Andreas Nitsch
Senior Solution Engineer

Use and Control of BESS

Hybrid Control & Ancillary Services

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Global expertise

50

GW installed

24,000

assets connected

31

countries with projects

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What brought us here?

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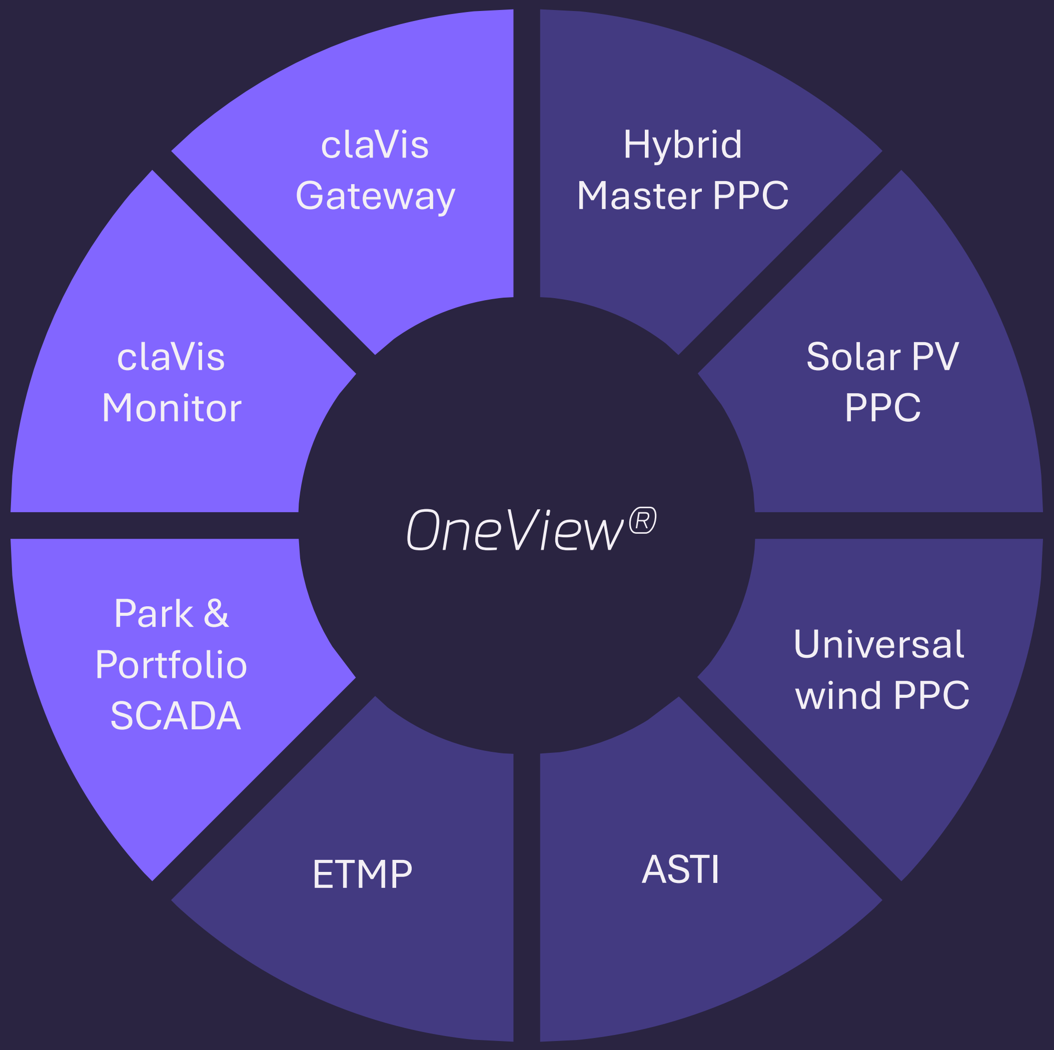
Monitor and control all your renewable assets in one system

With our integrated software →



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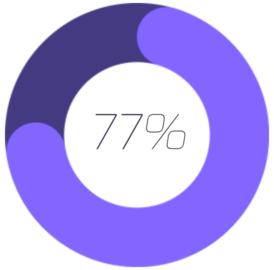
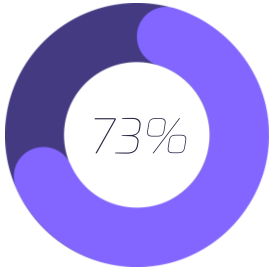
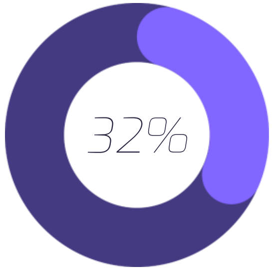
Why *you* are here



