

**Workshop on “Developing Albania’s  
Hydroelectric Potential”,  
Tirana, June 3, 2016**

**IMPLEMENTING Rrapun 3&4 HPP**

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***Chief Technical Officer***  
***Infrastructure Projects***  
**AKTOR S.A.**

# Expertise in HPPs / Dams



## MAJOR PROJECTS

• Thisavros HPP & Earth Dam	River Nestos, North Greece	~ 200 mi €
• Smokovo Dam & Leontari Tunnel	Central Greece	~ 80 mi €
• Platanovrissi HPP & RCC Dam	River Nestos, North Greece	~ 120 mi €
• Mujib and Wala RCC Dams	Jordan	~ 80 mi €
• Mesochora HPP & Earth/Concrete Dam	Central Greece	~ 75 mi €
• Ilarion HPP & Rockfill Dam	North Greece	~ 115 mi €
• Evinos Aquaduct	Central Greece	~ 220 mi €
• Aposelemi Earth Dam & Water Supply	Crete island, Greece	~ 105 mi €

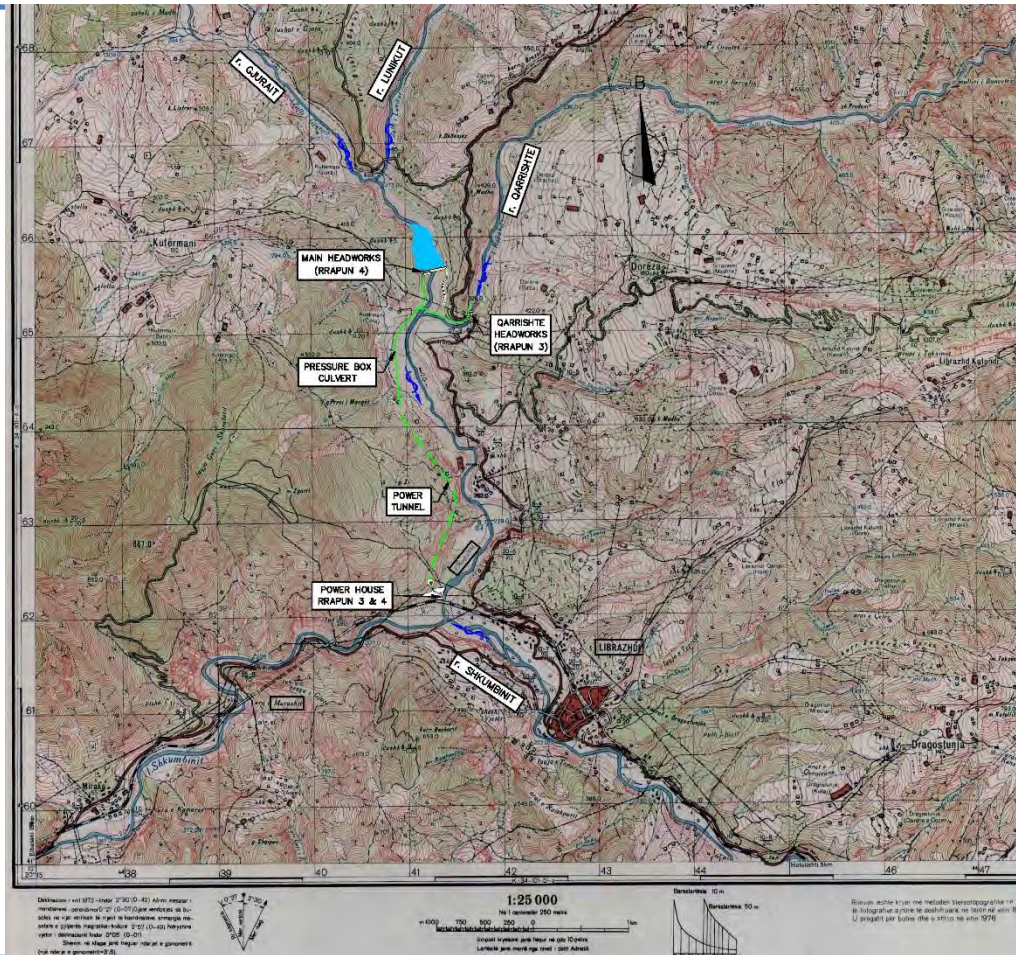
## MEDIUM / SMALL PROJECTS

• Papadia Earth Dam	North Greece	~ 35 mi €
• Pramoritza Earth Dam	North Greece	~ 21 mi €
• Setta-Mananikia Screening Dam	Evia island, Greece	~ 7 mi €
• Kannaviou Rockfill Dam	Cyprus	~ 35 mi €
• Gadoura Earth/Rockfill Dam	Rhodes island, Greece	~ 47 mi €
• Gratini Earth/Rockfill Dam	North Greece	~ 30 mi €
• Kritinia Dam	Rhodes island, Greece	~ 6 mi €
• Smixiotiko SHPP	North Greece	~ 10 mi €
• Rrapun SHPP	Librazhd, Albania	~ 24 mi €
• Metsovitikos HPP Supplem. Works	North Greece	~ 20 mi €

