



Deutsch-Portugiesische
Industrie- und Handelskammer
Câmara de Comércio e Indústria
Luso-Alemã

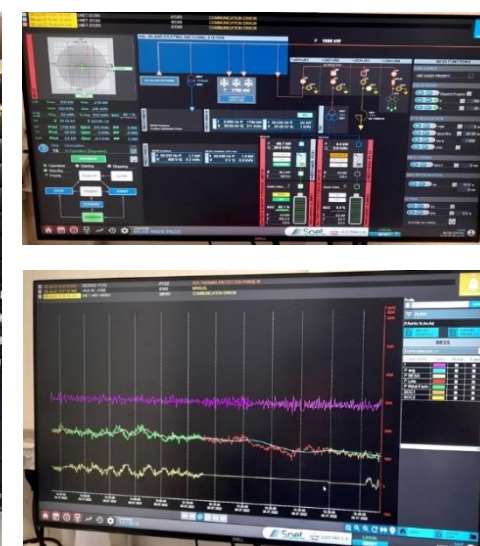


MITTELSTAND
GLOBAL
ENERGY SOLUTIONS
MADE IN GERMANY

VIII GERMANO-CAPEVERDEAN SYMPOSIUM FOR ENERGY “DIVERSIFICATION OF STORAGE AND SMART GRID MANAGEMENT IN CAPE VERDE”

Case study:

1 MWh OF BATTERY ENERGY STORAGE IN SAL ISLAND A PILOT PROJECT WITH CHALLENGES AND BENEFITS



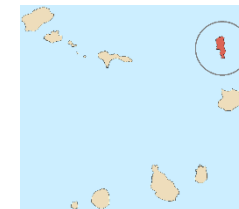
28th November 2022

Supported by:



on the basis of a decision
by the German Bundestag

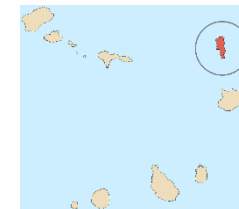




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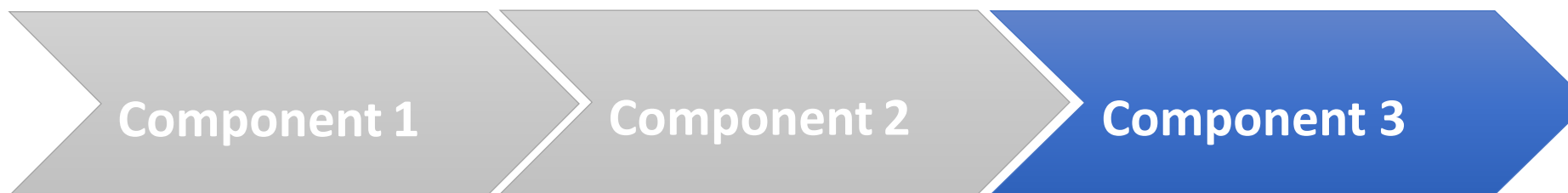
- 1 – Project Framework and Stakeholders
- 2 – Why of Chosen Sal island for project implementation
- 3 – Location of Storage System and Grid Connection
- 4 – Battery Storage system Design and Components
- 5 – Functions and Applications of Pilot Storage System
- 6 – Challenges and Benefits



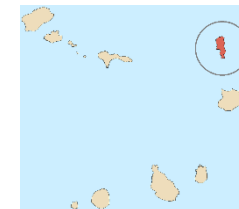


1. PROJECT FRAMEWORK AND STAKEHOLDERS

Losses Reduction and Power Quality Improvement Program



- Grid Studies
- Renewable Penetration Guidelines
- Project Implementation
Pilot Storage



1. PROJECT FRAMEWORK AND STAKEHOLDERS

Losses Reduction and Power Quality Improvement Program

STORAGE PILOT PROJECT

Target

- Installation of **Battery Energy Storage System** de 1MW / 1MWh;
- Installation of **shunt reactor 1MVar** for reactive power mitigation.

Financing

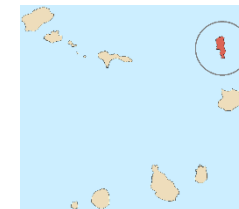
- European Investment Bank



Contract

- Contractor: SAET
- Amount: **1.450.000 €**
- Signature date: December 2019





2. WHY OF CHOSEN SAL ISLAND FOR PROJECT IMPLEMENTATION

GENERAL CHARACTERISTICS

- ✓ Population : around 36 Thousand hab
- ✓ Length: 30 km
- ✓ Area : 219,8 km²
- ✓ **Most Turistic Island of Cape Verde**

POWER SYSTEM BASIC CHARACTERISTICS

- ✓ Max. Electra Demand : **12,1 MW** (Year: 2021)
 - Including APP system Load
- ✓ Annual Electra Production: 58 650 MWh(Year: 2021)



Palmeira Thermal
Power Station
13,5 MW (actual)



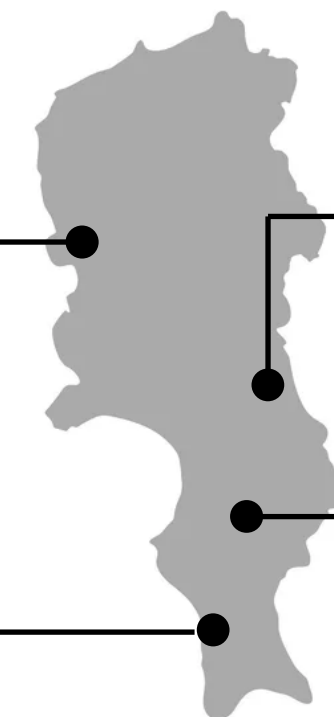
CABEOLICA
Wind Farm (IPP)
7,65 MW

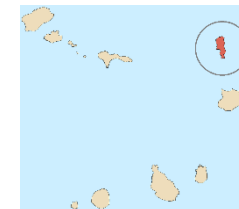


APP
Independent Producer
Thermal + PV



PV FATIMA
IPP
2,25 MWp





2. WHY OF CHOSEN SAL ISLAND FOR PROJECT IMPLEMENTATION

RENEWABLE PENETRATION RATE

2018	2019	2020	2021
26.4%	27.6	28.3%	29.3%

- ✓ Currently is the Island with the Highest Penetration Rate
- ✓ Curtailment of Wind Farm injection is being applied to Prevent System instability
- ✓ Ongoing projects to increase RE Installed Capacity



