European Parliament and of the Council, dated February 12, 2002 relevant to ozone at environment air.
 - + Council Directive 1999/30/EC, dated April 22, 1999 relevant to limit values for sulphur dioxide, nitrogen dioxide and nitrogen oxides, particle matters/substances and lead at environment air.
- Directive of European Parliament and of the Council on dangerous

waste:

- + Council Directive (75/442/EEC), dated July 15, 1975 on wastes.
- + Council Directive 91/689/EEC, dated December 12, 1991 on dangerous waste.
- Legal framework for actions of community at the sector of water policy:
 - + Directive 2000/60/EC of European Parliament and of the Council dated October 23, 2000.
- Directives of European Parliament and of the Council on VSM, EIA and Repair of Damages to Environment:
 - + Directive 2001/42/EC of European Parliament and of the Council, dated June 27, 2001 on the assessment of effects of fixed plans and programs on environment.
 - + Council Directive 85/337/EEC, dated June 27, 1985 on the assessment of effects of some environmental public and private projects.
 - + European Parliament's and Council Directive 2004/35/CE dated April 21, 2004 on environmental responsibilities relevant to prevention and repairing of environmental damages.
- Education for Sustainable Development - International Documents (UNECE strategy on education and sustainable development and Vilnius Agreement on UNECE strategy implementation of education and sustainable development).

When carrying out topographic, hydrologic or geological studies and stipulating project implementation there are reference works and analyses that guide Albanian and EU countries in technical and environmental standards. In project documentation there are well defined references for each work category. For the work categories or technical parameters that are not available in Albanian standards but that have to be respected in the project, the authors made reference to EU national standards.

In the case of Albania thus far there are not standards on "water flows" after they leave a hydro technical work that is necessary to maintain healthy existing natural ecosystems. Therefore as guidance for residual water flows, European regulations were consulted and it was concluded that the residual water should ideally be 20 % of minimal flow during dry seasons. Considering the special characteristics of the zone and natural monuments situated in the vicinity of the project the project studying team defines the quantity of 200 liter/sec to be the special norm for "the residual water" in the case of Lengarica HP Plant.

Following the Council Directive 85/337/EEC, dated June 27, 1985 the construction activity of Lengarica SHP Plant is classified as an environmental private project (Addendum II – Projects not subject to article 4(2), Article 3/h – Installation on hydro energy generation).

Meanwhile following European's Parliament and Council Directive 2000/60/EC on waters, dated October 23, 2000 project is determined/defined at Addendum II – Groundwater characteristics. The Western Balkan zone is classified as System A. Ecoregion for lakes and rivers – Rivers: Typology – median (270.6 km^2), Geology – limestone, Height, – average $200 \div 800 \text{ m}$ ($258 \div 410 \text{ m}$).

4. - Project description and environmental and social conditions

4.1. - Project area (Geographical position)

The valley of Lengarica river is located in the Southern Mountainous Zone of the Republic of Albania and more precisely in Dangellia and Leskovik zone. The subject under study, Lengarica SHP Plant, is situated in Gjirokaster Prefecture, Petran Municipality of Permet District. Water supply sources are those of Lengarica river and the mountainous streams that flow into it.

Catchment area, meteorological and hydrometric stations

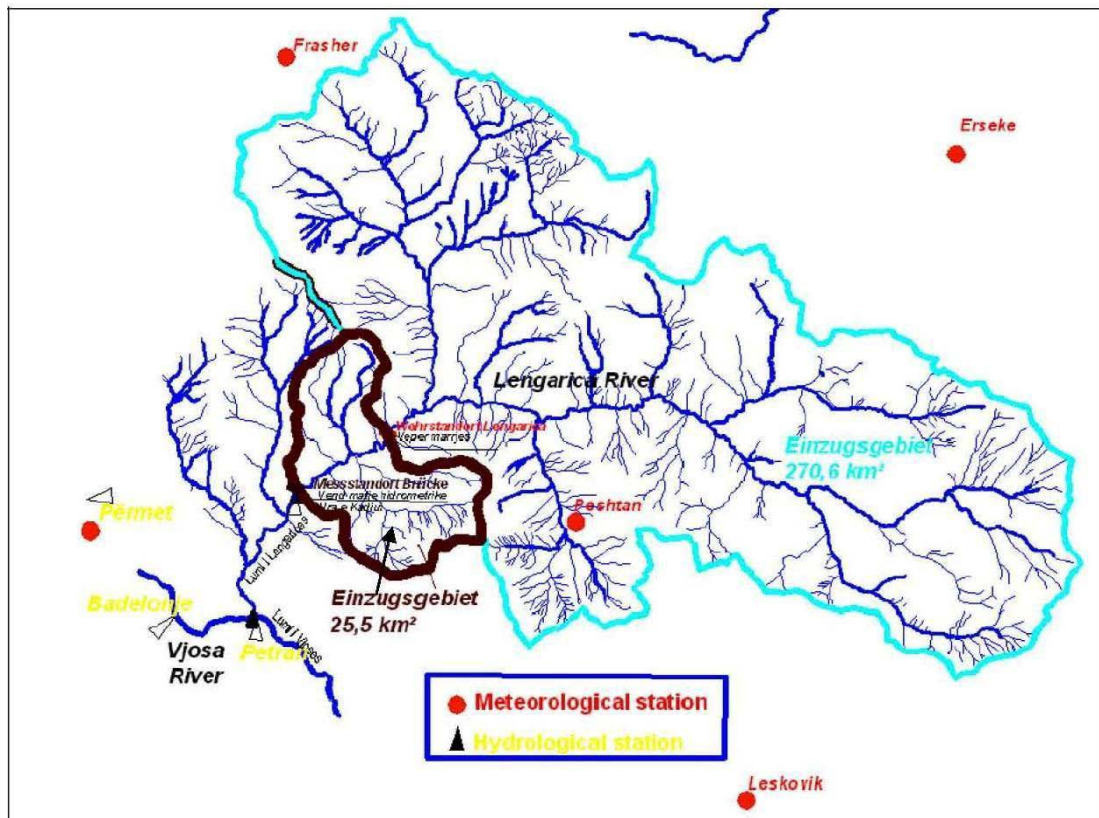


Photo: Map of catchment area of river

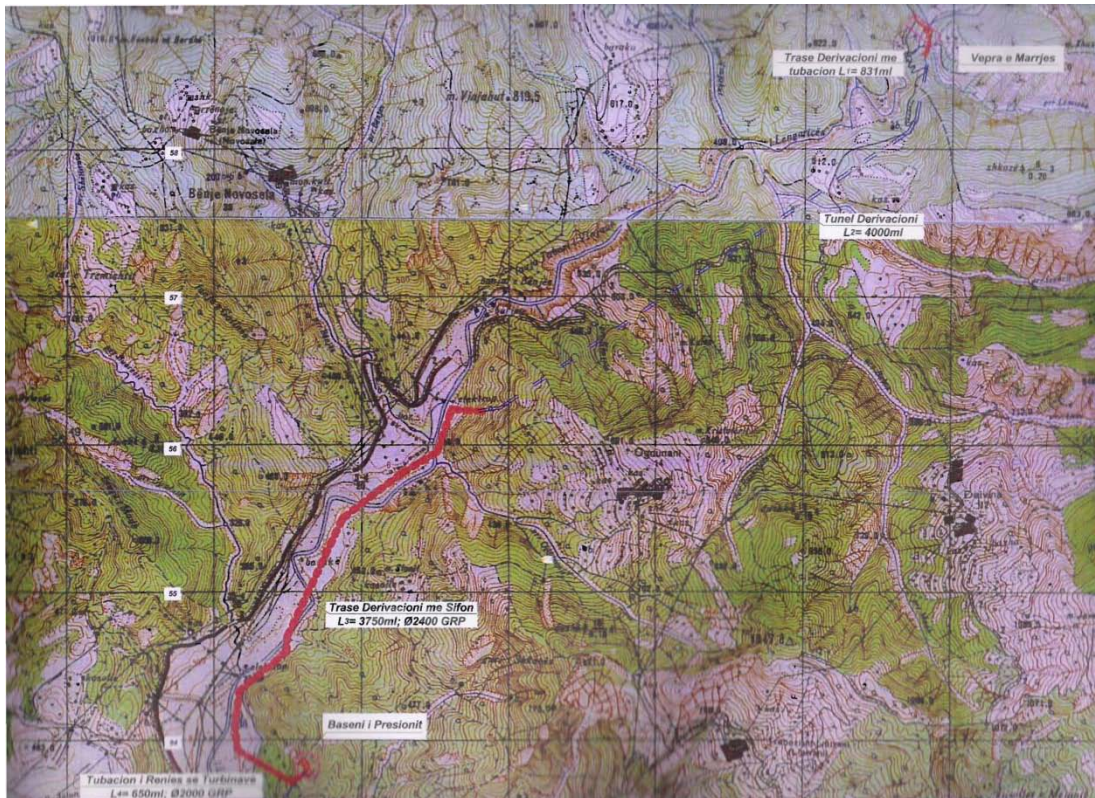
Lengarica river has its origin from western side of Kamenik (2043.8 m) and Mavris (1911.7 m) mountains between which rise Gollo (1933.0 m) and Arrez (1822 m) peaks that form the boundary line with Greece. The streams going down, generally flow from the east to the west and have carved deep beds with high riversides taking their names by the name of village they go through, like Qofka or Arreza Streams, Shollza or Omi Stream, Shellira or Barmashi Stream. All of them after receiving water from other smaller tributaries enter jointly, between Kamnik and Radimisht villages, in a real river bed with continuous water during all the year. Following the flow towards the west the stream valley receives the waters of the Osnat and Dedona streams on the right and those of Peshtanica on the left. From here it is known by the name of Stream and continues to flow from the north towards southwest. Here after receiving/collecting the waters of Gostivisht and Vinjau Streams at the elevation 408 m a.s.l. it enters Benja Canyon having a length of about 2.0 km and starts to enlarge and widen its bed after crossing Kadiu Bridge and flows into the Vjosa river close to Petran village 5.0 km downstream the before mentioned bridge.

Lengarica catching basin is part of Vjosa river catchment basin.

Map of Albania's rivers



Mapo of area Lengarica HPP



The zone under study is crossed by roads connecting Petran Municipality with its villages. The roads cross at the hydro-technical components except tunnel entrance and exit. The intake is located in a wide gorge at Lengarica river bed close to Benja Canyons at elevation 410 m approximately 7 km away from embouchure at Vjosa river. Than through a short channel 285 m the waters collected from the said intake pass in the tunnel. The tunnel entry is positioned at an elevation of 405 m. The length of the tunnel is approximately 4,000 m. The tunnel exit is at the elevation 402.00 m. Through a pipeline with 3670 m length Lengarica's SHP Plant waters exit from the tunnel and go to the surge basin located in a quiet zone over the deposits of aired basic formation. From there through a conducting pipeline of about 600 m long the waters arrive at the power house located in a still zone over alluvial deposits of river terrace at elevation 258 m.

4.2. - Technical description of the project

The technical implementation project of Lengarica SHP Plant is prepared by Austrian company Enso Hydro GmbH and Albanian companies "Elba" sh.p.k. and "E.F.B." sh.p.k.

The said project study is presented in two alternatives. The original version is the first project alternative.

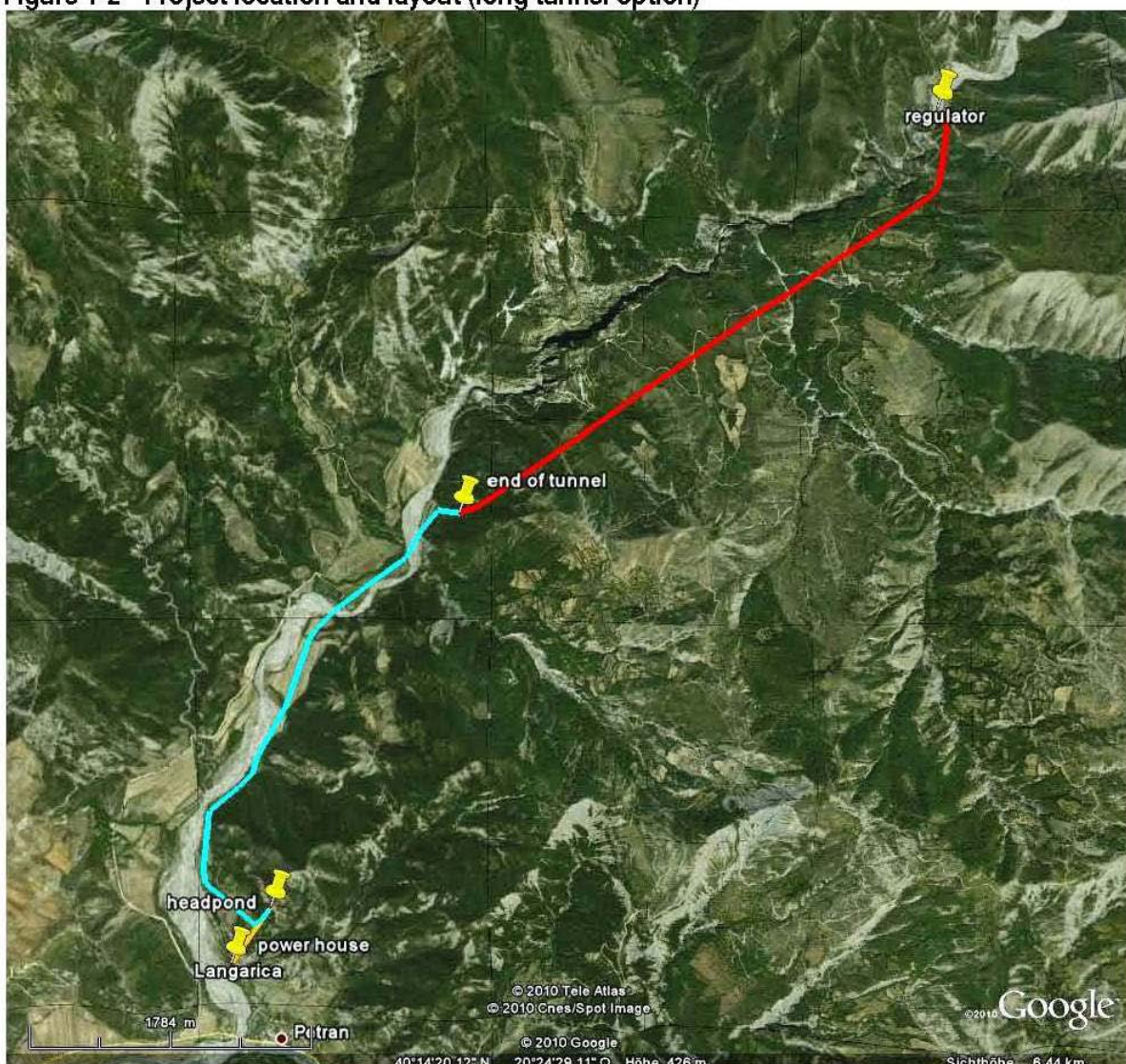
The first alternative includes a 4,000 m long tunnel and a 3,670 m long siphon.

In the second alternative the tunnel is 3,400 m long and the siphon – 4,300 m.

The other components i.e. the intake, desander, tunnel entrance, surge basin and power house do not change in their engineering details.

In the project documentation are foreseen and stipulated precise specifications or more precisely a summary of Terms of References for the categories of special works relevant to preparatory works, tunnel excavation, channel works, works on the channel and on other hydro-technical works, installations of processing of construction material and transport. The said works description according to construction categories are made out following “Best Practices” in construction.

Figure 1-2 Project location and layout (long tunnel option)



Project characteristics

The following parameters are those of the original version of Lengarica SHP Plant (length of tunnel 4 km):

- Catchment Basin 270.6 km² having average height 1040 m a.s.l.
- Design water flow 7.15 m³/s.
- Real head or Gross head (hydraulic losses not considered) between the intake and the turbine 152 m.
- Short tunnel project and its main components:
 - + Dam and intake having water mirror at 410 m a.s.l.,
 - + Sediments desilting,
 - + Conducting channel up to tunnel entrance 285 m.,
 - + Tunnel entrance elevation 405 m a.s.l.,
 - + Tunnel 3417.66 m.long,
 - + Tunnel exit elevation 402 m a.s.l.,
 - + Syphon channel (G.R.P pipes) Ø 2400 mm 3670 m. long,
 - + Water speed into syphon pipeline 2.0 m/s (max.),
 - + Transporting capacity 8 m³/s,
 - + Forebay basin at elevation 400 m a.s.l.,
 - + Penstock (G.R.P pipes) Ø 2000 mm 600 m. long,
 - + Water speed into pentstock 2.4 m/s (max.),
 - + Power house elevation 258 m. a.s.l.,
 - + Head between intake and turbine 152 m.
 - + Power house for 2 Francis type turbines with total installed capacity 8,6 MW and annual calculated output 28,4 GWh, being selected to work with very high efficiency especially under the conditions of low water flow, 1/3 and 2/3 of total water flow.
 - + Generator efficiencies from 25 to 100% of the drive power according to the equipment supplier,
 - + Tailrace channel 256 m. a.s.l.
- Connection to 35 kV transmission system at Permet electric substation, 6 km long,
- SHP Plant work annual operating regime will be with interruption following water flow,
- Operating time is calculated approx. 3,307 hours/annum (or 137 days) i.e. 37.5% of annual period. Average operating time with full water charge is calculated in 60 days/annum (optimal economic water flows are calculated in the range 50-90 days/annum),
- Period having higher water flows (more than 5 m³/s.) is December-April;
- Minimal water flow level foreseen to be taken by the intake is 0.5÷0.7 m³/s (or 500-700 lit./sec),

- Residual water at river bed is calculated at 200 lit/sec.,
- Lengarica SHP Plant is included in the area with maximal seismic and geologic activity of 7 Richter in the years 1800-2000,
- Exploitation project time (duration of concession contract) 35 years,
- Period of investment return 15 year,
- Construction period 34 months,
- Total investment value 17,332 thousand Euro,
- Eventual carbon credits:
 - ($t_{CO_2}/MW \approx 0.1$ factor/ton, price ≈ 10 EUR/ton)
 - $28\,400\text{ MWh} \times 0.1 = 2\,840\text{ t}_{CO_2}/\text{annum}$
 - $2\,840\text{ t}_{CO_2}/\text{annum} \times 10\text{ EUR} = 28\,400\text{ EUR/annum}$ might be the revenue from selling carbon credits.
- Feed-in tariff level for SHP Plants (fixed by Regulatory Body on Energy, RBE) for the year 2010 in Albania is 5.5 EURct/kwh or 6.5 Lekë/kWh.

Description of hydro-technical works

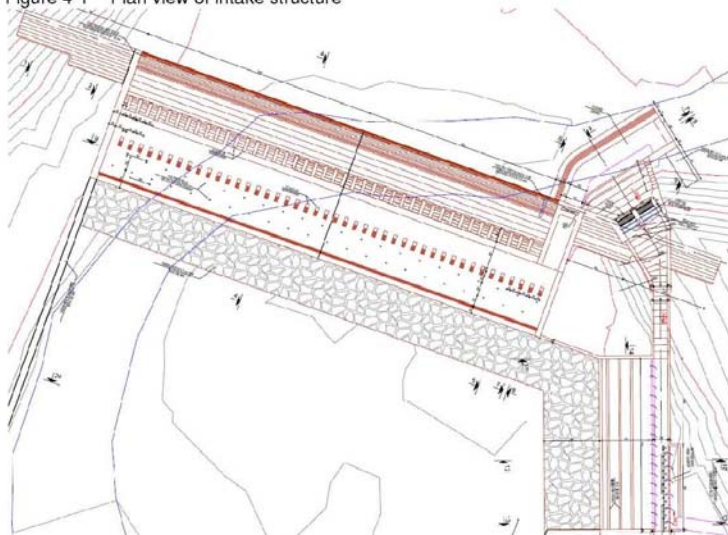
Intake

The intake from the river bed will be of "Tyrolean" type, which is based on a low dam (weir perpendicular to the flow), of the type with regulator and desander. It is calculated to collect waters amounting to 8 m³/s. Obstacle height will be approx. 10 m. It will be built on Benja Canyon at the wide part of river bed at elevation 410 m a.s.l.

Intake will have a length of 50 m.

Figure 4-3: 3D view of area around intake structure and dam area.

Figure 4-1 Plan view of intake structure



Section view. - Intake structure

Desander

The desander is the hydrotechnical work coming immediately after the intake and serves to filter the maximal deviated water quantity (8 m³/s). Its length, width and depth are calculated to retain solid sediments up to small grains having diameter of 0.2 mm. Its length is calculated in excess of 20 % to compensate the turbulence in river flow that make small particles be suspended for a longer distance compared to what was calculated. This engineering detail is thought to avoid to a certain extent the blur/turbulence effect that will ensure that the turbine propellers last up to 7-8 years before rehabilitation is necessary. That would avoid huge initial investment related to construction works.

Table – Desander characteristics

	Sediment basin		Overflow to the chanel	
Discharge	Q=	8000 l/s	Q=	2667.00 l/s
Velocity	V=	0.3 m/s	m=	0.44
Working depth	Hp=	210 cm	epsilon=	0.89
Max rendiment size	d=	0.25 mm	g=	9.81
Temperature	t=	10 °C	b=	440 cm
Sendiment velocity	omega=	2.05 cm/s	H=	49.6
Sefty koeficient	Ksig=	1.25	V=	1.22 m/s
Basin length	Lp=	45.4 m	epsilon=	0.96
Basin width	B=	2.20 m		
Work room number	Nr.	6	H=	48.00

Desander will have a length of 70 m. The total length of channel, connecting the intake to tunnel entrance, is 285 m.

The following rough calculation is made to estimate the surface to be used by the pipeline and the surface damaged by the new construction, later on serving as a service road:

$$S_{\text{chann.sect.}} = 285 \text{ m} \times (3 \text{ m road width} + 2 \text{ m channel width}) = 1425 \text{ m}^2$$

Figure 4-4 Plan view of desander

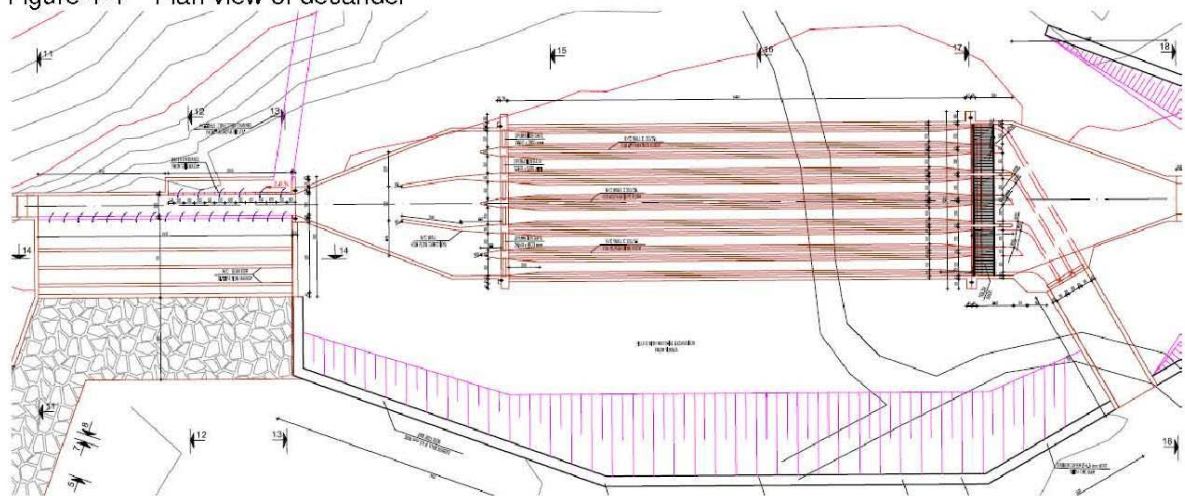


Figure 4-5 Section view of desander

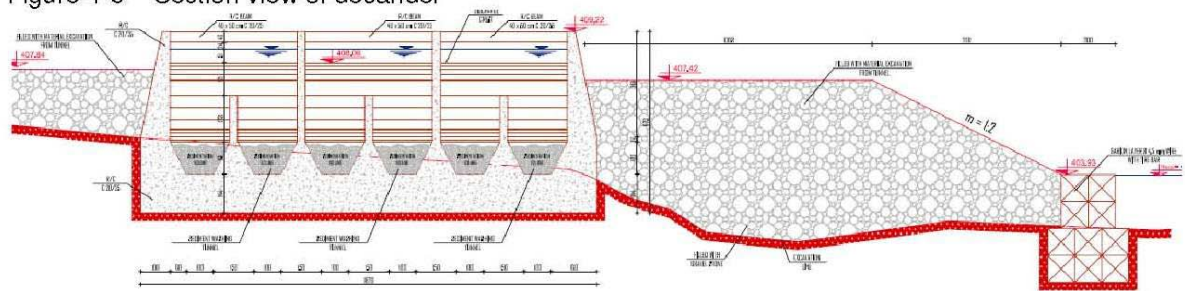


Figure 4-6 Plan view of bridge

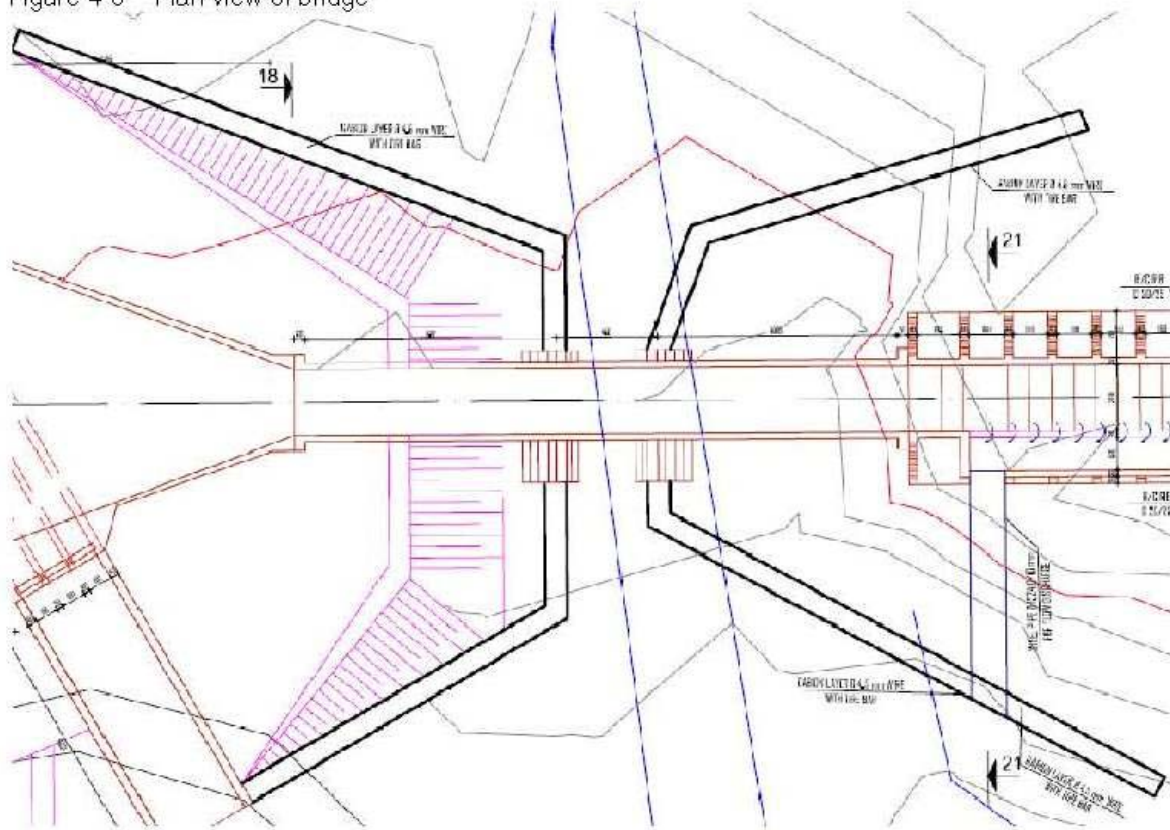
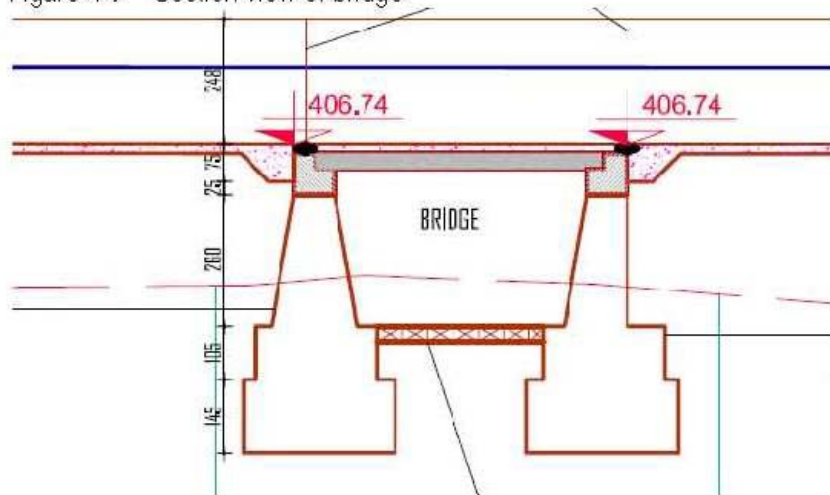


Figure 4-7 Section view of bridge



Tunnel

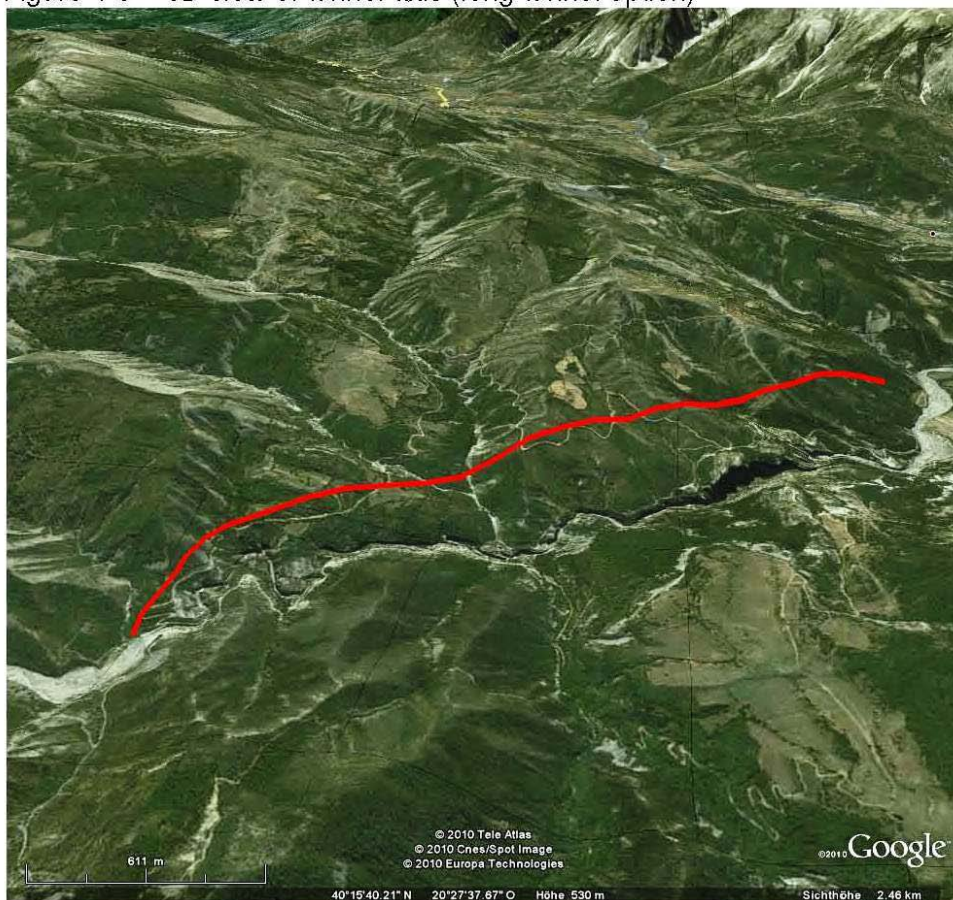
The tunnel is the most important and most complex work to be constructed. Through it will be realized SHP Plant water supply crossing some geological obstacles using underground ways. Different teams of topographers, geologists and hydro technical designers are engaged for its design. Tunnel is going through different geological formations as flysch at the entrance and at the exit and limestone at central part of rocky formations.

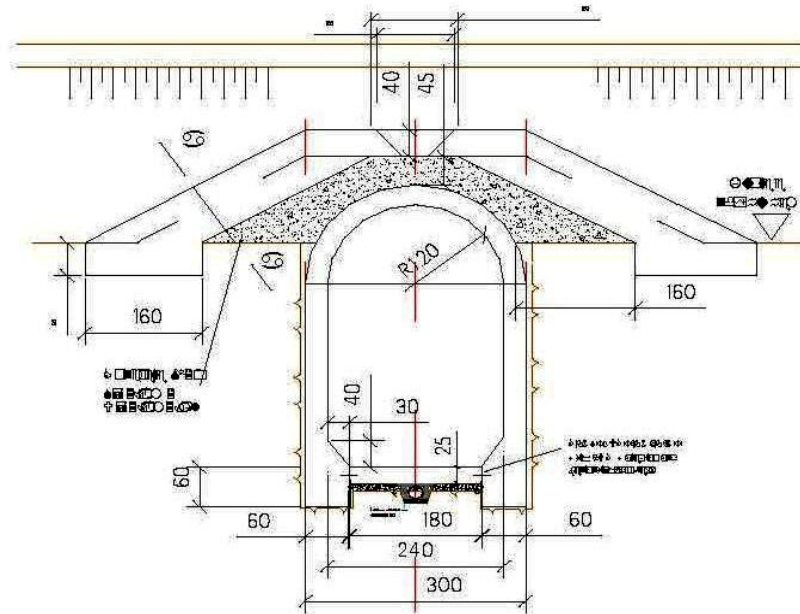
It is very important to stress out that the design of original tunnel version entirely avoid the interventions at Benja Canyon, carstic zone adjacent to it as well as Thermal Waters and goes out somewhere approx. 500 m downstream the thermal waters.

The tunnel length is 3977.05 m and the tunnel cross through some formations with geological smashes. Tunnel central line is a broken one having five curves/bends from the entrance to the exit. The gradient is 0,5 ‰. Tunnel entrance elevation is precisely 405 m, meanwhile that of the exit is 402 m.

The tunnel cross section, defined through hydraulic calculations, is 6.72 m². The tunnel is working under low pressure. Its entrance and exit are connected to other elements of SHP Plant and respectively to the channel coming from desander and to the penstock. The presented design foresees the tunnel construction only and does not explicitly include consideration of ventilation, lighting and water supply.

Figure 4-8 3D view of tunnel axis (long tunnel option)





Technical Report of Lengarica Tunnel, 2010

“ELBA” shpk

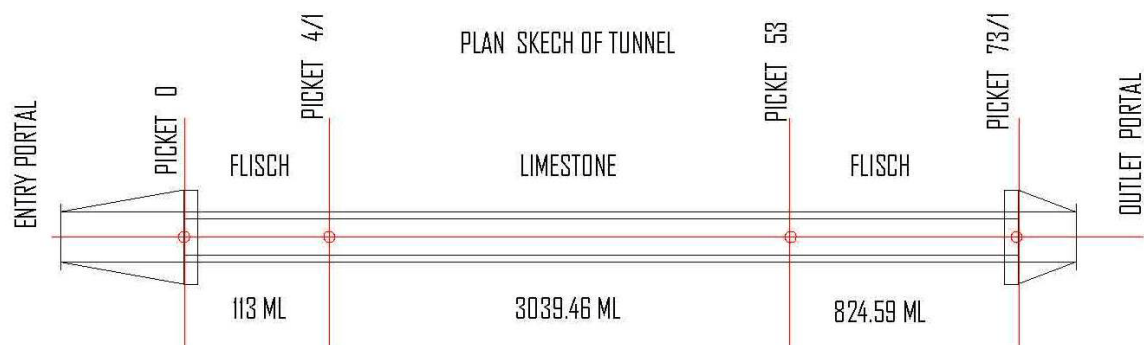
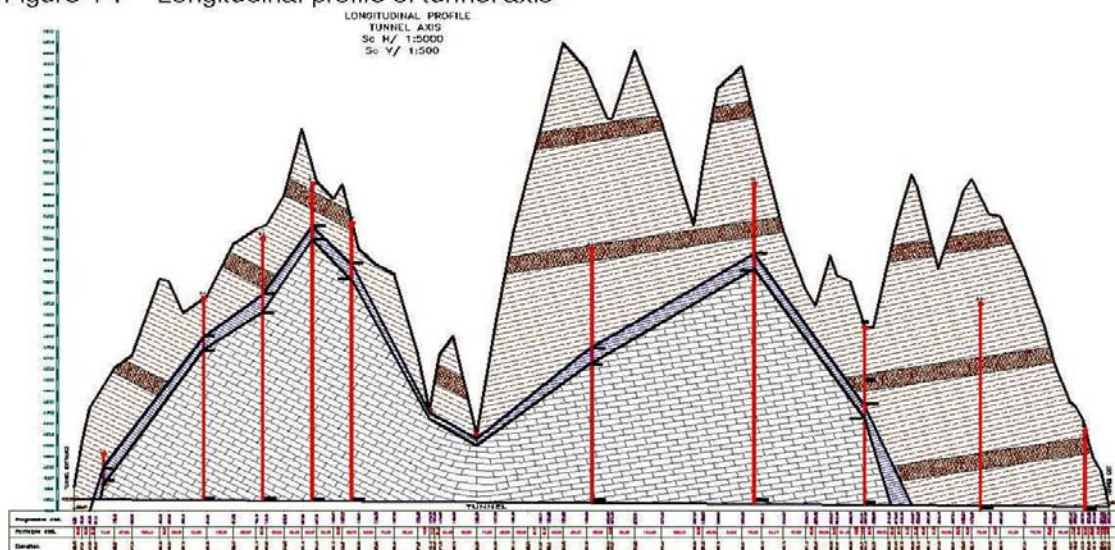


Figure 4-7 Longitudinal profile of tunnel axis



Geometric characteristics of the tunnel are the following:

- Tunnel length: 3977,05 m.
- Inner tunnel section:
 - + section profile $S_{\text{profile}} = 6,72 \text{ m}^2$
 - + tunnel light span $l_0 = 2.4 \text{ m}$,
 - + inner wall height $h_0 = 2.8 \text{ m}$,
 - + inner height of arch arrow $f_0 = 1.2 \text{ m}$.
- Tunnel geographical coordinates are:

Table of tunnel central line coordinates

Picket number	X	Y	Z (ground)	Z (floor)	Progressive Distance	Angle of Curve	Notes
0 (Entrance gate)	4458615.3853	4454819.2932	408.88		(-)3.00		
1 (Tunnel entrance)	4458612.4432	4454819.9150	410.66	404.03	0.00		
2	4458584.3725	4454825.8476	431.51	404.0156	0.00+28.69	177°49'44"	1-2-3
3	4458554.6941	4454833.3047	447.54	404	0.00+59.29	153°39'45"	2-3-9
9	4458201.7385	4454756.7805	490.74	403.8198	0.00+420.45	164°09'42"	3-9-10
10	4458118.7034	4454712.5930	498.35	403.7727	0.00+514.51	151°43'44"	9-10-68
68	4456244.6347	4451951.5375	449.97	402.1042	0.00+3851.52	154°31'47"	10-68-73/1
73/1 (Tunnel end)	4456226.0591	4451830.5051	416.97	402.043	0.00+3974.05		
Total tunnel length from picket 0.00 up to 73/1					3977.05		

Geological data consideration is carried out for total length of the tunnel. Hereinafter we briefly present the comment on these data relevant to materials to be excavated during tunnel opening. Tunnel works will advance following a time schedule that here is not defined. The most important is that the design defines precisely the length extension of flysch and limestone formations during tunnel road, their quantities and physical-mechanical characteristics of volumetric material.