# HPP Rrapun

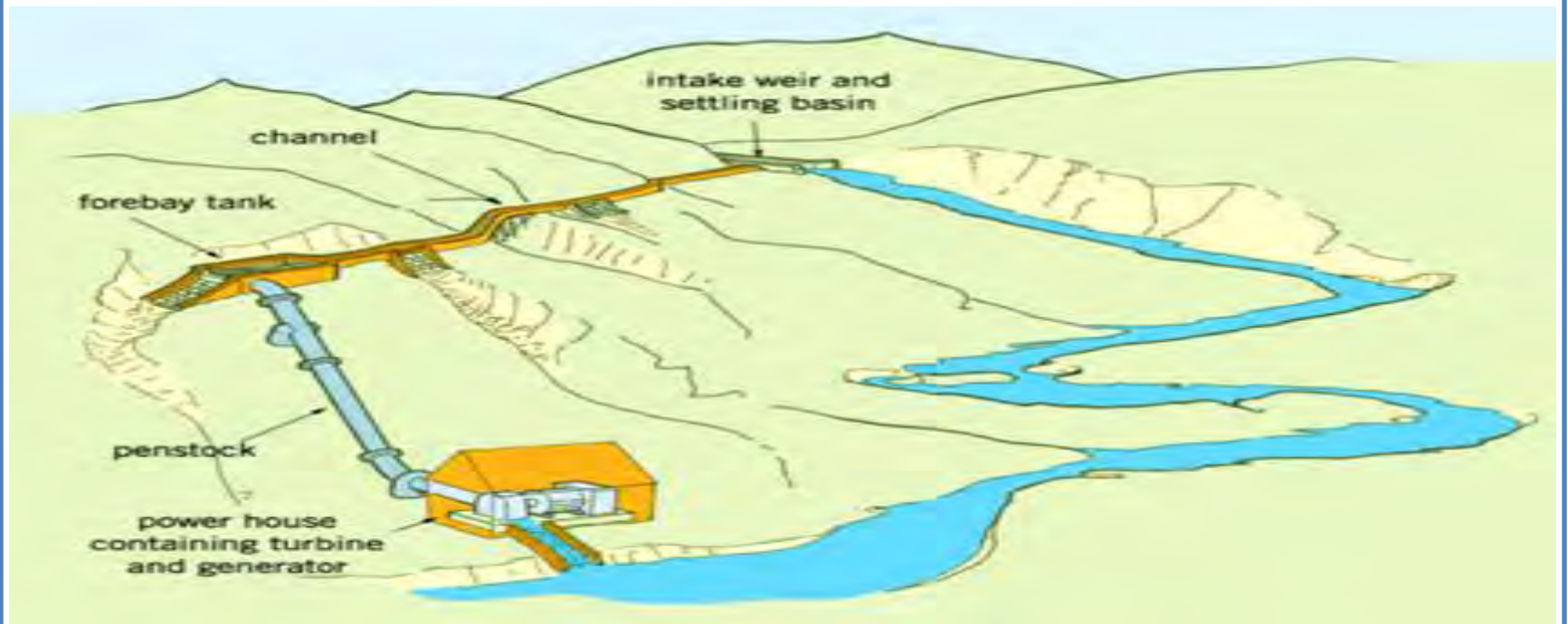


# HPP Rrapun





# HPP Rrapun



# HPP Rrapun

## Fact Sheet

### VALUE

Contract Value at Tender (excl. VAT)	14,500,000 €
Contract Value at Completion (excl. VAT)	24,000,000 €

### TIMELINE

Commencement Date	Aug. 2013
Expected Project Inauguration Date	mid July 2016

## Technical Characteristics

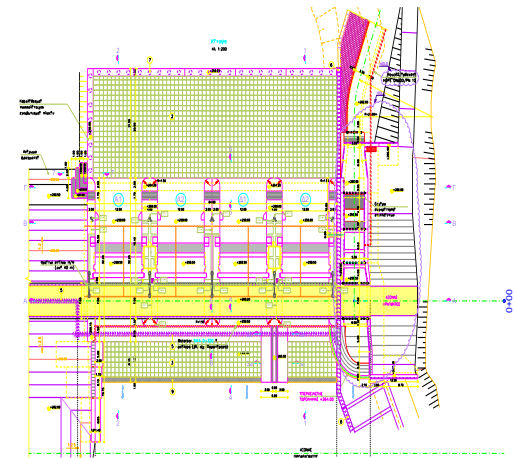
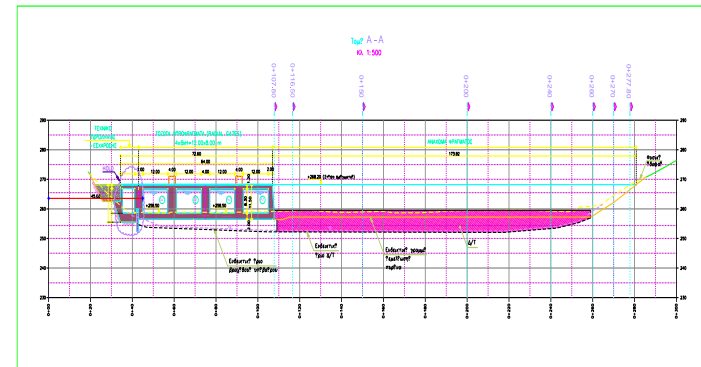
- Design Discharge : (17+10=) **27 m<sup>3</sup>/s** from two water intakes (Rrapunit, Qarrishte)
- Installed Capacity : **9,99 MW**
- Average Production : **43,83 GWh/year**

