


GridZero.ai

GPST ESIG Webinar
October 2025

Contact us: info@gridzero.ai

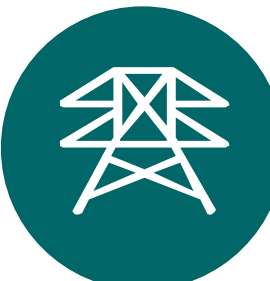
System Operational Challenges

1. FREQUENCY STABILITY AND CONTROL



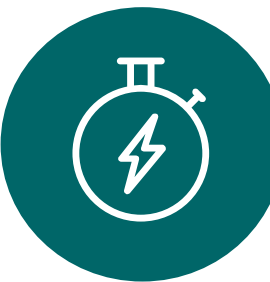
- Inertia
- Reserve
- Ramping
- Very low Frequency Oscillations

2. CONGESTION




- Transmission Congestion

3. TRANSIENT STABILITY




- Reduction in Synchronising Torque
- Reduction in Damping Torque

4. POWER QUALITY



- Harmonics

5. OTHER




- Voltage Dip Induced Frequency Deviation
- Frequency Regulation
- Power System Protection
- Power System Modelling
- Forecasting

CURTAILMENT




Curtailment due to overall power system limitations

6. VOLTAGE STABILITY




- Steady-State Voltage Control
- Dynamic Voltage Control
- Reduction in Available Fault Current

7. SYSTEM RESTORATION



- Less Black-Start Capable Plant

8. GENERATION ADEQUACY

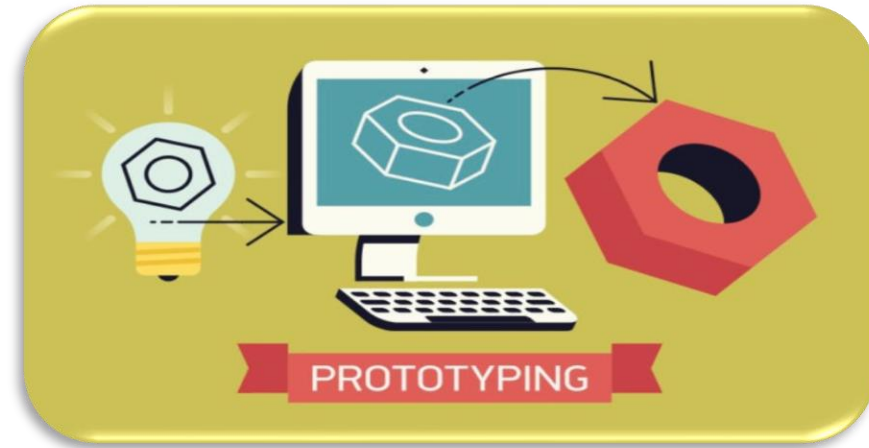
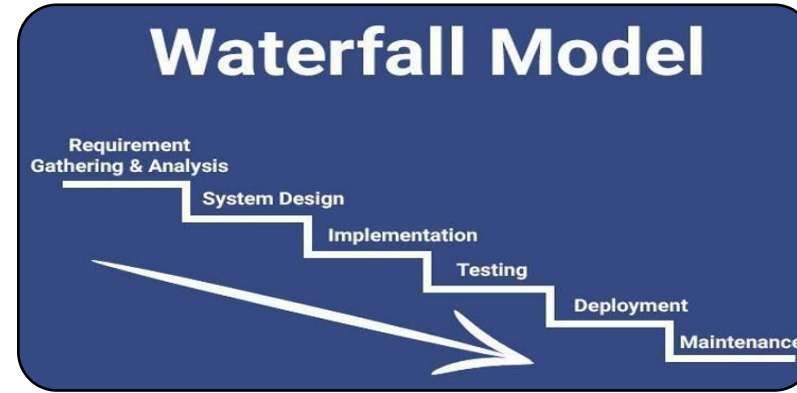


- Capacity Margin
- Weather-Related Events



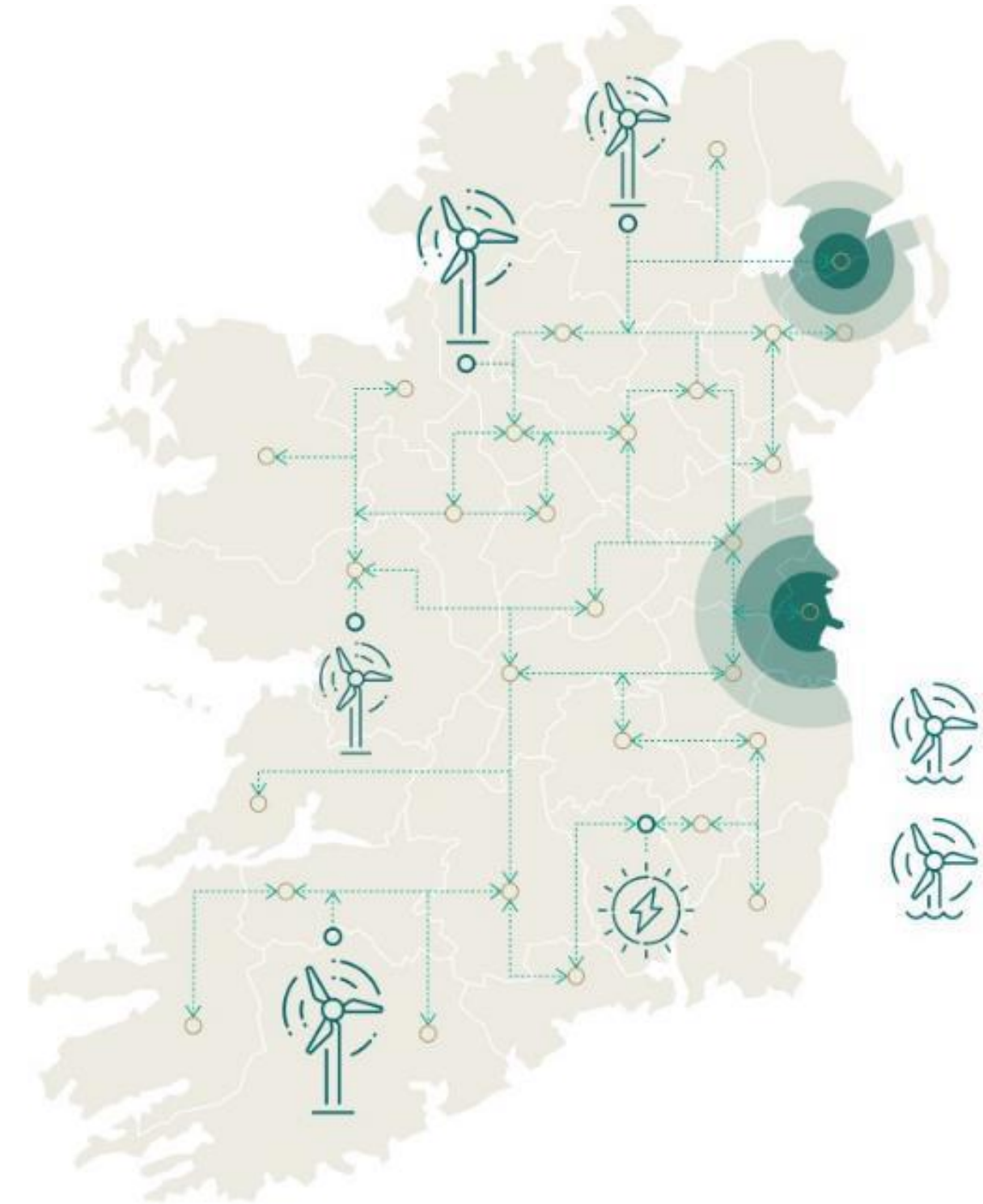
New tools and capabilities will be needed to ensure that the power system can continue to be operated in a secure and resilient manner

