Ministério da Indústria, Comércio e Energia

VIII SIMPÓSIO GERMANO-CABO-VERDIANO DE ENERGIA

DIVERSIFICAÇÃO DE ARMAZENAMENTO E GESTÃO DE REDES INTELIGENTES EM CABO VERDE

Praia, 28th November 2022

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DNICE

global trends in the power sector:

Decentralisation	Decarbonisation	Digitalisation
• Moving from conventional centralized top-down power systems towards a decentralized model. • High presence of Distributed Energy Resources. • Importance presence of distributed microgrids for rural electrification and reliability improvement.	• Reduce the CO2 emissions from power generation. • Increase the integration of renewable energy. • Increase the energy efficiency at consumption level. • Electrification of the energy consumption.	• Installation of sensors and actuators for power system monitoring and control. • Management of collected data and use for business application (e.g, optimal operation and planning, security improvement, quality of service, etc.). • Use of new IT and communications technologies to develop new services in the power system.

Table 9. Main challegnes and best practices in European islands according to Eurlectric report

Main challenges in islands	Best Smart Grid practices
• Energy dependence (generation mainly from fossil fuels) • Lack of economies of scale in power production • Operational energy constraints and small markets due to isolated nature • Additional challenges to decarbonise • Power generation plants have limited size • Need of integrate renewable energies without jeopardize the security of the power system	• Energy storage: several pilots in different islands • Distributed renewable generation + DERs Management System to maximize RES integration • Smart net metering for promotion of small scale PV technology • Electrical Mobility • Interconnections between islands in specific cases → need of business cases • Islands environments are interesting for testing Smart Grid pilots (due to reduced size and particular condition)

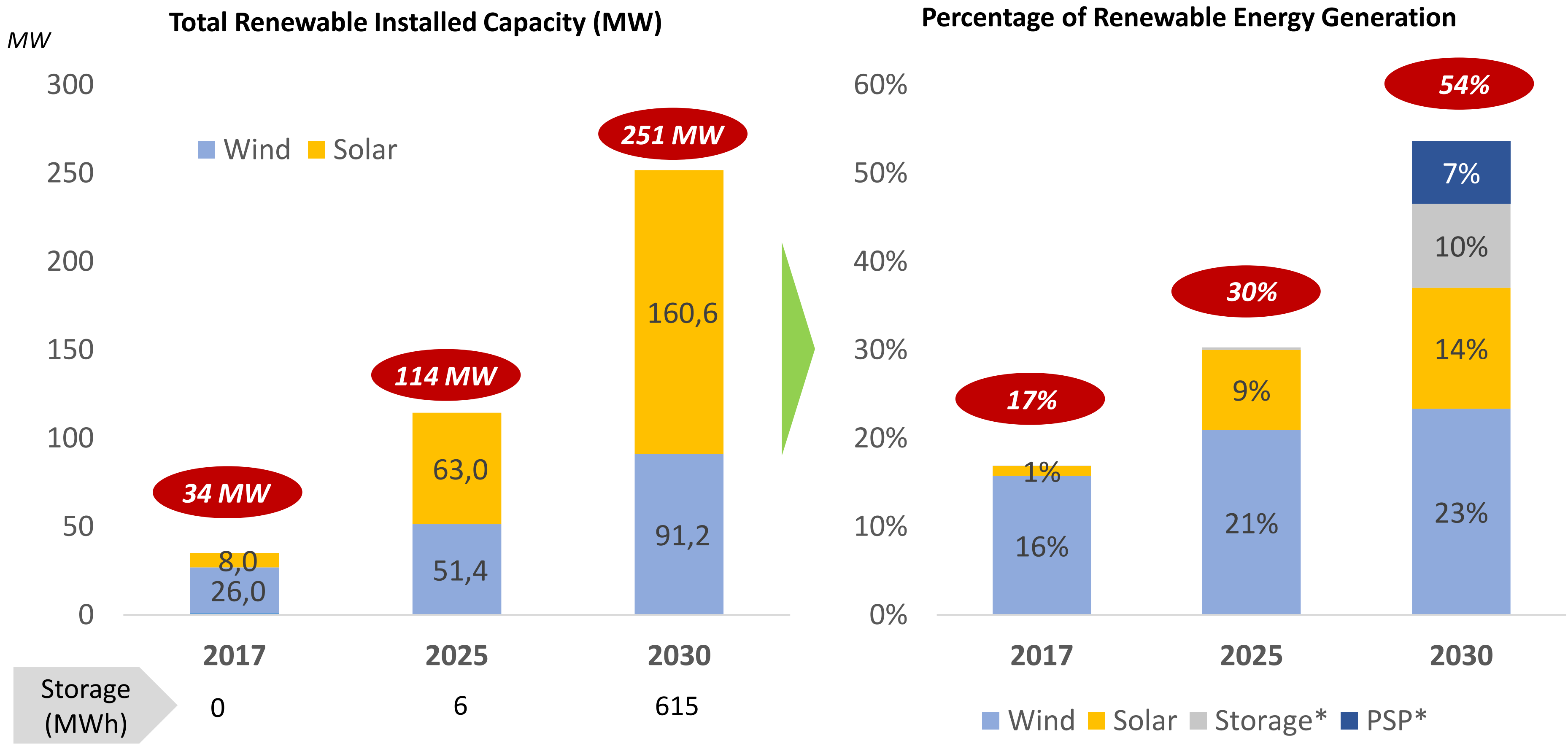
The National Program for Energy Sustainability (NPES)

