Real-Time PV Power Forecasting

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PV impact on TEP load

Can we achieve high PV penetration and maintain grid stability?

Maybe if we have reliable power forecasts!
PV Power Variability

EMS aggregate 2013-10-09

45 MW / 30 min
25 MW / 2 min

55 MW / 1 min on 9/26
Predicting power using PV data
Real-time data sources map

+ Black Mountain

+ Springerville
TFS to UA 1 min warning

Technicians for Sustainability
Local PV installer

UA Physics and Atmospheric Sciences
TFS to UA 1 min warning
TFS to UA 1 min warning
Network-based Forecasts

Retrospective forecasts based on data from 100 rooftops

Building system to do this in real-time
Network-based Forecasts

Retrospective forecasts based on data from 100 rooftops

Building system to do this in real-time
Hybrid forecasting

- Normalized Power Output (kW/kWpeak)
- Measured Power
- Power Under Clear Sky

- Derating Due To Clouds
- Measured Cloud Derating
- WRF Forecast
- Ground Sensor Forecast
- ANN Forecast
- Persistence Forecast
- Maximum Likelihood Forecast

7/18/11
Hybrid forecasting utility integration

Hybrid method for irradiance forecasting
- WRF Model
- Irradiance Sensors
- DG Metering Data
- Sky Cameras

PV Assets Map

PV Power Forecast

Forecast GUI For Utilities

Utility Co.
- Operations
- Marketing
- Resource Planning

Reserve Policy

ACE Scenario Simulations
ATMO Wind forecasting for TEP

Macho Springs Wind EMS, 801. 11/19/13 18:22:44

Time of Day (hr)
Solar forecasting for TEP

Correct features, only wrong by 1 hour
This is good!
Real time clearness maps

Tucson_interp 11/20/13 12:58:37
Website for TEP

Forecasts for TEP EMS sites, irradiance sensors, and rooftop PV

Maps
- Full dataset
- UA-STEP
- google map

TEP EMS data
- EMS Aggregate
- 901: FRV EMS
- 902: NRG EMS
- 903: Solon2 EMS
- 904: Astrosol EMS
- 905: Prairie Fire EMS
- 906: EON EMS
- 907: Solon1 EMS
- 908: Amonix EMS

Irradiance sensors
- 11181: OASIS DNI
- 11184: OASIS GHI
- 112: iSensor Solon1
- 115: iSensor Solon1
- 152: iSensor UA-STEP

kW rooftop PV
- 401: Sunny WebBox
- 403: Sunny WebBox
- 404: Sunny WebBox
- 406: Sunny WebBox
- 407: RPI Webbox
- 408: Sunny WebBox
- 415: Sunny WebBox
- 416: Sunny WebBox
- 418: Sunny WebBox
- 422: RPI WebBox

Overview figures
Sensor figures
Website for TEP

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- 909: EON Valencia
- 910: Black Mountain
- 911: DM Soaring Heights
- 912: Springerville Solar

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