



CIRED 2023 International
Conference & Exhibition
on Electricity Distribution

The Impact of Forecasting Accuracy on the Economic Performance of Flexibility Provision



Gary Howorth
University of Strathclyde

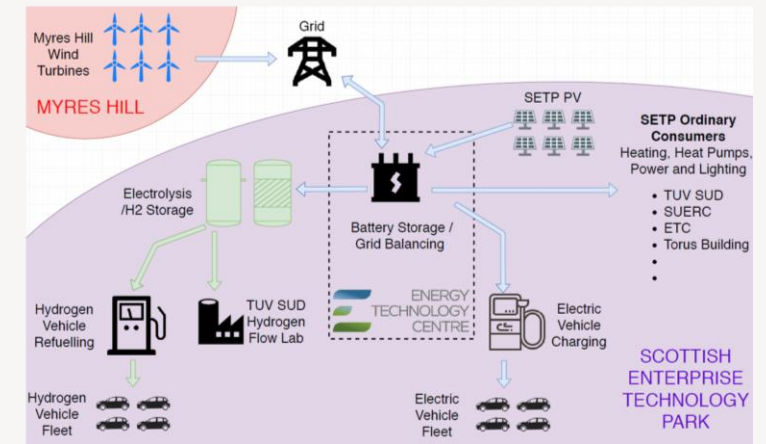
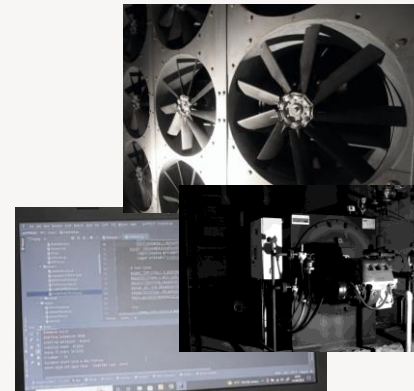
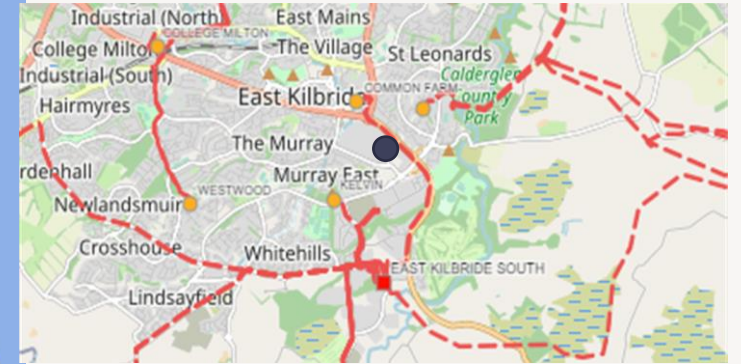
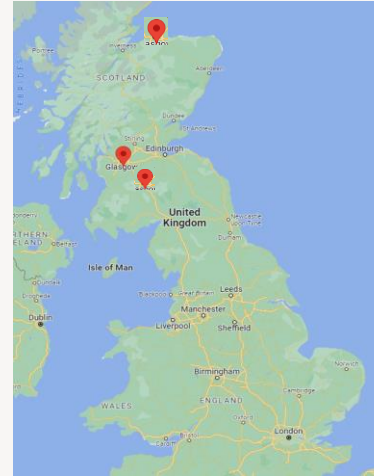
SIES (Smart Integrated Energy System)

Key Aims

- ERA-Net's SIES 2022 project focuses on the technological and business related barriers and opportunities of how VPPs can function in flexibility markets.
- The SIES 2022 project aims to develop a digital energy utility management service (VPP) capable of managing local and regional energy systems and markets using a number of energy pools & use cases. E.g. ETC.
- Key questions in this presentation
 - How good is the forecasting in a "real VPP"?
 - And how does this impact on the commercial performance of a VPP owner?