Main Axes

- Institutional Strengthening and Improvement in Business Environment
- Energy Market Reform
- Promotion of Energy Efficiency
- Renewable Energy Development
- Investments in Strategic Infrastructure

New Axes

- Promotion of Entrepreneurship and R&D
- Inclusion and Gender Equity



* Storage and PSP % represents part of renewable generation stored and discharged through inverters or turbine

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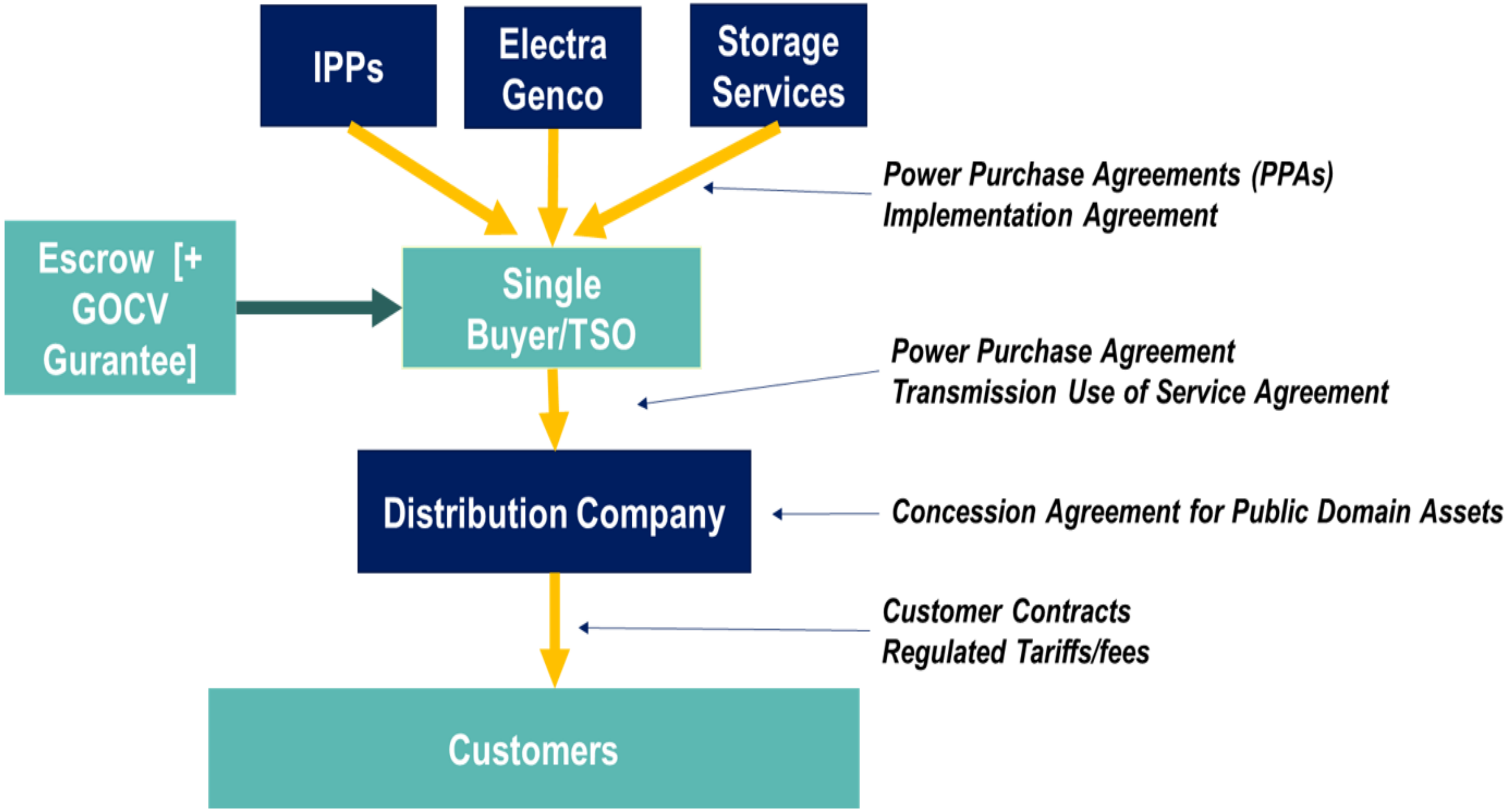
Fonte CV Master Plan 2018-2040

