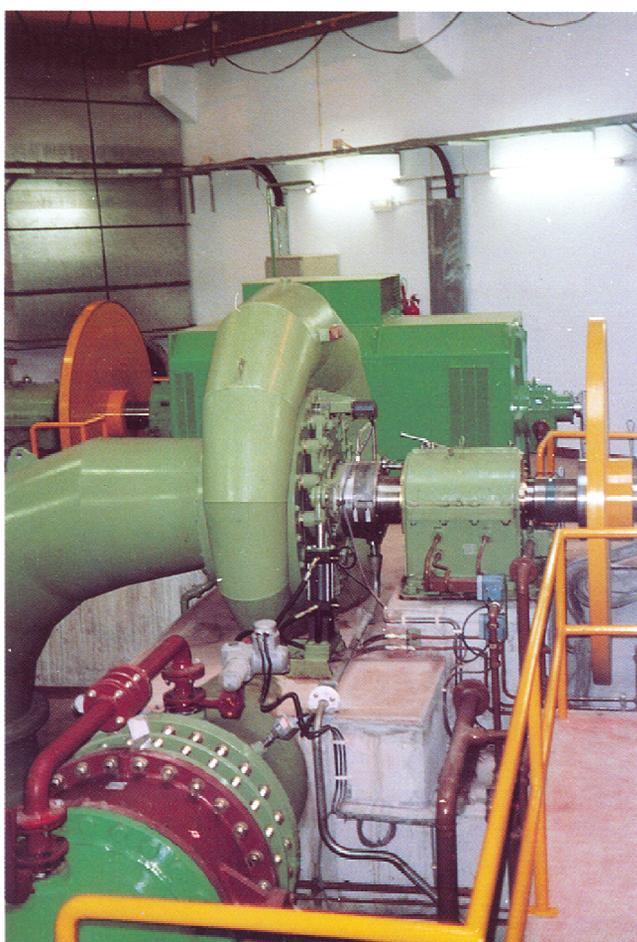




# **COVAS DO BARROSO**

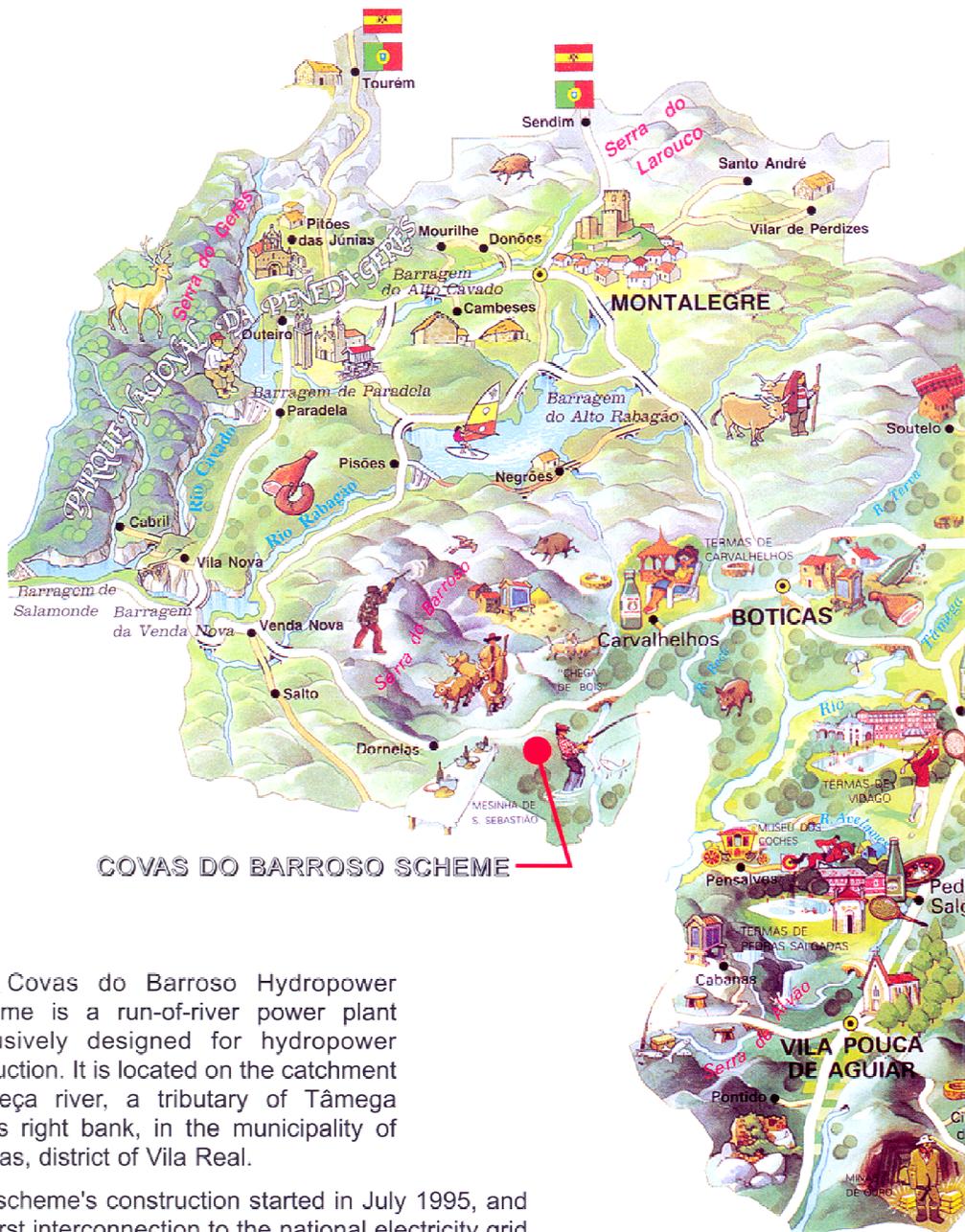
## **HYDROPOWER**

### **SCHEME**



**COVAS RIVER**

**COUTO RIVER**



COVAS DO BARROSO SCHEME

The Covas do Barroso Hydropower Scheme is a run-of-river power plant exclusively designed for hydropower production. It is located on the catchment of Beça river, a tributary of Tâmega river's right bank, in the municipality of Boticas, district of Vila Real.

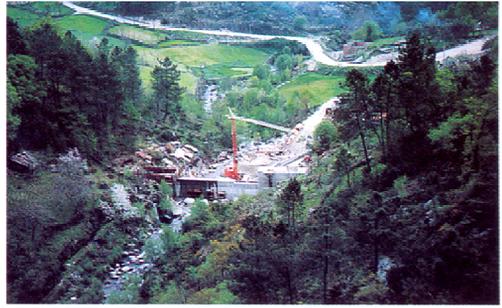
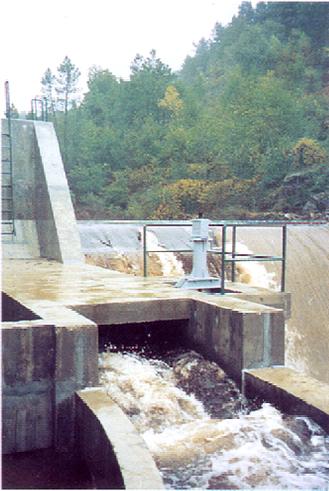
