

# 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

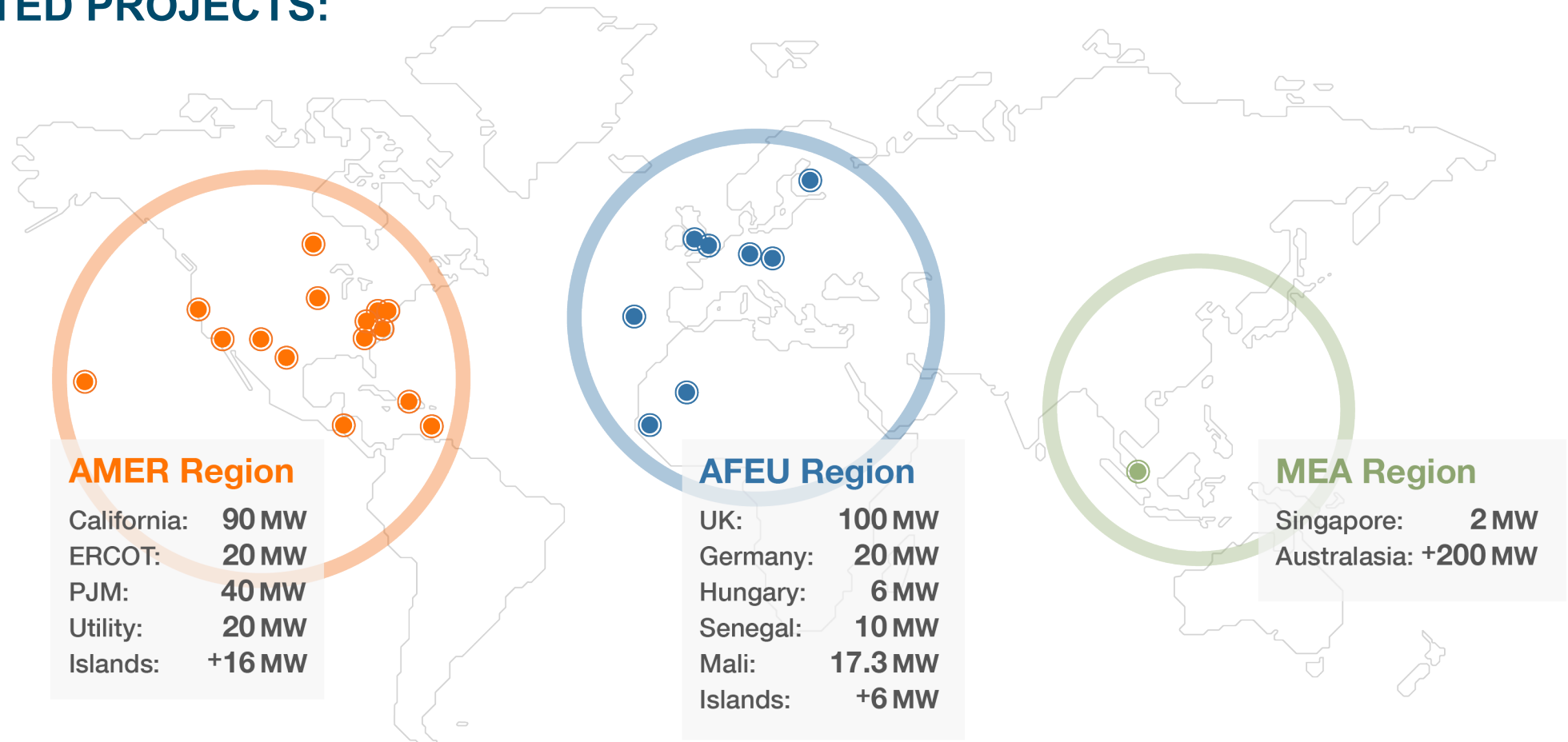
Energy storage solutions that build a resilient and intelligent power system. Industry-leading software can optimise any of the customer's assets and power systems.