Soft flysch formations are overlapped in layers at tunnel entrance and exit, having respective values of 2 kg/cm^2 and 30 kg/cm^2 for resistance in compression. The limestone massive or bigger part of tunnel volume has the value of 112 kg/cm^2 for resistance in compression.

The Bill of Quantities (BoQ) relevant to tunnel construction works is given in details in a separate format (excel). Hereinafter we are presenting some special parts of BoQ that are relevant for the environmental assessment.

A selective and summarized BoQ of the tunnel, divided in 10 chapters, is presented hereunder:

- 1) Entrance portal:
 - Ripping out low vegetation and roots 50 m²,
 - Total flysch excavations 203 m³,
 - Surface to be concreted 20 m²,
 - Concrete works 44.4 m³,
 - Concrete steel 2.43 ton,
 - Crushed stone filling 5.4 m²,

- 2) Exit portal:
 - Ripping out low vegetation and roots 200 m²,
 - Total flysch excavations..... 1 156 m³,
 - Surface to be concreted..... 20 m²,
 - Concrete works 44.4 m³,
 - Concrete steel 2.548 ton,
 - Crushed stone filling..... 5.4 m²,

- 3) Tunnel in flysch (L=110 m):
 - Excavation in soft rock, cat.V-VI 1457 m³,
 - Surface to be concreted 1540 m²,
 - Wagon transport of residual aggregates 1748.4 m³,
 - Concrete works 432.83 m³,
 - Profiles and metallic mesh..... 77.051 ton,

- 4) Tunnel in flysch (L=822 m):
 - Excavation in soft rock, cat.V-VI 10891.5 m³,
 - Surface to be concreted..... 11508 m²,
 - Wagon transport of residual aggregates 12655 m³,
 - Concrete works 3278.3 m³,
 - Profiles and metallic mesh 592.405 ton,

- 5) Tunnel in hard limestone (L=2999.5 m):
 - Excavation in hard rock, cat.IX 34203 m³,
 - Surface to be concreted..... 39465 m²,
 - Wagon transport of residual aggregate 41043.6 m³,
 - Concrete works 6348.6 m³,
 - Profiles and metallic mesh, steel bars 416.405 ton,

- 6) Tunnel in hard limestone (L=40 m)
 - Excavation in hard rock, cat.IX 480 m³,
 - Surface to be concreted..... 692 m²,
 - Wagon transport of residual aggregate 576 m³,
 - Concrete works 145.305 m³,
 - Profiles and metallic mesh, steel bars 10.66 ton,

- 7) Tunnel drainage (L=4100 m)
 - Excavation of tunnel ditches 630 m³,
 - Wagon transport of residual aggregate 630 m³,
 - Concrete works 75 m³
 - Profiles and metallic mesh, steel bars 10.66 ton

- 8) Water-proof materials:
 - PVC water-proof materials 21006 m

- Bentonit hydro flex water proof-materials 21006 m

9) Construction of temporary dekovil line:

- Construction of temporary dekovil line (narrow gauge rails) .. 4300 m
 - Gravel filling, 10 cm thick layer 6450 m²
 - Rotative plate for wagons 4 pcs
 - Dismantling of dekovil line 4300 m
 - Rails transport (twice) 332 tons
 - Transport of *dekovil* line (twice) 387 m³
 - Gravel wagon transport 1290 m³

10) Explosive materials:

- Explosive material, total 75055.34 kg
 - Dynamite fuse 77652.44 m,
 - Explosive detonators 63123.58 pcs,

Main works and respective summarized BoQ is presented hereinafter:

Summary of the works:

- Ripping out low vegetation and roots 250 m²
 - Total tunnel excavations 49020.5 m³
 + Flysch excavation, total 13707.5 m³
 + Hard limestone excavation, total 35313 m³
 - Outside surface to be concreted 40 m²
 - Concrete 10368.34 m³
 - Concrete steel bar, metallic mesh and profiles 1101.499 ton
 - Wagon transport of residual aggregates 57298 m³
 - Explosive materials, total 75055.34 kg
 - Dynamite fuse 77652.44 m
 - Explosive detonators 63123.58 pcs

Surface channel (with G.R.P. pipes), the Siphon

Further to the tunnel will be build the 3670 m long surface channel up to the surge basin. Lengarica SHP Plant water conducting channel is a hydro technical work having a special solution. It is projected following syphon principle and there will be lay down Ø 2400 mm. G.R.P. pipes. Its track steps down from tunnel exit (elevation 402 m) following the shortest way in Lengarica river bed, continues along its most appropriate terrain and steps up again the hill at the elevation 400 m a.s.l. where is located forebay basin. Water flow speed inside the pipes will be 2,0 m/s at maximum. Entering of water into the siphon will be carried out through a construction equipped with water flow regulating gate and the pipe getting out the air.

The alternative of the horizontally positioned track going from the slopes of the hills on the left side of river flow was also studied for the construction of the channel. This was difficult due to instability of soft flysch layers and of alluviums of hills slopes as well as due to erosion phenomena. The risk of project damages was high.

The alternative of original project although longer results to have the minimal impact on forestall vegetation fund. The line of water pipeline follows the river flow at its bed quite close to the power house

Figure 4-12 3D view of Siphon axis (long tunnel option)

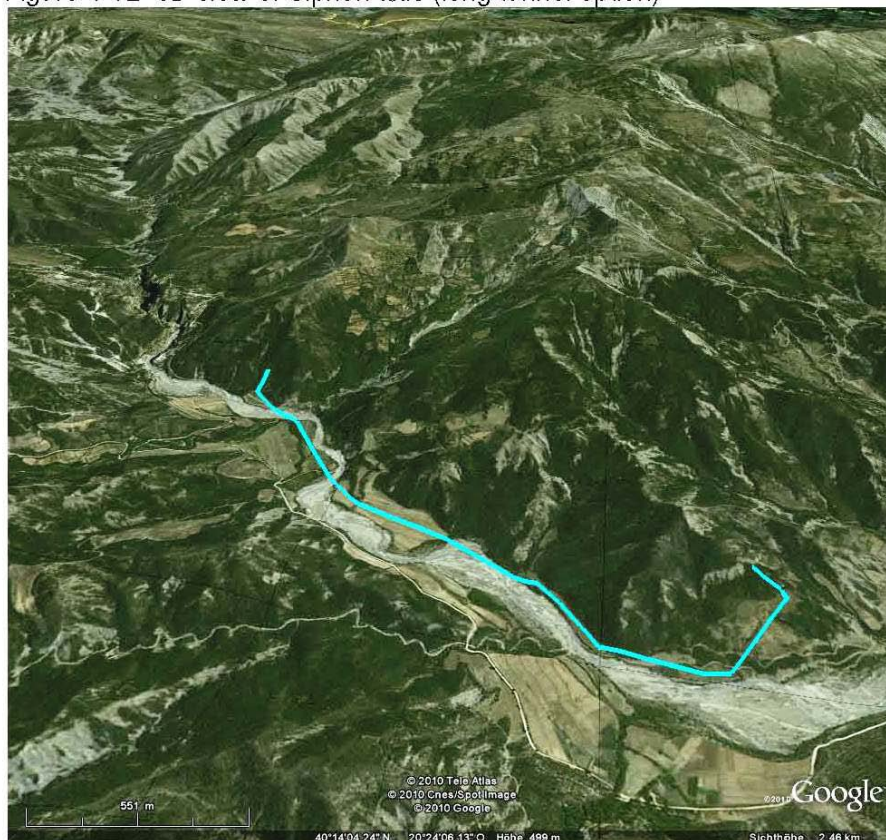


Figure 4-13 Plan view of tunnel exit

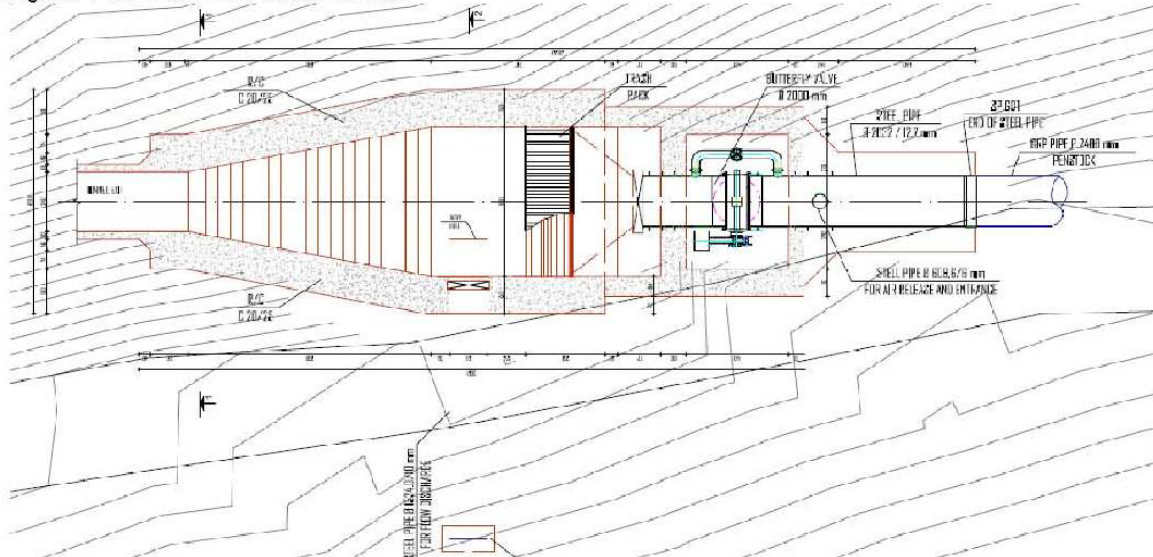
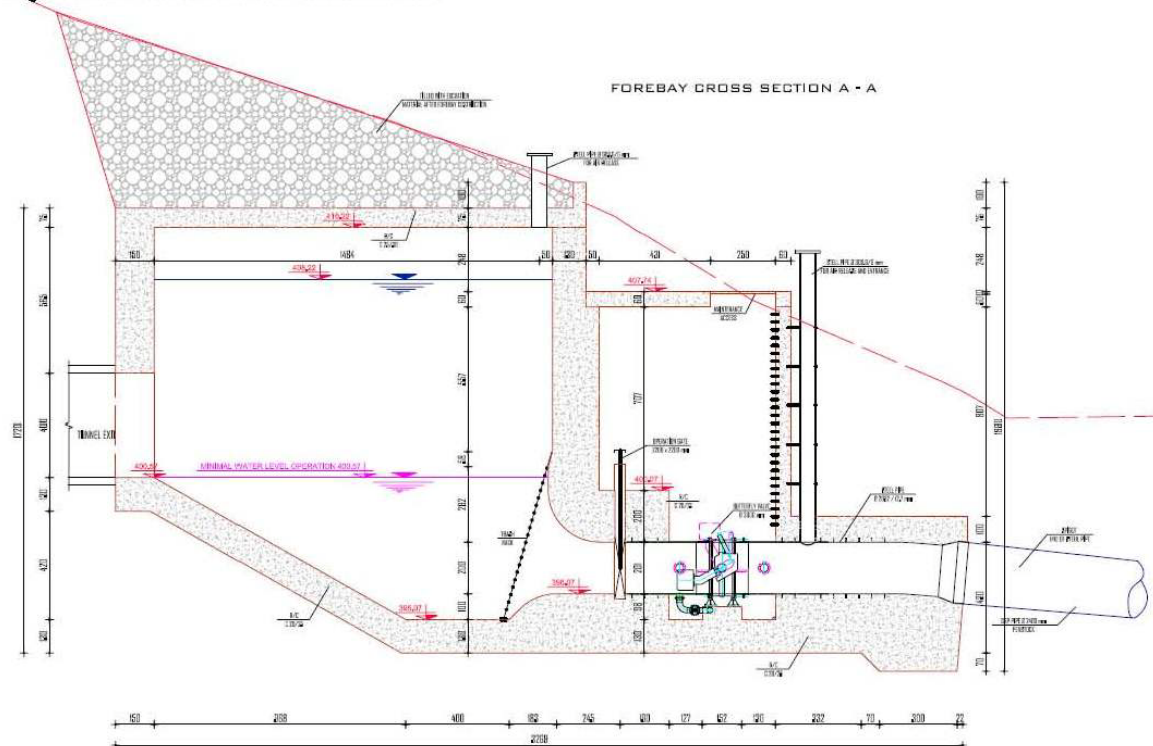


Figure 4-14 Section view of tunnel exit



Forebay basin

Forebay basin is the hydro technical work connecting conduction channel (siphon) to pressured turbines pipeline and it's located 400 m a.s.l. It is projected to regulate the supply and compensating volume of water during maneuvers in the power house in order to avoid hydraulic hammer in siphon and pressure pipe. In such cases it turns back the available water volume avoiding air entering in pressure pipeline and serves as a widening vessel for

oscillations of water quantities in the pressure pipeline itself. It is projected also to discharge flow water over 8 m³/s and to realize water closing in case of shutting down turbines.

The project of forebay basin has to meet higher hydraulic requirements than the intake. The fundamental issue in projecting surge basin is minimization of hydraulic charge losses. That is the reason why the changing of basin section from rectangular to round shape is done gradually and by increasing its length to reduce the losses. After pipeline shutting in turbine an extraordinary gate (butterfly) will block the water. In such case an aerating pipe avoids the negative pressure due to water and vacuum losses. The surplus water flow will be discharged in the existing valley in vicinity of forebay basin.

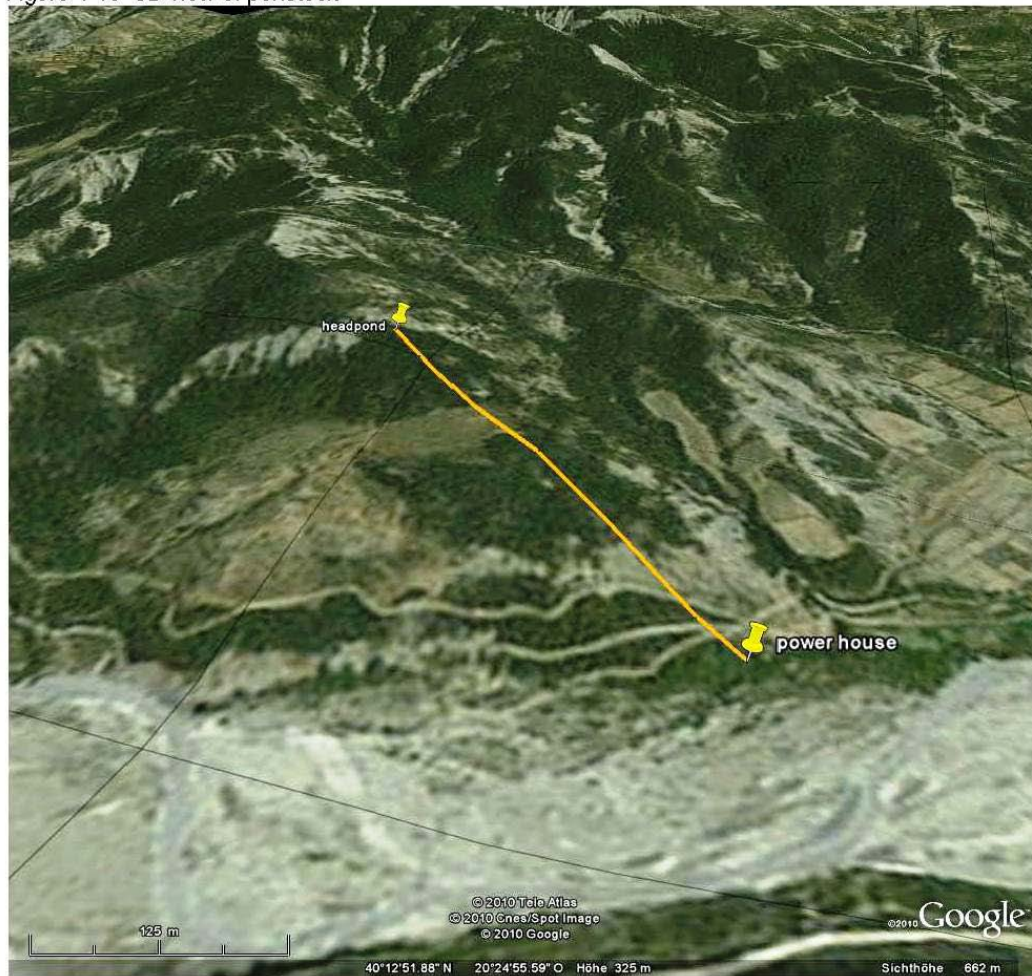
Table – Forebay basin characteristics

Discharge	Q=	8 m ³ /s		Start working turbine depth			Over flow discharge		
Pipe diameter	D=	2000 mm		Negative wave depth	Hn=	4.44 m	Over flow length	L=	14.2 m
Forebay velocity	V=	0.5 m/s					Over flow koefic.	m=	0.44
Forebay width	B=	3.4 m		Negative wave velocity	Cn=	6.10 m/s		epsilon=	0.89
Penstock velocity	v=	2.54 m/s					Over flow depth	H=	0.47 m
First condition				Stop working turbine depth			velocity	V=	1.19 m/s
Forebay depth	H=	4.800 m	First choice	Pozitive wave depth	Hn=	5.57 m	Total depth	HO=	0.55 m
Seconde condition				Pozitive wave velocity	Cn=	7.39 m/s		epsilon=	0.99
Vortex condition	a=	0.9915 m		New water depth	Hn=	6.30 m	Finale depth	H=	0.44 m
Reserve depth	d=	0.4 m		Over flow krest	h=	0.6			
Forebay depth	H=	3.4000 m	Seconde choice	Total over flow krest	Ht=	1.10			
Acept depth	H=	5.20 m							

Penstock

Water supply to the turbines will be done by the penstock. The connection of the surge basin to the power house will be done through a steel penstock having a thickness of Ø2100 mm and 22 mm. The pipes will be fixed in the terrain applying clipping/stapling and supporting structures following pipeline central line. 5 supporting blocks will be installed along pipeline profile. At the beginning of the pipeline will be installed a butterfly valve, followed by aerating pipe and at its end will be a discharging valve of “dumper” type. The length of pressure tube is about 600 m and the water speed will be 2.4 m/s for the maximal flow.

Figure 4-16 3D view of penstock

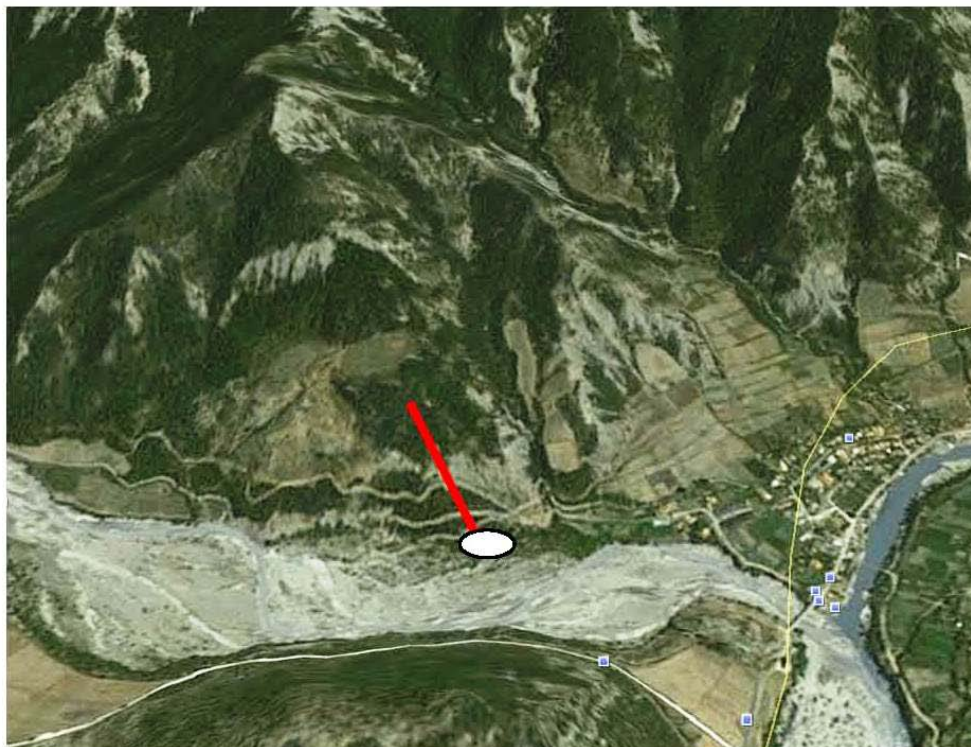


Power House

The power house will be positioned at Lengarica river bank (elevation 258 m) about 2 km far from in the confluence with the Vjosa river. Two “Francis” type turbines are foreseen to be installed in it. Their characteristics are the following:

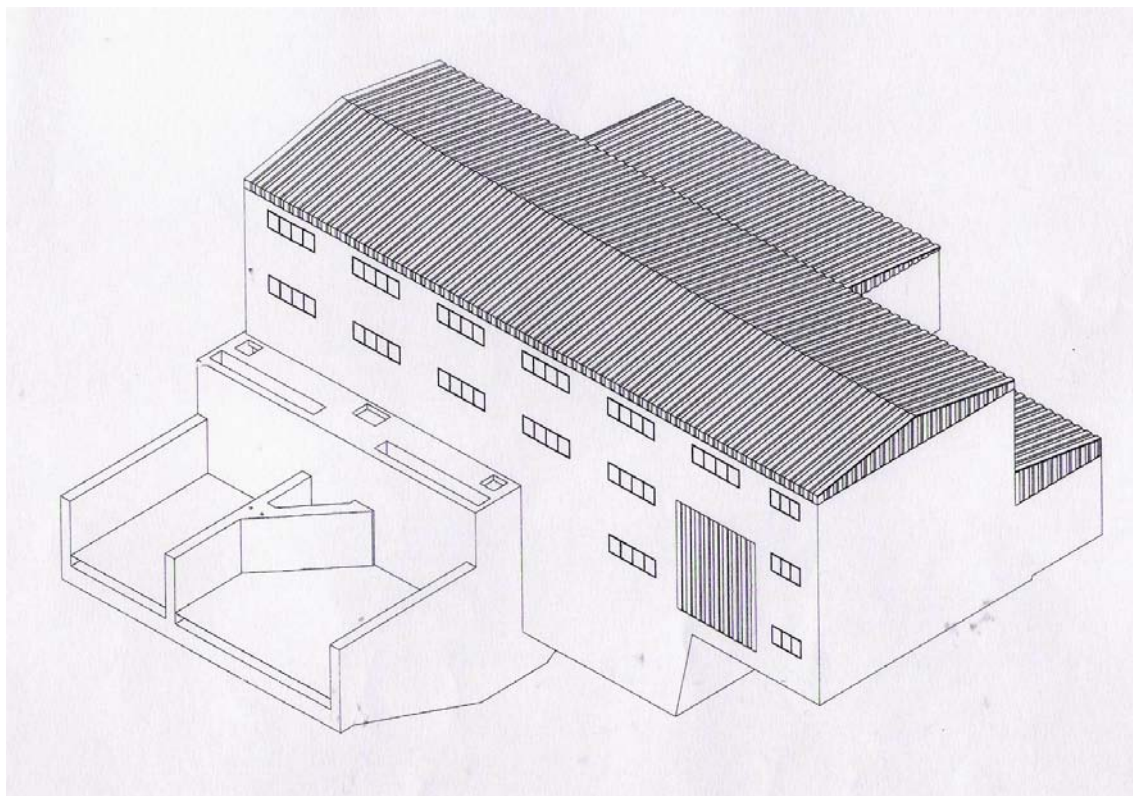
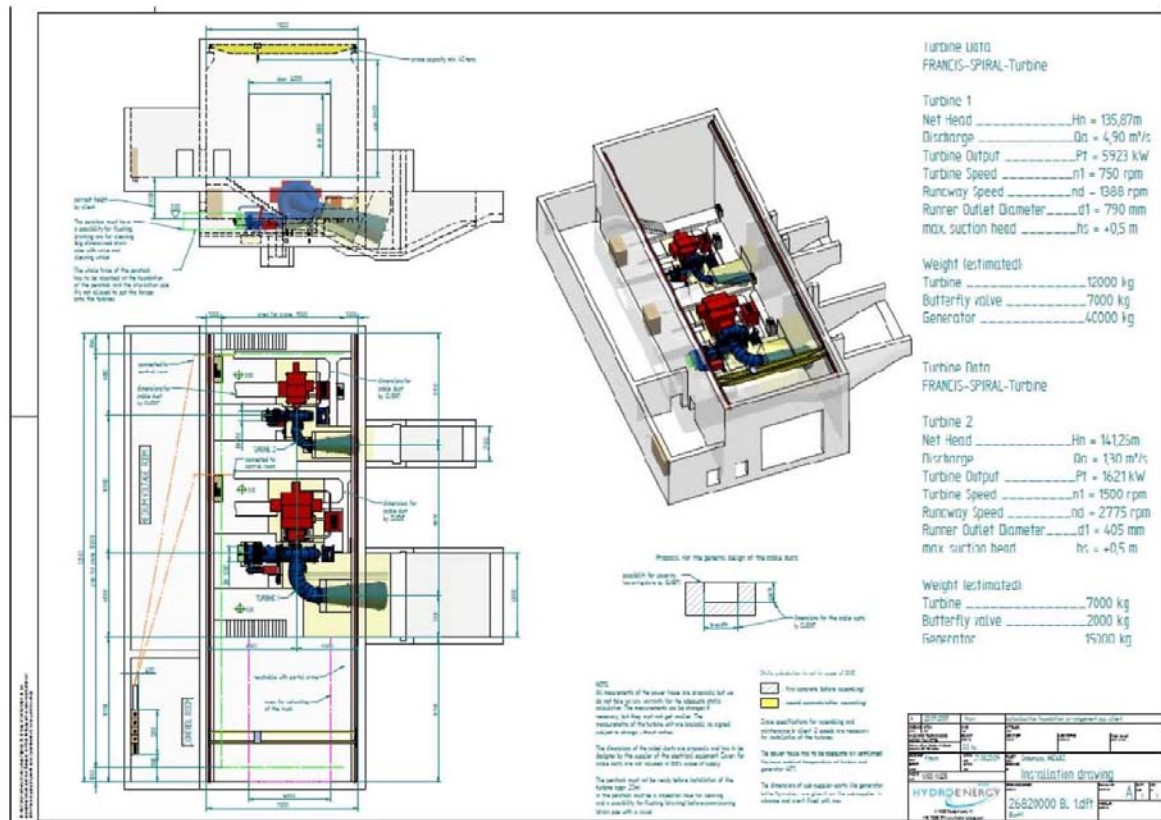
- Maximal capacity 4.82 m³/s with net head of 142 m.
- Maximal capacity 2.33 m³/s with net head of 142 m.

The project of electrical plant is included in the documentation for the approval of administrative permissions and in that of electro-mechanical supply.



Penstock route of long tunnel variant and power station at left side of Lengarica river.

Figure 4-20 Example – Power house ground view and sheer plan



Access Roads

Lengarica SHP Plant project is located at Petran municipality, in a rural area with a system of partly asphalted roads. Only Petran – Benje road is asphalted through Albanian Development Fund funding.

The road from Kadiu Bridge (Thermal Waters) up to the intake is 10 km long. It is part of the road connecting Petran community with villages of upper stream of Lengarica river. The investors of Lengarica SHP Plant have restructured this road segment. A new bridge, about 100 m downstream Thermal Waters, is foreseen to be built in order to connect the asphalted road of Benje village with the villages situated upstream Benja Canyons. Through this road the intake and Lengarica SHP Plant tunnel entrance and exit will be accessible.

The access to the power house will be completed through a rural road about 300 m distance from national road close to Petran village along Lengarica river.

The road going to the power house will be constructed from the public road along Lengarica river. This new road will be about 300 m long.



Photo (satellite) – Roads of IV category close to tunnel end and to intake



Photo – Roads at intake (right)

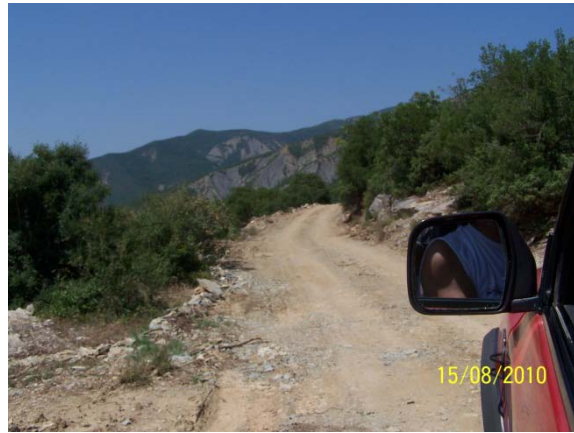


*Photo – Road Ura e Kadiut – Intake
(10 km (reconstructed))*



Photo – Asphalted road Petran village – Thermal Waters

Electromechanical Equipment

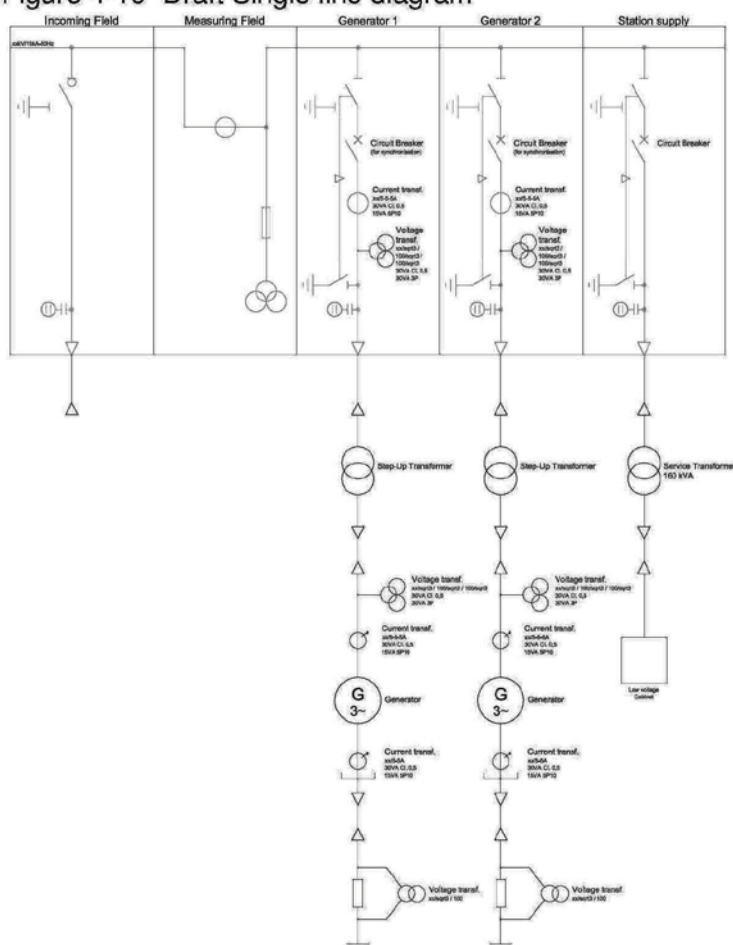
The necessary SHP Plant equipment is presented hereinafter:

- 2 sets of equipment of generating units including turbines, generators and hydraulic aggregates,
- installations of high voltage switching including synchronising equipment,
- installations of low voltage switching including control and monitoring equipment,
- meters of water level and control unit including signal transmitting equipment,
- generators of emergent energy supply for control systems,
- transformers for generating units,
- transformers for auxiliary equipment use,
- high and low voltage cables (control and energy cables),
- equipment to connect SHP Plant to public grid,

Table 4-1 Technical parameters for HPP Lengarica

Voltage level of generator 1	6.300	V
Voltage level of generator 2	6.300	V
Transformer voltage	20/6,3	kV
Nominal power transformer 1	3.500	kVA
Nominal power transformer 2	7.000	kVA
Nominal power auxiliary transformer	160	kVA

Figure 4-19 Draft Single line diagram



Turbines:

2 "Francis" type turbines

- + horizontal axis,
- + steering directly positioned at generator axis and
- + steering regulable blades

Generators:

3-phase synchrony generators are standard equipment. They are projected for separate operation as well as for operation in parallel with the public grid and are equipped with voltage electronic regulator and control equipment for power factor

Transformers:

Standard Specifications:

- + Type: three phase oil-cooled transformer with expansion tank
- + PCB (Polychlorinated biphenyls, $C_{12}H_{10-x}Cl_x$)-free insulation oil
- Cooling: ONAN
- + Frequency: 50 Hz
- + Connection: depends on Type of System used on grid side and in Hydro Power Plant
- + Taps: min. $2 \times \pm 2.5 \%$ on the primary voltage side; the exact taps are to be determined in co-ordination with the Electricity Authority.

In project documentation is given a detailed description on all electrical equipment in the power house and substation.

Auxiliary Equipment

Auxiliary equipment will be key elements to control and manage SHP Plant after it will be functioning.

At penstock entrance shall be installed a fine screen for the rigid materials and wastes at the settling basin. Also shall be installed a flat gate and an airing pipe to avoid negative pressure due to immediate vacuum water loss.

In the power house shall be installed emergent valves in order to close turbine piping before the water enters in. Due to the pressure created within these pipelines, valves shall be of butterfly type and the time of total shut down shall depend on maximum allowed hydraulic hammer. The Turbine itself will be shut down by respective shutting down of the guide vanes.

Connection to Public Grid

According to equipment manufacturer the voltage will be 6.3 kV. The tension of electric grid is defined to be 35 kV.

Albanian specialists offer 3 variants for the type of connection from the SHP Plant to the Permet substation of TSO/AEC (Transmitting System Operator / Albanian Electro energetic Corporation).

1st Variant: All electrical lines coming from other SHP Plant upstream Lengarica will be connected with the electrical substation of the latest one. From there the power will be transmitted to Permeti substation through a unique 35 kV line.

2nd Variant: Electrical lines from Lengarica SHP Plant and from other SHP Plant projects upstream of the Lengarica SHP Plant will use the same poles but having individual transmission lines.

3d Variant: Connection will be carried out at the 110 kV level.

The opinion of the project team represented by "Enso Hydro" GmbH, is supporting the 1st variant and using of a unique 35 kV transmitting line from Lengarica SHP Plant. The line losses for this variant are calculated at 2.5% for a cross section of 95 mm² of high voltage line.

The 1st variant offers several advantages:

- Expenses for the energy transformer and distribution center would be shared with other concessionaires of SHP Plants upstream.
- Cost of the 6 km electrical line from Lengarica SHP Plant to Permet substation would be shared with other concessionaires of SHP Plants upstream the river and unitary cost will be lower than that of installation of two individual systems.

Applying this solution the investor will have the chance to sell the energy at exit point of Lengarica SHP Plant. That would avoid energy losses from Lengarica SHPP to Permet substation.

The project at its final version defines an 35 kV electrical line having a length of 6 km from the substation up to the Permet electrical substation of TSO/AEC.

The construction of the transmission line needs 38 metallic poles of 4 different types relevant to the terrain. In the major part of its length the line goes through a hilly zone partially free of high forest vegetation. In the vicinity of Permet electrical substation it will pass through some small agricultural land parcels far from road and not in inhabited zones. According to an approximate calculation results that for the placing of metallic poles is necessary to procure a surface of land of 283 m². In it will be installed 95 to 100 tons of metallic profiles and about 150 m³ of concrete.