# HPP Rrapun

## Scope of Works

### 1. Rrapunit Water Intake: 17m<sup>3</sup>/s

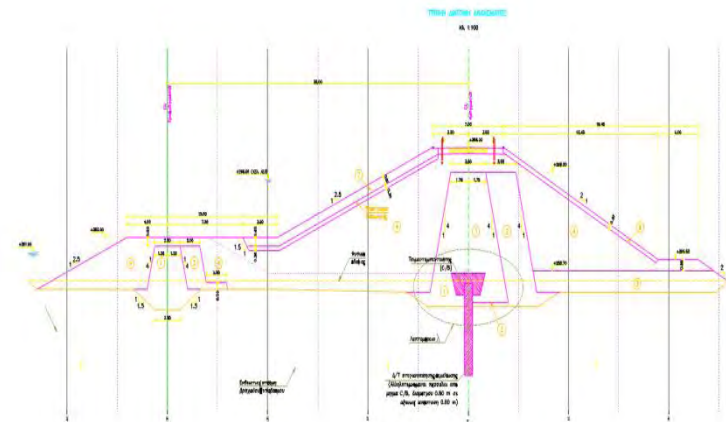
- Dam construction consisting of:
  - Three 12mx8m Radial Gates plus One 12mx8m Radial Gate with an 8mx2m flap (Overall length 65m - height 10m).
  - Earth Dam 177m long, 8.70m high above river bed with a 2.50m high foundation.
- The dam creates a basin 250m wide by 400m long (water intake area ~105.000m<sup>2</sup>, water volume ~400.000m<sup>3</sup>).
- Outflow from the dam through a lateral 16.30m spillway through a debris rack and into a concrete pipe.



# HPP Rrapun

## Earth Dam

- Core from **clay material**.
- Next to the clay material there are two types of **filter**.
- A number of **protection layers** from **selected aggregate** of variable sieve grading covers the dam.
- At the crest a **7m wide road** runs along the axis and is connected to a **7m wide bridge** over the radial gates.
- A **diaphragm wall** of interlocking **cement bentonite piles**,  $\Phi 800\text{mm}/600\text{mm}$ , runs along the dam in order to prevent leakage of water downstream.
- Construction of a **cofferdam** which will be part of the dam.

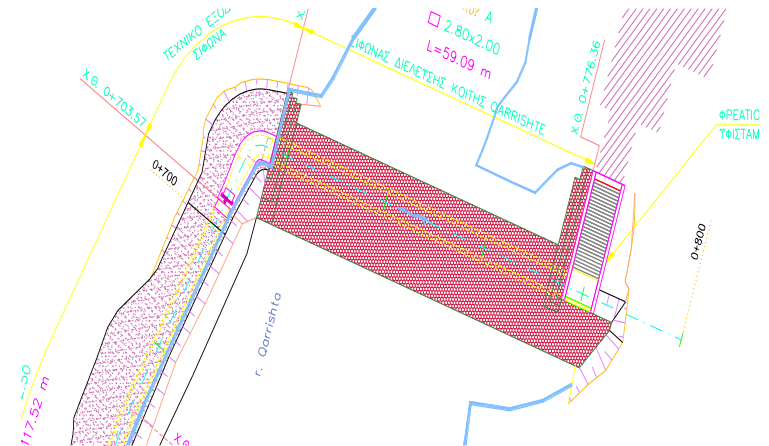




# HPP Rrapun

## 2. Qarrishte Water Intake: 10m<sup>3</sup>/s

- A **shaft** receives the outflow from HPP RRAPUN 2 and leads them to a **concrete pipe** through a siphon under the river bed of Qarrishte.
- A **concrete dam** with two 12mx6m **radial gates**, one of which with an 8mx1.60m **flap gate** for the reception of the flow in Qarrishte. The **outflow** goes through an 8m lateral **spillway** to a debris rack and into a concrete pipe.



# HPP Rrapun

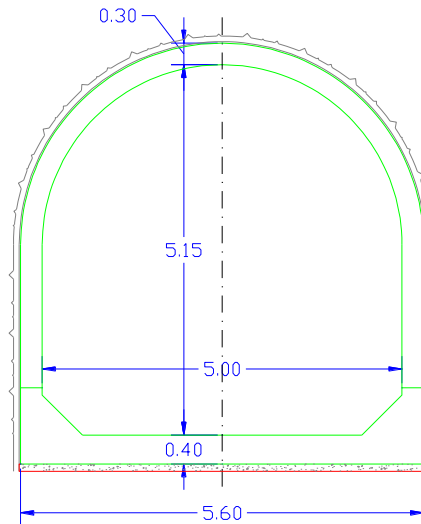
## 3. Flow from Intakes to the Plant

- A **single concrete box culvert** 3.30mx2.50 m carries the water **from Rrapun** intake for 400m.
- A **single concrete box culvert** with a 2.00mx2.50m and 2.00mx3.00m under free flow conditions leads the water **from Qarrishte** intake to a charging shaft and then to another single pipe with a 2.80x2.00 m under pressure, total length 780m.
- A **T junction** takes the water from the two branches into a **twin concrete box culvert** 2x2.80mx2.50m for **1.0km**.
- Then the water enters into a **2.3km tunnel**.
- At the end of the tunnel an 87m long, D 2800/15mm **steel pipe** receives the flow and leads it to the plant.
- Outside the power station the flow is divided into 3 parts, each part leading to a **Francis turbine**. Each pipe has an 1800mm diameter.

