
**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

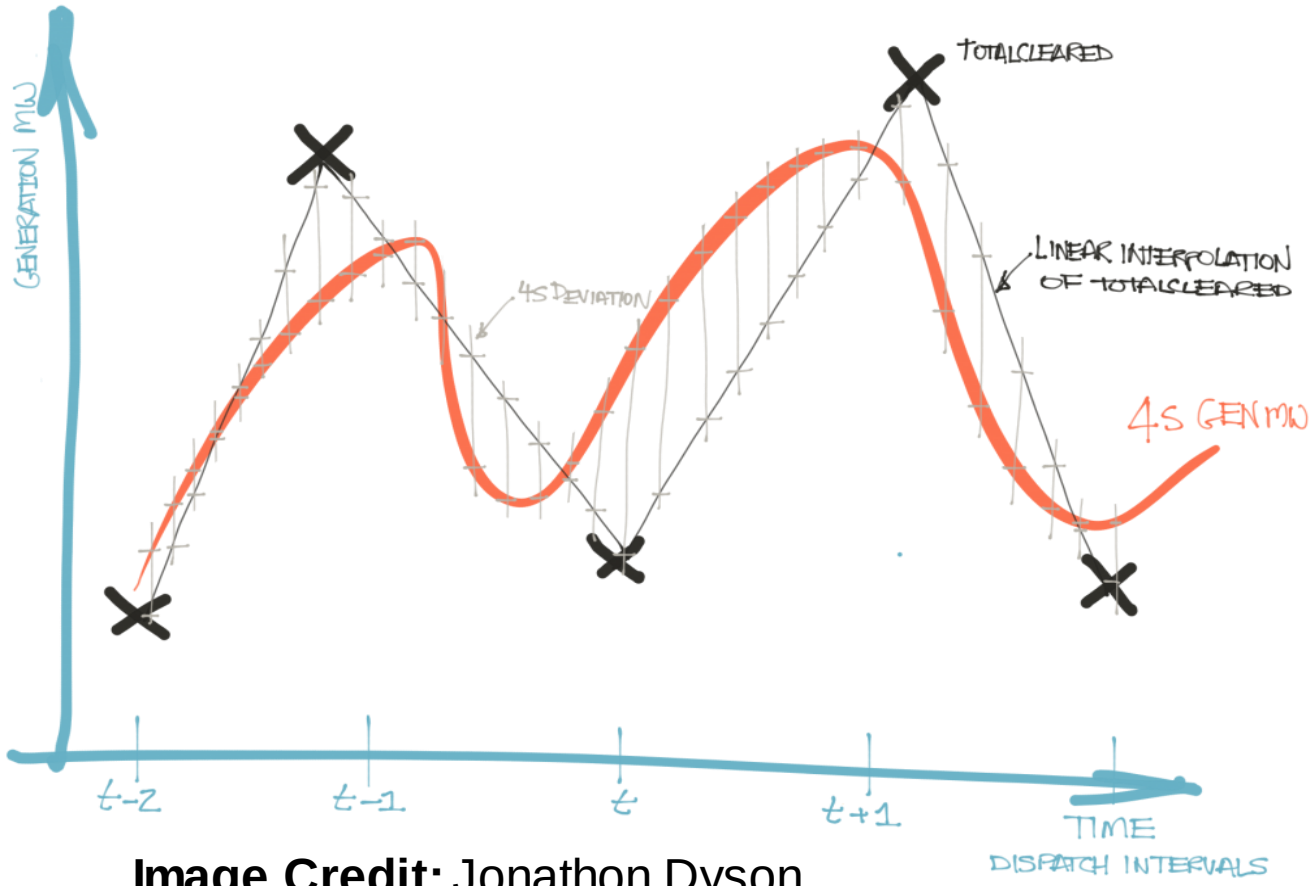
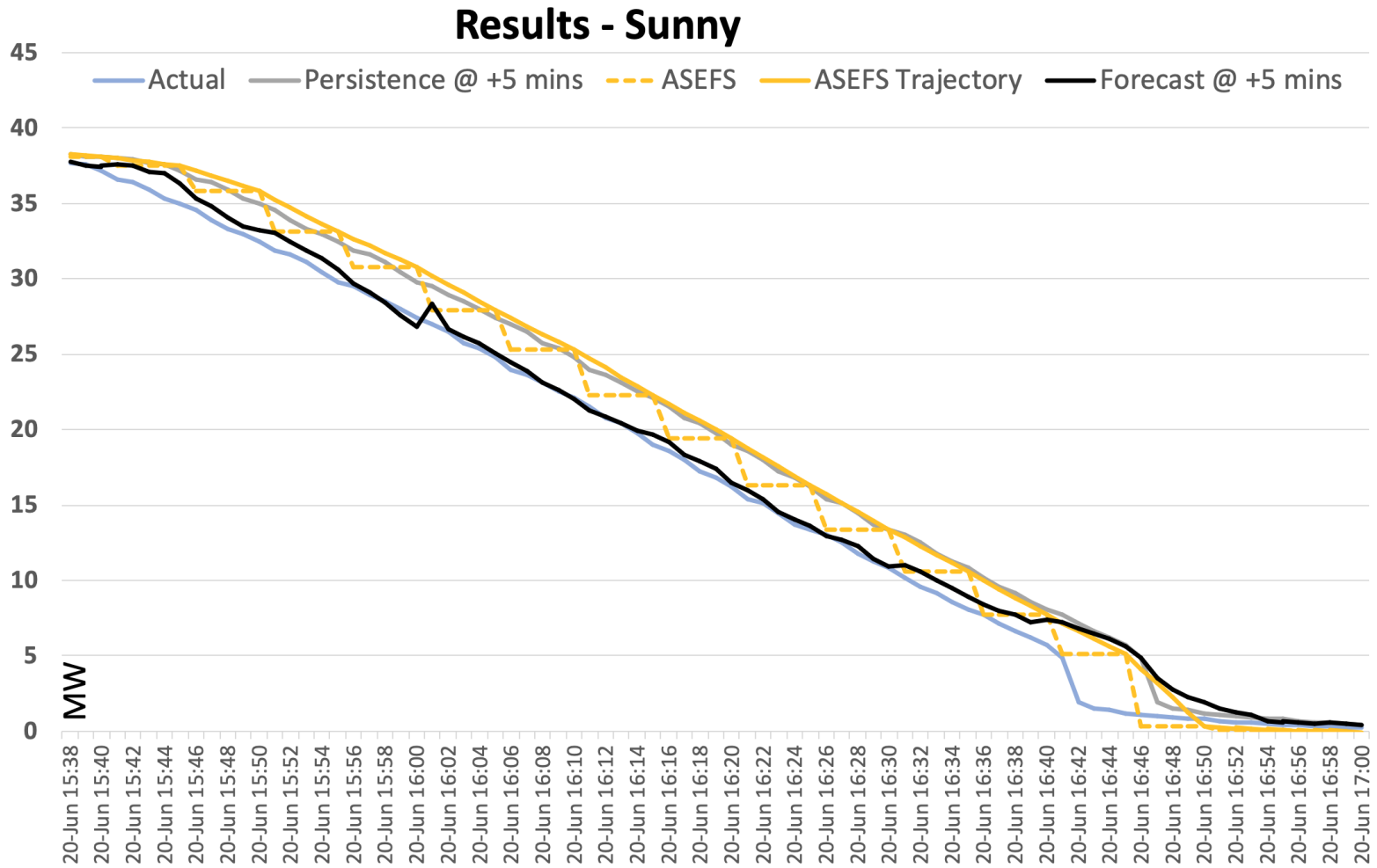