Map: Zone of electric line from Lengarica SHP Plant to Permet substation

Figure 4-25 Power line from HPP Lengarica to station Permet

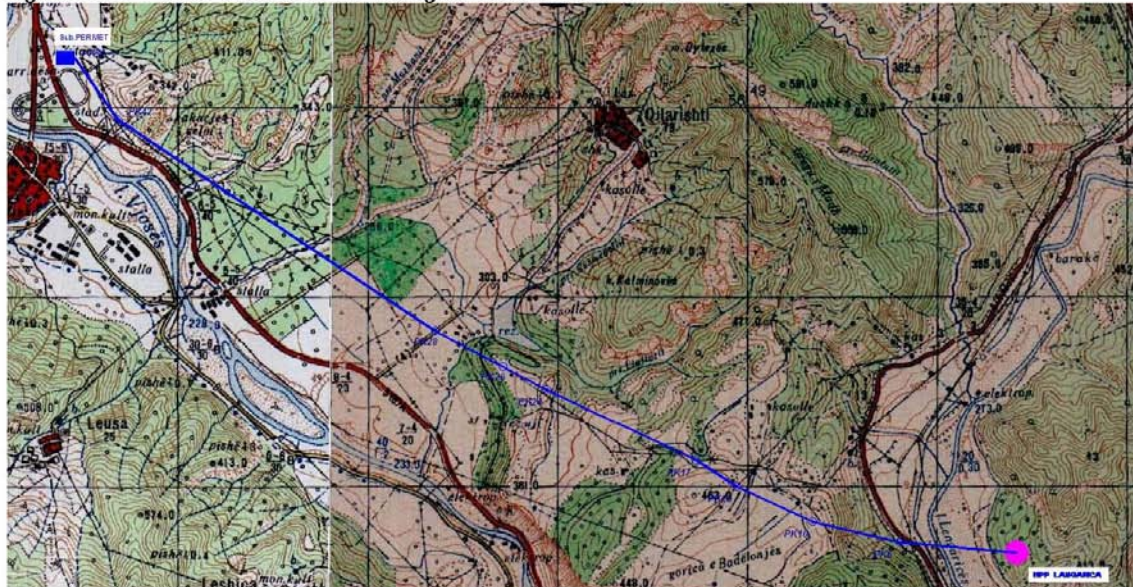
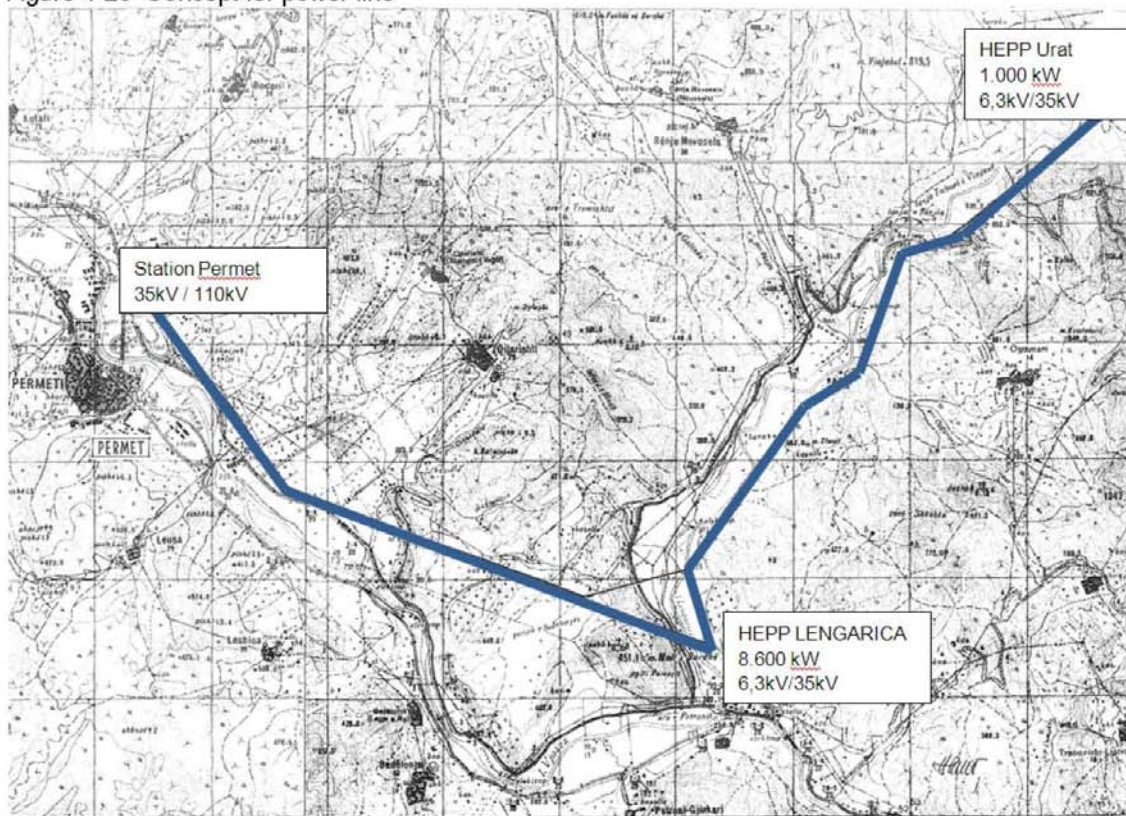


Figure 4-26 Concept for power line



Project Alternatives

The first alternative is that considering the 4000 m long tunnel and 3670 m long siphon.

The second alternative considers 3400 m long tunnel and 4300 m long siphon.

The other compounds of the project (intake, desander tunnel entrance, pressure basin and power house) do not differ in their engineering details.

As mentioned before, the original project aiming to use the hydro river potential, is the construction of SHPP Lengarica-1 and Lengarica-2 on the project area. The recent new studies demonstrated the economic convenience of constructing only one SHP Plant.

After the respective decision that was followed by amendment of the concession contract and by a new agreement, restarted topographical, geological and hydro geological studies of the zone under consideration. From this moment, the studies are focused to the two before mentioned alternatives.

Expert discussions were focused mainly to tunnel study. This works needs important geological-mineral works. The second alternative defines the tunnel length to 3400 m, i.e. saves 600 m. The tunnel entrance is the same with that of the first alternative of the tunnel. Meanwhile tunnel exit is situated in the same elevation but positioned closer to Thermal Waters. The tunnel trace is approaching to zone of Benja Canyon. In this case, the relief of the area where the tunnel route is geologically more accidental and karst phenomena are also more expressed. The geology experts aiming to avoid geological risk have putted in the balance construction expenses vis a vis the saving benefit do to shorter tunnel.

The main reason for not choosing the second option namely the tunnel, we would like to be avoidance of geological-mining interference to the complex of natural and historical monuments Canyon of Benja, Thermal Water, Caves and Kadiut Bridge.

Table- Tunnel data according to alternatives

Main project data	1st Alternative (Original Version)	2nd Alternative
Intake elevation	410 m	410 m
Tunnel length	4000 m	3400 m
Length of main channel (siphon)	3670 m	4300
Gross head	152 m	152 m
Penstock	600 m	572 m
Power house elevation	258 m	258 m
Tailrace channel	256 m	256 m

The definition of tunnel position conditions siphon length, position of its connection to tunnel exit and its positioning in the project area close to Thermal Waters. Original

project defines longer distance of tunnel extension at southern part of Thermal Waters. Siphon pipeline steps down Thermal Waters and further goes along riverbed.

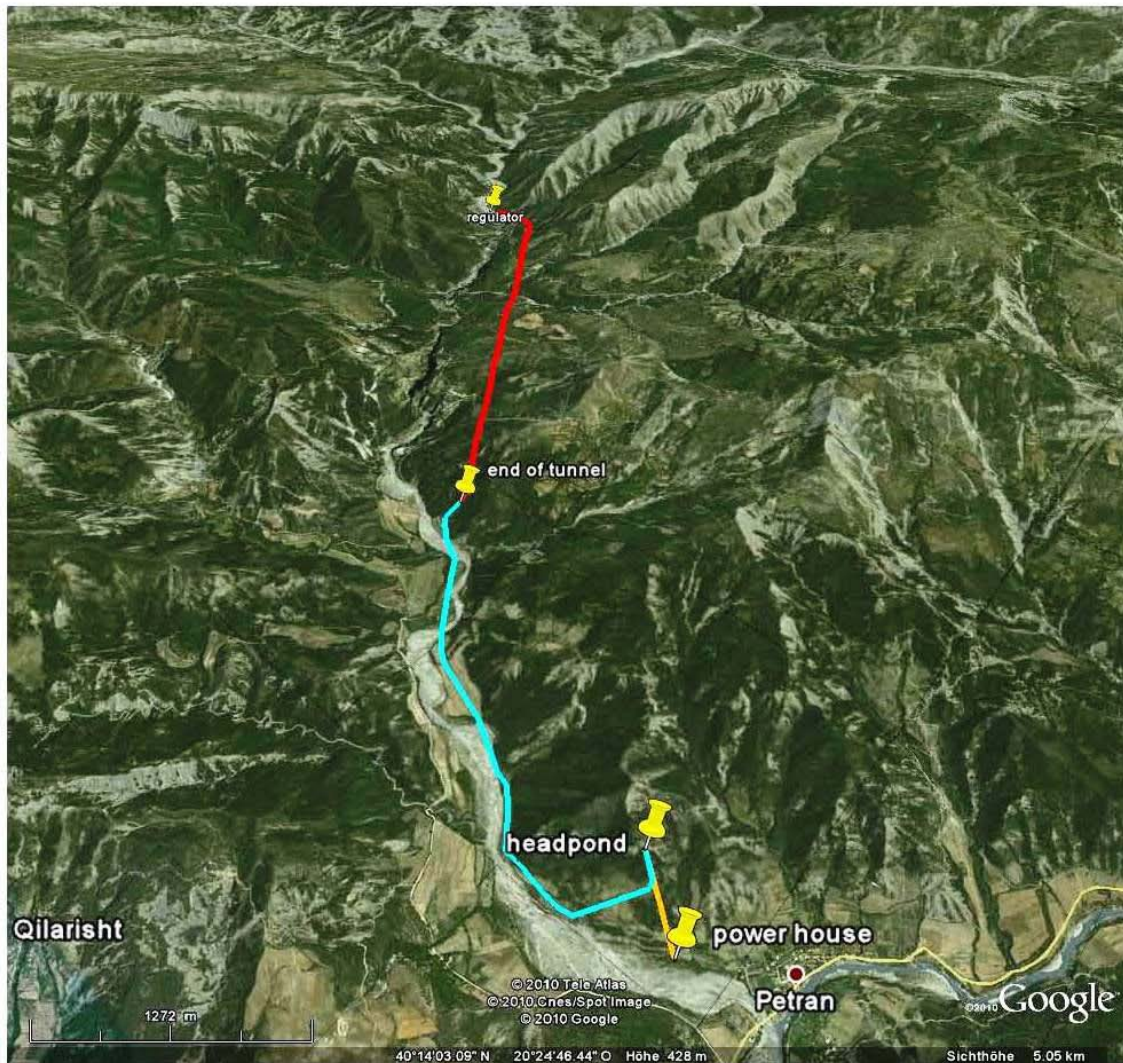
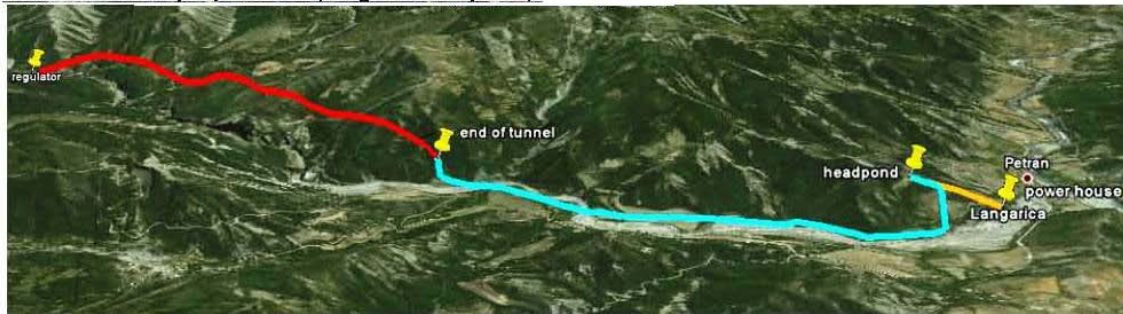
The following are the advantages of choosing the first alternative (original project):

- Tunnel in its longer part goes through stable rock zone minimizing its damage risk during operation.
- Tunnel is going considerably far from the sensitive geological area close to the canyon.
- Gate of exit tunnel results to be in the southern site of the hill over thermal waters avoiding the intervention at landscape of the area where are located Kadiu Bridge (historical monument), Benja Canyon Entrance (natural monument), Pigeon's Cave (natural monument) and all adjacent recreative area.
- Compared to cascade version of the project the pipeline of siphon channel does not cause damages to agricultural lands. It goes in the riverbed quite close surge basin and power house. This solution avoids expected effects of the erosion in the case of horizontal channel at hills slopes of the left side of river flow.
- In this solution version the original project is integrated softly to the recreative area of Thermal Waters and natural monuments having the best possible economical and environmental impact.

In order to have a clear idea on the positions of tunnel and siphon of both alternatives of Lengarica SHPP project hereinafter we present the respective satellite views.

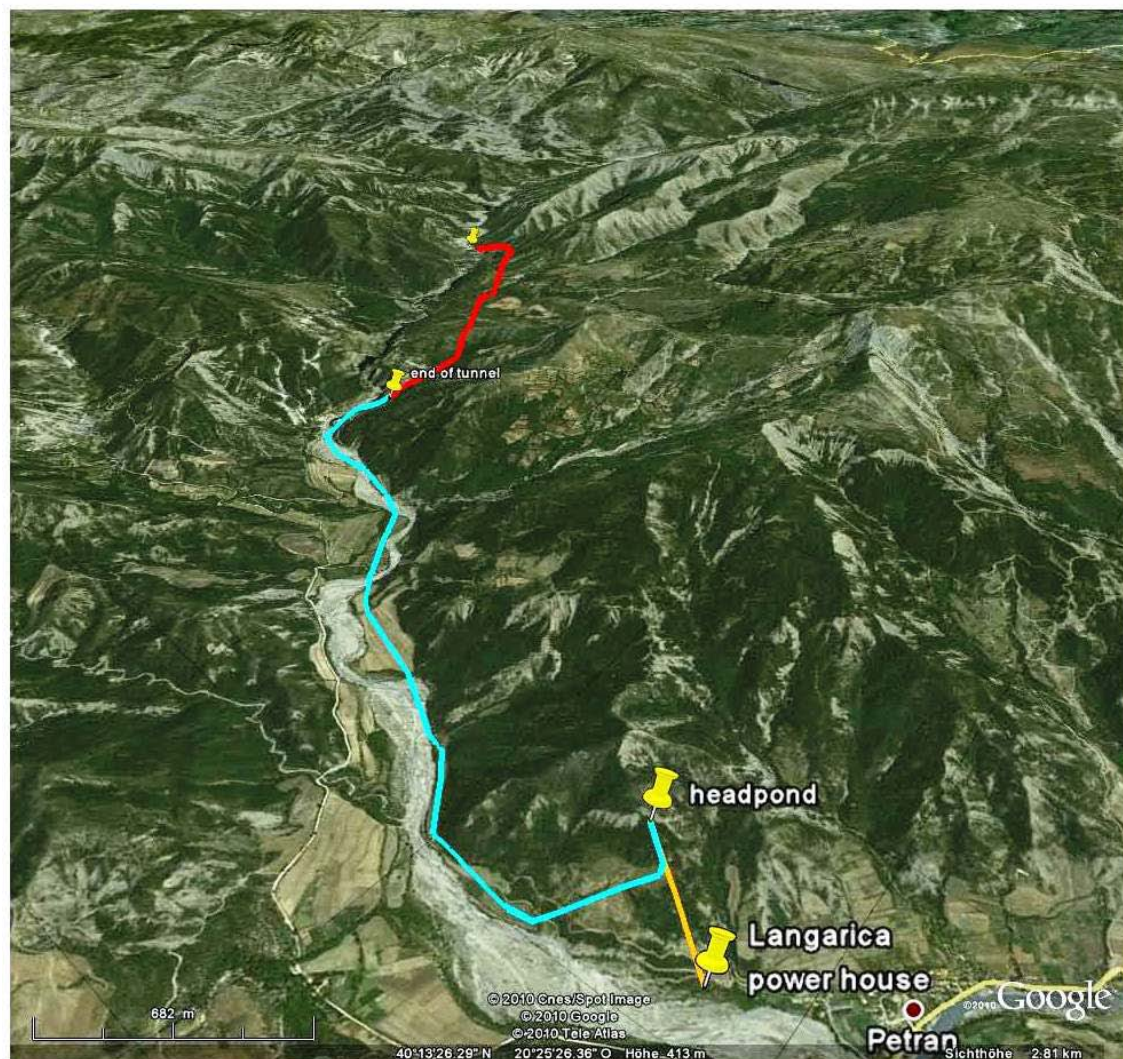
First alternative (original version):

3D overview of project area (long tunnel option)



Second alternative:

Figure 2-5 3D overview of project area (short tunnel option)



Project Implementation Plan

The technical project design is in its last steps. The investors group and the consultants foresee to start the implementation of the project design in the spring of 2011. The works are foreseen to last 34 months and Lengarica SHPP shall start operation in 2014.

Hereinafter is presented a table of successive actions for the constructions of SHP Plant. Although project implementation plan will be revised and precisely defined after revision of all the engineering project details, after getting all the permissions, after preparation of tender documents and contracts and after financial closing.

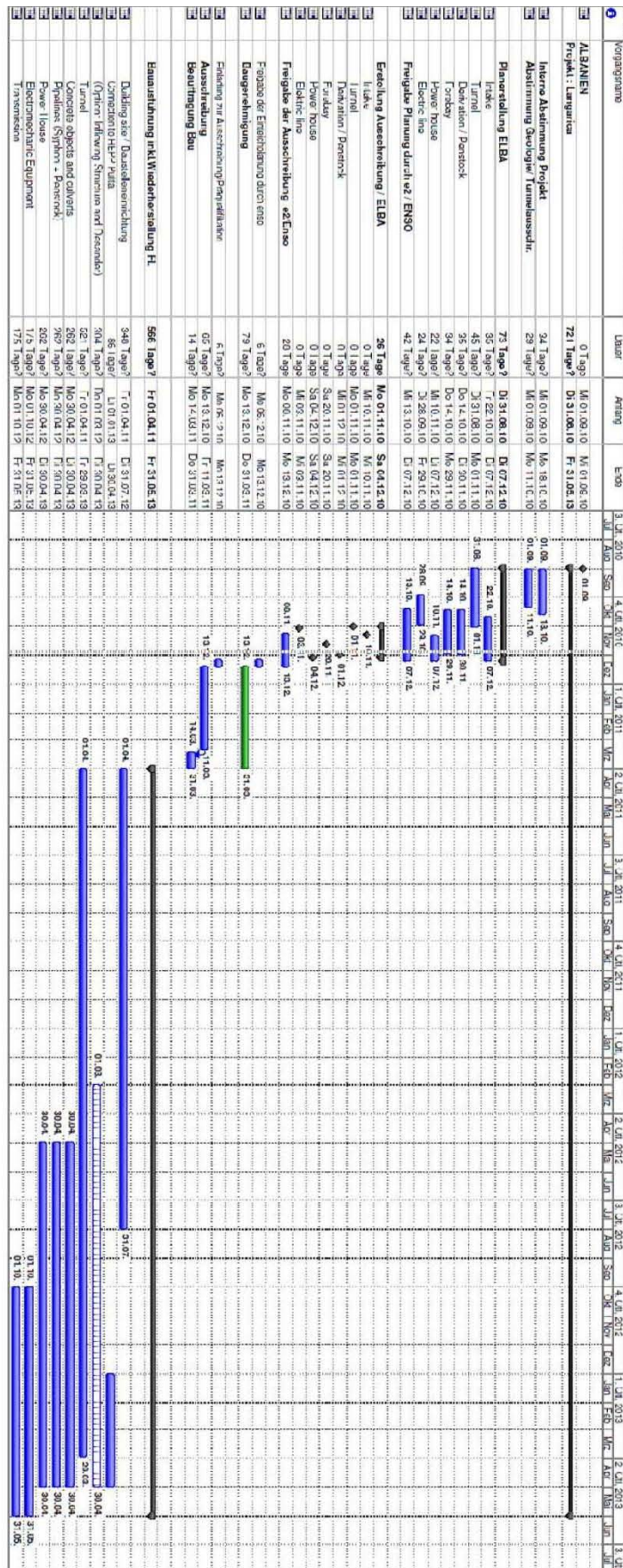
The final table will define special project activities, responsibilities and obligations of different contractors and the supervision of the project.

The works for SHPP construction are planned to be carried out through competent contractors according separate/individual contracts for the following works:

- Lot 1: Construction works for intake and desander.
- Lot 2: Technical details designing/projecting, tendering and construction of tunnel and its connection to penstock.
- Lot 3: Works for the construction of power house, supports and penstock anchors and for the construction of access roads to project components.
- Lot 4: Ordering, production and their delivery in the site as well as the assembling of penstock, turbines and discharge collector.
- Lot 5: Ordering, production and their delivery in the site as well as the assembling of Electro Mechanical equipment.
- Lot 6: Construction of energy transmitting line to Permet electric sub-station.

Economical and financial estimation of the project presents the following time development of the investment:

- Year 2010: 5 % of investment costs (further project development, design, tender, getting permissions),
- “ 2011: 30 % of investment costs
- “ 2012: 50 % of investment costs
- “ 2013: 15 % of investment costs

[illegible]

Economical estimation

The forecast and results of economical estimates are not given in this report. In the future, they may be subject to changes, probably due to changes in the implementation of the project, or due to financing conditions and price adjustments.

For the purpose of such estimation, economical internal rate of return (IRR) is defined as the interest rate by which the actual value of monetary entrances is equal with the actual value of monetary means. Future net benefits of the project must be sufficient to cover initial investment expenses. IRR is defined as discount rate by which NPV is equal to zero. IRR represents project profit and shows the discount rate the projects to be profitable (under the conditions of a positive NPV).

4.3. - Status of the project area (geological survey analysis, improvement of existing roads, tunnel excavation and construction, etc.)

Lengarica SHPP will be built at the lower part of Lengarica river flow in Permet district. It is positioned in a hilly and mountainous relief, at Benja Canyon zone. The said area, where will be developed engineering projects which have been already studied from a geological aspect.

There were previous geological studies for this project. Other advanced studies (using new geophysical methods on the determination of geological formations, structure and stability of the areas where are located the tracks of different works of SHP Plant) were carried out. Moreover, geologists consider it necessary monitoring of works especially for the opening of the tunnel and the construction of other hydro-technical works.

Lengarica SHPP region is part of Tomorr Tectonic Sub-zone (part of Kruja zone). Tomorr-Çorovode-Melesin is the mountainous anticline structural chain, representing the most western chain of Kruja Zone, that gradually passes to the Jonian Zone.

The SE side of anticline is clearly evident in Lengarica SHPP project area, close to the weir having descending azimuth of 70° and an angle of about 20°. Transforming strip and thin clay-aleurolith-sand layer are over Eocene limestone. The SE fall of limestone and transforming strip are also evident at the SW part of the carbonate fall at the right river side.

In the NE of the Vjosa river are located two important tectonic lines that also are parallel with Vjosa river. They are treated as super positioned plans that seem to have had their impact in the raising of carbonate structures. These have to be considered prudently during preparation of engineering project/design.

Prof. Kodra does not see any important tectonic fractures at NE side of project area close to weir/dam. There are quite vertical tectonic fractures at carbonic nucleus

zone and at sedimentary deposit layer that develop a blocking model. Anyway they are not too significant to create problems for tunnel excavations. The zone is seismically stable. Lengarica SHPP region as entire Petran municipality, based on the map of Seismic Regionalization of Republic of Albania, is characterized by seismic shakings of scale 7 Richter.

Geological construction of the zone where are positioned the components of the Lengarica SHP Plant is characterized by the presence of flysch rocks (clay-aleurolite and sandy) as well as of carbonate rocks (limestone).

From the geomorphologic aspect the zone where the works will be located does not present negative problems like slides, karsts, etc. In our study zone are encountered negative phenomena caused by the activities of some mountainous streams that cross the channel of entrance to the tunnel and the siphon.

We underline this problem is present only in short segments. We recommend the project/design to undertake protection engineering measures on these segments.

From hydro geological considerations the zone is characterized by the presence of underground waters that result in source form with low debit of 0.1-0.3 lit/sec at the low levels of the valley and away from works zone. We underline that thermal waters do not have any negative impact on hydro technical works of the object under our study.

The experts estimate there are not important geological risks that would have impacts on the project: The geological and seismic risks have been considered in the technical measurements and engineering calculations in order to protect construction structures. High risks, especially in the tunnel construction, are reflected in the expenses of its construction.

Geo-engineering description of the works

The project study team defined the positions where the new hydro technical works of SHPP will be built. Hereinafter follows the description of these.

Intake

The intake will be placed at Lengarica river bed, over alluvial deposits of Quaternary. These deposits, being in the middle part of Lengarica river flow, are represented by lithologic content very heterogenic where are encountered small and middle up to boulder-block fractions (having dimensions going up to 2 x 1 x 1m) and the filling material is gravel, sand and a little dust.

The first layer is represented by vegetation ground deposits composed by sub-clays with vegetation and tree roots. The material is presented wet and in plastic situation. As a filling material are terrace gravels found.

The second layer is represented by alluvial river deposits and is composed by middle to big size grains of gravel of carbonate and sandy composition.

The gravel is mainly of semi-round shape and its filling material is mainly gravel, sand and sub-sands. The material is presented water saturated and in average compressed. The thickness of this layer goes in the limits of 5.5 - 7.0 m.

The third layer represents the basic aired formation composed by flysch rocks. In order to define the thickness of gravel deposits a longitudinal section of Lengarica flow river at the area of the intake has been prepared.

To complete the works carried out at the intake were realized research-discovery works that should certify the precise thickness of gravel deposits. During these works along the central line of the intake, consisting of three sounding-pits realized by excavators, was verified a very heterogenic lithologic construction starting with blocks, boulders and gravel. The filling material is represented by sand and some sub-sand and dust. Due to the effected works the basic flysch formation was contacted in the depth of 6.30 m from natural ground surface.

Channel trace before the tunnel

From the 20 m long intake the trace goes across still zones without geo-engineering problems over the deposits of river terrace composed from brown and brown to beige color middle sub-clays. Material is presented with average moisture, plastic and in average compressed. The filling material is made out from gravel deposits mainly of carbonate-flysch. The percentage of filling material varies in great extent, from 35.0 % up to 50 %. The thickness of this layer is going from 5.5 to 6.5 m.

Under these deposits are positioned the highly aired deposits of basic flysch formation and with an intensive system of fractures, which ones here and there turn to be alluvial deposits consisting of flysch and carbonate deposits with crushed stones and sub-clays as filling material. The thickness of these deposits varies between 1.5 and 4.0 m.

From Pick.1 (picket no 1) to pick.3, will be constructed a discharger of overflows, serving as a channel and having a length of about 25 m. This track will be positioned over alluvial deposits consisting from basic (destroyed) flysch formation. Thickness if this layer varies between 2.0 and 3.0 m.

Under these deposits is situated basic aired flysch formation. From picket 3 to picket 10, having a length of about 70 m, will be located the desander. The said desander will be settled over the deposits of gravel terrace having a thickness of 4.0 ÷ 5.0 m. Under these deposits is situated the basic formation.

From picket 10 to picket 13, for a length of about 30 m, the channel track –through a bridge channel or siphon- cross a still zone without geo-engineering problems over deposits of basic aired formation.

From picket 13 to picket 23+5 ml, for a length of about 105 m, the channel track – through a bridge channel or siphon- cross a still zone without geo-engineering problems over deposits of gravel terrace, with a thickness of about 4.0 m to 5.0 m.

From picket 23+5 ml up to picket Pk.26+4 ml for a length of about 29 m, the channel track –through a bridge channel or siphon- cross a zone which relief is broken from

the aggressive activity of a mountainous stream, which deposits have a thickness from about 3.0 up to 4.0 m. Under these deposits is situated the basic formation.

From picket 26+4 ml to picket 29+4 ml, for a length of about 30 m, the channel track –through a bridge channel or siphon - cross a still zone without geo-engineering problems over deposits of flysch type. At picket 29+4 ml starts tunnel entrance.

Tunnel

Tunnel is also part of the study on Lengarica SHPP. The tunnel has a length of about 4.0 km. During recognition was defined even its track.

In order to realize geological study were defined even field works that would consist of:

- 1) Geological survey.
- 2) Geological-geophysical works.

1) Geological survey

As base of the study was geological map of the region in the scale 1:25000. After the definition of tunnel track on the map, during geological survey were defined natural exposures, contact of different formations that form the said zone, as well as surface works (excavations and pits) that were used to get samples with un-destroyed structure in order to define of physical-mechanical parameters of the rocks where the tunnel will pass.

During the recognition, in cooperation with geo-physical team, were defined the positions where field geo-physical works should be carried out.

Along the track should be carried out geo-physical studies using two methods (Tomography “TER” and electric vertical drillings “S.E.V.”)

Geo-physical methods would separate flysch from the limestone due to different specific electric resistance of the rocks.

2) Geological – geophysical works

During field works were carried out 8 “Electric Vertical Drillings”(SEV) as well as two “Tomography” (TER). To define physical-mechanical parameters of the rocks where will pass the track of the tunnel some samples were taken. For these parameters are carried out laboratory analyses.

Siphon

From the tunnel, water through siphon, goes from surge basin with a length of 3700 m. Siphon from tunnel exit to the progressive position 160 ml, goes over flysch deposits with aeration from 5.0 ÷ 8.0 m. Then, from the progressive 160 ml up to progressive 520 m (360 m long), siphon cross over gravel terrace deposits represented by the mixture of sub-clays with gravel.

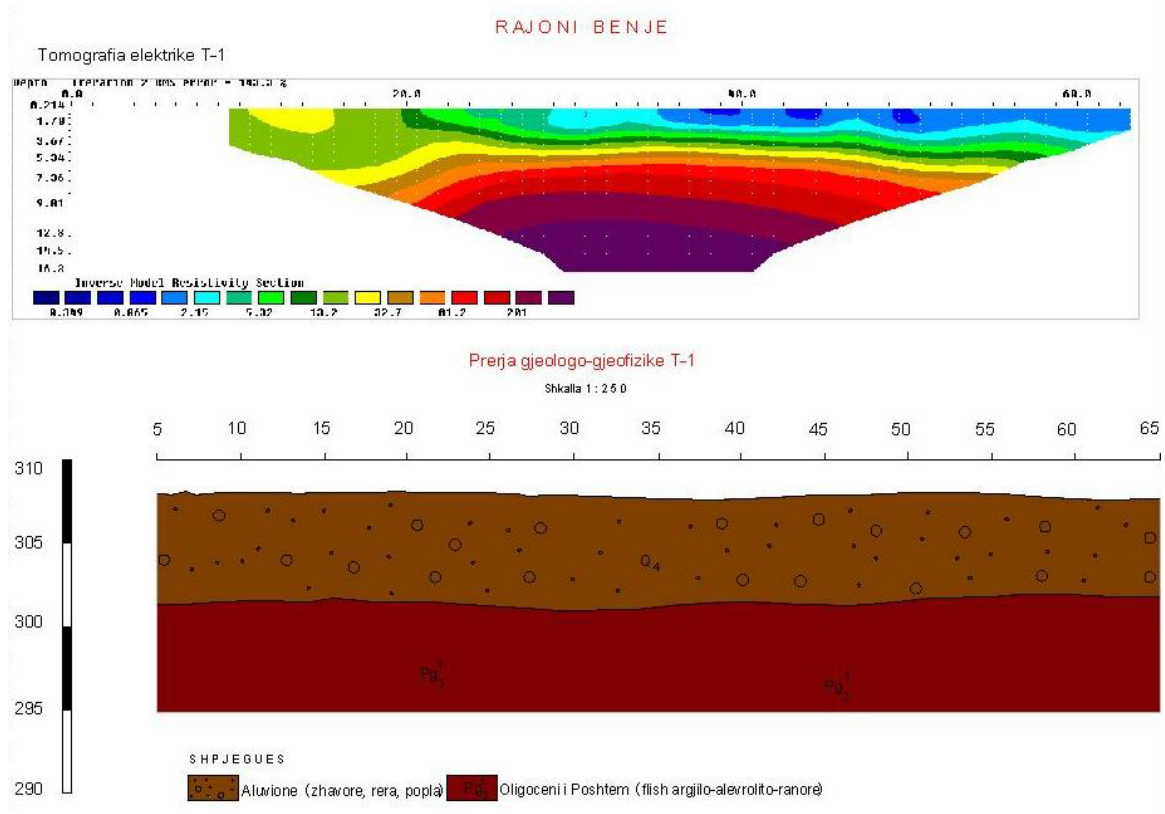
In the interval between progressive 520 ml up to progressive 536 ml (16 ml long) the siphon is interrupted by a mountainous stream that have to be taken into consideration by the projecting team.

From progressive 536 ml up to progressive 1106 ml (570 ml long) siphon cross over

gravel terrace deposits represented by the mixture of sub-clays with gravel.

From progressive 1106 ml up to progressive 1123 ml (17 ml long) is verified by the project/design team.

From progressive 1123 ml up to progressive 1823 ml (700 ml long) siphon goes on deposits of gravel terrace represented by mix of suckles with gravel.



From progressive 1823 ml up to progressive 2193 ml (370 ml long) siphon goes along Lengarica river bed on alluvial deposits represented by mix of gravel with some sand and sub-sand fillings.

From progressive 2193 ml up to progressive 3220 ml (1027 ml long) siphon goes on gravel terrace deposits represented by mix of suckle with gravel.

From progressive 3220 ml up to progressive 3675 ml (455 ml long) i.e. end of siphon (surge basin) siphon goes on flysch deposits having a deluvial – alluvial cover of thickness of 0.2 – 0.9 m.

Forebay basin

Forebay basin is located in a still zone over deposits of basic flysch formation with aeration 4.0 up to 6.0 m. A vegetation cover of thickness of 0.3 ÷ 0.5 m is settled over the basic formation.

Penstock

Penstock shall deliver Lengarica river waters from forebay basin to the power house (turbines). Its length amounts to about 600 m. The pipeline shall lay down on deposits of basic flysch formations at a stable zone. Aerated thickness goes from 4 to 6.0 m. There is a vegetation cover of 0.3 to 0.8 m over the said deposits.

A part of penstock goes over Lengarica river terrace gravel deposits. The said segment does not resent geo-engineering problems.

Power house

Lengarica SHPP power house will be situated in a stable area over deposits of gravel terrace having the thickness 12÷13 m. Over these deposits is placed a vegetation cover of the thickness 0.3 up to 0.8 m.

Access roads

In the project area there are roads of third category that go close to weir and desander and seems to be necessary to improve them or/and build alternative roads for tunnel excavations, laying of penstock and for other construction works.

4.4. - Hydrological analysis

Lengarica HP Plant is located in Gjirokastrë Prefecture, Petran municipality of Permet. Lengarica's river waters and those of streams that flow into it will be supply source for the HPP.

Hydro geological Map of the Region



Lengarica river from the source up to its flow into Vjosa river has a total length of $L=36.8$ km and catching area surface of 337.1 km^2 . It has an elevation of 987.6 m a.s.l. or has a height of 250 m more than Albanian average hydrological territory elevation that demonstrates its mountainous character. Slope inclination is $I_p = 260 \%$, meanwhile river inclination has the value $I_L=35 \%$.

At gauging station of Kadiu Bridge, Lengarica river has a length of $L=31.3$ km and a catching area surface of 295.0 km^2 , meanwhile the average height is $A_m=1040 \text{ m a.s.l.}$

Catchment area surface at the elevation of 410 m corresponding to the intake is 270.6 km^2 .

The waters are not aggressive towards steel and concrete. Based on the geological construction and on the recognitions carried out in the said zone is proved that water sources are scarce and these sources have their eruptions in the contact zones between flysches and carbonate rocks.

There are a lot of studies related to the sources, hydrology and water ecosystem of the zone under study. We consider to be of interest to mention the studies carried out by river from the source up to its flow into Vjosa river has a total length of $L=36.8$ km and catching area surface of 337.1 km^2 . It has an elevation of 987.6 m a.s.l. or has a height of 250 m more than Albanian average hydrological territory elevation that demonstrates its mountainous character. Slope inclination is $I_p = 260 \%$, meanwhile river inclination has the value $I_L=35 \%$.

Hydrology Department of Albanian Geological Service, the other one carried out by KESH sh.a. – Albanian Power Corporation as well as the recent studies carried out by “Enso hydro GmbH” and its projecting team.

Hereinafter the main references:

- Prof. Dr. Alaudin Kodra: “Study on geo-engineering conditions of Lengarica SHPP Zone”, Tirana 2008,
- Geo-Dhame Group: “Hydro-energetic exploitation of the lower part of Lengarica river”, June 2006
- Prof. Dr. Molnar Kolaneci: “Hydrological study on Lengarica river” Tirana December 2008.
- Geo-Dhame Group: “Geo-engineering Consideration of Lengarica SHPP”, Tirana 2006.
- Prof. Dr. Myzafer Kazazi: “Lengarica stream water flow”, May 2005.
- Dr.Molnar Kolanecit: “Data on river flow, precipitations, discharging zone, etc.” August 2009.

At Benja zone at the place named Kadiu Bridge, we encounter Thermal Waters. These sources have a special importance for the economic development of the zone. Generally speaking, thermal waters are very complex water natural formations and are considered by the local population to have numerous therapeutic effects. In Albania they are encountered at fractures of flysch deposits with carbonic rocks. They studied and classified according to geological zones.

Hereinafter we present Albanian catalogue of thermal waters where are included Benja's data. Their flows amounting to 160 lit/sec are a very important hydrological data that is considered from the project team.

ALBANIAN CATALOGUE OF THERMAL WATERS

No.	Source name and geological region		Coordinates		Debit l/sec	Temp in °C
			V	L		
1	Peshkopi	Korabi	41°42'10"	20°27'15"	14	43.5
2	Mamurras 1 and 2	UPA	41°35'24"	19°42'48"	11.7	21-22
3	Shupal	Z. Kruja	41°26'9"	19°55'24"	<10	29.5
4	Llixha Elbasan	Z. Kruja	41°02'	20°04'20"	15	60
5	Hydrat, Elbasan	Z. Kruja	41°1'20"	20°05'15"	18	55
6	Përroi i Holtës, Gramsh	Z. Kruja	40°55'30"	20°09'24"	>10	24
7	Kapaj, Mallakastër	Kruja	40°32'34"	19°48'42"	12	16.9-17.9
8	Postenan, Leskovik	Mirdita	40°10'24"	20°33'36"		Steam source
9	Vromoneri, Sarandaporo, Leskovik	Mirdita	40°5'54"	20°40'18"	>10	26.7
10	Ura e Kadiut-Lengaricë, Përmet	Mirdita	40°14'36"	20°26'	>160	30
11	Selenicë, Vlorë	Jonian Zone	40°32'18"	19°39'30"	<10	35.3
12	Finiq, Sarandë	Jonian Zone	39°52'54"	20°03'	<10	34

Benja or Thermal Waters (or *Llixhat*) are traditionally used for curative purposes. During the period 1964-1975 they have been organized by the then government for the public use. In practice, they are frequented during the summer time only, by Permet locals and tourists from other Albanian towns and even this is not organized. Thermal waters are special due to the fact that 4 of them (out of 6 in total) are sources with different physical-chemical qualities.

