Engineering, Architecture, Consulting

Delivering sustanaibility

IDOM

# HYDROPOWER

# Global Presence

**Canada**
TORONTO
NEW BRUNSWICK
**USA**
MINNEAPOLIS
ATLANTA
**Mexico**
MEXICO CITY
**Costa Rica**
SAN JOSE
**Panama**
PANAMA
**Colombia**
MEDELLIN
BOGOTA
**Venezuela**
VALENCIA
**Peru**
LIMA
**Chile**
SANTIAGO
**Argentina**
BUENOS AIRES
**Brazil**
SAO PAULO
**Paraguay**
ASUNCION
**Ireland**
DUBLIN
**United Kingdom**
MULTIPLE OFFICES
**Portugal**
LISBON
**Spain**
MULTIPLE OFFICES
**Belgium**
BRUSSELS
**Poland**
WARSAW
WROCLAW
**Slovenia**
LJUBLJANA

**Estonia**
TALLINN
**Latvia**
RIGA
**Lithuania**
VILNIUS
**Turkey**
ANKARA
**Saudi Arabia**
RIYADH
**UAE**
ABU DHABI
DUBAI
**Malaysia**
KUALA LUMPAR

**India**
NEW DELHI
**Morocco**
CASABLANCA
**Algeria**
ALGIERS
**Libya**
TRIPOLI

**Ethiopia**
ADDIS ADABA
**Senegal**
DAKAR

45
Offices Worldwide

125
Countries With Projects

1957
Founded In

3,800
People

900+
Partners

IDOM


Excellence
Technically Capable
Experienced.
Innovative.
World Class.
Innovation.
World-wide
front edge of engineering services.
Commitment
Relationship Driven
Focused on Client.
Flexible.
Committed.

# AREAS OF ACTIVITY

**CS** Consulting & Systems

**IE** Industry & Energy

**AB** Architecture & Building

**INF** Infrastructure

IDOM

# Providing World Class Engineering Services in Iconic Projects

## HVDC INTERCONNECTION ETHIOPIA HVDC 500 kV

**Full Engineering Design**

- **Converter stations,**
- **HVAC switchyards,**
- **Electrode detail engineering**
- **Electrode Calculation Assessment,**
- **Support to the Owner during execution**

IDOM

# 1000 MW PUMPING AND STORAGE HPP IN SPAIN

**Engineering Design**

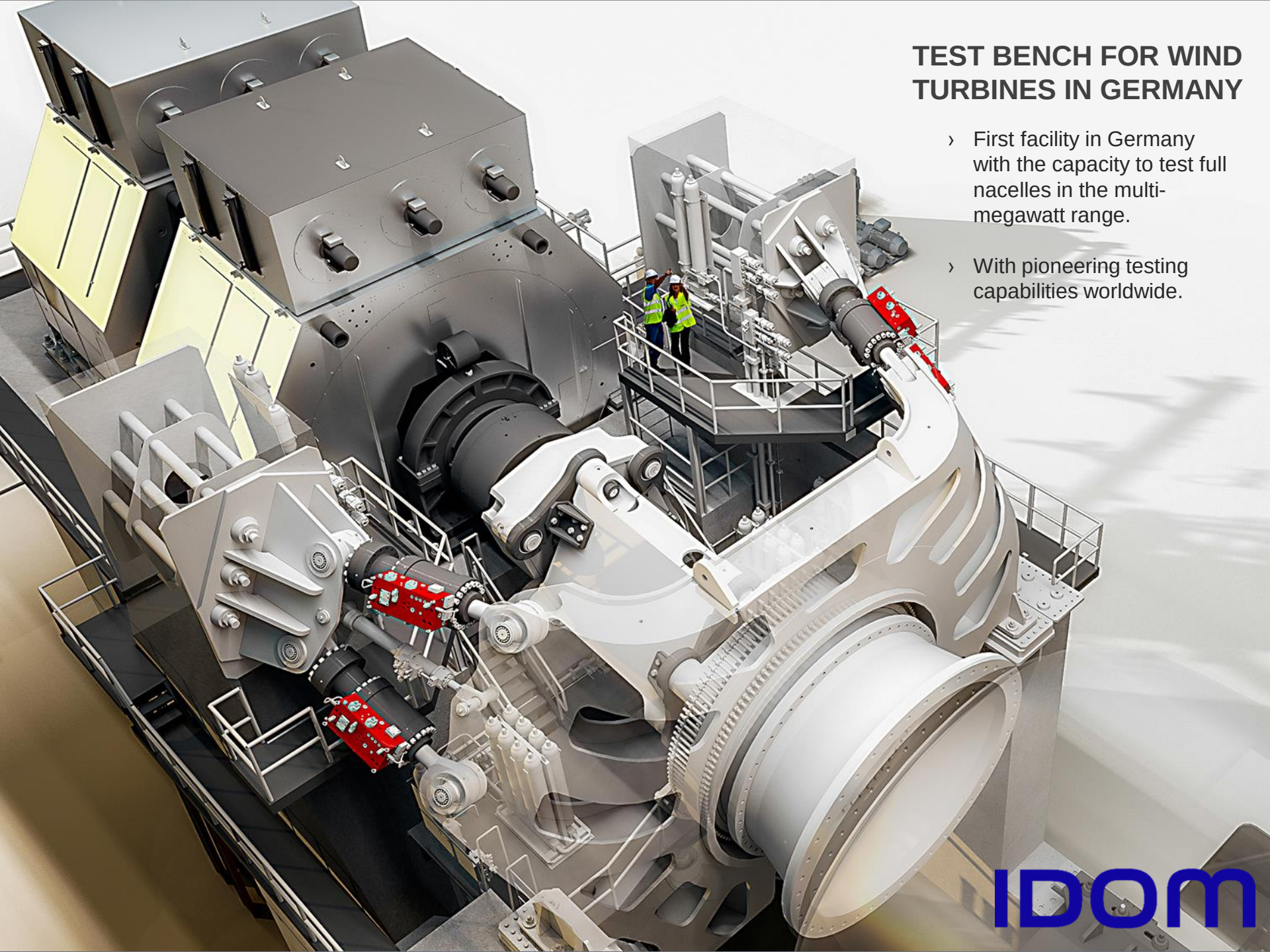
- 4X250 MW Francis Turbines
- Full Converters
- 338 m head
- 360 m3/s
- 400 kV Switchyard and OHL
- Underground Power Station and Machine House

IDOM

# INTERNATIONAL ITER PROJECT IN FRANCE

- The biggest international scientific project in the world researching energy
- Nuclear fusion as an energy source of the future
- Technical assistance for the supply, installation and integration of the systems
- Specialized engineering developing the technology of the systems and components

IDOM



# TEST BENCH FOR WIND TURBINES IN GERMANY

- First facility in Germany with the capacity to test full nacelles in the multi-megawatt range.
- With pioneering testing capabilities worldwide.

IDOM

# SOLAR TELESCOPE OF HAWAI IN USA

› The World’s largest solar telescope

› The dome is 26.6 m in diameter

› It will allow the sun´s motion to be tracked with millimetre-level accuracy

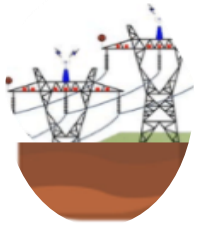
IDOM

# ENERGY

## Areas of expertise

Thermal Generation

Hydropower



E-Grid

Wind

Solar

Nuclear


Ranked in the **28** position by ENR in Power Business

IDOM

# IDOM HYDROPOWER PLANTS

## Delivering sustanaibility

## Our services:

- ❑DESIGN
- ❑CONSULTANTS
- ❑OWNER/CONSTRUCTOR ENGINEER

# IDOM HYDROPOWER

## DESIGN SERVICES

- Run of River (RoR), Storage (Reservoir), Pumped Storage and In-stream
- Surface and Underground facilities: Geotechnical Assesments
- Arch dams, Gravity dams, Arch-Gravity dams, Embankment dams
- Hybridization with other technologies
- New development, Rehabilitation & Upgrades