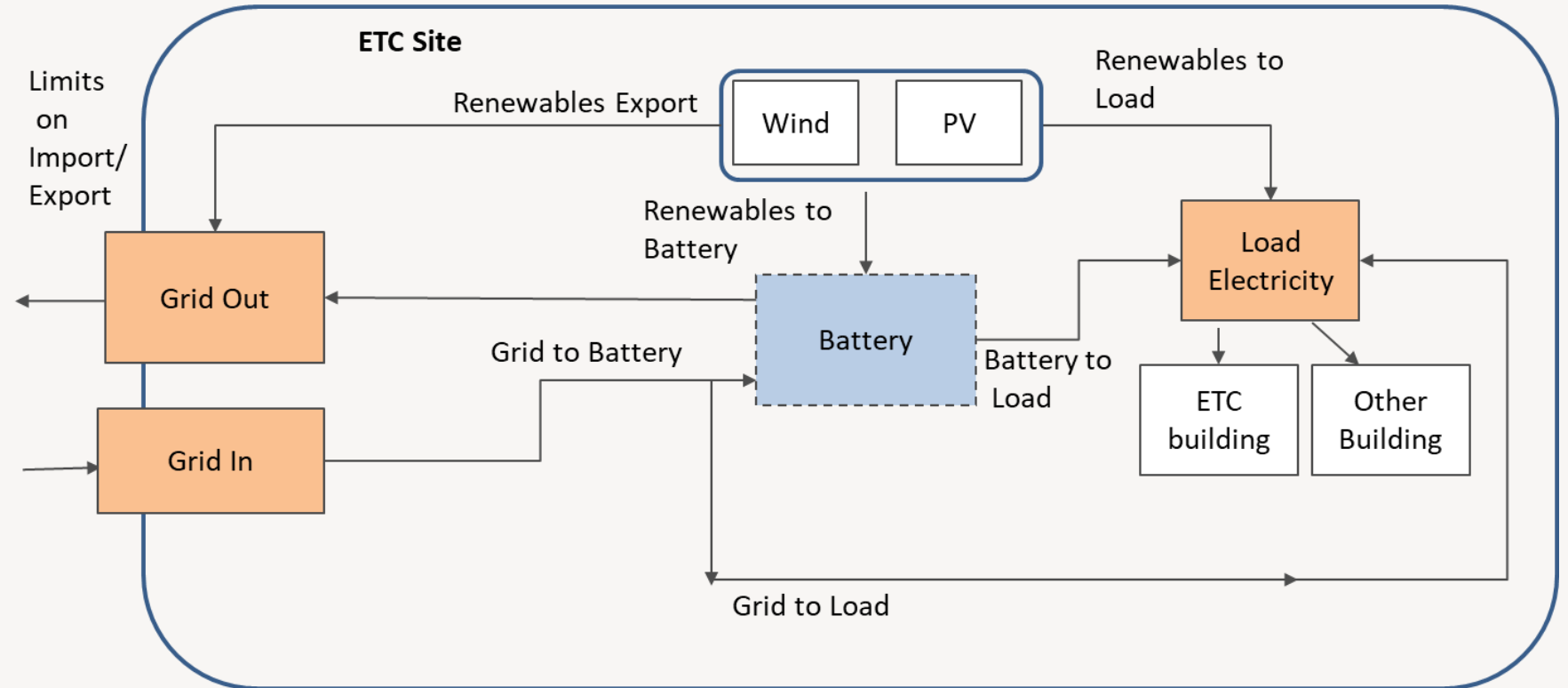
SIES Overview

- “Learning by Doing ” Project
- Multiple Energy Pools (FindHorn, ETC demonstrator site, Myres Hill ..)
- VPP ++ (connecting different types of assets including DSR), to maximize profits and provide support to an already congested grid
- Testing & developing Algorithms