## 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:

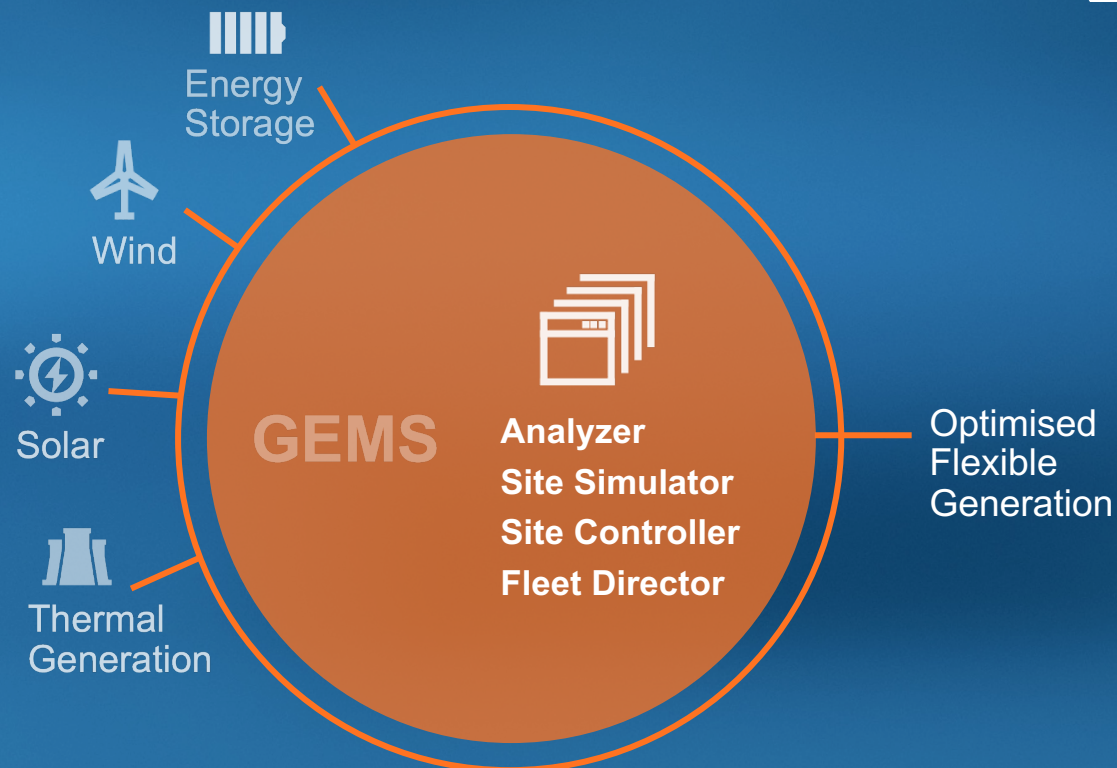
All Units are average AUD/MWh  
(numbers in orange boxes show a  
**SIGNIFICANT SHIFT** in prices  
between 2018 and 2019)