IDOM

# IDOM HYDROPOWER

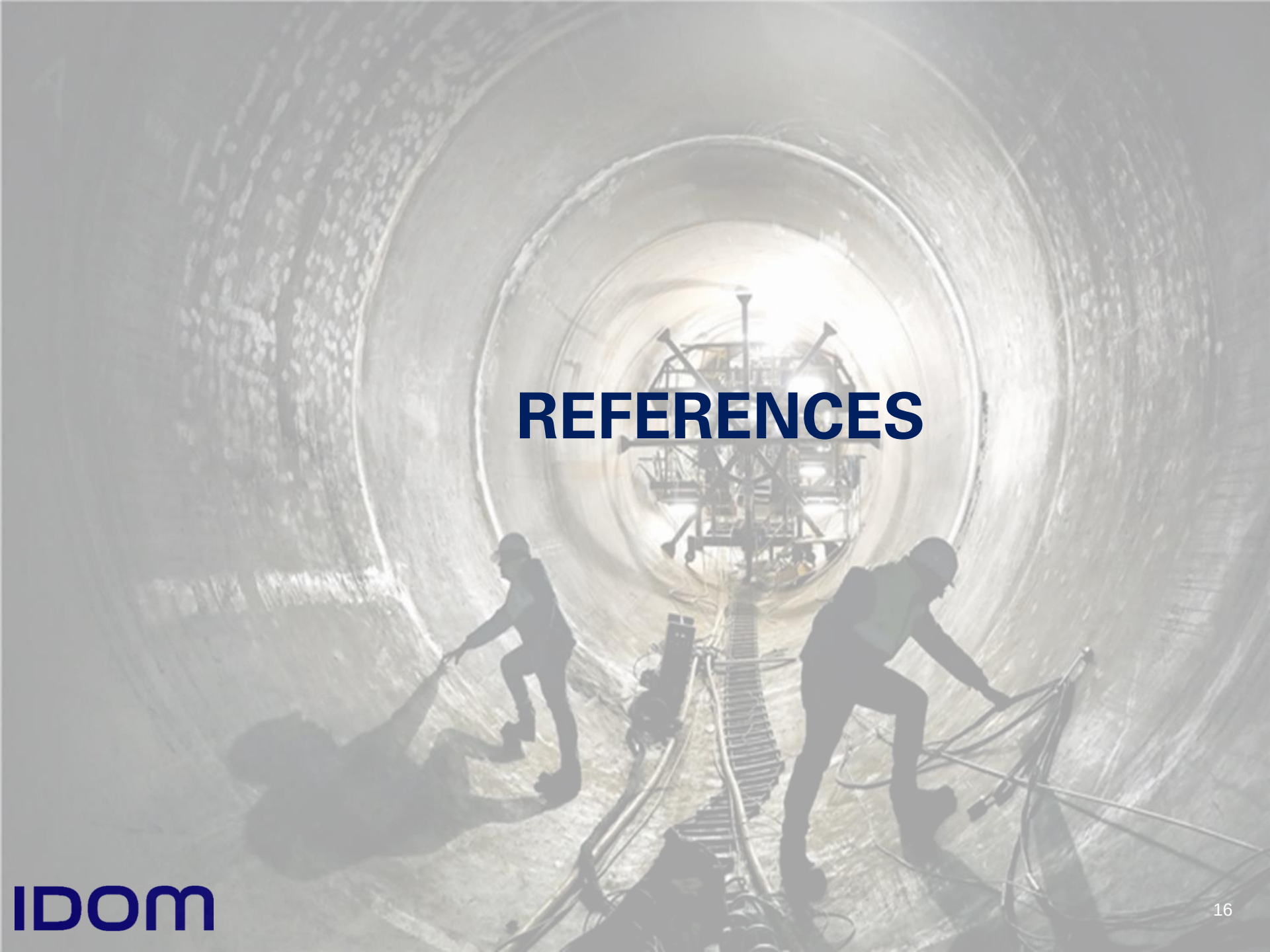
## HYDRO CONSULTANTS

- ❑ Master Plans
- ❑ Feasibility studies
- ❑ Configuration
- ❑ Conceptual design
- ❑ Bankability support
- ❑ Environmental Assessments
- ❑ Technical Due Diligiencies
- ❑ Programming
- ❑ Construction strategy
- ❑ Management of preliminary studies
- ❑ Technical and assesment reports
- ❑ Emergency action plans
- ❑ Electrictrical substation / grid studies

IDOM

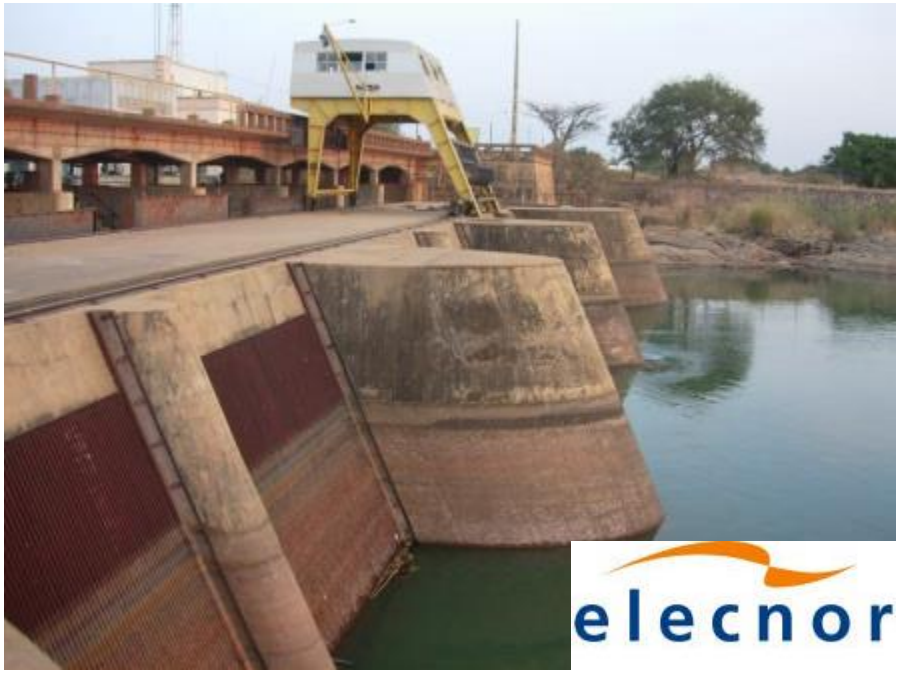
# OWNER´S ENGINEERING

- Lender's engineer
- Design Review
- Project Management
- Procurement  and tender assistance
- Programming
- Contract Management:
- Site Supervision



# REFERENCES

# Hydropower Plants: Delivering sustainability



**ELECNOR**

**MATALA HYDRO POWER PLANT 2X13,6 MW. INTEGRAL UPGRADING**

**DETAIL DESIGN**

**Matala (Angola)**

**Date: 2019 – Ongoing**

## DESCRIPTION

IDOM was contracted by ELECNOR to develop the detail design of existing hydro power plant in Matala river in Angola with the following characteristics:

- HYDRO TURBINES: 3X13,6 MW KAPLAN.
- GRID CONNECTION POINT: 150 Kv SYSTEM.

## SCOPE OF SERVICES:

- Detail design:
    - 220/ 150/ 33 kV SYSTEM.
    - HYDROGEOLOGICAL DESIGN.
    - INTEGRATION OF 3 NEW TURBINES.
    - ELECTROMECHANICAL UPGRADING.
    - HYDROMECHANICAL UPGRADING.
    - CONTROL & INSTRUMENTATION DESIGN.
    - BOP ELECTRICAL SYSTEM.
- Procurement support. Technical Specifications & Data sheet LV System.
- Technical support erection and commissioning stage-

IDOM

# Hydropower Plants: Delivering sustainability

**REPSOL GENERACION ELECTRICA**

**AGUAYO 2 PUMPING AND STORAGE 1000 MW**

**Basic and Design Development (ongoing)**

**Torina River, Cantabria**

**Date: 2020 – Ongoing**

## DESCRIPTION

IDOM was contracted by REPSOL GENERACION ELECTRICA to develop the CONSTRUCTIVE AND ENVINRONMENTAL design of the new uprating of the existing Hydropower Plant of Aguayo 1, the HPP Aguayo 2 will be equipped with 4 Francis Turfbines in a PS scheme with the following main design data:

- Total Power: 4x250 MW
- Head 338,73 mca
- Water flow: 360 m3/s

The scope of IDOM covers:

- Permitting support
- Geotechnical Evaluation and soil reports
- Envinronmental assessment and final report
- Electromechanical
- Technical Specifications
- HV/ MV/LV.