**Image Credit:** Jonathon Dyson
Greenview Strategic Consulting

# **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

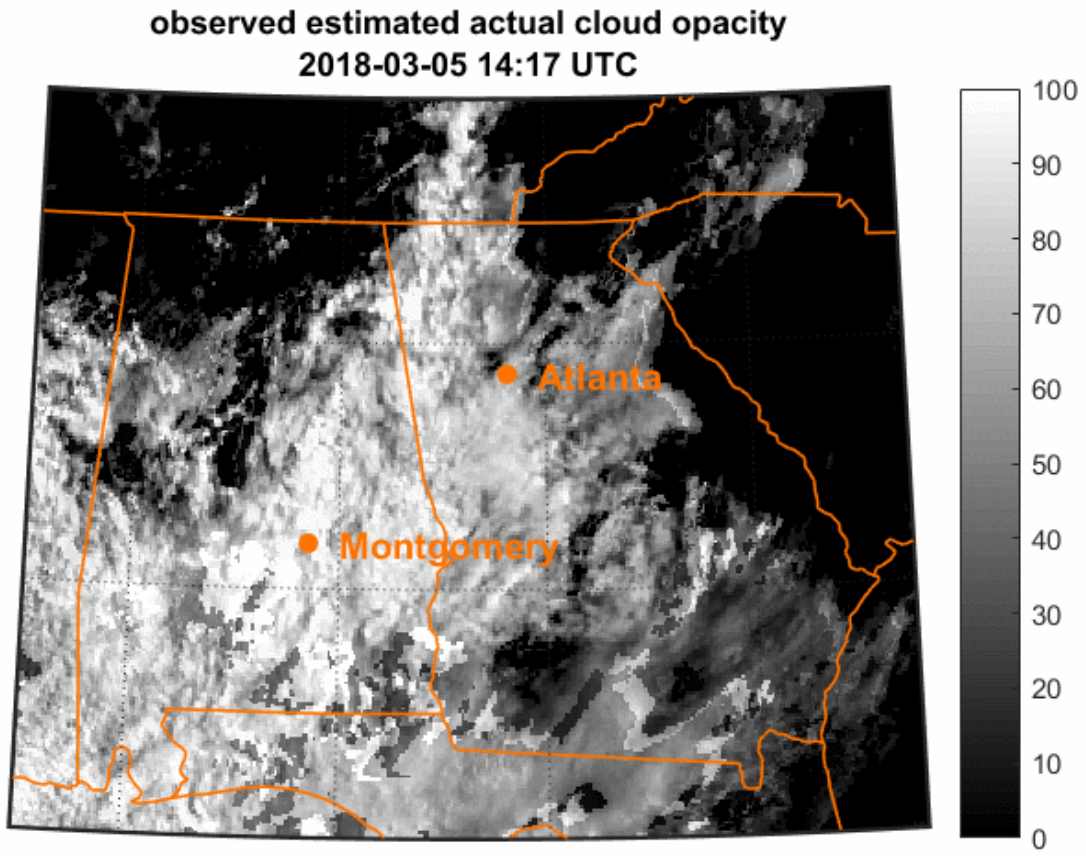
- Deploying 5-minute ahead forecasting tech
- 8 solar farms in the project
- Operational submission of forecasts to Australian Energy Market Operator (AEMO) via API

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

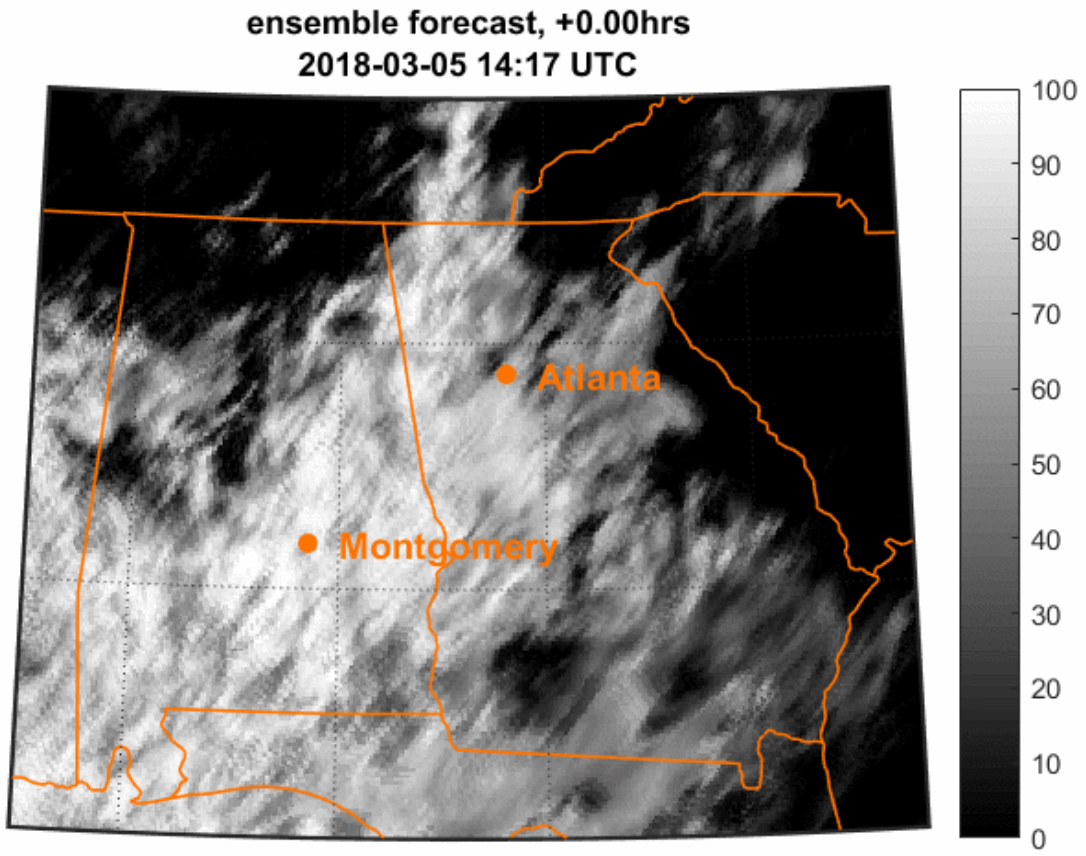
# **Solar Forecasting** – Methodology

- **Super Rapid Update** – forecasting product
- Utilises Three key inputs
  - Satellite based nowcasting (Himawari 8, 10 minute updates at 1km$^{2)}$
  - Real-time SCADA feed (15 seconds, continuous)
  - Sky-imager installed locally (onsite)