	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

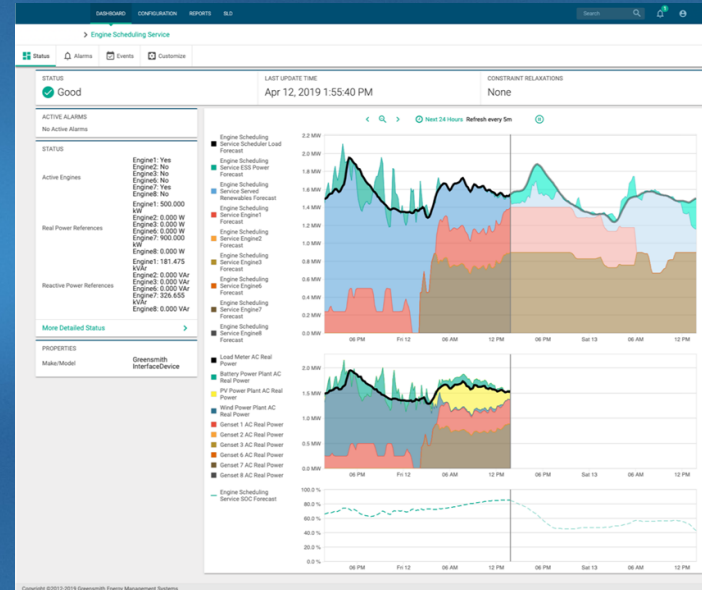
DEPLOYED IN **70+**  
PROJECTS GLOBALLY



## Two options:

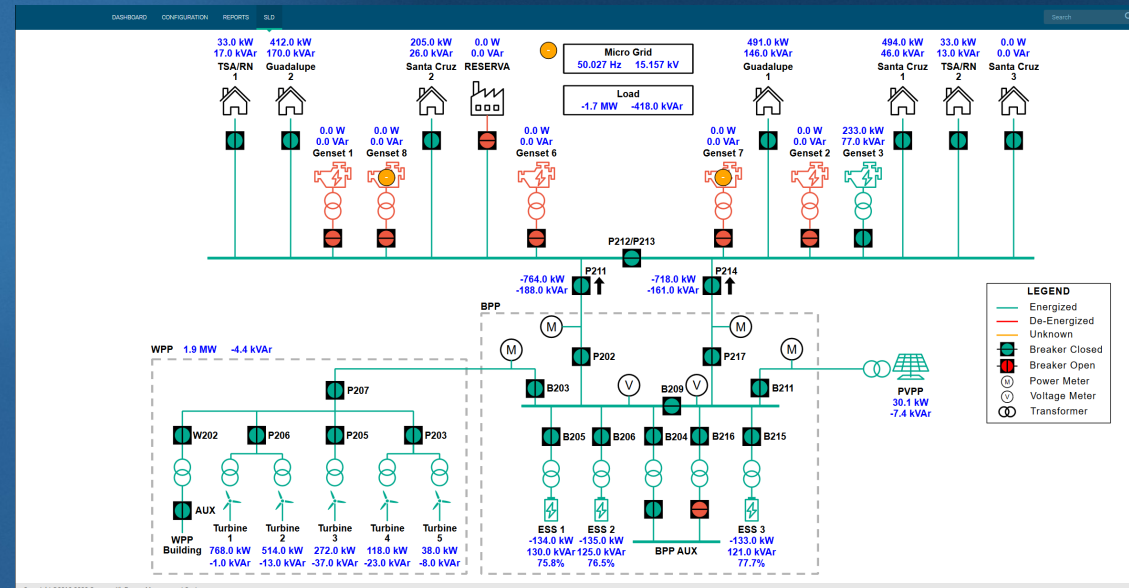
### LINEAR/QUADRATIC PROGRAMMING

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



### REINFORCEMENT LEARNING

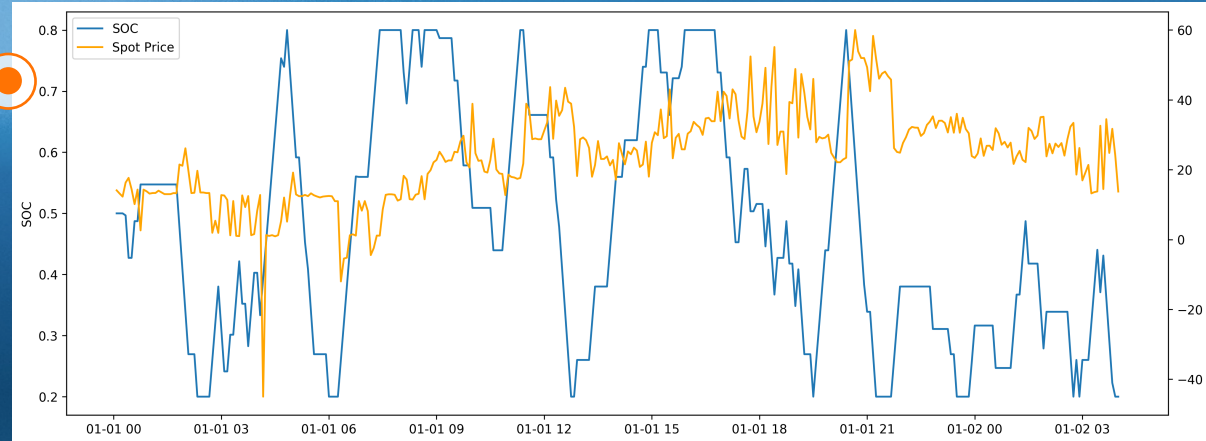
- Trained explicitly on historic data
- Exploration and exploitation
- More like a black box