The scheme's construction started in July 1995, and the first interconnection to the national electricity grid took place in December 1996.

This power plant, with an installed capacity of 6,4 MW, was designed for a maximum discharge of  $5,7 \text{ m}^3 \text{ s}^{-1}$  and a maximum gross head of about 135,0 m.

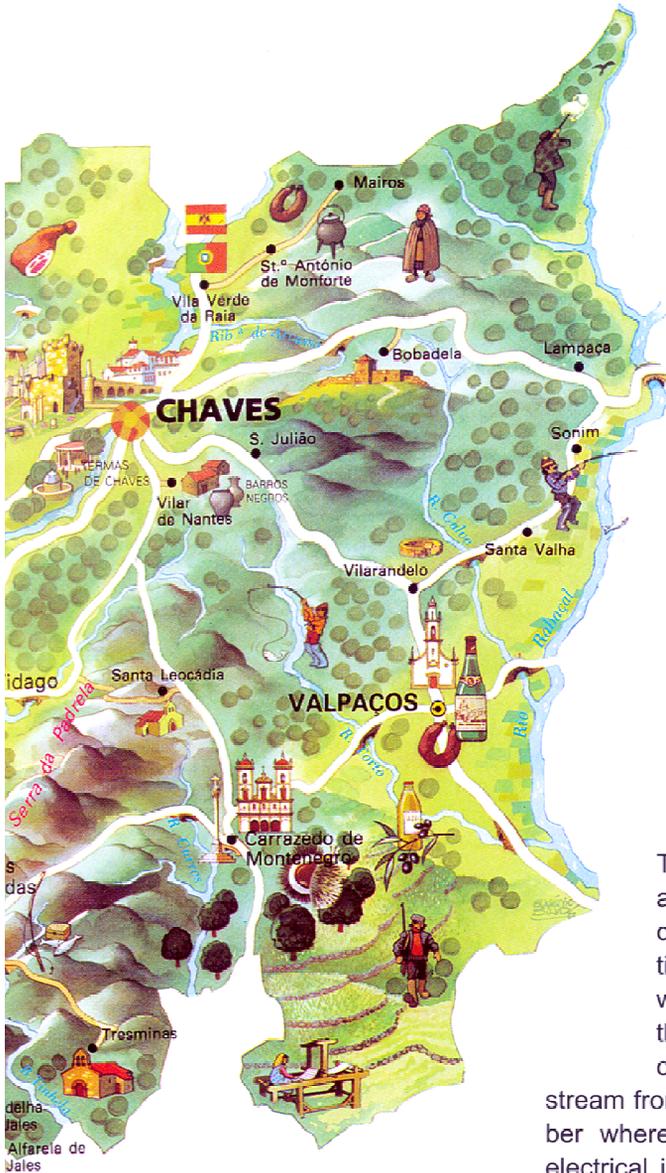
The mean annual energy production, of 18,4 GWh, is fed into the grid at Soutelo/Vila Pouca de Aguiar's switching station, through a 60 kV line, 21 km in length.

