DOCKETED	
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Document Title:	The Performance of Large-Scale Battery Energy Storage The Hornsdale Power Reserve, South Australia
Description:	Presentation by Rohan Ma at the June 20, 2018 IEPR Workshop on Renewable Integration and Electric System Flexibility
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NEOEN HORNSDALE POWER RESERVE

Project Highlights

Site Installation Highlights

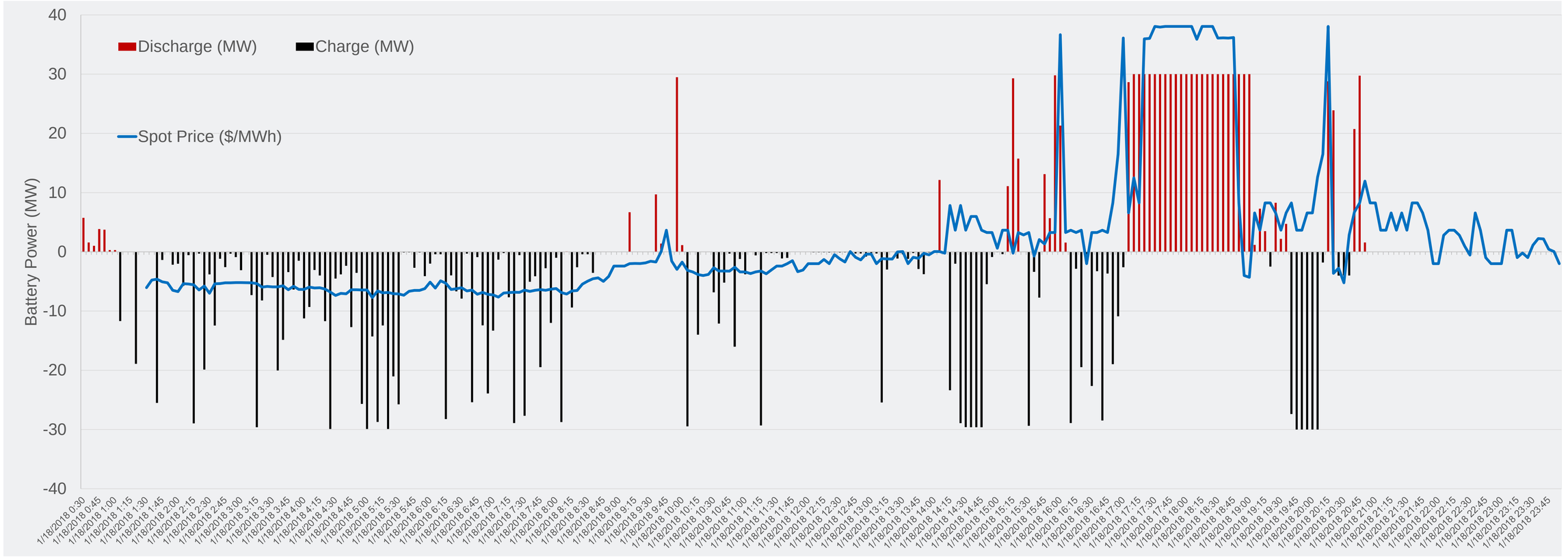
- 100MW | 129MWh
- Co-Located w/ 309MW Wind Farm

Market Registration

- Registered as Dual Resource
  - Discharge = Generator
  - Charge = Dynamic Load