The sources of Benja Waters are named by their curative values:

- 1) Bishop's Sources
- 2) Source of stomach sickness
- 3) Source of Skeen sickness
- 4) Source of rheumatic sickness

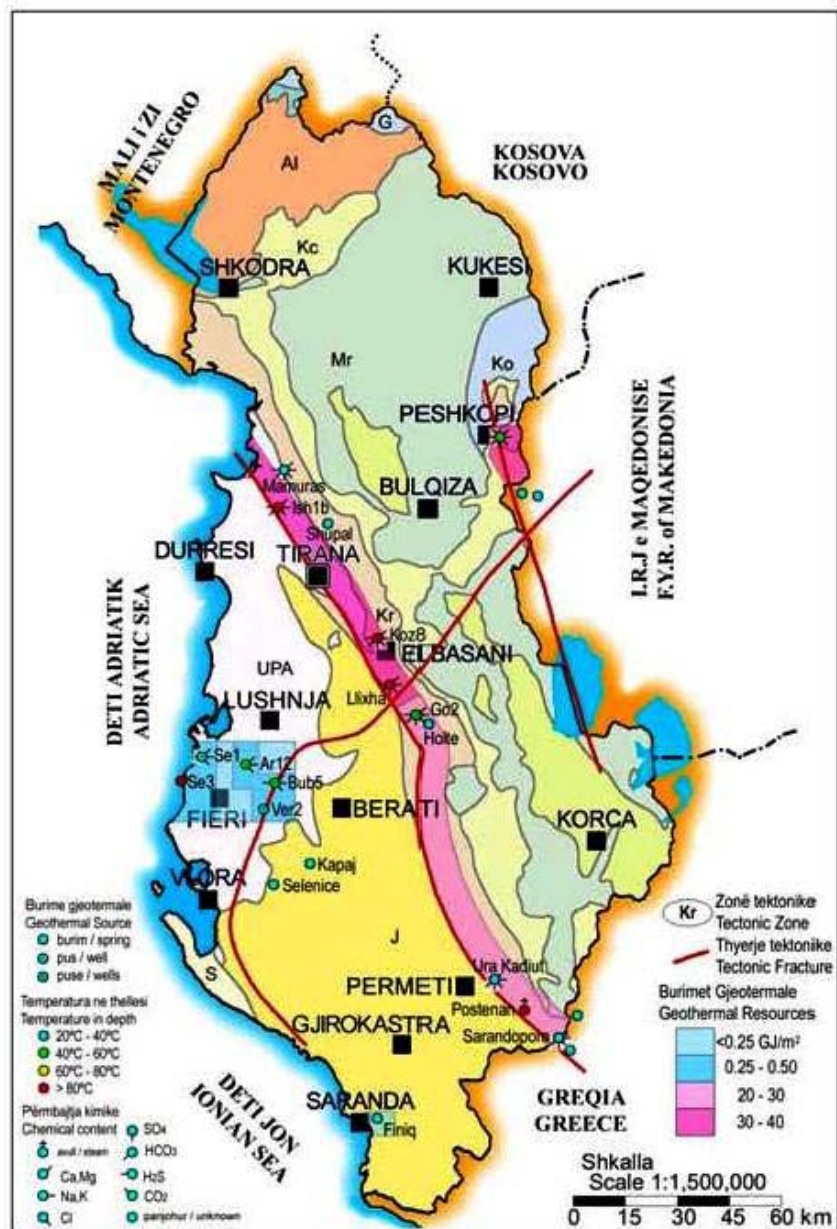
Their qualities according to the samples that were taken in the 4 above mentioned sources are presented hereinafter:

Table- Physical-chemical parameters of Benja's Thermal Waters at Lengarica river

Sample no.	1	2	3	4
Parameter				
conductivity (µS/cm)	2970	2740	2750	1894
pH	7.3 (21 °C)	7.4 (19.9 °C)	7.64 (18.8 °C)	7.35 (19.3 °C)
Temperature (spring)	29 °C	29 °C	29 °C	24 °C
Salinity (mg/L)	1.4	1.3	1.4	0.8

Author: Selfo ORUÇI - Department of Biology, FNS, University of Gjirokastra, Albania

Edition: BALWOIS 2010 - Ohrid, Republic of Macedonia - 25, 29 May 2010



Harta tematike gjeotermale
Geothermal Thematic Map

Hydrological measurements at Kadiu Bridge

Average river flow water at Kadiu Bridge results to be 4.90 m³/s. Here are taken into consideration the calculation of project team during the study of hydrological reports, the trend of water flow in defined years and meteorological phenomena caused by climatic changes.

Water flow at the weir is calculated considering natural water minus ecological flow of 100 l/s (ecological flow equal to 20% of the flow during the driest summer ~ Q95).

Average river flow water: Kadiu Bridge (Kadiu bridge):	4, 90 m ³ /sec.
Dam, natural flow:	4.74 m ³ /sec.
minus ecological flow:	4.64 m ³ /sec.

Flow by flood water (by calculations) in: 100 years	202 m ³ /sec.
1000 years	261 m ³ /sec.

Minimal flow (by calculations) in: 25 years	0.36 m ³ /sec.
50 years	0.33 m ³ /sec.
100 years	0.32 m ³ /sec.

Standard deviation of water flow may be calculated at 13.92 %.

Apart from measures of water flow, the project study team measured the conductivity and river water temperature. The conductivity has the increasing trend going downstream the canyon.

Water sample close to Kadiu bridge:	Electric conductivity 618 µS/cm
	Temperature 20.8 °C

Water sample at the weir:	Electric conductivity 377 µS/cm
	Temperature 29.2 °C

Water sample of one of the sources:	Electric conductivity 2002 µS/cm
	Temperature 24.9 °C.

Average monthly flow

The following table is prepared based on monthly measurements of water flow at Kadiu bridge gauging station during the years 1977-1991.

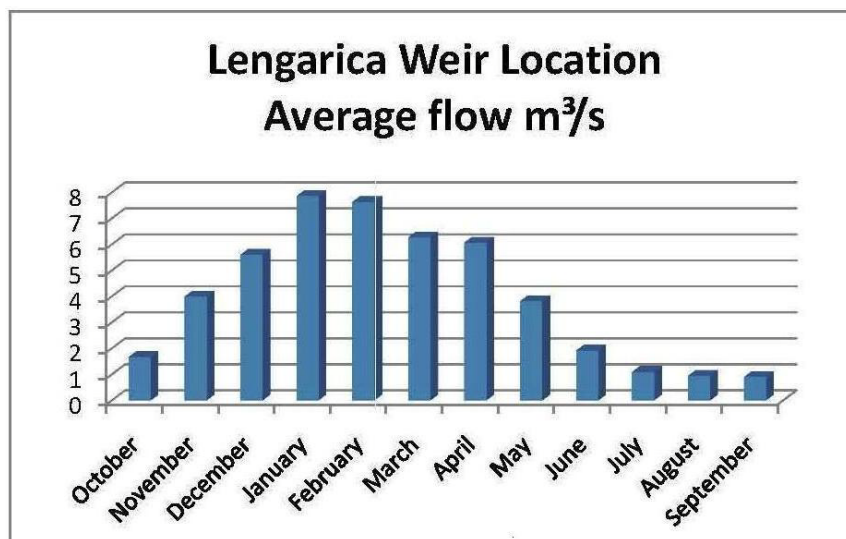
Table Average monthly Flow

Average monthly river flow: (correlation of data 1977 - 1992)

Location of weir - HEPP Lengarica, at the beginning of the canyon:

Month	Average flow in m ³ /s
January	7,86
February	7,64
March	6,28
April	6,07
May	3,82
June	1,92
July	1,10
August	0,95
September	0,90
Oktober	1,67
November	4,00
December	5,61

Figure Average monthly Flow



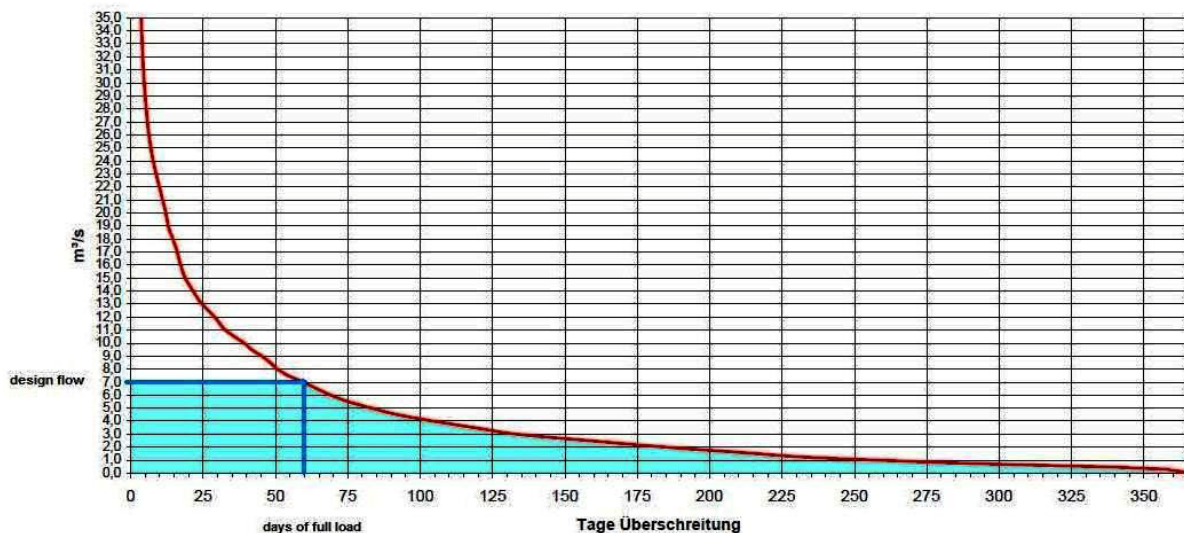
Projecting of optimal flow to be used and annual production

The defining/projecting of useful flow is based in measurements and hydrological calculations and after that are defined technical and economical parameters of the SHPP works and of electromechanical equipments on which ones was written above.

The parameters resulting by the calculation considering hydraulic losses and water flow left in the river bed are the following:

- Designed/projected water flow $7.15 \text{ m}^3/\text{s}$.
- Gross head (with hydraulic losses) intake – turbine 152 m.
- Gross head (without hydraulic losses) intake – turbine 142 m (height loss about 10 m).
- Optimal diameter of turbines pipe $D_{\text{opt}} = 2100 \text{ mm}$.
- Quantity of residual water is 200 l/sec .

Figure : Flow duration curve



Graph: duration water flow during the year

Optimal designed flow ($7.15 \text{ m}^3/\text{s}$) shows SHP Plant shall work with its full capacity only 60 days or 16.5% of the year.

In order to better use annual water flow the installation of two “Francis” turbines that will work with respective ratios of about $1/3$ and $2/3$ of the total water flow was suggested. This makes possible to have a higher general efficiency over the entire range of water flow especially in the case of a low water flow. Thus the water flow use is calculated for 3,307 hours/annum (or 137 days) i.e. 37.5% of annual time.

Calculation results are presented in the following tables:

Table Energy production by two turbines

Turbine 1								
Admission	Flow	Head surge tank	Friction pipe	Net head	Efficiency turbine	Efficiency generator	turbine power	generator power
%	m ³ /s	m	m	m	%	%	kW	kW
20%	0,963	142,3	0,18	142,12			0	0
30%	1,445	142,3	0,41	141,89	66,3%	94,7%	1333,5	1262,8
40%	1,927	142,3	0,73	141,57	76,8%	95,8%	2054,9	1968,6
50%	2,408	142,3	1,15	141,15	84,3%	96,3%	2811,3	2707,3
60%	2,890	142,3	1,65	140,65	89,1%	96,4%	3552,9	3425,0
70%	3,372	142,3	2,25	140,05	91,5%	96,4%	4238,6	4086,0
80%	3,853	142,3	2,94	139,36	92,4%	96,5%	4867,7	4697,4
90%	4,335	142,3	3,72	138,59	92,2%	96,5%	5433,8	5243,6
100%	4,817	142,3	4,59	137,71	90,8%	96,5%	5908,5	5701,7
Turbine 2								
Admission	Flow	Head surge tank	Friction pipe	Net head	Efficiency turbine	Efficiency generator	turbine power	generator power
%	m ³ /s	m	m	m	%	%	kW	kW
20%	0,467	142,3	0,18	142,12			0	0
30%	0,700	142,3	0,41	141,89	66,3%	94,7%	646,0	611,7
40%	0,933	142,3	0,73	141,57	76,8%	95,8%	995,5	953,7
50%	1,167	142,3	1,15	141,15	84,3%	96,3%	1361,9	1311,5
60%	1,400	142,3	1,65	140,65	89,1%	96,4%	1721,1	1659,2
70%	1,633	142,3	2,25	140,05	91,5%	96,4%	2053,3	1979,4
80%	1,867	142,3	2,94	139,36	92,4%	96,5%	2358,1	2275,5
90%	2,100	142,3	3,72	138,59	92,2%	96,5%	2632,3	2540,2
100%	2,333	142,3	4,59	137,71	90,8%	96,5%	2862,2	2762,1

Table Average Annual Production (Regular year)

	Exceedance	Available Flow	Turbine Flow	Power	Days	Energy
No	%	m ³ /s	m ³ /s	kW		kWh
1	100,0%	0,029	0,029	0	365,000	0
2	99,9%	0,03	0,03	0	364,630	0
3	99,8%	0,05	0,05	0	364,250	0
4	99,6%	0,1	0,1	0	363,500	0
5	99,2%	0,15	0,15	0	361,940	0
6	98,8%	0,2	0,2	0	360,440	0
7	98,4%	0,25	0,25	0	359,070	0
8	98,1%	0,3	0,3	0	358,000	0
9	96,6%	0,35	0,35	0	352,700	0
10	95,0%	0,4	0,4	0	346,890	0
11	91,7%	0,5	0,5	146	334,650	1.176.565
12	79,5%	0,75	0,75	714	290,050	3.948.154
13	70,6%	1	1	1.135	257,570	2.605.240
14	63,4%	1,25	1,25	1.497	231,530	2.011.909
15	59,4%	1,5	1,5	1.847	216,730	1.821.386
16	54,9%	1,75	1,75	2.196	200,360	1.678.270
17	50,6%	2	2	2.518	184,870	1.426.551
18	43,4%	2,5	2,5	2.978	158,520	1.748.689
19	36,5%	3	3	3.678	133,160	2.239.143
20	32,5%	3,5	3,5	4.379	118,540	1.993.224
21	28,6%	4	4	5.044	104,300	1.664.337
22	25,3%	4,5	4,5	5.569	92,190	1.163.415
23	22,8%	5	5	6.227	83,190	1.313.191
24	20,6%	5,5	5,5	6.918	75,070	1.243.860
25	18,9%	6	6	7.563	69,020	1.069.559
26	17,6%	6,5	6,5	8.109	64,080	839.334
27	16,4%	7	7	8.464	59,770	508.848
28	14,9%	7,5	7	8.464	54,400	0
29	13,9%	8	7	8.464	50,650	0
30	13,2%	8,5	7	8.464	48,090	0
31	12,4%	9	7	8.464	45,220	0
32	11,4%	9,5	7	8.464	41,780	0
33	10,7%	10	7	8.464	39,160	0
54	0,1%	100	7	8.464	0,370	0
SUM						28.451.676

It is important to note that the SHP Plant project foresees to use the lowest water flow up to 0.5 m³/s (or 500 lit/sec). The operating time of HP Plant and of river water is mainly that of the period December – April.

The said parameters of water flow use are important for the water flow left in the river bed for the following reasons:

- Firstly, is important for the survival of water ecosystem in the river segment,
- Secondly, the presence of sufficient residual flow in the river bed might be in

the interest of the population who partakes in the use of the thermal waters and,

- Thirdly, optimal period (December – April) of water flow use does not coincide with irrigation needs of the agriculture during the dry season (summer).

4.5. - Climate conditions

Climate regime

From the aspect of climate, the Lengarica river basin lies in the Southern Mediterranean Para-mountain Climatic and South-Eastern Mediterranean Mountain Zone and is characterized by a cold but not rigid winter. Southeastern Subzone is a mountainous part that receives the smallest part of precipitation in the country. The precipitation varies from $900 \div 1\,200$ mm/annum. The Number of rainy days varies from 100-110 days. In the subzone (Lengarica basin) it is documented a diminution of quantity of precipitations that is reflected in the water flow, too. Snow layers are verified from the first ten days of December and continue until the first ten days of April. Even the snow day's number is lower than in other subzones. During the year there are between $50 \div 60$ snow days, the maximal snow layer thickness varies between 30 and 40 cm. meanwhile in the mountain peaks at boundary line with Greece the snow level climbs to $1.5 \div 2.0$ m.

Temperature regime

The average annual air temperature (up to 1300 m a.s.l.) varies between $7 \div 10$ °C, in higher altitudes even between $3 \div 6$ °C. Average temperature of January is $-1 \div -2$ °C for the lower part of basin and $-3 \div -4$ °C for its higher part. Minimal absolute temperatures usually go to $-10 \div -13$ °C, meanwhile during severe winters the temperature drops down to $-22 \div -26$ °C. The number of lcy days in the upper part of basin is considerably high. The Average temperature of August varies between $16 \div 18$ °C and in the high mountains is going down to $12 \div 14$ °C.

Climate conditions of the zone generally speaking are similar to those of southern mountainous and hilly zone having Mediterranean continental weather with a hot and dry summer and a cold and wet winter. Conditioned by the temperature, geographical positions, precipitations and relief forms in the valley circulate and flow into river streams.

Due to warm winds blowing along the river valley, the climate in the area is generally mild. Canyons presence upstream of the bridge creates protected micro climates with considerable temperatures changes. The average perennial annual temperature is about 15 °C. January is the coldest month of the year with an average temperature of 6 °C. The warmest months are July and August having average temperature of 26 °C.

Precipitation regime

The area is characterized by monsoons that vary during the year, except for July and August. With a height of over 700 m, upstream canyon precipitations take the form of both snow and rain. At the height of 700 m. down to 300 m. a.s.l. precipitation is usually in the form of rain and rarely of hail.

There is a rich hydric regime that coincides and is in line with the purpose of energetic capacity of the SHPP. Average perennial quantity of precipitation in the zone is about 1,250 mm of rain. There is an unequal distribution of precipitation during the different months. December and January are months with more precipitation meanwhile July and August are the opposite. Maximum of registered precipitation during 24 hours is 240 mm. Average annual radiation is about 1,450 kWh/m².

Wind regime

The presence of the valley and geographical position of the zone favor blowing of winds along the valley and sweep both directions creating milieu with cold and warm winds that is reflected in the conditions of flora and fauna. The average wind speed is about 2.5 m/s. Under these conditions the vegetation in the area flourishes for about 8 months.

4.6. - Geomorphology

Hydro technical works that are part of the SHPP are located in the valley and in the hilly zone that lies on the left side of Lengarica river flow.

Its riverhead is close to Kamnik village of Kolonja district where the Shala and Barmash streams are joined. The valley crosses through zones with different lithologic-structural construction and due to this its geomorphology it is quite variable. At its beginning the valley crosses over carbonate (limestone) deposits and from this at its upper part is presented as a narrow and deep valley. It differs considerably at its lower part where encountered terrigen rocks are and is enlarged to a great extent. At its upper part the river flows through a narrow bed under the "siege" of giant limestone blocks going vertically down 80-100 m. on water surface. This rigid nature is maintained in some kilometers of the valley where the width of river rarely exceeds 1.5 ÷ 2.0 m. Here and there the valley is inaccessible because the river goes through underground tunnels and graduations/escalations and numerous caves that are connected to each other through tunnels and galleries. At the canyon exit, at both sides of the valley erupt strong and high debit thermal springs with a temperature of about 30°C. Going down the valley becomes larger and in its right side is distinguished loose gravel earth as well as the first and second level of erosive-accumulative terrace accompanied by a big deposit cone at Petran village.

There are some negative phenomena that are encountered in the valley from geomorphologic aspect; these ones are following:

- a) **Erosion** that in the area of our study is less present and the only at strip zones. Along the channel track erosion phenomena is encountered in small

segments, there where the vegetation is missing. Here and there are gravel-boulder deposits of carbonate and flysch composition, this is verified mainly in the channel trace.

- b) Slides.** They are not so much present and are verified along the pipeline trace. These are mainly slides of vegetative deluvial cover. Their thickness is not more than 1÷1.5 m. Negative slide phenomena are due to the water saturation of vegetal mass and of missing vegetation in these segments.
- c) Streams.** Along channel trace are present mountainous streams that cross the object of our study.
- d) Karst.** The said phenomena are present in our study zone and specifically at Benja zone (thermal waters), any way they are not present along pipeline trace.

4.7. - Ecology and biotic resources (ecosystem)

Introduction to ecosystem's state-of-art

Lengarica is a tributary to the larger Vjosa river system. The Aoos-Vjosa River flows in Greek and Albanian territory. The springs of the Aoos river are located in the Smolek and Agos Mountain in Greece. The main direction of the flow of the Vjosa River system is from SE to the NW.

Following the situation within the Lengarica tributary, the main issues that directly affect the biodiversity, specific habitats and entire ecosystem are:

- Erosion and sedimentation caused by the practice of poor land use, such as deforestation that is due to historical and political reasons that in a cumulative way is subject of the previous system and the current one;
- Water quality problems resulting from agricultural and communal pollution. This is less reflected in the case of Lengarica, but following further situation within in the Vjosa system pollution is rapidly increasing;
- The increased frequency of flooding and the negative impacts of sediment deposition: There are significant sediment movements in the river, but the rate has not changed drastically over time. During the fish sampling carried in August (period of minimum water flow in Lengarica) years 2006 and 2008 it has been identified as an important factor within entire tributary;
- There has been a lot of change occurring in how the land is used, but the net effect on stream discharge and sediment production, is minor. On the other hand this factor has been changing quite a lot in the last 20 years, due to the "new land use practices";

- The most significant factor contributing to flooding and sedimentation is river instability caused by gravel mining that is also present there. This might be considered along with geological special features with a high water flow in winter and minimum flow during the summer time, when several fish and amphibian species are put under increased levels of stress;
- Problems associated with land ownership patterns, population demographics, income sources etc. As far this has been identified as a serious problem in overall country, that affects greatly the forest and arable land surrounding;

Flora and Vegetation

The entire Lengarica system as a part of the larger Vjosa system and represents an area with high biodiversity values, rich habitats, flora and fauna species. The area includes some rare and endangered species. This is the only area in Albania where *Arbutus andrachne* is growing. This area can be considered as a typical zone in terms of floristic connections of Albania with neighbor countries, particularly with Greece. The high biodiversity richness can be explained due to the geographic position and high diversity of altitudes (200 – 2000 m above sea level), micro climate elements, mountains, edaphic factors and to some extent due to the various forms of traditional use of the forest areas and plants.

In some eroded parts of Lengarica the vegetation cover appears to be quite poor, while in the upper zone the main dominant species are the low-growing plants and these areas are use for grazing purposes. The area destination for the construction of Hydropower is mainly dominated by the flat composition of maquis belt that typically hosts shrubbery.

The shrubs can reach the height of 3m. The main characteristic shrubs are: *Pistacia lentiscus*, *P.terebinthus*, *Rosa sempervirens*, *Cercis siliquastrum*, *Rhamnus alaternus*, *Hedera helix*, *Arbutus unedo*, *Phyllirea angustifolia*, *Ph.latifolia*, *Viburnum tinus*, *Lonicera etrusca*, *L.implexa*, *Cistus sp.div.*, *Daphne gnidium*, *Myrtus communis*, *Coronilla emerus* etc.

Among the herbaceous belt are found: *Euphorbia characias*, *Teucrium chamaedrys*, *Stachys officinalis*, *Rubia peregrina*, *Asparagus acutifolius*, *Ruscus aculeatus*, *Asplenium adianthum-nigrum*, *Symphytum tuberosum*, *Dorycnium hirsutum*, *Cerithe major* etc.

In many cases the vegetation of these habitats is represented by a different stage of degradation of the original forest dominated by *Quercus ilex*. The cause is human influence with respect to forest clearing, fires, over grazing, etc.

Considerable area of the altitudes up to 700-800 m above sea level, mainly over the acid soils, with quite well developed stage in the valley of Pagria the Mediterranean macchie (Macchie, Maquis) that represents dense evergreen shrub mixture are present, (about 238 ha). It is believed that macchie represents a local climax, while

in many other cases it is a result of degradation of the Mediterranean evergreen forest. The main species that dominated this area are *Arbutus unedo*, *Erica arborea*, *Pistacia lentiscus*, *Myrtus communis*, *Quercus ilex*, *Phillyrea angustifolia*, *P. latifolia* etc. In the maquis formation are present the other species like *Spartium junceum*, *Cercis siliquastrum*, *Fraxinus ornus*, *Ostrya carpinifolia*, *Cotinus coggygria*. The quite dense structure of maquis is not allowing the growth of the herbaceous flora.

The vegetation of these habitats is represented by the species like *Ruscus aculeatus*, *Asparagus acutifolius*, *Teucrium polium*, *Cistus incanus*, *Cistus salviafolius*, *Bellis perennis*, *Smilax aspera*, *Dactylis glomerata*, *Arum italicum*, *Anemone hortensis*, *Cynodon dactylon*, *Anthoxanthum odoratum*, *Briza maxima*, *Chrysopogon gryllus*, *Poa bulbosa*, *Micromeria juliana*, *Cynosurus echinatus* and shrubs *Paliurus spina-christi*, *Pyrus amygdaliformis*, *Juniperus phoenicea* etc.

Faunistic elements

The forest area of Lengarica and the surrounding zone is characterized by diverse forms of vegetation and habitats. These different habitats are creating interesting habitats for the development of diverse fauna species, including invertebrates and vertebrates. In that way, these elements are vital part of the ecosystem.

Invertebrate species

From the rich world of invertebrate species we can mention the representatives of Class Hexapoda with dominating species of Order Coleoptera (*Coccinella septempunctata* L.).

Diverse forms of flowers feed the representatives of Order Lepidopter and have lead to some species facing quite intensive development stages. There we can mention representatives of Family Satyridae *Melanage galatea* and *Melanage larisa*, or butterflies of Family Pieride *Pieris basica* (cabbage butterfly), *Pieris napi*, *Pieris rape* apo *Pontia daplidice*.

Out from the rare representatives of family Papilionidae can be listed the following species: *Papilio alexanor*, *Iphiclidius podalirius* or *Papilio podalirius* as well *Papilio macaon*; *Chazara briseis* and *Nymphalis antiopa* as representative of many colors group of Family Nymfalidae.

The area is also a shelter for diverse forms of Arthropoda or parasite species like procesionaire. In the wider catchment area including streams, rivers, and forest areas are registered some Mollusca species and in this group can be mention *Helix pomata*, as economically valuable specie, etc.

Fish composition

Based on the fish surveyors (Shumka, 2009; Crivelli & Shumka, 2006) the fish composition of the Lengarica river is as following:

Table 1. Fish composition

Nr.	Fish scientific name	Abundance
1	Alburnoides bipunctatus	+++*
2	Barbus spp.	++
3	Nemachileus barbatulus	+++
4	Pachychilon	++
5	Leuciscus	+
6	Pseudorasbora	+++
7	Anguilla anguilla	+

*+++ common;
++ average abundance;
+ less present

Fishes mentioned above mainly populate the bottom of the river flow, near the river mouth Vjosa up a few hundred meters (approx. 1 km) above the power house.

Vertebrata species

Among the mammals can be mentioned the following species that are present in the area of concern: badgers (*Meles Meles*), wild rabbits (*Lepus europea*), hedgehogs (*Erinaceus councilor*), roe deer (*Capreolus capreolus*), wild boar (*Sus Serofa*)

Among the carnivorous species can be mention: wolfs (*Canis lupus*), foxes (*Vulpes vulpes*), beech marten (*Martes foina*) and weasel (*Mustela nivalis*).

Based on the analyses of collected material, results that two species inhabit the waters of these areas. According to Oruci (2010) *Rana graeca* that occurred in this area is a species that grouping in the mountain tributaries, so it cannot be found in the lowland tributaries. Two amphibian species of the family (Ranidae) particularly (*Rana balcanica* and *Rana graeca*) are common before reaching the thermal springs of Lengarica. Only (*Rana balcanica*) is commonly found only at the thermal waters of springs. This species (*Rana balcanica*) is found even after leaving the thermal springs, as well as in the Vjosa River.

Differences that exist in different parts of the water flow, before the clean water mixes with the thermal ones, account for the differences on the specie numbers. So 2 amphibian species are living in the upper part of the water flow (clean water), in contrary with one species in the thermal waters and the subsequent part of the water flow.

The Common turtle (*Testudo hermani*) and some lizards like: grass-snake (*Pseudopus apodus*), chicken head (*Anguis fragilis*), green lizard (*Lacerta viridis*), common lizard (*Radarcis muralis*), grass lizard (*Podarcis taurica*), and snakes: long arrow (*Coluber caspius*), copperhead with four steeps (*Elaphe quatourlineata*), common copperhead (*Elaphe longissima*), copperhead (*Malpolon monspessulonus*) and viper (*Vipera ammodytes*).

Some of the mentioned species are part of the red list, due to the fact they are facing different levels of threats. In this way we can mention wild boar, roe deer, wolf, heath cock etc.

Birds

A considerable number of birds are populating the forest areas of the wider zone and pastures close to valleys in direction to the Albanian Greek border. Among them are: Mountain partridge (*Alectoris graecus*), Eurasian woodcock (*Scrolopax rusticola*), wild pigeon (*Columbia livia*), turtle (*Streptopelia turtur*), goldfinch (*Carduelis carduelis*), blackbird (*Turdus merula*), wood pecker (*Pica sp.*), cuckoo (*Cuculus canoris*), magpie (*Pica pica*), gay (*Carrulus Glandarins*), cornix (*Cornus corone* cornix), troglodit (*Troglodytes troglodytes*), sparrow (*Passer alosrestica*), robin (*Erithacus rabecula*) and galer (*Galerida cristata*).

Among the night birds of prey are evidenced:

Stretch (*Bubo bubo*), atus (*Atus scops*), barn owl (*Athene noctua*).

Among the daily birds of prey are evidenced:

Falcon (*Falco sp.*), crow (*Cornus corax*).

Protected Areas

The Convention on Biological Diversity (BDC), that was signed by Albania on January 5th, 1994, considers the establishment and management of Protected Areas as one of the main mechanisms for biodiversity protection and ecological management. The Global Biodiversity Strategy and the Pan- European Strategy on Biological and Landscape Diversity (PESBLD), initiatives where Albania is actively participating, understanding and appreciating the importance of Protected Areas for the preservation of biodiversity, have recommended expanding Protected Areas and strengthening their management as high priority objectives for every country. These areas vary in dimensions and protection scale, and in the level of control of human use. They offer a number of products and services with local, national, and international benefits.

In the immediate area of the municipality Petran in Permet, there are several protected areas and natural monuments:

Table – Protected Zones and Natural Monuments in Petran Municipality

River	Protected Zone	IUCN Category	Decision Number
Vjosa	Bredhi i Petranit (Petran Fir) (300-350 m a.s.l.)	Natural Monument	1 ha (DCM No. 676-2002)
Lengarica	Ujrat Termale (Thermal Waters)	Natural Monument	14 km from Permet (DCM No. 676-2002)
Lengarica	Kanioni i Lengaricës (Canyon)	Natural Monument	2 km long, 150 high, 2 m wide (DCM No. 676-2002)
Vjosa	Hotova	National Park (III)	1,200 ha (DCM No. 1631 2008)
	Guri i Petranit (Petran Stone)	Natural Monument	(DCM No. 676-2002)
	Shpella e Pëllumbave (Pigeon's Cave)	Natural Monument	DCM Nr.676-2002

Endangered and Protected species

Based on classification of IUCN, there are a considerable number of rare and endangered floral species along the river Lengarica (Thermal Water – Power House). Among them to be mentioned: *Sambucus nigra*, *Cladium mariscus*, *Ranunculus lingua*, *Salix triandra*, *Juglans regia*, etc.

Among the known rare and endangered fauna species there are mainly amphibians (*Salamandra salamandra*, *Triturus vulgaris*, *Bufo bufo*, *Rana dalmatina*, etc).

Anguilla Anguilla is a well-known migratory species that is spread all over the river of Vjosa and is identified within the Lengarica tributary. *Salaria fluviatilis*, *Mugil cephalus* and *Liza ramada* are marine species that are migrating in large distances in the Vjosa River, but not identified in the Lengarica.

Table- The status of some faunistic species based on Albanian red list

Nr.	Species name	Status according to Albanian Red list/8.05.2007
1	<i>Anguilla anguilla</i>	EN
2	<i>Rana graeca</i>	LNrt
3	<i>Rana balcanica</i>	VU
4	<i>Testudo hermani</i>	LRnt
5	<i>Salamandra salamandra</i>	DD
6	<i>Anguis fragilis</i>	NE
7	<i>Bufo bufo</i>	LNrt

We note that about 70 km away from the Lengarica hydropower project area, the river downstream Vjosa, Kalivaç hydropower plant being built in the district of Tepelena. In this case there is an aquatic ecosystem fragmentation Vjosa River for major reasons. And, there is a resulting fragmentation of the ecosystem of the river flow downstream Lengarica. For many endemic and migratory aquatic species this is reducing their habitat.

Moreover, we can say that aquatic fauna of the Lengarica river, fish or rather, do not make use of economic importance. It just has value as a natural ecosystem for several endemic species living in natural conditions stressed due to high salinity (896 µs/cm measurements last January 2011).

References

- Bino, T. 1998. *L'avifaune aquatique du système lagunaire méditerranéen de Karavasta (Albanie) et sa conservation*. Thèse de Doctorat, Université de Montpellier II Sciences et Techniques du Languedoc. 218p.
- Crivelli, A., Shumka, S. 2008: Fishes of Albanian rivers; Report to the project on study of the fishes of lotic systems, supported by French Embassy, pp. 76
- Kayser Y, Bino T., & Gauthier-Clerc M., 1995: Recensement des oiseaux d'hivernants en Albanie. 17 Janvier - 7 Février 1995. Rapport de la Station Biologique de la Tour de Valat. 79 pp.
- Mersinllari M., Hoda P., 1985 - Vështrim gjeobotanik i bimësisë mesdhetare të zones.
- MMPAU, 2007: Urdher Lista e kuqe, Tirane
- Paparisto A., Keçi E., Pepa B., Muranyi D., 2008: Preliminary data on using insects and other invertebrate groups as biological indicators of water quality in some Albanian rivers. BALWIOS 2008- Ohrid, Republic of Macedonia, 27-31 May 2008.
- Ruci B., Vangjeli J., 1996- Të dhëna mbi vegjetacionin e ujrave të ëmbla dhe florën hidrofile e higrofile të Shqipërisë. (Botuar në: Uji-Pasuri e madhe Kombëtare, 171-176). Tiranë.
- Shumka, S. 2008. Identification of Alien and invasive fish species to Albanian freshwater. Balwois III
- Uruçi, S., 2010: Bio-Ecological Data on Amphibians of Thermal Water of Permeti Area (South Albania) Balwois 2010.

4.8. - Air quality

As mentioned before, the project is located in a forested area having different height a.s.l. and dappled climates. All local microclimate factors and contributors of different emissions influence the air quality. It should be underscored that emissions in the area are negligible and consist mainly of urban and vehicle traffic discharges in a zone with a limited number of inhabitants and without industrial developments. River

valleys and gorges ensure very good air ventilation thus balancing very fast in-air moisture and temperature levels.

The air in Lengarica SHP Plant zone is that of a Mediterranean para - mountainous and mountainous climate, fresh and natural.

There was not verified any evident discharge and this was the reason we did not practice measurement on air quality.

4.9. - Noise

Noise levels are in usual natural FON, being biggest contributors the scarce vehicle traffic, river and wind "noise". Noise, as result of agricultural and economic activity of area inhabitants is insignificant.

The same rationing on the air is used even for noise assessment. The rural area with a broken mountainous relief has no additional noise sources caused by human activities. This was the reason we did not practice measurement on air quality.

4.10. - Human environment

Population Characteristics

Përmet is 230 km from Tirana (capital city), 70 km from Gjirokaster (Prefecture Center) and 30 km from the Greek border (border point "Three bridges").

Petran municipality is in administrative unit of Përmet in Gjirokaster Prefecture. It lays down in the SE part of Albania, close to Përmet, in the right of Vjosa river flow.

The Total number of inhabitants in Permet district is 36, 724 (2010). In Petran municipality (16 villages) live 3, 243 inhabitants. The gender structure is 1,656 males and 1,587 females.

There are 820 families living in municipality, meanwhile 150 other families left it during the last years. Current population estimates count 1,200 persons. 36 % of municipality population is under 18 years old.

There are 4 religious communities living there in harmony with each other.

Population of the area in general has the same customs and traditions with that of Përmet town and of the villages close to it. Briefly we will present local characteristics of Permet.

Permet district is known for excellent cultural and historical traditions. It has good reputation for the hospitality, folk and especially for lyric folk songs. The population of the area inherits an extraordinary tradition of agricultural processing, distinguished one in production of drinks, canned products, handmade silver and needle

works. Gastronomy is also a cultivated characteristic in families and social services; it is special for the high quality and originality of cooked food. The area offers opportunities for the development of family's tourism, other sources of medical herb processing and has a rich cultural heritage.

Permet is distinguished for its culture and has real potential for rapid economic and social growth. Benja Thermal Waters, iconography of the churches, special traditional products, its vicinity to Greece, Vjosa river eco-tourism and considerable green areas make Permet one of the areas having the biggest potential for a fast and sustainable development.



Map of Permet municipalities

Religions and religious groups

In Permet district live about 36, 724 inhabitants having different religious origin, mainly orthodox, Muslim and *bektashi* (one of Sufi Muslim orders/sects). There is a community of Egyptians of about 8-10 % and a Greek minority of 2-3%. The churches more than cult objects are considered for their cultural value, distinguished for the construction way, architecture, frescoes/murals and iconography that show a high estimation of the spiritual life. There is also a mosque for Muslims and a take for bektashi, as well as a protestant church. It is notable that all religious sects live in harmony and show great respect for the festivities and traditions of each other.