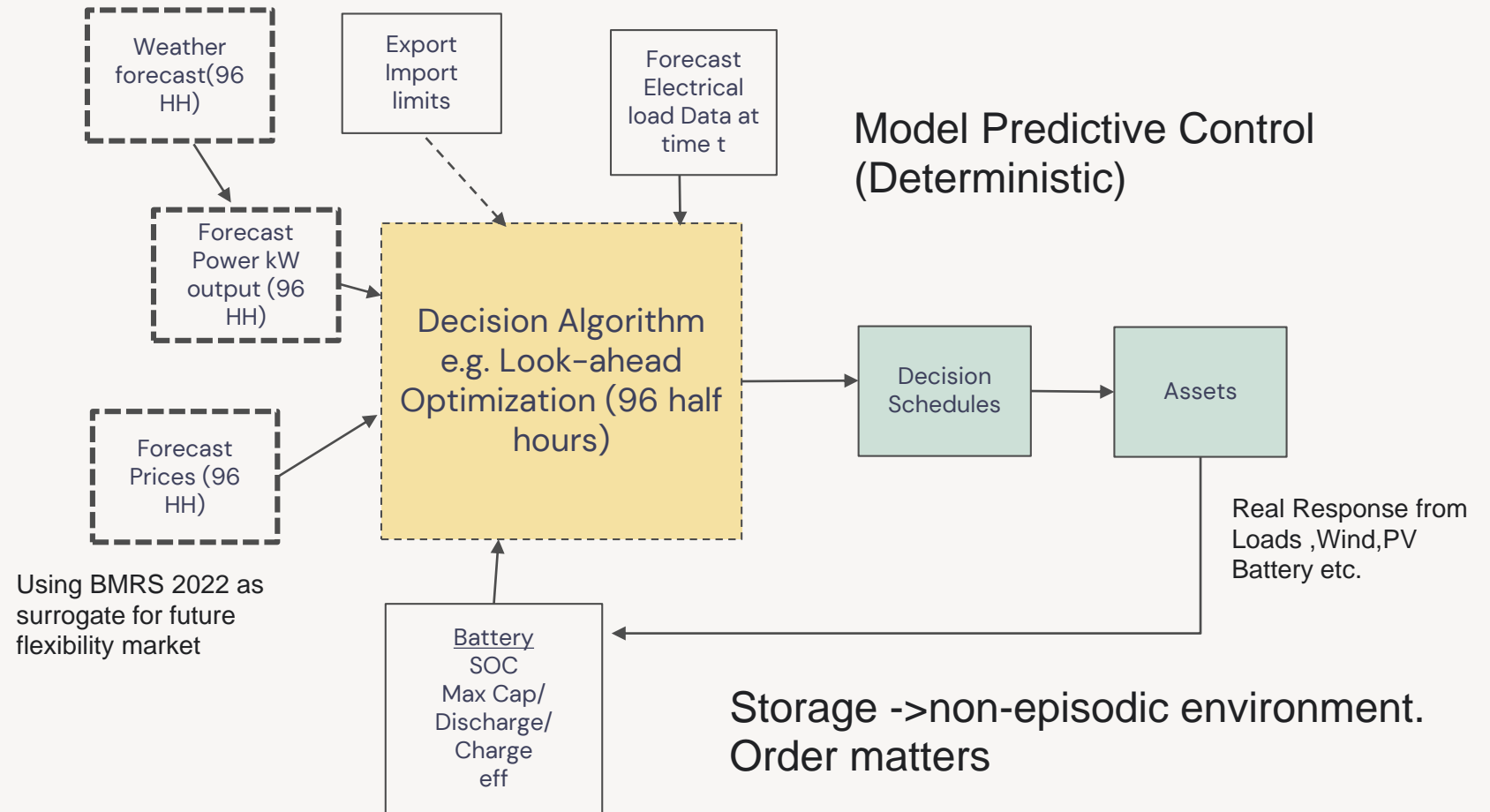
Use Case

- Focus on ETC
- Battery: 178 kWh
100kW
- PV Solar: 12 kW
- Wind Turbine :10 kW
- Load at site: 2-60 kW
- Export/Import limits