The scheme is provided with two intake structures without flow regulating functions, located on Covas river and one of its right bank tributaries, Couto river. These intake structures consist of two concrete weirs, 9,5 m and 15,0 m in height, respectively, Creager-type spillways, Tyrolian-type water intakes and hydromechanical equipment. They are still provided with ecological and downstream irrigation discharge control systems, with a joint maximum capacity of  $180 \text{ l s}^{-1}$ . The total submerged area, at the crests' elevations, is  $9\,500 \text{ m}^2$  only, corresponding to a stored volume of  $31\,000 \text{ m}^3$ .

Side spillways, to control the excess diverted flows, as well as desilting and pebbles removing structures, to remove the solid material, are located at the beginning of the hydraulic circuit just downstream from the weirs.



The hydraulic circuit extends along Covas river's right bank and Couto river's left bank. In its free surface branch, between the weirs and the forebay, it is composed of two reinforced concrete canals, with a global length of 3 200 m, and 0,85 m and 2,80 m wide rectangular sections.



Both canals include cut-and-cover branches and are provided with aqueducts, over small streams, pedestrian passages and rescue ramps, the latter every ca. 350 m. The canal along Covas river still includes two channel-bridges over more significant water lines.

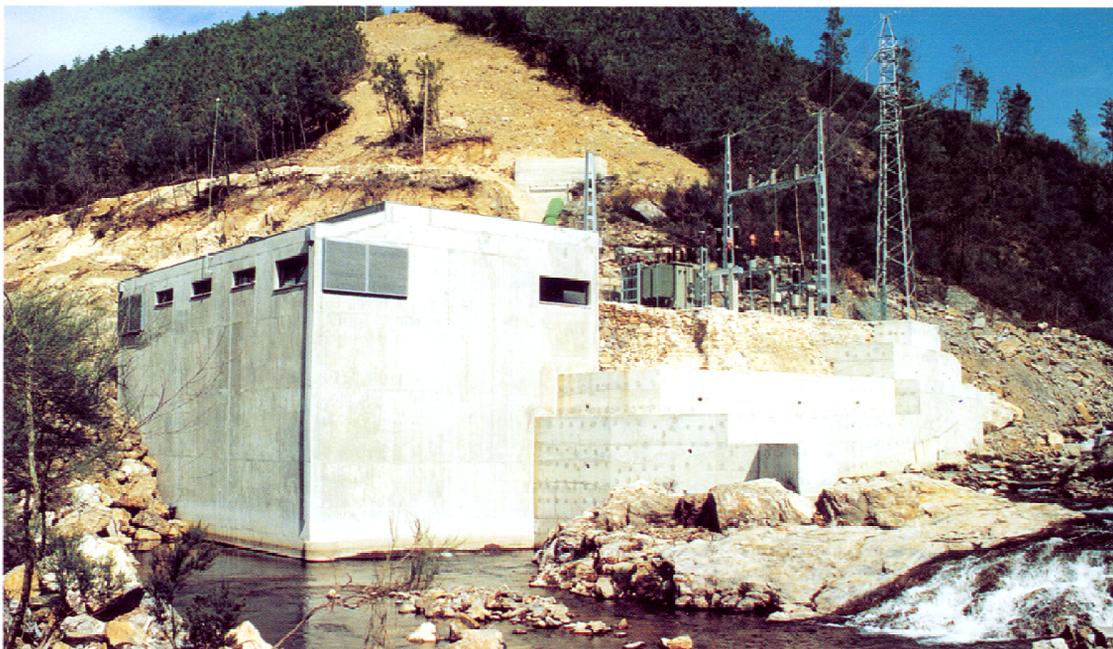
The forebay, with a horizontal area of 125 m<sup>2</sup> and a maximum depth of 6,3 m, where both adduction canals are joined, is equipped with level monitoring systems through which the diverted flow is controlled. Immediately downstream from the forebay is the valve chamber where, among other equipment and electrical installations, is situated the penstock protection butterfly valve. The penstock, buried in a trench, is made of heli-coidal welded steel ( $\varnothing = 1\ 200\text{ mm}$ ).