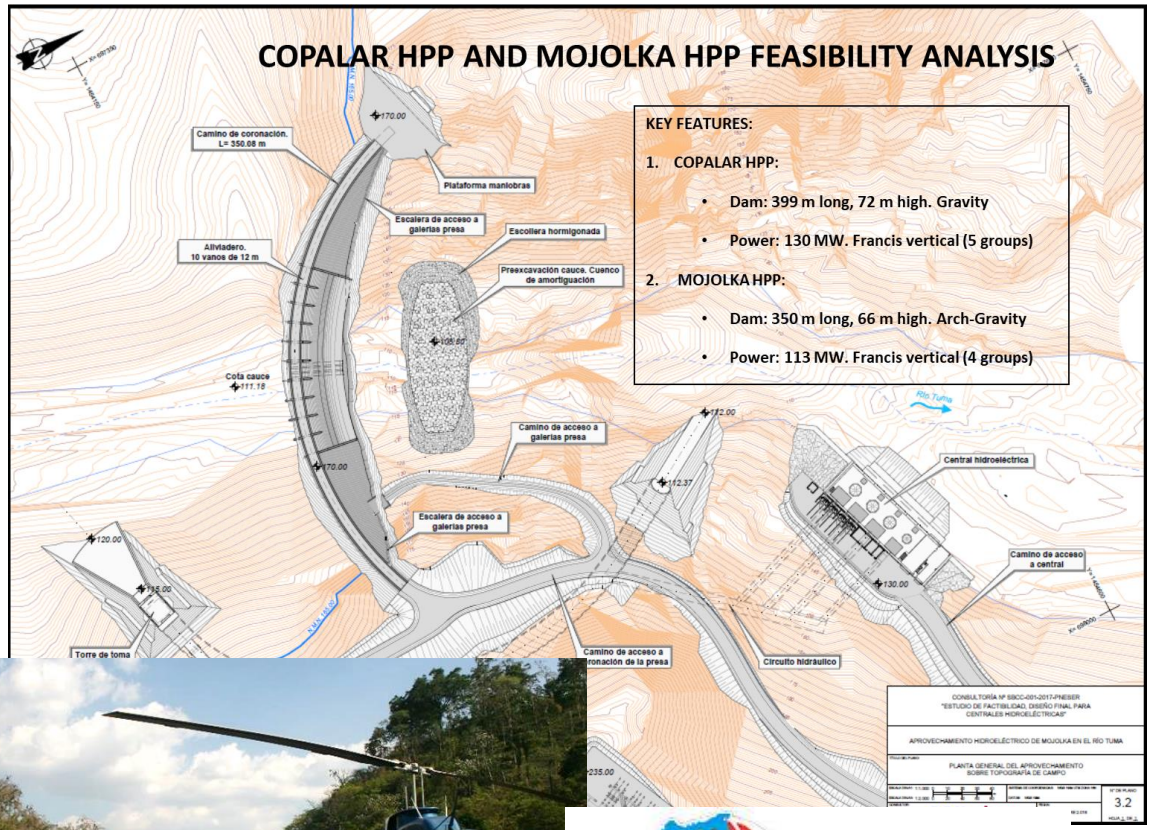
# Hydropower Plants: Delivering sustainability

## NICARAGUA COPALAR (113MW) AND MOJOLKA HYDROPOWER PLANTS (150 MW) (NICARAGUA)

### WORK PERFORMED

- Feasibility Report
- Conceptual Desing
- Feed Design
- Owner´S engineer (on going)

ENATREL AND PNSER have trust in IDOM in developing the desing and feasibility works to establish de best hydraulic facilities in Coco and Grande Rivers among twenty different posibilities.

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ENATREL
Empresa Nacional de Transmisión Eléctrica

# Hydropower Plants: Delivering sustainability

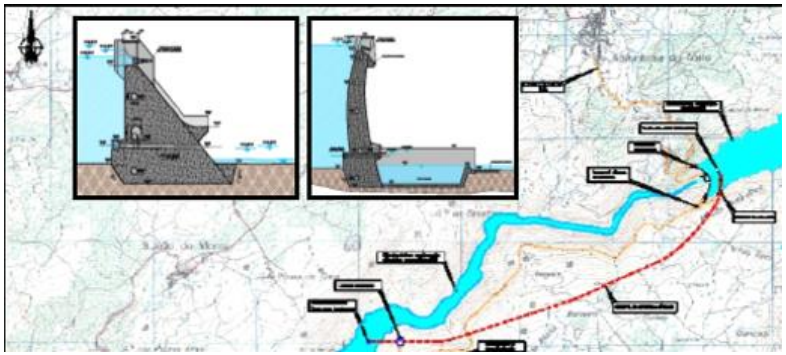
## HYDROPOWER PLANTS OF GIRABOLHOS AND BOGUEIRA (Portugal)

### WORK PERFORMED

- Design Arch dam, 95 m high, 2xFrancis (355 MW total, **Pumped Storage**)
- Design : Rock-fill-dam, 66,5 m high, 2xFrancis (29,50 MW total)
- Design flow: 505 m3/s
- Head: Maximum rated head: 73 m

### Main Design data

ENDESA hired IDOM to develop the « Avant Projet detaillé » on the Mondego River of a new Power Plant of 355 MW,

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# Hydropower Plants: Delivering sustainability


**HYDROELECTRIC/WIND HYBRID POWER AND PUMP STORAGE SYSTEM**

**Client: Gorona del Viento**

**2008 to 2013**

El Hierro, "the Island of Iron". of the Carnary Islands is one of the smallest of inhabited islands in the eastern Atlantic, will soon be "carbon neutral." With a population of around 10,000, the island will be powered and supplied fresh water by a unique combination of wind and hydroelectric power.

An 11.5 MW wind farm (five 2.3 MW Enercon turbines) will generate electricity for the island and pump water almost 2000 feet to a reservoir. When the wind is insufficient for power generation, water from the upper reservoir will be released and will turn 4 Pelton Hydropower turbines and generate up to 11.3 MW of power. Excess power will be used for desalination for irrigation and consumption.

**WORK PERFORMED**

- Basic and Detailed Engineering
- Procurement Management
- Architecture and Landscape Design
- Construction Management