Palmeira Thermal Power Station
13,5 MW (actual)



CABEOLICA Wind Farm (IPP)
7,65 MW

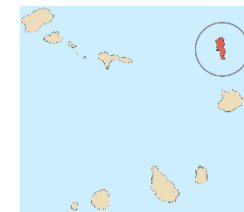


APP Independent Producer
Thermal + PV

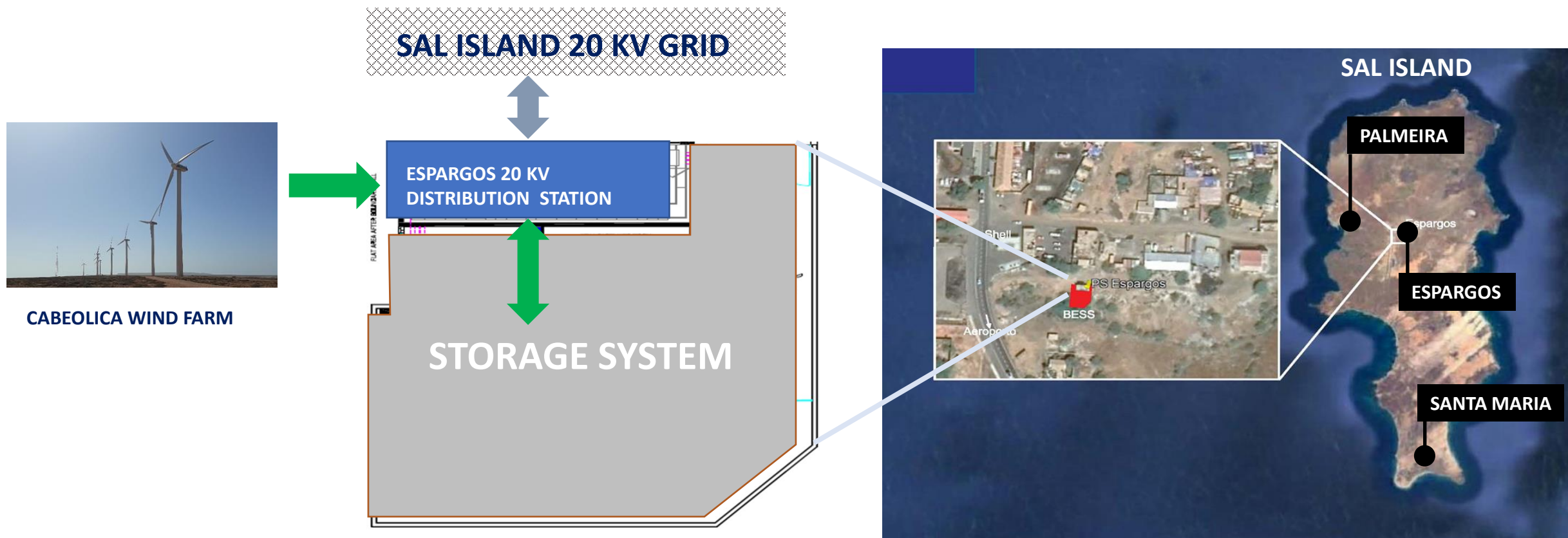


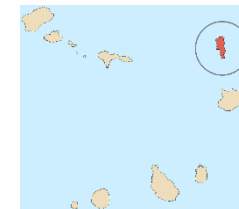
PV FATIMA IPP
2,25 MWp



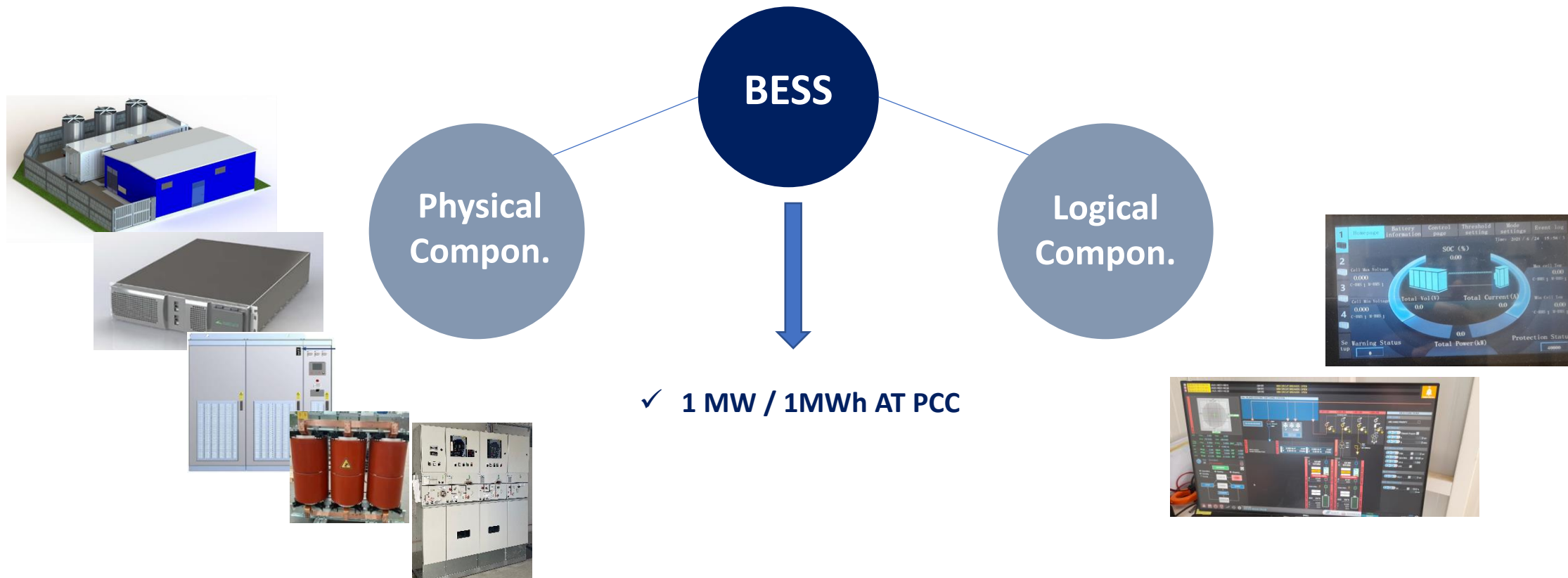