Figure ES-3: Proposed New Industry Structure



Power System Objetives

1. Increase electricity share from renewables
- To reduce energy dependency on fossil fuels

2. Guarantee stability and security
- Power system enhancement in presence of higher renewable sources

3. Reduce losses
- Losses have relevant values in the country

4. Generation & operation cost reduction
- Leading to lower cost of electricity for customers

5. Facilitate the integration of Distributed Energy Resources
- Customer empowerment and microgrids

6. Increase the efficiency of the electricity consumption
- Demand increase management and consumption pattern collection

7. Improve the quality of supply of customers
- To reduce outages

8. ICT and Cyber Security Enhancing
- Guarantee the adequacy of communication infrastructure and its security

9. E-Mobility and transport electrification
- Develop public infrastructure for charging management of electrical vehicles

Table 10. Value proposition of Smart Grids for power sector in Cabo Verde

Objective in Cabo Verde	Smart Grid benefits
1. Increase electricity from renewables	• Advanced **monitoring and control** solutions to increase the integration of renewable generation in the system, • Introduce **flexibility** for enhanced system operation under presence of variable non-controllable renewable generation, such as storage.
2. Guarantee stability and security	• Real-time **monitoring and detection of risking situation** for the system at different voltage levels, and implementation of automatic operations to correct them, • **Remote operation** of controllable solutions to guarantee network security. • Benefit **demand management** programs for supply and demand balancing and peak shaving.
3. Reduce losses	• Advanced Metering infrastructure for **accurate measurement** • Monitoring and data analytics for **identification of commercial losses** • Integrated AMI-billing system for commercial loss reduction.
4. Generation & operation cost reduction	• **Optimal dispatch** of the generation units, enhanced by the presence of remote control, advanced forecast algorithms, flexible resources), • **Reduce** the amount of **reserves** for secure operation of the system and, therefore, their associated cost. • Grid upgrade **investment deferral** by energy flow and DER management
5. Facilitate the integration of Distributed Energy Resources	• Introduce monitoring and control management systems for secure **massive integration of DERs** into the system, • Aggregation platforms for the dispatch of DERs, taking advantage of the added value of the **aggregated services**.

Objective in Cabo Verde	Smart Grid benefits
6. Increase the efficiency of the electricity consumption	• Facilitate the integration level of **auto-consumption** in customers, • Customer consumption pattern correction, • Provide information systems for an **efficient consumption management**, for example, smart lighting, smart building, customer web portal, etc
7. Improve the quality of supply of customers	• **Reduction of interruption times** required to identify, isolate and restore the supply • Advanced protection systems to identify in probable components failures. • Enhanced **voltage and frequency control** mechanisms.
8. ICT and Cyber Security enhancing	• Communication infrastructure and link management for distributed intelligence. • Facilitation of **new business functionalities** • Guarantee the **cyber security** of the ICT links and systems for Smart Grids
9. Mobility electrification	• Enable efficient management of **electromobility charging** • Facilitate the tariffs and information systems for **customer participation**

five priority projects to be implemented by 2025

Objective	Short term (2021)	Medium term (2025)	Long term (2030)
1. Renewable share increase	Advanced **RES forecasting** procedure revision & SCADA implementing **ESS management module** implementation in SCADA/EMS		
2. System stability	**TOU tariff** revision and implementation (data collection and billing) **Market revision** for RES and ESS participation in Anciliary services	Voltage VAR optimisation	
3. Loss reduction	**Smart Meter (AMI)** Deoployment Unified **Billing system** and customer account migration	**Data Analytic** Fraud Pevention	**Advanced Outage Management System**
4. Gen. & Op. cost reduction	**DR** program implementation	**DSM** program implementation	**Advance Asset Management** System Implementation
5. On-grid DER Management	Auto-generation Connection Procedure (**Tech. Assessment**) **DER module** in SCADA/DMS	Demand and Generation **Aggregation** Platform	
6. Energy efficiency	Demand Management program (**DR and DSM**) Customer campaing &Web **Portal**		**Smart Building** Control System
7. Quality of supply	**Protection Selectivity** Study Unified **quality index** procedure, measure and register (using SCADA and AMI data)		
8. ICT and CS Enhancing	**IT dept.** re-structuring	**Security policy** development and monitoring **Communication** requirement assessment and assignation	
9. E-Mobility		Public **EV** charging **infrastrature** Implementation G2V module implementation	

Ongoing Projects

- Development of 37 MW of RE as IPPs is underway
  - 5 MW solar PV IPP in Boa Vista Island (Gamma Solutions);
  - 13 MW wind farm IPP in Santiago (cabéolica exp. project);
  - 5 MW solar on São Vicente Island (APP/ Impulso);
  - 5 MW solar on Sal Island (APP/ Impulso);
  - 10 MW solar IPP in Santiago Island (on going tender);
- BESS 1MW/1MWh in Sal (to be concluded in Oct).
- New BESS 5MW/5MWh in Sal (cabéolica exp. project)
- New BESS 5MW/5MWh in Santiago (cabéolica exp. project)

New Projects 2022-2023

- Four small-scale solar PV projects:
  - 1.3 MW for Fogo Island;
  - 1.2 MW for Santo Antão Island;
  - 0.4 MW for Maio Island;
  - and 0.4 MW for São Nicolau
  - Battery storage investments for this systems are also been considered.
- Repowering existing 5MW solar in Santiago and 2,5 MW in Sal;
- BESS 5MW/5 MWh for Boavista;
- BESS 4MW/4 MWh for S. Vicente;
- **PSP 20MW/160MWh for Santiago**

