



**Data and tools for the the
solar powered future**

with Dr. Nick Engerer
Chief Technology Officer

11 June 2020

**ESIG Meteorology and
Market Design Workshop**

**Solar forecasting R&D
updates**

Super Rapid Update:

**Progress in short-term solar
energy nowcasting for utility
scale sites**

Motivation: Financial Penalties hit OPEX

- FCAS market utilised to offset forecasting error
- Causer Pays Factor applied proportional to forecast deviations of individual site vs. total FCAS costs for that month
- CPF >\$100k per month not uncommon

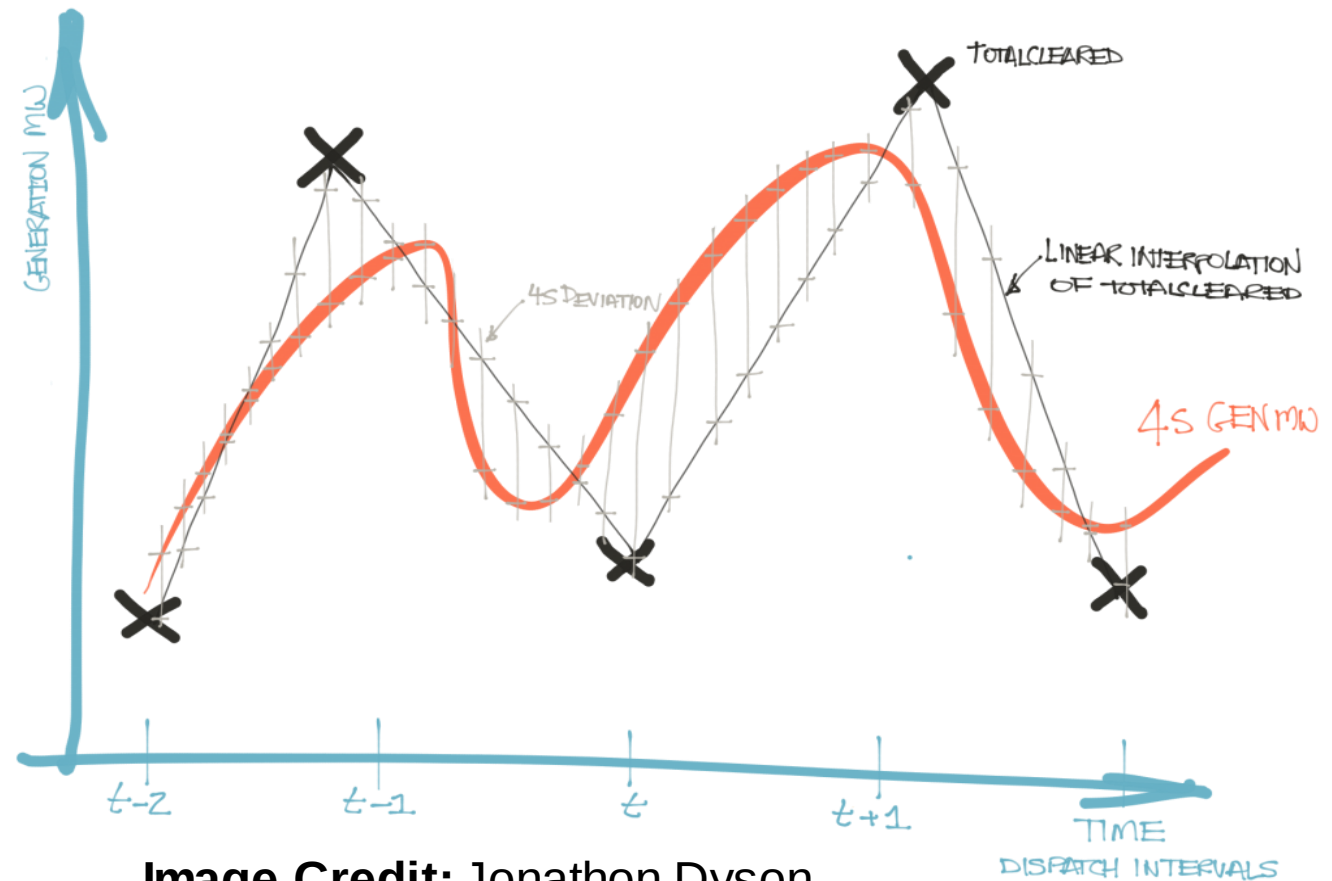
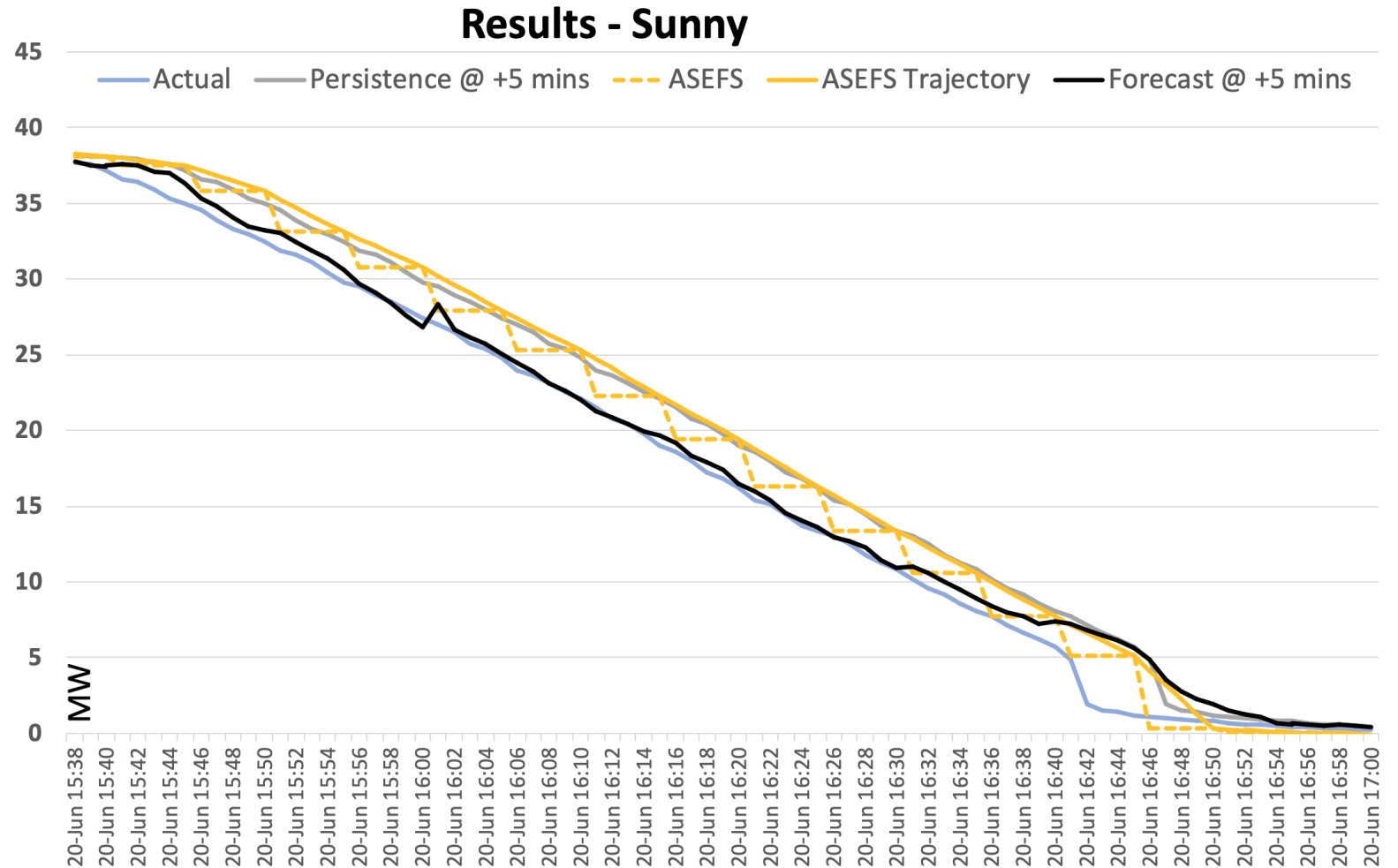


