#CE4EUislands – Workshop: Smart electricity systems for facilitating the decarbonisation of islands: demand-side management and flexibility

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What is there for the DSOs to do to enable the smartening of the islands?

The Autonomous Region of Madeira Use Case

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Madeira Island's "#CE4EUIslands - 30 for 30 Challenge" Transition Team

Brussels, 29th of January 2025

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EEM – Empresa de Electricidade da Madeira, S.A.

(Electricity Producer, TSO, DSO, Supplier)

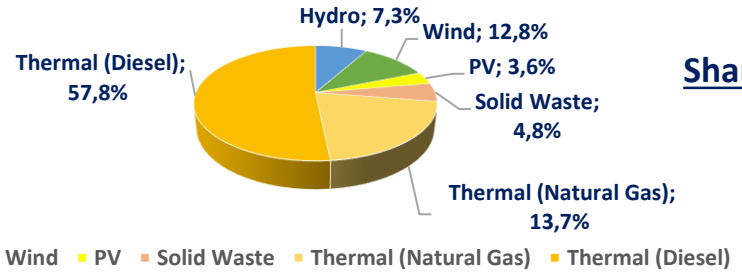
AUTONOMOUS REGION OF MADEIRA

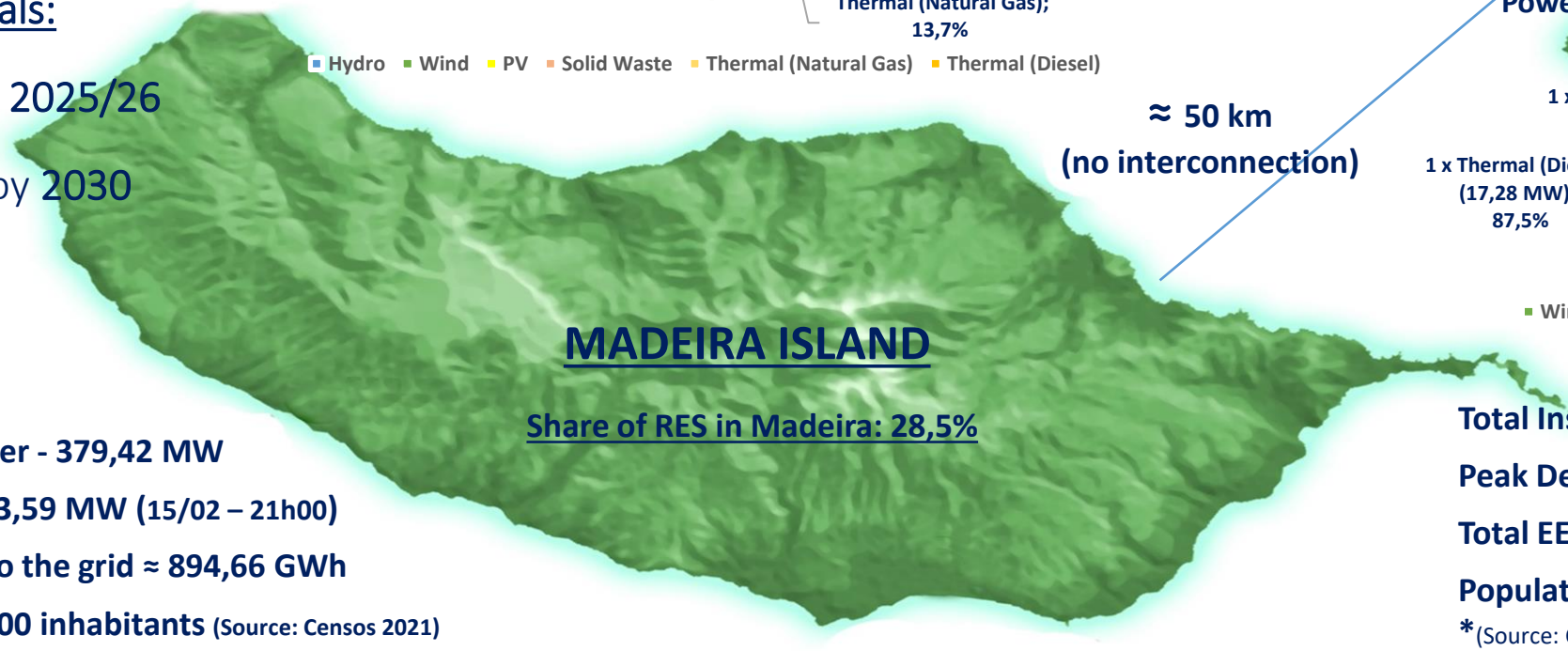
Islands Goals:

→ 50% RES by 2025/26

→ ≥ 60% RES by 2030

Power Generation Mix – 2023– Madeira Island





MADEIRA ISLAND

Share of RES in Madeira: 28,5%

Total Installed Power - 379,42 MW

Peak Demand ≈ 153,59 MW (15/02 – 21h00)

Total EE emission to the grid ≈ 894,66 GWh

Population ≈ 246 000 inhabitants (Source: Censos 2021)

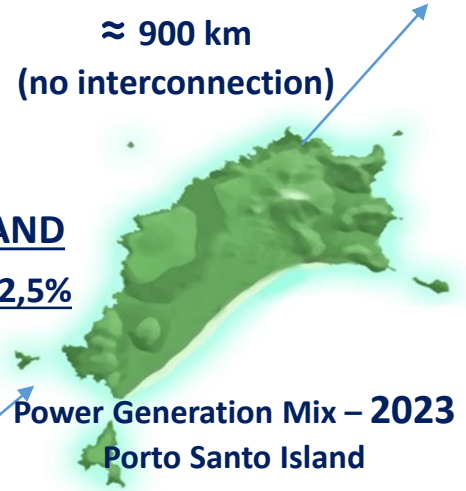
Area: 741 km²

≈ 50 km (no interconnection)

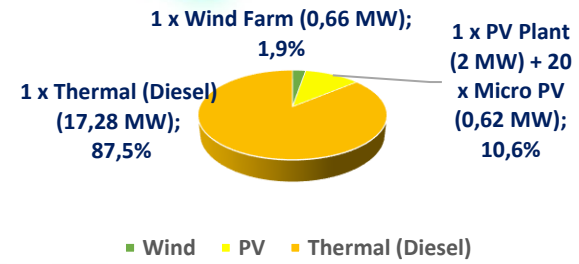
≈ 900 km (no interconnection)

PORTO SANTO ISLAND

Share of RES in Porto Santo: 12,5%



Power Generation Mix – 2023 Porto Santo Island



Total Installed Power - 20,34 MW

Peak Demand ≈ 7,97 MW (11/08 – 21h00)

Total EE emission ≈ 36,41 GWh

Population ≈ 5 151 inhabitants*

*(Source: Censos 2021)

Area: 42,48 km²

TOTAL POPULATION ≈ 251 000 inhabitants Source: EEM **EEM Clients ≈ 136 411 Madeira / 4 766 Porto Santo**

Grid Flexibility – The Madeira Use Case

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Generation Flexibility Level

- **TSO/SCADA/AGC** – Use of **consolidated management instruments** | **Smart Grids technologies** (forecast, sensing, remote command, communication systems…) | Coordination with **global management system (AGC)**;
- **Storage systems** (Reversible Hydroelectric Power Plants and large-scale **Battery Energy Storage Systems (BESS)**) + synchronous compensator* (2025);

Madeira's Grid Code (November 2019):

- **New RES installations** with **over 100 kW** installed power, shall communicate and be "controllable" by **EEM's Dispatch Center**;
- **Connection policies and requirements for RE** intermittent generation to be able **to support the system when needed** (during or following grid faults)…

+ Fundamentals of the Electricity Sector (January 2023) → Establishes the organization/operation of the electrical system of Madeira, adapting **DL 15/2022**.

Demand Flexibility Level

- **DSO/ADMS/DERMS** - Distributed Energy Resource Management System **(DERMS)** → part of an **ADMS architecture** and sharing data with it;
- **AMI** – Advanced Metering Infrastructures (**smart-meters information** → smartening and **digitalization of the grid** + **customer consumption profiles**);
- **EVMS** – Electrical Vehicle Management System → **V1G/V2G smart-charging**, innovative European Pilot Projects (***SMILE, INSULAE, AHEAD…***) and "***SPS:SFFI***"…;
- **"+ENERGIA"** - Regional Government financial incentives to buy "**behind-the-meter small scale battery storage systems**" for self-consumption regime of RES.

