Fulcrum3D: Solar Forecasting for the NEM

LESSONS LEARNT REPORT 2

Project Details

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Reporting Period	October 2019 – April 2020

This Project received funding from ARENA as part of ARENA's Advancing Renewables Program - Short Term Forecasting funding round.

EXECUTIVE SUMMARY

- Our forecasting models continue to be more accurate than ASEFS such that they pass AEMO's accuracy requirements with respect to RMSE and MAE on 5-minute power production.
- The MP5F API is increasingly robust. Further streamlining of the MP5F API registration and authentication processes is an area for improvement. The suggestion of some worked examples is an excellent idea.
- Accurate power modelling is non-trivial but provides bonus insights. It confirms our original hypothesis that a detailed physical based models are essential for accurate forecasting.
- There is currently minimal value in using forecasts for FCAS participation or export control but further increases in FCAS costs may strengthen the case for using forecasting for these services.

KEY LEARNINGS

1. Category: PROJECT STRUCTURE

1.1. Objective: Demonstrate the potential commercial benefits of wind and solar farms investing in short-term, self-forecasting solutions

Lesson Learnt No. 1.1.1: The project team is key

Details: Working with Genex, UGL and AEMO has been collaborative and productive and has been essential to the success of this project. Genex and UGL are excellent partners and we would like to acknowledge their invaluable and complementary contributions.

2. Category: TECHNICAL

2.1. Objective: Demonstrate the ability to submit five-minute ahead self-forecasts via AEMO's web based MP5F API

Lesson Learnt No. 2.1.1: The MP5F API is increasingly robust and reliable.
Details:

- There were some challenges around having two forecast providers on the same site that are providing forecasts through separate API connections. These have been resolved by open communications with the asset owner/AEMO participant.
- The MP5F API registration process continues to change as AEMO continues to refine the API processes.
- The regular expiration of API passwords is problematic. A secure automated (or semi-automated) system for resetting passwords is critical to operational efficiency. We understand AEMO is working on a better system for this.
- A published API connection process with worked examples would be helpful.

2.2. Objective: Demonstrate the five-minute ahead self-forecasts are more accurate than the AWEFS and ASEFS

Lesson Learnt No. 2.2.1: Self-forecasts can be more accurate than ASEFS.
Details: Our forecasting models continue to be more accurate than ASEFS such that they pass AEMO's accuracy requirements with respect to RMSE and MAE on 5-minute power production.

Lesson Learnt No. 2.2.2: Accurate power modelling improves accuracy.
Details: A detailed physical based model improves forecast accuracy. This includes:

- Modelling inter-row shading at low solar angles.
- Better modelling of spectral mismatch between CdTe (thin-film) solar panels and thermopile based pyranometers due to total precipitable water.
- Allowing for model tuning to deal with the fact that:
  - The unconstrained generation of inverters across the solar farms do not necessarily match in clear sky conditions (homogenous temperature, irradiance etc… across the site) and that they generally do match when limited to a set point.
  - DC current sensors are not always accurate (offset and slope). Higher accuracy DC current sensor accuracy would assist better system modelling and therefore forecasting.

Lesson Learnt No. 2.2.3: CloudCAM system hardware is robust.
Details: The CloudCAM system hardware has proved to be sufficiently robust in the high temperatures and often heavy rainfalls of Northern Queensland. It is was installed over 16 months ago and continues to operate well.

3. Category: COMMERCIAL

3.1. Objective: Demonstrate the potential commercial benefits of wind and solar farms investing in short-term, self-forecasting solutions

Lesson Learnt No. 3.1.1: AEMO's Causer Pays calculation can be replicated
Details: We have developed a model that replicates AEMO's calculation of causer pays charges using publicly available NEMWeb data. This will allow the commercial benefits of self-forecasting to be assessed.

Lesson Learnt No. 3.1.2: The business case for using self-forecasts for FCAS participation/export control is not strong
Details: The spot price for energy is generally significantly higher than the spot price for FCAS services so a generator is better off selling into the energy market. The terms of some PPA contracts may mean this is not the case for some solar farms (e.g. Take Or Pay contracts).

Further increases in FCAS costs may strengthen the case for FCAS participation. It should be noted that FCAS participation capability (technical and regulatory) would have been valuable to wind and solar farms during the recent South Australian islanding event.

- The Hornsdale wind farms are the only operational renewable generation FCAS providers in South Australia and so were the only renewable generators able to capitalise on the FCAS windfall that occurred during this event. All other wind and solar farms collectively paid more for their FCAS than the market value of the energy during that period.
- Allan O'Neil notes in his recent WattClarity article that *"generators who don't fully understand their exposure to FCAS, and have not developed mitigation strategies – even partially, perhaps through developing capabilities to become FCAS providers like the Hornsdale wind farms – can leave themselves open to very nasty surprises"*[1].
- The business case for FCAS participation is likely to strengthen if there are similar events in the future.

[1] O'Neil, Allan. Don't Forget About FCAS! *WattClarity* (17 February 2020)