# Satellite ‘Nowcasting’

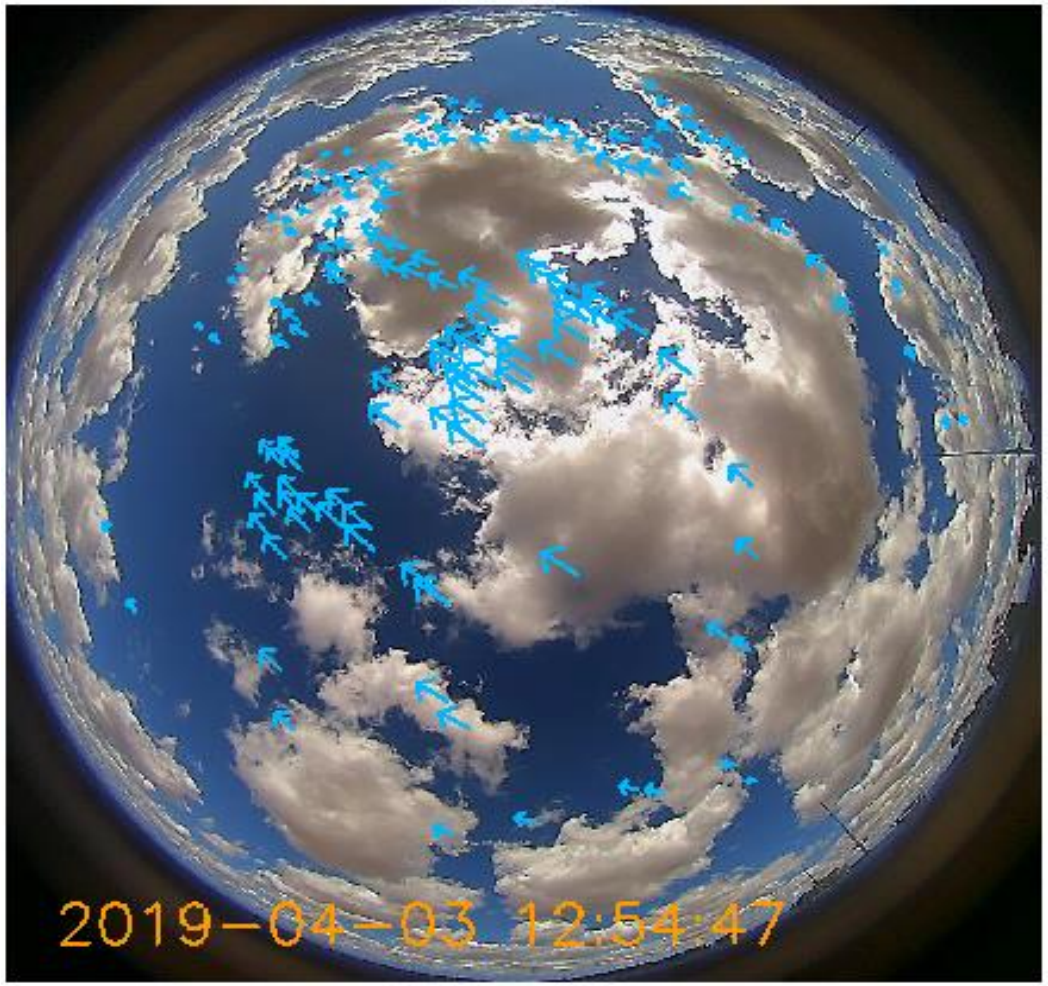



Cloud Observations

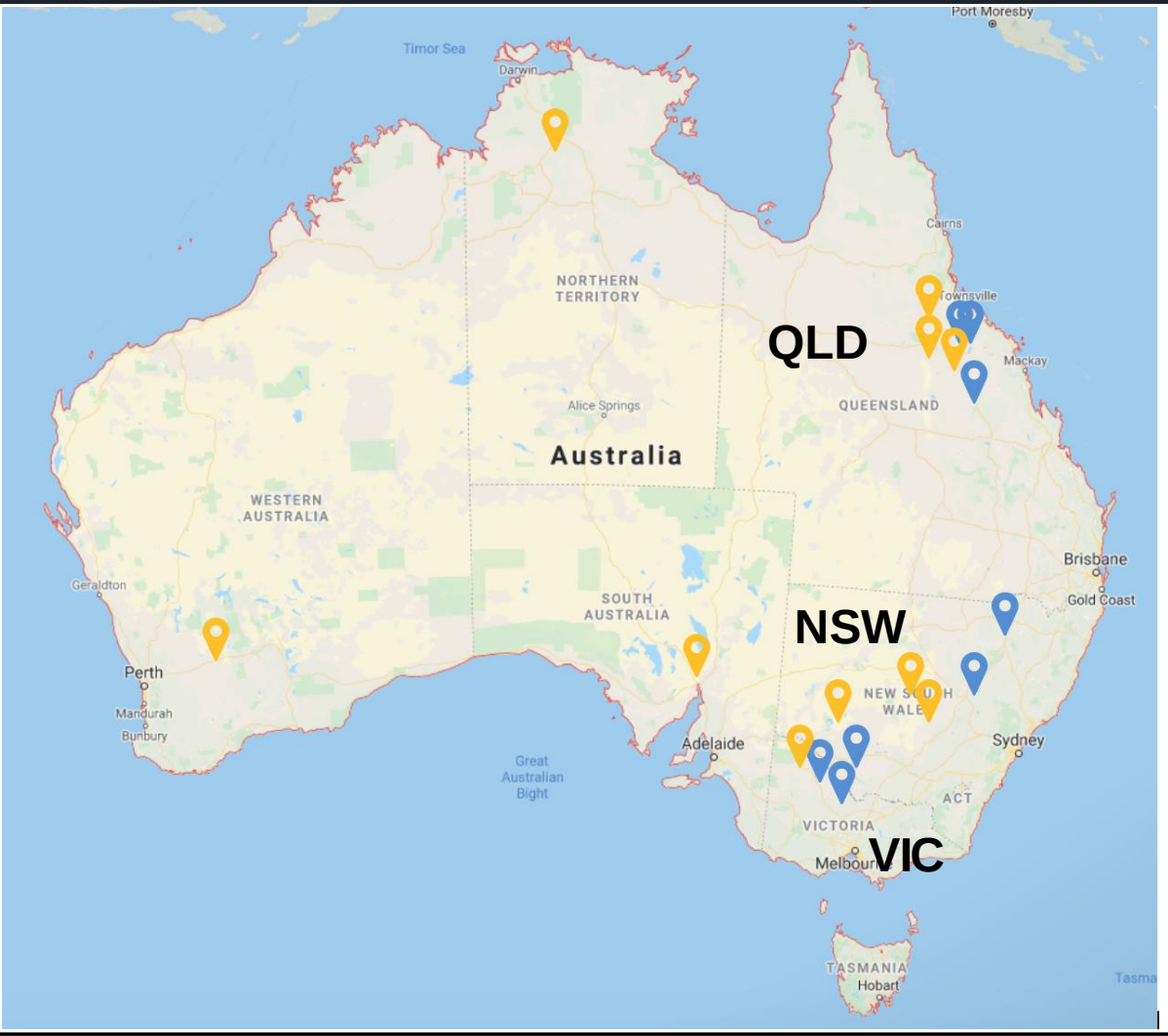



Example Forecast (0-2 hours)