Image Credit: Jonathon Dyson
Greenview Strategic Consulting

Opportunity: Beat ASEFS, save OPEX

- Australian Solar Energy Forecasting System (ASEFS)
- Dispatch forecast = simple regressive model

Source (at right): Dyson J et al, Utility scale solar short-term generation forecasting for improved dispatch and system security, 16th Wind Integration Forum, Berlin



R&D Project: 5-minute ahead funding round

- Recipient of \$780k R&D funds from ARENA



Australian Government
Australian Renewable
Energy Agency

ARENA

- Deploying 5-minute ahead forecasting tech
- 8 solar farms in the project
- Operational submission of forecasts to Australian Energy Market Operator (AEMO) via API

<https://arena.gov.au/news/9-million-funding-to-enhance-short-term-forecasting-of-wind-and-solar-farms/>

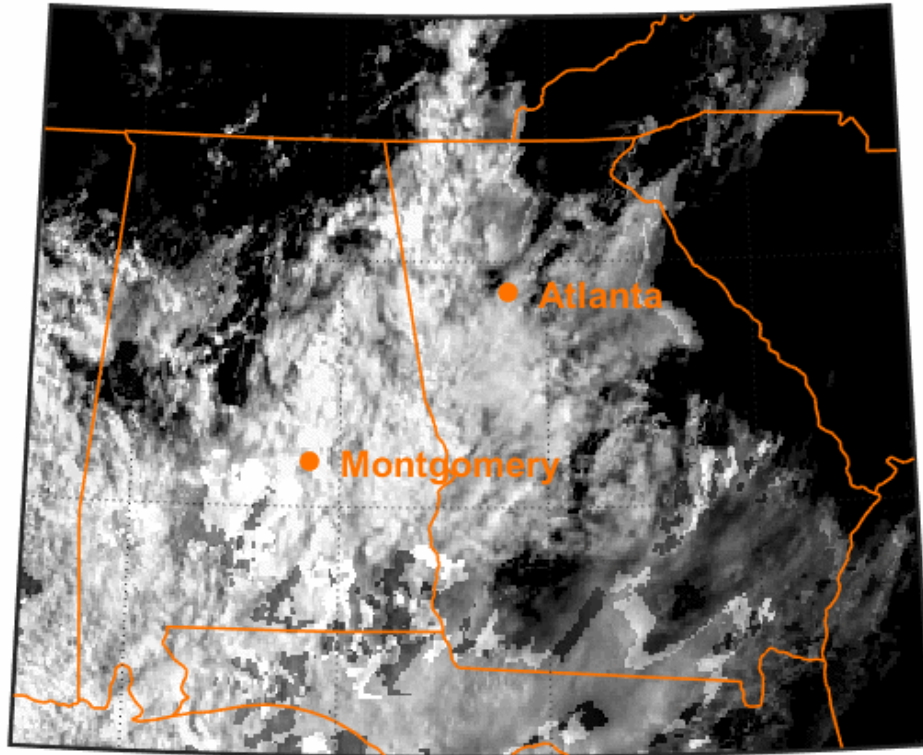
Solar Forecasting – Methodology

- **Super Rapid Update** – forecasting product
- Utilises Three key inputs
 - Satellite based nowcasting (Himawari 8, 10 minute updates at 1km²)
 - Real-time SCADA feed (15 seconds, continuous)
 - Sky-imager installed locally (onsite)



