

WEBINAR

Auto-Bidding: Optimising battery performance through energy management systems

Speakers



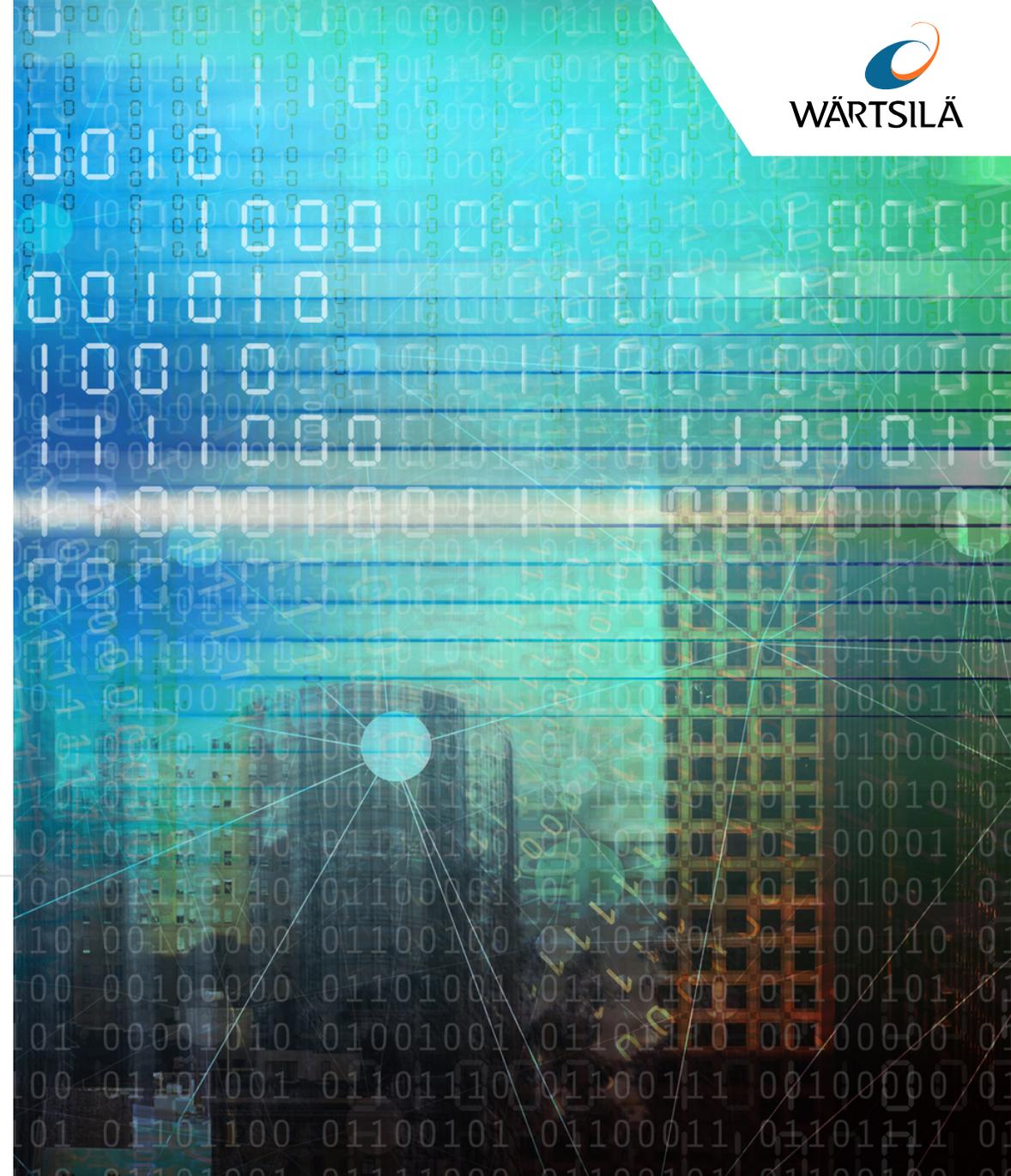
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Agenda

- Introduction to Wärtsilä
- Wärtsilä Energy Solutions and Energy Storage Systems
- References
- GridSolv
- Australian Market, Australian FCAS 2019
- GEMS, Cybersecurity
- GEMS: Product Suite, Cybersecurity, IntelliBidder, Optimisation
- Summary
- Demo
- Q&A

FOUNDED IN 1834

Global Leader

in sustainable solutions for the
marine and energy markets

COMPARABLE OPERATING RESULT

457 MEUR

ORDER INTAKE

5,327 MEUR

NET SALES

5,170 MEUR

OPERATIONS IN OVER

200 LOCATIONS

OUR PERSONNEL

19,000

NATIONALITIES

140

Financials are for fiscal year 2019. Location, personnel and nationalities figures are approximations based on the status in December 2019.