Exploring new Ways of Working



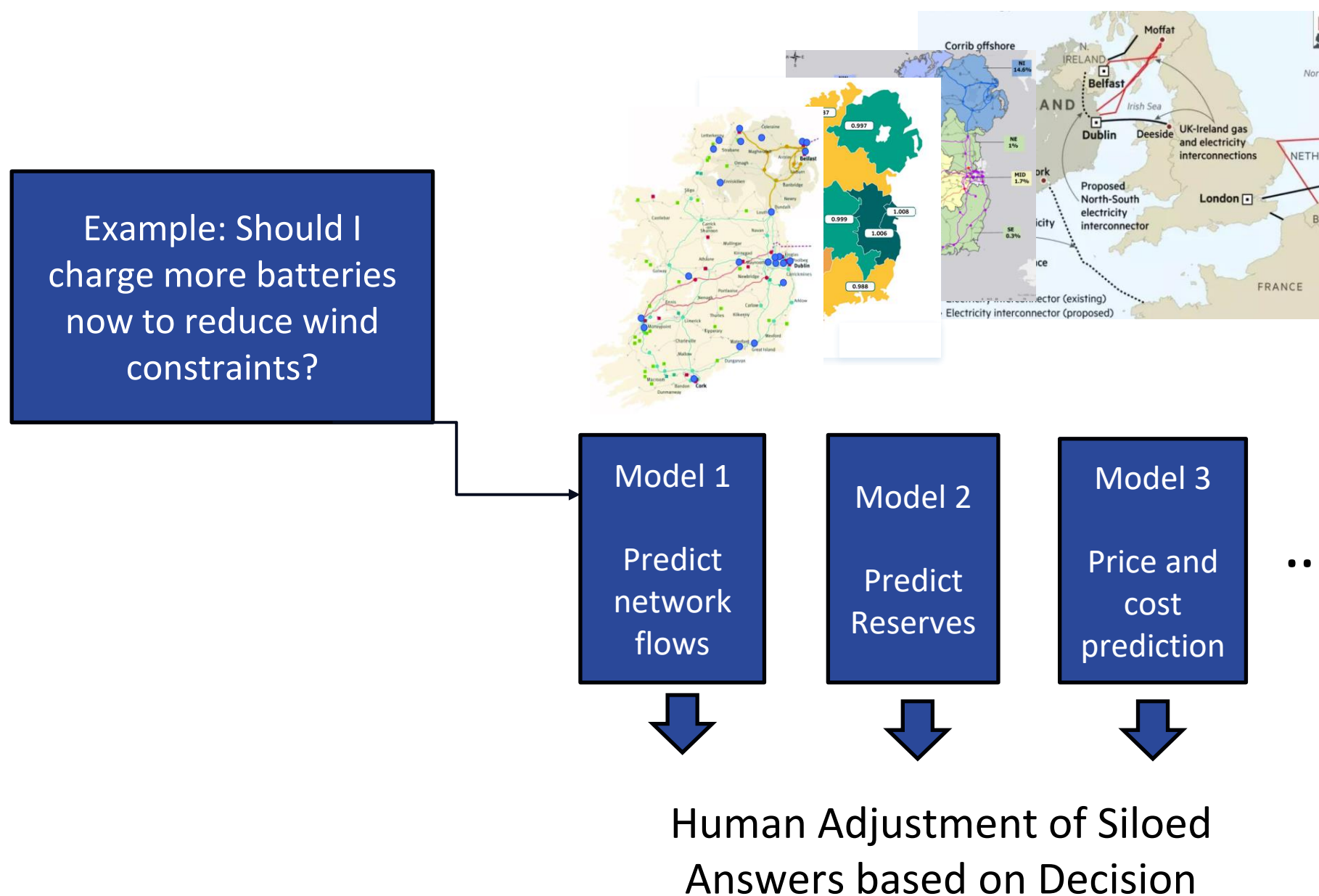
Objective: Explore new ways of working that would enable EirGrid to rapidly test and refine ideas, gain clearer insights into complex problems, and deliver more targeted and effective solutions.

