AEMO Redux - Executive Summary

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Motivation

During my 2022 UNSW CAPSTONE project, I was given the task of using linear regression models to forecast AEMO power demand. At that time, I was not involved with the neural network models for that team project. Fortunately, while the linear models were competitive to the AEMO forecasts, my teammates' neural network models did not work out.

Hence, out of curiosity, to see if I could personally "beat AEMO", I returned to the problem and built a new neural network from scratch (without using any of my former teammates' code).

Autoregression model

The autoregression model I chose was an LSTM model, plus a dense neural net, with drop-outs, to forecast one time-step periods (30 mins). I split the data into two sets: a training & validation set (~87% of the data) and a held-back test set (~13% of the data). The training was via time series cross-validation (sliding window), which was strictly segregated from the test data. As my team had previously, I too utilised available statewide photovoltaic data from each state to augment my model. The usage of this historical, but never future data, is termed "being PV aware".

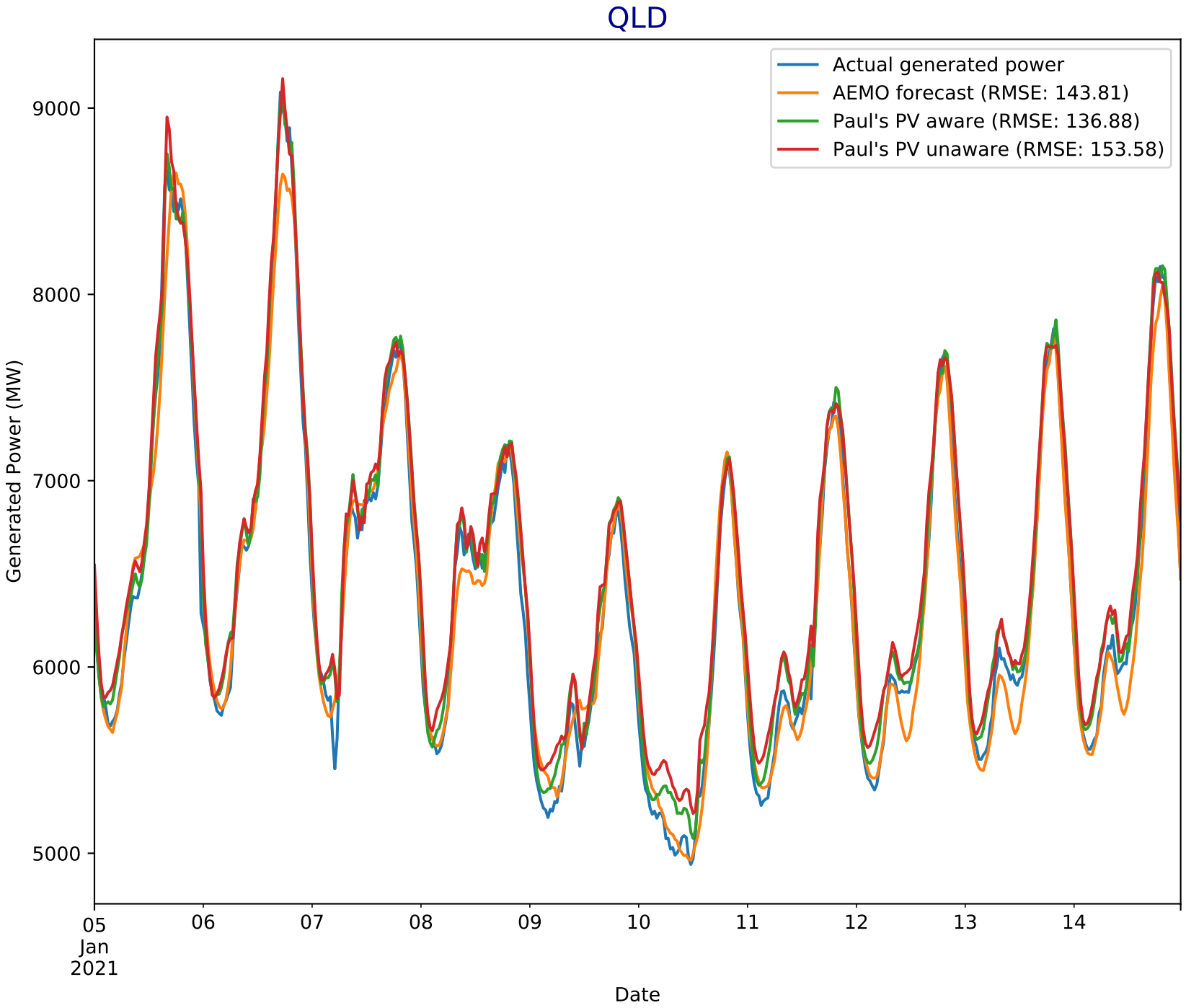
The two-year training/validation period covered: **01/01/2019 -> 31/12/2020.**
The three & a half month testing period covered: **01/01/2021 -> 18/03/2022.**