# HPP Rrapun

## 4. Tunnel

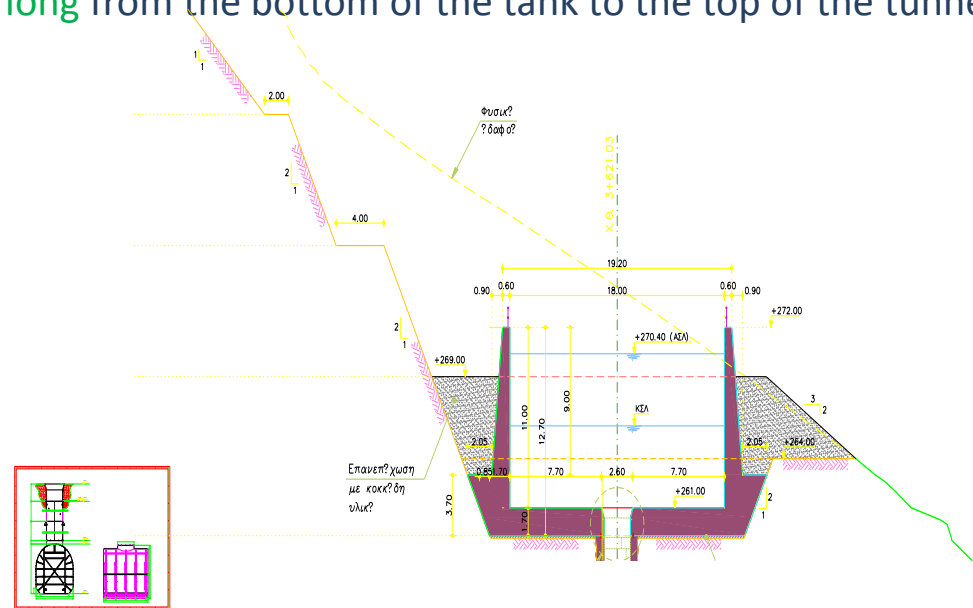
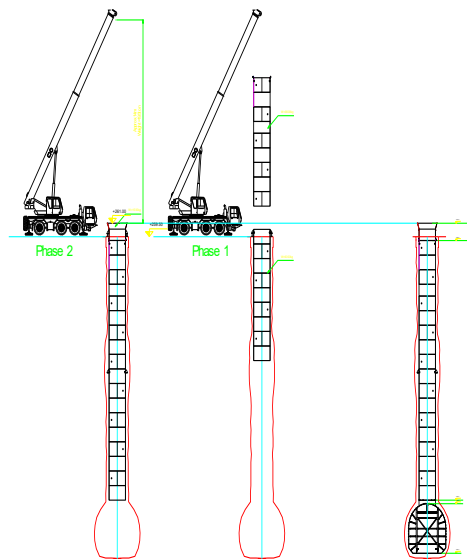
- Cross section **5.0m x 5.15m** forming an arc at the top, total length 2.3km.
- Construction method : **NATM**
- Construction of **adit**, total length 85m.



# HPP Rrapun

## 5. Surge Shaft/Tank

- An 18m in diameter, 11m high circular tank.
- A steel pipe  $\Phi 1800\text{mm}$ , 30m long from the bottom of the tank to the top of the tunnel.



