Adding forecasts to PVLIB Python

Solar power forecast methods continue to be developed at a rapid pace. We propose that both public and private solar power forecasters will benefit from standardized, open source, reference implementations of forecast methods that use publicly available data.

PVLIB and Python are natural choices for developing an open source tool that combines weather forecasts and PV models. Python is easy to read and write, portable across platforms, free and open source, and it has a large scientific computing community. Python has also been identified by Unidata as a key technology for geosciences.

We chose to use Unidata’s Siphon library to easily and programmatically download forecast data in Python. The Siphon library provides access to a Unidata THREDDS server that hosts forecasts from the Global Forecast System (GFS), North American Model (NAM), Rapid Refresh (RAP), and National Digital Forecast Database (NDFD). Siphon and THREDDS simplify the process of obtaining available data.

Forecast module structure

We model forecasts using a base ForecastModel class and a series of subclasses corresponding to each of the supported weather models. ForecastModel defines the data retrieval and basic processing methods. Each subclass may redefine its own combination of the processing steps. The result is a consistent API for all weather models that makes analyzing data easier and less error-prone. Users can easily create new classes and modify the existing ones.

PV power forecasts from multiple forecast models

PVLIB provides standardized, yet extensible, classes for PV system modeling. Users can represent a system with a PVSystem or a SingleAxisTracker object, a simulation using a ModelChain object, and drive the simulation using downloaded and processed forecast data. The example below uses the Sandia Array Performance Model to forecast the power generation of one inverter of a utility-scale power plant. A PV forecast is created for each of the weather models supported in PVLIB. The mean bias error and mean absolute error of the forecasts from multiple forecast models are shown above. The forecasts are derived from 5 different weather models. PVLIB forecasts are derived from 5 different weather models.

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https://github.com/pvlib/pvlib-python