Case Study: Forecasting of Largest Single Infeed (LSI) and Largest Single Outfeed (LSO)

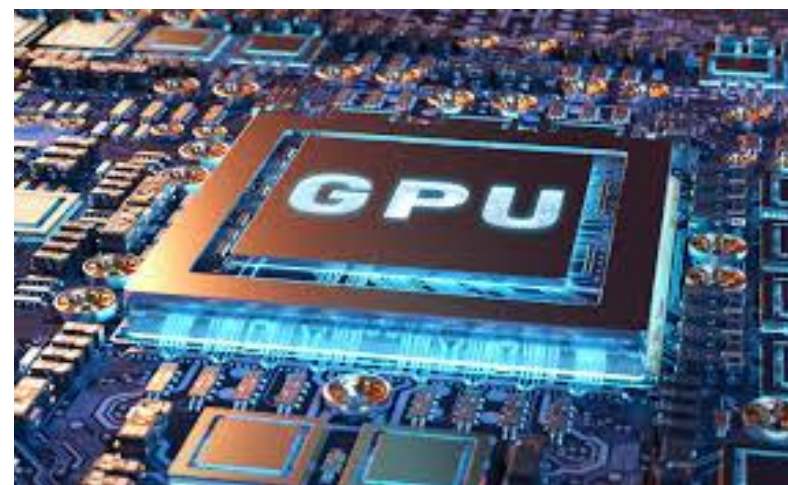
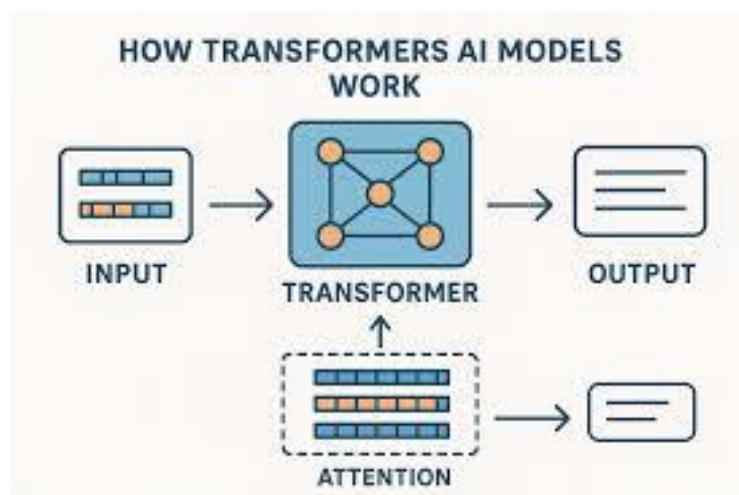


Dedicated single solutions for each specific problem

- Accurate predictions when most of uncertainty is exogeneous and with stable distributions
- Inferences on one label using subset of engineered features
- Do not model feedback and spatial correlations
- Not adaptive to recent information



Point solutions do not work well for a complex interconnected grid with continuous decision making and strong feedback loops.



Transformer Models

1. Model sequences across space and time
2. Parallelizable computations
3. More adaptive
4. More generalizable
5. What-if analysis and amenable to closed loop systems

GPUs

1. Massively parallelizable
2. Very fast inference
3. Cost of training and inference going down fast

Industry Specific Foundational Models

1. Text: GPT, Gemini etc.
2. Ads ranking
3. Robotics & Self driving cars
4. User promotions

Recent Advances in AI are ripe for applications in a more volatile and coupled energy systems with strong feedback loops

Training Data Sources:
1st and 3rd party



Model Predictions

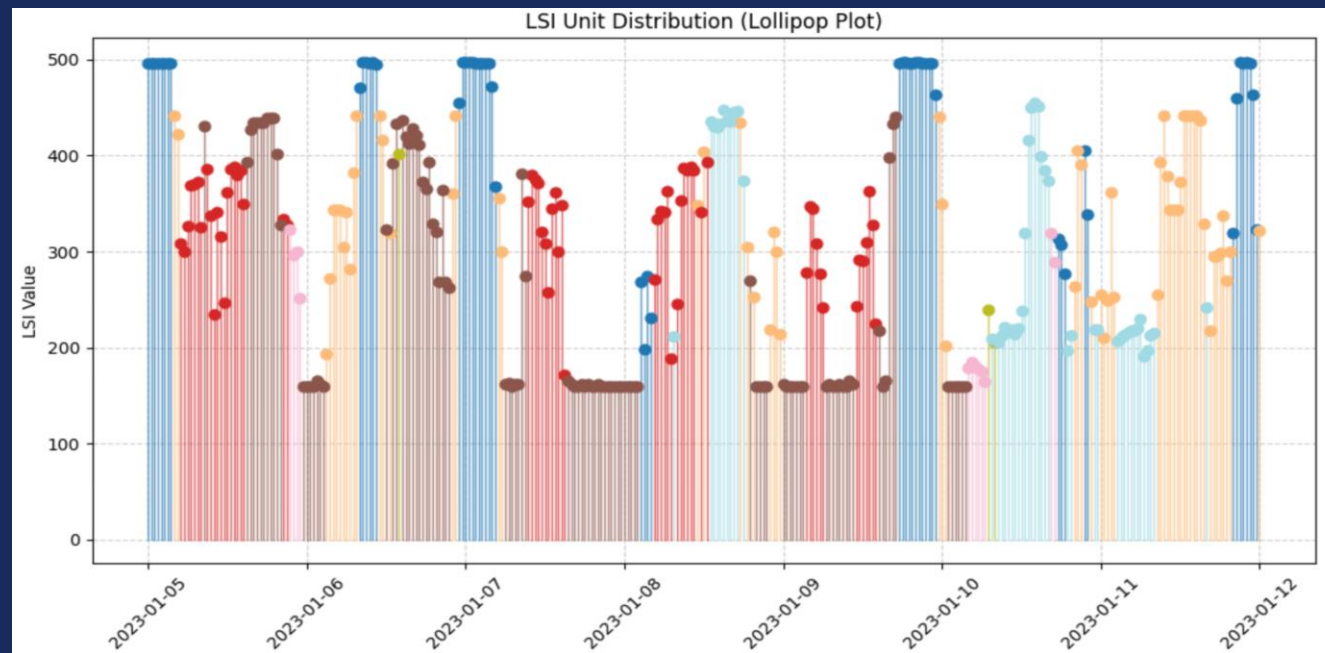
SME Evaluation and Feedback



Self-reinforcing flywheel: data, more use cases, customer feedback/domain expertise for rapid improvement of core model.

