Development of an Open AI Energy Market Environment

Luke Marshall
Structure

1. Electricity Markets & Trading
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Electricity Markets and Trading
National Electricity Objective

“...to promote efficient investment in, and efficient operation and use of, electricity services for the long-term interests of consumers of electricity with respect to price, quality, safety, reliability, and security of supply of electricity; and the reliability, safety and security of the national electricity system.”

• The NEM is the main decision-making mechanism
The Wholesale Market

Every 5 minutes, a new electricity ‘reverse auction’.
Electricity Reverse Auctions

Demand = 3 MWh

Pool Price

Bid ($/MWh)

1 2 3 4

Demand = 3 MWh
California Electricity Crisis

“The smartest guys in the room.”
The Promise of AI Approaches
AI is Going Crazy

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AlphaGo (2016)

“Even if I become the number one, there is an entity that cannot be defeated”
– Lee Se Dol
AlphaZero (2017)

The entirety of human chess knowledge overcome in 72 hours of self-play.
AI as a bidder in electricity markets...

Extremely low cost relative to possible benefits.
"The smartest guys in the room" become

"The smartest AIs in the room"
The Case for Open Electricity Market AI
The Case for Open Electricity Market AI

- Somebody is going to do it
- Likely to be a private entity
- Closely guarded trade secret

- Open AI will encourage:
  - Informed Regulators
  - Level Playing Fields
Why not keep it secret among regulators?

- Unfair competitive advantages among participants.
- Clear, Honest & Fair rulemaking.
Why is it important for renewables?
Why is it important for renewables?

Renewables are fueling transitions in electricity markets. It’s happening at the same time as the AI revolution.

• Smooth Integration
• Zero-Marginal Cost (Price Takers)
• Storage (Arbitrage)
Open AI & How it Works
Open AI

“Are we really willing to let our society be infiltrated by autonomous software and hardware agents whose details of operation are known only to a select few? Of course not.”
How Open AI Works

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How Open AI Works – Electricity Market Environment

Development of an Open AI Energy Market Environment
Open AI Electricity Market Sim (OAEMS) Architecture
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OAEMS: Functionality & Applications

‘Plug and Play’ Electricity Market Simulator for AI

• ‘Sandbox’ and ‘NEM’ modes

• Test, train, compare AI bidding models

• Measure impact of market rule changes

• Predict strategic behaviour
Research User Interface

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https://github.com/UNSW-CEEM
Understanding the National Electricity Market

Basic Structure of the NEM

Derivative Markets

Wholesale Market

Retail Market

Generators

Retailers

Consumers