Enabling sustainable societies with smart technology

INNOVATING
SINCE 1834

TOGETHER

FOR A SUSTAINABLE
FUTURE

Energy Business

Wärtsilä Energy Business leads the transition towards a **100% RENEWABLE ENERGY FUTURE**. We help our customers unlock the value of the energy transition by optimising their energy systems and future-proofing their assets.

Our offering comprises flexible power plant solutions, energy management systems, and storage, as well as lifecycle services that ensure increased efficiency and guaranteed performance. Wärtsilä has **72 GW** of installed power plant capacity in **180 COUNTRIES** around the world.

Solutions to support the energy transition

FLEXIBLE POWER PLANTS

Flexible power plants utilising modular and future-proof technology to provide the best means of support to the power system.

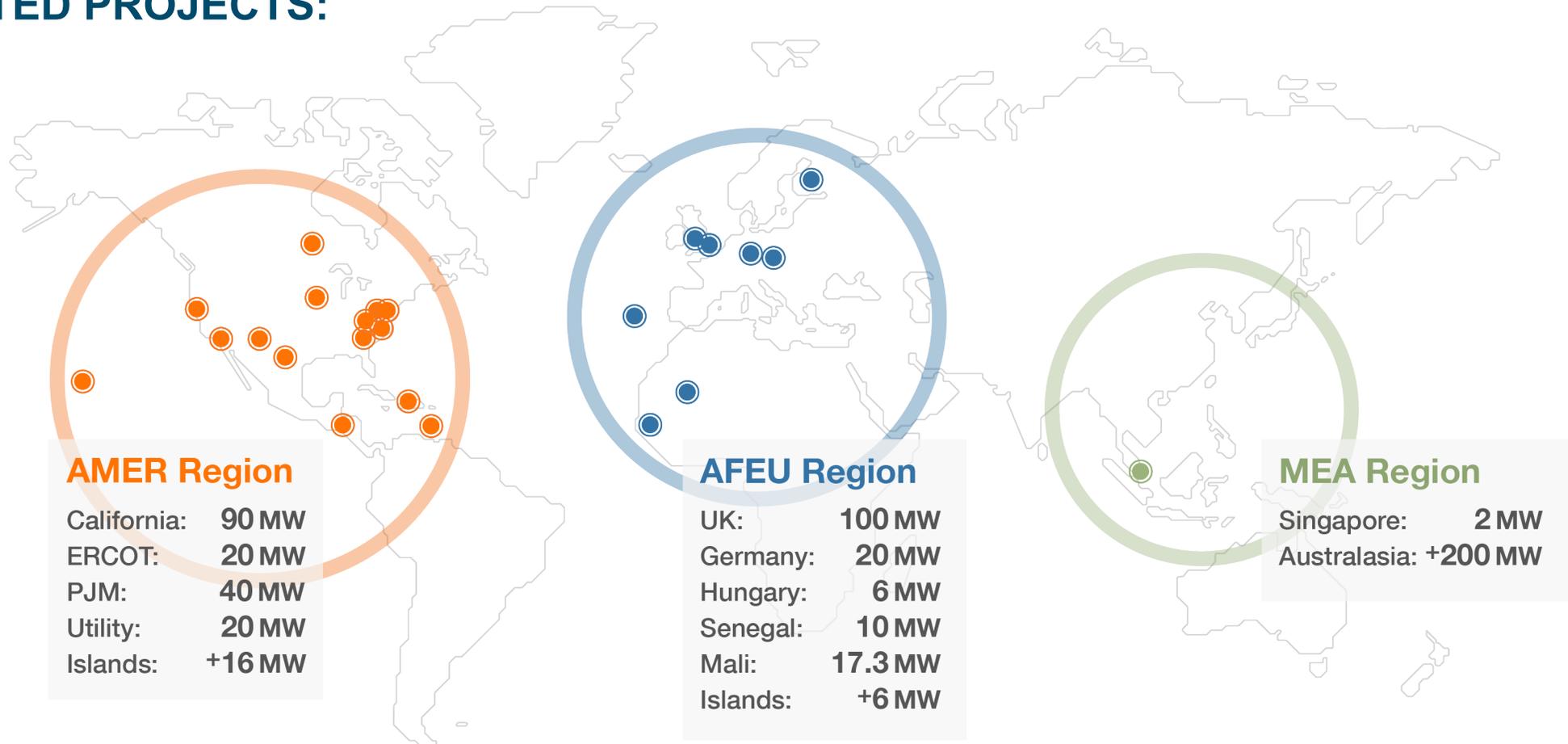
ENERGY STORAGE AND OPTIMISATION

Energy storage solutions that build a resilient and intelligent power system. Industry-leading software can optimise any of the customer's assets and power systems.

LIFECYCLE SERVICES

Lifecycle services encompass performance and maintenance management as well as operational expertise, leading to safe, reliable, and environmentally sustainable operations.

OVER **650 MW** IN OPERATION, DEPLOYED OR CONTRACTED
HIGHLIGHTED PROJECTS:



Container Standardisation