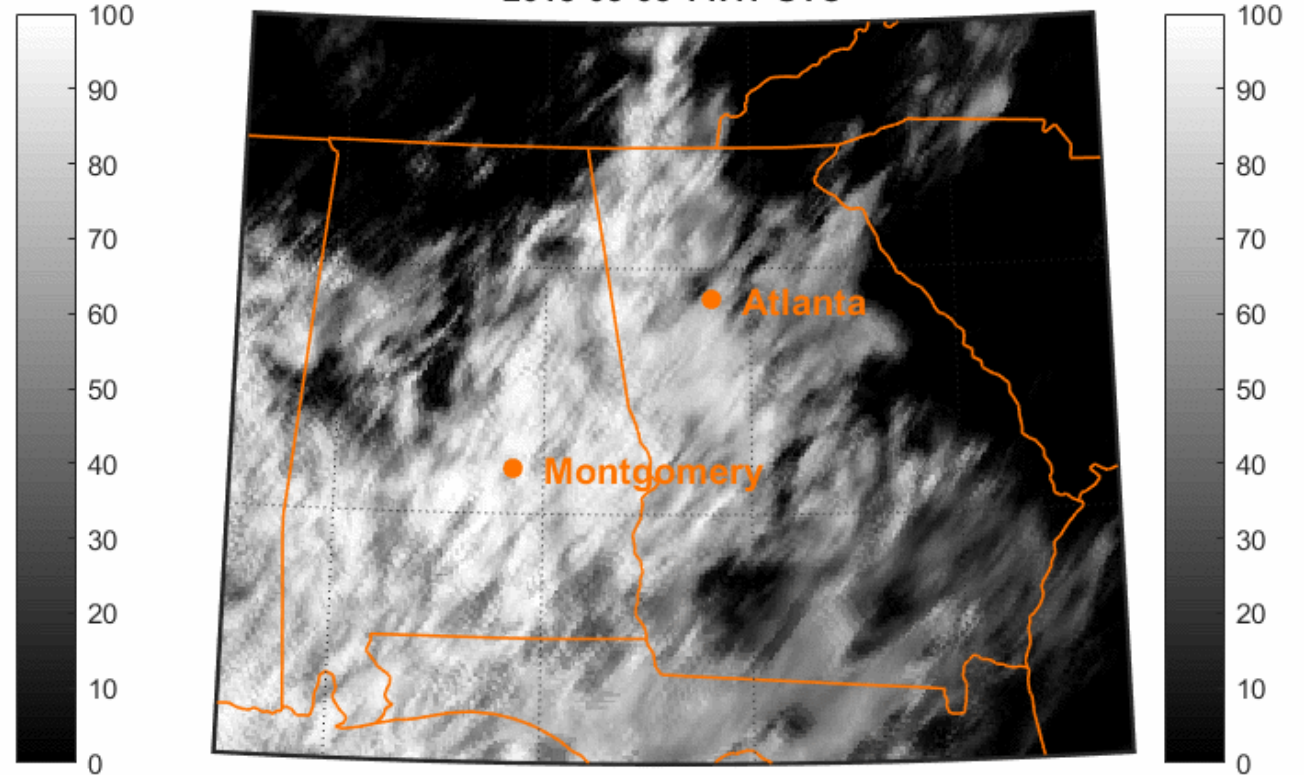
Satellite 'Nowcasting'

observed estimated actual cloud opacity
2018-03-05 14:17 UTC



Cloud Observations

ensemble forecast, +0.00hrs
2018-03-05 14:17 UTC



Example Forecast (0-2 hours)

Sky-imager Nowcasting



Solar Farms – Operational Deployment

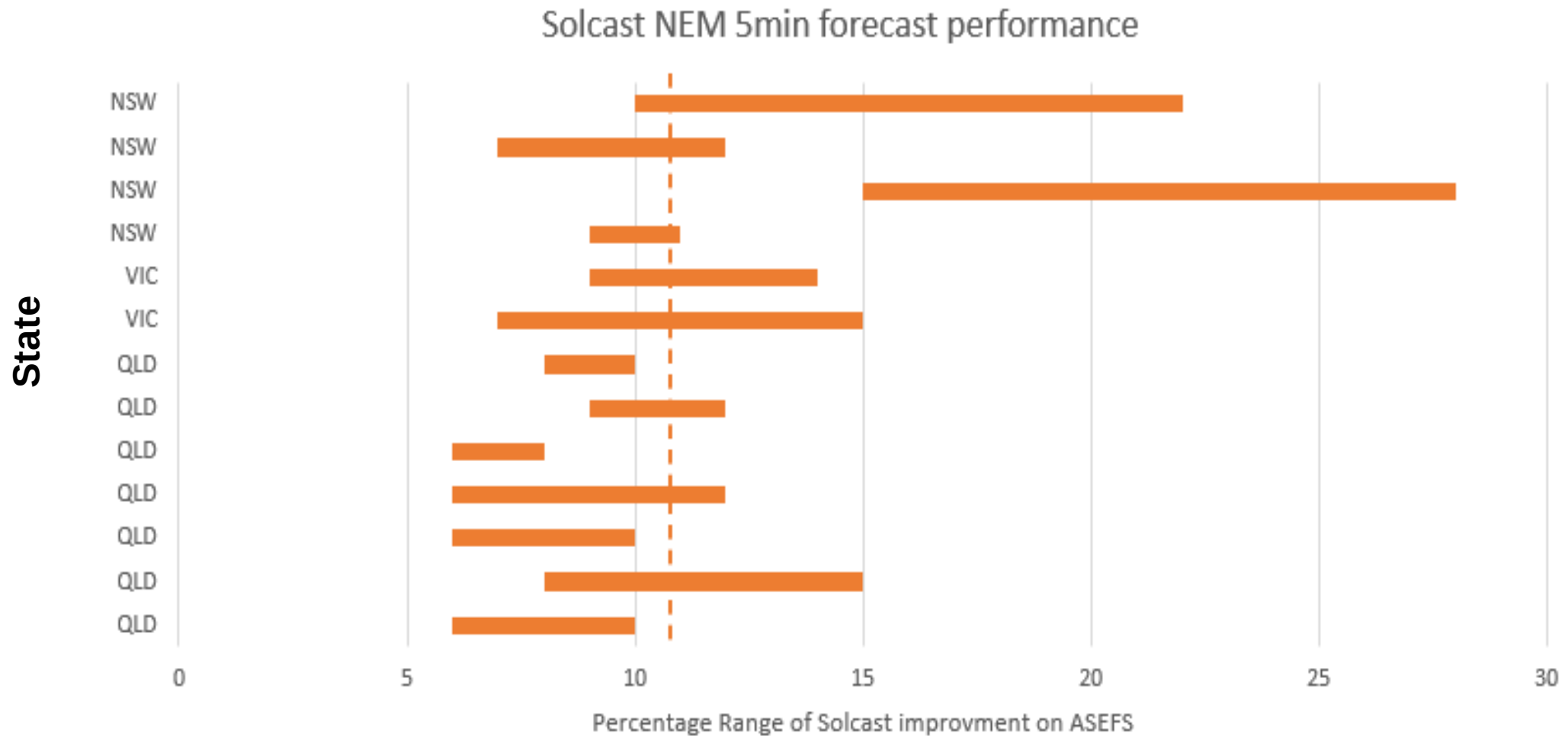


- 8x project sites (blue)
- 18 total operational sites (orange & blue)