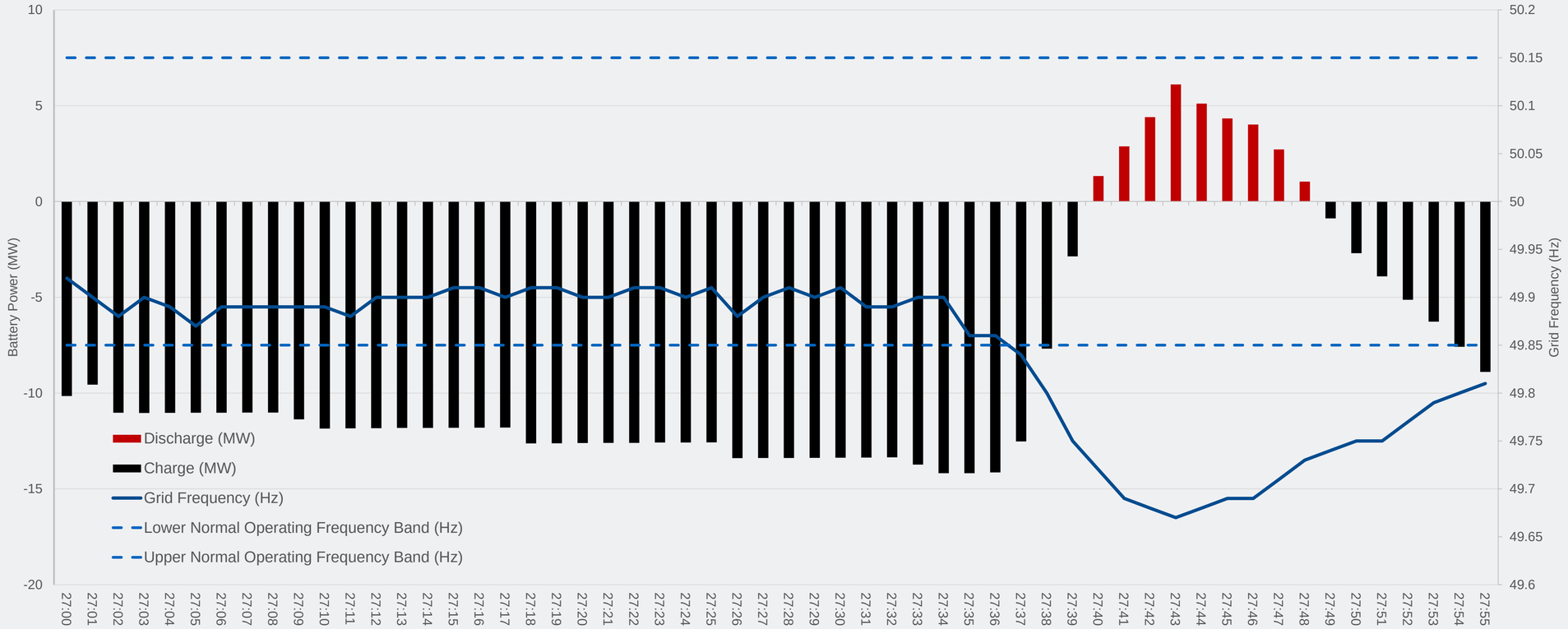
- Registered for 9 Products
  - Energy (RRP)
  - FCAS Regulation Raise
  - FCAS Regulation Lower
  - FCAS 6S Raise Contingency
  - FCAS 6S Lower Contingency
  - FCAS 60S Raise Contingency
  - FCAS 60S Lower Contingency
  - FCAS 5M Raise Contingency
  - FCAS 5M Lower Contingency