IDOM

# Hydropower Plants: Delivering sustainability


**IBERDROLA**

**TAMEGA HYDRO COMPLEX 1158 MW**

**ELECTRICAL DETAILED DESIGN OF BOP SYSTEM**

**in Tamega, Portugal**

**Date: 2017 – Ongoing**

IDOM

## DESCRIPTION

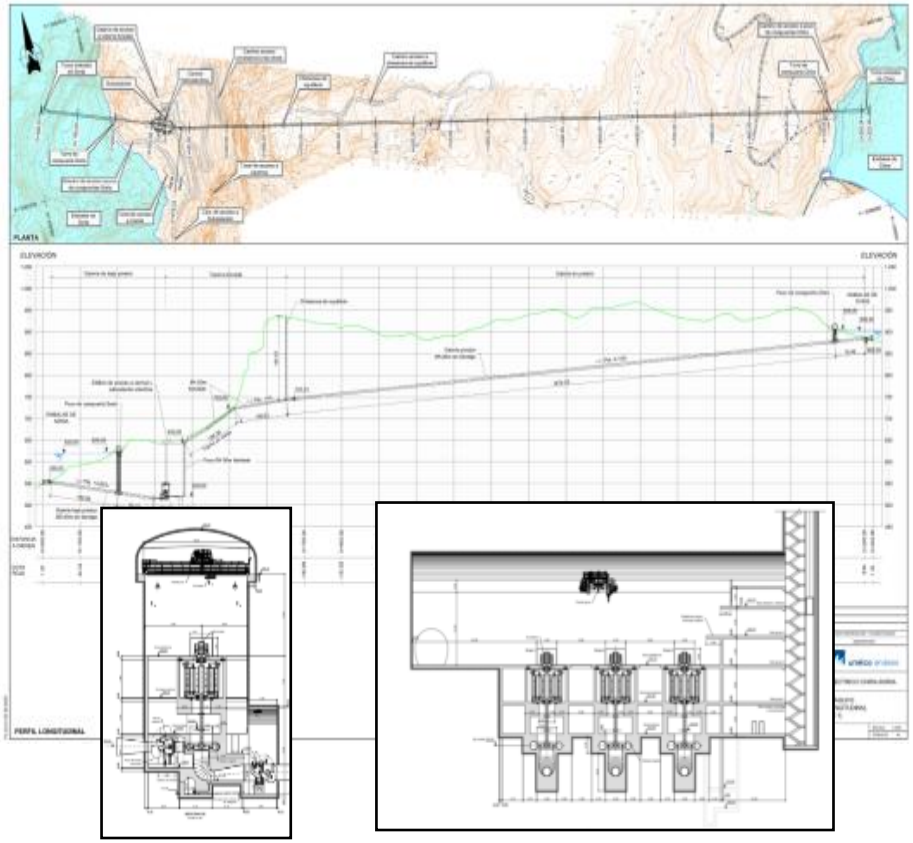
IDOM was contracted by IBERDROLA to develop the electrical detailed design of three new hydro power plants in Tamega river in Portugal with the following characteristics:

- GOUVAES: 4 X 220 MW (PUMP AND STORAGE SCHEME)
- DAIVOES: 2X57 MW.
- ALTO TAMEGA: 2X 80 MW.

## SCOPE OF SERVICES:

- Permitting support in terms of EHV/ HV/ MV/ LV electrical facilities of three hydro power plants.
- Electrical calculations reports:
    - Load Flow analysis.
    - Short circuit study.
    - MV/ LV Cable sizing.
    - Trenches and Trays.
    - Grounding system.
    - Lighting system.
    - MV/ LV Transformers sizing.
- Technical Specifications & Data sheet LV System.
- Detailed drawings. Lighting system/ Trenches/ Trays.
- HV/ MV/ LV Wiring diagrams/ Routing.

# Hydropower Plants: Delivering sustainability



## REE

**CHIRA – SORIA REVERSIBLE HYDROELECTRIC POWER PLANT,**

**GRAN CANARIA, SPAIN**

**June 2011 – Ongoing**

RED ELÉCTRICA DE ESPAÑA

IDOM

## DESCRIPTION

IDOM has worked for ENDESA until 2014 to develop of basic design and detailed design for the construction of Chira-Soria Reversible Hydroelectric Power Plant on Gran Canaria in Spain.

Subsequenly, this project was transferred to REE, which has hired IDOM to:

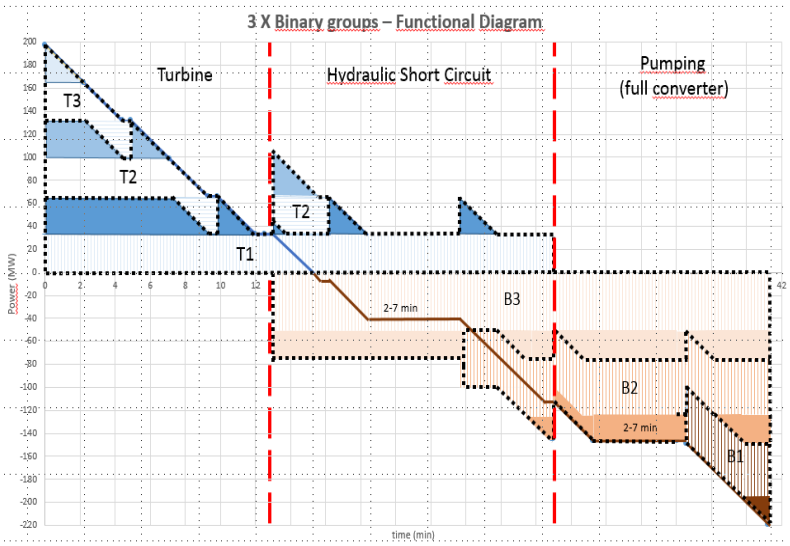
- Configuration study (See next slide).
- Update the construction project to to attend REE during permitting process.
- Update the geothecnical and topograhfical campaign.

The facility uses two existing dams with an elevation difference of 1125 ft (343 m); the Soria dam and the Chira dam. The 200 MW of total power installed is provided by six Francis pump-turbines of 33.3 MW each. This equipment is installed in a cavern powerhouse located 131 ft (40 m).

The project also includes the construction of a new 1.37 mil. gpd (5,200 $m^3$/day) desalination plant to restore the water volume captured by the system to the actual users of the dams.

- Elevation drop: Maximum head of 1125 ft (343 m).
- Design flow: 17,500 gal/s (66 $m^3$/s)
- Turbines: Francis (3), vertical axis. 66.6 MW.
- Hydraulic elements: Reservoirs intakes; 13.1 ft (5.0 m) diameter pressure gallery 5 ft (1.505) m long, 13.1 ft (4.0 m) diameter steel lined tunnel 570 ft (173 m) long, 13.1 ft (4.0 m) diameter buried steel pipe 745 ft (227 m) long, 13.1 ft (4.0 m) diameter steel lined shaft 395 ft (120 m) long and 16.5 ft (5.0 m) diameter low pressure hydraulic gallery 1,560 ft (475 m) long.
- Substation and power line: 220 kV power line 17 km long

# Hydropower Plants: Delivering sustainability




**CHIRA – SORIA REVERSIBLE HYDROELECTRIC POWER PLANT,**

**CONFIGURATION STUDY**

**June- September 2015**

RED ELÉCTRICA DE ESPAÑA

## CONFIGURATION STUDY DESCRIPTION:

- Feasibility study for local authority to study the new facility in Gran Canaria Island and its integration in the power system including the following activities:
  - Evaluation of estimated energy production.
  - Predesign connection grid.
  - Power risks evaluation.
  - Operation strategy definition.
  - Cost estimate.
  - Support in permitting stage with local authorities.
- Configuration study of hydro-pump storage power plant including:
  - Adequacy of configuration to functional and technical requirements of REE, as new promoter of power plant.
  - Study of alternatives taking into account:
    - Turbine family (Francis/ Pelton).
    - Binary or ternary power groups.
    - Hydraulic operation mode: Pumping / Turbinating/ Short- circuit hydraulic.
  - Analysis of impacts at civil/ hydraulic/ electrical level.
- Definition of operation strategies to integrate the new facility into isolated power system.

IDOM

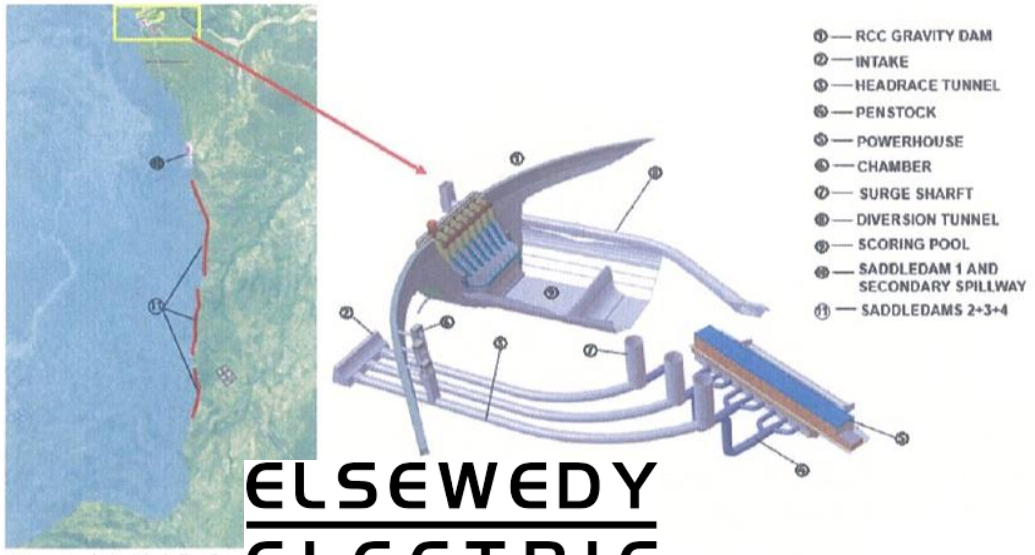
# Hydropower Plants: Delivering sustainability

