UA Regional Weather and Power Forecasts

UA-WRF

Power Forecasts Driven by Open Source Software
PVPerformance
MODELING COLLABORATIVE

Data Assimilation

Power Data

GOES imager

Forecast users

TEP
aps
PNM
IDAHO POWER

forecasting.energy.arizona.edu

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Utility Wind
820 MW

Utility Solar
1080 MW

Distributed Solar
1250 MW

Total
3150 MW

Load
7000 - 24000 MW

2 years of solar power
Utility Wind
820 MW

Utility Solar
1080 MW

Distributed Solar
1250 MW

Total
3150 MW

Load
7000 - 24000 MW

2 years of wind power
Utility Wind
820 MW

Utility Solar
1080 MW

Distributed Solar
1250 MW

Total
3150 MW

Load
7000 - 24000 MW

2 years of load
UA WRF weather forecasts available at atmo.arizona.edu

5.4 km, 1.8 km nested domains
Configured to perform well in SW US

Blue: low elevation
Red: high elevation

3D Visualization of Monsoon Thunderstorms
Animation available at:
http://forecasting.energy.arizona.edu
UA high res. model
1.8 km grid, AZ + NM
Global Horiz. Irradiance

UA WRF weather forecasts available at atmo.arizona.edu
Weather to Power: PVLib Python

• Tool for modeling solar power systems

• Open source

• Benchmark implementations of clear sky, solar position, transposition, AOI losses, temp. losses, DC power, AC power models...

• Foundation of UA solar power forecasts

• Truly a community effort
  • UA, Sandia, Sunpower, First Solar, DNV-GL, and others from across the world.

github.com/pvlib
Solar power forecast from UA weather model
Satellite Derived Irradiance

Light reflected from the tops of clouds

Light that gets through clouds
Ground irradiance data to improve satellite irradiance estimates

Satellite irradiance estimates rely on algorithms that convert the observation (light reflected by cloud tops) into transmitted irradiance.

Use ground PV and irradiance data to improve estimates by 25%

Published in Solar Energy (Lorenzo 2017)

See posters by Tony Lorenzo and Travis Harty

Optimal Interpolation

Better satellite-derived estimate of GHI
What about the forecasts from NOAA/NWS?

**Problem:** NOAA forecasts are challenging for many users to download and process into a solar forecast due to lack of model and process standardization.
Solution: Add open source, forecast data processing methods to PVLib-Python.
- Makes forecasts accessible to non-experts.
- Promotes fair, transparent forecast benchmarking.
Open Source Evaluation Framework for Solar Forecasting

• New Department of Energy sponsored project selected for funding (not yet awarded)

• In a fair, transparent, reproducible way, answer...
  Is solar forecast A better than forecasts B, C, and D?
  Which solar forecast is best for my application?
  How do we quantify “better” using standardized metrics for solar forecasting?

• Industry partners with data or funding commitments: TEP, Southern Company, Vaisala, Abengoa

Schematic of framework design

Seeking more industry partners!
What are the top weather & climate issues for energy stakeholders in the SW US?

What is the $ values of weather/solar/wind forecasts for SW US stakeholders? Across scales & seasons? How would you approach this?

What are technical and social challenges to increased forecast adoption?

How can PV monitoring data can benefit forecasters and how can forecast data benefit PV monitors?

What are the benefits of quantitative probabilistic forecasts for decision support? What are the barriers to adoption?
Thanks to our partners and sponsors

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RESEARCH, DISCOVERY & INNOVATION
Institute for Energy Solutions

Additional support from

The SVERI utilities

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