Project ID	SPV-4MVA/4MWh-SV1
Project size	4 MVA / 4 MWh
Site	Lazaretto Power Station
Site location	South of Power Station, nearby public road, 300 meter from North-East corner along the road
Site coordinates	Lat: 16.869869° Long: -25.016397°
Land owned by	Electra
Current occupation of site	Idle
Electrical interconnection	Spare feeder at SS available

CAPEX [M€]
2,55

Project ID	BSS-5MVA/5MWh-BV1
Project size	5 MVA/ 5 MWh
Site	Parcela Power Station
Site location	Adjacent to Parcela Substation 2.
Site coordinates	Lat: 16.135215° Long: -22.896979°
Land owned by	Municipality
Current occupation of site	Idle
Electrical interconnection	Space in substation available. No spare feeder

CAPEX
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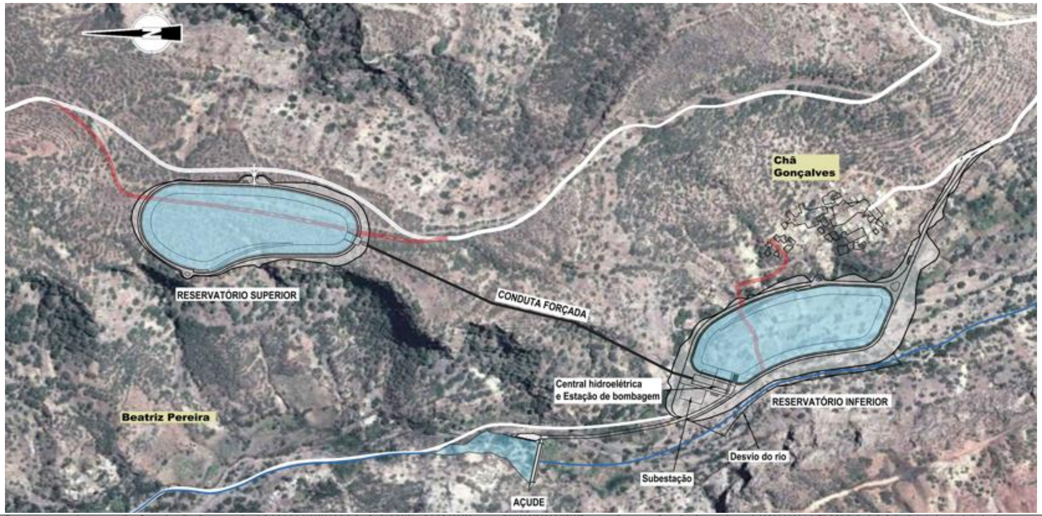
Location of the Santiago Island PSP

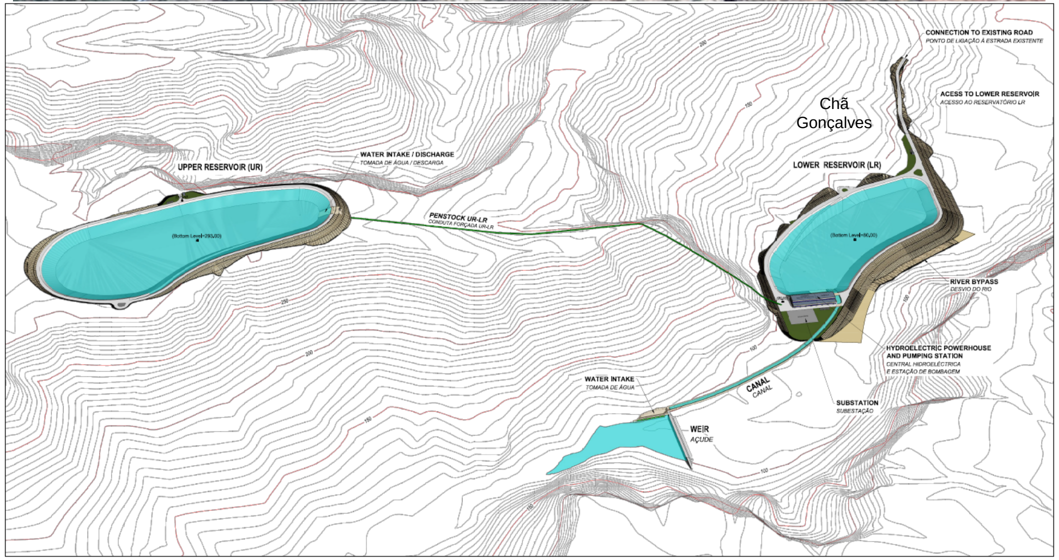
The Santiago PSP will be located in the valley of Ribeira de São João, about 20 km west of Praia city.