Our standardized GridSolv Max container is a **COST-EFFECTIVE SOLUTION** for meeting customer energy needs while adequately protecting their hardware assets



Real-time markets: **Many commonalities.** **Many differences.**

We offer configurable automated bidding solutions for:

- ERCOT (Texas)
- CAISO (California)
- MISO (Midwest)
- AEMO (Australia)
- National Grid ESO (UK)

COMMONALITIES:

- Real-time market is cleared on **5-minute intervals**
- Several rounds of bidding **occur ahead of dispatch** (week ahead, day ahead, hour ahead, ...)
- **One energy market for generation/load:** bids are placed to supply/use *an amount of power (energy)*
- **Other markets for frequency regulation:** bids are placed to provide frequency control ancillary services in *power capacity*
- Most other ISOs, both inside and outside the US, have similar structure

DIFFERENCES:

- **Settlement,**
- **Types of ancillary services**
- **Bid timing**
- **Penalties**
- **Incentives...**

AEMO Market Description

Energy Market + 8 FCAS Markets:

- Regulation Raise/Lower
- 6 sec Raise/Lower
- 60 sec Raise/Lower
- 5 min Raise/Lower

The contingency services

(6 sec, 60 sec, 5 min) interleave, and are deployed sparingly for large frequency deviations

Markets are dispatched and cleared on

5-minute dispatch intervals by NEMDE

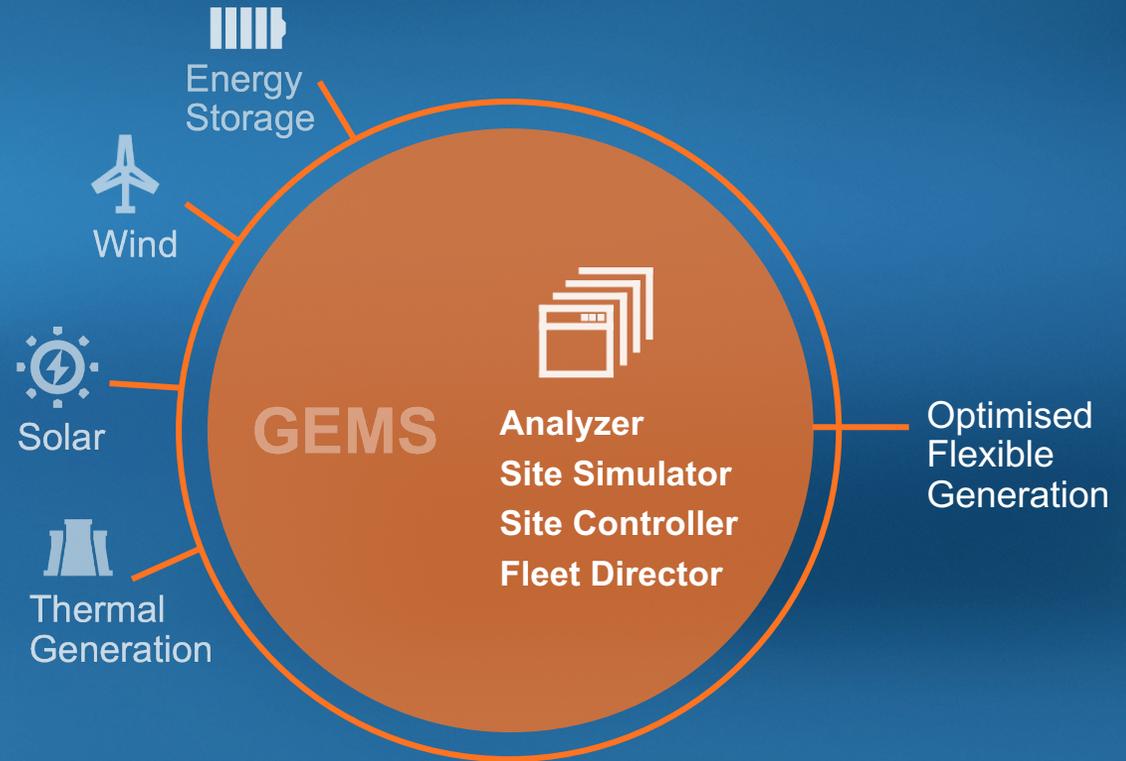
The table shows the change of the FCAS and Energy Market prices from 2017–2019:

All Units are average AUD/MWh (numbers in orange boxes show a **SIGNIFICANT SHIFT** in prices between 2018 and 2019)

	CONTINGENCY		REGULATION		ENERGY MARKET
	RAISE	LOWER	RAISE	LOWER	
2017	27.1	0.29	27.1	0.29	94.7
2018	34.8	0.33	23.2	11.4	79.0
2019	16.4	0.55	39.9	18.6	84.8

GEMS Solutions Suite

The leading energy system management platform



A SUITE OF PROPRIETARY SOFTWARE PRODUCTS FOR BUILDING, MONITORING AND INTELLIGENTLY

OPERATING POWER PLANTS AND ENERGY RESOURCES

OPTIMISES ALL GENERATION ASSETS

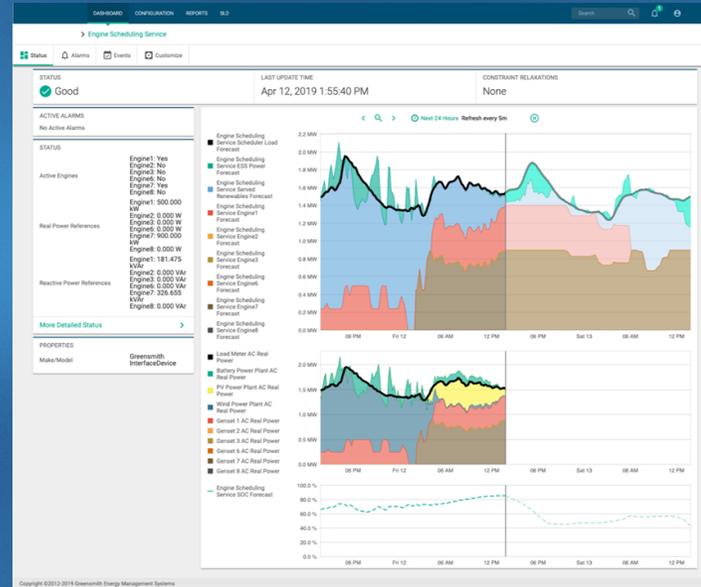
SECURE, FLEXIBLE, SCALABLE

DEPLOYED IN **70+** PROJECTS GLOBALLY

Two options:

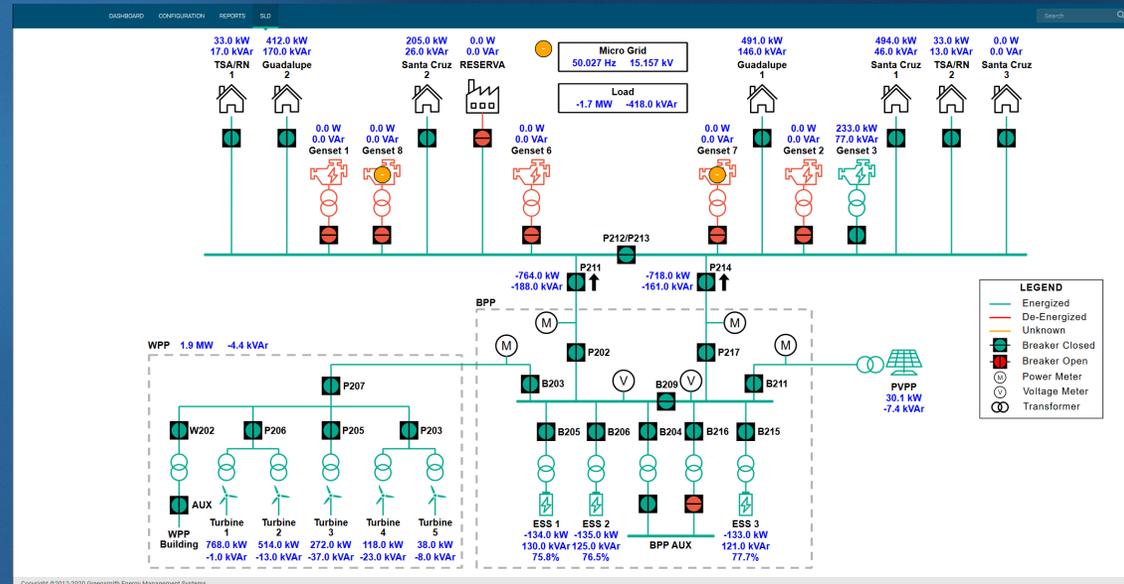
LINEAR/QUADRATIC PROGRAMMING

- Formal optimisation → Maximise profit
- Requires detailed model definition
- Enables more control and human interactions
- Provides a detailed forecasted view



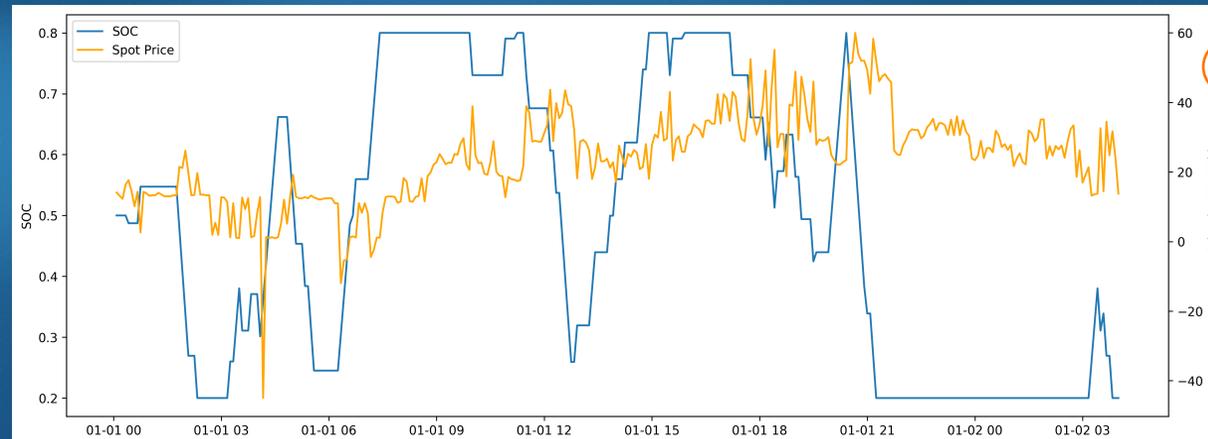
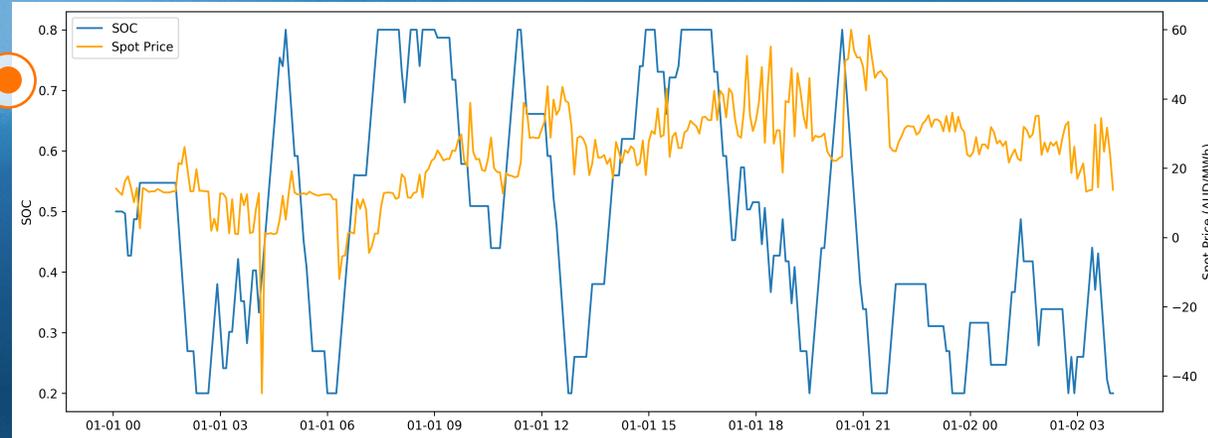
REINFORCEMENT LEARNING