## ‘RUFIJI POWER PLANT’ 2115 MW (9X235 MW)

### WORK PERFORMED

- Owner´s engineer: Consultancy Services During Contract Negotiation:

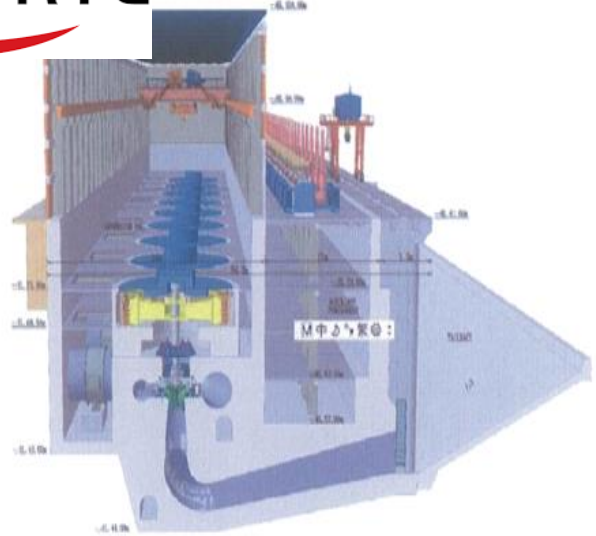
- Contractual Design Review
- Overall DoR matrix
- Detailed description scope of works
- Contracts Interface
- Technical Specifications for Site Works
- Master Schedule Review




ELSEWEDY ELECTRIC

### Main data

- Reservoir Area: 158000 km2
- Average Flow: 890 m3/s
- Installed Capacity: 2115 MW
- Dam: RCC Gravity
- Total Elevation: 190 m, Height: 131 m
- Dam Length : 1025 m.
- Scheme: 9 x 235 MW Francis

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Hydropower Plants: Designing sustainability

# SAN ESTEBAN HYDROPOWER PLANT (SPAIN)

## WORK PERFORMED

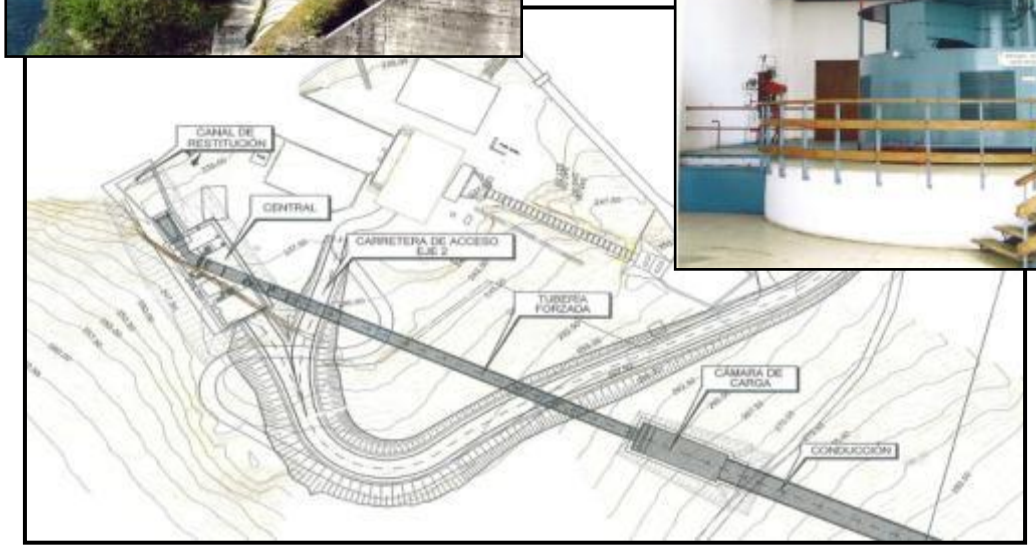
- Detailed Design
- Technical Assistance

**175 MW SAN ESTEBAN II, SPAIN**.

IBERDROLA selected IDOM as Design partner to develop the complete Civil Engineering Detailed Design for the full range of structures and civil works placed within San Esteban II underground turbine hall.


IDOM

# Hydropower Plants: Delivering sustainability




**HYDROELECTRIC POWER PLANTS OF FERVENZA, POINT OLVERIA AND NUEVO CASTRELO**

**Client:** **ELECNOR**

**Year:** **2004**

elecnor

IDOM

**DESCRIPTION**

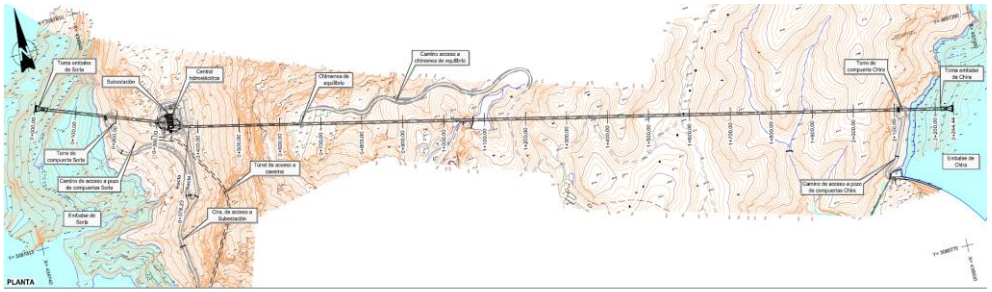
The project includes the detailed design of each of the three hydroelectric plants for ELECNOR. Each project was similar and consisted generally of the design of a tunnel of about 1.2 miles (2 km) of length as central pipeline providing flow to a Kaplan turbine as depicted in the Nuevo Castrelo plant illustrated in the adjoining pictures.

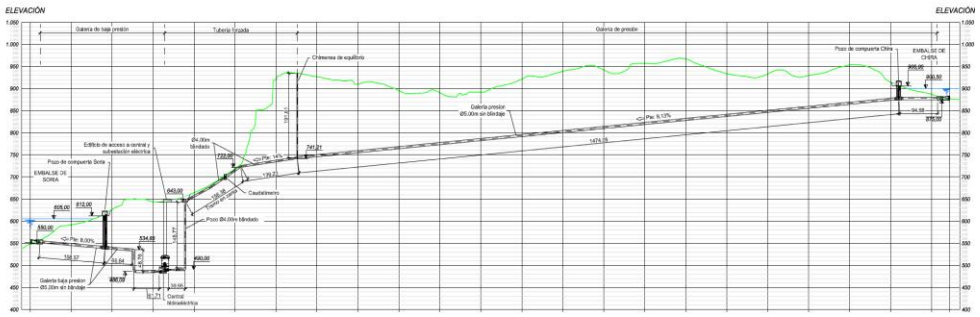
Turbine: Horizontal axis Kaplan

Q max : 0.5 mil.gpm (35 $m^3/s$)

Power: 6.3 , 6.5 and 6.1 MVA respectively

# Hydropower Plants: Delivering sustainability




**DESCRIPTION**

In the Canary Island ENDESA promoted a new PS power plant between Chira and Soria existing dams, IDOM was awarded and developed the construction design; the main characteristics to be highlighted are:

Total head: 343 m

Flow: 66 m3/s

Total Power: 198 MW

Tunnel length: 2200 m, 5 m diameter.