The powerhouse is located on the confluence of Couto river with Covas river and has a horizontal area of ca. 220 m<sup>2</sup>. In the

lower floor we may find the two turbine-generator units, the turbine protection butterfly valves, the electro-hydraulic governors, the lubrication systems and the generator's excitation systems. In the upper floor are the electrical installations, namely the protection, signal, automation and electrical/hydraulic control panels, the auxiliaries panel and the metal switch gear at the generation voltage.

The power station is automatically operated by two PLCs (Programmable Logical Controllers), one per each turbine-generator unit. These control systems provide for the signal and fault processing, as well as for the teletransmission of messages, the latter via a switched telephone network and a modem. Next to the powerhouse there is a platform for vehicle access and manoeuvres, and also the external 6,6/60 kV substation, where a main 8 MVA transformer and a circuit breaker are installed.

The Covas do Barroso Hydropower Scheme was designed and executed in such a way as to ensure a good environmental and landscaping integration, the improvement and enlargement of the existing accesses to the water lines, as well as the multi-functional use of the constructed hydraulic and road infrastructures.



## GENERAL COORDINATION

HIDROERG - Projectos Energéticos, Lda.

## DESIGN

HIDROTÉCNICA PORTUGUESA - Consultores para Estudos e Projectos, Lda.

## CIVIL WORKS

Sociedade de Construções SOARES DA COSTA, S.A.

## HYDROMECHANICAL, ELECTROMECHANICAL AND ELECTRICAL EQUIPMENT

GENERAL CONTRACTOR: Consórcio SOFOMIL - Soc. Fornecedor de Máquinas Industriais, Lda.

VOITH HYDRO TOLOSA, S.L.

SUBCONTRACTORS:

GERCO - Sociedade de Engenharia Electrotécnica, S.A.

INDAR - Construcciones Electro-mecánicas, S.A.

## INTERCONNECTION TO THE NATIONAL ELECTRICITY GRID

EPME - Empresa Portuguesa de Montagens Eléctricas, Lda.

SINTEME - Sociedade de Montagens Eléctricas e Construções Cívicas, Lda.

## SUPERVISION OF THE CONTRACTS

PENGEST - Planeamento, Engenharia e Gestão, Lda.

HIDROTÉCNICA PORTUGUESA - Consultores para Estudos e Projectos, Lda.

# TECHNICAL DATA

## HYDROLOGIC CHARACTERISTICS

MAIN WATERSHED

WATERSHED'S AREA (km<sup>2</sup>)

MEAN ANNUAL FLOWS (hm<sup>3</sup>)

100 - YEAR DESIGN FLOODS (m<sup>3</sup> s<sup>-1</sup>)

COVAS  
RIVER

COUTO  
RIVER

TÂMEGA RIVER

21,3

53,9

28,3

78,3

110

360

## HYDRAULIC CIRCUIT

HEIGHT OF THE CONCRETE GRAVITY WEIRS (m)

DESIGN FLOWS (m<sup>3</sup> s<sup>-1</sup>)

LENGTH OF THE ADDUCTION CANALS (m)

AREA OF THE FOREBAY'S GRID

DIAMETER AND LENGTH OF THE PENSTOCK

COVAS  
RIVER

COUTO  
RIVER

9,5

15,0

1,5

4,2

980

2180

2 x (2,50 x 3,17) m<sup>2</sup>

1200 mm/ 350 m

## POWERHOUSE

HORIZONTAL SHAFT TURBINES

GENERATORS

DESIGN NET HEAD

INSTALLED CAPACITY

MEAN ANNUAL ENERGY PRODUCTION

TWO

FRANCIS

TWO

SYNCHRONOUS

m

126,1

kW

6400

GWh

18,4

## INTERCONNECTION TO THE ELECTRICITY GRID

MAIN 6,6/80 kV TRANSFORMER

SUPPLY VOLTAGE

SECTION AND LENGTH OF THE LINE

SWITCHING STATION

kVA

8000

kV

60

AAC 160 mm<sup>2</sup>/ 21 km

VILA POUCA DE AGUIAR

## WORK QUANTITIES

EXCAVATION

CONCRETE

m<sup>3</sup>

58 500

m<sup>3</sup>

11 300