At least one third of future projects are hybrid

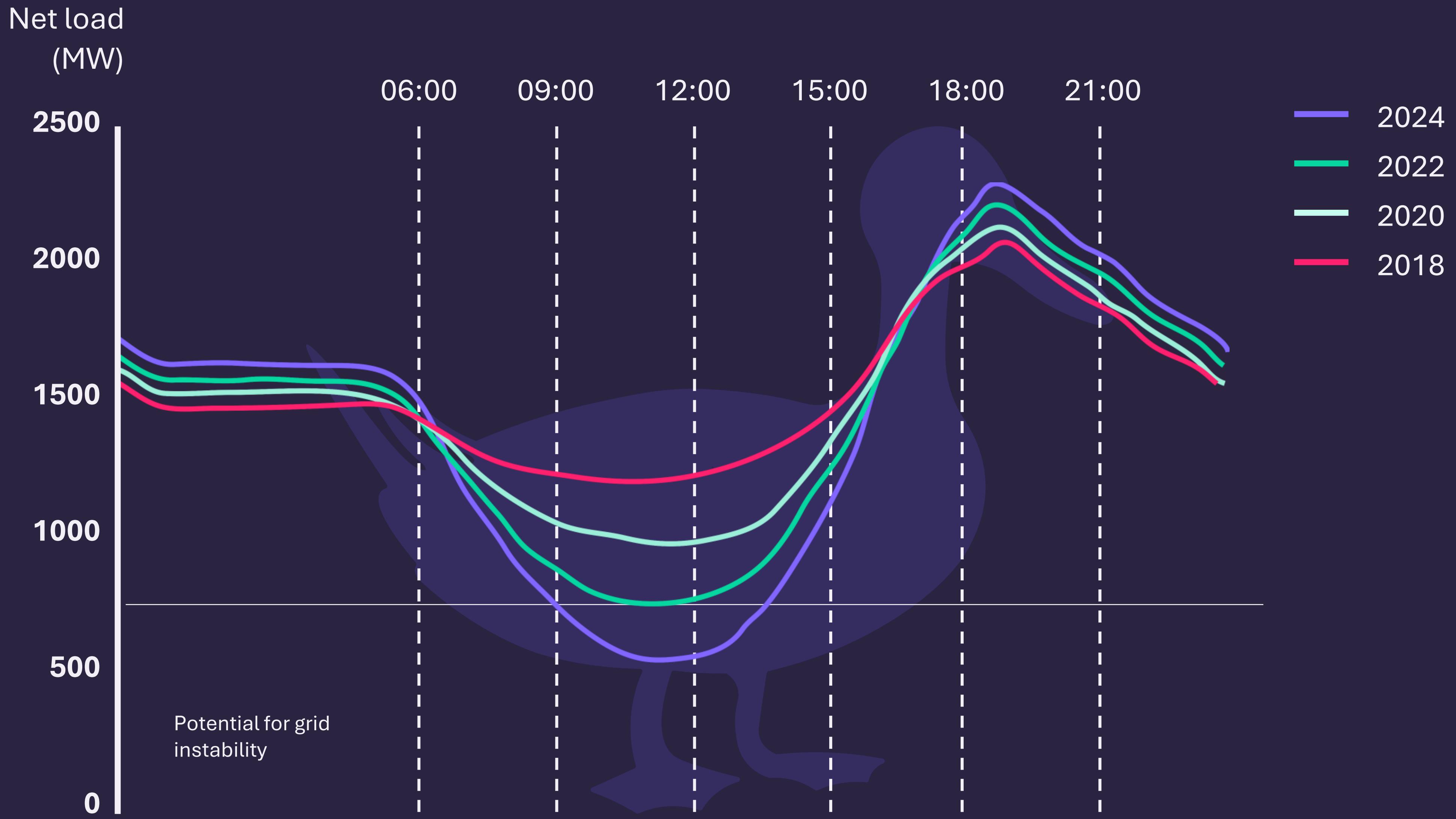


Grid connection & approval processes requires most of your attention



Don't know your primary purpose of using BESS

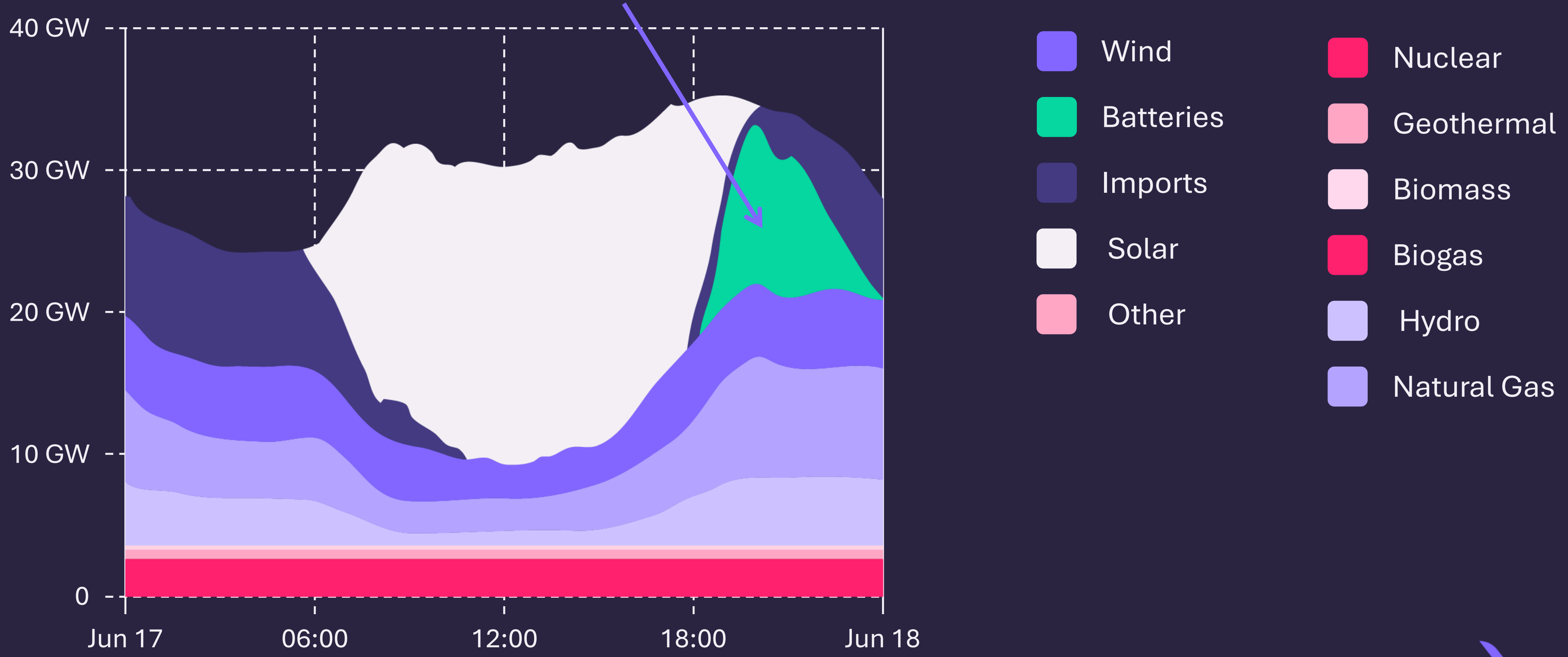
The duck curve brought us here...