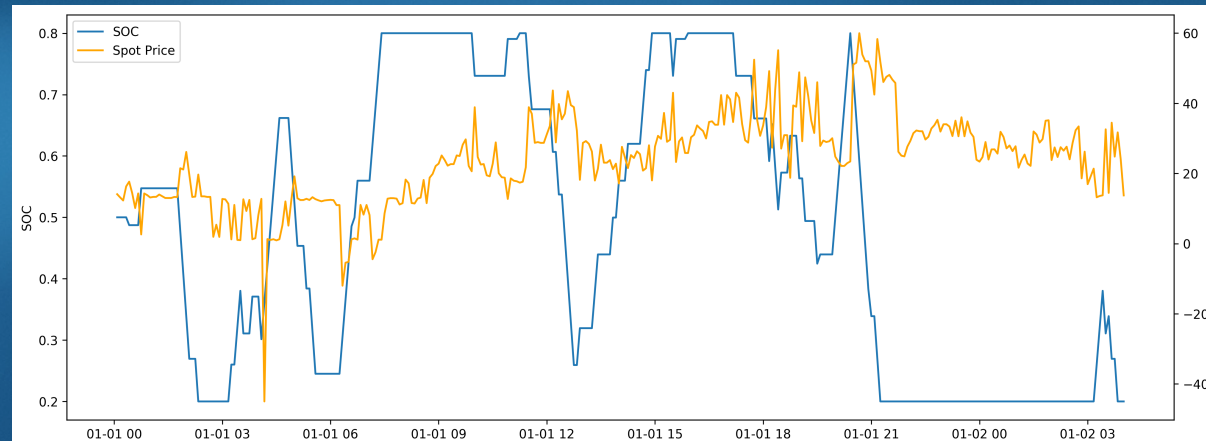


# Battery usage profile tuned with cost parameters

**10 \$/MWh  
THROUGHPUT**

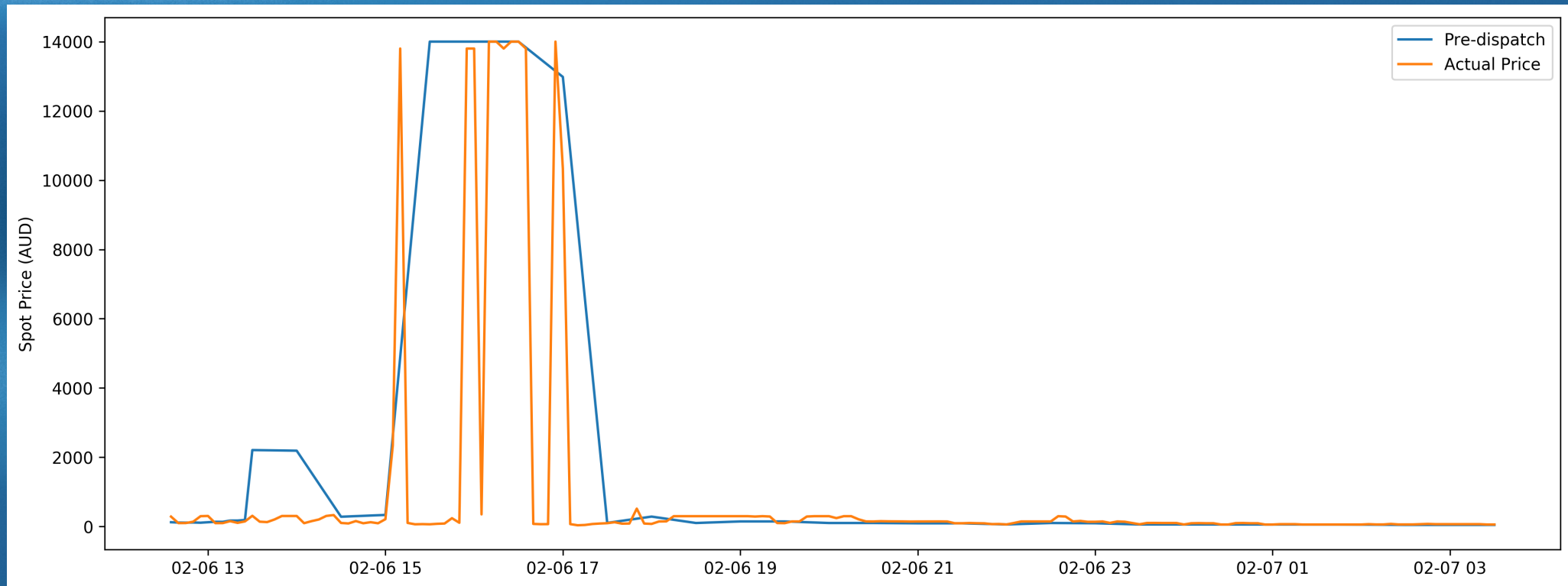


**30 \$/MWh  
THROUGHPUT**