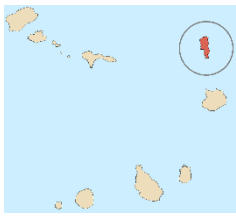
3. LOCATION OF PILOT BATTERY STORAGE SYSTEM AND GRID CONNECTION





4. PILOT BATTERY STORAGE SYSTEM DESIGN AND COMPONENTS

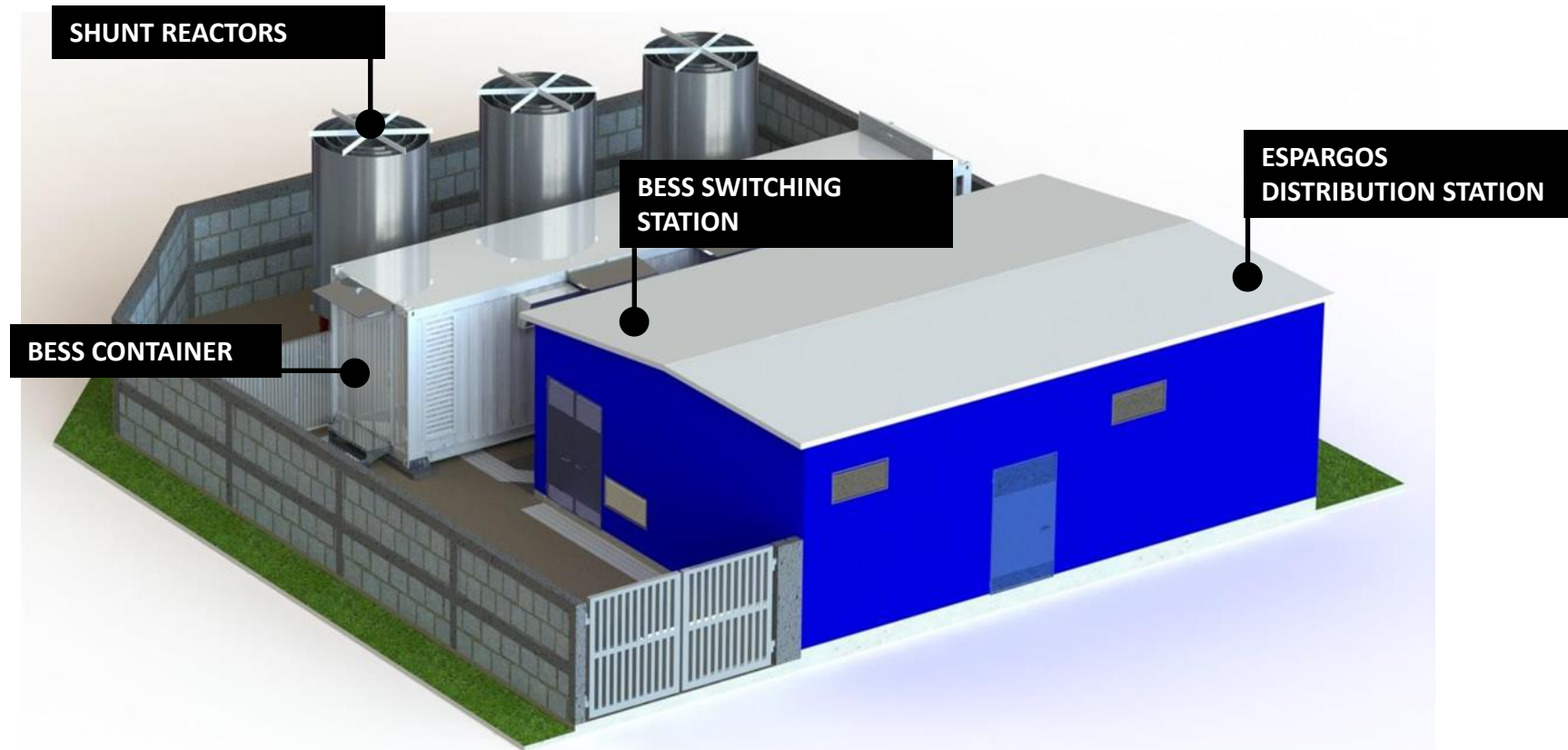


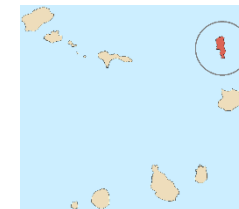


4. PILOT BATTERY STORAGE SYSTEM DESIGN AND COMPONENTS

Physical
Compon.