Ethnic groups and racial distribution

In Permet municipality and in seven local municipalities around it there are for communities.

The actual existing communities:

- Rom community inconsiderable,
- Egyptian community 8-10 %,
- "Vllah" community..... inconsiderable,
- Greek minority community..... 2-3 %.

Population number:

*Table- Data on population of Përmet District - 2010**

Nr	Municipality/Local Municipalities	Males&Females	Males	Females
1	Përmet Municipality	10 921	5 440	5 481
2	Këlcyrë Municipality	5 417	3 219	2 198
3	Çarshovë Local Munic.	3 191	1 616	1 575
4	Petran Local Munic.	3 243	1 656	1 587
5	Piskovë Local Munic.	3 522	1 766	1 756
6	Deshnicë Local Munic.	3 356	1 708	1 648
7	Suke Local Munic.	3 010	1 566	1 444
8	Ballaban Local Munic.	3 108	1 577	1 531
9	Frashër Local Munic.	956	460	496
	District	36 724	19 008	17 716

*Data sources are local institutions of Përmet

There are 16 villages in Petran local municipality:

Kaludh, Petran, Gjinkar, Badelonjë, Leshnicë, Leuse, Bodar, Qilarishtë, Tremishte, Novoselë, Skutaraq, Lipivan, Bënjë, Ogdunan, Delvinë, Trepozishtë

Population relocation

Démographie (Petran municipality– Permet district).

Table- Natural increase of population in Petran municipality and Permet district (2010)

Nr.	Beginning of year		Births	Deaths	Infant deaths (< 1 year)	Infant deaths (1-4 years)	Marriages	Situation at end of year
1	Permet district		218	138	-	-	129	36 724
2		Petran municipality	43	15	-	-	20	3 243

Table – Mechanical increase of population in Petran municipality and Permet District (2010)

Nr	Total		Newcomers within the district	Newcomers from outside district	Total newcomers	Leaving from the district	Leaving outside the district
	Permet district	Petran municipality					
1	3	-	3	-	3	-	-
2	-	-	-	-	-	-	-

Table- Basic data - Petran municipality

Nr	Basic data	Petran municipality	Permet district
1	Total number of population	3243	36 724
2	Active population	1200	16 296
3	Active population working abroad (seasonally)	300	-
	Agriculture land (ha)	1 377	13 055
	Agriculture irrigated land (ha)	110	-
4	Families number	820	9 862
	Number of families leaving during last years	150	-
	Surface (m ²)	18 4230 000	929 560 000
13	Density population (persons / m ²)	>	>

Institutional Structure and Community

Table- Local and central public institutions

Nr	Central Institutions of Permet district
1	Forest Department
2	Central Office on Education
3	National Informative Service (SHIK)
4	Police Commissariat
5	Water Department
6	Regional Water Utility
7	Agriculture and Food Department
8	Department of Public Health
9	Albanian Electro energetic Corporation
10	Alba post
11	Albtelecom
12	Tax Department
13	Labour and Social Assistance Office
14	Health Insurance Office
15	Social Insurance Office
16	Local public institutions
17	Përmet Municipality
18	Enterprise of Cleaning and Green Surfaces
19	Center of Arts and Cultural Monuments
20	Library

Private Sector Institutions

Table- Local branches of private institutions

Nr.	Institutions of private sector
1	Banka Popullore (Societe Generale)
2	Tirana Bank
3	Raiffeisen Bank
4	AMC
5	Vodafone
6	Western Union
7	Private Police
8	Albsig

Associations of voluntaries are presented together with NPA List acting in Përmet district.

Table- Non Profit Associations (NPA) (Voluntary)

Nr	NPA	Head of NPA
1	Përmet association	Landi Stathi
2	Forum of citizen development	Dhiogjen Kristo
3	"Elena Gjika" association	Niko Mihali
4	"CIOFF" association	Niko Mihali
5	Veterinary association	Llazar Thanasi
6	"Drita" association	Refan Ponoçi
7	Association of political persecuted	Bektash Osmani
8	Wine producers' association	Roland Dama
9	Health Educators	Haxhire Dhama
10	Arumunes association	Dhimitër Liçi
11	Association of producers	Andon Cullufe
12	Association of medical and flavored herbs	Flamur Hajdini
13	Bee masters' Association	Berti Male
14	Writers' League	L.Kolleshi
15	Writers' League "Pegaso"	Agron Shele
16	Association of Children and Young people	Agron Shele
17	Association "Environment in Community"	Agron Shele
18	Dairy producers	Vasil Todhe, Klement Ndoni
19	Association of Orphans	Xhemil Maksuti
20	Association of Handicapped People	Ligor Shyti
21	Association of Labor Invalids	Vasil Stefani
22	Association of blind people	Ervehe Toska
23	Association of retired army officials	Lefter Kovi
24	Businessmen association	Gjergji Kaleshi

4.11. - Occupational health and safety

Workers have to be aware on standard technical safety measures. They also have to sign with their full responsibility on training courses and gained qualification. Technical leader or supervising engineer have to present to staff Environmental Management Plan (EMP), environmental permission and especially obligations coming out by mitigation measurements plan on social and environmental impacts. Supervising engineer must be well informed on the obligation towards Regional Environmental Agency on monitoring of implementation of Environmental Management Plan.

Supervisor Engineer shall report with KESH and Regional Environmental Agency (REA) on Environmental Management Plan (EMP) a month in advance. Apart that he has to facilitate preparation of quarterly reports on implementation of the said plan following Environmental Permission of REA. The form of report shall be in accordance with the format of REA. In case of accident or negative environmental impact (not foreseen from EMP or ESIA) supervising engineer shall report immediately to KESH and REA.

4.12. - Socioeconomic conditions in and around project area

Economic development of Petran municipality

Most farm families' incomes are generated mostly from their own private farm activity. Employment level in sector, private and public, is quite low. Most of the active people are employed in the construction and service sector but these kinds of employments are not permanent. The total number of employed people is 1,247. The main work forces are engaged in the agriculture, stock-breeding, fruit culture and small businesses. About 50% of working force of the zone is engaged in agriculture, 20% in sheep farming, 5% are self-employed in commerce and service, and about 25% of them have emigrated, mainly to Greece and Italy.

The work force in Petran municipality is about 1 200.

In the area there are small agriculture farms and sheep farmings. Apart Leuse village, all families of other villages own about 0.1÷0.4 ha land per each person in family, distributed in 5÷8 parcels per family.

Each family owns 1÷2 cows.

During last years the farmers are focused in grape, vegetable and fruit cultivation. There are actually 71.5 ha of vineyards, out of which 28.5 ha are new ones. The municipality has a tradition in food processing, mainly in grape processing producing wine, raki (local snaps) as well as different fruit drinks.

The tradition and the interest to invest in agriculture is an excellent opportunity to develop agroturism.

The system of irrigation water supply covers a limited land surface, about 8 % of municipal agriculture land and 13 % of cultivated lands. As results even from the above mentioned data the level of irrigation water supply remain among the main concerns related to the improvement in agriculture zones.

Tourism

Petran municipality has good tourism potential but it lacks the infrastructure to attract tourists. In all there are 3 hotel/restaurants some coffee bars. Benja Thermal Waters are frequented by a considerable number of tourists. About 20,000 numbered visitors might have spent 15 summer days during June-August and even during September and October.

The tourist revenues are calculated to be between 30, 000 ÷ 45, 000 Eur.

Another group of tourists are hunters. There are about 1 800 hunters visiting the area during hunting season and the respective generated revenues are considered to be about 30, 000 Eur.

Another special category of tourists come to visit and celebrate religious ceremonies as well as Petran cultural monuments.

The following table presents socio-economic conditions of the zone:

Table- Number of the employees in public sector 2010

No.	Type	No of employees in Permet District	No of employees in Petran municipality
1	Përmet Municipality + administration of local power	193	20
2	Health Sector	173	14
3	Education Sector	253	13
4	Forest Department	37	-
5	Tax Office	5	-
6	Banks (Popullorë+Tirana+Raiffesisen)	21	-
7	Labor Office + Inspectors	5	-
8	Postal Office	18	-
9	Albtelecom	27	-
10	ASKSh	14	-
11	Social Insurance Office	10	-
12	Real Estates Registration Office	4	
13	Sub-prefecture	14	
14	Road Department	29	
15	Statistic Office	2	
16	Office on land compensation and reversion	1	
17	Treasury Office	4	
18	KESH	70	
19	Water Utility	35	
20	Environmental Inspector	1	
21	Private Sector	2 013	1 200
	Total No. of employees	2 929	1 247

Private sector employment for Petran municipality, Permet District

Table of private businesses and employment for Petran municipality, Permet District

No	Type	Përmet District		Petran Municipality	
		Number	Employees No	Number	Employees No
1	Small business		482	18	60
2	Big business		584	-	-
3	Business with foreigners		215		
4	Local business with foreigners		363		
5	Agriculture Sector		42	-	600
6	Production Sector		88	-	-
7	Construction Sector		105		
8	Other		-	-	240
9	Seasonal employment (Greece)		-	-	300
10	Trade Sector		82	11	
11	Service Sector		52	7	
	Total	573	2013	18	1 200

Table- Commercial, construction and production activities, Permet District 2010

Nr	Type of activities	Total
1	Total No of subjects	573
2	Small business	503
3	Retail	302
a	Food	-
b	Industrial	90
c	Bar restaurants	106
4	Wholesale	-
5	Production activities	44
a	Bread Wheat Products	-
b	Food Products	-
C	Duraluminium and wooden products	-
6	Free Professions	28
7	Handicraft service	47
8	Transport	66
9	Register of local roads	-
10	Subjects with considerable capital	70
11	Construction Sector	47
12	Sector with foreign capital	2

Table- Investments from Central Government and Foreign Foundations (last 5 years)

No	Organization name	Specific Object	Value in Lek (local currency)
1	Norwegian Fund	School "N. Bulka"	20 000 000
2	CESVI	Reconstruction of Health Center	2700000
3	CESVI	Reconstruction Sports Building	8 000 000
4	World Bank	Reconstruction of high school	41 000 000
5	World Bank	Reconstruction of Surgery Pavilion	6 700 000
6	World Bank	Reconstruction Lab equipment	1 500 000
7	World Bank	Reconstruction	25 000 000
8	Albanian Development Fund	Reconstruction of water supply system	11 000 000
9	Albanian Development Fund	Reconstruction Asphaltting quarter "Sede".	40 000 000
10	Albanian Development Fund	Reconstruction Asphaltting "Lagjen e Re".	20 000 000
11	Albanian Development Fund	Reconstruction Asphaltting Petran-Benjë road	97 000 000
12	Albanian Government	Reconstruction Asphaltting Leshicë village road	5 600 000
13	Albanian Government	Reconstruction Asphaltting Badelonjë e Re village road	12 000 000
14	Albanian Government	Reconstruction Asphaltting Petran road	19 600 000
15	Albanian Government	Reconstruction Asphaltting Bënjë village road	5 500 000
	Total		315 600 000

Education

There are 15 schools in the villages, out of which:

- 13 elementary schools,
- 2 nine-year schools.

In the municipality there are 15 public kindergartens and not one private one. The total number of the pupils, at both above mentioned levels, has decreased. Total number of Petran municipality pupils amounts to 214, out of which 73 frequent nine-year school.

The low number of pupils frequenting elementary and nine-year school became a concern. The same stands even for the number in the high schools.

Table- Education 2010

Organisative Structure	Permet District	Petran Municipality
Students no in 2010	162	7
Teachers no.	337	13
Pupils no in 9-years schools	2 223	73
Pupils no in high schools	834	-
Children no in day nursery-kinder gardens	522	10
Library	2	-
Museum	2	-

4.13.- Community response (e.g. results from public consultations, Community perceptions)

Following Aarhus Convention and Albanian and EU legislation on the collection of the opinion of groups of interest (inhabitants of Petran municipality) it was prepared the following questionnaire that was delivered mainly at Petran municipality where SHPP will be built. Other interested citizens and intellectuals from Permeti town were invited to join the questionnaire.

We collected 100 filled questionnaires. The respective results are presented herein after at summarized table matrix.



Photo – Aspects during work with questionnaires

Table- Matrix of Questionnaire of Petran-Përmet public					
Nr	QUESTION	OPTIONS			Remarks Specifications
		a)	b)	c)	
1	Which are main information sources in your community?	43	50	7	
2	How much families are aware on the project, how much are not aware?	67	33	-	
3	How important will be SHPP construction according to your opinion?	36	62	2	
4	Which are benefits they hope the project shall bring to them?	27	63	10	
5	Which are the negative effects according your opinion?	14	5	81	
6	Which are suggestions related to positive impacts and benefits?	50	47	3	
7	Which are their suggestions on negative effects reduction?	86	13	1	
8	Do you think the water reduction would have impact on agriculture land?	10	80	10	
9	Lengarica waters: have been them for irrigation?	-	93	7	
10	Which are problems the potential river derivation would bring?	67	23	10	
11	Are there affected families that might require compensation?	93	7	-	
12	Are there families that might require support for rehabilitation?	100	-	-	
13	Do you think will be verified any effect on cultural sources, tourism and protected areas?	71	16	13	
14	Do you think there will be changes reflected on the land?	10	-	90	
15	Do you think to have effects on topography, land erosion, sedimentation etc.?	87	3	10	
16	Do you think to have effects on water sources, hydrology, hydro-geology and on groundwater and underground water quality?	86	7	7	
17	Do you think to have effects on air quality, noise and ground vibration levels?	86	14	-	
18	Do you think to have effects on ecology, forests, wild animals, water ecology and fishing?	53	40	7	
19	Do you think to have effects on the health and sanitary conditions of the community?	99	1	-	
20	Does SHPP affect pedestrian's safety, traffic and road safety?	90	10	-	
21	The project, may it cause natural risks –flood, spate, fire in the forest, landslides/snow slips?	93	7	-	
22	Do you think Lengarica SHPP will bring national, regional and community level benefits?	14	79	7	
23	Which will be direct and direct benefits (due to SHPP) of your community?	3	83	14	
24	Do you think the project will have positive impact on the employment?	3	94	3	
25	Which are expected improvements due to continuous power supply of your community?	3	83	14	
26	Will continuous power supply have positive impact on the increasing of zone touristic potential?	7	66	27	
	SUMMS	7	66	27	
	TOTAL NUMBER				

Table- Model of public questionnaire

No	Questionnaire on Social Impact		
1	Which are main information sources in your municipality?		
	a) Written Media	b) TV	c) Others
	-	<i>Television</i>	Municipality, internet
	Specify: <i>Notification is given from all media and from local government.</i>		
2	At which extent the families are aware on the project?		
	All of them	b) In average	c) They are not aware
	<i>Yes, all know it</i>	-	-
	Specify: <i>It is since some years this important project is discussed</i>		
3	What is your opinion on the importance of construction of Lengarica SHPP?		
	It is very important	b) It is important	c) It is not important
	<i>Yes, it is very important</i>	-	-
	Specify: <i>Do you think it will stabilize power supply in Përmet region.</i>		
4	Which are expected benefits they hope project will bring?		
	a) Very high benefits	b) Usual	c) No benefits
	<i>Very high benefits</i>	-	-
	Specify: <i>Power supply, irrigation water, community revenues increase.</i>		
5	Which are negative effects according to you?		
	a) Many negative effects	b) Negative effects	c) No negative effects
	-	<i>There are negative effects</i>	-
	Specify: <i>Flow at Thermal Waters endangers, the same for natural monuments of Kenyon's and Thermal Waters, the same for fauna and especially for aquatic fauna, slope erosion at tunnel entrance and exit.</i>		
6	Which are suggestions related to positive effects and benefits?		
	a) No suggestions	b) There are suggestions	c) There are many suggestions
	-	<i>Yes, there are suggestions</i>	-
	Specify: <i>The channel to be at the disposal for irrigation during summer time.</i>		
7	Which are suggestions related to reduction of negative effects?		
	a) No suggestions	b) There are suggestions	c) There are many suggestions
	-	<i>Yes, there are suggestions</i>	-
	Specify: <i>It is required project to implemented, especially to leave the remaining water at the river bed at level of 0.5 m3/sec. Also, it is requested to apply protection measures against erosion at all works of SHPP and with tunnel excavations to be restructured zone roads.</i>		
8	Do you think water reduction will have any impact on agriculture lands?		
	a) No impact	b) There is impact	c) There is considerable impact
	<i>No, there is not any impact</i>	-	-
	Specify: <i>Agriculture lands, during dry season, may be irrigated with clean water without mineral salts, differently from now.</i>		
9	Lengarica waters, are they used for irrigation?		
	a) Not used	b) Used	c) Yes, they are used too much
	-	<i>Yes, they are used</i>	-
	Specify: <i>River waters are traditionally used to irrigate agriculture lands of valley.</i>		
10	Which are the problems the potential river derivation might cause?		
	a) No problems	b) Little problems	c) A lot of problems

	-	-	Yes, it cause a lot of problems
	Specify: <i>Interferes to hydrology of Canyons and Thermal Waters, destroys ecosystem and vanishes fish.</i>		
11	Do you think will be affected families claiming compensations?		
	There are not affected families	b) There are affected families	c) There are a lot of affected families
	<i>No, there are not such families</i>	-	-
	Specify: <i>All works of the project are located in forestall zone, mainly unproductive.</i>		
12	Would be families to ask support for rehabilitation?		
	a) There are not such families	b) There are such families	c) There are a lot of such families
	<i>No, we do not believe to have</i>	-	-
	Specify: <i>In project zone there are not buildings or real estate that might damaged.</i>		
13	Do you think to have any impact on cultural objects, tourism and protected areas?		
	a) No	b) A little	c) a lot
	-	-	<i>Yes, there are</i>
	Specify: <i>Water reduction at Canyon damages protected areas and ecotourism.</i>		
14	Do you think might be changes to be reflected in the land?		
	a) No	b) A little	c) A lot
	-	<i>Yes</i>	-
	Specify: <i>Potential disposal of tunnel excavation may occupy free land space in a delicate area planned for touristic development, damages the landscape.</i>		
15	Are there effects on topography, land erosion/sedimentation etc.?		
	a) No	b) A little	c) A lot
	-	<i>Yes</i>	-
	Specify: <i>At tunnel entrance and exit will be a slight change due to mining works and remodeling of hill gradient/slope: During works at river bed will be verified erosion phenomena and sediment production.</i>		
16	Are there effects on water sources, hydrology, quality of ground and underground waters?		
	a) No	b) A little	c) A lot
	-	-	<i>Yes, there are</i>
	Specify: <i>Derivation of water from SHPP may cause reduction of waters at thermal ones and decrease water at Canyons. The considerable reduction of water at river bed will increase mineral salts concentration.</i>		
17	Are there effects on quality of environmental air, noise level and ground trembling?		
	a) No	b) A little	c) A lot
	-	<i>Yes, there are</i>	-
	Specify: <i>Impact on air quality, noise and ground vibration levels are encountered during the construction period only.</i>		
18	Are there effects on ecology, forests, wild animals, water ecology and fishing?		
	a) No	b) A little	c) A lot
	-	<i>Yes, there are</i>	-
	Specify: <i>Project will have its impact on water ecology mainly, harms fish at its reproduction stage during April and May: The forests are damaged less due to the fact the works will be located on no productive forestall surface. Wild animals and birds will be disturbed during construction time and may repopulate again their areas.</i>		
19	Are there effects on community health and sanitary conditions?		
	a) No	b) A little	c) A lot

	<i>No, there are not</i>	-	-
	Specify: <i>Works do not negatively impact on inhabitants health. Using of clean water for irrigation (taken from derivation upstream thermal waters) will improve sanitary conditions of inhabitants.</i>		
20	Does the project affects pedestrians safety, is there any impact on traffic and on safety in the road?		
	a) No impact	b) Small impact	c) Considerable impact
	<i>No, there is not any impact</i>	-	-
	Specify: <i>Water channel track does not cross pedestrians or motor ways. In the contrary, due to SHPP needs road infrastructure will be of better quality.</i>		
21	The project, may it cause natural risks –flood, spate, fire in the forest, landslides/snow slips?		
	a) No risks	b) There are risks	c) There are considerable risks
	-	<i>Yes, there are risks</i>	-
	Specify: <i>Landslides may be verified in some special positions where pass penstock, due to the potential presence of other waters.</i>		
22	Do you think Lengarica SHPP will bring national, regional and community level benefits?		
	a) No benefits	b) There are benefits	c) There are a lot of benefits
	-	-	<i>Yes, there are a lot of benefits</i>
	Specify: <i>Lengarica basin with its hydro energetic potential will bring regional and national benefits on the production of clean and renewable energy.</i>		
23	Which will be direct and direct benefits (due to SHPP) of your community?		
	a) No benefits	b) There are benefits	c) There are a lot of benefits
	-	-	<i>Yes, there are a lot of benefits</i>
	Specify: <i>Community will directly benefit in power supply stabilization, new road and irrigation infrastructure, get sustainable for other economic developments, especially tourism.</i>		
24	Do you think the project will have positive impact on the employment?		
	a) No positive impact	b) There is a positive impact	c) There is a considerable positive impact
	-	-	<i>Yes, there is a considerable impact</i>
	Specify: <i>Construction of SHPP needs manpower. Due to mentioned positive impacts indirectly will be promoted the employment of other employees on the new activities that will be created.</i>		
25	Which are expected improvements due to continuous power supply of your community?		
	a) No improvements	b) There are improvements	There are considerable improvements
	-	-	<i>Yes, there are considerable improvements</i>
	Specify: <i>Continuous power supply directly improves consumers supply, ensure stability of economic development and reliability for new investments.</i>		
26	Will continuous power supply have positive impact on the increasing of zone touristic potential?		
	a) No positive impact	b) There is a positive impact	c) There is a considerable positive impact
	-	-	<i>Yes, there is a considerable impact</i>
	Specify: <i>Power generation from the said new local energy source will strongly support familiar tourism, ecotourism and other economic developments.</i>		

*Completing of the said special questionnaire form was made possible based on the opinion of majority of the questioned people.

Inhabitants and other interested people have expressed different point of views related to SHPP construction. A portion was confused because they confused different project versions with the recent original alternative.

At the meetings as well as from the questionnaires are evidenced different claims and concerns of the inhabitants. A part was concerned regarding potential irrigation impacts during summer season, as well as safeguarding the water ecosystem, especially the fish.

Of particular concern from interested public regarded the potential for Lengarica SHPP project interference with Thermal Waters. This issue is discussed one due to the fact inhabitants see themselves directly connected with the direct benefits. There are people having found there the rehabilitation, other ones realize there their actual incomes and in the future are expecting to have better perspectives. Benja Thermal Waters are in general a significant part of the local identity of Permet inhabitants. The problem lies with the uncertainty caused by river bed derivation related to mineralized waters flow regime. At part of interested inhabitants think the potential limitation of river flow at its own bed will decrease the flows of the Thermal Waters. And this has a great significance for them; it would hamper the future construction of a curative and recreative center.

4.14. - Cultural heritage (architectural and historic heritage)

The town and the entire Permet zone incorporate an excellent cultural and historical heritage. Even today there are remarkable tracks of old-time urban and town development in architectonic and historical monuments. This underscores the fact that Permet has been since the antiquity an important economic and cultural center.

Permet dates back to the XV century and there are many interesting legends regarding its name. Vjosa valley has been settlement of the "Paraways" tribe and the town name is connected with king's name "Premti", meanwhile Vjosa name is linked to "Aos". There is an Illyrian castle in Permet (Bolengë) located in the SE of the town. meanwhile "Shkëmbi/Guri i qytetit" (The rock/Towns' stone) (cultural monument) was an observation post to check wagon trains during XVIII-XIX centuries. The town includes an old part with characteristic causeways and stone homes with special architecture, meanwhile in periphery is located "Harku i Urave" (Arch of Bridges) of XVIII century.

Benja Thermal Waters are known for their curative values. Very well known are the rocky Canyon and Pigeons' Cave at its eastern part. These natural elements with historical-cultural values are tracks of an ancient development. Pigeons Cave is known as an Illyrian settlement, meanwhile Kadiu Bridge dates back in XVIII century.

Ancient voyagers, including Pougeville, Edit Durham and others had highly appreciated generosity, hospitality and the very clean town environment. At her book

"The Burden of the Balkan" Edit Durham wrote "Përmet with the high/tall cypress and green spring seemed to me amongst most beautiful place in the world".

Permet is known as a town of the culture, laid done on the foundation of national culture. It is native place of distinguished patriots of Albanian National Renaissance, Frasheri brothers and of many other artists in painting, sculpture, history, folk music, linguistics etc. as Dora d'Istria (Elena Gjika), Tefta Tashko, Odise Paskali, Nonda Bulka, Janaq Paco, Fatmir Haxhiu, Hektor Dule, Stefanaq Pollo, Androkli Kostallari, Kristo Frashëri, Mentor Xhemali, Laver Bariu, Sejfulla Malëshova, etc.

In the town and surrounds there are many cultural and monumental objects as post-byzantine Church of "Shën Premtes", "Shën Mërisë", "Leusa", "Kosina", "Buali", "Bënja", etc.

4.15. - Urban planning of the project area

The project area is not distinguished for its economic development. The Administrative municipality center is Petran village situated close to the Lengarica outlet in the Vjosa river. Apparently the limited urban development was due to the economic situation. Many people from the villages have migrated to other countries.

Although the area has a reliable potential for economic and urban development, as mentioned before, here there are important sources of hydropower. Benja Thermal Waters are used for their curative values, climate and natural splendor to be used for ecotourism, agro tourism and familiar tourism.

At Petran municipality are presented some development plans. One of them is Lengarica SHPP. There are projections to build 2 more SHPPs in the upper part of Lengarica river. Many other ideas are at the stage of studies or finance rising.

The most important document on economic development, until now presented, is "Plan of Tourism Development in Petran Municipality" – June 2009, financed by European Bank for Development (CEB).

Petran Municipality already has prepared "Local Development Plan" identifying main fields for its urban and economic development. The majority of projects listed in the plan are appropriate for the creation of basic infrastructure for touristic development of the zone.

The first already realized projects are those of reconstruction of some socio-cultural objects and road segments. The plan continues with a list of projects on the rehabilitation of water-supply systems, restoration of cultural monuments as well as the promotion of private initiatives on touristic investments.

An important urban project of the "Local Development Plan" is expected to be developed by municipality using the Thermal Waters and building of a curative center in Benja.

5. - Description and assessment of the environmental and social impacts of the proposed project: Significant changes to be identified to environmental and conditions likely to occur as a result of the pre-construction, construction and operation of the proposed project.

It should be first clarified that in the description of special work item there is a lack of technical information. More precisely are missing:

- data on auxiliary road tracks (to enter at tunnel entrance and exit),
- data on channel for discharging overflows or in case of defects at the reservoir connecting exit tunnel with siphon entrance,
- data on auxiliary road going to surge basin,
- data on channel for discharging overflows or in case of defects at surge basin.

Also the data on physical intervention in the ground are taken from bill of quantities of works related to implementation project.

Data on the calculation of surfaces of special elements of SHPP are taken approximately from the designs supposing the pipeline will engage the space of 2.5 m., auxiliary road will be 3 m. wide.

Calculations on quantities of vegetation layer to be taken-off are made supposing the surfaces and layers of vegetative cover have regular and uniform geometric forms.

The said empirical estimation method was imposed by the lack of data for these details in the present stage of its development.

5.1. - Impacts associated pre-construction and preparatory works (transport of equipment, trucks, personnel, etc.)

Geotechnical studies on SHPPS and more precisely on 2 have started since 2006. Meanwhile the study and implementation project on 1 had terminated in 2008.

After the modification of concession contract and project concept, in 2009 another studying team started its work. The Austrian Company "Enso Hydro GmbH" led geotechnical field works and stipulation of SHPP implementation project in cooperation with Albanian companies "Elba" sh.p.k. and "E.F.B." sh.p.k.

In all cases the ESIA team did not directly participate in the joint inspections due to its engagement after these inspections. However, based on written geotechnical documentation and on project as well as in-situ verification of SHPP components the following can be stated:

- During 2010 "Lengarica & Energy" sh.p.k. owners have restructured the road 10 km long from Ura e Kadiut (Judge Bridge) to the intake. So the road was enlarged and the route of the existing road was leveled in most of its length.

There were carried out tractor works and stabilizing filling.

The result is infrastructure improvement with a minimal environmental impact, categorized under excavation and earth works in not big volumes time after time combined with erosive elements, emission of gases resulting from vehicle fuel and probably a temporary discomfort of faunistic habitats. The social impact of these rehabilitation works was improvement of inhabitants transport conditions upstream the intake and temporary employment of some local people.

- Geophysics studies consist on the realization of the following works:
 - + Carrying out of 15 measurements using the method of Electric Tomography of the Resistance (TER), respectively in 3 spots at the dam, 9 at the tunnel and 3 in the river bed,
 - + Carrying out of 9 measurements using the method of Vertical Electric Surveying (electric sounding SEV) respectively in 8 spots at the tunnel and 1 spot at power house.
 - + are excavated 9 hole-sound, respectively in 3 spots at the dam with 6.3 m depth, 7 spots at the river bed during the pipeline track and in 1 spot as fore bay basin.

Environmental impacts during geophysical works have been inconsiderable. Digging of test bores were carried out mainly in the river bed without creating problems related to river sedimentation increase. Considering all geophysical measurement spots and already realized geological expeditions we can non state that any visible environmental impact shall be verified.

- Studies or more precisely hydrological measurement had taken place during 2÷3 expeditions in the summer and winter of 2009.

All expeditions and in situ movements due to SHPP project study enliven the life and economic activity in the zone creating a positive social impact creating seasonal employment and increasing the revenues from hotel and touristic service.

Following implementation project plan and that of special lots of works is planned the dam, desander and water conducting channel to be one of the lots, siphon another separate lot and the same holds for the power house and surge basin.

Each construction company may establish its own construction site or all of them be grouped in a sole construction site. In order to precisely define the effects, another social and environmental assessment would be required.

Preliminary we can state the alternative of sole construction site where are to be installed dormitories, warehouses, transport vehicles, auxiliary

equipment and kits. All these preparatory works are part of general social and environmental impact. Their impact duration lasts more than SHPP construction, i.e. required time for their settlement and installation and respective dismantling at the termination of the works.

Social and environment issues of the construction site/s are related to engagement of temporary use of a necessary land surface, employment and vital activity of works, providing of potable and technologic water, power provision, transport of staff, supplies and equipment, impact of temporary workshop and transport vehicles, preparation or the production of prefabricated materials, site dismantling at works termination and at last rehabilitation of the site.

In principle we would suggest the establishment of a site close to the place where will be installed the installation of aggregates and concrete production. Probably a first option would be the construction site close to the power house or as a second option a construction site close to tunnel exit and Thermal Waters in Benja village zone.

There are no available data on the quantitative assessment of this project element.

5.2. - Tunnel construction impacts (to include detailed explanation on disposal of excavated material)

Tunnel construction is the most important work considered from the size, complexity and financial cost aspects.

The total cost of tunnel and of the reservoir connecting it to the siphon amounts to 5.2 MEUR.

Tunnel will be build respecting standards:

- KTP 4-78, Technical Conditions on Designing Tunnels of Water Channels in Republic of Albania, 1978
- KTP 2-89, 1989
- Euro Code Nr.2

Tunnel construction works may be initiated at both sides simultaneously.

The level of physical intervention and volume of preliminary and mining works is as following:

- site cleaning and vegetation at tunnel entrance and exit in a total surface of grabbing 250 m²,
- flysch excavation (following geological report) 13707 m³,
- lime excavations (following geological report) 35313 m³,
- total of excavation (following geological report) 49020.5 m³,
- total transport of excavation (following geological report and considering scarification coefficient) 57298 m³,

- steel bars, metallic profiles and mesh: 1101.499 ton,
- transport of steel, concrete, gravel, rails and wagons and other materials and others necessary for tunnel works,
- consumption of fuels, lub-oils and spare parts necessary for tunnel works,
- site establishment and vital activity of tunnel workers.

Use of different materials and mining works for the construction of the channel has their social and environmental impact in the project zone. Tunnel works have their specific nature of underground. In an analytical way these impacts shall be presented following the presented methodology on special environmental elements.

The most important problem of tunnel works are the residues of underground water channel amounting to about 49,020.5 m³ materials from flysch and limestone rocks that scarified by physical processing result to go to 57,298 m³ transportable residues.

Construction residues are subject to Law No. 9010 dated February 13, 2003, "On the Environmental Management of Solid Residues" that are defined as "construction residues" at the article 3 of the said Law. Treatment of construction residues must follow article 12 of the Law, i.e. "through reuse or burial/landfill" and Regulation No.1 dated March 30, 2007 "On treatment of construction residues since their creation, transport and liquidation" and Instruction No.6, dated November 27, 2007 "On approval of rules, content and terms for the preparation of management plans on solid residues".

Based on Decision of Council of Ministers No.99, dated February 18, 2005 "On the approval of Albanian catalogue of residue classification", following Addendum I, point 3 these residues are classified as follows:

Residue Category 17: "Residual by construction and demolitions (including excavated earth from contaminated zones".

We specify that in our case there are not contaminated earths but construction residual classified as follows:

- 17 05 04, earth and stones residual from pockets within flysch and limestone formations;
- 17 05 06, residual clay from slag of;
- 17 05 08, gravel (most of residues from stone comminuting);
- 17 09 04, residual from site dismantling.

Tunnel works as per their nature are geo-mining works.

Most of the excavated material is limestone and less is flysch. These may be used as raw material for installation of construction aggregates.

In this case the aim is not to unearth minerals but materials resulting from these works to be classified as mineral residuals following the classification:

- 01 01 02, residuals resulting from unearthing of non-metallic minerals.

Their treatment may be carried out even following the regulation on treatment of mineral residuals.

So, would be a double classification, as construction residuals and, at the same time, as mineral raw material for the construction industry.

Treatment of such construction residuals shall be carried out according local plan on management of solid residues of Petran municipality. The company engaged with tunnel works shall be the owner of residues.

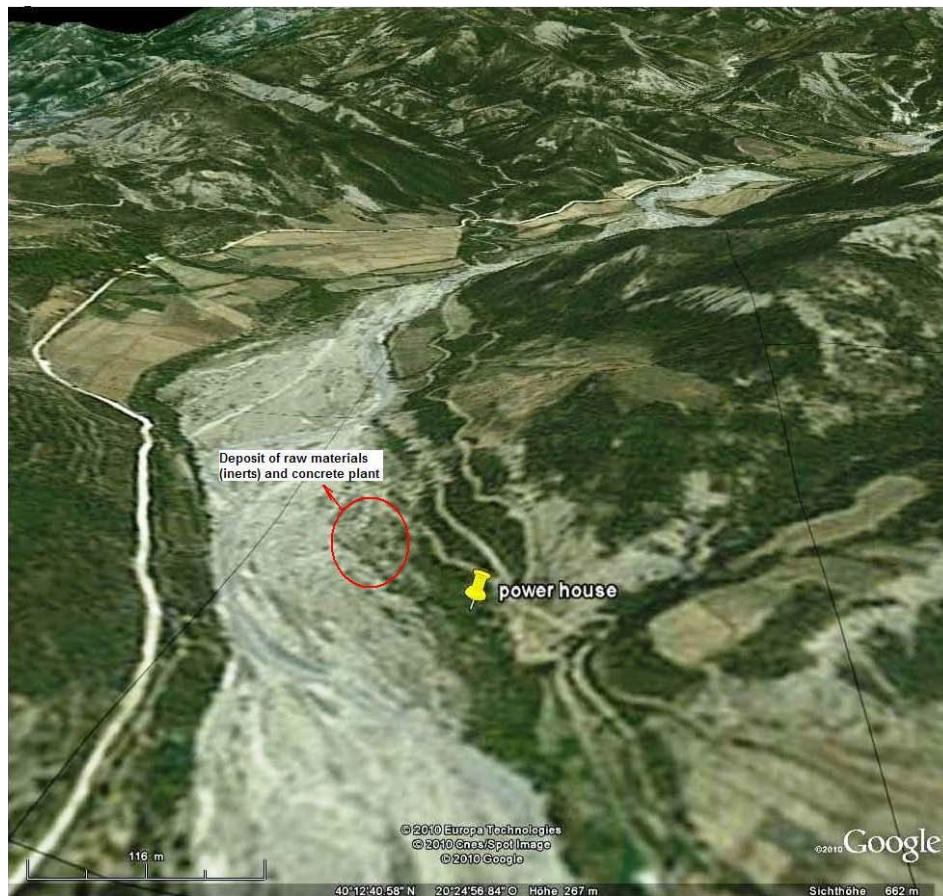
We would propose two methods on treatment of construction residues resulting from tunnel excavation:

- a) reusing method and
- b) temporary depositing method aiming their reuse as raw material for construction industry.

Precisely, flysch material resulting from tunnel entrance and exit may be used as filling material on the reconstruction of the roads within project zone. The total of flysch residues is 13,707 m³. They are softer and more scarified than limestone. In addition to that may be used even in a small quantity of thin gravel that may result from limestone excavation. These materials may be used as stabilizing for third category roads and auxiliary ones. An estimation on road reconstruction is not available and we are not in position to evaluate the quantity that may be used for the purpose. The additional portion shall be treated with the other quantity of excavation residuals.

Materials excavated from limestone result to be in bigger quantities, about 35,313 m³. Our proposal would be, at first these residues to be used directly for the construction of protecting walls at the dam/weir, in the filling of big spaces during tunnel concreting. The remaining may be used as raw material at crushing and fractioning of aggregates that shall be installed for the construction of SHPP.

The second treatment method of the residuals is the temporary depositing aiming their reuse as raw material for construction. Their deposit may be realized close to the crushing and fractioning raw materials installation or to concrete plant.



Google view. - Proposed site for aggregate depositing

This may be the right moment to propose even the site of crushing and fractioning installation of raw materials and that of concrete production: river bed close to power house. There it is possible to set even the depositing site of tunnel excavation residuals. This site has the advantage being close the object, does not engage agriculture land or any private one and does not have any impact on forest vegetation. Their location in front of SHPP power house (in the direction of river flow) and, in the same elevation (258 m. a.s.l.) would not create any risk due to high water flow. The proposed site would require the reconstruction of a road segment from power house to the road downstream Thermal Waters at the left side of river flow. Actually it is a damaged road of fourth category but would be an appropriate one to realize the connection with all components of the SHPP via the shortest way including even the auxiliary road going to tunnel entrance. This road segment about 2 km long would be the shortest going to the site of temporary depositing of tunnel excavation residuals. The said road segment shall not be mentioned at the project data description.