Source: Pebblex Energy

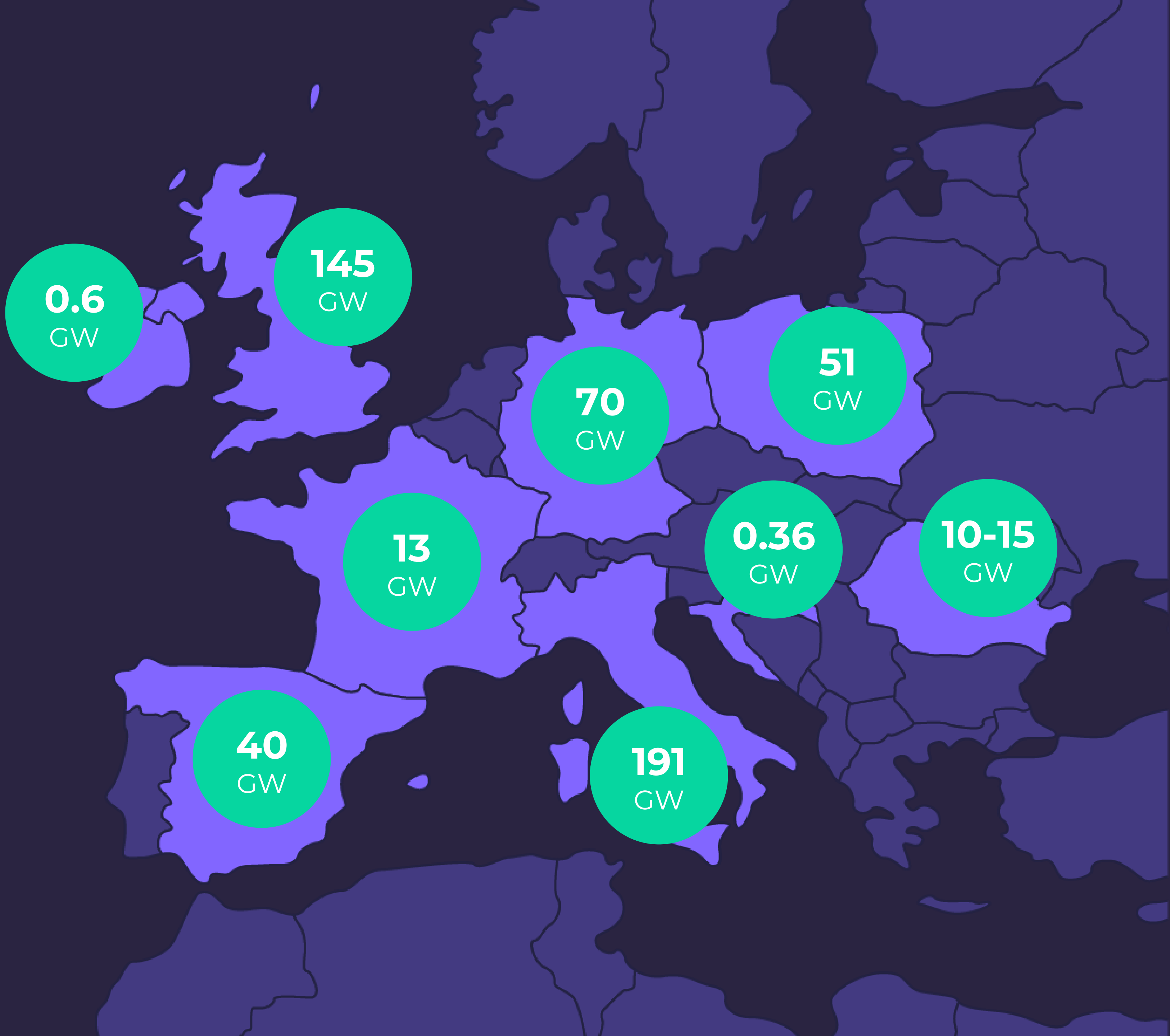
...but hybridization with BESS can bring back stability

June 17, 2025 20:05: batteries peak at 32% of supply and are the largest source of supply for nearly 3 hours