LSI/LSO

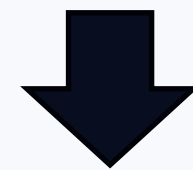
Largest Single Risk on Power System



LSI and LSO forecasts enable optimized reserve planning.

At the time of prediction, multiple inter-dependent market factors are not known: RES output, trader behaviors, physical notifications from generators.

These processes are highly interdependent on each other making the forecasting problem challenging

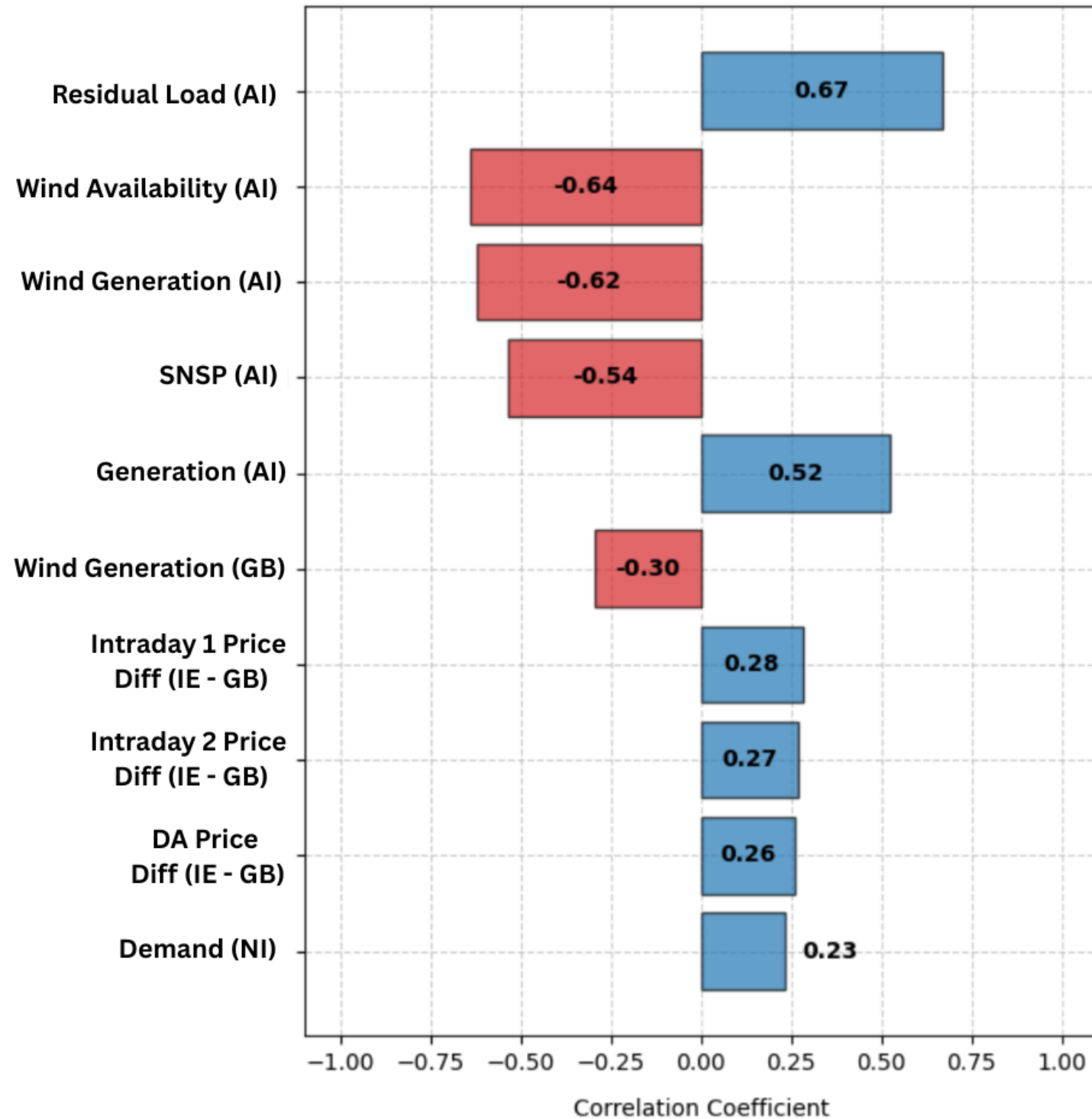


Drives necessary reserves by half hour

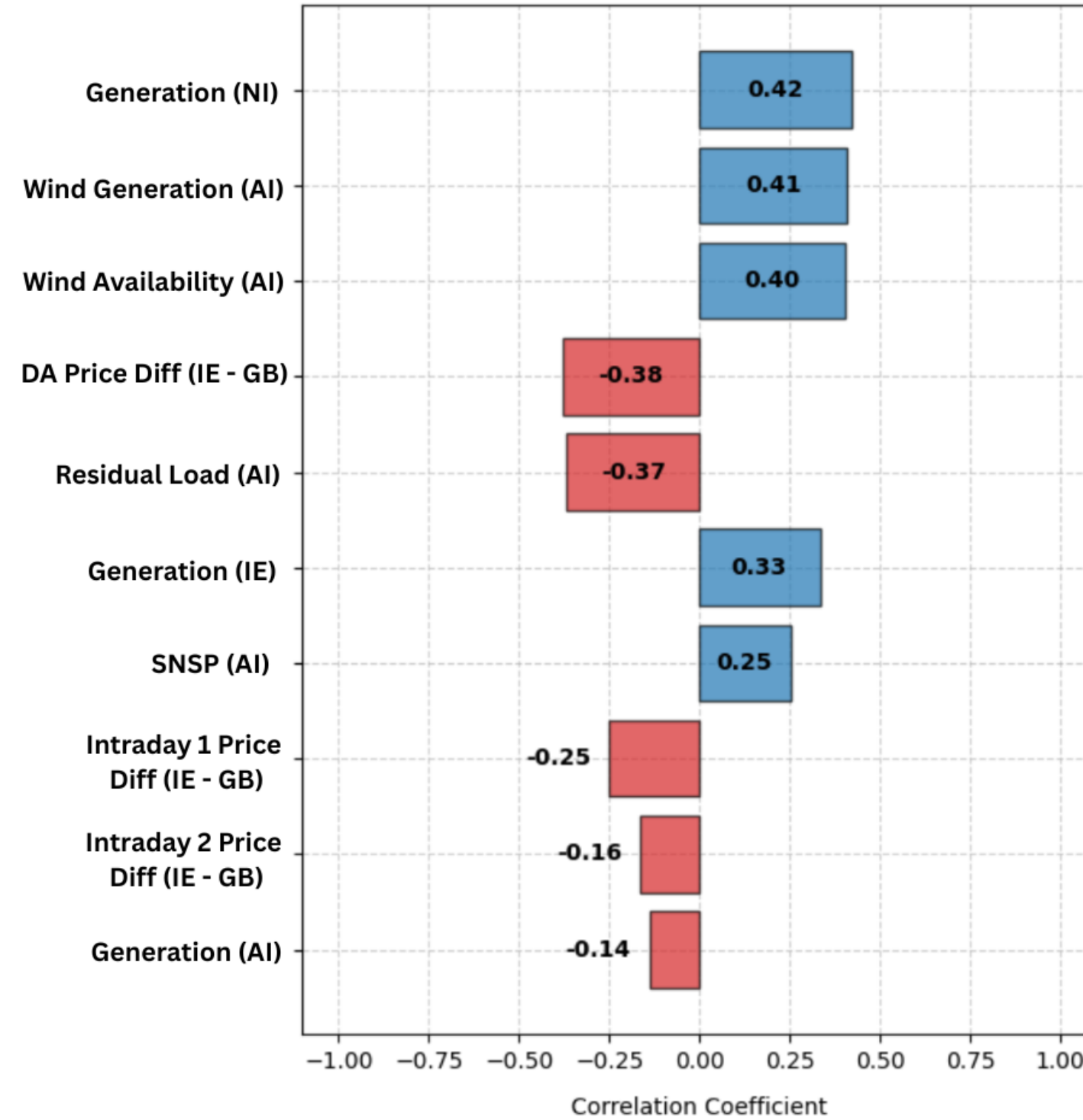
Top 10 Features that contribute to LSI/LSO

2022-08-25 to 2024-08-14

LSI Correlations



LSO Correlations

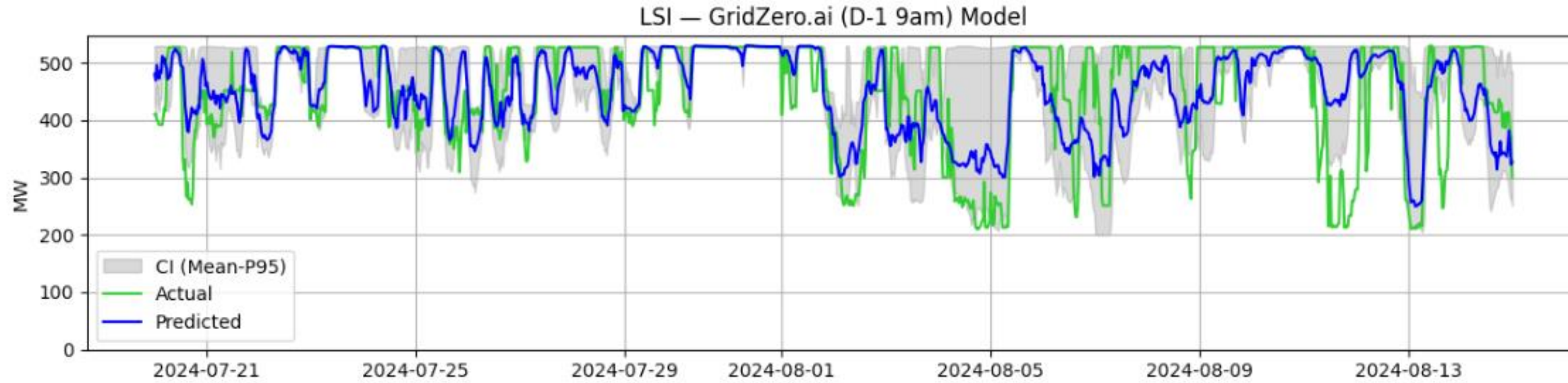


Pearson Correlation Method

AI (All Island)
 GB (Great Britain)
 IE (Ireland)
 NI (Northern Ireland)