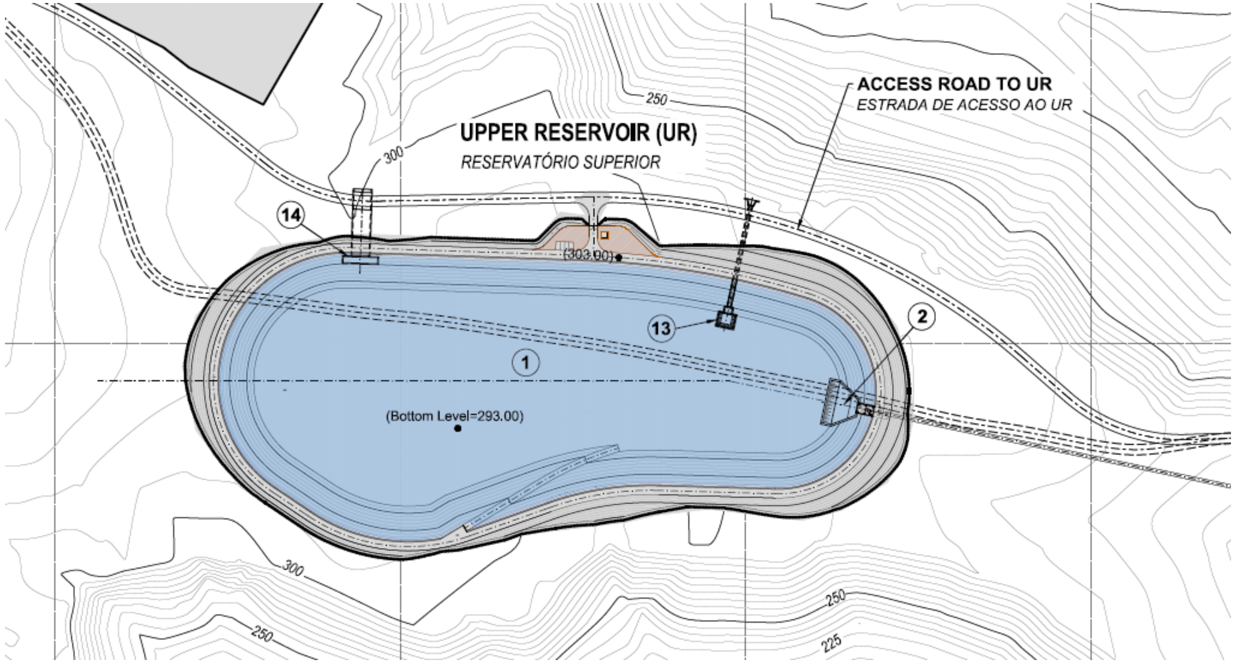
Feasibility Study for the Construction of a Pumped-Storage Station in Santiago Island – Cabo Verde

- INCEPTION REPORT
- D1&2 - DETAILED GEOLOGICAL AND GEOTECHNICAL ASSESSMENT REPORT
- D3 – HYDROLOGICAL (WATER AVAILABILITY) ASSESSMENT
- D4 – ASSESSMENT OF THE ENVIRONMENTAL AND SOCIAL CHARACTERISTICS AND RISKS
- D5 - SITE ASSESSMENT REPORT
- D6 – STUDY OF ALTERNATIVE LAYOUTS
- D7A – GRID CONNECTION AND DYNAMIC STABILITY STUDY
- D7B – PSP OPERATION AND REMUNERATION MODEL
- D7C – ENGINEERING AND ECONOMIC DESIGN
- D8 – PRELIMINARY ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT
- D9 – FINANCIAL ANALYSIS AND IMPLEMENTATION STRATEGY