# HPP Rrapun

## 6. Power Plant

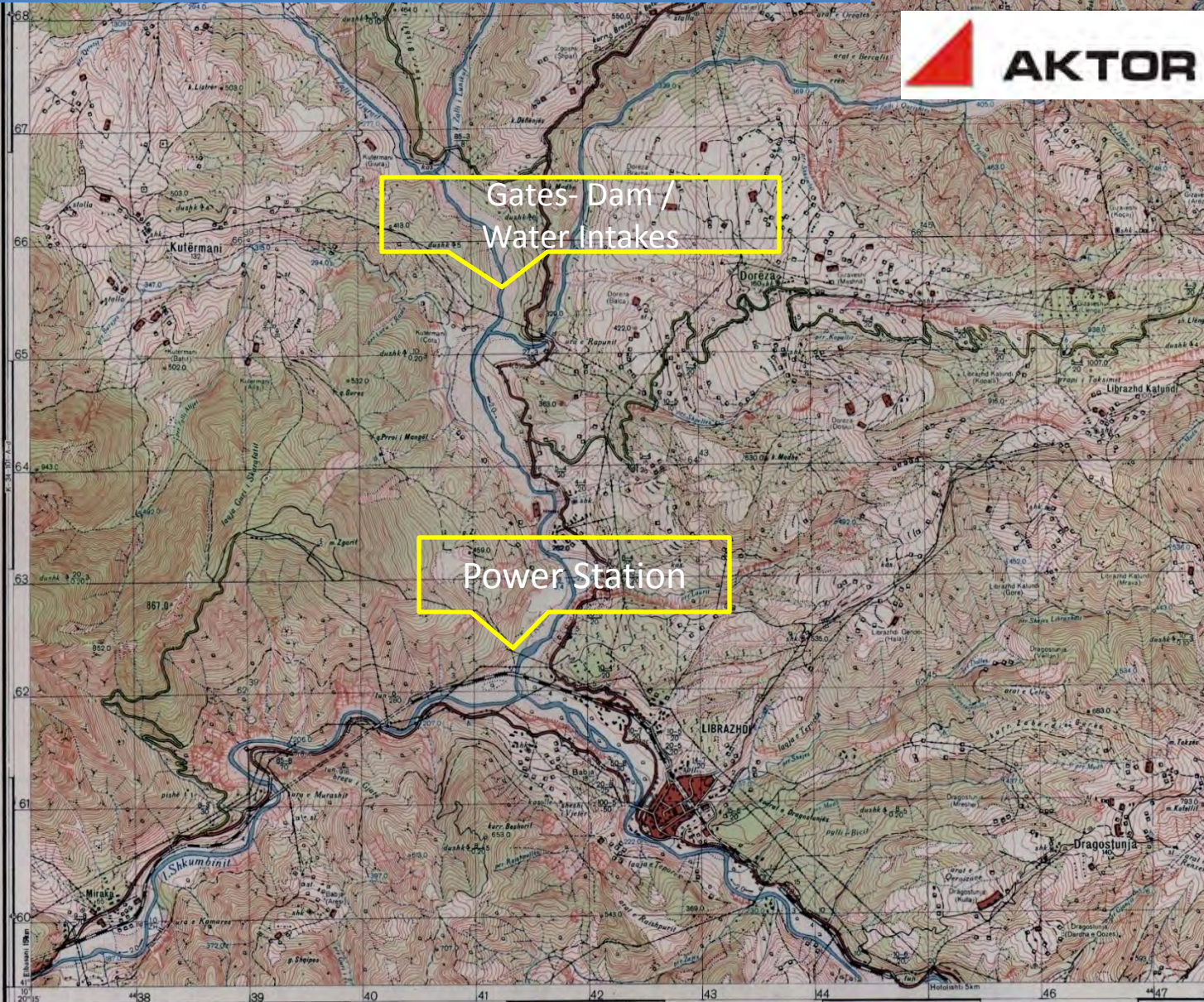
- The power station will have an **area** of approximately **900m<sup>2</sup>** and a height of 13m for the 600m<sup>2</sup> and 4.40m for the 300m<sup>2</sup>.
- A **crane** with a **30tn lifting capacity** and an **11.00m span** will serve for the installation and maintenance.
- **3 Francis turbines** with maximum output 3.3 MW per each
- **3 generators** with power output 3.780KVA-6.3KV-429rpm per each
- **3 main inlet valves** DN1800/PN6bar
- **3 Hydraulic Power Units**
- Step-up **power transformer** with output 12 MVA
- Outer **high voltage(110 KV) substation**
- Medium voltage(6.3KV-16KA/1sec) , low voltage and automation panels



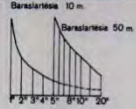
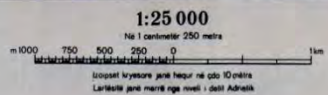
## HPP Rrapun

- At the start (**July 2013**)

# HPP Rrapun



Dëshmimi i vitit 1973 (indor 2'30 (0-42) Altim metar) i meridianeve - gjeodezike 0°27' (0-07) (Gjatë meridianeve të barabartë në një vertikale të rrejtë të koordinatave shtrëngje në shtetë e gjatësra magnetike - indore 2'37' (0-49) Ndryshimi vjetor e deklinacionit indor 0°05' (0-01)  
Shkrimi në klasën e parë regjistrat e gjeodezimit (në një rreth të gjeodezimit-3,6)



Rilindimi është kryer me metodën stereotopografike në bazë të fotografive ajrore të dëshifruara në tetën në vitin 1973  
U përgatit për botim dhe u shtyp në vitin 1976