BUILDING
3D VIEW

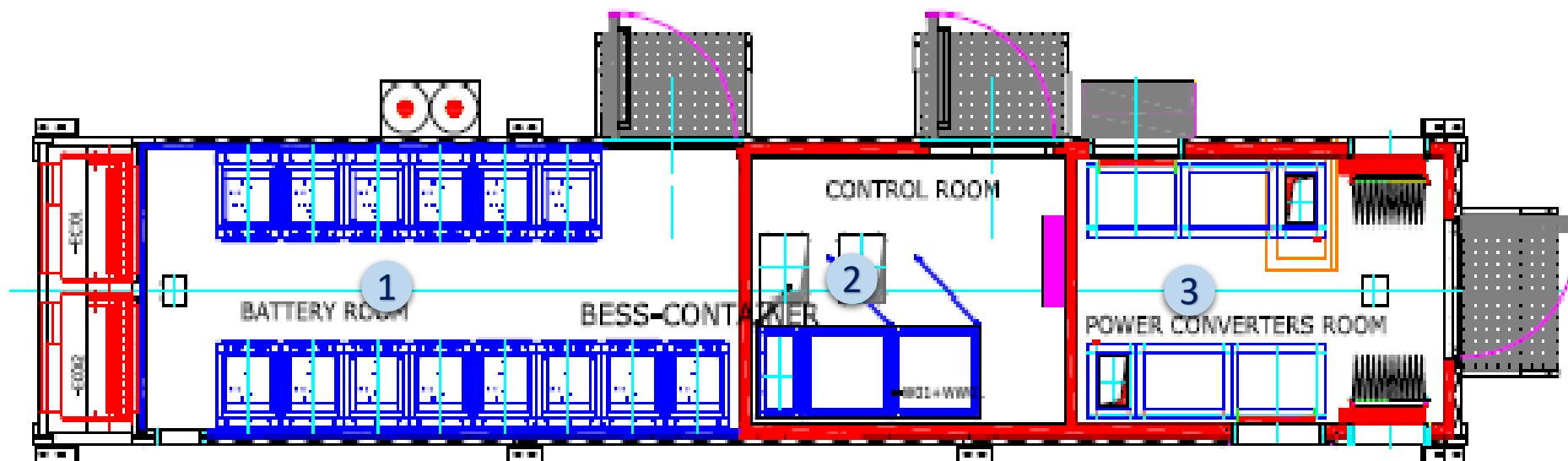




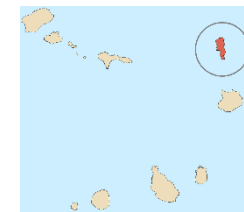
4. PILOT BATTERY STORAGE SYSTEM DESIGN AND COMPONENTS

Physical
Compon.

BESS
CONTAINER



- 1 Battery room
- 2 Control room
- 3 Power Converter Room



4. PILOT BATTERY STORAGE SYSTEM DESIGN AND COMPONENTS

Physical
Compon.

BESS
CONTAINER

BATTERY
ROOM

14 Racks



Fan Box



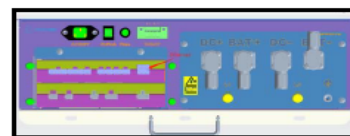
16 Modules



Modules (cells)



BPU (Bat. Prot. Unit)



Energy:

- 104 kWh

Nominal Voltage:

- 828.8 V

Voltage range:

- 672 to 941 V

Capacity:

- 126 Ah

Module (cells)



Technology:

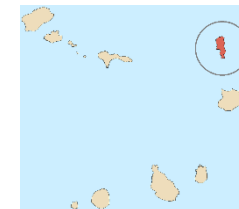
- Lithium-ion battery
- NMC - nickel, manganese, and cobalt

Voltage:

- 42 to 58.8 V, per module
- 3 to 4.2 V, per cell

Energy:

- 6.5 kWh per module
- 233 Wh per cell

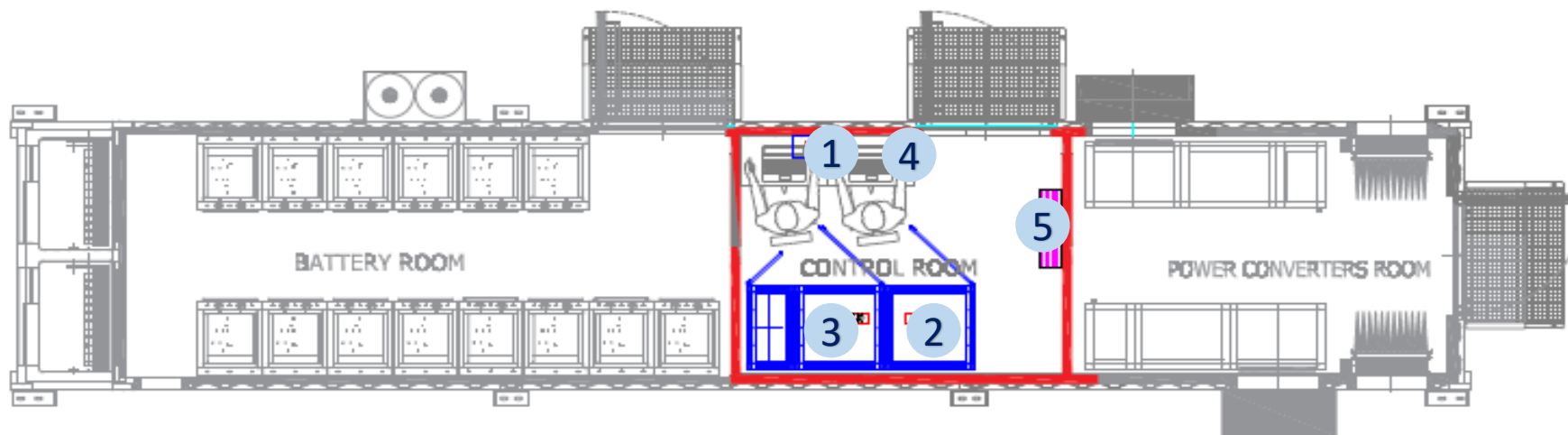


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Physical
Compon.