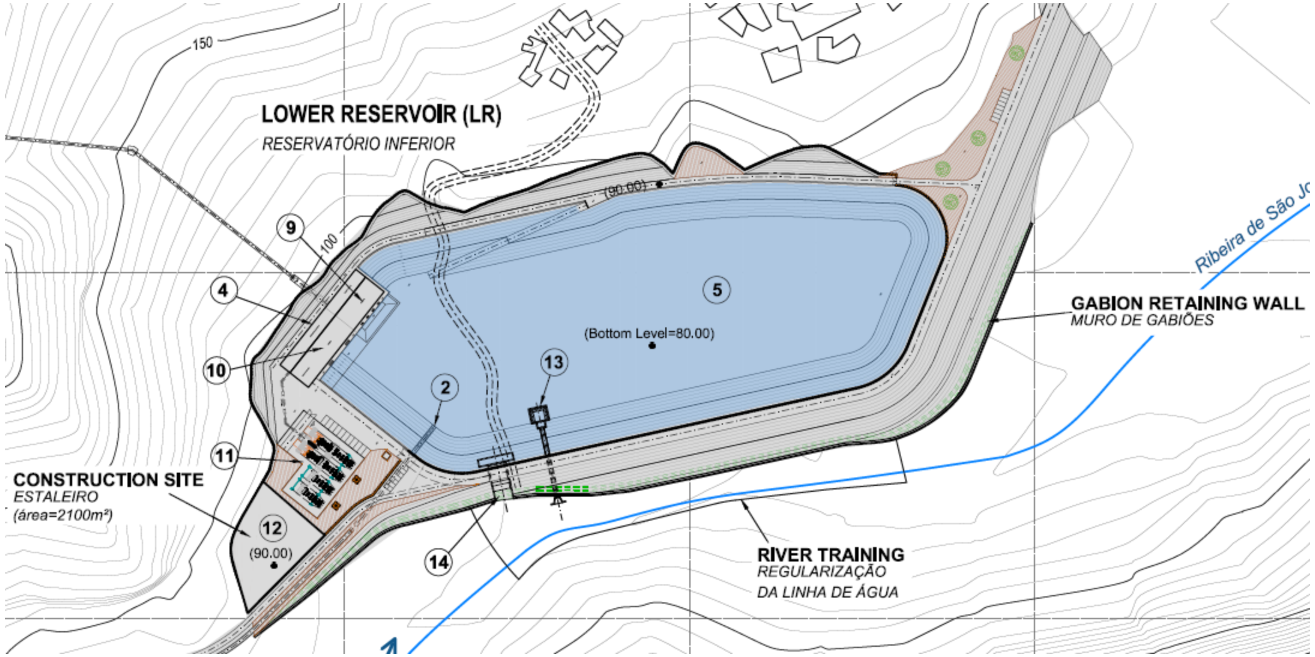
- installed capacity of **<u>20 MW</u>**
- **<u>150.8 MWh</u>** energy storage capacity,
- two large off stream reservoirs, of **<u>320 000 m^3</u>** and **<u>360 000 m^3</u>**, connected by a penstock with length of **<u>0.8 km</u>**, with a surface Powerhouse / Pumping station.
- small diversion dam in ribeira de São João and a desalinated water supply system, both for reservoir filling and compensation of water losses.