Turbine: 3 Francis Machines

**CHIRA SORIA PUMP AND STORAGE HPP**

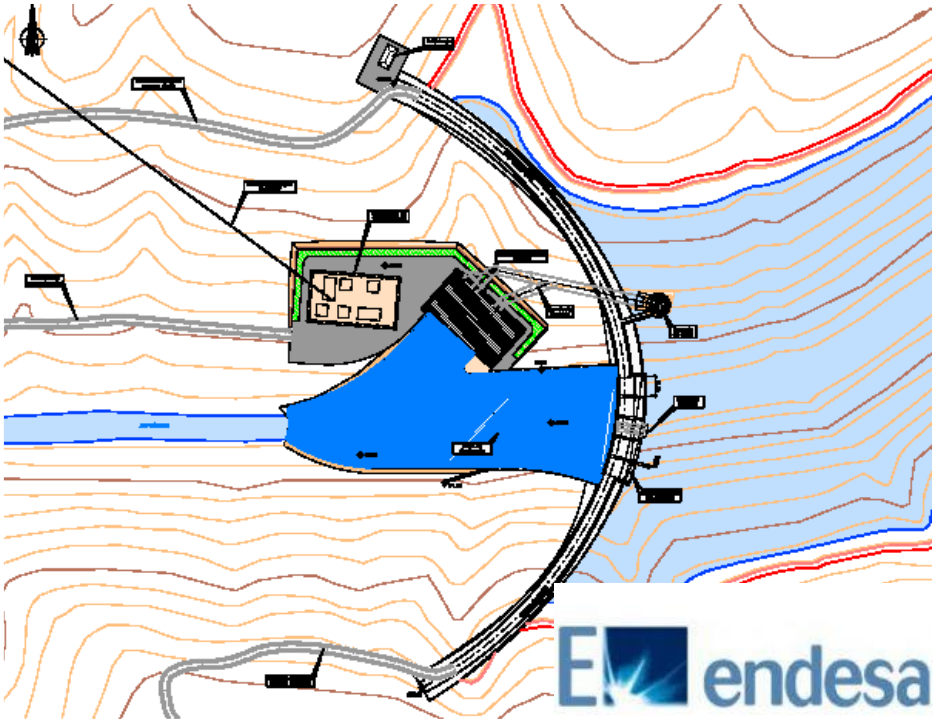
**Client: Endesa**

**Year: 2011**

endesa

IDOM

# Hydropower Plants: Delivering sustainability



**FRIDAO-ENDESA HPP**

**Client: Endesa**

**Year: 2011**

**DESCRIPTION**

ENDESA trusted in IDOM to develop the FEL design of a new hydroelectric PS schemed in the Tamega River (Portugal) associated with the Portuguese development plan (PNBEPH) to promote high potential hydroelectric facilities for new power plants, IDOM did the Basic Design of this 178 MW PS PLANT with the following here below data details:

Total head: 84 m

Flow:120 m3/s

Total Power: 178 MW

Turbine: 2x Francis

# Hydropower Plants: Delivering sustainability

**DESCRIPTION**

IDOM developed the Construction Design for the new PS HPP of JABALCÓN, between an existing dam, NEGRATIN and a new reservoir as pumping vessel; the Project has the following design data:

Total head: 840

Flow: 76 m3/s turbine, 58 m3/s pumping

Total Power: 550 MW

Turbine: 2 Francis Machines

**JABALCON COMPLEX PUMP AND STORAGE HPP**

**Client:** **Endesa**

**Year:** **2011**

IDOM

# Hydropower Plants: Delivering sustainability

## Selga de Ordas Hydropower plant

**WORK PERFORMED**

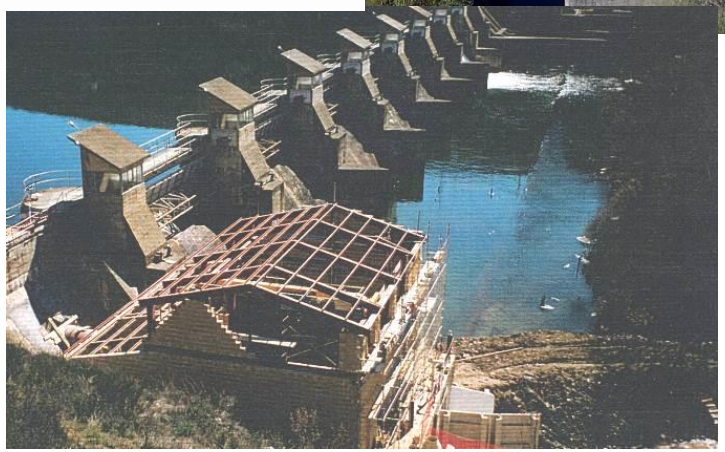
- Design
- Procurèrent Assistance
- Site Supervision

### Main Design data

IDOM developed a full professional servides contract for this power plant, located at León (Spain) in the Barrios de Luna River.

**CLIENT: IDAE; MINISTRY OF ENERGY, SPAIN**

- Head: 15 m
- Flow: 6 m3/s
- Power: 0,6 MW
- 1xKaplan .



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# Hydropower Plants: Delivering sustainability

## NIÑAS-SORIA Hydropower plant

### WORK PERFORMED

As one of the overall HPP services delivered to ENDESA to promote new HPPs in the Canary Islanda, IDOM develops the feasibility and basic study of a new Pumping and Storage new power plant between Niñas and Soria existing reservoirs, IDOM developed the Basic design; with the following Project main data:

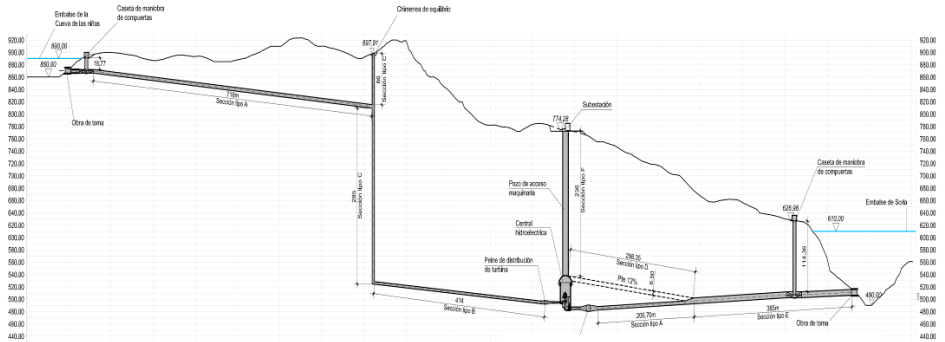
Total head: 325 m

Flow: 56 m3/s

Total Power: 201 MW

Tunnel length: 2245 m.

Turbine: 3 Francis Machines




IDOM

# Hydropower Plants: Delivering sustainability

**GRUPO ESSENTIUM**

**Yecil Hydroelectric Power Plant**

**Turkey, September 2009**

## DESCRIPTION

Grupo Essentium retained IDOM to perform an external audit on the design and the construction of theHydroelectric Mini-Power Plant in Sivas (Turkey).

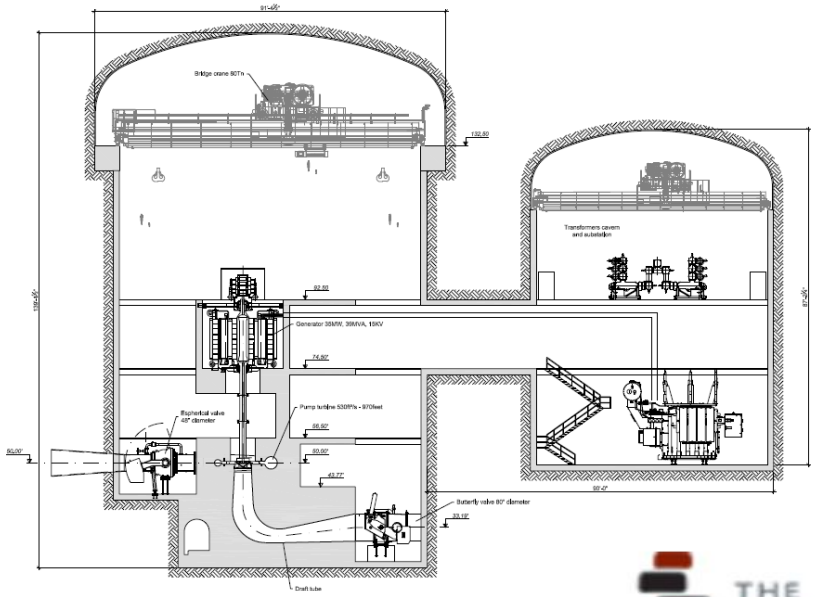
The Plant is composed of the following elements: weir height of 20 ft (6 m), low pressure underground pipe with a 6.5 ft (2 m) diameter and 4.3 miles (7,000 m) in length. The collecting reservoir has a capacity of 2.4 mil. gallons (9,000 $m^3$) and the plant has a turbine building as illustrated.