RESPONDING TO HIGH ENERGY PRICE EVENTS



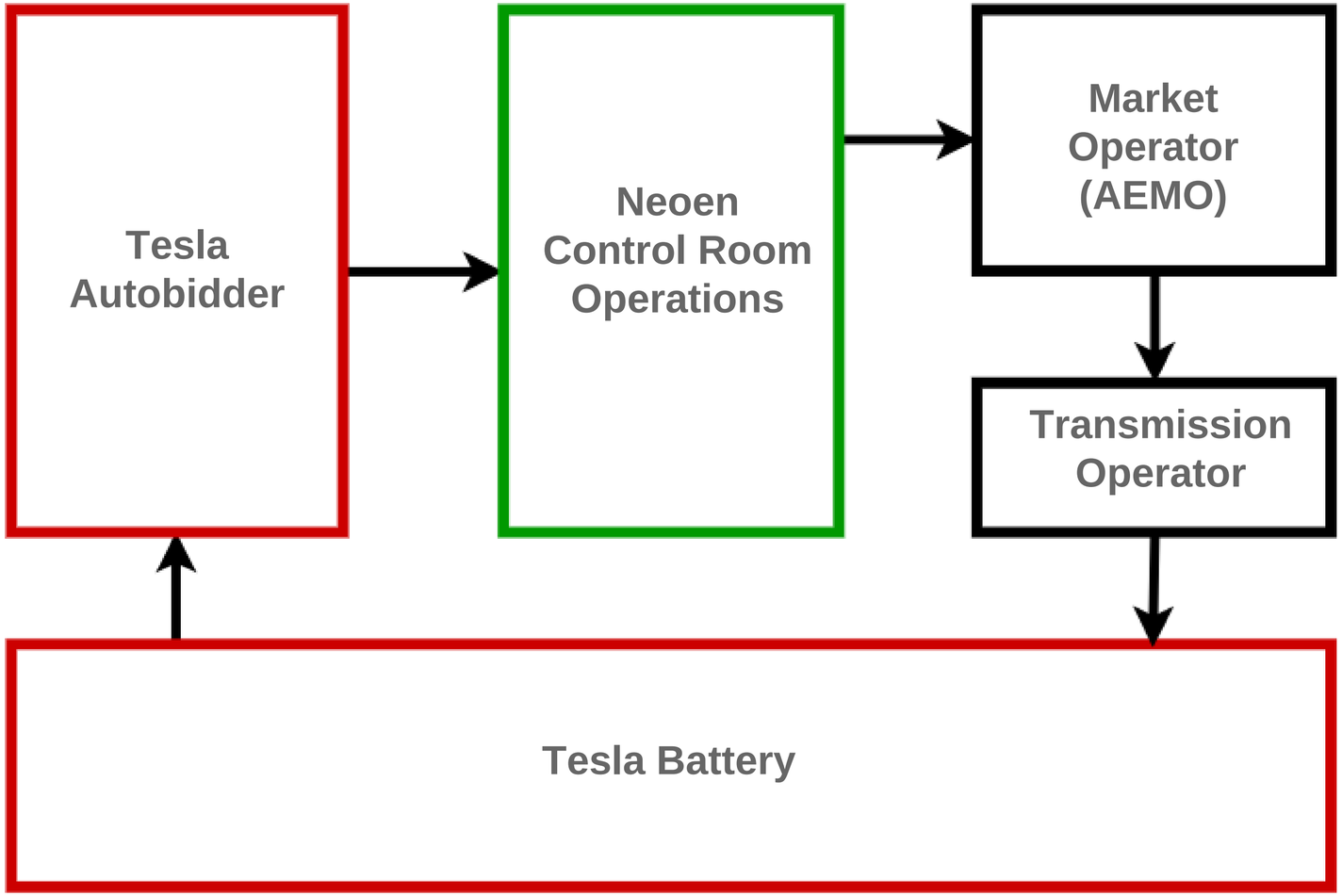
Source: Based on Data from Australian Electricity Market Operator