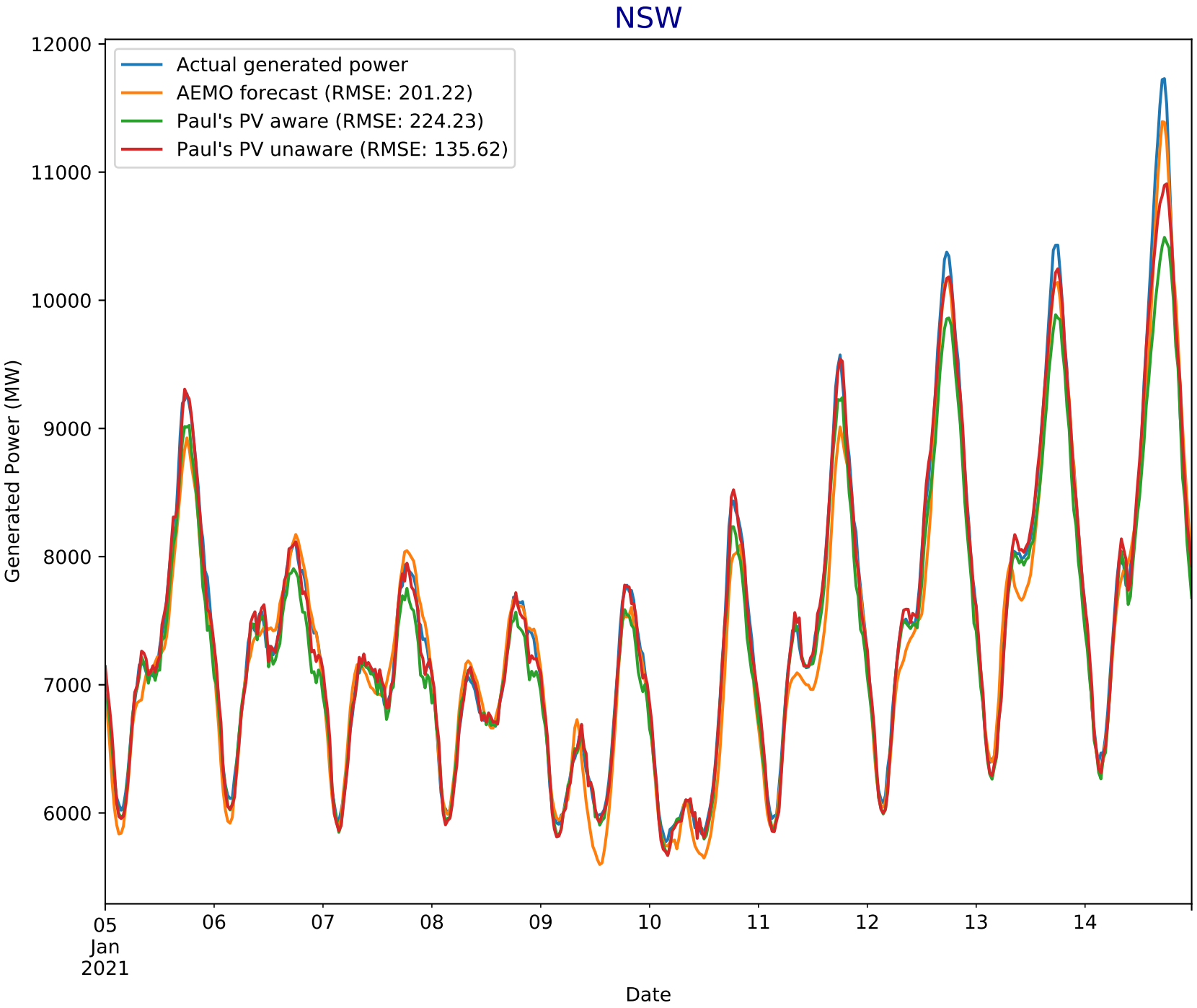
The testing period intentionally included a mid-summer, where other models tended to fail. As an autoregression model, no "future time" data was used during the training (e.g. no future PV data).