# Sky-imager Nowcasting




# **Solar Farms** – Operational Deployment




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

**Project Partners:**

Edify

NEOEN

First Solar®

FRV

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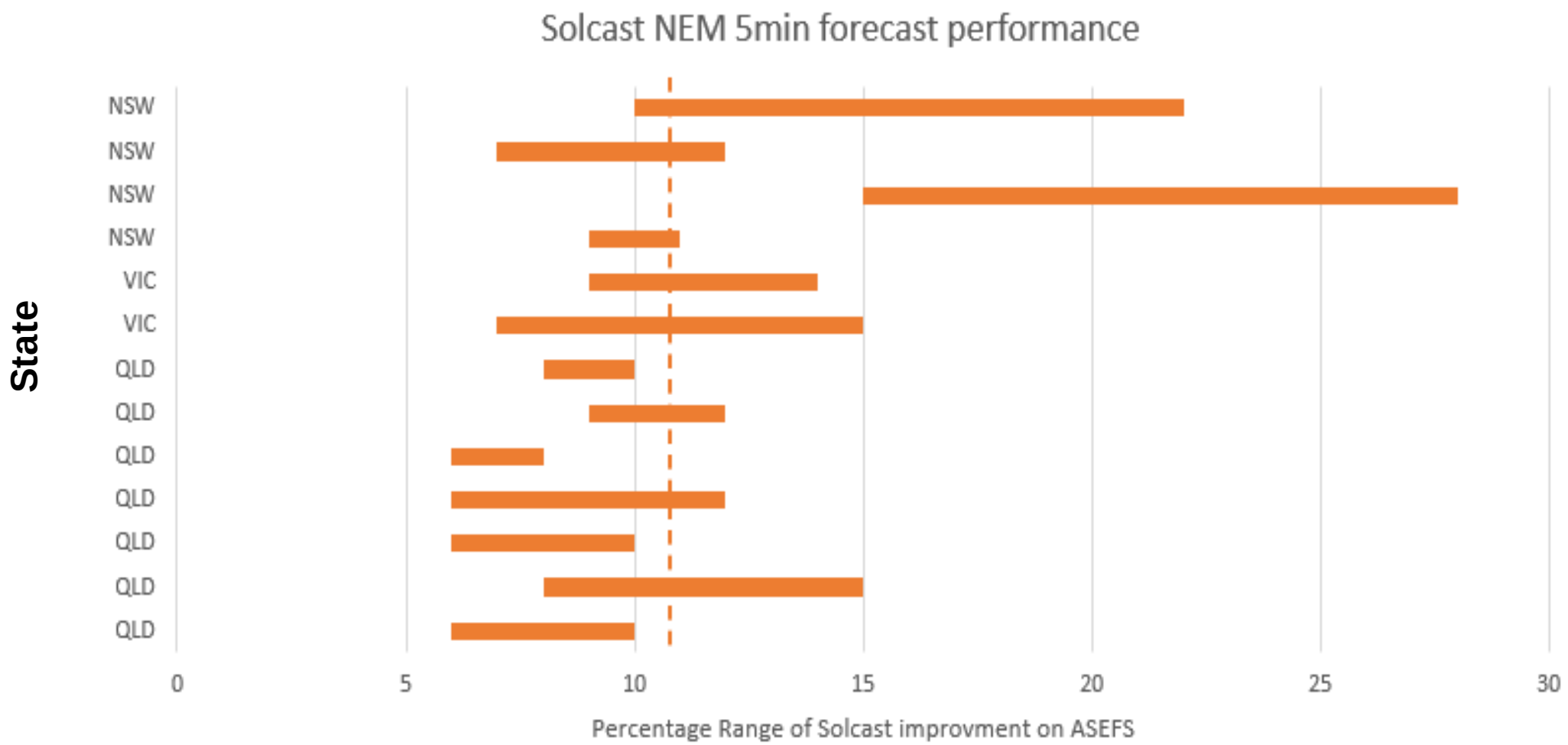
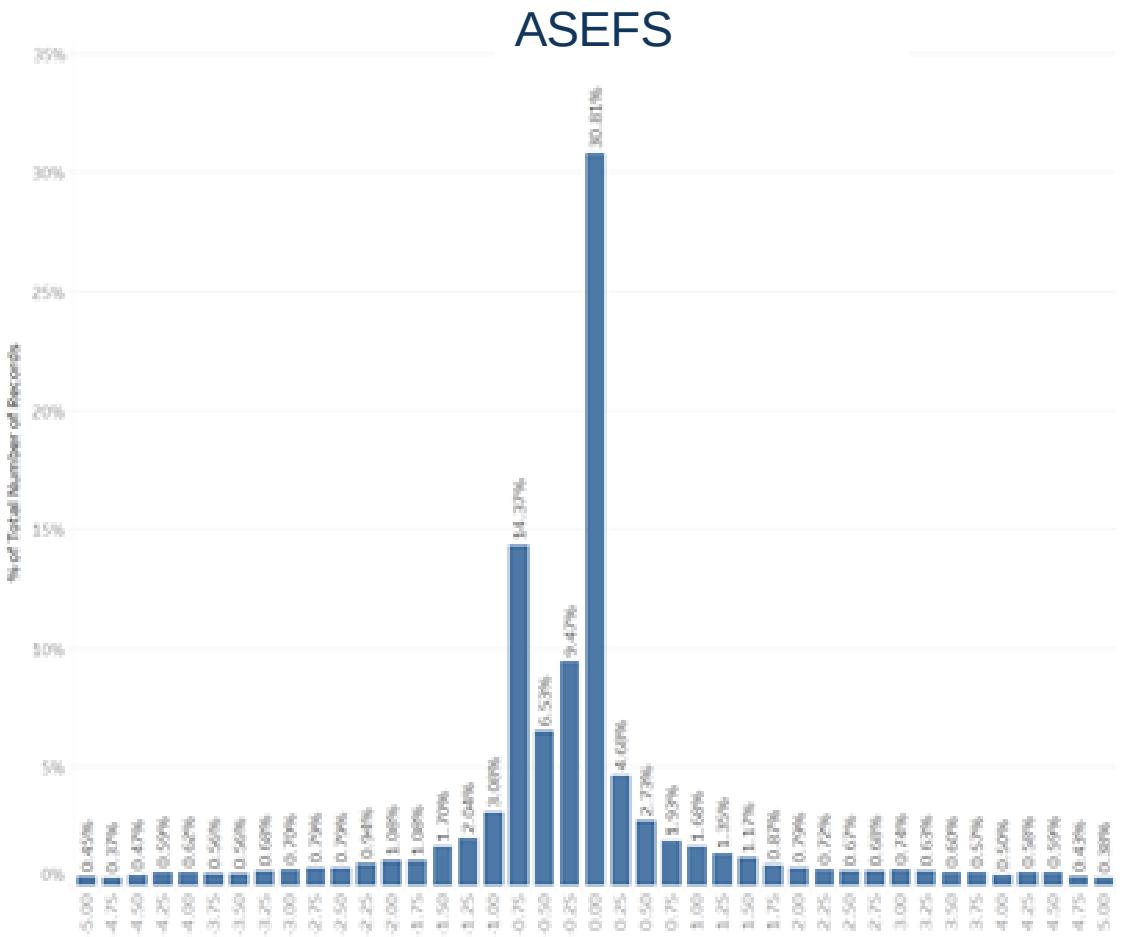
# **Solar Forecasting** – Performance by Region