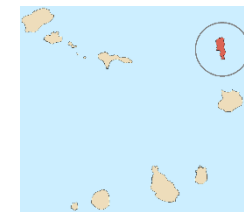
BESS
CONTAINER

CONTROL
ROOM



- 1 Workstation with interface to BESS SCADA (EMS)
- 2 PLC Controller
- 3 Auxilaries LV Control Painel
- 4 HVAC
- 5 Fire detection system



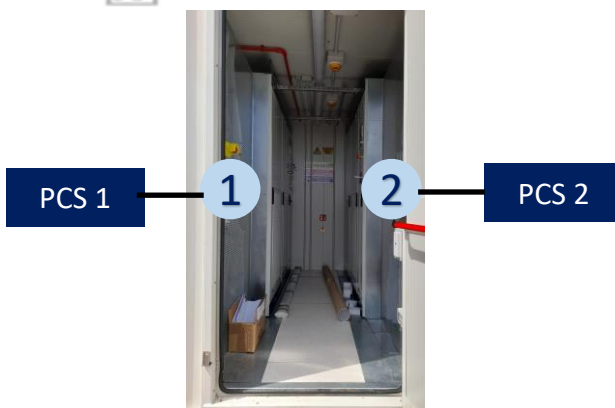
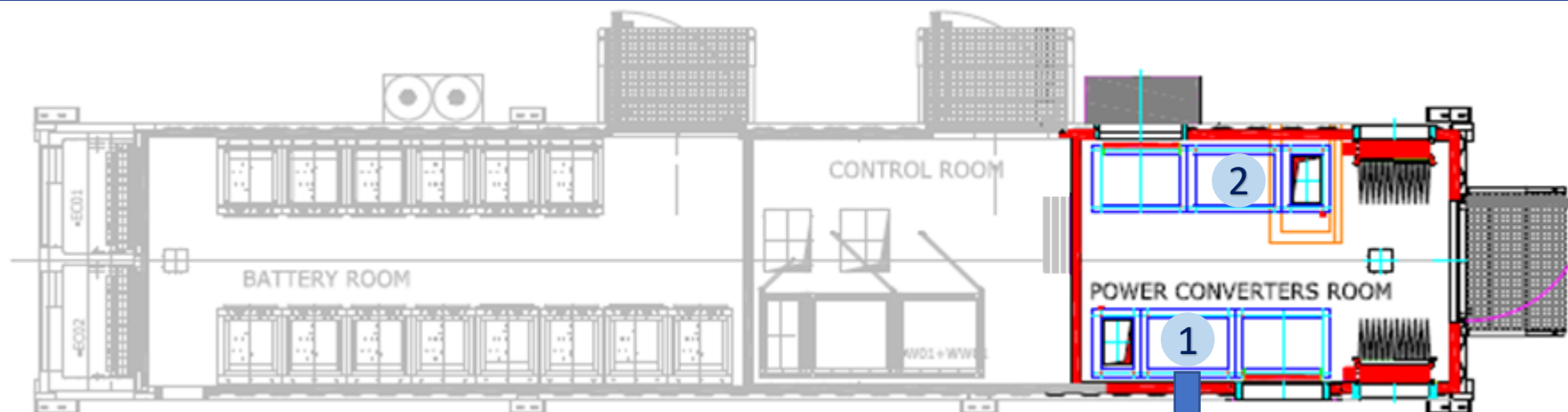


4. PILOT BATTERY STORAGE SYSTEM DESIGN AND COMPONENTS

Physical
Compon.

BESS
CONTAINER

PCS
ROOM



DC SIDE

Max Voltage:

- 1000 V

Max Current:

- 1250 A (Total)
- 500 A (per PCS)

AC SIDE

Nominal Voltage:

- 380 V (+/- 10%)

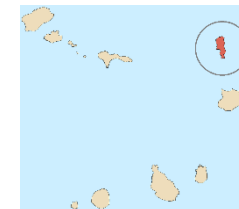
Frequency:

- 50 Hz

Rated Power:

- 550 kVA (per PCS)