Forecasting and Optimisation

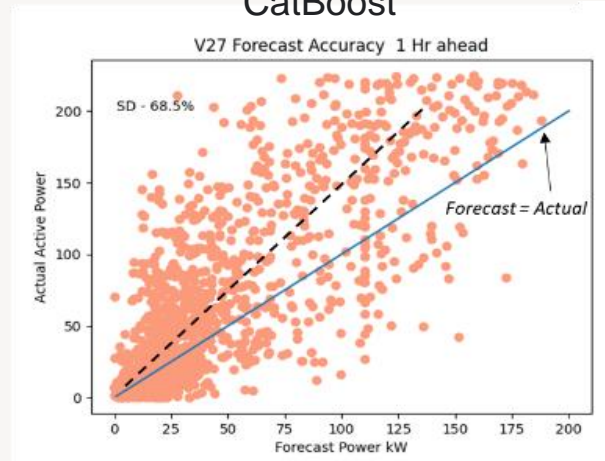
- Forecasting is key to commercial success
- But how good is the VPP Performance
- Use real data to assess errors
- Uses optimisation decision algorithm (MPC)



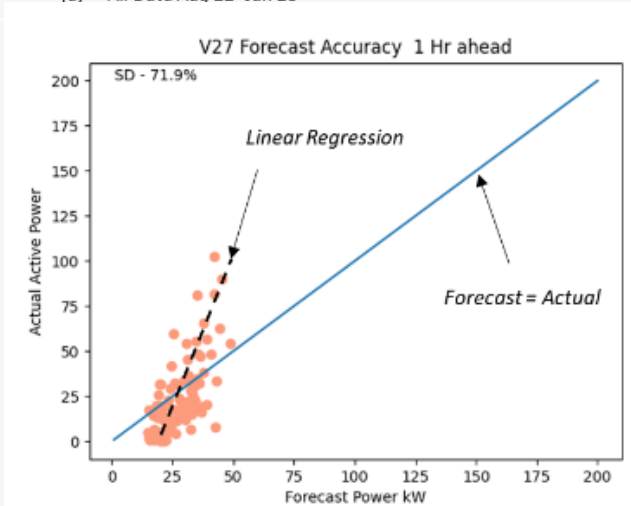
Power Output Forecasting (kW)

- Driven by wind
- Used machine learning CatBoost
- And simpler Logistic Regression Equation
- Note simpler method more accurate.
- Is ensemble better? (30% reduction?)

CatBoost

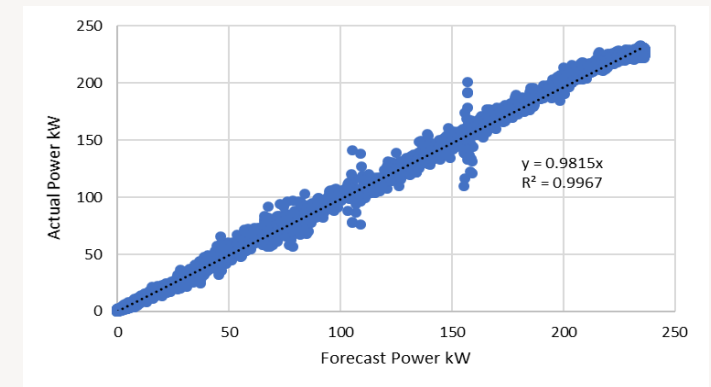
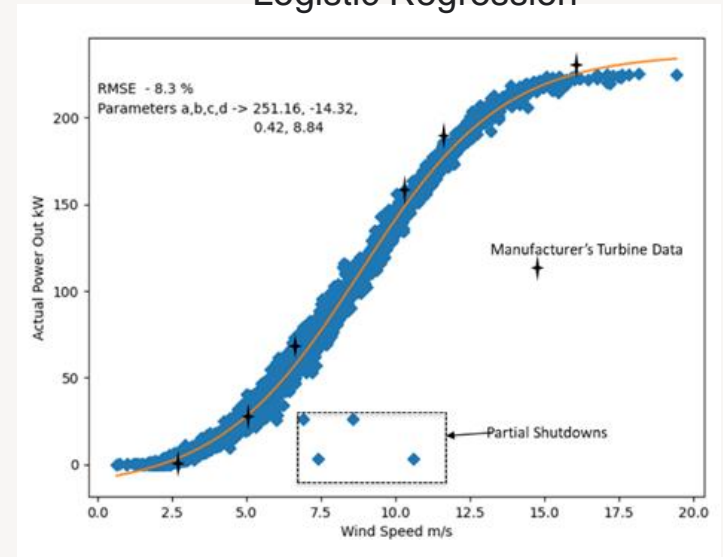