# **Solar Forecasting** – Performance (Cumulative)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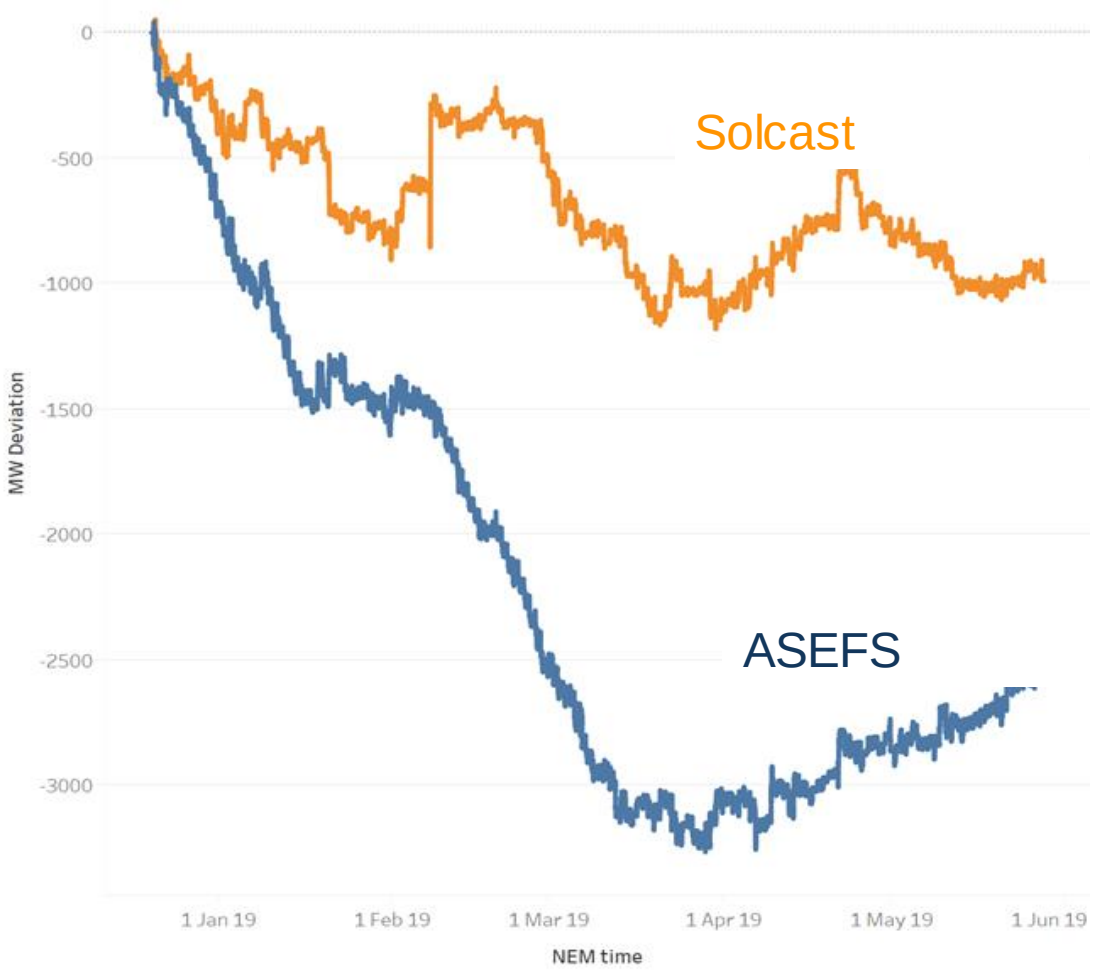