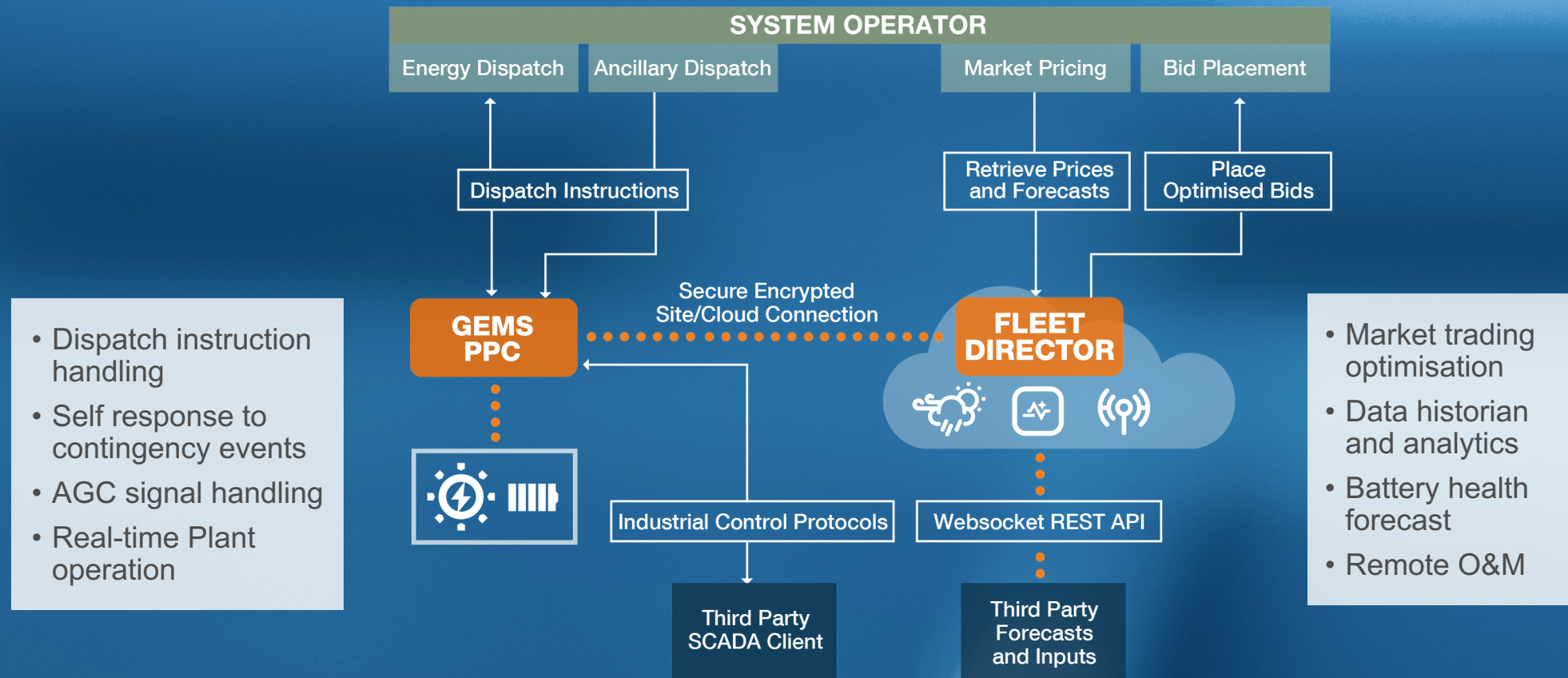


## Raw AEMO 15-hour pre-dispatch energy market forecasts are not very accurate





# 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**