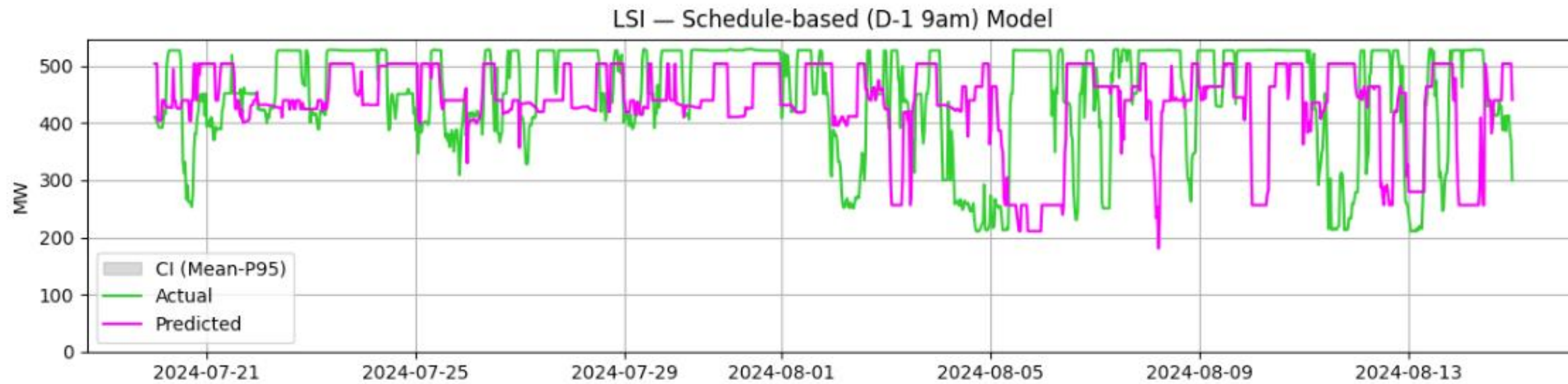
LSI: Results

Daily Percentage Error nMAE	
GridZero.ai (D-1 9am)	9.8% (44.5 MW)
Schedule-based (D-1 9am)	19.9% (89.7 MW)
Schedule-based (Rolling Hour-8)	8.7% (39.3 MW)



**GridZero.ai
D-1 9am**

Predictions from GridZero.ai's adaptive learning Foundational AI Model using only data available at D-1 9am.



**Schedule Based
D-1 9am**

A simplified view of the expected LSI and LSO at 9am D-1.

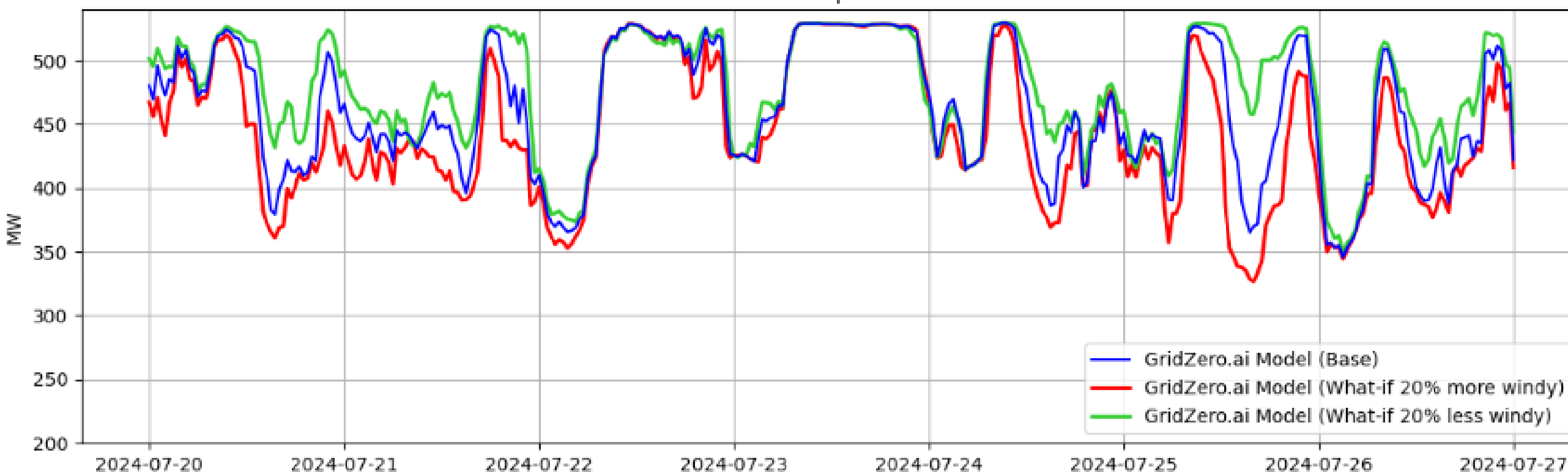


**Schedule Based
Rolling Hour-8**

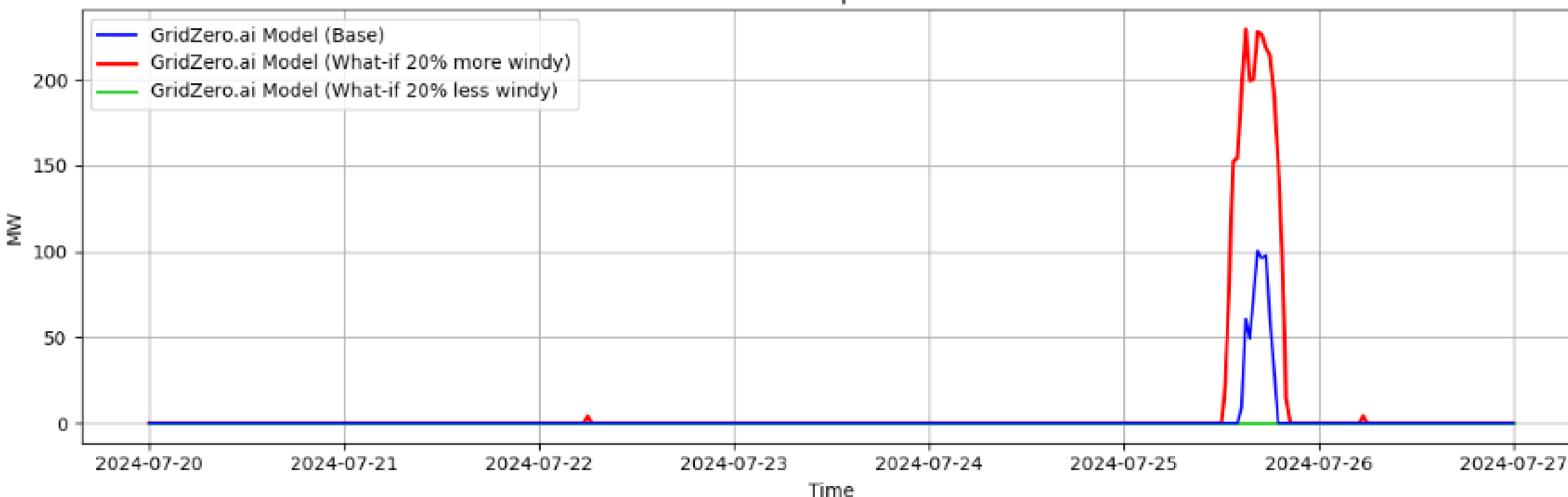
A rolling prediction of the expected LSI and LSO derived from 8 hour ahead SCUC LTC runs.