RESPONDING TO FREQUENCY EVENTS



Source: Based on Data from Australian Electricity Market Operator

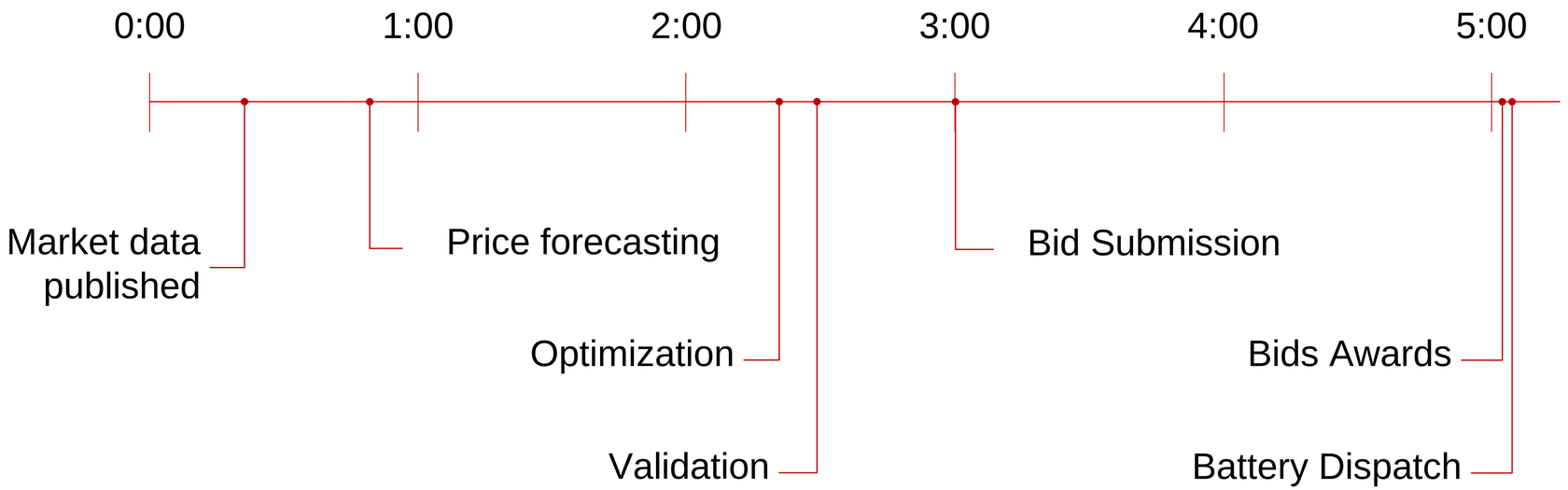
MARKET PARTICIPATION OPERATIONS



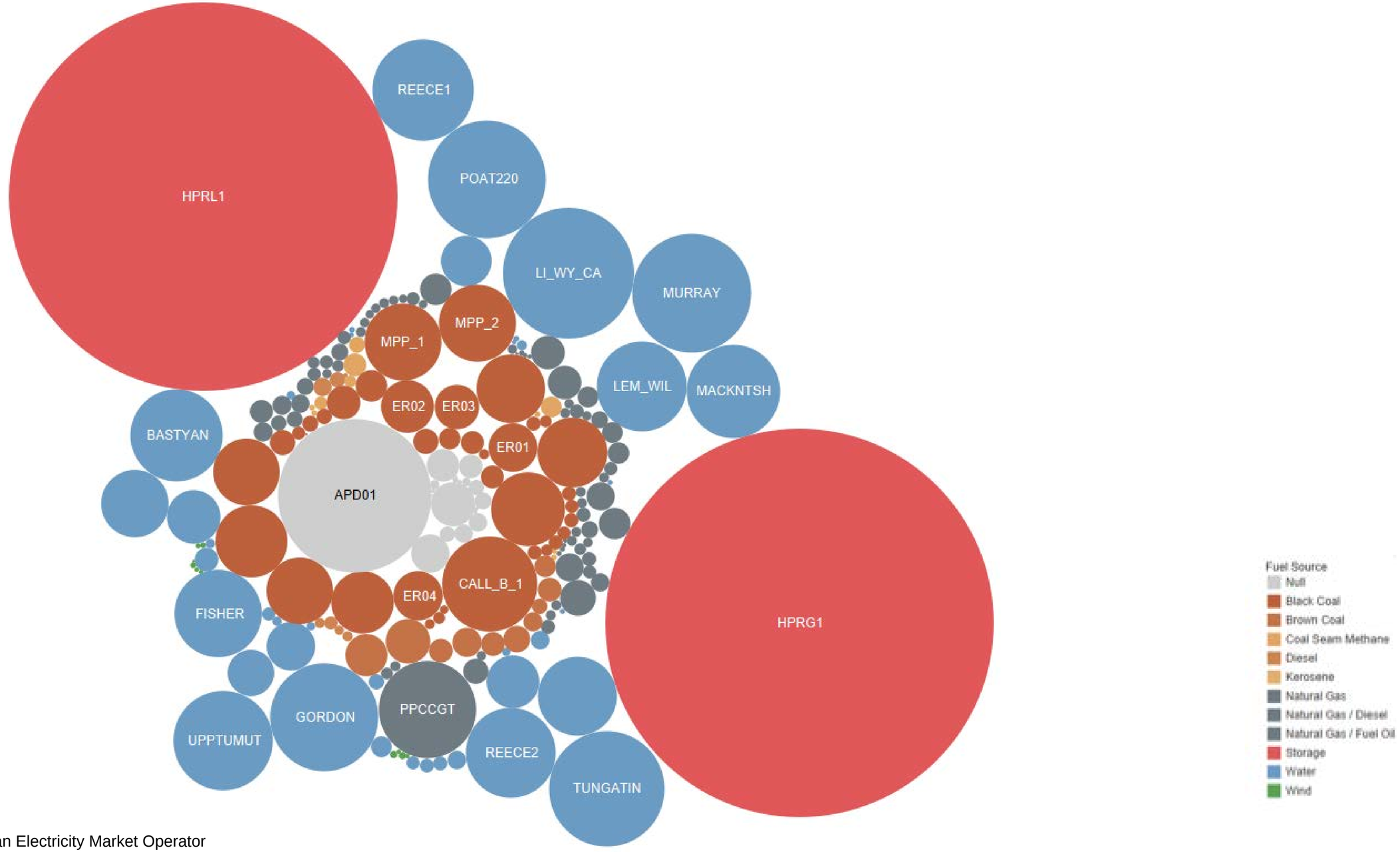
FIRST PRINCIPLES OF BATTERY DISPATCH

Resource Types	Examples	Marginal Cost	Derivation for Bidding
Thermal / Fuel	Coal Gas	Fundamental	Cost of fuel, heat rate, variable O&M
Renewables	Solar Wind	Fundamental	No fuel, variable O&M