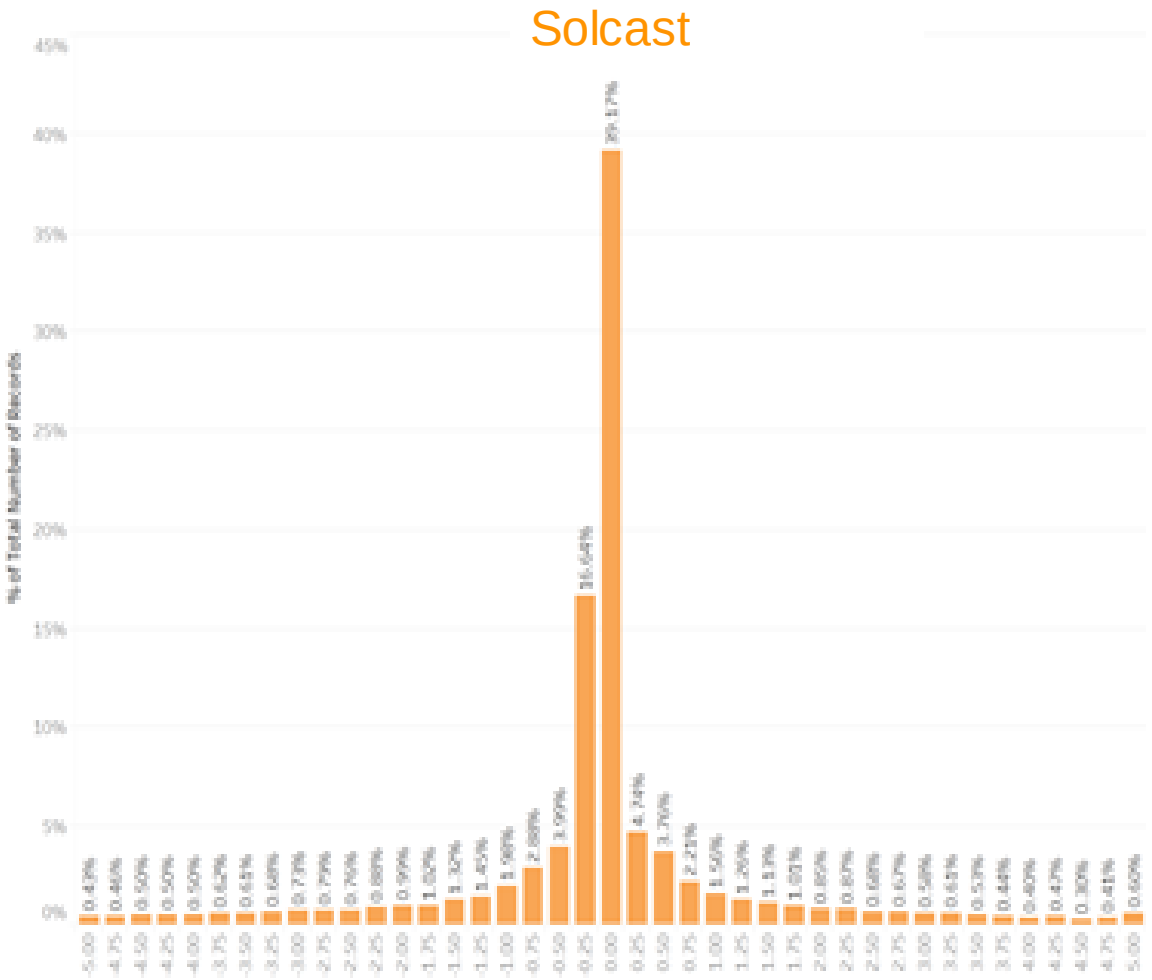

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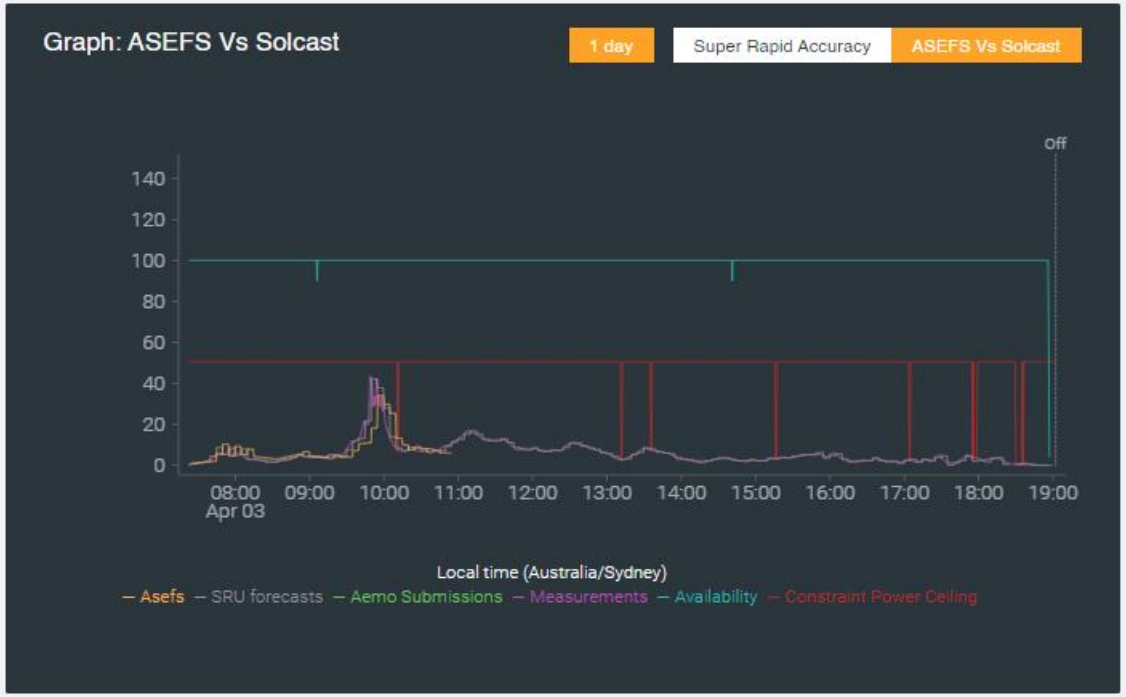
# Super Rapid Update Customers

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

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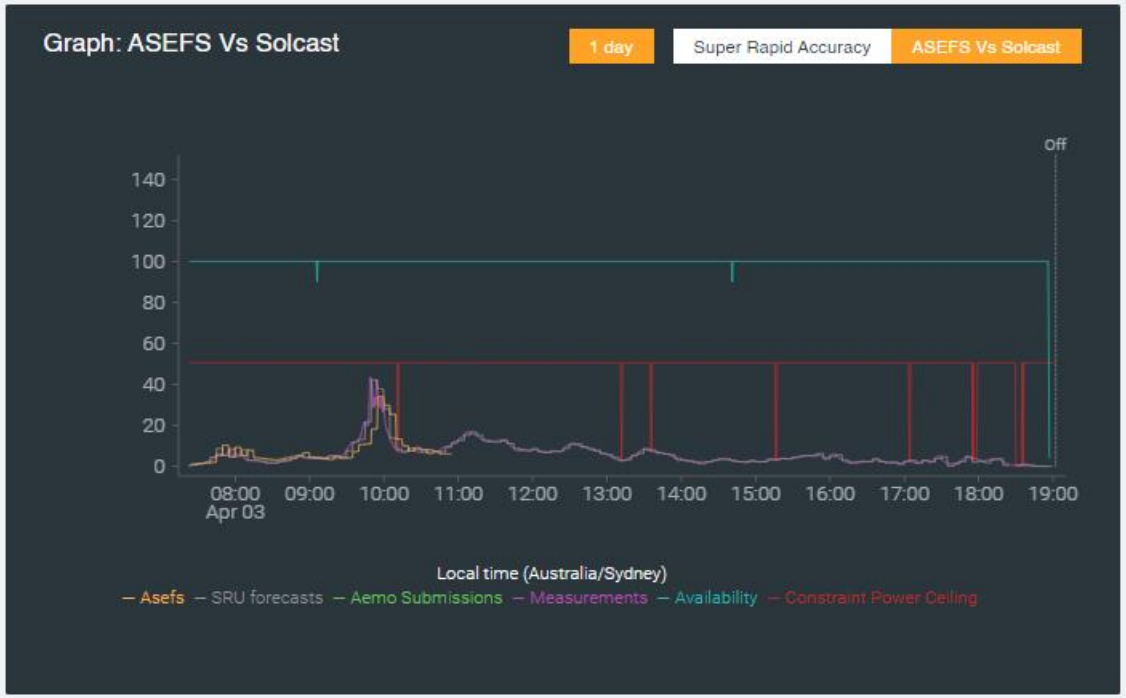