Gates - Dam Crest Elevation +268,00

HWL +266,00







**Gates - Dam**

**JULY 2013**





**JULY 2013**

Existing Bridge  
KUTERMANI – River Banks





JULY 2013

QARRISHTË Banks



TUNNEL Portal &  
INLET Location





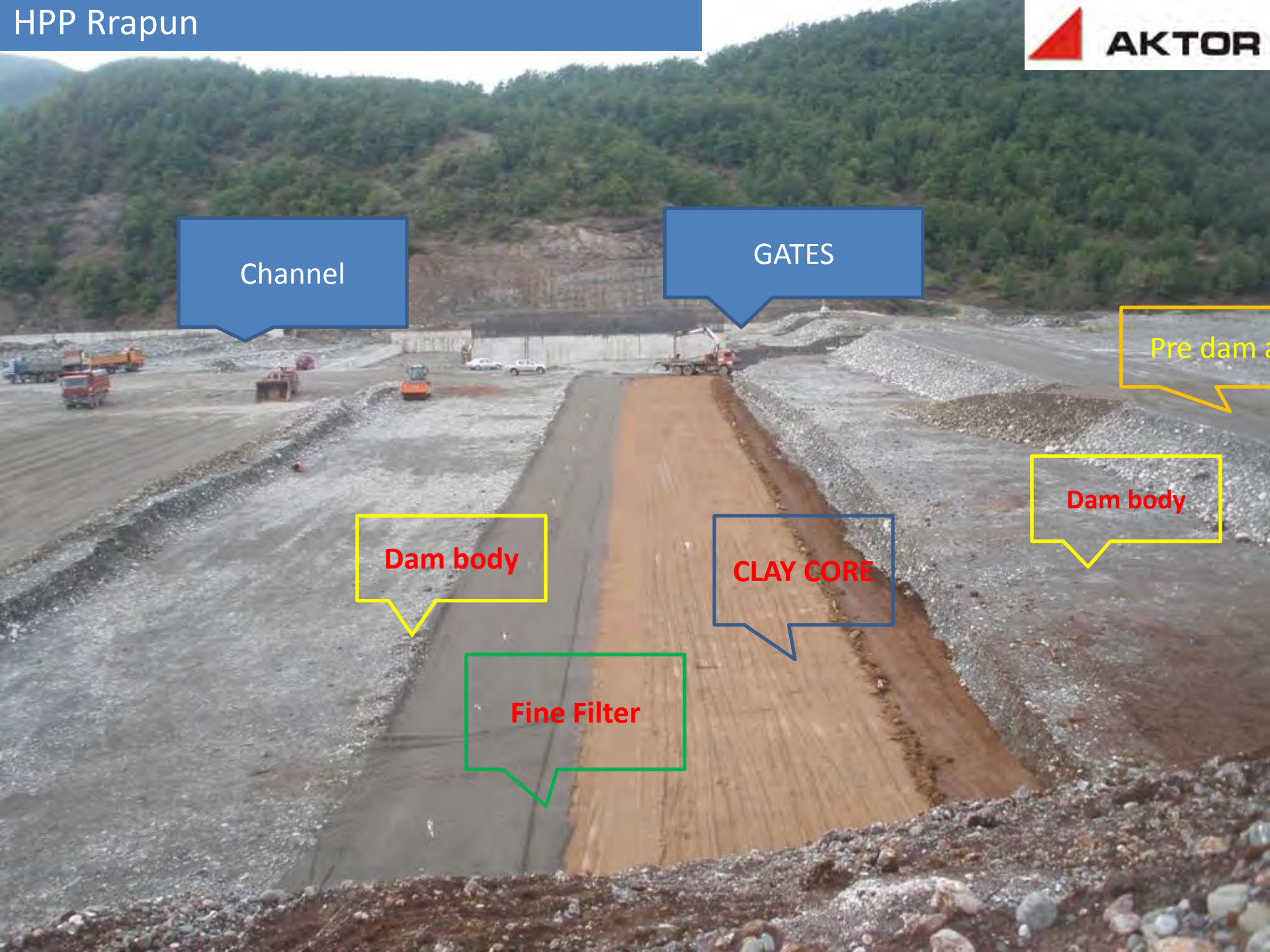


**POWER STATION**  
**Location**

## HPP Rrapun

- In the end (**April 2016**)





Channel

GATES

Pre dam a

Dam body

CLAY CORE

Dam body

Fine Filter





Surge Tank

TUNNEL Outlet

POWERSTATION  
Location





22/10/2013

Location of HV Substation



Rrapun



Rrapun





# HPP Rrapun





# HPP Rrapun



## HPP Rrapun

- [Rrapun Slideshow](#)