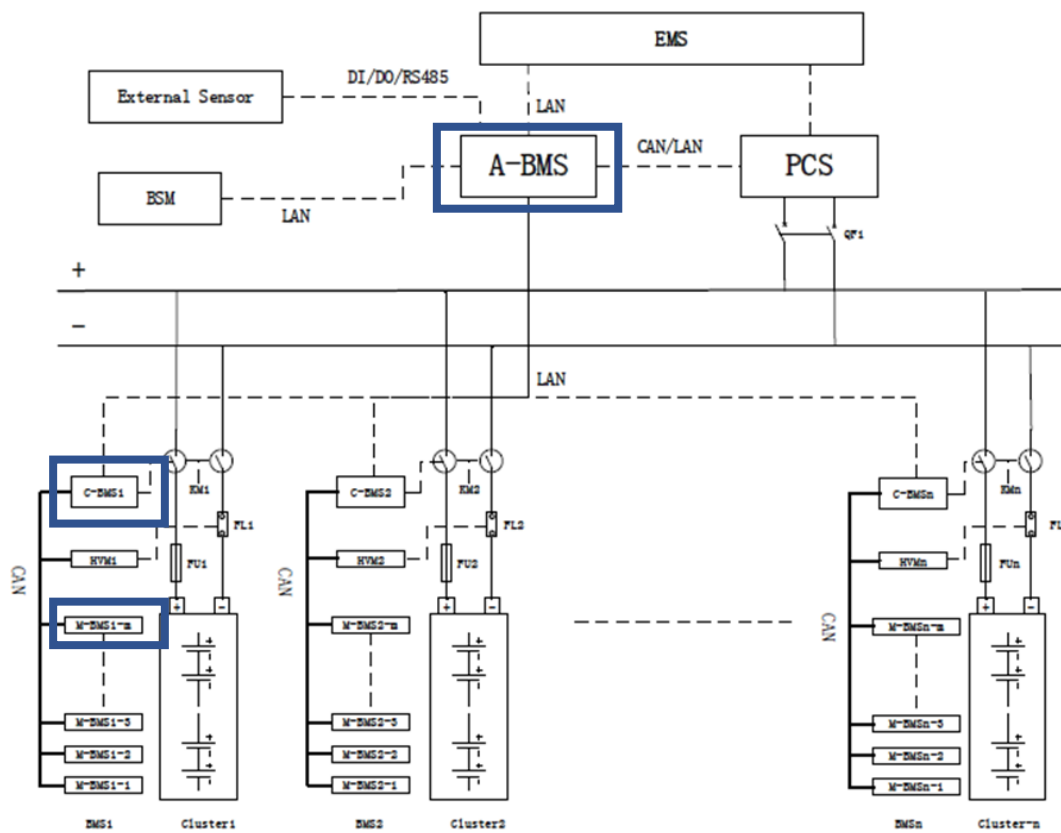




4. PILOT BATTERY STORAGE SYSTEM DESIGN AND COMPONENTS

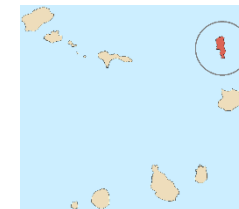
Logical
Compon.

BMS



BATTERY MANAGEMENT SYSTEM





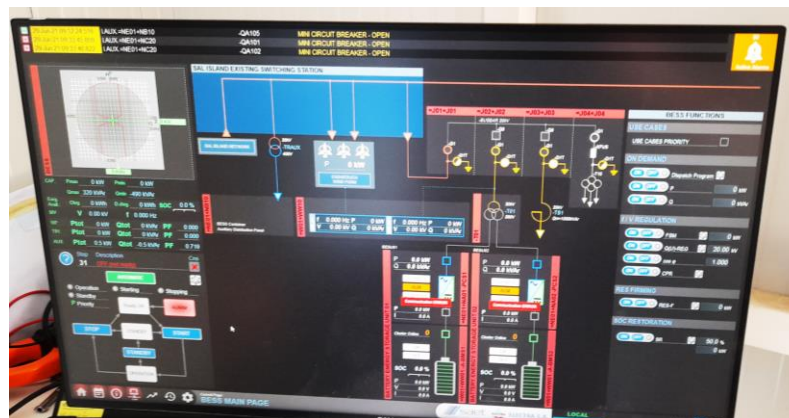
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Logical
Compon.