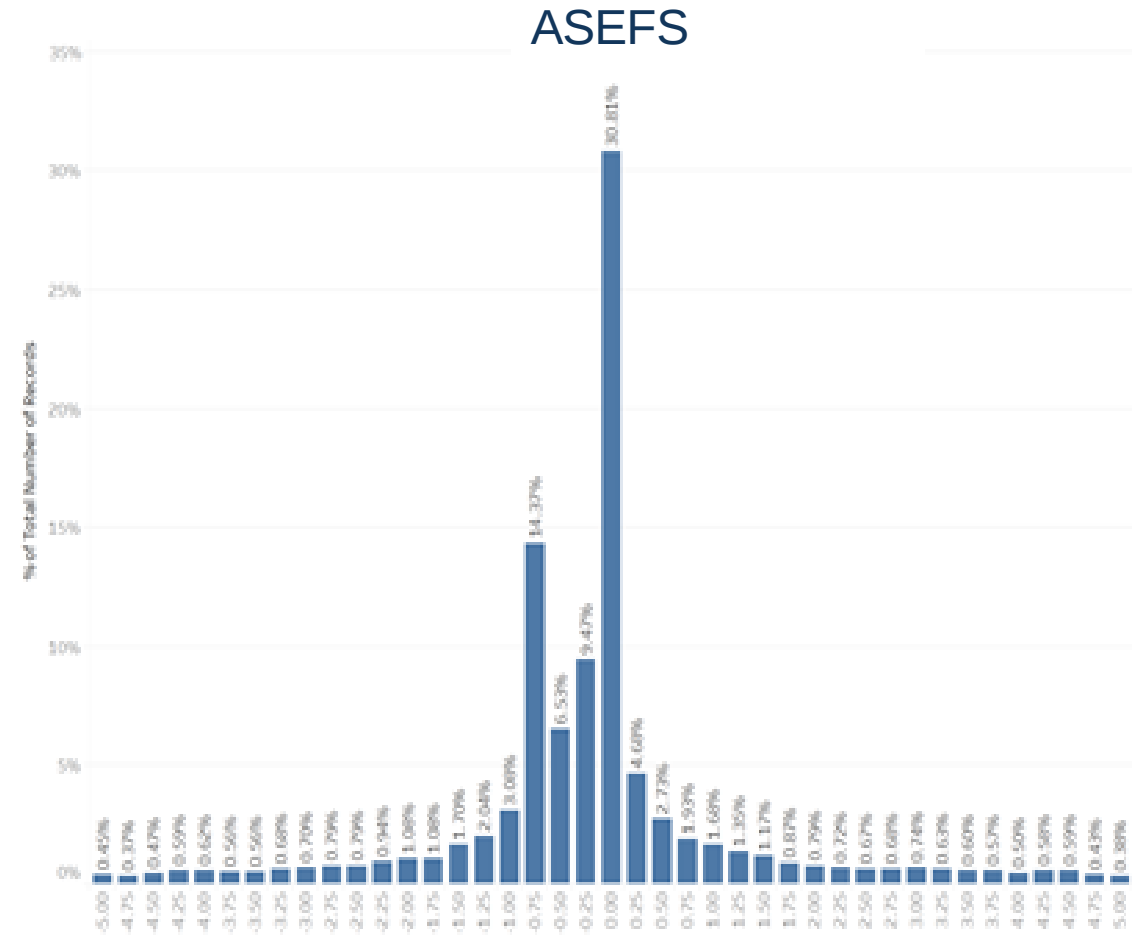
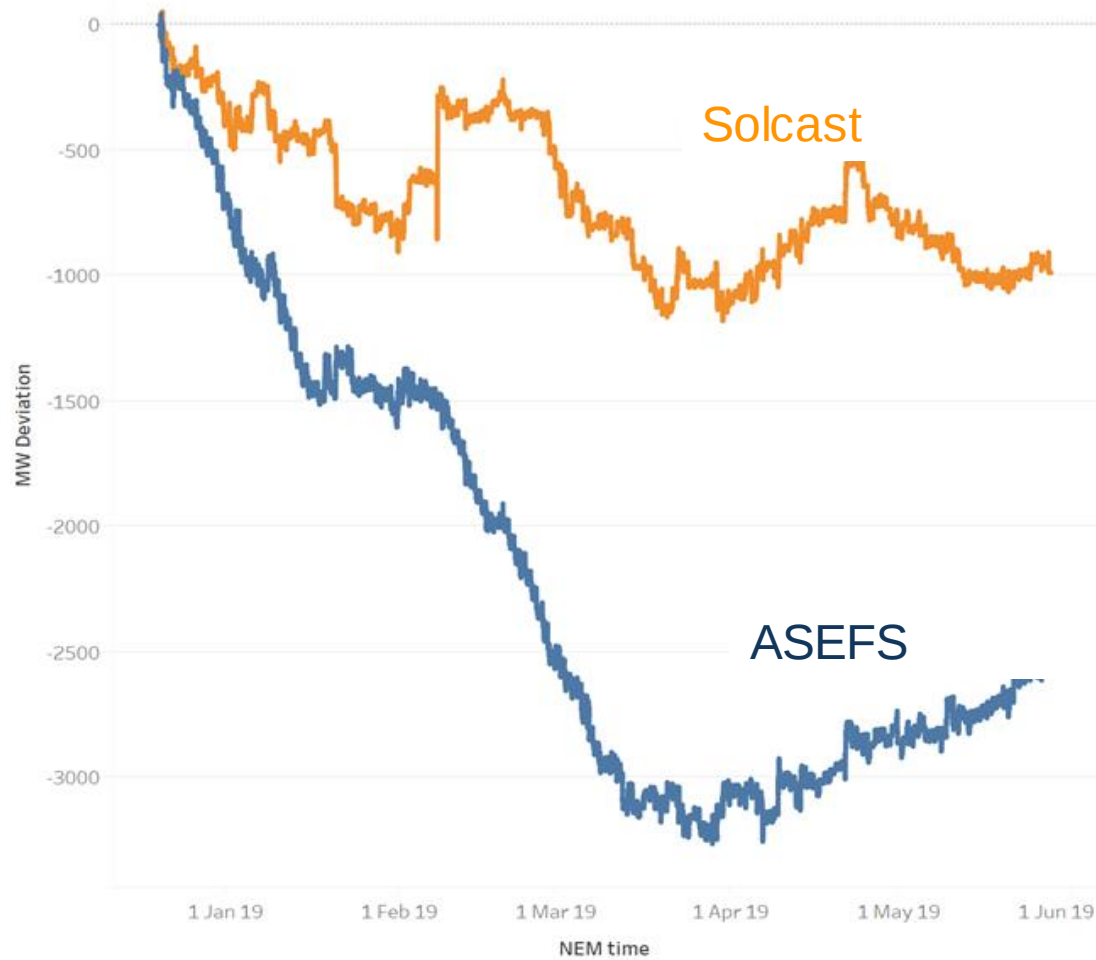
Project Partners:



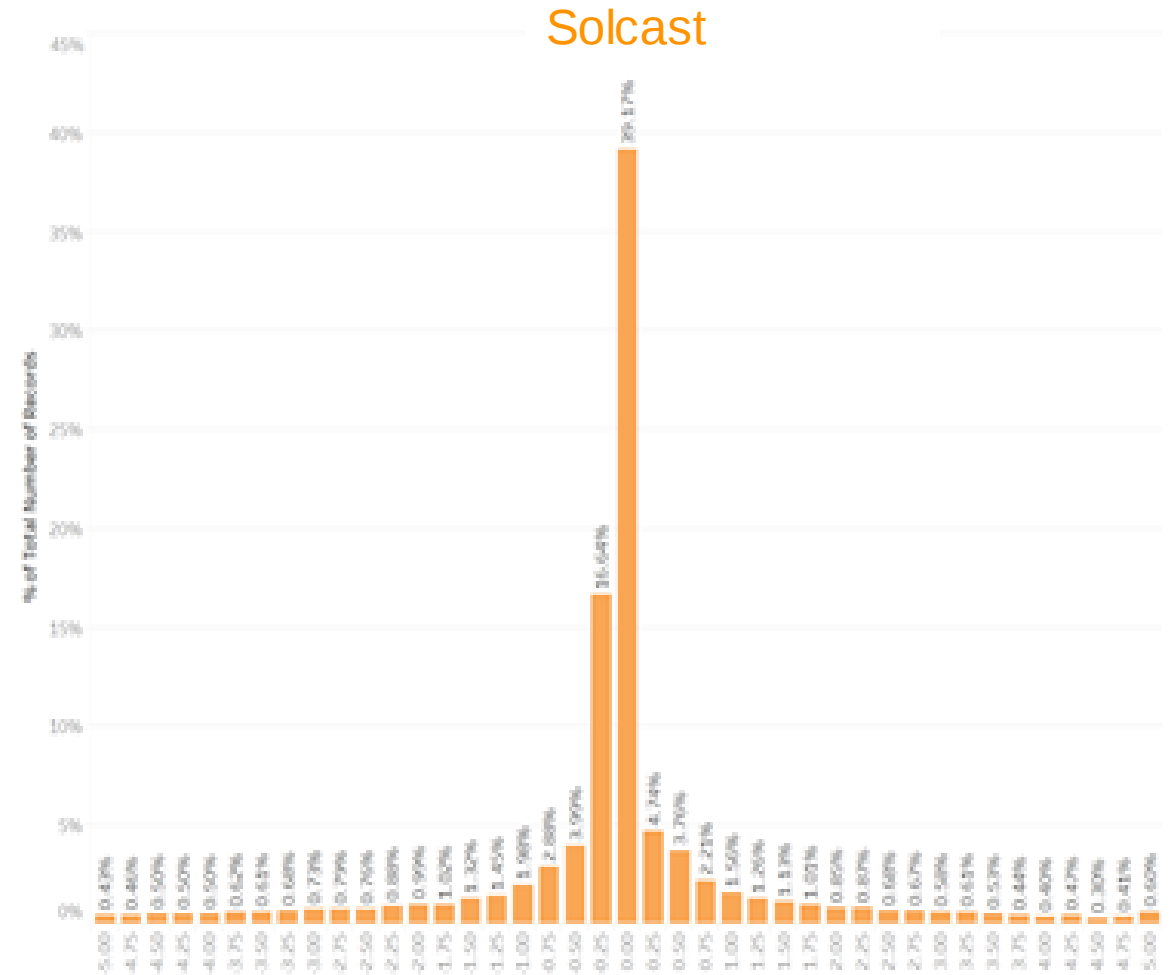
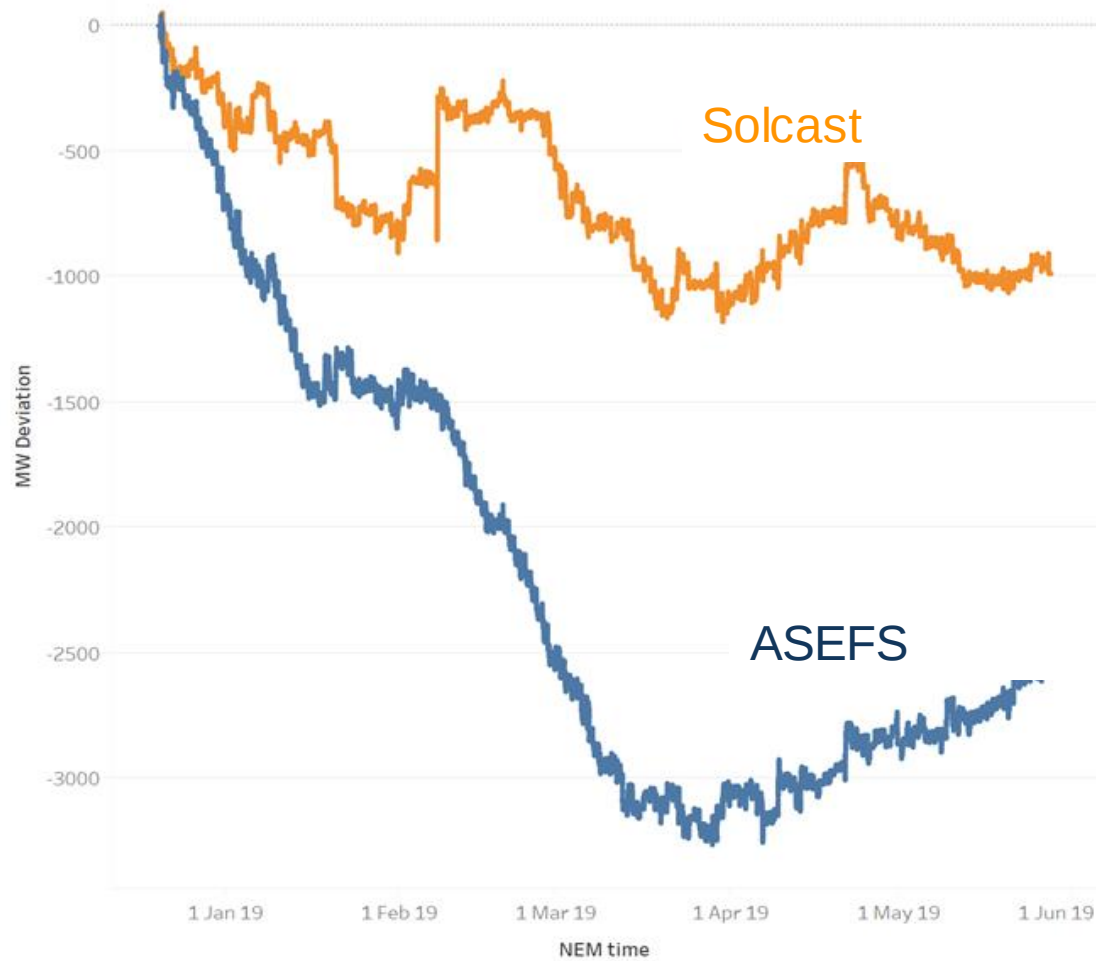
Solar Forecasting – Performance by Region