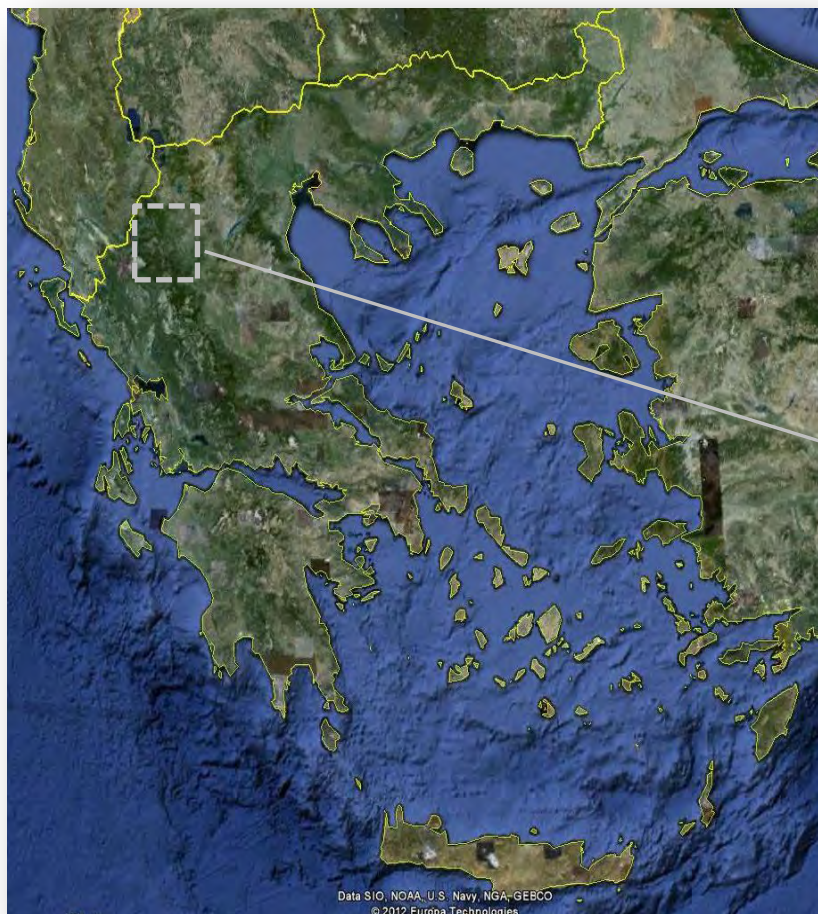


# HPP Rrapun

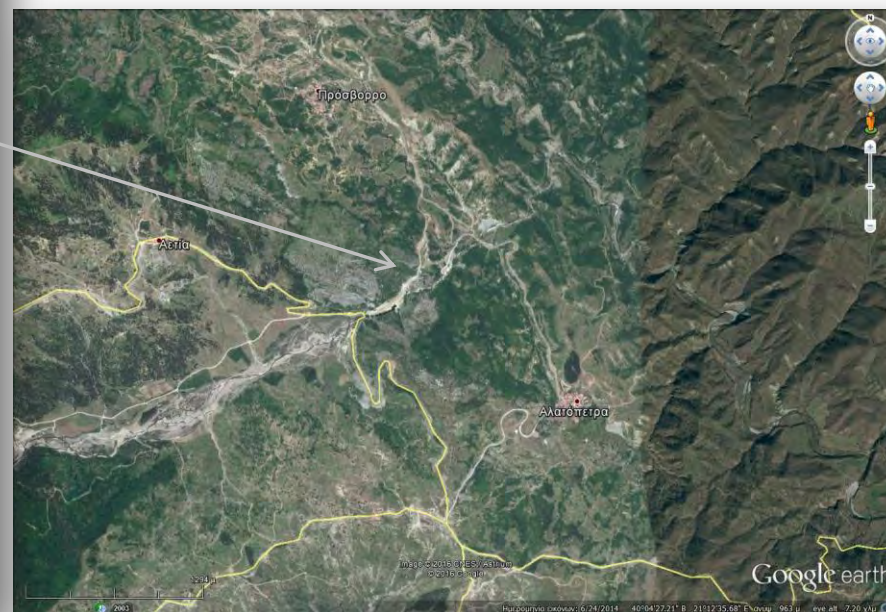




# SHPP SMIXIOTIKO S.A.



SHPP SMIXIOTIKO  
4,95 MW



# Project Identity

- Site : Smixiotiko stream, Grevena, Greece.
- License holder : “SHPP SMIXIOTIKO S.A.” (ELLAKTOR Group & PPC)
- Technology : Small hydro
- Licensed capacity : 4,95 MW
- Rated flow rate : 3,8 m<sup>3</sup>/s
- Gross head : 155 mWG
- Units : 1x2,6 m<sup>3</sup>/s Francis, horizontal  
1x1,2 m<sup>3</sup>/s Pelton 4j, vertical
- Energy yield : 12 GWh/yr
- CAPEX : 8,8 m€
- Commercial oper. : 03/2013





## Location - Licenses

Site : Sixiotiko stream, approx. 30 km W of Grevena  
Municipality of Grevena, Region of W. Macedonia.

### Licenses

- Production License : 12/2001
- Environmental License : 05/2012
- Operation License : 03/2013



# Key technical data



## SITE

Catchment area : 62 km<sup>2</sup>  
 Design flood (T=50 yrs) : 123,6 m<sup>3</sup>/s  
 Elevation : +958 m

## INTAKE

Type : gated, side spilway  
 Rated flow rate : 3,8 m<sup>3</sup>/s  
 Ecological flow rate : 112 l/s  
 Main gate : radial, 7,0 x 5,0 m, hydraulic  
 Service gate : radial, 1,5 x 2,0 m, hydraulic  
 Safety gates : flat, twin 1,5 x 1,5 m, hydraulic  
 Settler : twin, parallel concrete tanks, l= 23 m long  
 3% longitudinal slope  
 design sand capture mean diameter d = 0,35 mm  
 electric flushing gates (2)

## WATER WAY

Culvert (concrete) : l= 53 m (1,60 x 1,60 m), slope 0,3%  
 open channel flow,  
 Penstock forebay : 7 m long concrete tank  
 steel rack, 20 mm free bar spacing  
 hydraulic, automatic trash rack cleaner  
 Penstock : l = 500 m, DN 1200x12 mm,  
 steel (mat. no. 1.0254), spiral seam  
 outer protection PE coat (DIN 30670S-v)  
 inner protection epoxy resin min. DFT 400 µm  
 Quality control : 100% X-ray (on site welds) & pressure tested