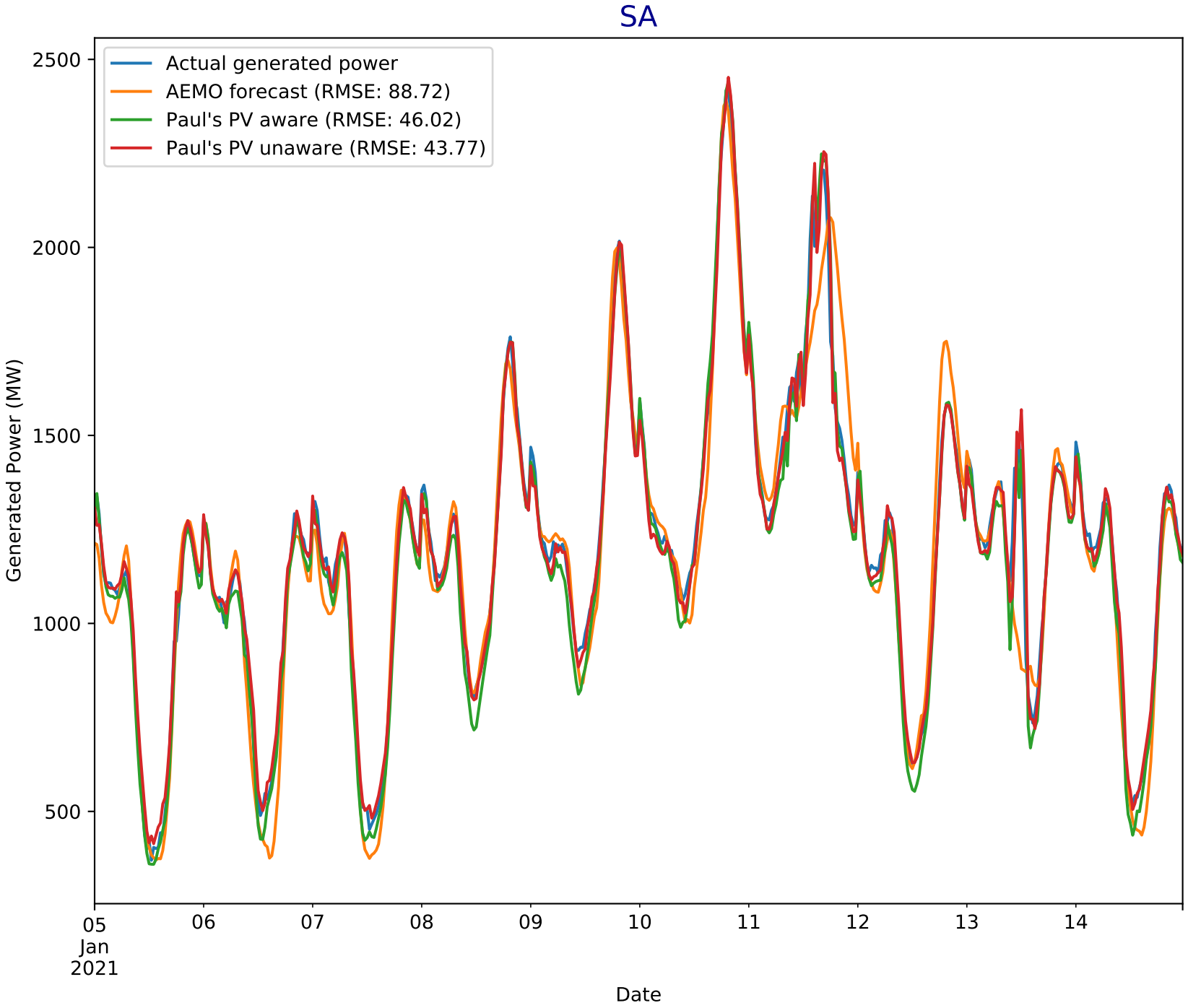
Comparative accuracy results

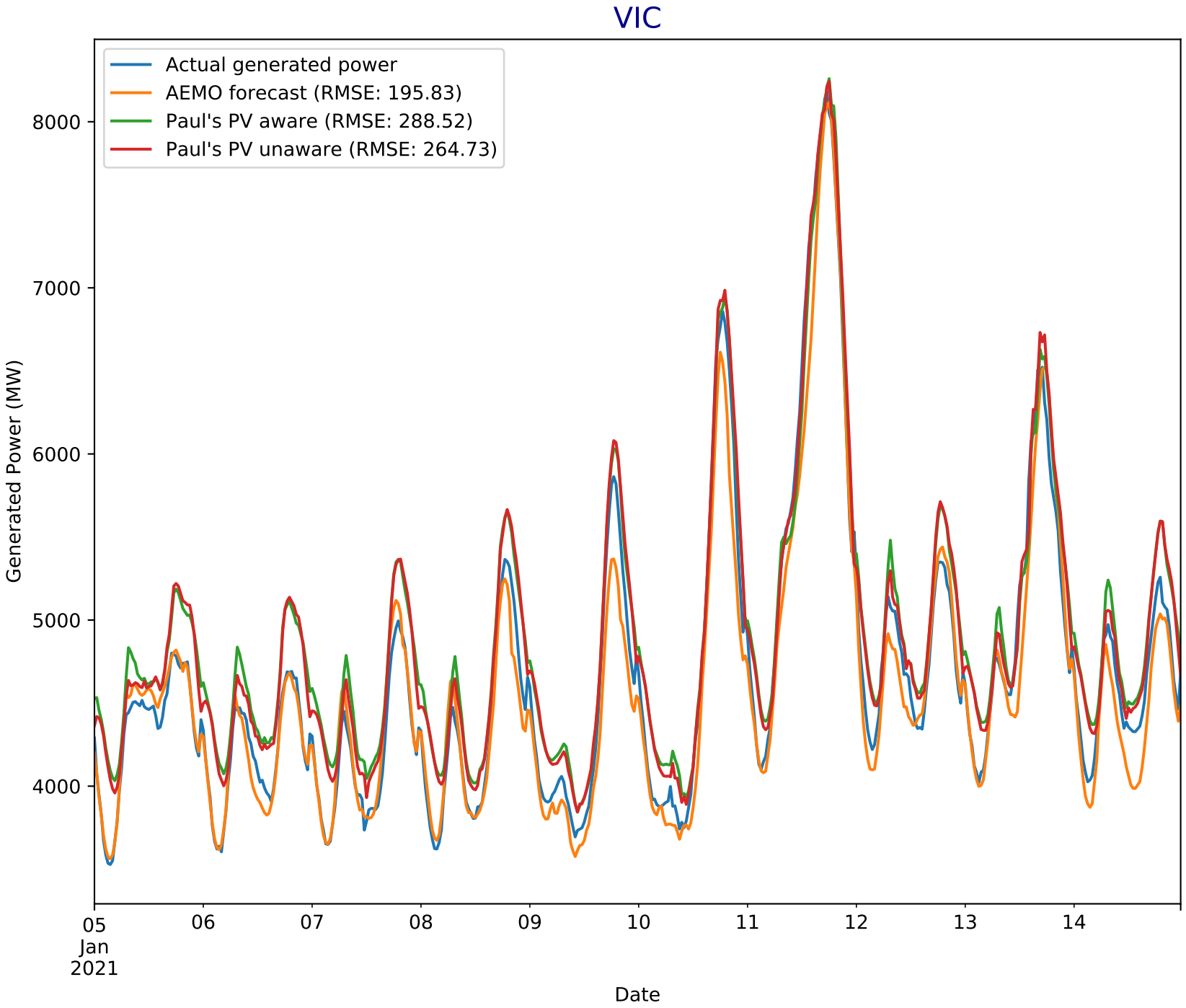
The following table gives the Root Mean Square Error (RMSE) in forecast demand vs actual demand, for the various models, including AEMO's forecast. The RMSE values are for the entire three & a half month's testing period - see the visual results for each of the four states (QLD, NSW, SA, and Vic), for a small, subset period from Jan 5, 2021, till Jan 15, 2021.

	AEMO forecast (RMSE)	Paul's PV aware (RMSE)	Paul's PV unaware (RMSE)
Queensland	**143.81 MW**	**136.88 MW**	**153.58 MW**
New South Wales	**201.22 MW**	**224.23 MW**	**135.62 MW**
South Australia	**88.72 MW**	**46.02 MW**	**43.77 MW**
Victoria	**195.83 MW**	**288.52 MW**	**264.73 MW**


QLD
Actual generated power
AEMO forecast (RMSE: 143.81)
Paul's PV aware (RMSE: 136.88)
Paul's PV unaware (RMSE: 153.58)
Generated Power (MW)
9000
8000
7000
6000
5000
05
Jan
2021
06
07
08
09
10
11
12
13
14
Date


NSW
Actual generated power
AEMO forecast (RMSE: 201.22)
Paul's PV aware (RMSE: 224.23)
Paul's PV unaware (RMSE: 135.62)
Generated Power (MW)
12000
11000
10000
9000
8000
7000
6000
05
Jan
2021
06
07
08
09
10
11
12
13
14
Date


SA
Actual generated power
AEMO forecast (RMSE: 88.72)
Paul's PV aware (RMSE: 46.02)
Paul's PV unaware (RMSE: 43.77)
Generated Power (MW)
2500
2000
1500
1000
500
05
Jan
2021
06
07
08
09
10
11
12
13
14
Date


VIC
Actual generated power
AEMO forecast (RMSE: 195.83)
Paul's PV aware (RMSE: 288.52)
Paul's PV unaware (RMSE: 264.73)
Generated Power (MW)
8000
7000
6000
5000
4000
05
Jan
2021
06
07
08
09
10
11
12
13
14
Date