What if 20% more / less wind (LSI/LSO)

LSI Comparison

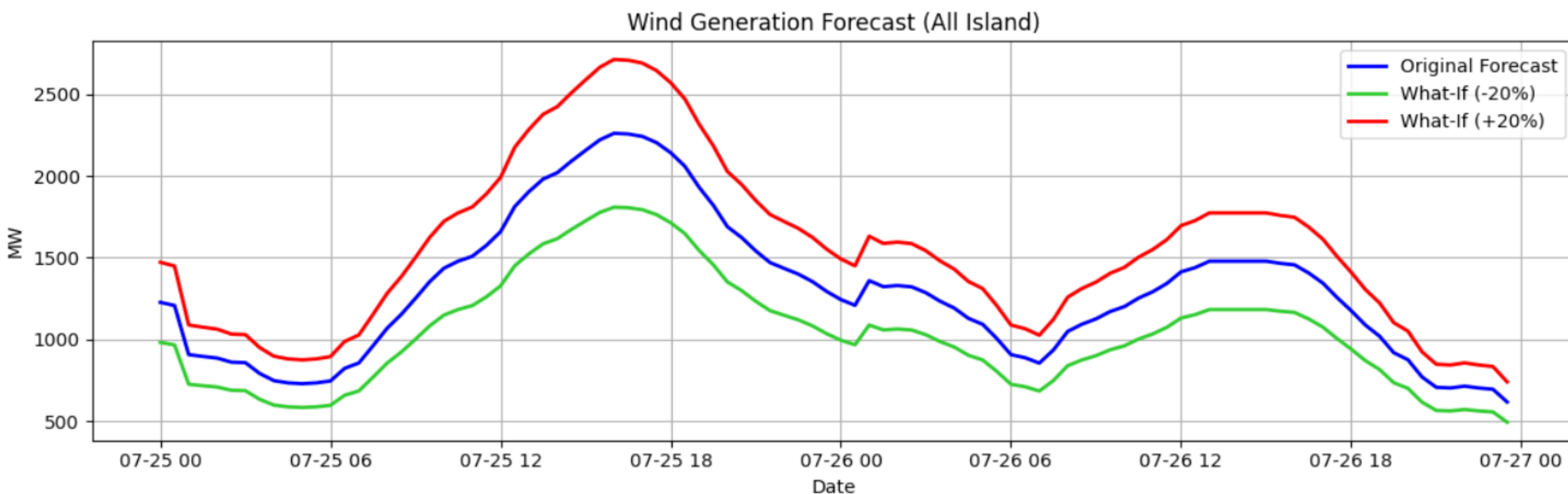
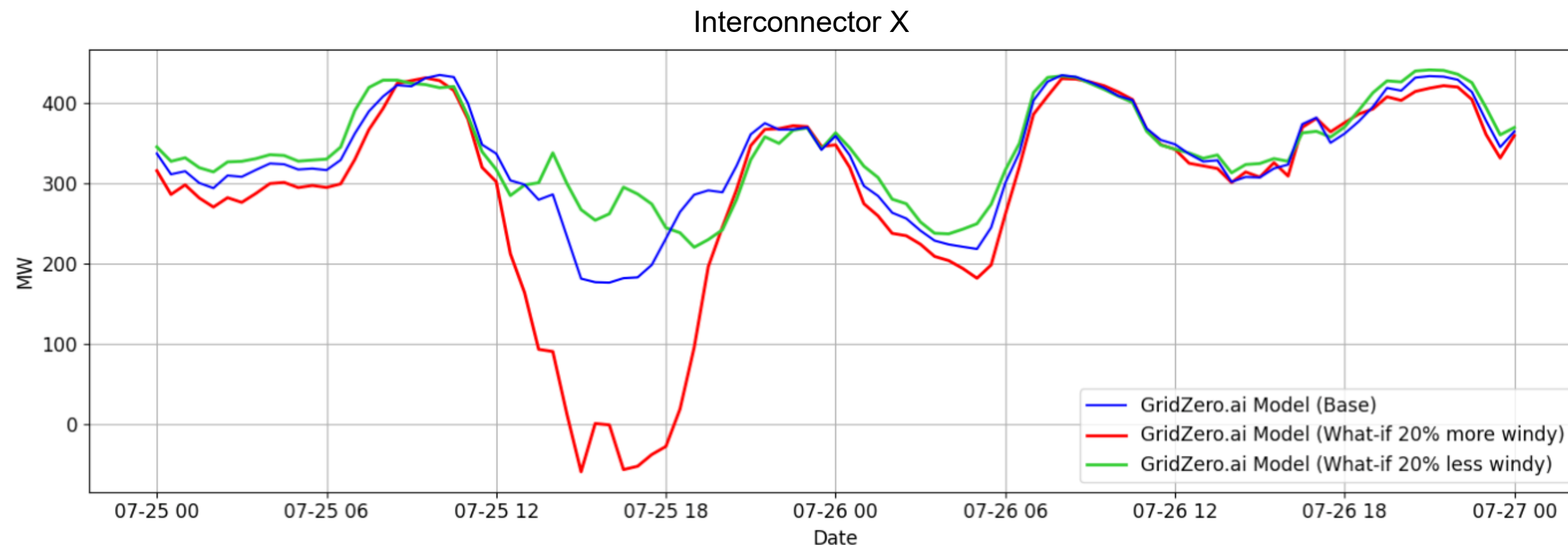