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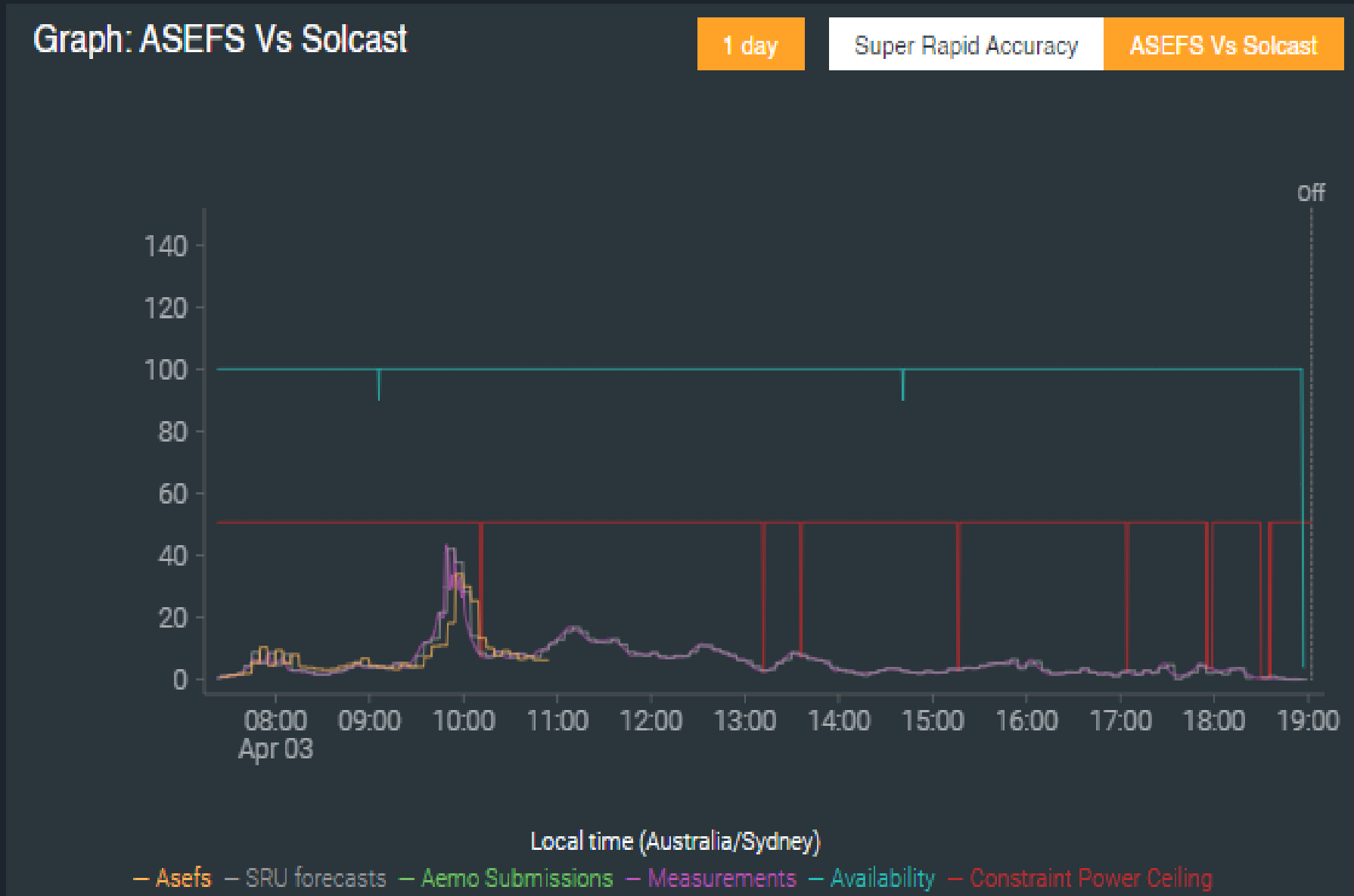

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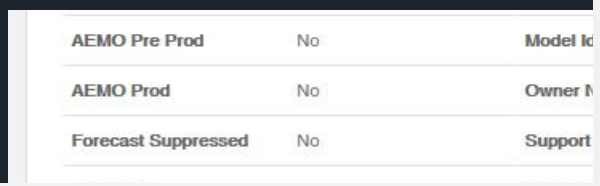
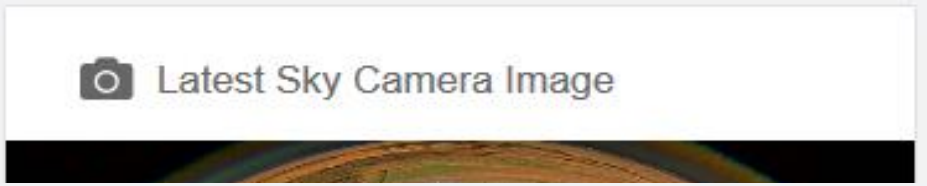
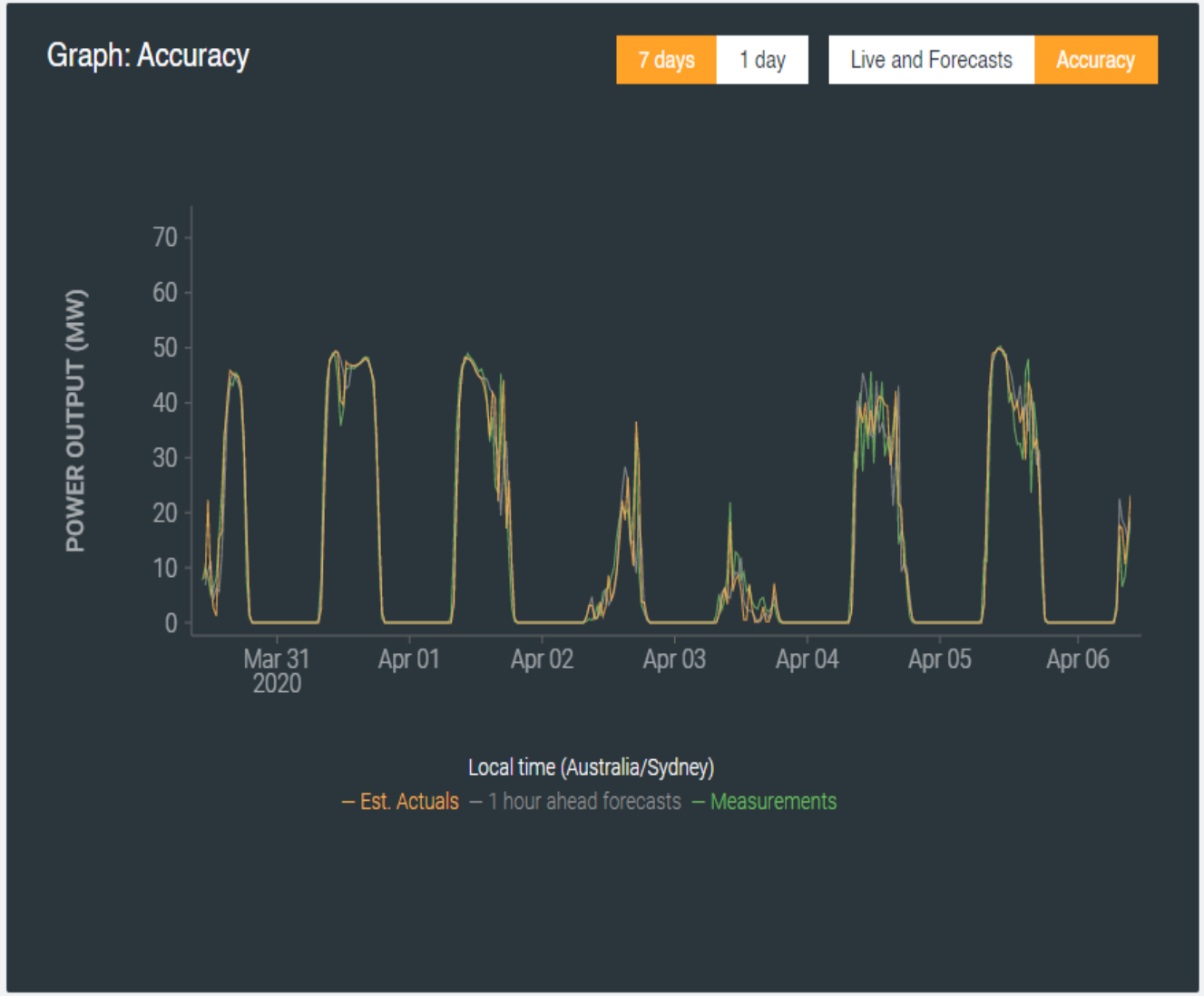