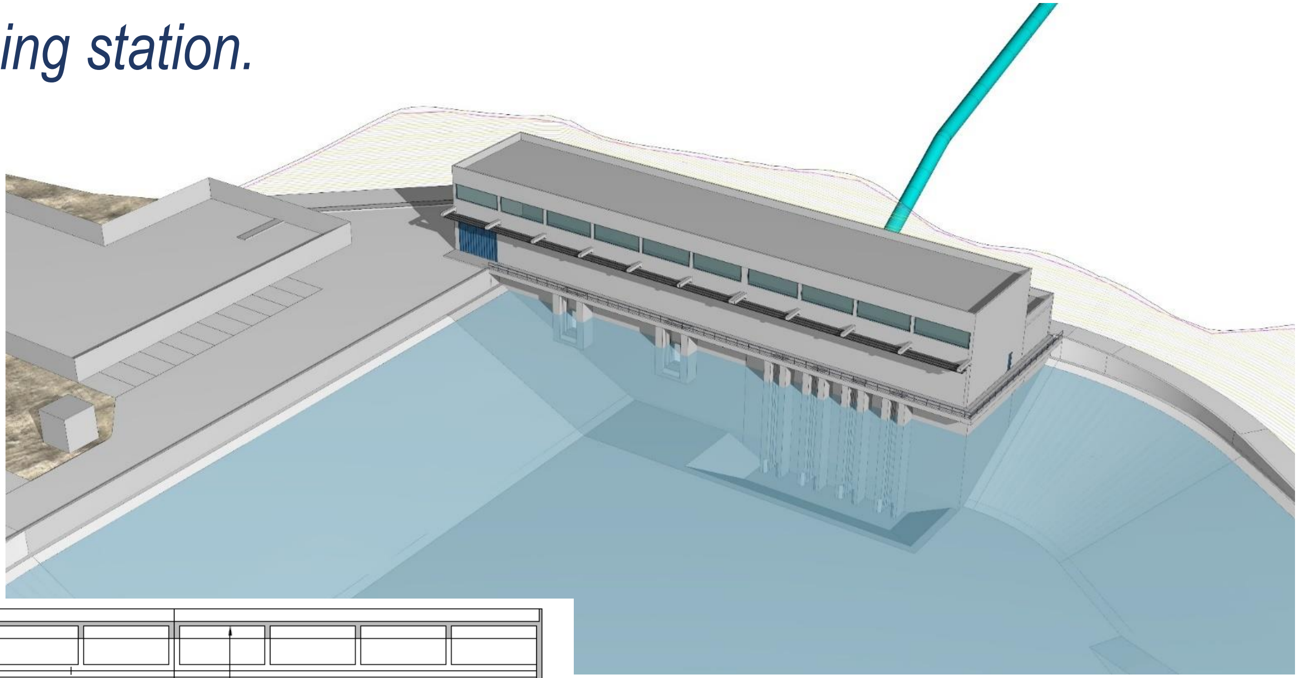


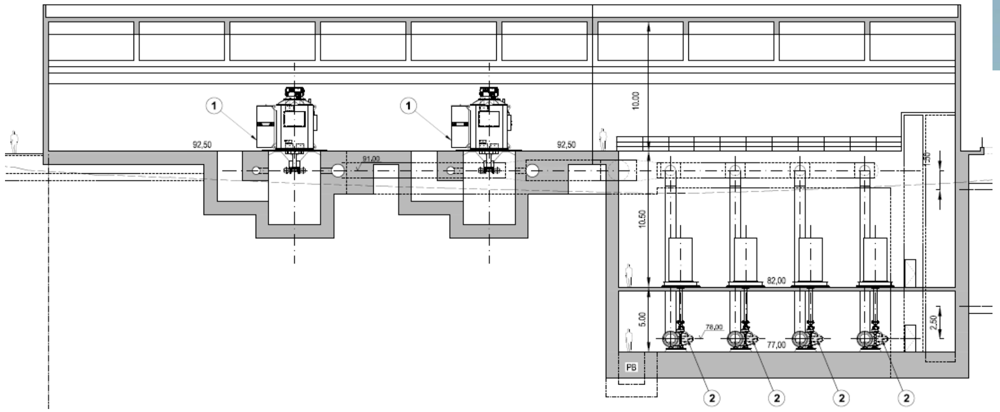
UPPER RESERVOIR (UR)
RESERVATÓRIO SUPERIOR
ACCESS ROAD TO UR
ESTRADA DE ACESSO AO UR
250
300
14
(303.00)
13
2
1
(Bottom Level=293.00)
300
250
250
225



LOWER RESERVOIR (LR)
RESERVATÓRIO INFERIOR
150
100
(90.00)
9
4
10
5
(Bottom Level=80.00)
13
2
11
CONSTRUCTION SITE
ESTALEIRO
(área=2100m²)
12
(90.00)
14
RIVER TRAINING
REGULARIZAÇÃO
DA LINHA DE ÁGUA
GABION RETAINING WALL
MURO DE GABIÕES
Ribeira de São Jo

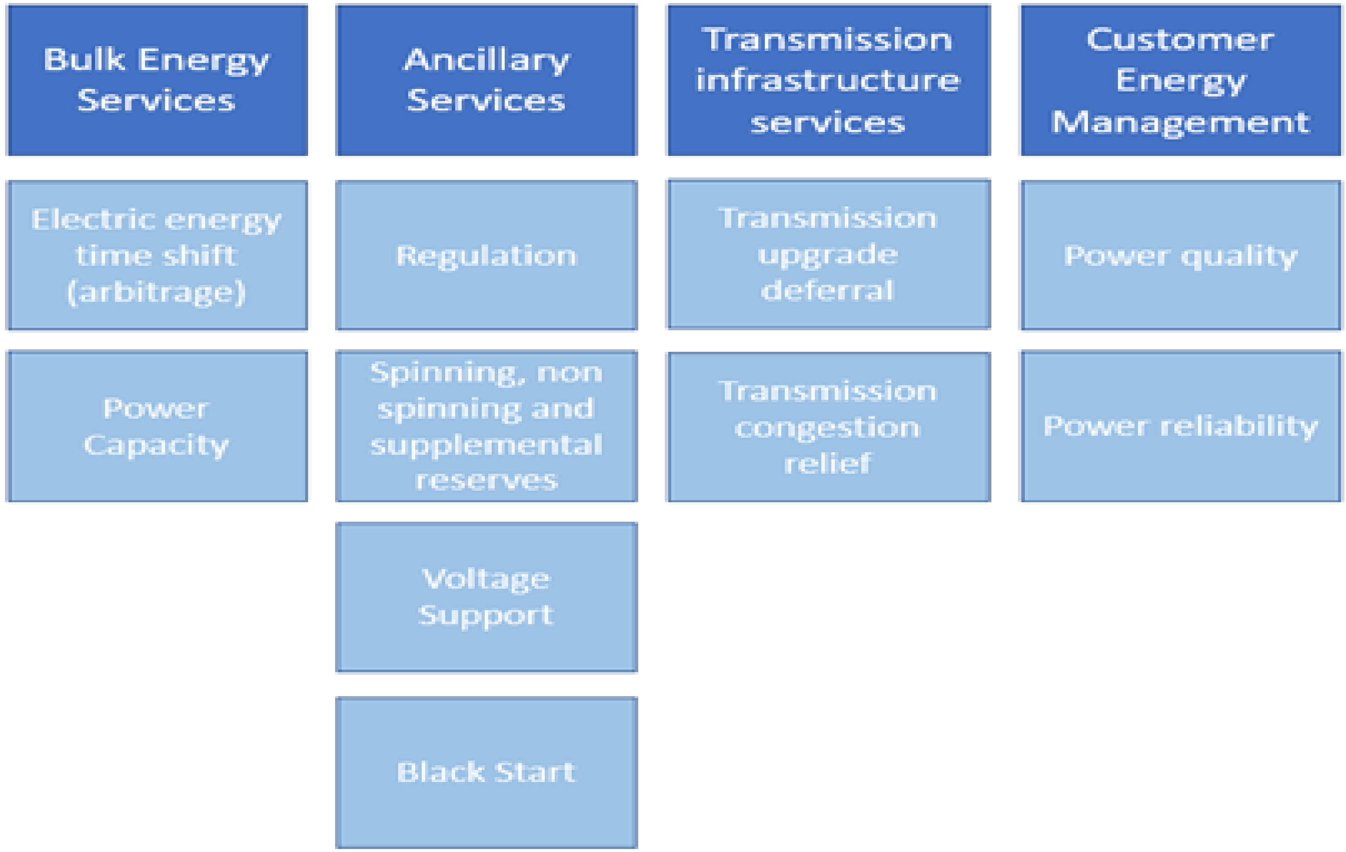
Powerhouse/Pumping station.