Petran municipality and the nearby zone close to Permet do have not any installation of aggregate processing and concrete production. Such investment would be in the service of the project under study, urban development of municipality and entire Permet zone. That would be an additional reason for the temporary depositing of tunnel excavation residuals.

Site selection of this installation is only a theoretical proposal and it would need to be the subject of further environmental and technical assessment. We are of the opinion the said depositing in another site closer to Thermal Waters would not be appropriate.

The other environmental impact of the tunnel is its interrelation with the landscape. The Tunnel entrance is beyond Benja Canyon at the upper river flow. It is situated in an area that is completely veiled from the view from the motorway. Meanwhile the exit is located at the right of river flow, at Southern side of the hill at Thermal Waters about 500 m downstream. Of all project alternatives this was the best solution due to the fact the tunnel exit is invisible from Thermal Waters. It is veiled at their Southern part not giving any impact to the landscape of natural complex Canyon – Thermal Waters – Pigeons Cave and Kadiu Bridge. This is project solution integrated with picturesque elements of Natural Monuments of the area and with other its development plans.

Tunnel construction is not a risk to inhabitants' health and to the workers who shall live there.

Tunnel interference to the forest surface is minimal. From the designs of the project result that a forest surface (250 m²) with vegetation cover shall be at tunnel entrance and exit. As mentioned before there are not available data for the auxiliary road going to the tunnel.

The social impact of tunnel construction is positive. The investment of 5.2 MEUR in a rural area is considerable. There are no available data on employment but is quite evident its construction shall require new manpower from the project area community. Further, indirectly shall benefit many other economic and social subjects. The tunnel itself and SHPP in general shall initiate other business activities significantly empowering economic impact in Petran municipality and Permet area.

5.3. - Impacts associated with construction related to water diversion (intake, weir, etc.), waterways (penstock, channels, etc.) and electromechanical equipment (powerhouse, turbines, etc.)

The construction of the intake, main water conducting channel (siphon), forebay basin, penstock, power house and tailrace channel will cost about 10 MEUR. It is a considerable investment.

The construction of the components shall be done through the following physical interventions:

- surface occupied by entrance channel: 1425 m²,
- surface occupied by channel siphon: 1570 m²,
- surface occupied by penstock: 1500 m²,
- surface occupied by surge basin: 40.8 m²,

- surface occupied by power: 1500 m²,
(in total there are 6300 m² actually with forestall vegetation, shrubs and herbage).
- vegetation mass at entrance channel into tunnel: 5500-6000 m³, (all vegetation mass excavation in total are: $\approx$ 6000 m³,
- concreted surface: 136 m²,
- materials like steel bars and concrete,
- metallic accessories and other for channel and pipeline gates, etc.

We may present in detail that there are about 6,300 m² of damaged low (herbage and shrubs) and high/tall (oaks) forest vegetation. At entrance channel into tunnel are encountered some oaks and herbage vegetation. Meanwhile at siphon channel and penstock are encountered mainly low shrubs without herbage vegetation.

Following the handbooks of the forest service, a tall tree occupies 10 m² of forest surface and, thus from the works to be carried out there could be damaged up to 346 trees.

Excavation will amount at about 6000 m³ of soil containing sub-clays, sand, tree roots and stones.

Following "Albanian Catalogue on Residual Classification", Addendum I, point 3 these kind of residual are classified as follows:

Residual category 17: Construction and demolition residuals (including excavated earths from contaminated areas").

We stress one more that in our case we have not contaminated earths but construction residuals classified as follows:

- 17 05 04, earth residuals containing vegetation roots and stones (main part);
- 17 05 06, clay residuals;
- 17 09 04, residuals from site dismantling (small quantities);
- 17 01 01, concrete residuals resulting during concreting (small quantities).

Earth residuals of soil vegetation cover are the main part and the calculation we made is related to them. We are of the opinion their removal should be done not far from channel track. They may be moved and relocated at the nearby forest terrain.

Site residuals shall be processed at the termination of works and shall be deposited in the places assigned by the municipality.

Construction of the weir, entrance channel, surge basin, pipeline and power house does not form any risk to the health of inhabitants and workers that shall work there.

The construction of the above mentioned components shall be done in invisible or less visible parts of the relief. The intake, desander and entrance channel are beyond Benja Canyons and are not visible from Benja and Petran villages. The location of channel siphon had a rationale solution having minimal impact on forest

found and zone landscape. Its descent from tunnel exit is going down to the river bed through the shortest way. As was mentioned the descent shall be done from a place that is veiled from those visiting the Thermal Waters and is without any vegetation. The track in the river bed is an engineering solution that avoids intervention to privately owned small agriculture parcels and in forest vegetation areas. Earth excavated for the construction of pipes support will be settled alongside the pipeline by filling and leveling the terrain. It is not necessary to transport it in other depositing places.

The powerhouse shall be constructed on the river bottom terrace, quite at the river bed where high vegetation is rare. The excavated earth shall be used for filling the terrain.

A special attention has to be focused in the proper operation of the project, generally of all hydraulic line of SHPP. The dam is 10 m high and is designed to handle maximal water flow of 8 m³/s. The additional flow will be turned back directly into river. The channel after the dam and after the desander is equipped with metallic gates to block the water in case of defects or maintenance work. These two components have channel to wash out/ rinse out the sediments and to turn back the waters into river. Depositing of sediments is a physical-mechanical process that shall protect the blocking of the other subsequent components and shall increase the turbines lifespan.

The channel at the tunnel part is underground but not under pressure.

At the tunnel exit and at the forebay basin there are two respective reservoirs regulating the water flow regime, avoid turbulence and remove the air from the pipeline protecting them and turbines from hydraulic hammer, they are equipped with special gates ("butterfly" type) that block the further water going, avoid flow pressure and vacuum created from water removal. Further, these reservoirs remove supplementary waters and discharge them into the river. For the said emergency discharging pipeline there are not available data on the project. By sure they shall be presented at the full completion of the project but in the worst case the not functioning of the said pipeline would put in danger these components, would create hydraulic problems in the pipeline and in the turbines. And, in the case it should not be constructed the water flow should cause erosion problems on the side hills sites at the canyon exit.

Would be the appropriate step the additional water discharging channel (at surge basin) to be connected with irrigation (during dry season) channel network of Petran and Badelonje.

At the powerhouse water going out from the turbines through special exits enters directly in the tailrace channel ending at the lower flow of Lengarica river about 500 m upstream Vjosa river embouchure below Petran village.

The social impact of construction of these works is positive. Investing 10 million EUR is significant for economic development of Petran municipality and generally speaking, of the entire zone. The community shall directly benefit through seasonal

employment, meanwhile the farmer's downstream river flow during summer season shall benefit irrigation of their arable lands with clean not mineralized water.

Many other economic and social subjects will have indirect benefits, too. The alternative of the project with longer tunnel/siphon/surge basin/powerhouse would enable use of the water for irrigation purpose from the elevation of the surge basin.

5.4. - Noise

SHP Plant construction and operating activities will be carried out following the Law No. 9774 dated July 12, 2007 'On assessment and management of the noise in environment' and instruction No.9774 dated November 12.07.2007 "Limit noise levels in defined environments".

All Lengarica SHPP components are located in different positions of the terrain and the intake and tunnel are far away from the nearest inhabited center. The siphon, forebay basin and powerhouse are more than 300 m from the nearest house of Petran village. We are of the opinion the noise impact will not create harmful effects due to source distance. Noise level will be within the allowed limits in urban areas ($LA_{eq} \leq 85$ dBA; $LA_{Fast} \leq 110$ dB).

During installation in the site it is necessary to take into consideration noise environmental impact at the general ecologic level.

The project noise (acoustic pollution) may be evaluated with difficulties due to the numerous variations of work conditions and environmental factors. Harmful noise effects will be function of the variety of equipment and work operations that cause the noise. Secondly, they are function of terrain conditions, including the relief, the space between noise source and subjects (human and natural habitat) that are subject to it.

Anyway main noise sources of the project under study may be listed according their importance:

- Diesel motors,
- air compressors,
- excavation vehicles,
- heavy transport vehicles,
- pneumatic drilling equipments,
- explosive materials,
- wagons for tunnel inner transport,
- tractors and loaders,
- sand and gravel production plant,
- concrete production plant,
- concrete vibrators,
- mechanical part being in movement as pulleys, transporting belts, hammers,
- service installations (including pumps, cylinders, pneumatic, etc.),
- water gates,
- turbines,

- tailrace channel,
- any other vehicle or tool, activity or work emitting noise.

It is necessary to consider the noise impact of short distances to the workers who are directly exposed to it. These workers are not numerous and normally they are the drivers and operators of technologic installations. The noise level within industrial zones should be within the allowed norms ($LA_{eq} \leq 70$ dBA; $LA_{Fast} \leq 110$ dB).

Impact of noise sources to the natural phone due to project implementation in the natural environment consists in troubling forest fauna. Harmful effects in this case shall be scaring and probably temporary remove of birds, animals and reptiles from their habitats as long as shall continue the work in a defined object.

To mitigate the harmful noise effects outside the sites these ones are frequently located in zones protected by natural obstacles or in depressed areas under the level of the terrain that might be object of the impact. Even placed in open environment it is possible to adapt a similar environment using aggregate stocks in order to create artificial barriers against the noise.

The proposed sites of project activities meet the requirements of mitigation of harmful noise effects towards urban and natural environment.

5.5. - Impact on surface water

Lengarica river waters shall be used following the Law No. 8093, dated March 1996, as amended by Law No. 8375, and dated July 15, 1998. Water reserves and their basin are managed at local level (prefecture) from Water Basin Council. Studying and protection of ground waters is carried out through an integral system of Albanian environmental laws and in accordance with Directive 2000/60/EC dated October 23, 2000 of European Parliament and of the Council.

Following EU Directive "On the water" the waters of project zone are identified as river waters of Western Balkan Zone, classified at system A of Addendum II with following typology of the rivers:

- typology for the elevations: medium 258÷410 m (200÷800 m) a.s.l.
- typology for the extension: medium 270.6 km² (100÷1000 km²),
- typology for the geology: limestone and silica,
- average flow of natural waters: 4,74 m³/s,
- being tributary to Vjosa river,
- conductivity 377 µS/cm and temperature 29.2 °C upstream the canyon,
- joining thermal waters at the lower flow,
- conductivity 618 µS/cm the temperature 20.8 °C together with thermal waters,
- specific pollution: ion Na⁺ and Cl⁻ and other cations and anions from thermal waters,
- ecologic statue: poor close to thermal waters, moderated in the lower flow close to Vjosa river embouchure.

SHPP project interferes into Lengarica river waters at the extent that follows:

- use energetic potential of Lengarica river water resources that is the main project goal,
- decrease negative effects of stormy flows during precipitation season,
- offer irrigation possibly using waters without increased salt level and increase the possibility to irrigate additional surfaces,
- modify river bed at the dam,
- change water flow regime decreasing its quantity in the old river bed during the operation,
- the quantity of derivate water (having a variations regime) is at the range flow of $0.5 \text{ m}^3/\text{s} \div 7.15 \text{ m}^3/\text{s}$,
- operation time is 4÷5 months/year (3307 hours or 137.8 days/year),
- ecologic water quantity at the old river bed is calculated at $0.200 \text{ m}^3/\text{s}$
- excavation works at the dam and at the river bed where the siphon pipeline will be laid down shall cause a temporary increase of sediments in the river,
- decrease of clean water flow may increase salt level downstream thermal waters or even decrease thermal water flow, increase the level of pollutants in the said river segment and as result decrease irrigation water quality,
- decrease habitat of aquatic species.

The residual water flow of $0.200 \text{ m}^3/\text{s}$ (or 200 lit/sec.) behind the dam in the river bed, can protect different functions of the river, providing habitats for plants, wildlife and aquatic species, forming elements of the landscape, food for aquifers or pollution removal.

Lengarica SHPP in Benja is a special case because it relates to a complex of natural monuments and, the presence of water has a multiple role. We believe that this residual water flow in the riverbed of Lengarica, not compromised the use of thermal waters for curative and tourist purposes. Thus, the project integrated with local plans for tourist development of Petran municipality.

We think that this technical parameter of the project (residual water flow – 200 l/sec) is adapted to the integrated value for aquatic ecosystem protection and other projects development.

Despite the changes or modeling of water characteristics of Lengarica river, the main impact on surface waters is the social one. The waters are shown to be poor in

biological characteristics and in their qualities for irrigation and fish. In the version presented, the project can improve capacity and quality of waters for irrigation. It offers to Petran village farmers the possibility to irrigate additional agricultural lands. Investors state they may install pumps after the turbines for the mechanical lifting of the water for the need of the agricultural farms downstream river flow.

Hereinafter are presented photos of the place where are taken the samples as well as analyze sheets on the sample taken in some place of interest at Lengarica river.



Photo: Taking of samples at the location of the power house

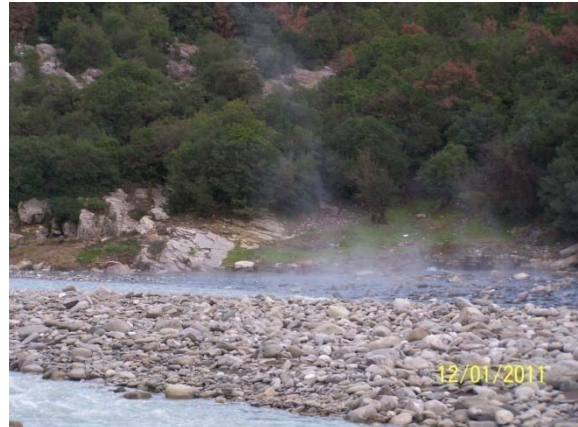


Photo: Taking of samples at the location of one of the springs

Republika e Shqipërisë
Ministria e Bujqësisë, Ushqimit dhe Mbrojtjes së Konsumatorit
Qendra Transferimit të Teknologjive Bujqësore
Sektori ; Laboratorit

Nr. 9-prot

Fushe-Kruje 20/01/2011

RAPORT ANALIZIMI (UJRA) dt 19.01.2011
Lista 1

Porositesi : Agustin CARA
Vendi : Komuna Petran – Lumi Lengarice
Moster uji e sjelle per analize nga vet porositesi

Parametrat	Simboli	Njesia Matese	M1 Uje central	M2 Uje burimi stomaku	M3 Burim reumatizme	M Burim pucrave	M5 Ura Kadiut	M3/1 Burim reumatizme
Permbajtja e kriperave								
Konduk. Elektrik	ECW	ds/m	0.896	2.82	2.01	1.65	2.78	2.01
Katione dhe anione								
Kalcium	Ca 2+	m.g / l	80.8					
Magnez	Mg 2+	m.g / l	27.2					
Natrium	Na +	m.g / l	79.8	474.6	203.7	200.8	463.3	320.3
Karbonatet	CO3 2-	m.g / l	14.4					
Bikarbonatet	HCO3 -	m.g / l	215.6					
Kloruret	CL -	m.g / l	138.8	646.1	454.4	386.3	660.3	461.5
Sulfatet	SO4 2-	m.g / l	134.2					
Elementet Ushqyes								
Azoti +Amonjakal	NH4	mg/l	0.14					
Azoti + Nitror	NO3	mg/l	0.14					
Fosfatet	PO4 3-	mg/l	0.225					
Potasi	K +	mg/l	5.1	17.2	10.9	9.83	16.5	10.4
Faktore te ndryshem								
Aciditeti	pH	- log [H+]	7.55	7.07	7.12	7.18	7.07	7.09
Mbetje e thate		mg/l	600.0					

Analizoi
Besnik Caslli, Manushaqe Poga

Pergj.Laboratorit
Miranda Huta



The test of analyses/sounding gives us the following information:

Location where the sample is taken	Enso measurement (30.10.2009)	Measurement U.Gjirokastër (S.Oruçi, 05.2010)	ESIA's measurement (12.01.2011)	pH measurement ESIA (12.01.2011)	pH measurement U.Gjirok. (05.2010)
Kadiu Bridge	618 µS/cm	-	2780 µS/cm	7.07	-
Power house	-	-	896 µS/cm	7.55	-
Thermal spring (Nr.3)	2002 µS/cm	2750 µS/cm	2820 µS/cm	7.07	7.4

Content of cations K^+ , Na^+ , anions Cl^- , HCO_3^- , SO_4^{2-} , PO_4^{3-} and of other ions is relatively high, measurements carried out in different times (with different water regimes) show the salt content does not change (with reduction trend while the river water flow is increased), in contrary seems to be higher.

The said fact strengthen the position of the hypothesis presented by working group that the deep thermal waters have ground contact with river waters and recipitation (rain-river-karst) which one is being increased in proportion with the last ones.

Our comment on ground waters (in our case “residual water” in the river) is that those have a relation. Based on the data on thermal waters flow level (160 lit/sec.) our way of rationing is as follows. In case the residual water (200 lit/sec.) downstream the dam gave to supply the thermal waters (without taking into consideration they might be supplied even from other underground springs), then thermal waters flow would change slightly or not at all. This is just a hypothesis. Anyway, following the same way of rationing, the said value of “residual water” is at its critical limit and must be preserved during HP Plant operational stage. We think there is a lack on the hydrologic information and it forms an element of uncertainty while the issue is estimated.

Main priority of water use is the use of hydro energetic potential with high economic profit. At the same time the use of thermal waters for curative and touristic purposes is another, also important, priority. The SHPP project supports development of other economic projects of the area.

5.6. - Impact on underground water

Underground water of project area is represented from Benja geothermal water coming out at the end of Lengarica Canyon. They consist of 6 different sources having a total flow of 160 lit/sec. The description of Albanian studies so far concluded is the following.

Geothermal zones of Albania have different geological and thermo-hydro geological characteristics. Thermal waters are located in three geothermal zones. Lengarica thermal sources in the Southern part of Albania, are part of the Kruje geothermal zone. It represents a high geothermal potential zone. Kruja zone is 180 km long. It lies from Adriatic Sea in the North and continues in the South-Easter zone of Albania and in Konitza zone in Greece.

The Kruja geothermal zone represents an anticline structural chain with carbonate nucleus from Cretaceous-Eocene era. They are covered with Eocene-Oligocene flysch. Anticlines are linear with lengths between 20÷30 km. and asymmetric. Their western sides are spared by disintegration tectonics. Geothermic aquifers are represented by a carbonate neritic formation karstified with many fractures and micro fractures. sources temperatures are between 6÷31 °C (source: Kolaneci 2005).

Project geological and hydro-geological studies had to precisely clarify geological situation close to the thermal waters, especially at the left side of Canyon. There is described the possibility of their study to clarify issues related to water age, supply sources, the possibility of river waters impact in the deep geothermal layers.

In fact the project has find a solution that keeps away Canyon and karstic zone at its left side where are situated thermal waters and the complex of natural monuments. From the natural landscape elements protection aspect this is a good solution, but is not given a precise answer on the possibility of thermal waters supply from Lengarica river waters





Photo- views of thermal waters in different seasons

5.7. - Impact on flora and fauna (to be explained in detail and to include clarity on fish stock situation in the river)

As from the beginning we state Lengarica SHPP have considered and generally speaking does not interfere in natural protected areas nearby.

The only intervention of note is water derivation before Lengarica Canyon. Lengarica Canyon, Thermal Waters, Pigeons Cave and Petran Stone are natural monuments in the vicinity of SHPP project.

Project impact on flora and forest fauna takes place in a limited time period that coincides with that of SHPP construction.

Separately, impact in forest flora is relatively assessed (total damaged forest surface of 6,300 m²). The surface is not entirely covered with high forest vegetation. Much of the forest area is un-productive. For methodical assessment reasons and for the investment related to rehabilitation we defined to be about 346 damaged forest trees (oaks and shrubs). The real damage to forest trees shall happen during preparatory works for the desander, entrance channel and tunnel entrance. The said forest surface is estimated before as the sum:

$$1425 \text{ m}^2 + 50 \text{ m}^2 = 1475 \text{ m}^2 \text{ (channel entrance + tunnel)}$$

In about 70% of this surface there are high vegetations. Calculating that a forest tree engages 10 m², and then we can state that approximately 103 forest trees should be damaged only before the tunnel, mainly oaks and shrubs. These ones are not included in threatened and in excitation danger trees.

Forest fauna in the vicinity of the project are is various. It will be temporary disturbed by construction works, mainly at the area before entering to the tunnel and that of

surge basin. It probably may temporarily leave the place but channel track will not damage their nestling and habitats.

Lengarica river aquatic ecosystem zone is not a "Protected Zone". The said ecosystem is fragmented by Benja Thermal Waters. The ecologic status of the river segment impacted by the project is "poor" close to thermal waters and "moderated" at the lower flow close to Vjosa river embouchure. Presentation of river fish is based in the observations of Shumka (2009) and Crivelli & Shumka (2006).

Fish is mainly at the lower river part, close to Vjosa river embouchure until up 1 km above power house. Fish species that are identified in river are *Alburnoides bipunctatus*, *Barbus spp.*, *Nemachileus barbatulus*, *Pachychilon*, *Leuciscus*, *Pseudorasbora* and *Anguilla Anguilla*. From above mentioned studies result that 3 kind of fishes are more common, respectively *Alburnoides bipunctatus*, *Nemachileus barbatulus* and *Pseudorasbora*.

Lengarica SHPP impact on fish habitat is smaller than on other aquatic species because they shall normally use the lower river part up to powerhouse. In the flow close to thermal waters they are rarely encountered. *Anguilla Anguilla* fish and some other migratory species may be damaged more from narrowing their space of moving due to the fact Vjosa river is going to be fragmentized as habitat due to the construction of HPP Kalivaç in Tepelena.

In Lengarica river flow there are only two kind of amphibian of the family Ranidae, especially *Rana balcanica* and *Rana graeca*. They are encountered in the clean waters upstream thermal waters and in the lower flow as well as in Vjosa river. In the vicinity of Benja thermal waters is only *Rana balcanica*. *Rana graeca* is a species that grows in mountainous tributaries. It may be found in the clean waters mainly upstream thermal waters.

In Lengarica river is encountered even the water snake (*Pseudopus apodus*).

Flow decrease in the river bed shall limit habitats of species of aquatic flora and fauna. The most endangered ones should be some rare floral species along the river like *Sambucus nigra*, *Cladium mariscus*, *Ranunculus lingua*, *Salix triandra*, *Juglans regia*, etc. Among known rare and endangered species are mainly amphibians (*Salamandra salamandra*, *Triturus vulgaris*, *Bufo bufo*, *Rana dalmatin*).

Aquatic fauna of Lengarica river and especially the fish are not of any economic importance. It has just the value of a natural ecosystem for some endemic species that live under stressed natural conditions due to high water salinity.

5.8. - Impacts on geology and topography of the project area

Lengarica SHPP project is conceived in several components already described. Excavation in flysch and limestone formations, in ground and tunnel is an intervention to the geological structures of the zone where shall be built the components. Meanwhile we shall consider as intervention to the topography of project zone changing of terrain elevations.

Hereafter we will present in more details at which extent each element of SHPP works exercise its impact in the geology and topography of project zone.

At the intake the works consist in excavation of Quaternary deposit layer that is represented by alluviums having boulders, fragments, gravels and even sand having their size up to 7 m. Reinforced concrete foundations will be laid down more 2-3 m being planted at Lower Oligocene (Pg31). The work shack shall be raised by excavating in two geological layers from the elevation 398 m. a.s.l. up to the elevation 410 m that shall be water level behind the dam. So to build a new reinforced concrete structure we shall be obliged to break and move volumes from two geological structures of the river bed. Geological impact is not important; the stable flysch layer in this spot is 20-30 m thick. It shall be filled with concrete realizing the joining of basic structure with the new construction and doing that the stability will be reinstated.

Flysch structure continues along the length of channel entering to tunnel, than for another 113 m into the tunnel and is interrupted at limestone formation 3,039.46 m long and further up to the tunnel exit continues flysch formation 824.59 m. long. Thickness of these formations is going to be increased from the river bed up to 100 m at tunnel exit. Geological impact consists in the setting of channel basement in a longitudinal line of the said geological formation. Calculation of new concrete structures is done considering rock stability and in the way to ensure stable connection/binding between them.

Topographic changes, due to excavation, is presented with changing of river bed elevation, completing and after the raising through artificial concrete structures up to the elevation 410 m.a.s.l. This situation changes the terrain presentation creating a small basin. In this case we have a positive impact to achieve the goal of the works and also due to the fact this shall decrease river flow speed.

Topographic impact at the tunnel shall change entrance and exit tunnel elevations. Intervention to geological formations within the tunnel is more complex and needs continuous monitoring following the works progress. Within the tunnel, along channel track there are two types of rock formations. At their contact points during mining works may be verified problems related to work safety and to works cost increase due to not uniform movements of the rock blocks. The limestone geological formation tunnel part presents its specifics. It is already identified that there are karst phenomena at tunnel part from Canyon part. This means that during tunnel opening there might be encountered rock fractures, cavities, water packets that increase

tunnel instability and make the works more difficult. Geological impact, in the case of tunnel, is considerable.

A similar situation in terrain and in rationing way is even siphon construction at the river bed. Along the interruption of the track by two springs we have a geological situation that is more complex than usual. These geological implications shall be considered in the technical calculations as well as in the cost of construction structures.

Meanwhile topographic impact in the case of siphon construction is quite special. From tunnel exit to the river bed, in a length of about 160 m the pipeline will be positioned on structures installed directly in flysch having a gradient of more than 70 %. Topographic impact is considerable and mutual due to the fact gravel and suckle layers varies along the river bed. So, to maintain the appropriate gradient and pipeline linearity, it is necessary to excavate and construct supporting elements having depths changing one spot to another. This needs calculation and cost for each of them.

Construction of powerhouse will be carried out on gravel layers 12÷13 m thick with a vegetation cover of 0.3÷0.8 m. In this depth shall be implemented stable foundations improving layers geological situation. Geological impact is positive and apart the main function the powerhouse shall protect river shores from erosion.

SHPP structures, in entire their length, except the tunnel, are raised on ground surface modifying the topography of the relief in every point of the tunnel track. The modification is gentle and here and there are veiled from the pedestrians sight. Water channel along entire its length does not cross many roads to create obstacles, difficulties in other activities and unpleasant views for the tourist sight.

5.9. - Impact on air and climate

Impact on warming and global climate changes (carbon credits)

Air and climate impact assessment of Lengarica SHPP construction project is based in an integrated system of national laws, international conventions and directives, air emission normative and special normative acts on air pollution protection.

Generation of electric energy using renewable sources, especially hydric ones, is a great contribution in decreasing green-house gas emissions (GHG: CO₂, CH₄, N₂O, etc.) and generally speaking of climate changes.

Albania has ratified through a special law UN Convention on Climate Changes (October 3, 1994), and is adopted in Japan Kyoto Protocol (April 2005). There is set an inter-governmental cooperation framework to face the challenge of climate changes.

The main target of the international cooperation is reduction of green-house gases. Green-house gases are the main contributors in the Global Heating and Climate Change. The industrialized countries have set defined obligations to decrease emissions of GHG at the national level. The obligations are expressed in unit following their national plans.

To make countries member cooperation more concrete the Kyoto Protocol foresees three flexible mechanisms that may be used to meet a defined part of their obligation for the reduction of in-air emissions:

- Emissions Trading
- Common Implementation
- Clean Development Mechanism.

The Albanian government had issued Regulation No.1 dated March 25, 2009 "On Assessment and Approval of Procedures related to Projects of Clean Development Mechanism". SHPP is approved by applying the procedure of CDM. This means to generate energy without emitting GHG or acid rain, i.e. to replace the energy produced by thermo central plants with the one based on water resources use. HP Plants generate clean energy using renewable sources. This is the main environmental impact on air and global climate.

In this context industrialized countries may sell a defined amount of their obligations to reduce emissions under the form of bonds (carbon credits). This form release these countries from obligated reductions and these late ones are transferred to the country that buys them, Albania for example.

Lengarica SHPP developed following CDM procedure has included in the respective calculations buying of a defined annual amount of obligations to reduce GHG under the form of a financial crediting for the project development.

Putting into operation of the said new SHPP shall reduce GHG emissions. Under the conditions of combined energy production in Albania is foreseen an electric net factor equal to 0.1. With its annual average production of 28.4 GWh, CO₂ emission reduction is expected to be at about 2,840 ton CO₂/equivalent years. The revenues should be created from selling carbon credits based on CDM shall be a financial stimulus. Actually credit units are sold in the market for 10 euro/ton. So, without considering price increase, the additional expected revenues are:

$$2,840 \text{ ton/year} \times 10 \text{ euro/ton} = 28,400 \text{ Eur/year.}$$

So, briefly shall have:

Net factor: $0.1 \approx 1 \text{ t}_{\text{CO}_2}/\text{MWh}$

Price: $1 \text{ t}_{\text{CO}_2} = 10 \text{ Eur}$ ($\text{t}_{\text{CO}_2}/\text{MWh} \approx 0.1 \text{ factor/ton}$, price $\approx 10 \text{ Eur/ton}$)

Annual production: $28.4 \text{ GWh} = 28,400 \text{ MWh}$,

$28,400 \text{ MWh} \times 0.1 = 2,840 \text{ t}_{\text{CO}_2}/\text{year}$

$2,840 \text{ t}_{\text{CO}_2}/\text{year} \times 10 \text{ EUR} = 28,400 \text{ EUR/year}$

28,400 EUR/year are expected revenues from selling of carbon credits.

Impact on project zone air

Air quality protection in Albania is based in the Law No. 8934, dated September 5, 2001 "On environment protections" as amended, Law No. 8990 dated January 23, 2003 "On assessment of environmental impact" as amended, Law No. 8997 dated May 16, 2002 "On protection of the aid form the pollution" as amended with Law No. 10266 dated April 15, 2010, Decision No. 803 dated December 4, 2003 "On approval of air quality norms".

During the construction activities and operating of the SHPP the use of heavy vehicles, work installations and tools are accompanied with emissions in air of gases due to fuel consumption and dust.

Main sources of in air emissions in the project area may be listed according to their importance:

- generators with diesel motors,
- excavation vehicles,
- heavy transport vehicles,
- explosive materials,
- tractors and loaders,
- installation of sand and gravel production,
- cement silos,
- others that emits dust and polluted gases.

More precisely the activity of transporting tunnel excavated materials may emit gas of fuel consumption and small particles in different sizes.

Tunnel works activity causes dust and emitted gas from explosion of dynamite used for the scarification of rock formations, filling of wagons and removal of aggregates from the tunnel.

Activity of aggregates production like sand and gravel emits mainly dusts (in the zone nearby the production site).

All work processes related to excavation and those ones accompanied with emission of polluted gases must meet limit discharge levels defined in the standards of air quality.

Under the conditions of our project harmful effect of polluted element (gas or dust) in the air is minimized due to the natural ventilation in the terrain and long distances between the objects.

Exposure extent of inhabitants of the zone and of the urban areas is limited. Project is developed in a mountainous terrain far from individual houses and inhabited centers. Number of works exposed to such pollution is small. In order to be protected from dust and harmful gases workers of some specialties are bind, through regulations of technical safety, to use individual protection measures (IPM).

5.10. - Impact on irrigation of the project area surroundings

Lengarica SHPP interferes in the irrigation system of Petran village and partially of Badelonje one. This is because River waters are to be diverted in the SHPP to generate electricity.

In the present social and environment assessment we shall try to analyze project impact in the irrigation of agriculture land of the zone.

Agriculture lands downstream of the Lengarica river are irrigated traditionally with waters of the river. Many years before (probably 20 years) it was an operating irrigation channel that passed somewhat lower than the level of forebay basin of Lengarica SHPP. Today the irrigation channel is fully damaged and its tracks are nearly invisible.

The goal of the farmers is not to hamper SHPP construction but to have available irrigation water during dry season and if possible to use the SHPP components to take clean waters without salts. This is a sensitive issue and they are uncertain in how to deal with it.

At first let analyze irrigation water quality downstream thermal waters.

At water analyses report on Lengarica river at power house, presented at paragraph 5.5, is given chemical quality of waters used for irrigation.

Referring to analyses carried out on January 20, 2011 hereinafter is presented the river water qualities (directly used for irrigation):

- pH-: 7.55
- Electric conductivity:
0.896 dS/m (1 dS/m = 1000 EC unit = 1000 μ S/cm = 640 ppm)
- SAR value (Sodium Adsorption Ratio): 1.044 g/lit.

SAR (Sodium Adsorption Ratio) value: is calculated based on the following formula:

Guidelines for interpretation of water quality problems for irrigation (Ayers, et.al.1994, FAO irrigation and drainage paper) is as follows:

Table – Guide for water quality problems for irrigation

Water parameters	Symbol	Unit ¹	Levels applied in water irrigation	
SALINITY				
Salt content				
Electrical Conductivity	EC _w	dS/m	0 - 3	dS/m
(or)				
Cations and Anions				
Calcium	Ca ²⁺	meq/l	0- 20	me/l
Magnesium	Mg ²⁺	meq/l	0- 5	me/l
Potassium	Na ⁺	meq/l	0- 40	me/l
Carbonates	CO ₃ ²⁻	meq/l	0- 0.1	me/l
Bicarbonates	HCO ₃ ⁻	meq/l	0- 10	me/l
Chlorine	Cl ⁻	meq/l	0- 30	me/l
Sulfates	SO ₄ ²⁻	meq/l	0- 20	me/l
NUTRIENTS ²		meq/l		
Nitrate-Nitrogen	NO ₃ ⁻ - N	meq/l	0- 10	mg/l
Ammonium- Nitrogen	NH ₄ ⁺ - N	meq/l	0- 5	mg/l
Phosphate-Phosphorus	PO ₄ ³⁻ - P	meq/l	0-2	mg/l
Potassium	K ⁺	meq/l	0- 2	mg/l
OTHERS				
Boron	B	meq/l	0- 2	mg/l
Acidity/Alkalinity	pH	1–14	6.0- 8.5	
Sodium Adsorption Ratio	SAR	(meq/l) ¹ , ²	0- 15	

General classification of water risks from Sodium based on SAR values:

Table – Classification of water risks

SAR values	Sodium risk in water	Comments
1-9	Low	Are used sodium sensible herbs, must pay attention
10-17	Medium	Additions are applied (as gypsum) and needs washing
18-25	High	Generally does not continue with their application
≥26	Very high	Generally, not appropriate to be used

Referring to FAO instructions and standards, the allowed norms for water to be used in irrigation are in the interval:

Table – Optimal limits for irrigation

Parameters	Unit	Limits
pH	- log [H ⁺]	6.0 - 8.5
Conductivity (ECW)	(dS/m)	0 – 3
Dry residue	gr/l	
SAR	m.e/l	0 – 15

Table – Nutrients limits

Nutrients	Unit	Allowed norms
N- NO ₃ ⁺	mg/l	0-10
N- NH ₄ ³⁻	mg/l	0-5
PO ₄ ³⁻	mg/l	0-2
K ⁺	mg/l	0-2

Basic criterions of salinity (based on plants tolerance) are grouped according to average results following conductivity values EC (ds/m), we may judge in the interval 0.95 ÷ 1.9 dS/m in water or land from “low” in “Sensible herbs”

Table – Salinity criterions

Plan groups and salt tolerance	Levels Water or agriculture land	Conductivity values (dS/m)
Sensitive plants	V. Low	< 0.95
Less sensitive plants	Low	0.95 ÷ 1.9
Plants with moderated tolerance	Medium	1.9 ÷ 4.5
Tolerant plants	High	4.5 ÷ 7.7
V. tolerant plants	V.high	7.7 ÷ 12.2
Too saline	Extreme	>12.2

References

Ayers RS, Westcot DW, (1989) *FAO irrigation and drainage paper*, 29 Rev. 1, 1994.
Ayers RS, Westcot DW, (1976) *Water Quality for Agriculture. Irrigation and Drainage. Paper No. 29.* Food and Agriculture Organization of the United Nations. Rome.

Our comment related to results compared with allowed irrigation norms according FAO is as follows:

- Conductivity values, SAR and pH are within the allowed use levels of irrigation. Herbs mineral salt tolerance varies from “low” to “very low” or “less sensible herbs” to “sensitive herbs”.
- Total salinity (dry residual = 600 mg/l). Cations and anions considered separately results high following FAO instructions. Their behavior in different quality lands may alternate tolerance values in irrigation.

However, let us confine ourselves here only to the water quality of Lengarica river in terms without developing the project.

Hydropower project by changing the amount of water in the river bed, designed to "residue water flow" 200 liter/sec, generally will maintain unchanged the amount and

quality of river water during all seasons.

Approximately inflow of water after thermal waters are expected to be about 300 l/sec. It will provide sustainable quotas during the use of hydropower. This situation is comparable to the period of ecological flow. Also, water in river's fragmented segment, will result in salinity probably moderate to high as now. But, in the waters of the river that used to produce electricity, not generally applicable land irrigation by farmers. Irrigation will be needed from the end June until middle September. Lengarica hydropower project provides irrigation of agricultural land in every season. Therefore, the real impacts of project on the irrigation of agricultural lands downstream Lengarica river, is positive during all seasons of the year when needed. Investors of the project declare this option at any time for farmers.

Water flow rate 200÷300 l/sec after Thermal Resources, is satisfactory in conditions of the project to feed the aquatic ecosystem near the powerhouse almost every season.

The project of Lengarica SHPP in the version that presents, could offers this opportunity to give farmers clean water (without salt). The project long tunnel / siphon / forebay basin / penstock, would be a suitable solution for farmers because, they can more easily take water for irrigation from the exhaust pipe excess water to the forebay basin.

The water sample taken at the dam upstream the canyon has the electric conductivity: $EC = 0.377 \text{ dS/m}$, (or $377 \text{ }\mu\text{S/cm}$ – Enso Hydro GmbH measurement).

Area of agriculture land with irrigation water, as a result of the project of SHPP Lengarica, can grow from 13% (or 179 ha) up to 70% (or 837 ha). While, surface total agricultural land was 1377 ha.

In such case the project implementation should have a positive impact with tangible social economic impact. This would require an agreement between investors and concession owners from one part with Petran municipality with the other one.

5.11.- Impact on the river

Project use Lengarica river waters for the generation of energy in a SHPP with derivation scheme. This means the impact would be of an extent of 7,670 m length. After the waters comes back to the old river bed behind the powerhouse about 2 km upstream Vjosa river embouchure.