PV Tuning ✔
Correlation coefficient: 0.97
Attempted: 2020-04-02

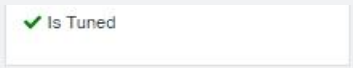
Last Measurement
Period End: a few seconds ago
Time granularity: PT0S
See all measurements

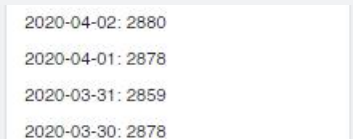
Accuracy (past 7 days)
Mean error of forecasts vs estimated actuals for past 7 days, as a percentage of capacity (MAPE)

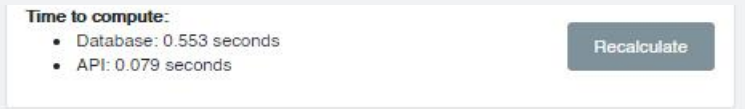
**Hourly Average Power Output**
Hour Ahead: 4.03%
Day Ahead (est.):
4.84% to 11.09%

**Daily Total Energy Production**
Hour Ahead: 1.71%
Day Ahead (est.):
2.05% to 4.69%

Download 7 day comparison data

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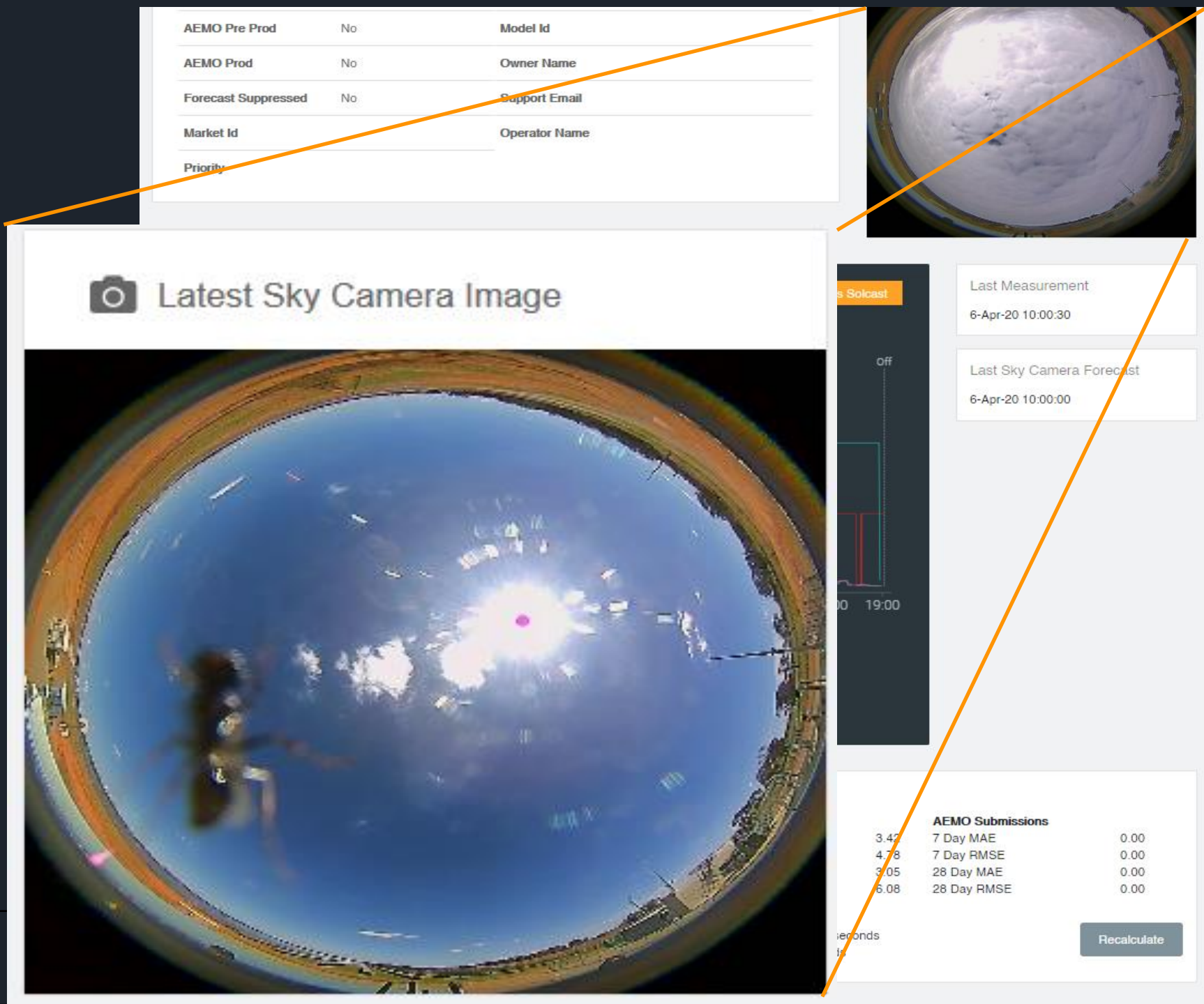


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# **Outcomes:** OPEX savings, further savings coming

- 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 | Improvement | 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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