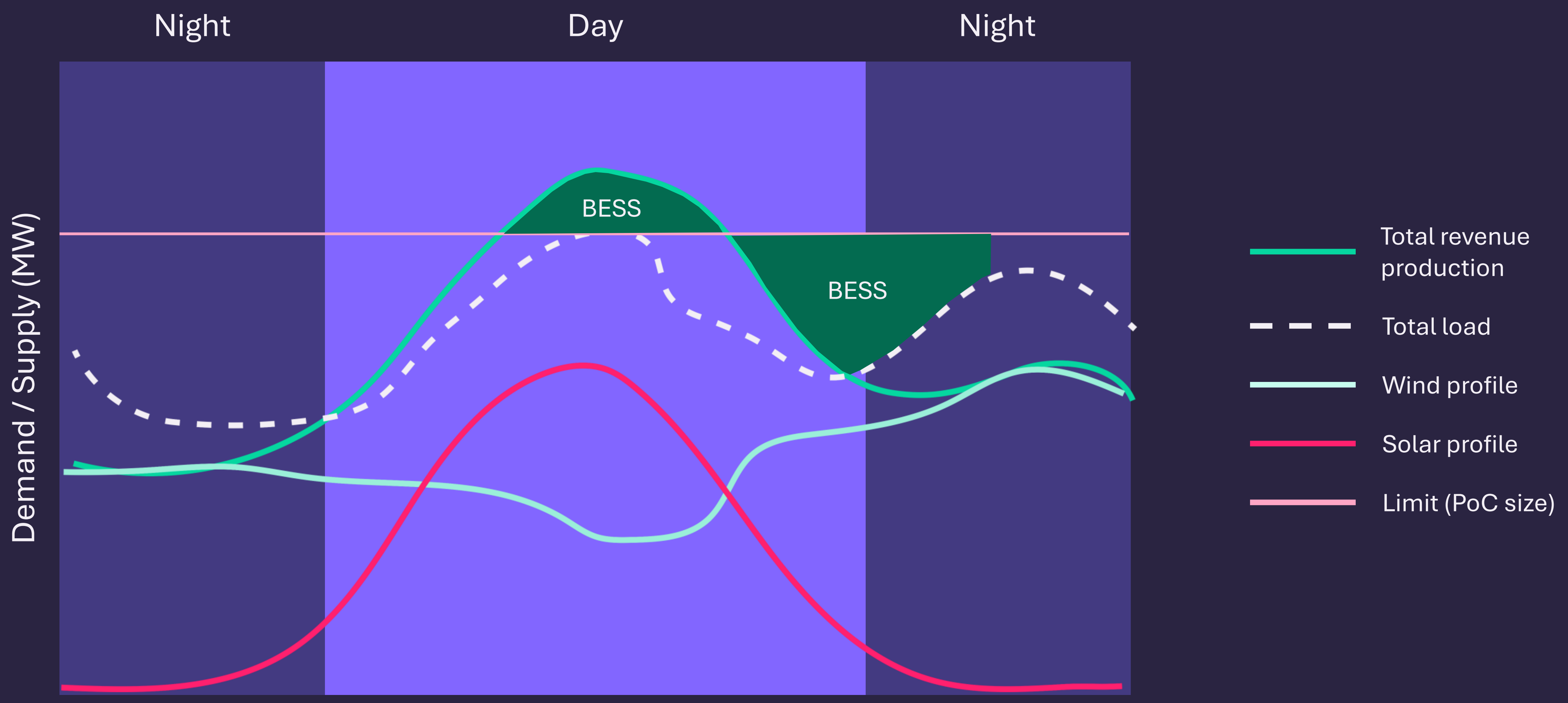
Source: CAISO (gridstatus.io)

Current grid connection queues across Europe



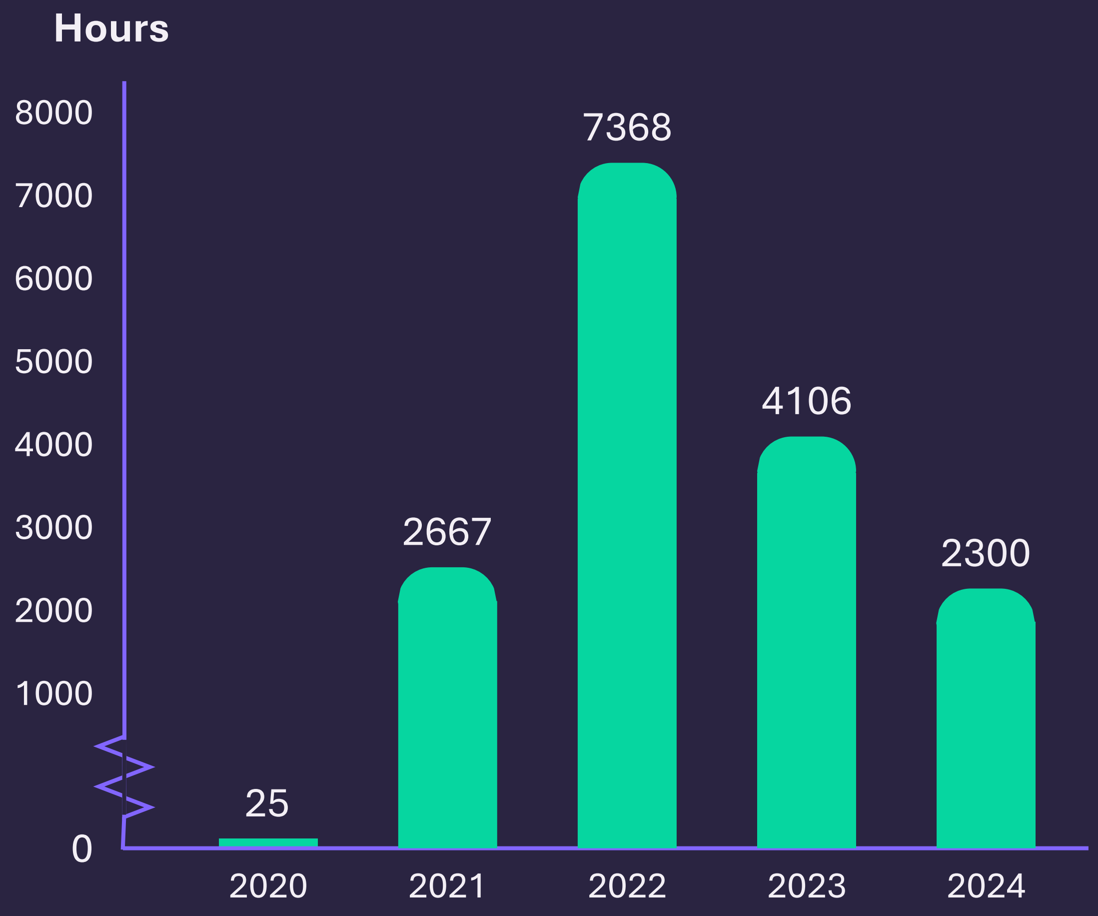
Source: Wind Europe, 5. July 2024

Peak Shaving



Overview of high energy prices in Germany 2020-2024

Hours with prices above 100 EUR / MWh (day-ahead)