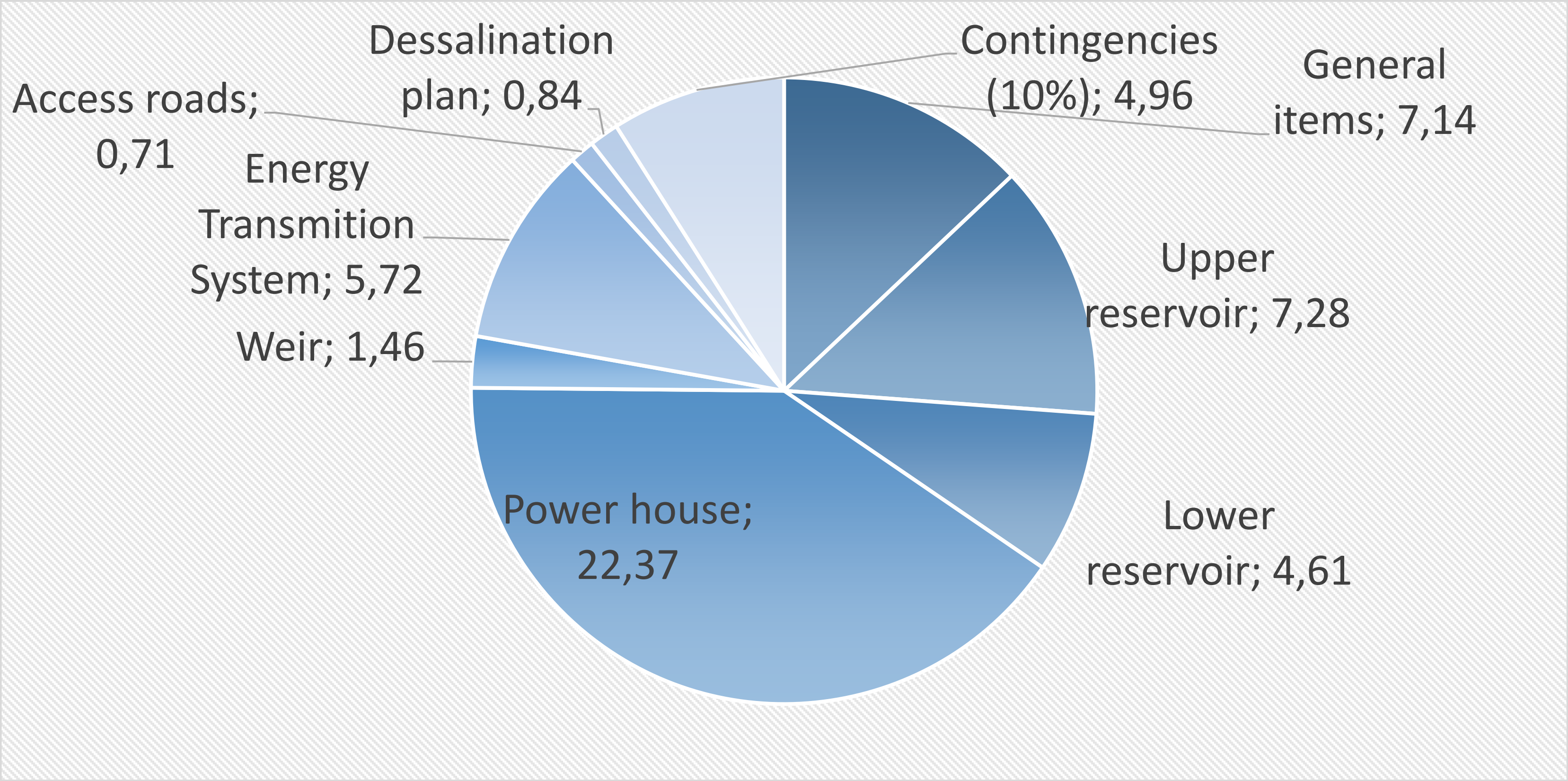


2 x10 MW Pelton turbines
4x5 MW fixed speed pumps

PSP ROLE AND PERFORMANCES IN THE 2030 SYSTEM



The preferred alternative from a technical point of view is Alternative 3 (2 Pelton turbines + 4 fixed speed pumps), with a total cost of 54.65 M€,



Expected Time Schedule

- 2022/23 – Environmental and Social Impact Assessment (EISA); Definition of financial and contractual conditions.
- 2023/24 – PPP / BOT tender; Preliminary works.
- 2024/26 - Construction.
- 2026/27 – Start of operation.

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Thank you!

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