- Trained explicitly on historic data
- Exploration and exploitation
- More like a black box



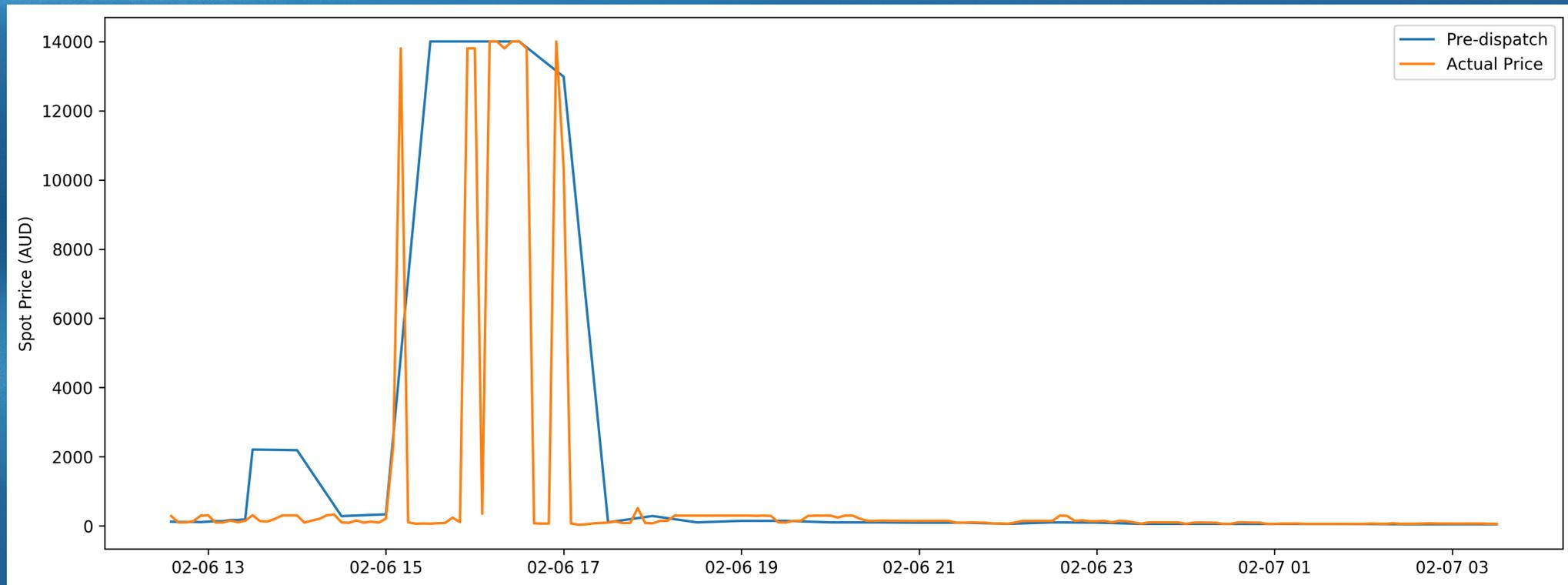
Battery usage profile tuned with cost parameters