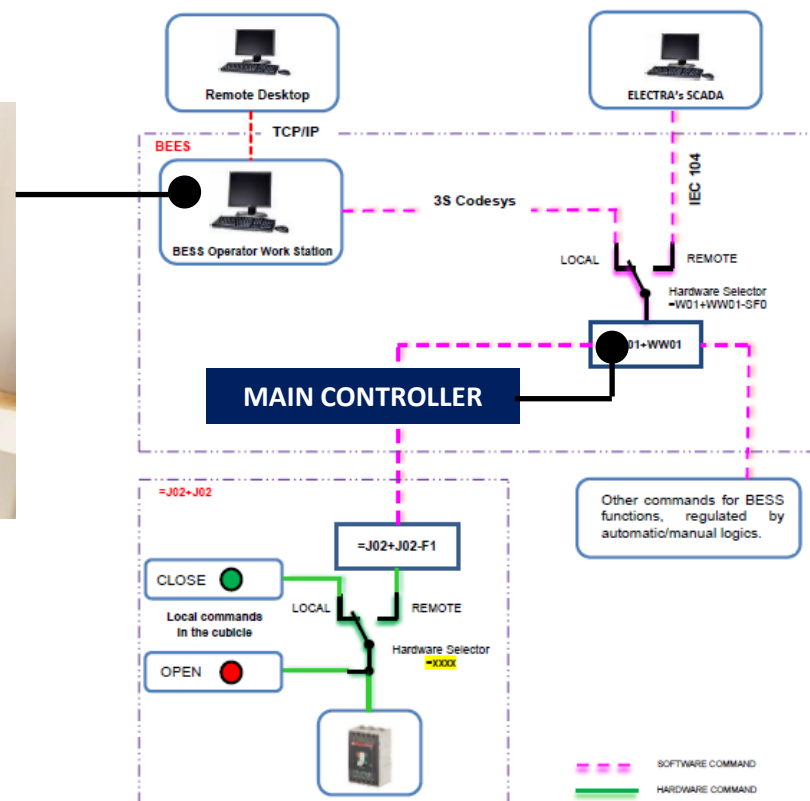
EMS

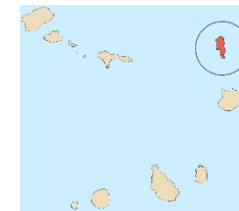


ENERGY MANAGEMENT SYSTEM

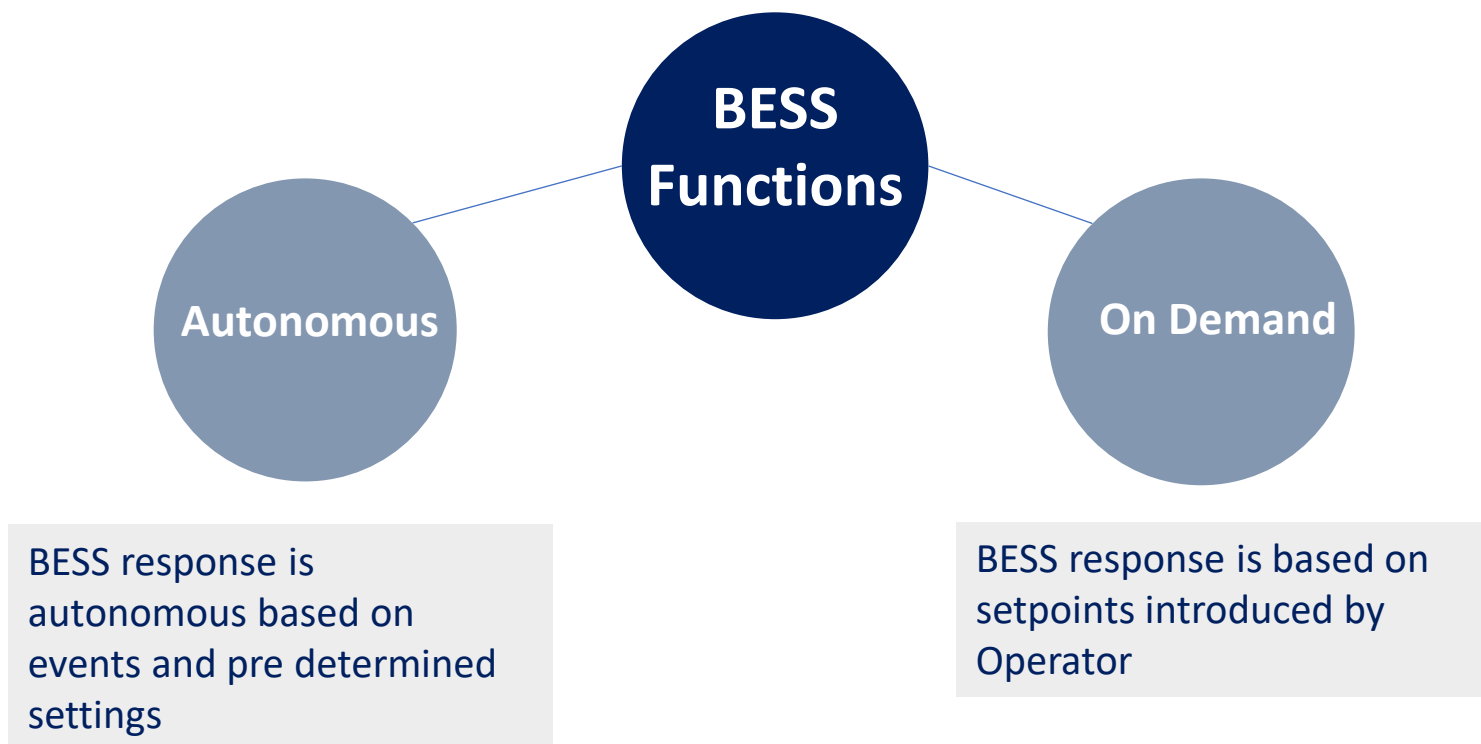


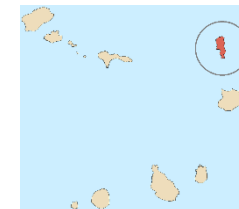
HMI





5. FUNCTIONS & APPLICATIONS OF PILOT STORAGE SYSTEM





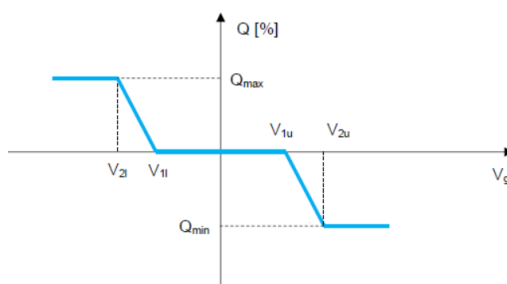
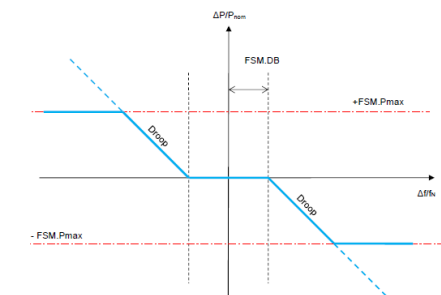
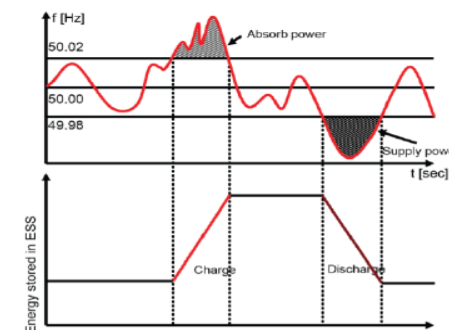
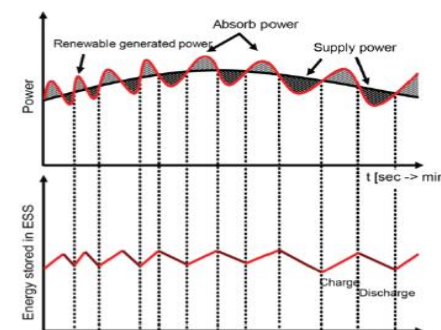
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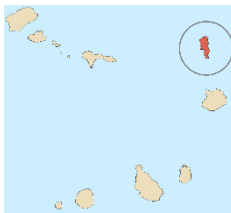
BESS Functions