At paragraphs 5.5, 5.5 and 5.10, were explained some aspects of SHPP project impact.

Derivation of a part of the Lengarica river gives an impact which characteristics we will try to present briefly hereinafter:

- Project use hydro energetic potential of the river in a said segment. This

hydro energetic reserve is renewable and is of great value compared with other benefits the segment river offers.

- At the upper part of the river (upstream the dam) shall be created a small basin that will decrease river speed, shall limit bringing of aggregates and sediments and, as a consequence, shall brake erosion phenomena. Here the modification of river bed shall create stability of the shores and appropriate condition for development of species, especially floristic ones. In this river part was encountered amphibian *rana graeca* that is grown in mountainous tributaries. This species is encountered in the clean waters mainly upstream thermal waters.
- Project shall limit water at Benja Canyon, Natural Monument. Water reduction in the canyon shall decrease its touristic and landscape values. Benja Canyon is frequented from tourist that like mountainous tourism and especially water sports.
- Water derivation may have its impact in water flows at Benja Thermal Waters. The hydro geological information does not offer full information related to underground or not contact of river water with thermal waters. This is an uncertainty in information and assessment.
- We stress out Benja Thermal Waters must be protected from the damages not just as natural monuments to be protected by the law but due to the fact they are of unique values for their curative medical values.
- Petran municipality development plans foresee a special feasibility study called "Tourism Development Plan – Petran Municipality, tourist development based just in these natural treasures like Thermal Waters, Benja Canyons, mountainous landscape and architectonic and historical objects.
- Lengarica SHPP project does not interfere in the "Protected Zones" of Permet such as National Park of Hotova, Petran Fir. It is limited at the lower part of Lengarica river where its works avoid physical intervention at natural monument complex close to Benja village.
- Project limits Lengarica river aquatic habitats. The derivate river part is projected to have a residual flow of (200 l/s) after intake. We believe that this residue flow it is acceptable to protect the biotic systems and to provide other functions of Lengarica river.

Before, at paragraphs 4.7, 5.5 and 5.7 were considered the issues related to ecosystem and endangered species of flora and aquatic fauna. Lengarica river is not economically important for fishing. Ensuring the continuity of biotic systems survival in the lower river part is of scientific importance for biodiversity values.

5.12.- Impact on the forest

All Lengarica SHPP components are foreseen to be built on municipality forest lands. The channel track of 7,670 m length lies in municipality forest lands of Benja and Petran villages. Forest surface to be used under works track, including intake up to the power house, is 3,458 m² excluding transmission line.

Planning and using 6,300 m² of forest surface for construction is an important impact. The surface foreseen for the work construction shall turn into a construction site and shall be deleted from forest found. From channel track along its length shall be removed about 6000 m³ of vegetation earth mass. The said amount shall not be transported elsewhere but will be systemized close to channel track filling and leveling different parts of terrain.

Removal of the vegetation earth mass and grubbing of about 346 forest trees, mainly oak and shrubs is another impact on the forest found of project zone.

In the project is foreseen a gentle intervention in all segments of water channel track. The forest zone where is foreseen to develop the project presents diversity in its natural elements where the main feature is broken relief with stressed dis-levels from lower parts of Lengarica valley in vicinity of Vjosa river up to hill heights upstream Benja Canyon. Due to that, forest project zone itself is presented separated in small subzones having different features one from the other.

Forest surface of tunnel exit is inclined and forest stripped. To be prepared for the construction here must be carried out surface works on 200 m². This part will have the impact of part of siphon 160 m long going down the Southern site hill up to Lengarica river about 500 m downstream Thermal Waters as well as that of auxiliary road segment from river bed level up to tunnel exit.

The siphon channel is 3,670 m long and passes in a forest surface without vegetation, defined as Lengarica river bed. The impact of siphon track construction is minimal compared to all other alternatives. The said solution for this construction site has to avoid supposed damages of forest vegetation and also the alternative of big excavations accompanied with potential erosion phenomena.

The forebay basin, powerhouse and pipelines close to them are foreseen to be built in a forest subzone of the project having soft characteristics of the relief and with more rare forest vegetation. It is quite close and in North of Petran village. Impact in this forest land is foreseen to consist in becoming it a construction site and in removal of about 1,000 m³ of earth mixed with gravel and vegetation mass.

At the end of our comment on the intervention on forest found we underline the attention shown under project framework to engage minimal necessary surface for transmission lines.

5.13. - Impacts associated with operations of the plant (residual water flow, irrigation, watercourse damming, flora and fauna, geology and topography, new electric lines, energy production)

The final work lines configuration signs the termination of physical intervention in the natural environment and of all negative temporary effects of the construction stage. SHPP enters operational stage for the power generation according to project forecast.

The operation of signs the first positive impact, i.e. generation of clean energy having high economic, social and environment benefits.

Production of 28 400 MWh/annum shall directly eliminate from general scheme of in-air emission of 2 840 tons CO₂ gas. The benefit goes further with the additional revenues of about 28 400 Eur/annum from selling carbon credits and so alleviating production cost. This is clean production according to "Clean Development Mechanism".

Production of clean energy from renewable hydraulic sources of Lengarica SHPP, Permet is a positive general contribution in the improvement of air quality and of global climate.

The other environmental and social impacts of SHPP during its operation will be listed hereinafter.

Residual water flow

The quantity of residual water in the river bed downstream of the weir, projected at about 200 lit/sec., is less than the ideal of 300 l/s, but acceptable.

Just "residual flow" after the intake subjected to a separate discussion. Our claim was to be greater for the reasons mentioned above and of natural monuments found near the project. The idea was to preserve as much as possible the natural function of the affected area. We appreciate this fact because they are considered more natural factors, environmental, economic and social development.

Intake, weir

The derivation weir of river flow shall stabilize water flow, reduce sediment quantity and river aggregates in flood cases, increase stability of river shores and shall create a small habitat for many natural species, especially floristic ones.

Metallic gates

Metallic gates mounted in defined positions of channels and pipelines ensure fully controlled flows, protects pipelines from hydraulic hammers. The low noise they generate during their functioning shall be part of surrounding environment phone. They are important elements of the system that avoid its damage risks with potential risks in the close environment.

Pipes of emergency discharges

At desander, basin connecting tunnel with siphon pipe and surge basin are installed discharging pipes to pour additional quantities in emergency cases. Their function is the protection of the pipelines and defects repairmen. Their potential negative impact is produced during the discharges at the side sites of hills. They may cause land rinse and erosion of receiving terrain.

The project does not provide data on their connection to safe channel system and on other protection works.

Irrigation

The phase of use of hydropower changes scheme and the existing conditions irrigation of agricultural lands. Investors claim that the power plant will establish a water pumping station after the exit from the turbines to make possible use of clean water for irrigation by farmers in each period year.

Waste water in the river may be unusable for irrigation due to high salts concentrations. However, the hydropower project does not affect irrigation in the dry season (June-September) because it is anticipated that the hydropower not work in the dry season.

Lengarica SHPP shall create a social and economic positive impact for the farmers. The SHPP channel systems shall provide clean irrigation water. The high elevation and the sufficient water quantity are expected to increase the percentage of irrigated surface up to 70 % of arable lands.

Flora and fauna

In the forest project zone after works termination and rehabilitation works shall be reinstated the normal situation. The forest vegetation shall be renewed more slowly in the affected spots; meanwhile fauna might be reinstated faster in frequenting and nestling of abandoned areas.

Aquatic systems (lotic) and other habitats close to river shores are expected to be more affected, more limited in their development due to reduction of the water flow. Endemic species defined in the red list as in-extinction danger of are more endangered.

Fish shall frequent always the lowest part of the river, downstream powerhouse. Their habitats are somewhat limited but they shall not be threatened any more than other aquatic species (lotic).

Geology and topography

Problematic geological zones that might present problems or default during project operation are those of the tunnel, intersections of streams with channel line before and behind the tunnel. We may state the project construction works are calculated with maximal safety for the sustainability towards different factors.

The tunnel always shall face such phenomena as karst and tectonic movements. Karst is more expressed at its right side from Canyon side (according geological study). Anyway project had considered since the beginning geological risk factor and is calculated for the maximal safety up to 100 years. Meanwhile the intersections of channel pipelines with the streams may be monitored easily in continuity.

Geographic terrain is somewhat modified in the works line. Topography will influence the project with difficulties that might be faced during repairing services and eventual defects in different objects.

New electric lines

According to the project in the central of Lengarica SHPP shall enter another line from SHPPs of the upper part of Lengarica river and shall exit another line of medium voltage to finish at Permet electric substation. Despite the fact they cross forest and agriculture zones, generally far from motor road and houses, they will cause a small negative environmental impact.

Any other later project and investment, being it urban or industrial, must respect the electric line easements as defined according technical condition and urbanity regulation.

During repairs and service to the electric lines in the terrain and forest zones where the line passes shall have interventions with transport vehicles. This activity shall be accompanied with interventions and casual physical changes of terrain situation. Lengarica electric sub-station of SHPP is another object with electromagnetic emissions. It is located close to power house and far away from inhabited center. Impact of electromagnetic factor regards the staff that is exposed to it.

Repairing and service for the eventual defects in the electric substation might be accompanied with oil cooled transformer defects. Oil transformer presence creates a possibility or a small risk, any way possible, of land and ground water pollution in the vicinity.

Potential of the risk is smaller even due to the fact oils do not contain PCB (Polychlorinated Biphenyls, $C_{12}H_{10-x}Cl_x$) that are considered dangerous and sustainable pollutants.

Energy production, power house

Production of electric energy under the aspect of concrete interest is an additional contribution in Albanian energy system. It shall influence the power supply stabilization in entire Southern part of the country and especially in Permet zone. It shall also influence the improvement of technical parameters of transmission.

SHPP operation needs employment of assigned staff. From here comes out the considerable and important economic and social effect.

In the central shall be installed equipment of high technology. Power generation shall be carried out under the conditions of a broad range of water flow from 1/3 up to 2/3 of total projected flow. Power generation is continuous and with maximal efficiency under the conditions of projected water flow,

Repair of casual defects and those of hydraulic and electro mechanic equipment shall be accompanied with interruption of power generation, with consumption of equipment and energy and production of different residuals such as mechanical and electrical parts, unusable grease and oils, etc.

Turbines and other aggregates functioning emits a continuous noise of certain level to which is exposed the service staff only.

6. - Impacts associated with the construction of the transmission power line to the project site (both intake and powerhouse areas, also to address electromagnetic fields)

Assessment of intervention on terrain

The Transmission line of 35 kV (MV) from SHPP or Permet substation is 6 km long. It starts from the 110 kV substation close to SHPP, crosses the Lengarica river and continues for Permet following the shortest way on the hills of right side of Vjosa river. Depending on the terrain (5 types) shall be used 38 different poles to mount 95 mm² cables of the overhead line. The axis of electric transmission line, in most of its length, cross forest lands and only 304 m² agriculture land.

The total surface engaged from the poles is calculated at about 283 m².

The works for the contractions of the said line consist on installation of poles into ground, cable lying and their mounting on the poles and at last the mounting of respective feeders at each electric substation.

Considering the extent of intervention in the terrain, emissions and traffic troubles the environmental impact is minimal. From electric substation to Permet town a sole transmission electric line shall be built.

Health assessment

Project of 35 kV line and of 110 kV Lengarica SHPP electric substation foresee electromagnetic field values, that compared to those used in EU countries and with WHO recommendations, are far below the recommended limits.

To explain the impact caused by electromagnetic fields of MV and HV transmission lines on man health hereinafter we present data from the technical literature (ESIA report 1 SHPP).

Impact of electric stream and electromagnetic field on the man

Repeated exposure of staff to electric substations and high tension lines (>110 kV) to electromagnetic fields has been study subject of many experts and scientific studies. They came to the conclusion that there were not any clinique problems and paraclinique and biologic criterions modification. Clinique examinations, general and specialized, have verified that hematologic and biochemical constants, EKG and LEG, biologic tests on function of kindness, thyroids, liver, genital organs etc, had no evident changes to be concerned.

Basic analysis criteria used by scientific studies show the main mechanism of interaction with the organism considering that biologic phenomena are attributes of endogen streams.

Depending on stream density, applied in wide bands, are verified biologic phenomena as hereinafter presented:

- For stream density in organism at the limits $\delta = (1-10) \text{ mA/m}^2$, no health problems were verified, stream densities are at the threshold of their perception.
- For stream density in organism at the limits $\delta = (10-100) \text{ mA/m}^2$, are verified clear phenomena related to sight system and to central nervous system.
- For stream density in organism at the limits $\delta = (100-1,000) \text{ mA/m}^2$, are verified clear phenomena related to stimulation of excitable tissues and health consequences are possible.
- For stream density in organism higher than $\delta = 1,000 \text{ mA/m}^2$ extra systoles and ventricular fibrillations may be verified.

Taking into consideration a safety factor 10 times, different countries have defined as norm limitation of stream density $\delta = 10 \text{ mA/m}^2$ for inducted streams.

Electromagnetic field of electric transmission line

Based on the methodology the following parameters of electric and magnetic fields intensities are considered in the calculations:

- Vertical component E of electric field created on the ground by high voltage line,
- Horizontal component B of magnetic field created on the ground (or nearby) by high voltage line.

Calculation formula of component E is quite dual with that of component B.

To have a more clear idea on distribution of electric field of HV lines 110 kV, we present a measurement example from an EU country. So, measurements on electric and magnetic field distribution are carried out by changing the distances from pole axis. Similar measurements are carried out for the same distances from pole exist but at the position where the line cable is at its lowest point.

- In the first case maximal value of electric field of 0.5 kV/m was verified in the distances 2-6 m from pole axis, meanwhile in this point maximal value of magnetic field was $0.82 \mu\text{T}$. Minimal value of electric field of 0.01 kV/m is verified in the distance 15-16 m, meanwhile minimal value of magnetic component in this point was $0.012 \mu\text{T}$.
- In the second case of measurements, carried out in the middle of line length,

where is its shortest distance from the ground, maximal value of electric field is 0.82 kV/m and magnetic component is $1.42 \mu\text{T}$, both them being measured in the distances 2-6 m from line axis.

International Standards and Recommendations

World Health Organization gives some recommendations on protection from electromagnetic fields:

- Considering endogen streams issue -to establish the norm- as reference point was taken induced stream density of 10 mA/m^2 , so this is basic reference norm.
- The said stream corresponds to man's exposure at electric field with gradient 25 kV/m and magnetic field with induction 5 mT , frequency 50 Hz.

WHO also considers appropriate -in function of the care to be shown to the exposure, its time duration etc. - to recommend wider limits for short time exposures or narrower ones for longer exposures.

Comparing Albanian applied standards for HV transmission lines (110, 220,400 kV) and electric substations (400/220/110 kV) with WHO recommended standards results the Albanian ones to be quite below them. Following respective standards the electric line impact is at acceptable level.

7.- Description of mitigating measures and measures to enhance environmental and social benefits (social and environmental management plan): Measures to be recommended to avoid significant adverse project impacts or to reduce them to acceptable levels. Social and environmental management plan to address pre-construction, construction and operations activities and to include necessary resources to implement mitigation measures.

7.1.- Organizational measures, capacities and responsibilities

7.2.- Technical measures

7.3.- Environmental and social protection measures

(See Environmental Management Plan – Part A: Mitigation measures)

8.- Environmental and social monitoring plan

8.1.- Pre-construction phase

8.2.- Construction phase

8.3.- Operational phase

(See Environmental and social Plan – Part B)

GREEN FOR GROWTH FUND
SOUTHEAST EUROPE
INVESTING IN ENERGY EFFICIENCY
AND RENEWABLE ENERGY

TECHNICAL ASSISTANCE FACILITY
REPRESENTED BY

OPPENHEIM ASSET MANAGEMENT

**GREEN FOR GROWTH FUND
SOUTHEAST EUROPE
INVESTING IN ENERGY EFFICIENCY
AND RENEWABLE ENERGY**

**TECHNICAL ASSISTANCE FACILITY
REPRESENTED BY**

OPPENHEIM ASSET MANAGEMENT

**ENVIRONMENTAL MANAGEMENT PLAN
ON
LENGARICA HYDROPOWER PLANT**

PETTRAN MUNICIPALITY - PERMET

GJIROKASTER PREFECTURE

Part A: Plan of Mitigation Measures

Stage	Problem	Mitigation measures (Environmental& Social)	Cost		Institutional Responsibilities		Comments (f.e. secondary impacts)
			Installation	Operation		Installation	
Construction	Material Supply and Hiring new manpower						
	a) <i>Hiring manpower</i> Emplotement of local new manpower	a) Selection and testing of new manpower	a) Supervisor	a)	a) Site manager Employment office	a) Site manager	a) To be specified in individual work contract documents.
	b) <i>Site construction</i> Land engagement, water and power supply, removal of sewage and wastes	b) Find and use a safe place, possibly close to work place. Settlement of dormitories, warehouses and parking. Providing of water and power supply, installation for WC, removal of sewage and wastes.	b)	b)	b) Site manager	b) Site manager	b) In tender documents for subcontractor to be specified work technical conditions and materials to be supplied.
	c) <i>Concrete plant, stone Quarry</i> Dust, gas from fuel consumption, noise, health and work safety, ecosystem concerns.	c) Use the nearest concrete plants Use excavated material (stones and crushed stones) from tunnel.	c)	c)	c) Concrete plant and tunnel manager	c) Concrete plant and tunnel manager	c) In tender documents for subcontractor to be specified work technical conditions and materials to be supplied..

	<i>d)) Explosives and auxiliary equipment</i> Warehouse safety and hiring of guard personnel.	d) Use safe place and possibly close to work place.	d)	d)	d) Safety responsible of the object	d) Safety responsible of the object	d) In tender documents for subcontractor to be specified work technical conditions and materials to be supplied.
	Material Transport						
	<i>a) Stone and crushed stones from tunnel</i> Dust	a) Cover the loaded truck	a) 50 €/month	a) Minimal	a) Truck's driver	a) Truck's driver	a) To be specified in tender docs.
	<i>b) Sand and gravel</i> Dust	b) Cover the loaded truck	b) 50 €/month	a) Minimal	a) Truck's driver	a) Truck's driver	a) To be specified in tender docs.
	<i>c) Traffic Management</i> Noise, discharge of gas from fuel consumption, traffic blocking	c) Use non-peak traffic hours Use alternative road	c)	c)	c) Truck's driver	c) Truck's driver	
	Intake, desander and entrance tunnel construction						
	<i>a) Construction works</i> Earth structure damage	a) Apply excavation following project	a)	a)	a) Project constructor	a) Works leader	a) In tender documents for subcontractor to be specified work technical conditions and materials to be supplied.

	<i>b) Construction works</i> Waters	b) Implement dam works following project Ensure stabilized normal residual water in the river bed	b)	b)	b) Project constructor	a) Works leader	b) To be specified in technical docs.
	<i>c) Ecosystem</i> Surface cover and vegetation mass Flora and fauna	b) Implement excavations following project Earth mass to be kept for terrain filling and flattening During works for excavation of channel track and desander to respect surface with forest vegetation, trees and vegetation.	b)	b)	b) Works leader	b) Works leader	b) To be specified in technical docs. .

	c) <i>Rehabilitation</i> Terrain systematization, Planting forest trees Protection works	c) Earth distribution filling holes and leveling surface. Planting autochthon trees: - buying saplings - dig holes - sapling planting Protection walls construction at landslides and stream crossing.	c) 3 € x 103 = 309 € 1.5 € x 103 = 154.5 € 0.5 € x 103 = 51.5 €	c)	c) Works leader	c) Works leader	c) To be specified in technical docs.
			Shuma: 515 €				
	Tunnel construction						

	<i>a) Construction works</i> Damages from mining works Channel construction works Risks to health and work safety	a) Implement excavation following project, Work monitoring by geologists Implement requirement of technical safety during mining works and explosive use, individual work protection means to be used	a)	a)	a) Project constructor	a) Works leader	a) In tender documents for subcontractor to be specified work technical conditions and materials to be supplied.
	<i>b) Transport in the tunnel</i> Excavated material, concrete and prefabricates for channel construction	b) Implement works following project Stone and crushed ones to be deposited at the entrance to be than removed by trucks Concrete and other materials transport with trucks, inside tunnel with <i>dekovil</i> (narrow gauge railway), no stockpiles to be created Implement requirement of technical safety for each work category	b)	b)	b) Works leader	b) Works leader	b) To be specified in technical docs.

	<i>c) Rehabilitation</i> Terrain systematization at entrance and exit gate	c) To systemize slopes and terraces over tunnel entrance following project To be drained relief part over upper part of tunnel entrance and exit Remove excavation and concrete residues from tunnel entrance and exit.	c)	c)	c) Works leader	c) Works leader	c) To be specified in technical docs.
	Pipe line construction						
	<i>a) Construction works</i> Earth structure damage, Pipeline assembling emergent discharging pipes to the reservoir connection to penstock	Implement work following project Build a channel or pipeline up to the river at the reservoir at tunnel exit to discharge emergent waters.	a)	a)	a) Project constructor	a) Works leader	a) In tender documents for subcontractor to be specified work technical conditions and materials to be supplied.

	<i>b) Ecosystem</i> Surface cover and vegetation mass Flora and fauna	b) Implement excavation following project Deposited earth to be used for filling and terrain flattening. Respect forest vegetation, trees and herbs when executing excavation of pipeline track. River gravel not to be touched for construction activities	b)	b)	b) Works leader	b) Works leader	b) To be specified in technical docs.
	<i>c) Rehabilitation</i> Systeming of gravel, sand and su-clay at the river bed area. Terrain systeming, planting forestal trees at river shores and other places where erosion is verified. Protection works.	c) Distribute earths filling holes and leveling surface close to pipeline track. Planting autochthon trees: - buying saplings - dig holes - saplings planting Protection walls construction at landslides and stream crossing	c) 3 € x 243 = 729 € 1.5€ x 243 = 364.5 € 0.5€ x 243 = 121.5 €	c)	c) Works leader	c) Works leader	c) To be specified in technical docs.
			Shuma: 1 215 €				

	Powerhouse construction						
	<i>a) Construction works</i> Earth structure damage, Pipeline of water discharges in the river	a) Excavations following the project. Build a channel or pipeline up to the river at at exit tunnel reservoir to discharge emergent waters.	a)	a)	a) Project constructor	a) Works leader	a) In tender documents for subcontractor to be specified work technical conditions and materials to be supplied. .
	<i>b) Ecosystem</i> Surface cover and vegetation mass	b) Implement excavation following project Deposited earth to be used for filling and terrain flattening.	b)	b)	b) Works leader	b) Works leader	b) To be specified in technical docs. .
	<i>c) Rehabilitation</i> Flattening terrain, Protection works	c) Distribute earths leveling surface Weir and protection wall construction at river sides	c)	c)	c) Works leader	c) Drejtuesi i punimeve	c) To be specified in technical docs. .

	MV transmission line construction						
	<i>a) Construction works</i> Earth structure damage, Poles and cables line	Implement excavation of pole holes following project Carry out MV transmitting line mounting using line axis	a)	a)	a) Project constructor	a) Works leader	a) In tender documents for subcontractor to be specified work technical conditions and materials to be supplied.
	<i>b) Ecosystem</i> Damaged vegetation, Surface cover and vegetation mass	b) Implement excavation and concreting of poles following project Deposited earth to be used for filling and terrain flattening	b)	b)	b) Works leader	b) Works leader	b) To be specified in technical docs.
	<i>c) Rehabilitation</i> Systeming terrain,	c) Earth distribution leveling surface	c)	c)	c) Works leader	c) Works leader	c) To be specified in technical docs..

	Management of emission in air, water and land						
	<i>a) Solid waste</i> Construction and urban waste	Stockpiling of all construction residues at every SHPP compound. Their removal at assigned (by municipality) place and terrain flattening. Collection of urban waste resulting from staff life activity and their treatment with municipality urban waste.	a)	a)	a) Sector leaders	a) Site manager	a) In tender documents for subcontractor to be specified work technical conditions and materials to be supplied.
	<i>b) Land and waters pollution</i> Fuel supply, vehicle repair, workshop operation	b) Prudently manage fuel and oil supply of vehicles and motoric means Motoric means repairmen works and other ones in workshop, separate management of used oil waste and spare parts. Oil to be kept in special container to be recycled.	b)	b)	b) Sector leaders	b) Site manager	b) To be specified in technical docs.

	c) <i>Emission in air</i> Dust and gas	Use installation and machineries certified in EU countries. Wet excavated materials during loading & unloading. Wet drilling to be used in mining works Use individual work protection means when necessary (protecting mask)	c)	c)	c) Sector leaders	c) Site manager	c) In tender documents for subcontractor to be specified work technical conditions and materials to be supplied.
	d) <i>Noise emission</i> Noise during construction works	d) Use installation and machineries certified in EU countries. Use individual work protection means when necessary, in tunnel, nearby heavy machineries, etc.	d)	d)	d) Sector leaders	d) Site manager	d) In tender documents for subcontractor to be specified work technical conditions and materials to be supplied. .
Operation	Operation of SHPP						
	a) <i>Operation regime, maintenance</i> Generation, service	Keep under control production technical parameters and of equipment control Respect work technical safety requirement	a)	a)	a) Shift chief	a) Technical leader	Specify in contract docs. – Technical specification for machineries and equipment use and maintenance..

	<i>b) Noise</i> Noise emission during turbine work	b) Use equipment and systems certified in EU countries Respect work technical safety requirement for exposure to noise	b)	b)	b) Shift chief	b) Technical leader	b) Specify in technical docs. On SHPP operation
	<i>c) Solid waste</i> Repair and urban waste	c) Collect recyclable solid waste and treat them following environmental law acts Urban waste to be treated with municipality ones.	c)	c)	c) Shift chief	c) Technical leader	c) Specify in technical docs. On SHPP operation
	<i>d) Land and water pollution</i> Use of materials polluting land and air	d) Keep under control equipment and work operations causing land and water pollution with oil and other pollutant Respect technical safety requirements during equipment repairs and using of pollutants	d)	d)	d) Shift chief	d) Technical leader	d) Specify in technical docs. On SHPP operation
	<i>e) Substation, electric line of MV transmission</i> Electromagnetic fields	e) Use equipment and systems certified in EU countries. Respect work technical safety requirement for exposure to electromagnetic fields	e)	e)	e) Shift chief	e) Technical leader	e) Specify in technical docs. On SHPP operation

	<i>f) Water Flow Management</i> Design water Residual water Irrigation water	f) During use of design water follow the project. Keep a normal and stabilized residual flow in the river bed to not endanger habitat and water system (lotic) Design residual water flow standards (0.1 m³/s) to be revised. The sufficient flow of residual flow must be 0.3 m³/s in order ecosystem to be safe. During irrigation period of agriculture lands to be respected terms of contract with Water Basin Committee and Water Association. Create possibilities to farmers in need for irrigation to use HPP water channel. Stop power generation during irrigation period (July-September).	f)	f)	f) Shift chief	f) Technical leader	f) Specify in technical docs. On SHPP operation
Environm. Consultant: Dr.Magdalena Cara,	Prof.Dr.Spase Shumka, Agustin Cara			Page 137 of 177			

GREEN FOR GROWTH FUND
SOUTHEAST EUROPE
INVESTING IN ENERGY EFFICIENCY
AND RENEWABLE ENERGY

TECHNICAL ASSISTANCE FACILITY
REPRESENTED BY

OPPENHEIM ASSET MANAGEMENT

8.- Environmental and social monitoring plan

- 8.1.- Pre-construction phase**
- 8.2.- Construction phase**
- 8.3.- Operational phase**

GREEN FOR GROWTH FUND
SOUTHEAST EUROPE
INVESTING IN ENERGY EFFICIENCY
AND RENEWABLE ENERGY

TECHNICAL ASSISTANCE FACILITY
REPRESENTED BY

OPPENHEIM ASSET MANAGEMENT

Part B: Monitoring Plan

Stage	Parameters under monitoring?	Where is the parameter to be monitored?	How shall be monitored parameter / type of monitoring equipment?	Where shall be monitored ? (measurement frequency or continuously)	Why shall parameter be monitored? (compulsory)	Cost		Institutional Responsibilities	
						Installation	Labor		
Before the construction									
Material supply									
(1) <i>Site construction</i>	a) Site situation	a) Work conditions, dormitories	a) By inspection	a) Before starting work	a) a) To be ensured work conditions meet health safety environment protection requirements	a) Supervisor	a)	a) Site leader	a) Site leader

<i>b) Concrete plant</i>	b) If the license is valid	b) Concrete plant	b) By inspection	b) Before starting work	Technical requirements on concrete	b) Supervisor	b)	b) Plant operator	b) Plant operator
<i>c) Explosive materials' warehouse</i>	c) Its situation	c) Custody conditions	c) By inspection	c) Before starting work	For technical safety	c) Supervisor	c)	c) Warehouse keeper	c) Warehouse keeper
Materials' Transport									
<i>a) Stone and crushed stones, sand, gravel, other materials</i>	a) Cover of truck	a) Work place	a) By inspection	a) Once a week, in evening	a) To be ensured work conditions meet health safely and environment protection requirements.	a) Minimal	a) Minimal	a) Works' leader	a) Works' leader
<i>b) Technical control of vehicles while not working</i>	b) Technical situation	b) Parking place	b) By inspection	b) Preadvised inspections during work	b) To be ensured work conditions meet health safely and environment protection requirements.	b) Minimal	b) Minimal	b) Works' leader	b) Works' leader

<i>c) Water and land pollution from solid, liquid wastes, from fuel supplying equipment and transport vehicles</i>	c) Water and land quality (suspense staff; oil, grease)	c) Transport road and parking place	c) By visual inspection, lab analyses if required from work supervisor	c) During work and especially when are verified atmospheric precipitation	b) To be ensured work conditions meet health safely and environment protection requirements.	b) Minimal	b) Minimal	b) Works' leader	b) Works' leader
Hydropower plant construction									
<i>a) Construction of intake, desander, and entrance channel to tunnel</i>	a) Works on surface, excavations, construction of concrete structures Water and land quality (suspense staff; oil, grease)	a) Work place, in river	a) By visual inspection, lab analyses if required from work supervisor	a) Before starting work	a) To be ensured work conditions meet health safely and environment protection requirements.	a) Minimal	a) Minimal	a) Works' leader	a) Works' leader
<i>b) Tunnel construction</i>	b) Excavation works, concrete structure construction Tunnel air quality, noise	b) Work place,	b) By visual inspection, lab analyses if required from work supervisor	b) Before starting work and during work	b) To be ensured work conditions meet health safely and environment protection requirements.	b) Minimal	b) Minimal	b) Works' leader	b) Works' leader

<i>c) Penstock construction</i>	c) Work on channel track, concrete structure construction Water and land quality (suspense staff; oil, grease)	c) Work place, In river	c) By visual inspection, lab analyses if required from work supervisor	c) Before starting work	c) To be ensured work conditions meet health safely and environment protection requirements.	c) Minimal	c) Minimal	c) Works' leader	c) Works' leader
<i>d) MV transmission line construction</i>	d) Construction works for pole and cable assembling Water and land quality (suspense staff oil, grease).	d) Work place, Along line axis	d) By visual inspection, lab analyses if required from work supervisor	d) Before starting work	d) To be ensured work conditions meet health safely and environment protection requirements.	d) Minimal	d) Minimal	d) Works' leader	d) Works' leader
<i>e) Rehabilitation of terrain in HPP works</i>	e) Works on flattening of surface, planting, supporting walls construction Water and land quality (suspense staff; oil, grease)	e) In each works, In site	e) By visual inspection, lab analyses if required from work supervisor	e) After work termination	e) To be ensured work conditions meet health safely and environment protection requirements.	e) Minimal	e) Minimal	e) Works' leader	e) Works' leader

HPP operation									
<i>a) HPP operation</i>	a) Hydraulic line, gates, valves, turbines and generators, control equipment	a) Work place in each works,	a) By visual inspection, by measurement apparatus check and measurement s if required by technical operational leader	a) Before starting work	a) To be ensured work conditions meet health safely and environment protection requirements.	a) Supervisor	a)	a) Maintenance responsible	a) Technical leader
<i>b) Monitoring of hydraulic line</i>	<i>b) Monitoring of hydraulic line</i>	<i>b) Monitoring of hydraulic line</i>	b)By visual control and technical manouvre if required by technical operational leader	b) Before staring work.	b) To be ensured work conditions meet health safely and environment protection requirements.	b) Supervisor	b)	b) Shift chief	b) Technical leader
<i>c) Monitoring of water flow</i>	<i>c) Monitoring of HPP flow water, Monitoring of river bed residual water</i>	c) At dam or in HPP, At dam	c) By metering water quantity	c) Every day	c) To be ensured work conditions meet health safely and environment protection requirements.	c) Supervisor	c) Minimal	c) Shift chief	c) Technical leader
<i>d) Monitoring of water quality</i>	<i>d)Monitoring of HPP water quality, Monitoring of</i>	d) At surge basin At the	d) Measuring of water quality (physical and chemical	d) Every 3 months (following Council of Ministers	d) To be safe on production parameters and on the fact work	d) Supervisor	d) Minimal	c)) Shift chief	c) Technical leader

	<i>river bed residual water quality</i>	fragmented river segment (downstream thermal waters)	parameters). - pH, - Conductivity - Temperature - COD - BOD ₅	Decision No.1189 dd. Nov. 2009 "On monitoring of environment in Republic of Albania).	conditions are respecting environmental protection.				
<i>e) Monitoring of noise</i>	e) Measurement of noise level	e) At powerhouse	e) By visual inspection, lab analyses if required from work supervisor	e) Every month	e) To be ensured work conditions meet permanently health safely and environment protection requirements	e) Supervisor	e) Minimal	e) Shift chief	e) Technical leader
<i>f) Monitoring of wastes</i>	f) Collection and removal of solid wastes, used oils, recyclable mechanical spare parts Water and land quality (suspense staff, oil, grease)	f) At powerhouse	f) By visual inspection, lab analyses if required from supervisor	f) Every month	f) To be ensured work conditions meet health safeTy and environment protection requirements.	f) Supervisor	f) Minimal	f) Shift chief	f) Technical leader
<i>g) Monitoring of electro-magnetic field</i>	g) Measurement of electromagnetic field components	g) – At HPP substation, - Along line axis	g) By instrument measurement	g) – twice a year : - Once when generate in full capacity,	g) To be ensured work conditions permanently meet health safety and	g) Supervisor	g) Minimal	g) Shift chief	g) Technical leader

				- Once when generate in low capacity	environment protection requirements.				
<i>h) Monitoring of air</i>	h) Air quality measurement	h) At powerhouse	h) By instrument measurement	h) Every quarter	h) To be ensured work conditions permanently meet health safely and environment protection requirements	h) Supervisor	h) Minimal	h) Shift chief	h) Technical leader

GREEN FOR GROWTH FUND
SOUTHEAST EUROPE
INVESTING IN ENERGY EFFICIENCY
AND RENEWABLE ENERGY

TECHNICAL ASSISTANCE FACILITY
REPRESENTED BY

OPPENHEIM ASSET MANAGEMENT

9. - Conclusions and Recommendations

We are of the opinion that under the project:

- New and detailed geological and hydrological studies are carried out; local resources and community interest of project zone are reconsidered.
- Project studies have advanced in projecting improved parameters of water resource use.
- Implementation project tried to solve integrally possibilities that are offered for technical details with natural environment protection, other plans and projects of local development and interests of project zone community.

In the summary of updated social and environmental assessment of Lengarica SHPP project, ESIA group has identified some problems and is of the opinion to present them to projecting group and to the audience.

Hereinafter follow some our recommendations:

- Information regarding underground waters hydrogeology of project area had to be more complete. We are of the opinion the said information must be completed considering river flow interaction, karst phenomena and deep geothermal springs located in the fragmented zone of Lengarica river.
- Design standard on “residual water” flow at dam (200 lit/sec. or 0.2 m³/s) is acceptable for Lengarica small tributary river. It makes possible the survival of fragmented zone of the river, especially aquatic system (lotic) downstream Thermal Waters and some endemic species of the “red list” in extinction danger.
- To maintain during all the year a stabilized minimal level of “residual water”.
- Considering the period 15 June – 15 September is the typical climatic period with fewer rains the water flow has no be used for power generation.
- To the farmers of the lower part of the river might be created the possibility to use HPP waters for irrigation during dry season.

Appendices:

**Annex 1: Matrix of Negative and Positive Environmental and Social
Impacts**

Definition of Main Environmental Impacts

of

Project proposed by “Lengarica & Energy” sh.p.k.

for

**SMALL HYDROPOWER PLANT
Petran - Përmet Municipality, Gjirokastrë Prefecture**

(Following ESIA methodology presented in the Environmental Minister Instruction No.6, dated December 27, 2006 “On preliminary assessment of environmental impacts of a project or an activity”)

Subject’s addressee and contact

Subject: “Lengarica & Energy” sh.p.k.

Subject’s headquarter and contact details:

“Lengarica & Energy” sh.p.k - a member of enso hydro
Rr. „Eqerem Çabej“- Nd. 6 - H. 2,
Njesia Bashkiake Nr. 5
1022 Tirane
Tel. +43 (3182) 2216-810, Fax DW -380
NUIS: K83026602A

Name of the person in charges:

ANNEX I

Table 1. Interactions with the environment. Potential/essential impacts

The present table includes a series of requirements being of assistance to asses if a project shall have interactions with environment as well as to decide if an activity shall have or not potential/essential impacts in the environment elements.