Source: Forschungsstelle für Energiewirtschaft (FfE)

- 2022 was they year with the highest number of times where a MWh was more than 100 EUR
- On the 6th November 2024, day-ahead price was 800 EUR / MWh
- A BESS system could be a benefit during times of high energy prices

What is possible with adding BESS

Different options for BESS utilization

1 Peak shaving / Green Storage

- Change/discharge of excess green energy (wind and solar)
- Compliant with the German Innovation tender
  - **90 EUR*/ MWh**
  - Onshore wind: 73.5 EUR* / MWh
  - PV plants > 5MW: 68 EUR* / MWh

2 Load shifting / Grey storage / Arbitrage

- BESS is charged from the grid
- Non-compliant with the German Innovation tender
- Often used for stand-alone BESS business cases

3 Ancillary services

- Grid services sold to TSOs for frequency support
- Standby-assets available for balancing grid stability
- Available for hybrid setups

* Highest allowed auction price

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Ancillary services

- Spinning reserve
- **Balancing energy**
- Sheddable loads

Frequency measure

Voltage compensation

- Power factor correction
- Loss energy

- Monitoring of the grid
- Feed-in management
- Redispatch

Operational management

Reconstruction of supply

- Black start

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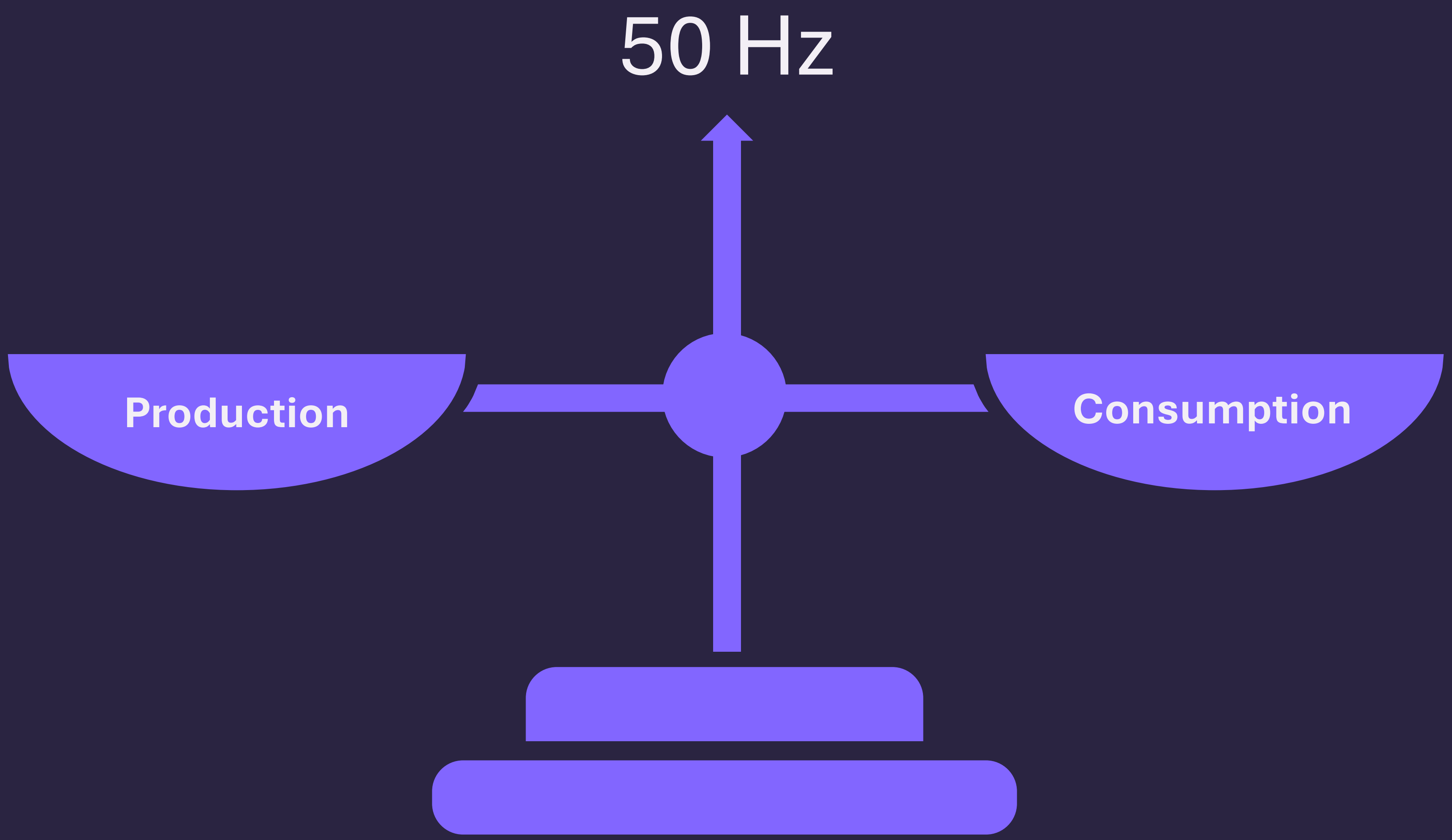
The need for grid stability causes both negative and high energy prices