## POWER HOUSE

Area : 373 m<sup>2</sup>  
 Height : 8,3 m  
 Elevation : +809 m

## TURBINE

Rated flow (m<sup>3</sup>/s)  
 Rated head (mWG)  
 Speed (rpm)  
 Rated power (kW)

Manufacturer

## GENERATOR

Capacity (kVA)  
 power factor  
 Voltage (kV)  
 Cooling  
 Code

Manufacturer

## TRAF0

Capacity (kVA)  
 Voltage (kV)  
 tap changer  
 uk  
 Cooling

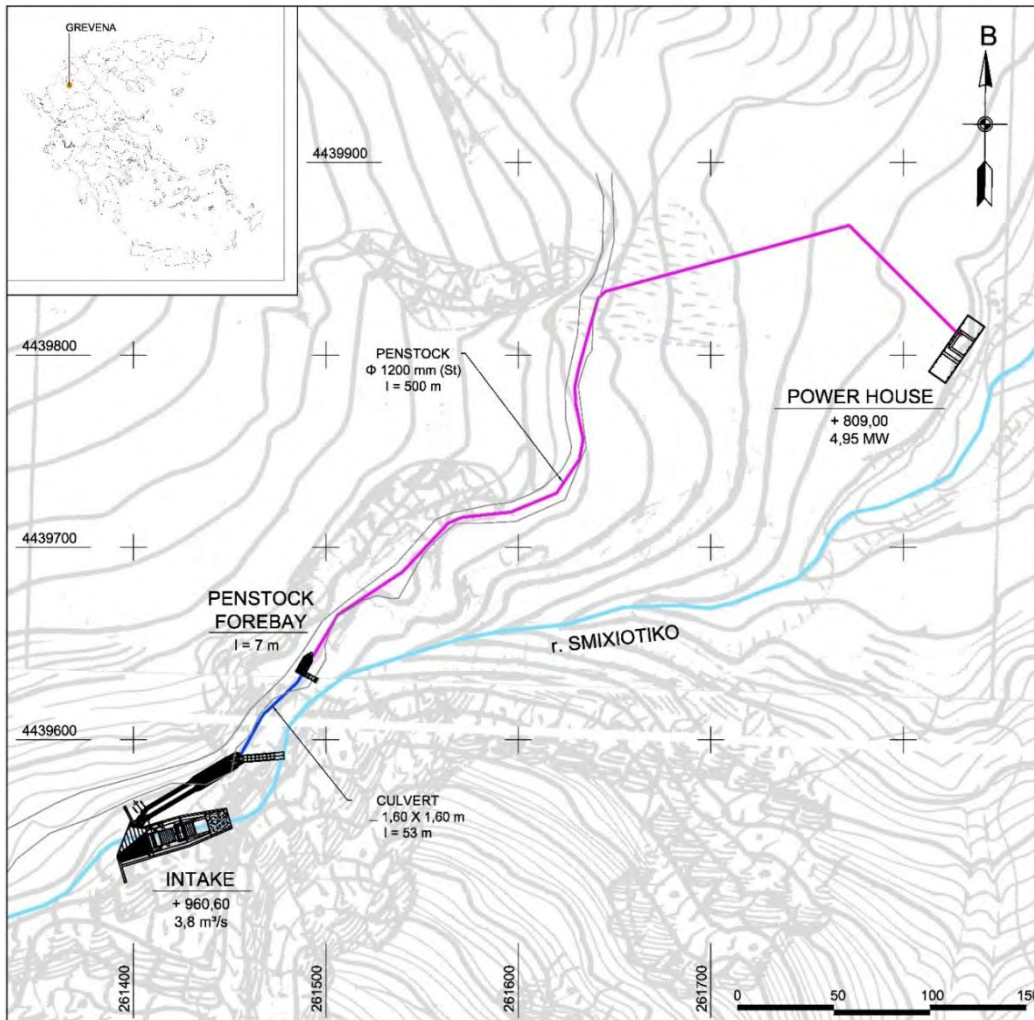
Manufacturer

## SWITCHGEAR

Type  
 M.V. switchboard  
 Breakers  
 L.V. switchboard  
 PLC  
 SCADA  
 Communication  
 Control principle

	<b>UNIT 1</b>	<b>UNIT 2</b>
	Francis	Pelton
	horizontal	4j vertical
	2,6	1,2
	150,6	150,9
	1.000	600
	3.485	1.590
	Kossler GmbH (Austria)	
	synchronous	
	3ph AC, 50 Hz	
	4.000	1.745
	0,9	0,9
	6,3	0,66
	IC21	IC21
	IEC 31	IEC 31
	AvK (Germany)	AEM (Germany)
	4.000	2.000
	6,3/20	0,66/20
	+/-2x2,5%	+/-2x2,5%
	>= 6%	>= 6%
	ONAN	ONAN
	Siemens	
	type tested (TTA)	
	SIMOSEC	
	Vacuum/3AH6/Siemens/630A/16kA(1s)	
	SIVACON	
	SIMATIC	
	fully auto & remote control	
	VDSL (OTE)	
	const. upstream water level	

# General arrangement







**Thank you for your attention**