(a) All Data Aug 22- Jan 23



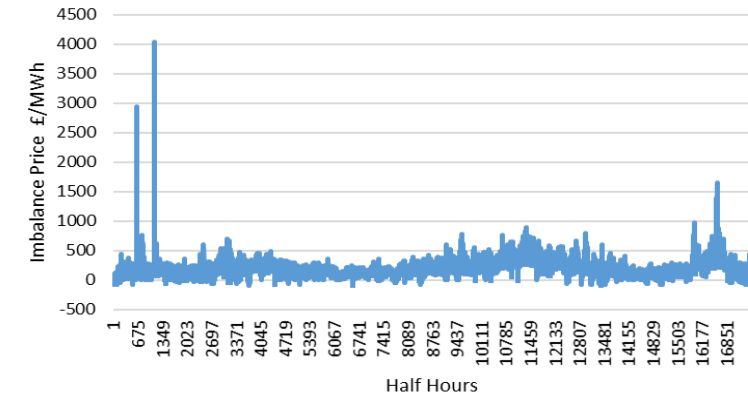
(c) 5 Days Oct 22

Logistic Regression

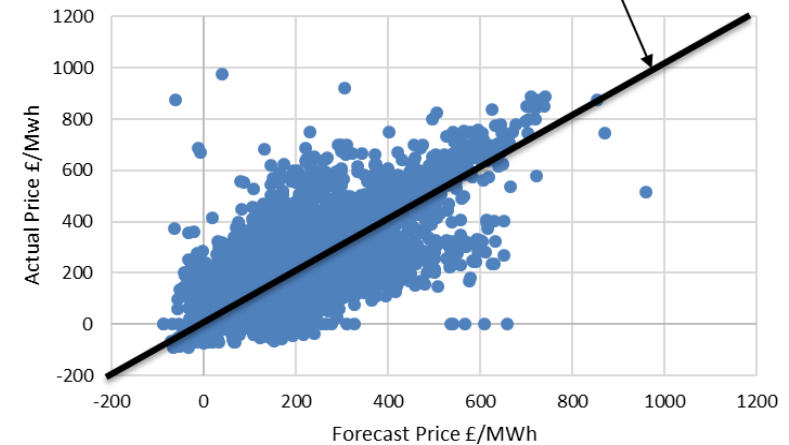


Price Forecasting (BMRS 2022)

- Many routes to market – focus on Balancing Mechanism 2022 as a surrogate for Flex
- Forecasting such flexibility markets are proving to be difficult
- Forecasting price algorithm using ForecastPro
- XGBoost better results (post paper)
- Note ML better this time but depends



Forecast = Actual



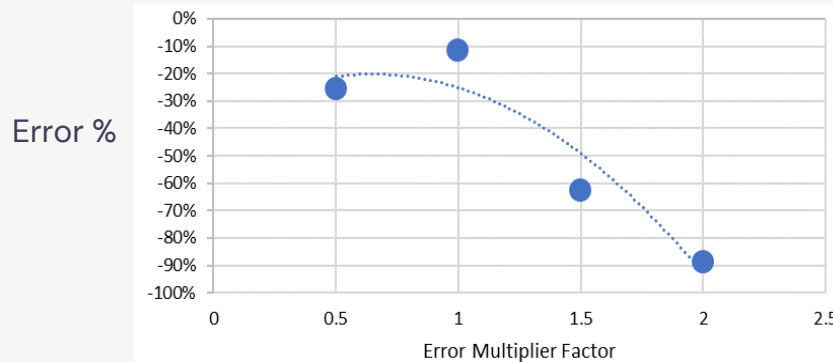
Impact on VPP Performance

- What you should have done (Perfect) vs what you did (Forecast)
- Compared net revenues

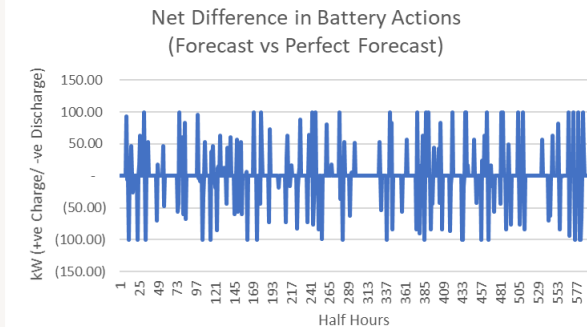
$$Net\ Revenues = \sum_{t=0}^{horizon} (Sellprice_t * Export_t - Buyprice_t * import_t)$$