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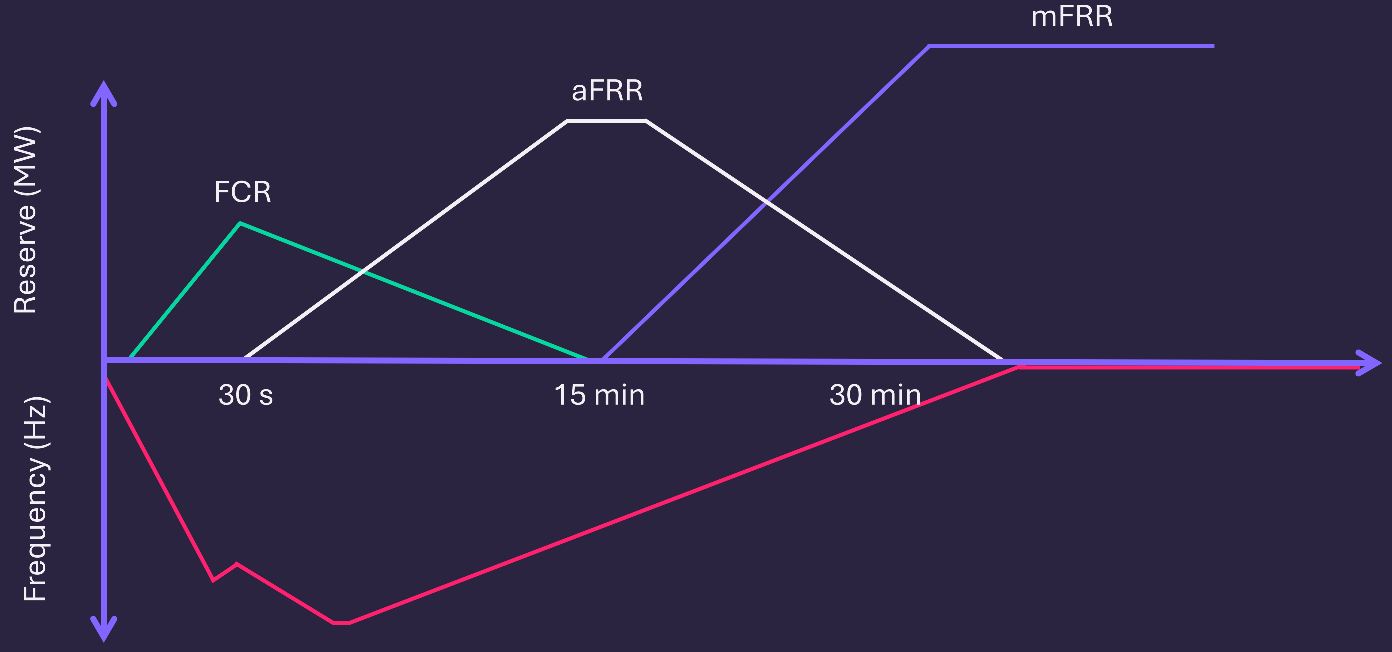
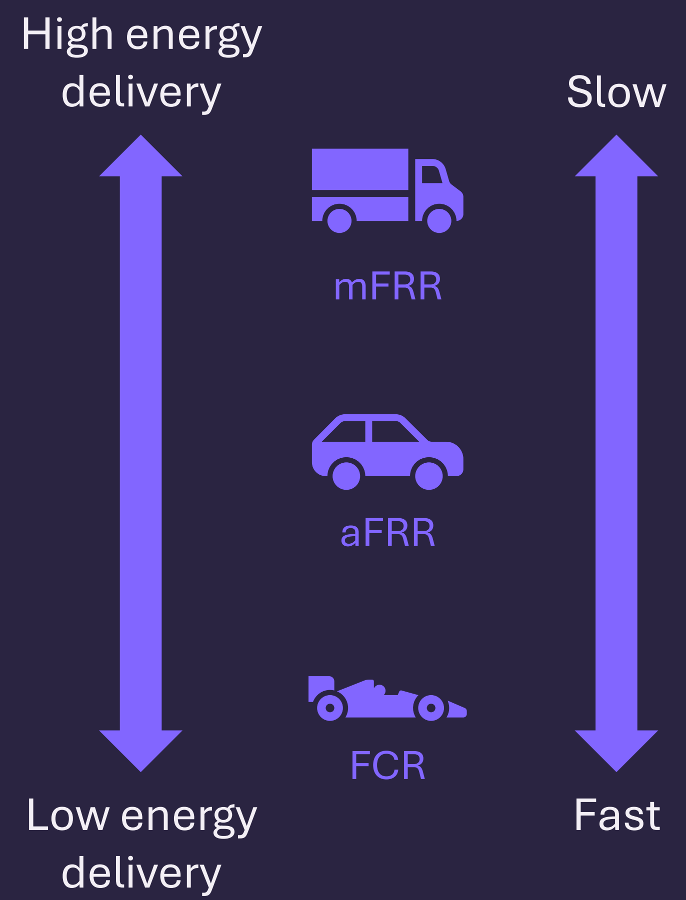
Different activation types for frequency control