DSM-Besides TOU (time-of-use tariffs already implemented) (ERSE), to raise awareness in the local society for the need to optimize the energy use, there are also several planned projects and demonstrators to use electric mobility (mitigation of peak demand and network overloads) as well as focusing on other possible controllable loads that can be tested locally, such as large-scale cooling (HVAC) systems from the Touristic Sector.

BESS Porto Santo I

Nominal Power: 5,4 MVA / 4,3 MW

Capacity: 3,3 MWh

PA: 06/2020

Source: EEM

Eligible Total Cost: 3.576.843,12 €

EU Financial Support: **641.958,64 €**

BESS Madeira I –Vitória

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Nominal Power: 23,7 MVA / 15 MW

Capacity: 16,4 MWh

PA: 09/2022

Eligible Total Cost: 9.308.857,27 €

EU Financial Support: **7.788.276,32 €**

Source: EEM

Co-financed by POSEUR (Cohesion Fund):

POSEUR
PROGRAMA OPERACIONAL SUSTENTABILIDADE E EFICIÊNCIA NO USO DE RECURSOS 2014 20

REGIÃO AUTÓNOMA DA MADEIRA

PORTUGAL 2020

UNIÃO EUROPEIA
Fundo de Coesão

BESS Porto Santo II

Nominal Power: 12 MVA / 8,92 MW

Capacity (BoL): 17,89 MWh

PA: 06/2024

Source: GR.Madeira

Total Cost (Investment): 12.354.688,14 €

Actual EU Financial Support: **11.770.798,00 €**

BESS Madeira II - Caniçal

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Nominal Power: 27 MVA / 18,7 MW (AC)

Capacity (BoL): 16,1 MWh (AC)

PA: 01/2025

Total Cost (Investment): ≈ 15.900.000,00 €

Actual EU Financial Support: **15.891.820,00 €**

Source: Hitachi Energy Portugal | EEM

Financed by Portugal's Recovery and Resilience Plan (PRR):

PRR Plano de Recuperação e Resiliência

REGIÃO AUTÓNOMA DA MADEIRA

REPÚBLICA PORTUGUESA

Financiado pela União Europeia NextGenerationEU

Madeira and Porto Santo BESSs – Impact

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Source: EEM

ENERGY TRANSITION

Source: EEM

Turn off diesel thermal **generators**

Spinning **Reserve**

Generation flexibility to increase renewable energy integration

RES intermittency effects **smoothing**

Reduction of CO_2 emissions

Reduction of RE **curtailment**

Reduction of maintenance **costs** (Thermal Power Plants)

Better **grid stabilization** and **security of supply** by improving key parameters of the electrical grid (**frequency & voltage**):

- **more flexibility…**
- **stronger grid…**

TARGET: "0" thermal generators, everytime there are available RES

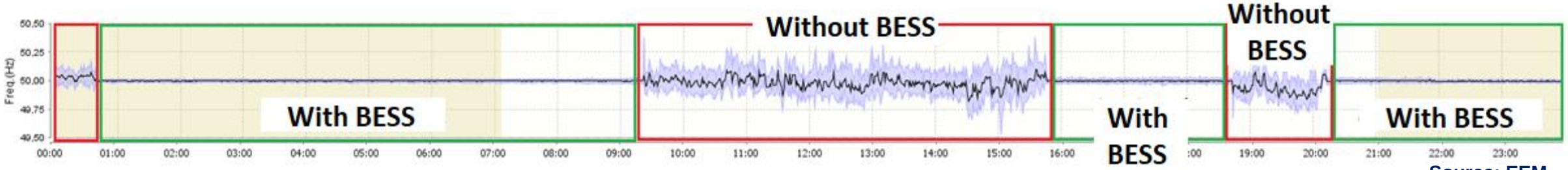
Madeira and Porto Santo BESSs – Impact and Results

✓ Substantial reduction of frequency variation achieved:

Speed Droop Control: Frequency Droop = 2 %

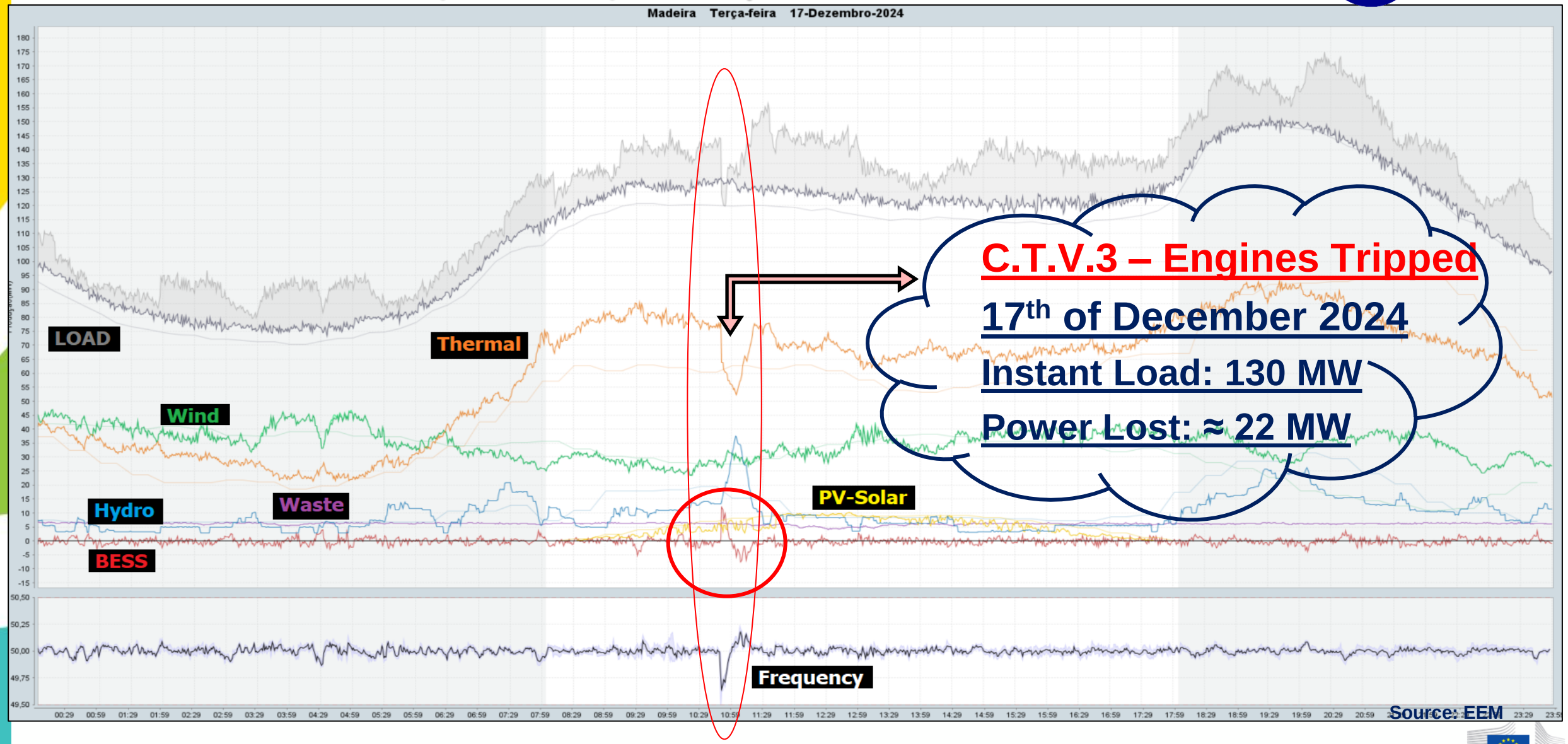
✓ Substantial improvement in the quality of service provided to customers:

"Isochronous speed control emulation"



Source: EEM

BESS Madeira I (Vitória) – Impact & Practical Results



Source: EEM

Future & Opportunities:

- To proceed supporting specific legislation for the context of small-scale outermost islands, such as in Autonomous Region of Madeira - **legal and regulatory framework**;
- Keep on structuring our electrical system to operate without fossil fuels;
- Continue to pursue "disruptive" new technologies – **sm@rtering the grid + grid flexibility**;
- Create attractive conditions for private investment in RES sector under competitive circumstances – **at least 60% of RES both in Madeira and Porto Santo Islands in the near future (2030)**;
- Innovative technologies to increase electrical network resiliency, sustainability and productivity **(smart grids, smart metering/charging, VPP, microgrids and BESS, big storage capacity, EVs, etc.)**;
- Contributions to reduce Madeira's external energy dependence;
- To carry on with **Cybersecurity** improvements.

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Thank You!

More information?

https://eeminov.eem.pt/

https://youtu.be/S9tpRr5iX5Q

https://youtu.be/wJq89TitUeA

Source: EEM