Error %
Actual over Perfect Forecast

Case	Yearly Revenues			Disbenefit £ Impact on Revenue	%
	Forecast	Perfect Forecast	Outturn		
Base Case	3,594	2,925	2,585	-340	-12%
Error x 0.5	3,879	2,925	2,179	-746	-26%
Error x 1.5	5,171	2,925	1,094	-1,831	-63%
Error*2	5,971	2,925	333	-2,592	-89%

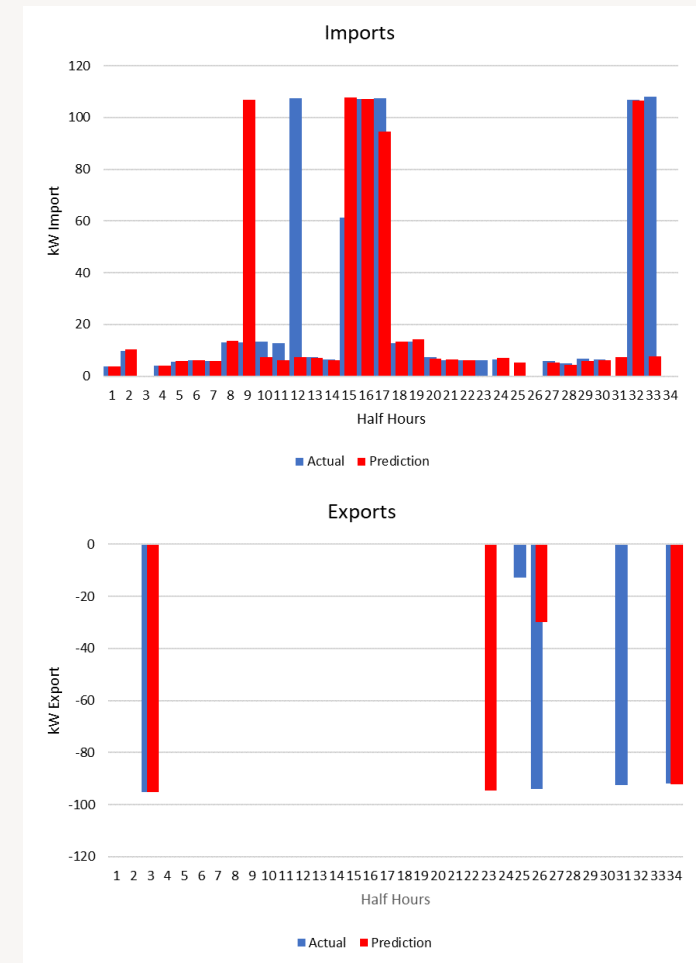


Battery Action Errors



Impact on DSO

- 15% of the time large difference in dispatch Patterns (what was expected vs what actually happened)
- How to address
 - Better forecasting (ML) 50–60% reduction
 - Multiple aggregators could reduce this by a factor 2–3 in % terms (assuming independence)
- If still exposed– is Risk Management required?



Conclusions

- Current revenue error ~ 12%
- With better price forecasting using ML – 5% (XGBoost)
- Paper focus on Commercial performance of aggregator (VPP) but what about the DSO...
- For 15% of the time large errors in dispatch volumes (Imports or Exports) could occur.

Final Thoughts

- Financial Risk management for VPP owners with exchange options (Europe- currently limited) will limit commercial risk – but at what cost?
- DSO needs a better understanding of aggregator actions to be able to efficiently risk manage.
- Physical risk management with longer terms contracts ? – but there is a DSO cost to this – Large availability fees? Or is there a better way



CIRED 2023 International
Conference & Exhibition
on Electricity Distribution

Thank You

Gary Howorth
gary.howorth@strath.ac.uk
University of Strathclyde