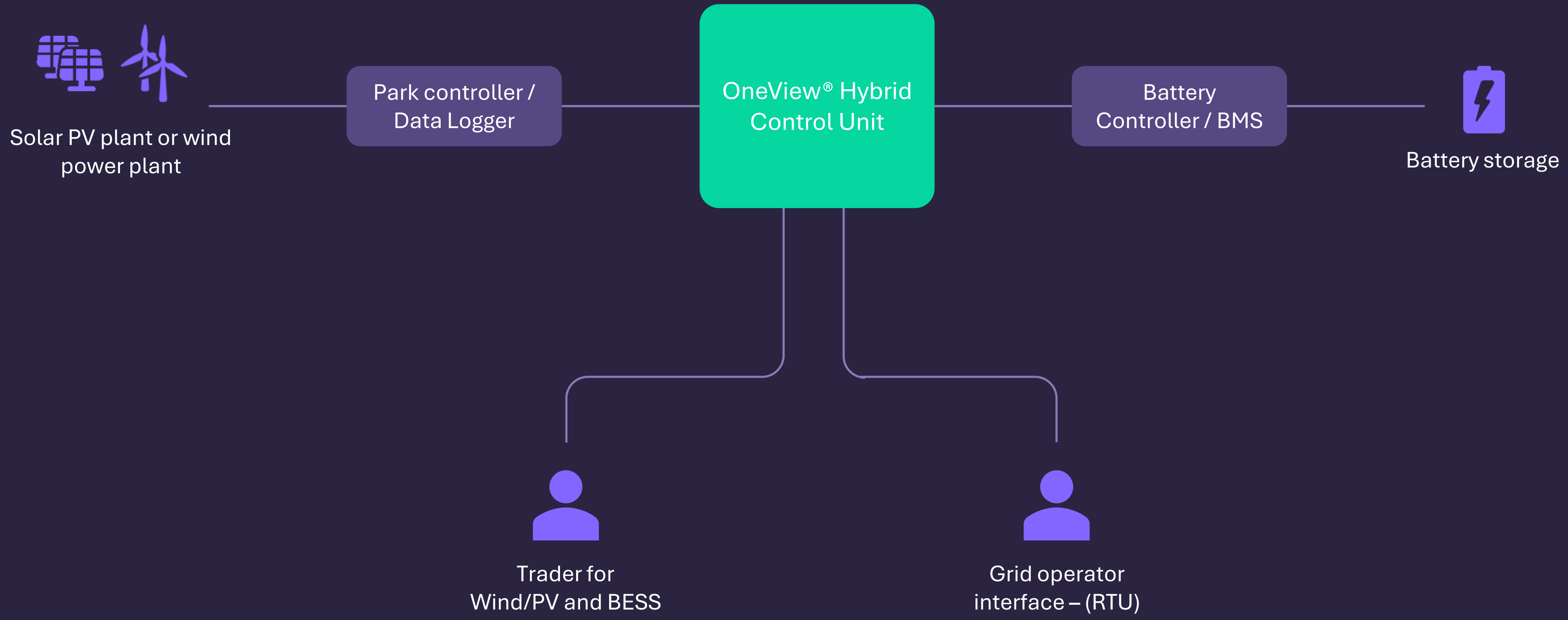
In Central Europe, there are 3 types of ancillary services



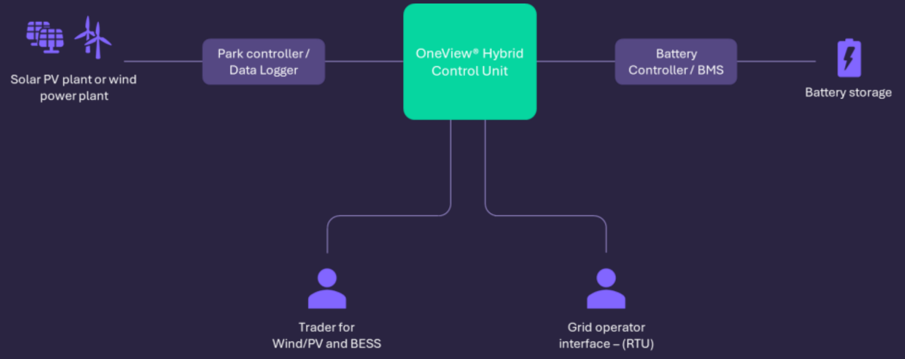


Source: Energinet (Danish TSO)

How you can manage a hybrid control loop setup



How you can manage a hybrid control loop setup

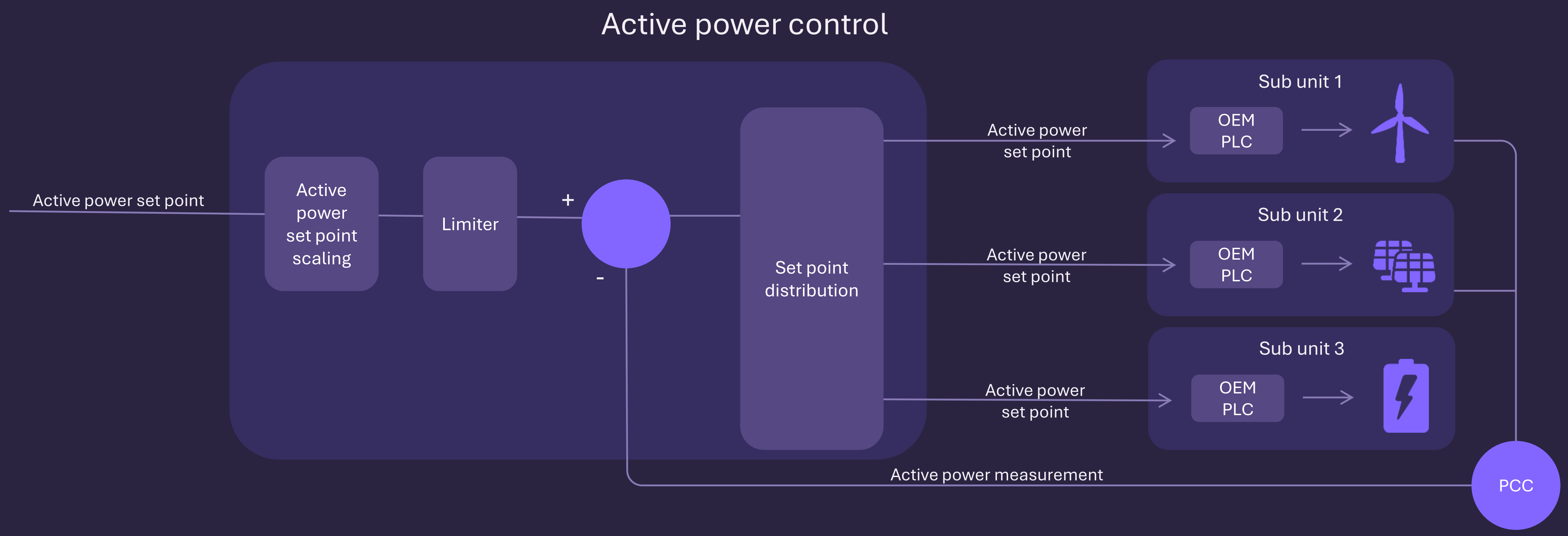


Ancillary service	Site level	Sub unit level	Sub unit level	Sub unit level
mFRR ↑	✅	✅	✅	✅
mFRR ↓	✅	✅	✅	✅
aFRR ↑	✅	✅	✅	✅
aFRR ↓	✅	✅	✅	✅
FCR	✅	✅	✅	✅