Questions to be considered for the classification	Yes / No / ? Briefly describe	Shall be verified important interaction/impact? Yes / No / ? - Why?
During project implementation or operative activity:		
1. Shall be verified physical changes in territory (in topography, land or water sources use etc.)?	Yes. In all SHPP works shall be carried important excavation, especially in opening 4000 m long tunnel. Additional road construction infrastructure works will be carried too.	Yes. This shall be accompanied with land use and small topographic changes, water use on power generation. Lengarica river shall be derivate; a tunnel for water channel shall be opened. Excavated earth shall be used to fill depressed locations defined by local authorities. Meanwhile rock material, gravel, shall be reused in construction.
2. Shall be used natural sources: as land, water, materials or energy, especially those sources that are not renewable or are scarce?	Yes. River water and land for construction shall be used.	Yes. Shall be river flow changes, land destination changes (from forest to construction one) as result on the said project. From the activity shall have: - consumption of these natural sources and supplies. - power and technologic water consumption in processing and production of construction materials.
3. Is it foreseen the storage, transport or production of substances or materials harmful to the health and environment?	Yes. - It is foreseen explosive material use such as trotyl (75055.34 kg, fuses, detonators. - it is foreseen fossil fuel use for transport vehicles.	Yes. - There is as considerable interaction in the process of tunnel excavation and in the scarification of rock material. - Fuel (gasoil) gases are in a moderated quantity and have a seasonal distribution.
4. Shall be verified the	Yes.	Yes.

production of solid wastes?	- During preparatory works will be removed vegetation mass and earth from the rocky surface. - From tunnel excavation activity, the construction of objects and vital activity of plant workers is calculated to have a minimal quantity of 10÷15 kg per day of solid wastes	- Shall be excavated and removed about 6000 m³ vegetation mass, earth that shall be distributed in the nearby filling depressed parts of terrain. - Shall be produced and transport ad about 57298 m³ rocky material, crusted stone.
5. Shall be verified in-air discharge of pollutants, dangerous, toxic or poisoning substances?	Yes. During tunnel opening activity shall be emitted gases of explosive materials and of transport vehicle gases.	Yes. In-air gas discharge of explosive material gases and of fuel burning is a negative relatively small contribution in polluting the zone air. Polluted gas in-air discharge in rural areas theoretically is calculated as a negative impact diminished due to fast in-air dilution.
6. Shall be verified noise, vibrations or light, energy or electromagnetic radiation?	Yes. During construction activities is calculated to have such processes for relatively short time periods.	Yes. Environmental impact of noise, vibrations, radiations and thermal energy is negative and moderated. Application of activities with explosion, excavation, welding, aggregate and concrete production is important for the construction of SHPP works.
7. Shall be verified any danger for land or water pollution due to pollutant discharge on ground surface or ground & under-ground waters, or sea waters?	No. Practically are not foreseen periodical or casual discharges of different pollutants on ground surface, on waters.	No. No environmental interaction.
8. Is there any accident risk that may affect man's health or environment?	Yes. There are such risks.	Yes. Construction works in a broken mountainous terrain, especially in tunnel works, transport of materials in big volumes, may affect health and work safety of the workers. Environmental impacts, especially in terrain damage, shall be inconsiderable and controlled.
9. Shall be verified social impacts (demographic, in the	Yes. Shall have positive social and	Yes. Social and economic impact is

traditional life style, employment etc.?)	economic impacts.	significant and very important for community of the zone: - seasonal and definitive employment shall be verified. - shall be improved supply quantity and service quality of power. - shall have animation of economic activity of other businesses such tourism, social service, trade, and small handicraft and industrial production. - irrigation system shall be improved and shall be increased irrigated surface. - No demographic movement of population is foreseen due to the realization of the project.
10. Are there other factors to be considered as consecutive developments that may affect the environment or possibility of different impact superimposition, being them from existing or planned activities in the zone?	Yes. River water derivation: - Limits habitats of flora and fauna, especially aquatic one (lotic). - may have effects on thermal water sources situated in the fragmented river segment. - changes irrigation system of agriculture lands.	Yes. - At first, the project is classified as clean production (CMD) and using renewable hydric sources, contributes every year on pollution reduction in the air and on climate changes, in general, with 2,840 ton CO ₂ / year. - Environmental impact is related to the threatening of some endemic species of flora and aquatic fauna. - Project may have its impact on the project of using thermal waters for cures and tourism.
11. Are there protected areas from international / national legislation for their biodiversity, ecological, landscape values or having cultural, historical and archeological values, in the said zone?	Yes. At Petran municipality, Përmet are the following zones and objects with such values: - Bënja Canyon – natural monument, - Bënja Thermal Waters - natural monument, - Pigeons Cave – natural monument. - Brigde of Kadiu – historical architectonic monument, - Rock of Petran – natural monument - Fir of Petranit – natural monument - Area of Hotova firry – national park. - Kisha e Shën Mërisë, Kisha	Yes. Protected natural, archeological, historical and cultural objects are guides for ecotourism, cultural and curative tourism in Petran municipality, Permet. They support zonal economic development. Project is integrated to the nature and shall support zonal economic development.

	e Leuses, Kisha e Bënjës (churches) are protected historical religious and cultural monuments.	
12. Are there sensitive zones like bogs, seaside zones, mountains, forests, pastures, flora and wild fauna, fruit trees etc.?	Yes. In the vicinity are these sensitive zones: - Benja Canyon, - Thermal waters situated in the fragmented part of river bed.	Yes. - Derivation of water flow shall decrease water at the Canyon. - Additional hydro geological information needed to consider river flow impact on thermal waters supply.
13. Are there zones with protected, important or sensitive species, endangered, in extinction danger of fauna and flora p.sh. fee. coupling, nestling, rest, wintering, migration etc,	Yes. Along Lengarica river are zones with protected, endangered species according to IUCN: - flora species: Sambucus nigra, Cladium mariscus, Ranunculus lingua, Salix triandra, Juglans regia, - fauna species: Salamandra salamandra, Triturus vulgaris, Bufo bufo, Rana dalmatin.	Yes. Project limits partially their habitat. - Part of river close to thermal water is less affected because it's less frequented from these species. Close to it is encountered only amphibian <i>Rana balcanica</i> . - At lower river part, where is located powerhouse, again we have the joining of fragmented flow to the existing river bed. That is why the impact is partial.
14. Are there areas with ground, underground or sea waters?	Yes. - Lengarica river water is object of SHPP project. - About 2 km downstream, at the river bed are located Benja thermal waters.	Yes. We think that the lack of information we cannot judge on the extent of the impact between surface and underground waters.
15. Are there areas with distinguished landscape features?	Yes. There are areas with distinguished landscape features in the vicinity of SHPP: - Benja Canyon, - Karstic caves at Canyon, - Brigde of Kadiu, - Rock of Petran and embouchure in Vjosa river. - Nëmërçka mountain and all mountainous area close to it, are areas with distinguished landscape features.	Yes. The said areas and natural objects will serve to touristic guides.
16. Are there roads or similar infrastructure used by the public to go in spa etc. or transport overcharged roads that might be affected?	Yes. - There is the reconstructed motor road going from Permet to Thermal Waters.	Yes. Activity impact on the road infrastructure is positive because these reconstruction roads are results of

		implementation of the project in the said area.
17. Are there existing land use (housing, industry, trade, recreation, agriculture, forest, tourism, green surfaces, sports, other private ownership) or future plans that may be impact subject?	Yes. In the area nearby the project are located: - Benja Thermal Waters used for curative purpose, - Canyon and nearby area is used as diverting, sportive and mountainous tourism zone, - Agriculture lands downstream valley river are used for the growing of different agriculture cultures, vineyards, etc.	Yes. - Project improves irrigation and quality system of agriculture land irrigation. - Support other plans of land use through power supply improvement.
18. Is the zone under pollution or environment damage (where environmental standards are exceeded)?	No. It is a rural zone free of industrial pollutions.	No. There are not important interactions of damage of natural environment due to intervention fro works construction.
19. Does the zone have problems related to earthquakes, landsides, extreme climate conditions (temperature changes, fogs, strong winds)?	No. The zone has no problems related to such natural phenomena.	No. There are not important interactions. Rare natural erosion phenomena are verified.

Lengarica SHPP shall be constructed on river, Petran municipality, Permet. Permet is located in the Albanian Southern mountainous zone.

Type of SHPP is with water flow derivation including intake, tunnel, and penstock, in a length of about 7 km.

Intake shall be build upstream Benja Canyon at the elevation of 410 m. a.s.l.

Powerhouse will be located at 258 m. a.s.l., 500 m upstream Vjosa river embouchure.

The installed capacity is 8.6 MW with annual production of 28.4 GWh. Total investment is foreseen at 17.322 MEUR.

ESIA is carried out based on EU Directive No.85/337/EEC dated June 27, 1985 "On the assessment of the effects of certain public and private projects on the environment", Appendix II, Article 3/h and Albanian Law No.8990, date 23.01.2003 "On Environmental Impact Assessment", Appendix II, article 3 / e

Note hereinafter where is classified the project or activity:

Advanced ESIA	
Summarized ESIA	Yes
No need for ESIA	

A N N E X II

First part

Table 1. Identification of environmental impacts of the activities and environment issues to be considered by ESIA

No.	Questions to be considered during selection stage	Yes/No	Which are environmental elements that may be affected and how?	Does the impact shall be significant for environment? Why?
1.- Do the construction, operation or closing of activity and dismantling of technology and project installation include actions that shall cause physical changes in topography, land use, changes to water corpus etc.?				
1.1	Temporary and definitive changes on land use, ground cover or topography including land use intensity?	Yes	- River bed, - River flow, - Forest land where shall be located channel track and power house	- Definitive impact on land use (It shall be engaged). - Change and removal of ground cover material. - Small and definitive change and modification of topography of geographic terrain. - Water flow derivation in a river segment of about 7,670 m. - Intensity of river flow use is 3307 hours/annum (or 137.8 days), distributed in 4-5 months per annum, mainly December – April.
1.2	Cleaning of existing land, vegetation and constructions?	Yes	To construct the object it is necessary to remove the vegetation and earth.	Environmental impact is relatively small. Such works affect: - a surface of about 6,300 m². - removal of cover and vegetation material of a mass of about 6000 m³
1.3	Creation of new land use?	Yes	Land surface changes destination from forest to construction one.	Environmental impact from construction use of the land is relatively small, definitive.
1.4	Investigations before construction stage such as drillings to get samples, land and earth tests?	Yes	At project site are carried: - geophysical studies and getting of earth samples. - hydrologic measurement and getting of water samples.	No such impacts in the environment.

1.5	Construction works?	Yes	Works on: Work construction for - intake construction, desander and channel entrance 258 m long at the elevation 410 m, - construction of 4000 m long tunnel, - construction of 3,670 m pipe line, - construction of power house.	Relatively small environment impact.
1.6	Demolition works?	No	No such actions and works.	No such impacts in the environment
1.7	Temporary sites for construction works or sheltering construction workers?	Yes	It is foreseen construction of one or some construction minisites according to contracts for different SHPP works.	There are environment impacts on land use, changing its destination for construction of objects such as dormitories, warehouse, aggregate and concrete installation, vehicle parks, etc.
1.8	Over-ground works, structures or ground works including linear structures, excavations or filling?	Yes.	- Site establishment works with excavations, ditch opening, earth removal, terrain filling. - Construction works, walls and concrete structures, pipeline installation.	Environmental impact is moderated, definitive.
1.9	Underground works including mines or tunnels?	Yes	There are works for tunnel opening.	Environmental impact is considerable, definitive.
1.10	Improver works?	Yes	Derivation of water flow shall have a double use: power generation and agriculture land irrigation.	Economic and social impact is big.
1.11	Excavation for channel opening?	Yes	A total of 7,670 m is the length of water-way.	Environmental impact is considerable.
1.12	Seaside structures such as dam, wharf ages?	Yes	For a part river flow is foreseen construction of a mountainous derivation weir.	Definitive, relatively small environmental impact.
1.13	Structures in sea?	Yes	Not foreseen such structures.	No such impacts in the environment.

1.14	Different production processes?	Yes	Foreseen power generation according CDM procedure using hydro energetic potential of Lengarica river.	Impact is : - social and economic, considerable and continuous; - negative, small due to damage of geographic terrain and natural habitats.
1.15	Space for storage of goods and different materials?	Yes	Minisites and shall plan warehouse for equipment different materials.	Positive and negative additional environmental impacts.
1.16	Installations for treatment or depositing of solid wastes or liquid discharges?	Yes	Solid wastes of tunnel excavations shall be processed to produce aggregates for construction.	Small negative environmental impact.
1.17	Objects for long-term sheltering of operational stage workers ?	Yes	Provisional dormitories shall be build for SHPP workers.	Small negative environmental impact.
1.18	New road, marine or railway traffic during construction or operation?	Yes	- Reconstruction works on rural roads of 3d category, Petran municipality. - Shall be constructed 3 auxiliary road segments in total 500-600 m	Impact is: - very small negative environmental, - positive, social and economic for the extension of road infrastructure in project zone.
1.19	New road, railway, airline, marine or other transport infrastructure including new or alternated roads and stations, ports and airports etc.?	No	There are not such new construction.	There are not such environmental impacts.
1.20	Closing or deviation of existing roads or infrastructure causing changes in traffic flow?	No	There are not such new construction.	There are not such environmental impacts.
1.21	New transferring transmitting lines or pipelines?	Yes	Shall be build a underground water transmitting pipeline visible when cross the river.	There are such environmental impacts.
1.22	Reservoirs, dikes, underground channels, settlements or other changes in hydrology of water	Yes	- It is foreseen construction of a weir for derivation of a part of water river flow, water channel supplying SHPP	Environmental impact consist in: - limitation of habitat and aquifer system causing the threatening of some

	flows or aquifers?		and irrigation, other construction such as protecting wall etc.	species included in the "red book" or book of natural species in extinction danger. - Other not foreseen impact may happen in the hydrology of project zone
1.23	Streams interruptions	No	Full water streams interruptions shall not happen.	There are environmental impacts.
1.24	Extraction or transfer of water from underground or ground water?	Yes	Shall be a partial transfer of river water flow.	Environmental impact in the ecosystem of the fragmented river segment.
1.25	Changes in water corpus or in land surface that affect drainage of water removal?	Yes	- Residual water flow at fragmented river segment changes. - Irrigated agriculture land surface shall be increased.	- Negative and relatively small environmental impact on river ecosystem. - Considerable social impact to the farmers.
1.26	Transport of staff or construction, operational or waste materials?	Yes	- Shall have goods, materials and solid wastes transport during construction and operation time. - Shall have transport of staff.	- Environmental impact of staff, goods and wastes is negative. Due to fuel consumption shall have air pollution and urban waste production. - Positive social impact, improvement of staff work condition.
1.27	Long-term dismantling works to get out activity waste or restoration works?	Yes	Shall have such works not for longtime periods.	No sensible negative environmental impacts.
1.28	Activities during destination change that may result in environmental impact?	Yes	- River flow derivation works, - Tunnel construction works, Channel and powerhouse works.	There are negative environmental impact.
1.29	Temporary or continuous entrance of people in the zone?	Yes	In project zone shall enter project specialist and construction workers.	- Negative environmental impacts are inconsiderable. - Expected positive social impact for zone community.
1.30	Introduction for cultivation of not local species?	No	No such actions.	No negative environmental impact.
1.31	Loosing of local	No	No such actions.	No negative environmental

	species or genetic diversity?			impact.
1.32	Any other action?	No	Not identified any other actions.	No environmental impact
2.- Shall be used, during construction and operational use of the project stage, natural sources such as land, water, materials or energy, especially those sources that are not renewable or are scarce?				
2.1	Land extremely poor or agriculture land?	Yes	Forest land partially with high forest vegetation shall be used for construction site.	Relatively small negative environmental impact.
2.2	Water?	Yes	River water shall be partly used for SHPP power generation.	Environmental impact consists in use of renewable natural sources.
2.3	Minerals?	No.	No such actions.	No environmental impact.
Questions to be considered during the selection				
2.4	Stockpiling of construction materials (gravel, etc.)	Yes	There are such activities using construction stage.	Small environmental impact.
2.5	Forests and timber	Yes	All surface to be used is forest one.	- Environmental impact consists in engaging and destination alternation of forest found. - About 346 forest trees shall be damaged.
2.6	Energy including electricity and fuels?	Yes	Project foresees use of electric energy and fuels for vehicles.	- Small, temporary environmental impact of fuel use that emits in atmosphere gases produced by fossil fuels. - Positive economic and social impact.
2.7	Any other source?	No	Not identified any other source.	No environmental impact.
3.- Shall the project include use, storage, transport, processing and production of substances or materials that might be harmful for men health or for the environment and increase the concern on actual and potential risks on men health.				
3.1	Does the project foresee use of substance or materials that are harmful or toxic for	Yes	Project foresee use of explosive materials and detonators.	Small risk of damages and environmental impact. Foreseen to be carried out construction and mining works certified according

	men health or environment (flora, fauna, water supply)?			to respective EU countries norms.
3.2	Shall the project result in changes showing sickness or with effect in sickness vector (f.e. sickness transmitted through insects or water infections)?	No	No activities with such effects.	No impact in inhabitants' and workers' health.
3.3	Shall the project have impact on men well-being, f.e. changing life conditions?	Yes	Construction project of Lengarica SHPP (Petran municipality) is activity of power production based on hydric natural reserves of the zone.	Positive, definitive social impact of the project in favor of zone community for: - employment, - power supply stabilization, - improvement of irrigation conditions, - support of other businesses, especially mountainous tourism.
3.4	Are there group of people (especially sensitive) that may be affected by the project, f.e. hospital patients, old people)?	No	- Project does not directly affect such group of people.	- No negative health impact in group of people with such problems.
3.5	Other reasons ?	No	No other reasons.	No environmental and health impact.
4.- Shall be verified the production of solid wastes during construction, operational stage or getting out of function?				
4.1	Earth, gravel or mining wastes?	Yes	During construction (mainly tunnel) shall be produced aggregates, stones, crushed stones 49 020.5 m ³ .	Small environ. impact. Such wastes shall be used as construction material.
4.2	Urban wastes (indoor and/or commercial)	Yes	By sure shall have natural and urban wastes from life activity of staff and visitors.	Their environm. impact shall be v.small, negative and definitive. Their treatment and remove shall be done following respective Albanian law.
4.3	Dangerous or toxic wastes (including radioactive ones)	No	No such wastes.	No environmental impact. .

4.4	Other wastes resulting from industrial processes?	No	No such wastes	No environmental impact.
4.5	Additional products?	No	No such activities	No environmental impact.
4.6	Sewage or other washes by liquid discharge treatment?	Yes	- Shall have sewage from life activity, in septic holes of dormitories	Inconsiderable environ, impact due to sewage.
4.7	Construction or demolition wastes?	Yes	Construction wastes shall be removed at work termination.	Small environmental impact
4.8	Machineries or equipment wastes?	Yes	Machineries defect repairment, during construction and operation, shall generate wastes: unusable spare parts, metallic, plastic.	Small environmental impact Metallic, plastic, paper, used mineral oils that are changed shall be collected and sent in defined recycling destination.
Questions to be considered during selection				
4.9	Polluted lands or other ones?	No	No land or other polluted materials.	No environmental impact.
4.10	Agriculture wastes?	No	No such wastes	No environmental impact.
4.11	Other solid wastes?	Yes	No such wastes	No environmental impact.
5.-Shall be verified in-air discharge of pollutants or dangerous, toxic or harmful to health substances?				
5.1	Discharges of fossil fuel consumption from stationary or mobile stations?	Yes	Shall have discharges from: - burning of fossil fuels from vehicles, even generators in case of need. - explosion of explosives in tunnel.	Small, negative, temporary environmental impact. Their discharging norms shall be within Albanian and EU norms.
5.2	Discharges from production processes?	Yes	From technological processes of construction materials, sand, prefabricated concrete, granulated stone.	Small environmental and health impact.
5.3	Discharges from material processing including their depositing or transport?	No	No such wastes.	No environmental impact.
5.4	Discharges from construction activities including installations and equipment?	Yes	During construction process shall have waste discharges.	Small environmental impact.

5.5	Wastes or smells from material processing including construction materials, sewage and wastes?	Yes	Such wastes and smells may result during hydro isolation works, painting, etc.	Their negative impact is quite small, temporary. Limited staff persons shall be exposed. Their cleaning shall be done through tools of advanced technology.
5.6	Discharges from garbage incinerators?	No	No such wastes	No environmental impact..
5.7	Discharges from burning wastes in open air (materials from tree cutting, construction wastes?	No	No such wastes	No environmental impact.
5.8	Discharges from other sources?	No	Not results to have such wastes/discharges..	No environmental impact.
6.- Shall the project produce noise, vibrations or light, energy or electromagnetic radiation?				
6.1	From work of equipment such as motors, ventilation and frantumation installation, etc.?	Yes	Shall be verified noise, vibration emissions, energy release in some technological processes of mining works, in welding steel bars, in pouring the concrete, etc. These actions are time limited.	Negative, not big, temporary action. Noise and vibrations shall be in acceptable limits for such technologies. Installations and equipment shall be certified following Albanian and EU standards.
6.2	From industrial processes or similar ones?	Yes	Operational SHPP generates noises and electromagnetic fields.	Environmental impact is within accepted norms and standards.
6.3	From construction or demolition?	Yes	Shall have such emissions during construction.	Very small environmental impact.
6.4	From explosion or pile installation?	Yes	Dynamite to be used in tunnel mining works for rock disintegration.	Shall have environmental impact.
6.5	From traffic during construction or operation?	Yes	Material and excavation tunnel wastes transport will emit noise (vehicle circulation, loading, unloading).	Temporary negative impact of noise and vibration from traffic, to it is exposed a limited number of staff and inhabitants.
6.6	From lighting or cooling systems?	No	Most of construction work is done in open air.	No environmental impact.

6.7	From e-magnetic radiation sources (consider effects on nearby sensitive equipment, on people also)?	Yes	Electric substation and MV transmission line create e-magnetic fields,	No environmental impact, within allowed limits.
6.8	From any other source?	No	No other sources.	No environmental impact..
7.- Shall be verified any danger for land or water pollution due to pollutant discharge on ground surface, potable water pipelines and sewage channel or ground & under-ground waters, or sea waters?				
7.1	From processing, depositing, use or discharge of dangerous or toxic materials?	Yes	Temporary storage of explosive materials, dynamite in the warehouse of tunnels materials may happen.	Uncontrolled use of these materials comprises risk of environment damage. Their impact, being within accepted norms for such works category, is acceptable.
7.2	From sewage or other flow (processed or not) discharges in water or land?	No	No such risks.	Acceptable environmental impact.
7.3	Depositing of pollutants discharged in air, water or land?	No	No such risks..	Negative, minimal and within limits of Albanian and EU standards – environmental impact.
7.4	From any other source?	No	No other identified source.	No environmental impact.
7.5	Is there any long-term accumulation of pollutants in the environment from these sources?	No	No such risks..	Negative, relatively small, definitive, without any risk – environmental impact. Their treatment shall be within EU standards..
8.- Is there any accident risk, during construction and operational stage of project, that may affect man's health or environment?				
8.1	From explosion, fire, depositing or use of dangerous or toxic substances?	Yes	Project foresee explosive use.	There is risk of negative impact on environment and men health while using explosives. All actions with explosives shall be carried following regulations and respective norms of use.

8.2	From events exceeding limits of normal environment protection, i.e. pollution control system damage?	No	Project does not have equipment or installation to cause such events and damage of pollution control system.	No negative environmental impact due to these reasons.
8.3	From any other reason?	No	No such risks for any other reason..	No negative environmental impact
8.4	May project be affected from natural disasters that cause environmental damages (such as flood, earthquake, landslide, etc.)	Yes	Project may be damaged from river stormy fluxes, earthquakes, tectonic movement of rocky formations being support of channel track.	- Considerable economic and social impact. - Shall be impact on environmental damage
9.- Shall be verified social impacts (demographic, in the traditional life style, employment etc.) due to project implementation?				
9.1	Changes in population size, age, structure, social groups etc.?	No	Project shall not result in such changes.	No social impact due to these reasons.
9.2	From sheltering of people or house, community spaces such as schools, hospitals, social spaces, etc.	No	No such impacts for any other reason.	No social impact due to these reasons.
9.3	Through migration of new inhabitants or creation of new communities?	No	No such impacts shall be verified.	No social impact due to these reasons.
9.4	From meeting of increasing demand on social space and service such as accommodation, education, health?	No	No such impacts shall be verified.	No social impact due to these reasons.
9.5	From jobs created during construction or operation or losing jobs with impact on economy and un-employment?	Yes	During construction and operation of SHPP new jobs shall be created.	Positive impact in improving social situation and employment of their families.
9.6	Any other reason?	Yes	Is foreseen touristic center development, daily tourism, curative one that shall cause social and demographic changes.	Expected social, demographic and economic impact – very positive.

10.- Will the project lead to pressure for further developments that may have a significant impact on the environment, for example, more housing, new roads, industry or other support activities, etc.?				
10.1	Shall project create pressure for further development that might have a defined impact on environment such as accommodation/sheltering, new roads, supporting industries or public services.	Yes	Project shall support infrastructure of power supply for other new development activities.	- Considerable social impact for community of zone. From new construction activities shall have some land destination changes, use of mountainous terrain for touristic guides, use of natural resources, waste emissions, etc.
10.2	Shall the project lead in the development of supporting environments, in supportive development or development initiated by the project that might have Environmental impact, such as 1. supporting infrastructure (roads, power supply, treatment of waste or used waters, etc.), 2. development of accommodation 3. extracting industries 4. supplying industries 5. other?	Yes	Project foresee supporting development on tourism, road infrastructure, development of agricultural production processing, agricultural farms, etc. As a result, is foreseen to be increased the cultivated surface soil age plants.	- Positive important social impact. environmental impact related to urban and agro industrial development.
10.3	Shall project lead in reusing construction site after works termination, causing an additional environmental impact?	Yes	If an aggregate processing site/plant (no available information) shall be erected it shall be of use for entire Permet zone (there is not any of this kind).	Shall be environmental impact.
10.4	Shall the project lead on creation of a percent for later development?	Yes	Project shall alleviate different economic development. It foresee to enable further economic development in zone.	Small environmental impact due to perspective development. Very important and positive social impact.

			Power generation shall support commercial activities, social service and tourism.	
10.5	Shall project have cumulative consequences due to vicinity with other existing or planned projects with similar impact?	No	Our opinion is project under consideration does not have cumulative consequences with other objects.	Small, negative and definitive environmental impact. It shall be within Albanian and EU standards.

A N N E X II

Second part

Table 2. Characteristics of environment where project shall be developed

Question: Are there features of local environment to the nearby project location that may suffer impacts due to the project?

1.- Protected areas from international, national or local legislation for their ecologic, landscape, cultural and other values that may suffer impacts due to the project?

a.- Other important or sensitive zones due to their ecology as f.e.

Yes

b.- Bogs

No

c.- Water flows or other water corpuses –

Yes. Nearby project and in the fragmented river part are located Benja Thermal Waters.

d.- Coastal Zone:

No

e.- Mountains

Yes

f.- Forest or forest surface

Yes

2.- Zones used from protected, important or sensitive flora and fauna species, f.e. for coupling, nestling, food, rest, wintering, migration that may be affected by the Project?

Yes

3.- Inner, in-land, coastal, maritime and underground?

Geothermal Benja waters are close to project. Impact on them is not clear.

4.- Zone with high landscape and scenic values?

Yes

5.- Roads or other environments used by the public for rest or other activities?

Yes

6. – Transport overcharged roads (potential traffic problems) or cause environmental problems?

No

7. – Historical or cultural important zone?

Yes

Question – Is the project located in a zone that may be quite visible from many people?

No

Question – Is project located in a zone undeveloped before where shall have losing of green land?

Yes. Object construction shall be carried out in a forest surface covered with high forest vegetation, about 6,300 m².

Question – Are there existing land use in/nearby implementation project place that may be affected by project? For example:

a. Houses, yards or other private properties

Yes, not so close there are some rare houses and private properties.

b. Industry :

No

c. Recreation:

Yes. Close to project and in the river derivate segment are located Benja Thermal Waters.

d. Public spaces

Yes. Municipality forest zone.

e. Community' Environment

Yes. Automobile road leading to Benja Thermal Waters and going further to the villages of upper flow Lengarica river.

f. Agriculture

Yes. In vicinity are agriculture lands of Petran and Benja villages.

g. Forests

Yes. Petran Municipality forests.

h. Tourism Yes. Zone of Benja Canyon, Benja Thermal Waters, old Churches and other natural and architectonic monuments are used from tourists. i. Quarries or mines No
Question – Are there plans for future land use in or nearby to implementation project place that may be affected from it? - Yes. Petran Municipality Local Development Plan foresee establishing of a curative and touristic center close to Benja Thermal Waters. During the upper flow of Lengarica river are foreseen two other SHPPs.
Question - Are there, in the implementation project zone or in its vicinity, areas with high population or construction density that may be affected by it? No
Question – Is there any zone in / or nearby implementation project zone engaged in sensible land use that may be affected from it? a.- Hospitals No b.- Schools No c.- Cult objects No d.- Community' Environments No
Question - Is there any zone in and nearby the project which one includes high-quality or rare important sources that may be affected from it? a.- Underground water sources Yes. At project zone are situated Benja Thermal Waters. b.- Ground waters Yes. Lengarica river ground water shall be fragmented at project zone. Lengarica is tributary for Vjosa river. Power house is close to Vjosa river and endemic species

of river flora are exactly in the area from Lengarica embouchure to the vicinity of Water Terms. Also, migratory species of the river frequent the said river segment. c.- Forest Yes. d.- Agriculture Yes. e.- Fishing No f.- Tourism Yes. e.- Minerals No
Question - Is there any zone in and nearby the implementation project zone which actually is subject of pollution or environmental damages f.e. where existing environmental legal standards are exceeded and that may be affected by project? No. There are not polluted or damaged environmental zones.
Question – Does implementation project zone is sensible to earthquakes, landslides, erosion or other unfavorable or extreme climate conditions? No. Project is located in a seismic zone having magnitude 7 of Richter scale. During stormy atmospheric precipitation season mountainous river Lengarica turns in a tempestuous one.
Question – Are there probabilities the project to cause changes in physical conditions of from environment components? 8.- Atmospheric environment includes microclimate, climate conditions – local or even of a great extent? Yes. Project influence directly in the reduction of GHG emissions generating clean energy from hydric sources of Permet zone. Impact extent is reduction of 2,840 ton gas CO₂ equivalent. Water reduction in SHPP river segment has a small impact in the microclimate of zone. 9.- Water – f.e. quantity, flow or river levels, lakes, underground waters, Nozzle Spills, coastal or marine waters? Yes. Project foresees Lengarica river flow use for power generation. This causes

physical changes in the fragmented river part due to sensible residual water reduction up to 200 l/s.

10.- Land – f.e. quantity, depth, moisture, land stability or erobility?

Yes. 6,300 m² of forest land shall be engaged for construction changing its physical conditions. No risk for stability and land erosion where is located construction object. Derivation of water protects from erosion river side and agriculture lands hereby.

11.- Geological conditions and land surface?

Yes. Concrete structures strengthens geological conditions of the land on which shall be raised object deeds. Object construction shall be done on stable rock formation.

Question – Are there probabilities that discharges from project implementation influence in the quality of any environment components?

12.- Quality of local air?

No. Impact is very small.

13.- Quality of global air including climate changes and narrowing of ozone layer?

Yes. Generation of power from water resources substitutes power production from fossil fuels contributing directly in reduction of emissions in the air. The change is of global nature and consists in reduction of GHG and climate changes.

14.- Water quality: rivers, lakes, underground waters, embouchures, coast or marine waters?

Yes. Water reduction in the river bed may increase the salinity of Lengarica waters in the fragmented segment downstream thermal waters.

15.- Alimentary status and water eutrofication?

Yes. This may happen in the case of non uniform residual flow and behind Benja geothermal sources.

16.- Acidification of land or waters?

No.

17.- Land?

No.

18.- Noise?

Yes. During project construction and operation noise impact on the nearby environment quality is quite small.

19.- Temperature, lighting or electromagnetic radiation including electric intervention?

Yes. Shall have emissions of electro-magnetic field created by MV transmission line and electric substation but within allowed norms.

20.- Productivity of natural or agriculture systems?

Yes. Forest vegetation surface shall be limited by project development. Project influences improving of irrigation systems and increasing of irrigated agriculture lands.

Question – Are there possibilities the project to influence insufficiency of potential sources in local and global level?

a.- Fuels

No

b.- Waters

No

c.- Minerals and aggregates

No

d.- Timber

No

e.- Other not renewable sources

No

f.- Capacity of local infrastructure: waters, sewage, power generation and transmission, telecommunication, roads for waste depositing, railways?

Yes. Project increase considerably regional power generation and improves transmission system, increase and improve road structure of zone.

Question – Are there possibilities project to influence health or well being of community in the zone?

a.- Air, water, food and every other product consumed by man?

Yes. Project influence food quality through improvement of irrigation system and irrigation water quality.

b.- Morbidity or individuals, communities or population mortality due to exposure to pollution?

No.

c.- Appearance or distribution of sickness hosts, insects included?

No.

d.- Sensibility of individuals, communities or populations towards illness?

No.

e.- Individual perception of personal safety?

No.

f.- Cohesion and community identity?

No.

g.- Cultural identity and associations?

No.

h.- Minorities rights?

No.

i.- Accommodation conditions?

No.

j.- Employment?

Yes. Project creates opportunities for seasonal and definitive employment.

k.- Economic conditions?

Yes. Project helps economic condition improvement and well being increase of community of zone.

l.- Social institutions?

Yes. Project may influence positively in assistance to social institutions.

A N N E X II

Third Part

Criteria list on assessment of environmental and social impact importance Questions to be considered

1.- Shall be verified big changes in the environment?

Yes. Project causes big changes for a small community.

2.- Shall impact and repercussion in zone be unusual or complex?

Yes. It is expected impact to be unusual due to its complexity. Shall be verified positive economic and social impact and negative environmental ones having a complex nature in habitats and water systems, thermal waters, forest found.

3.- Shall impact and repercussion be extended in a big zone?

Yes. Impact is extended in a relatively big zone, compared to size of two villages of Petran municipality.

4.- Would be possible any potential cross border impact?

No

5.- Would have impact on considerable man and businesses groups?

Yes. Project shall create a positive impact on a considerable man and business group connected to project.

6.- Shall floristic and faunistic species having special protection status be affected?

Yes. Habitats of some endemic species classified in Albanian "Red Book" as endangered ones shall be limited.

7.- Shall natural sources with special values be affected?

Yes. SHPP construction indirectly shall produce a relatively small, negative

and definitive impact on complex of natural monuments in the nearby project zone.

8.- Does the risk of exceeding environmental standards exists?

No. In no case project causes risk to exceed environmental standards.

9.- Does the risk of negative impact on protected zones exists?

No. There are not protected zones nearby project.

10.- Does impact shall last for a long time?

Yes. Impact shall last as long as SHPL shall be operative. It is calculated for 100 years.

11.- Shall impact be more definitive than provisional?

Environmental impact shall be more definitive. Engagement of lands for construction and natural source use is definitive impact.
Generation of renewable energy and reduction of GHG shall be definitive in global level.

12.- Shall impact be irreversible?

Construction stage impact is irreversible (land engagement for construction),

13.- Shall be difficult to avoid, reduce, repair or compensate the impact?

Project succeeded to integrate very good its impact with many natural elements of nearby zone. It is possible to reduce and repair expected damages in habitats and river ecosystem, the potential impact on underground waters and other waters by increasing the quantity of residual flow in the river bed by going to in-depth study of hydrology of underground water of zone.

ANNEX III

List of consultations with other parties

Main groups of organizations and individuals which must be consulted during identification process (Table 1 as follows) are:

1.- Environmental Authorities:

a.- Regional and local authorities:

- Regional Environmental Agency, Gjirokaštër,
- Department of Public Health, Gjirokaštër,
- Water Basin Committee, Gjirokaštër.
- Petran Municipality

b.- Authorities responsible to control the pollution, including water, residues, land, noise and polluted air:

- Technical staff and managers of company implementing project
- Regional Environmental Agency, Gjirokaštër,
- Institute of Public Health Tirana,
- KESH Albania
- Hygiene Department Gjirokaštër,
- Environment Institute Tirana and other qualified organisms monitoring the pollution,

c.- Authorities responsible for protection of nature, cultural treasury and landscape:

- Technical staff and managers of company implementing project,
- Petran Municipality,
- Regional Environmental Agency, Gjirokaštër,

d.- Health Authorities:

- Department of Public Health, Gjirokaštër,
- Inspectorate Gjirokaštër,
- Petran Municipality.

e.- Authorities control land use, planning:

- Ministry of Public Works and Transport,
- Ministry of Economy, Trade and Energy,
- Ministry of Environment, Forest and Water Management,
- Council on Territory Regulation, Gjirokaštër Prefecture,
- Urbanity Office of Petran Municipality,

ë.- Authorities of neighbor countries in case of cross border impacts.

- Authorities responsible of neighbor countries that may be subject of impacts

2.- Other interested organizations:

- Local, national and international environmental groups as well as interested social groups:
 - Environmental associations,
 - Population of project zone,
 - Representatives of interested business.
- Responsible persons of governmental departments on waters, agriculture, energy, forests, etc. which interested might be affected
 - Administration of local government (Petran Municipality),
 - Water Basin Committee Gjirokaštër,
 - Regional Environmental Agency, Gjirokaštër,
 - Agriculture and Food Department, Gjirokaštër,
 - Department of Road Service, Gjirokaštër,
 - Department of Power (Energy) Service, Gjirokaštër,
 - Water Sewage Service Utility, Gjirokaštër,
- International and cross border agencies, which interested might be affected, such as water basin commission, etc.;
 - Unidentified organisms.
- Local employees and business associations such as Chamber of Commerce, commercial associations, etc.:
 - Chamber of Commerce Gjirokaštër,
 - Other business associations and other interested
..... Unidentified,
- Employers' organizations such as commercial unions etc.:
 - Green for Growth Fund
 - European Investment Bank, KfW Entwicklungsbank
 - EU countries.
- Groups representing environment users such as farmers, fishermen, tourists and local groups dealing with wild animals:
 - Unidentified organisms.
- Research-science institutes, universities and other expertise centers:
 - Unidentified organisms.
- Common public:
 - Inhabitants of Petran village,

- Specialists and other experts interested for cooperation.

3.- Common public:

a.- Owners and inhabitants

- Owners being at 'the border' with forest land proposed in the study,
- Inhabitants of project zone.

b.- Representative of local and broad public:

- Inhabitants of Petran Municipality,
- Environmental Associations, business ones and other interested,
- Other interested individuals.

c.- Elected representatives and community personalities such as religious community representatives, teachers etc.:

- Unidentified

d.- Local groups of community, residential groups, etc.:

- Inhabitants being owners nearby zone project,
- Other unidentified.

Table 1. The present table is useful to identify other actors that may be evolved at ESIA process

#	Party	Role and interest to the project	Need for information and consultation
1			
2			
3			
4			
5			
6			
7			