Solar Forecasting – Performance (Cumulative)



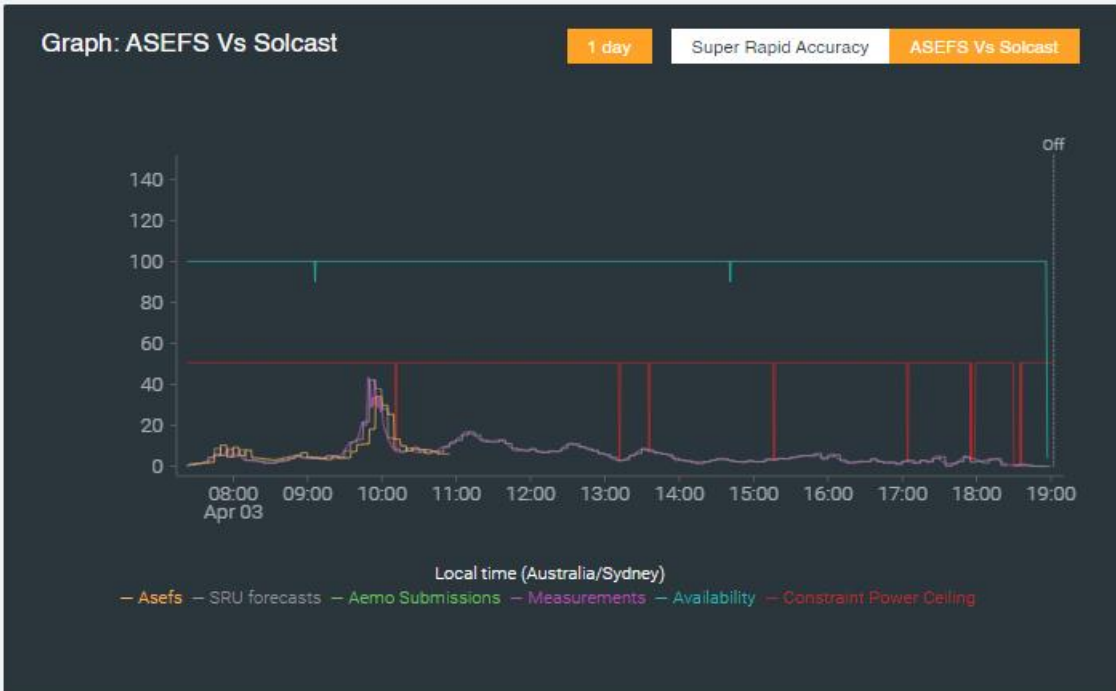
Solar Forecasting – Performance (Cumulative)



Super Rapid Update Customers

- View recent forecast performance
- Check uptime
- Review SCADA feed
- Check sky-imager

AEMO Pre Prod	No	Model Id
AEMO Prod	No	Owner Name
Forecast Suppressed	No	Support Email
Market Id		Operator Name
Priority		



Last Measurement
6-Apr-20 10:00:30

Last Sky Camera Forecast
6-Apr-20 10:00:00

Super Rapid Setup

- ✗ Has Pre Prod Credentials
- ✗ Has Prod Credentials
- ✓ Super Rapid Enabled
- ✓ Has Sky Camera
- ✓ Is Tuned

Measurement Daily Count

2020-04-06:	2
2020-04-05:	2880
2020-04-04:	2640
2020-04-03:	2880
2020-04-02:	2880
2020-04-01:	2878
2020-03-31:	2859
2020-03-30:	2878

Accuracy Statistics

Historic Forecast		AEMO Submissions	
7 Day MAE	3.42	7 Day MAE	0.00
7 Day RMSE	4.78	7 Day RMSE	0.00
28 Day MAE	3.05	28 Day MAE	0.00
28 Day RMSE	6.08	28 Day RMSE	0.00

Time to compute:

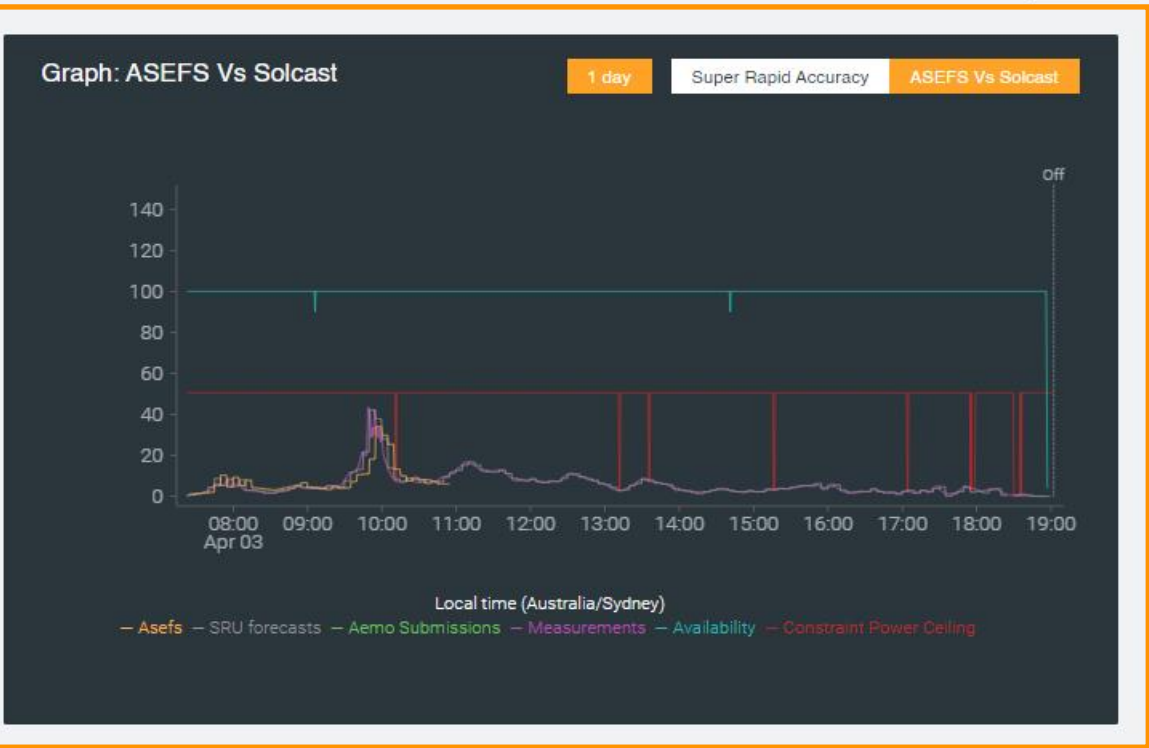
- Database: 0.553 seconds
- API: 0.079 seconds

Recalculate

Super Rapid Update Customers

- View recent forecast performance
- Check uptime
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Accuracy Statistics

Historic Forecast

7 Day MAE3.42

7 Day RMSE4.78

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AEMO Submissions

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Recalculate

Super Rapid Update Customers

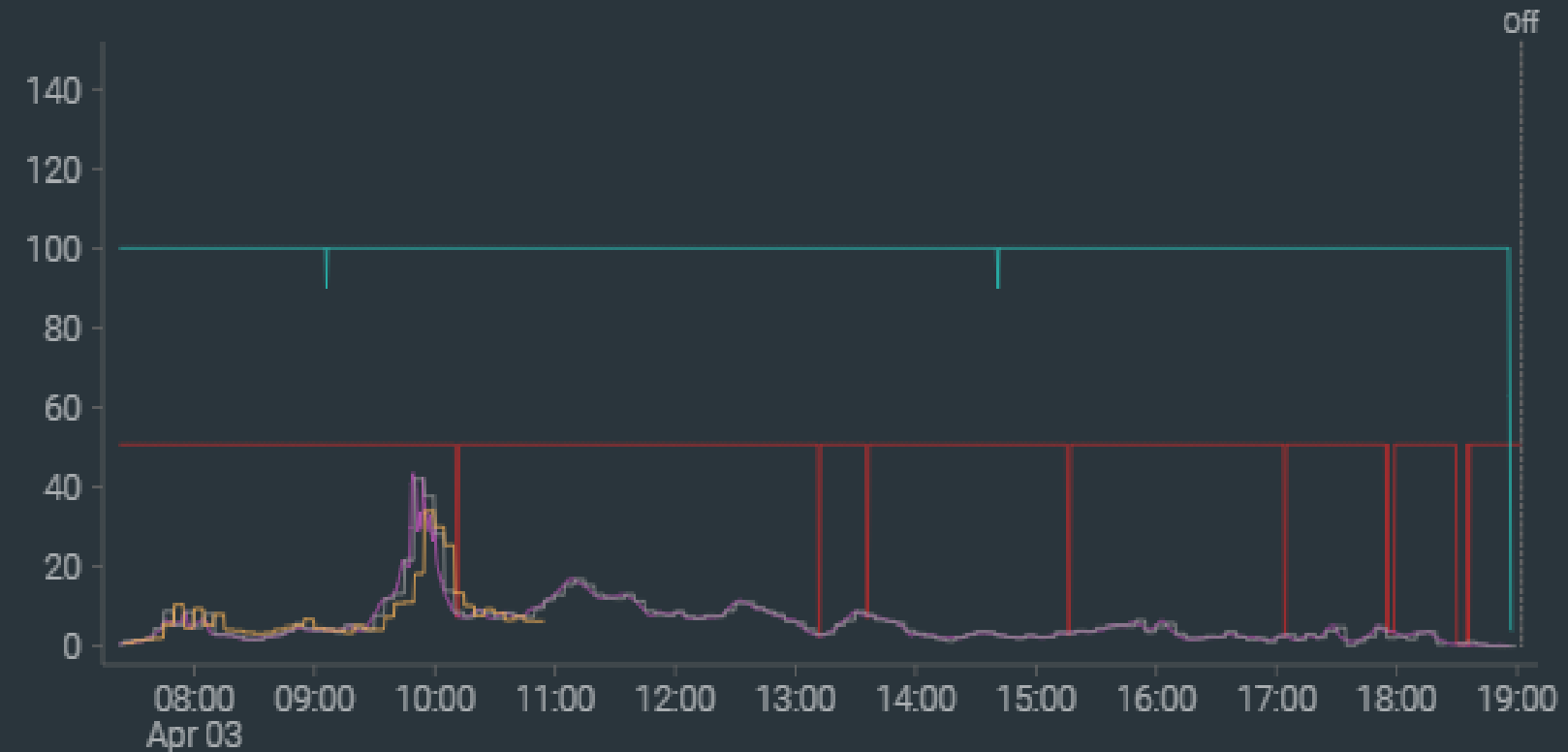
View recent forecast
performance
Check uptime
Review SCADA feed
Check sky-imager