LSO Comparison



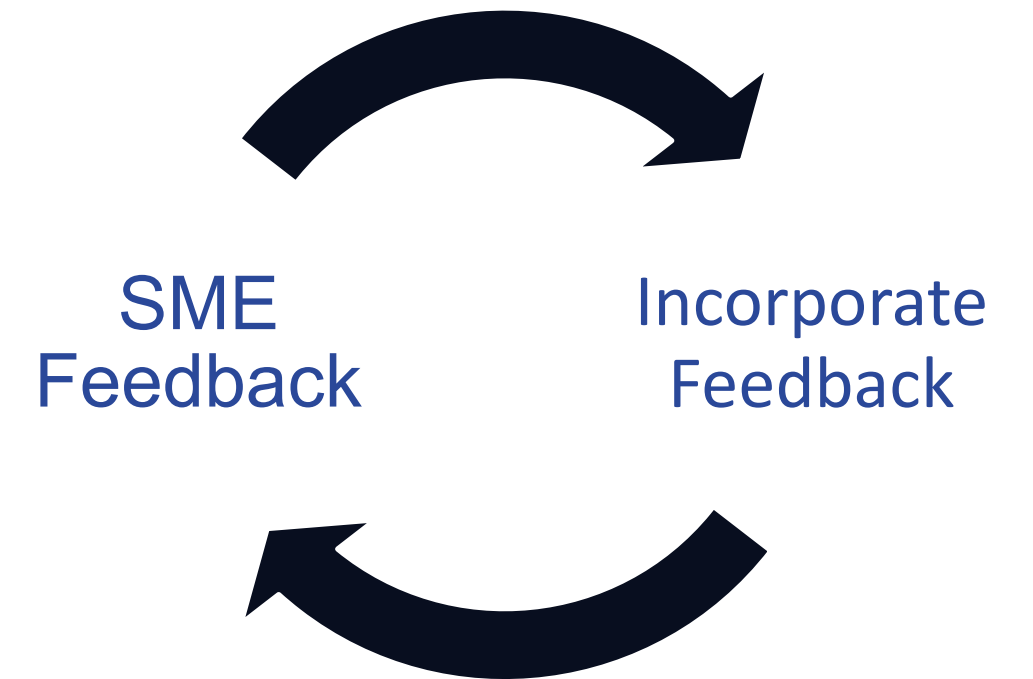
- **Scenario:** Modify All-Island wind generation forecast by $\pm 20\%$ while keeping GB wind fixed; only relevant features (e.g. residual load, renewable forecast) adjust accordingly.
- GridZero.ai model learned the interdependencies among grid and market variables, and picks up correct correlations between wind generation forecasts and grid/market responses.
- This enables rapid scenario testing, exploration of grid sensitivities, and more informed decision-making.

What if 20% more / less wind (Interconnector X)



- The left panel illustrates how outputs of a single interconnector would vary under the same what-if scenarios.
- Interconnectors exhibit higher sensitivity to wind generation forecast compared to generators.
- Interconnector flows exhibit nonlinear sensitivity to wind generation forecasts: flow predictions may shift from net import to net export.

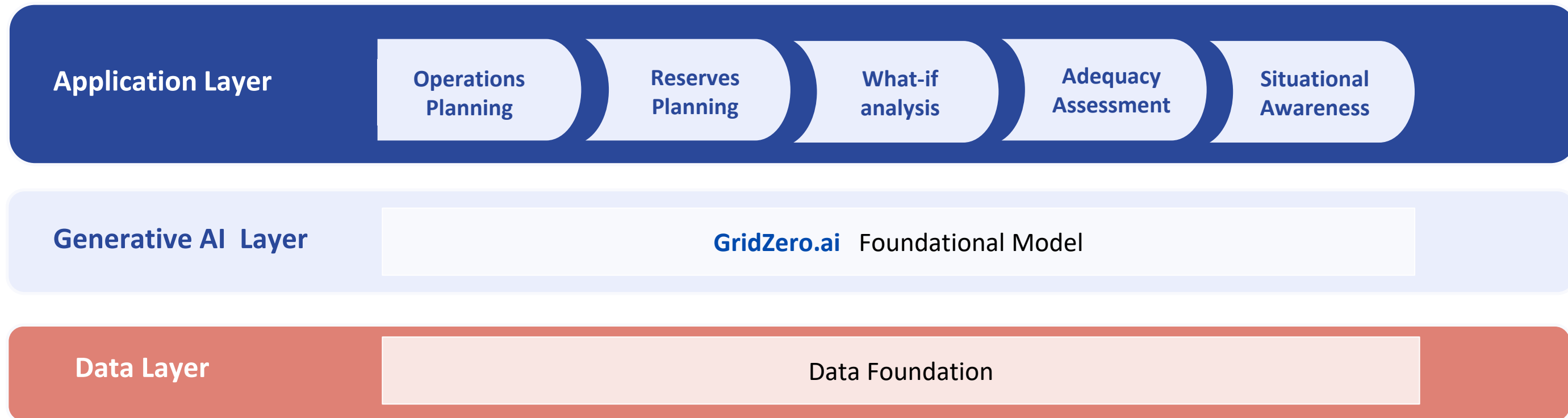
Timeline



Collaborative working approach between EirGrid and GridZero.ai

Multiple streams of work in parallel adaptive to SME feedback

Technical Vision: One Platform Many Uses



Thank you

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