10 \$/MWh
THROUGHPUT

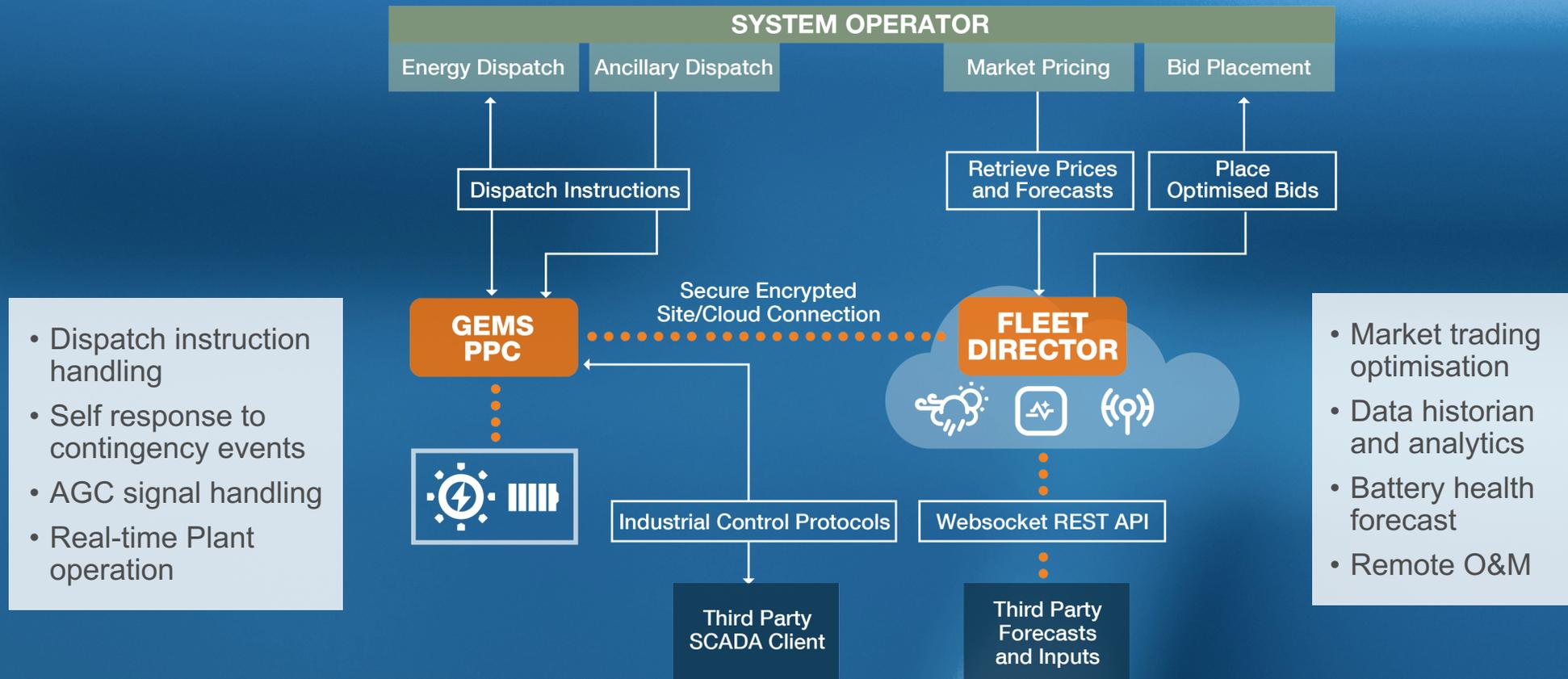


30 \$/MWh
THROUGHPUT

Raw AEMO 15-hour pre-dispatch energy market forecasts are not very accurate



Wärtsilä GEMS: End-to-End Bidding and Dispatch Solution



GEMS Value Proposition



Maximise ROI

- Optimise equipment sizing
- Advanced algorithm design
- Co-optimize hybrid asset operation



Speed to Market

- Project development **in weeks**
- Site commissioning **in days**
- Software updates **in minutes**



Future Proof Assets

- Repurpose existing ESS assets
- **Flexible** augmentation plans
- No equipment lock-in



Platform Maturity

- 9 years development; 5th gen
- 70+ projects
- **Cybersecurity best practices**
- End-to-end project management from design to O&M

Demo!

Q&A



WÄRTSILÄ