Graph: ASEFS Vs Solcast

1 day

Super Rapid Accuracy

ASEFS Vs Solcast



Local time (Australia/Sydney)

— Asefs — SRU forecasts — Aemo Submissions — Measurements — Availability — Constraint Power Ceiling

Super Rapid Update Customers

View recent forecast performance
Check uptime
Review SCADA feed
Check sky-imager

AEMO Pre Prod	No	Model Id
AEMO Prod	No	Owner M
Forecast Suppressed	No	Support

 Latest Sky Camera Image

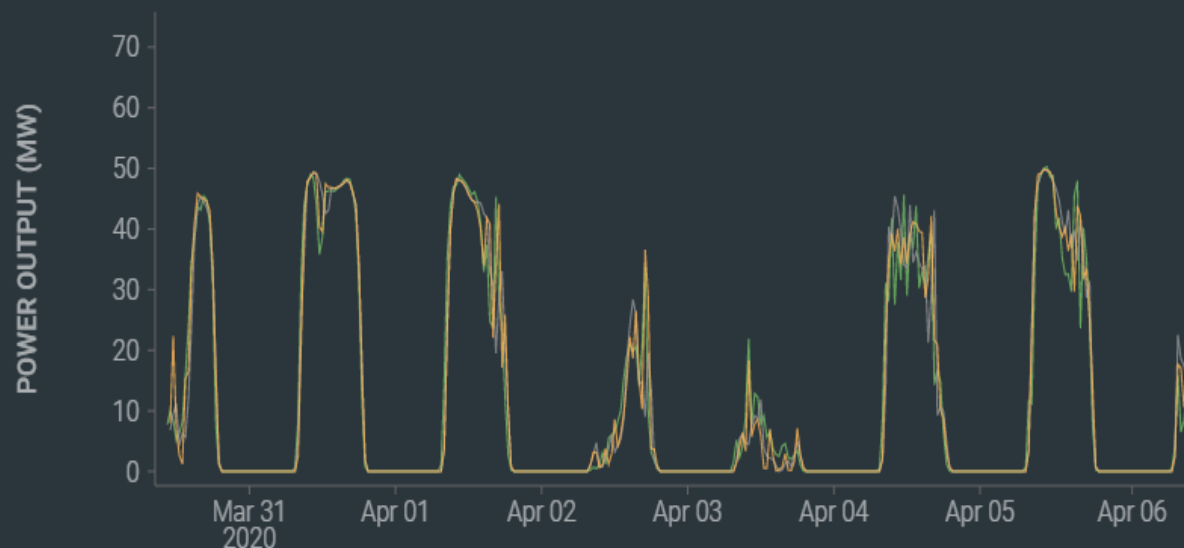
Graph: Accuracy

7 days

1 day

Live and Forecasts

Accuracy



Local time (Australia/Sydney)

— Est. Actuals — 1 hour ahead forecasts — Measurements

PV Tuning ☒ ?

Correlation coefficient: 0.97
Attempted: 2020-04-02

Last Measurement

Period End: a few seconds ago

Time granularity: PT0S ?

[See all measurements](#)

Accuracy (past 7 days)

Mean error of forecasts vs estimated actuals for past 7 days, as a percentage of capacity (MAPE) ?

Hourly Average Power Output

Hour Ahead: 4.03%

Day Ahead (est.): ?

4.84% to 11.09%

Daily Total Energy Production

Hour Ahead: 1.71%

Day Ahead (est.): ?

2.05% to 4.69%

[Download 7 day comparison data](#)

☒ Is Tuned

2020-04-02: 2880

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2020-03-31: 2859

2020-03-30: 2878

Time to compute:

- Database: 0.553 seconds
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Recalculate

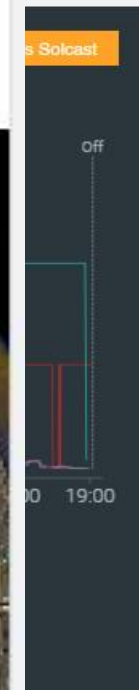
Super Rapid Update Customers

View recent forecast
performance
Check uptime
Check SCADA feed
DEBUG sky-imager

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seconds
Recalculate

Outcomes: OPEX savings, further savings coming

- Achieved 11% average forecast accuracy improvement relative to ASEFS (**range 6% to 28%**)
- Average CPF saving of **\$10-20k per month** estimated on 10% accuracy improvement
- Development of a financial model that can link forecast accuracy to FCAS reductions
- Tech improvements = **Further 10-20% forecast accuracy improvement** (16% - 38) possible

Outcomes: Cost Benefit Analysis

Assumptions: 30-50MW solar farm, simplified FCAS, sky-imager cost upfront, maintenance free, based on current solutions providers

Case	Improv ement	CPF Saved Monthly	Sky- imager \$	Service Fee Monthly	ROI horizon	OPEX saved (1year)
#1	10%	\$10k	\$0	\$1.1k	0 months	\$106k
#2	20%	\$20k	\$1.25k	\$1.6k	1 month	\$220k
#3	20%	\$20k	\$20k	\$5k	2 months	\$160k
#4	25%	\$25k	\$100k	\$7.5k	5 months	\$110k

Direct questions to
nick@solcast.com



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- ✓ Solar Radiation 0-7 Day Forecasts
- ✓ Utility Scale Solar Forecasts
- ✓ Real-time Global Solar Radiation Data
- ✓ Rooftop Solar Live & Forecast Data
- ✓ Up to 20 Years of Historical Data (time-series and TMY)