Ancillary service	Possible sub init parallel operation	
mFRR ↑	●	
mFRR ↓		●
aFRR ↑	●	
aFRR ↓		●
FCR	●	●

How you can manage a hybrid control loop setup

Example: wind and solar PV and BESS



Scaling of utility signal

Other limits:
- Protection
- Ancillary services
- Trading

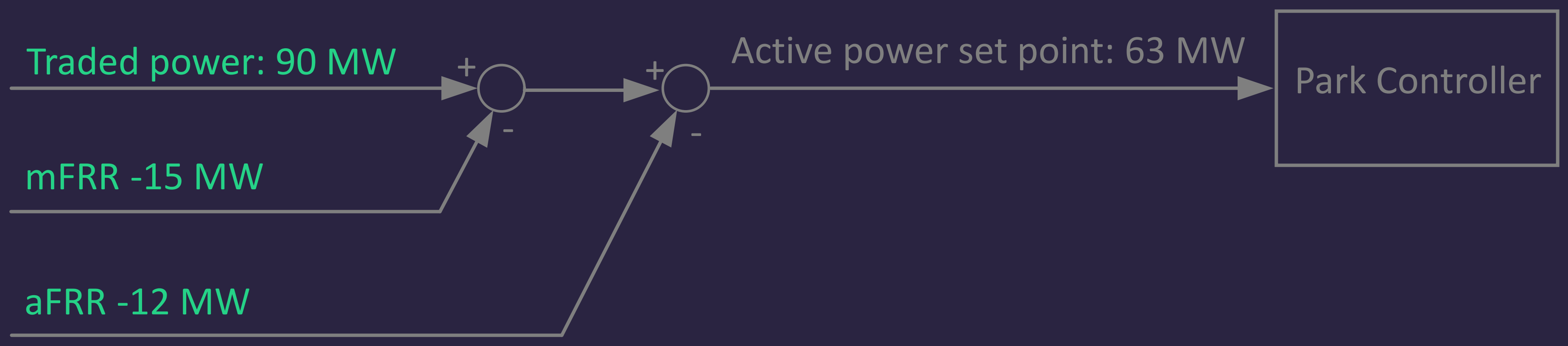
Distribution strategy:
- Priority
- Speed

Asset / OEM specific interfaces

Measurement

How you can manage a hybrid control loop setup

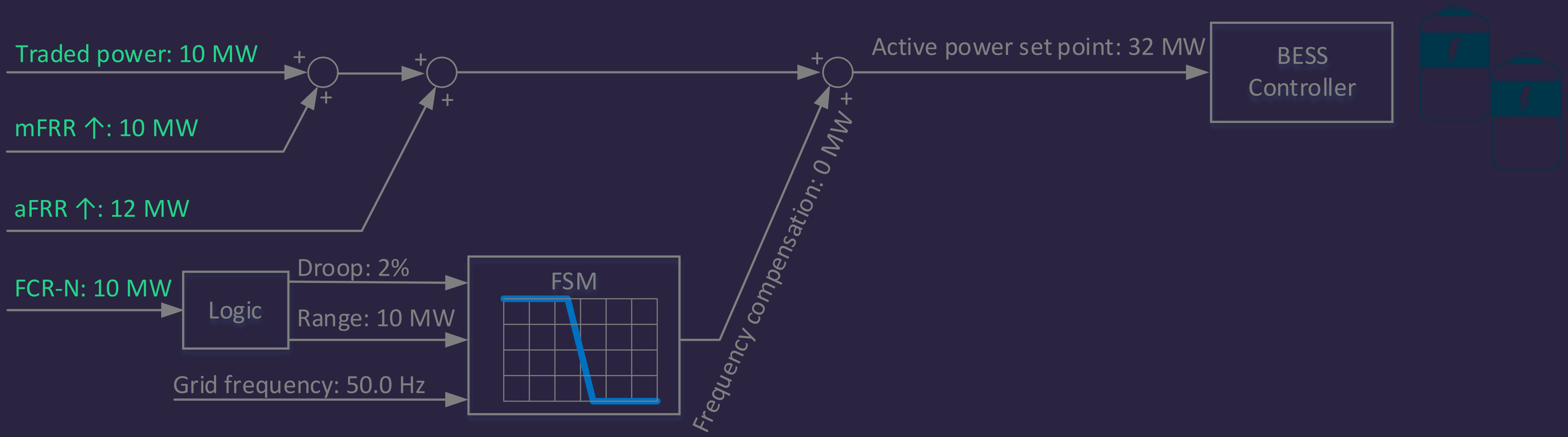
Example: wind and solar PV and BESS



Ancillary Services on Power Plant Level

How you can manage a hybrid control loop setup

Example: wind and solar PV and BESS



Ancillary Services on Subunit Level

BESS has the potential to reduce the impact of negative prices and profit in instances of high energy prices

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3 takeaways

01

Co-locating assets give compensation effects and improves grid connection efficiency with flexible curtailment

02

BESS integration unlocks new revenue streams and limits the risk of negative and high energy prices

03

The immaturity of new asset types increases complexity – get a head start on unit and grid modeling to get compliant

Thank you!

Connect with us!

Frank Riemer
Sales Director DACH

frr@opoura.com

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