The audit on the design and the construction of the plant was requested for due diligence prior to the acquisition.

## MAIN CHARACTERISTICS

- Generated power: 14 MW
- Turbine type: Francis horizontal axis (3)
- Flow each turbine: 2.25 $m^3/s$
- Penstock diameter: 4.9 ft (1.5 m)
- Net head: 800 ft (245 m)
- Penstock length: 2,625 ft (800 m)
- Total flow: 6.75 $m^3/s$

# Hydropower Plants: Delivering sustainability




**PEBBLE PARTNERSHIP**

**NEW HYDROPOWER HYBRIDIZED PLANT**

**Alaska, 2013**

## DESCRIPTION

THE PEBBLE COMPANY retained IDOM to perform environmental, technical and feasibility study of a ne pumping and storage power plant, hybridized with a Wind Power Farm to secure the electrical supply to a mining complex in Alaska; the new power plant designed was to be built in a cavern with the following main data:

.

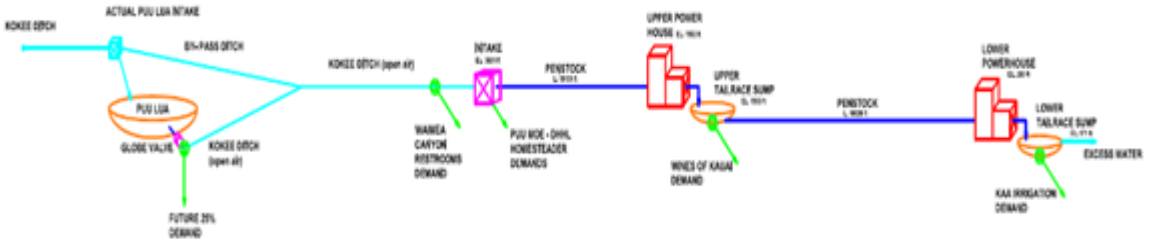
## MAIN CHARACTERISTICS

- Generated power: 210 MW
- Turbine type: Francis horizontal axis (4)
- Flow : 90 $m^3/s$
- Net head: 300 mt

# Hydropower Plants: Delivering sustainability

**DESCRIPTION**

Basic Design for a new combined facility formed by two hydropower plants in the Puu Lua River (Hawai)




| UPPER PUU LUA | LOWER PUU LUA |
|---|---|
| • **Head: 342 m** | • Head: 508 m |
| • **Flow: 1 m³/s** | • Flow: 1 m³/s |
| • **Power: 3,33 MW** | • Power: 4,46 MW |
| • **2xFrancis** | • 2xFrancis |

**Client: PACIFIC LIGHT AND POWER**

**YEAR: 2011**

IDOM

# Hydropower Plants: Delivering sustainability

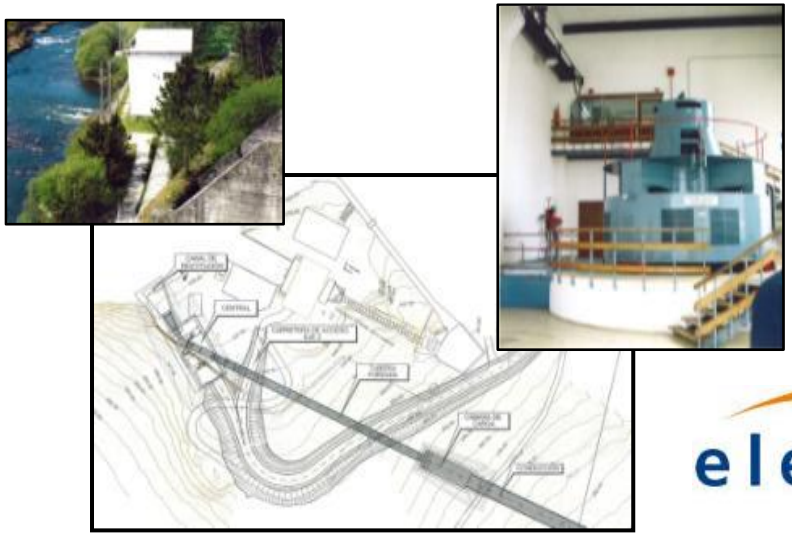
**DESCRIPTION**

Upgrade and modernization of three small hydropower plants in Xallas rib¡ver, with the following characteristics:

| FERVENZA II | PONTE OLIVEIRA II | NUEVO CASTRELO |
|---|---|---|
| • Head : 21,3 m<br>• Flow: 32 m³/s<br>• Power: 6,3 MW<br>• 1xKaplan | • Head: 21,2 m<br>• Flow 35 m³/s<br>• Potencia total: 6,5 MW<br>• 1x Kaplan | • Head: 20,5 m<br>• Flow: 35 m³/s<br>• Power: 6,1 M<br>• 1xKaplan |

**ELECNOR**

**Spain , 2004**



elecnor

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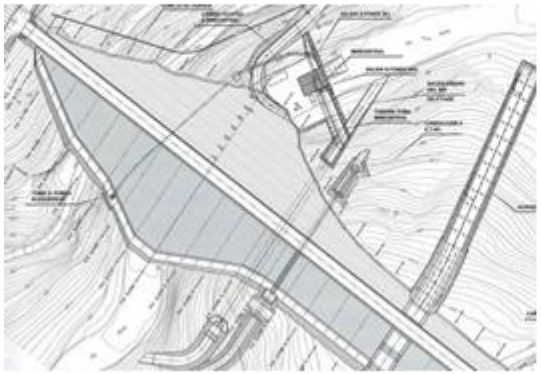
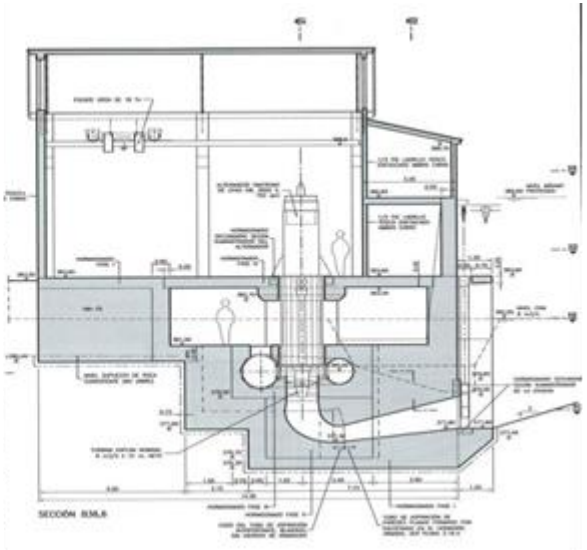
# Hydropower Plants: Delivering sustainability

**DESCRIPTION**

Detail Design of a new PUMPING AND STORAGE Hydropower PLANT in the Narla Dam, the new power plant consisted in a 31 m head facility and installed in a cavern between two existing reservoirs:

- Head : 31 m
- Flow: 8 m3/s
- Power: 2,4 MW





MINISTERIO DE FOMENTO

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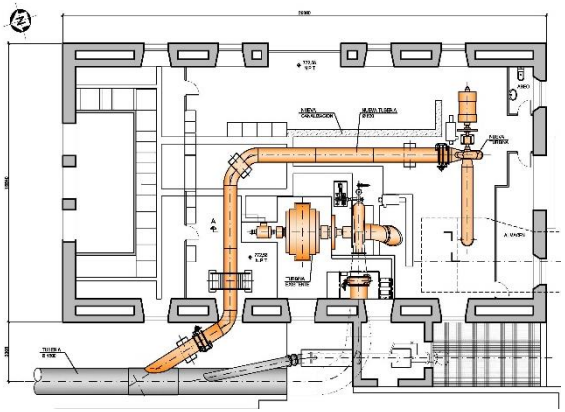
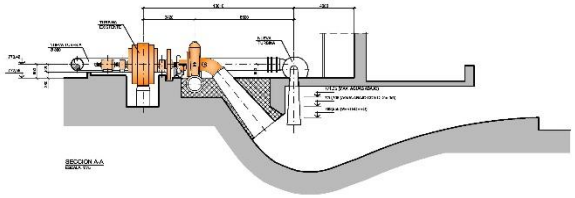
# Hydropower Plants: Delivering sustainability

**DESCRIPTION**

Detail Design to upgrade the Navallar Power Plant with a new machine of 1,3 MW; the plant has the following main features::

- Head : 91 m
- Flow:1,6 m3/s
- Power: 1,3 MW
- 1xFrancis
- Client : Canal de Ysabel II
- Year: 2012





Canal de Isabel II

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# Hydropower Plants: Delivering sustainability

## Huesna River Small Hydropower Plant

### WORK PERFORMED

- Design
- Procurèrent Assistance
- Site Supervision

### Main Design data

IDOM developed a full professional servides contract for this power plant, located at León (Spain) in the Barrios de Luna River.