Energy Limited	Energy Storage Hydro Use-Limited Thermal	Opportunity Cost	Expectation of future

5 MINUTE BIDDING LOOP



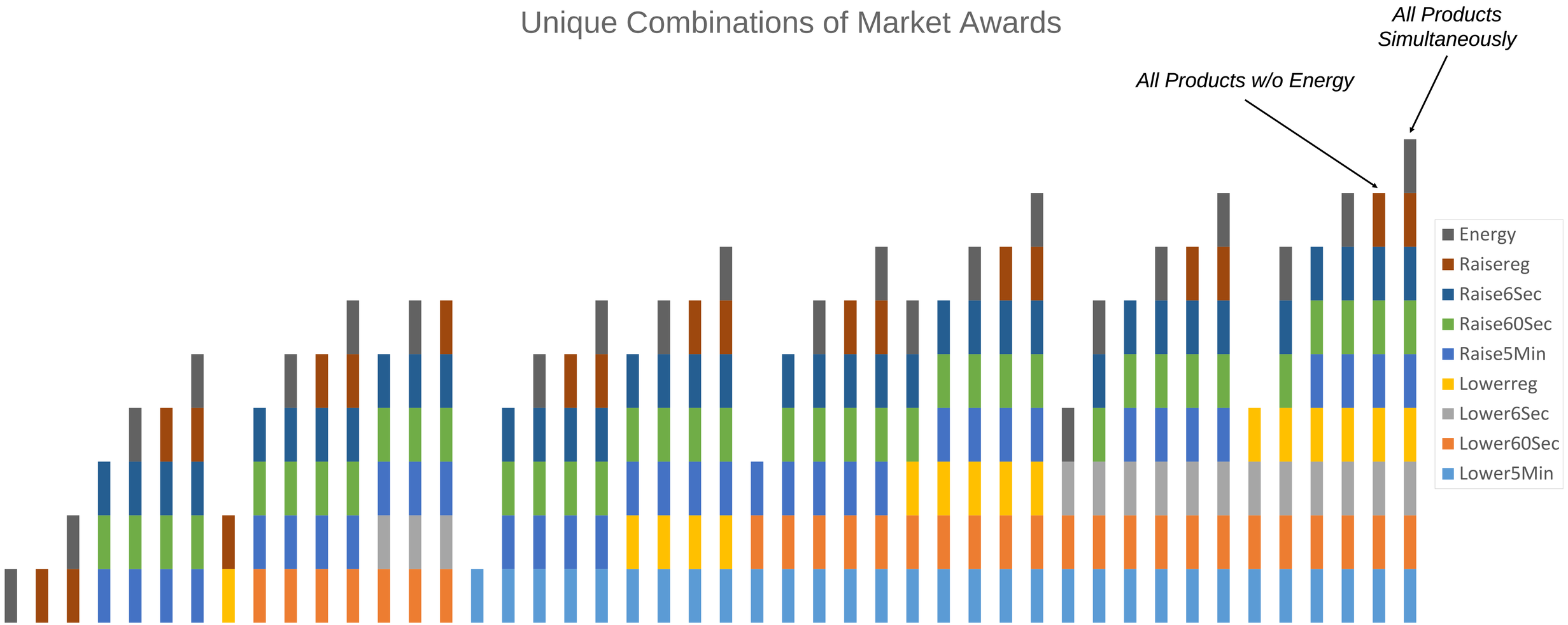
MARKET ACTIVITY SINCE HORNSDALE ENTRY



Source: Based on Data from Australian Electricity Market Operator

VALUE OF FLEXIBILITY

Unique Combinations of Market Awards



47 Unique Combinations of Market Awards in first month

Source: Based on Data from Australian Electricity Market Operator