AUTONOMOUS FUNCTIONS

- Capacity Firming (RESF)
- Frequency Sensitive Mode (FSM)
- Voltage Control (Q (U) -REG)
- Power Factor Control - COSPHI-REG

AUTONOMOUS





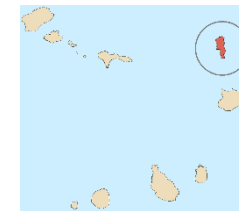
5. FUNCTIONS & APPLICATIONS OF PILOT STORAGE SYSTEM

BESS Functions

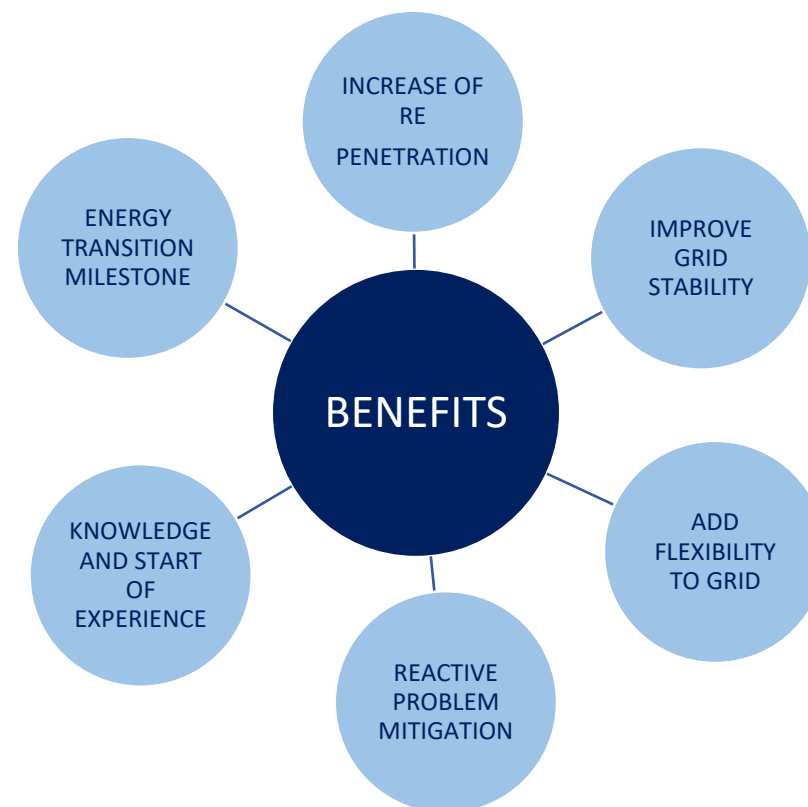
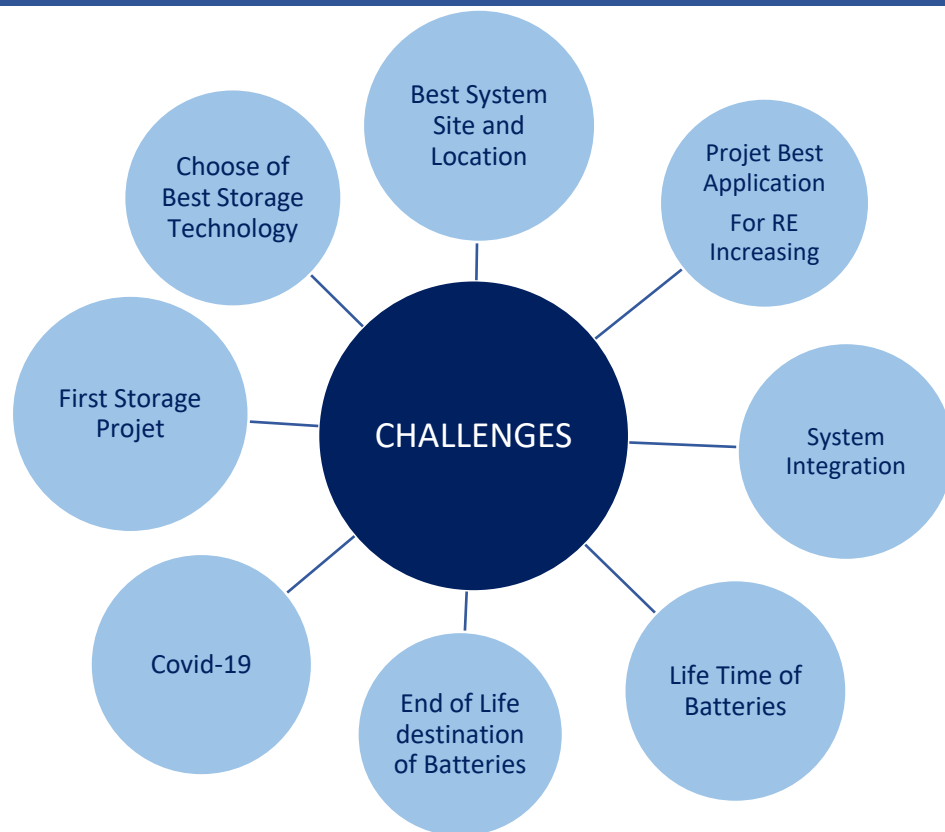
ON DEMAND FUNCTIONS

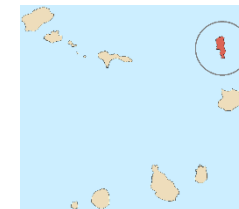
- (P) – Active Power (kW)
- (Q) – Reactive Power (kVAr)
- Dispatch program

AUTONOMOUS



6. CHALLENGES AND BENEFITS





END

OBRIGADO
DANKE
THANK YOU

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