**CLIENT: IDAE; MINISTRY OF ENERGY, SPAIN**

- Head: 64,5 m
- Flow: 1,6 m3/s
- Power: 1 MW
- 1xKaplan .

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# Hydropower Plants: Delivering sustainability

## DESIGN OF "LA CONCEPCION" DAM: 767 m x 135

### WORK PERFORMED

Design of La Concepción Dam, regulating the water provided by three main rivers (Verde, Guadalmina, Guadaiza et Guadalmansa (Costa del Sol


### Main Design data

- Gravity Dam, RCC
- Length : 767,9 m
- Height : 135,7
- Volume of RCC : 3.626.000 m³
- Volume of regular concrete : 50.000 m³
- Volume of reservoir : 185.000.000 m³

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# Hydropower Plants: Delivering sustainability

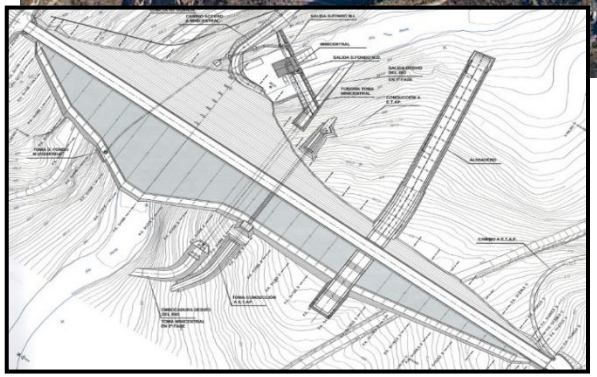
## New Narla DAM (Lugo, Spain)

### WORK PERFORMED

- Design

### Main Design data

Concrete-faced Rock-fill embankment dam, 41 m high with a length of 415 m. The volume of the reservoir is 9,6 $hm^3$



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# Hydropower Plants: Delivering sustainability

## Carbonero New Dam (Spain)

**WORK PERFORMED**

- Design

**Main Design data**

CARBONERO DAM DESIGN: Wide arch concrete gravity dam, 32 m high, with a reservoir capacity of 24,2 $Hm^3$


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# Hydropower Plants: Delivering sustainability

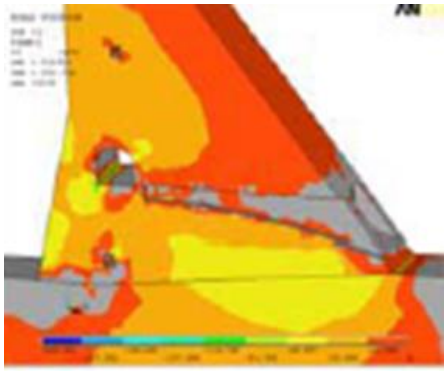
## ‘LA BREÑA II’ DETAILED DESIGN

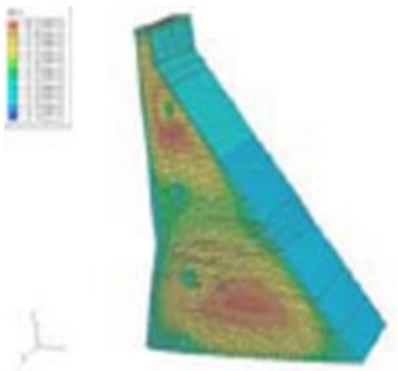
### WORK PERFORMED

- Construction Design

### Main Design data

La Braña II is a RCC 125 m high and a total volume of water of 800 hm3.



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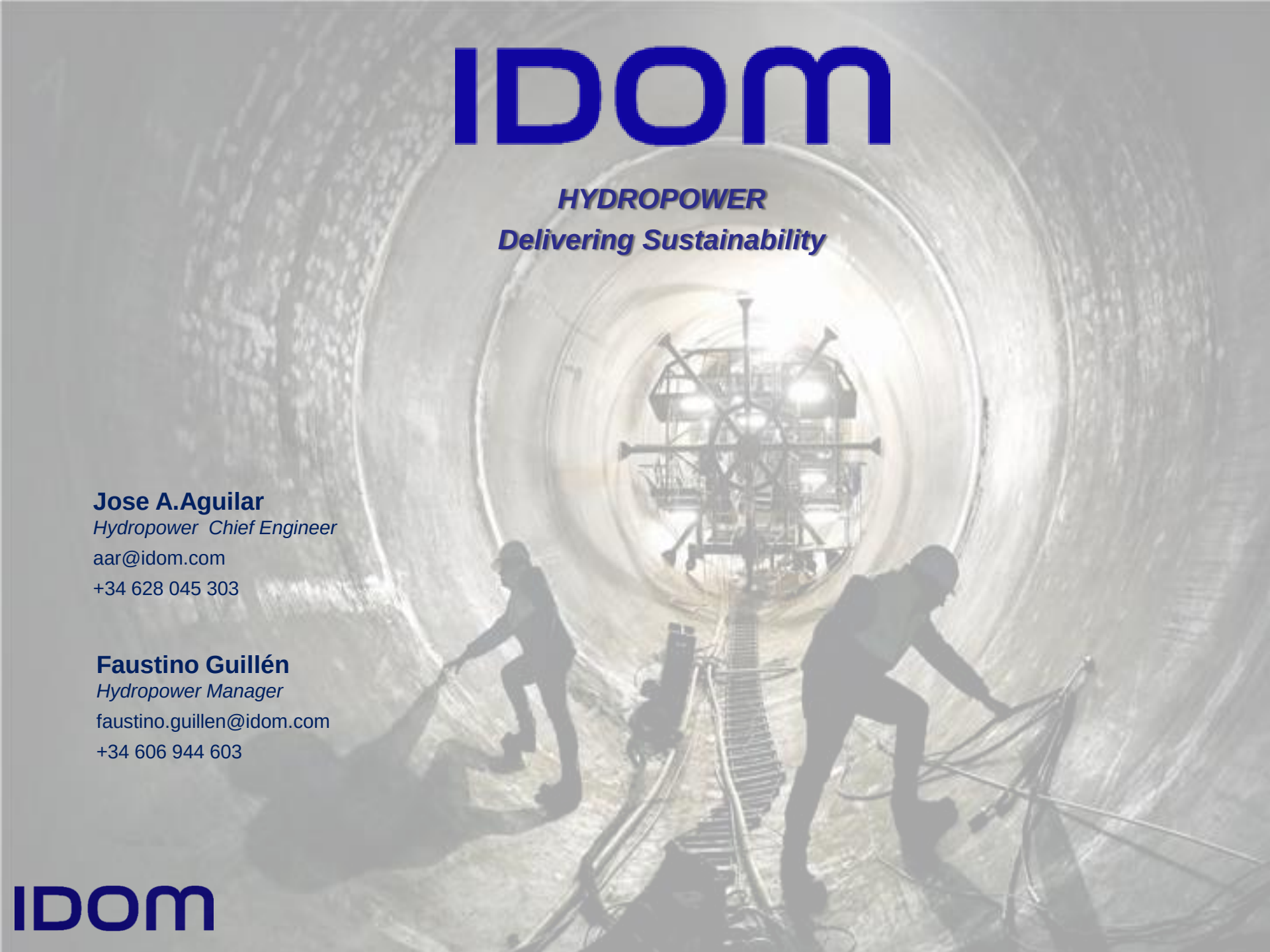
# *HYDROPOWER*

## *Delivering Sustainability*

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