Wind and Solar Forecasting Methodology for Scheduling and Dispatch

V1

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1 INTRODUCTION

This methodology document expands on the wind and solar forecasting information provided in SONI and EirGrid's Balancing Market Principles Statement.

2 FORECAST PROVIDERS

The TSOs procure wind and solar forecasts from two independent forecast providers. Each forecast includes the forecast power output from each wind farm and solar farm included in the forecast along with the total aggregate forecast power production and an uncertainty of the aggregate power forecast in the form of confidence bands around the forecast.

3 TIMELINES

Each forecast provider provides the TSOs with an updated forecast every 6 hours. These updates are made before 06:00; 12:00, 18:00 and 00:00 Coordinated Universal Time (UTC) every day. The forecasts received are at a resolution of 15 minutes, with a time horizon of 96 hours.

4 GENERATORS INCLUDED IN THE WIND AND SOLAR FORECASTS

In Northern Ireland and Ireland, all wind and solar farms (in the future in the case of Ireland) with a Maximum Export Capacity (MEC) of 5 MW or greater are individually modelled in the renewables forecast. In both jurisdictions, each new wind or solar farm of 5 MW or greater is added as it connects to the transmission or distribution system and undergoes operational testing. In Ireland, a number of wind farms smaller than 5 MW have historically been included in the Energy Management System used in the Control Room. The source of data for these wind farms is the DSO published list of distribution connected wind. Therefore, these smaller wind farms are also included in the wind forecasts. These are updated periodically, based on the latest information available from the DSO as published on their website.

5 DATA PROVISION TO FORECAST PROVIDERS

5.1 WIND

Standing data is provided to the Forecast Providers for each wind farm. This data is provided by the relevant wind farm prior to connection and as updated. For wind farms less than 5 MW in Ireland, the best available information is used, such as information received from the DSO for planning studies. The standing data is sent to the forecast providers on a daily basis.

- Installed Capacity (MW)
- Latitude and Longitude
- Nearest Transmission Station
- Connection date
- Turbine Information:

- Turbine Manufacturer(s)
- Turbine Model(s)
- Turbine Size(s) (MW)
- Hub Height

- Permissible Capacity (MW) – The permissible capacity is designated as the capacity of the wind farm that the forecast providers shall forecast for. The permissible capacity is generally set equal to the lower of the installed capacity and the MEC. At times, however, it may be set to a lower value, such as during commissioning and is updated as required in the daily feed to the forecast providers.

The following data is provided to the Forecast Providers for each wind farm (where available[1]) every 15 minutes:

- Active Power Output (SCADA signal received from the wind farm)
- Available Active Power
- Wind Farm Outage
- Meter Data
- Dispatch Instructions
- % Mechanical Availability
- % High Speed Shutdown
- % Not Generating Due to Low Wind
- Wind Speed (m/s)
- Wind Direction (degrees)
- Air Temperature (^{0}C)
- Air Pressure (mbar)

5.2 SOLAR

The forecasting for solar farms has only been in place since Q2 2017 and is being developed. Standing data is provided to the Forecast Providers for each site and revised as updates are made. This data is provided by the developer prior to connection and whenever changes are made.

- Installed Capacity (MWp - DC)

[1] This data is not available for all wind farms. In particular data will generally not be available for non-telemetered wind farms, those less than 5 MW and those that have not completed commissioning.

- MEC
- Latitude, longitude and altitude
- Nearest Transmission Station
- Slope angle
- Azimuth angle
- Surface area
- Number of inverters installed
- For each inverter type; number installed, manufacturer, nameplate rating, temperature rating, model ID, inverter response, performance de-rating
- Connection date
- Number of panels installed
- For each panel type; number installed, manufacturer, nameplate rating, model ID, temperature rating, material used
- Permissible Capacity (MW) – The permissible capacity is designated as the capacity of the solar farm that the forecast providers shall forecast for. The permissible capacity is generally set equal to the lower of the installed capacity and the MEC. At times, however, it may be set to a lower value, such as during commissioning and is updated as required in the daily feed to the forecast providers.

SCADA, metered and meteorological data is not currently provider to the forecast providers for each solar farm on an ongoing basis, as the enduring solar forecasting solution is still in development.

6 HOW THE FORECAST PROVIDERS CALCULATE THE WIND FORECASTS

Each forecast provider uses the standing data provided, historical SCADA and meteorological data to develop and train wind speed and direction to wind power models for each wind farm. The models are trained for various weather conditions. The ability of the models to accurately forecast the wind farm power output is dependent on the quality of historical data used for training. To ensure only good quality data is used, the historical data is filtered to exclude spurious entries. The availability of data for different weather conditions will depend on the time period over which the historical data has been captured and what weather conditions arose most frequently during that period. For prevailing wind conditions, generally westerly and south-westerly wind directions, there is usually sufficient data to perform a good quality check and to train the models. However in some instances, such as a north-easterly wind direction for example, the filtering of data will be less accurate, due to less historical data. This is particularly true if the roughness and slope of the terrain for north-easterly wind differs from other directions. For this reason, the power curve models for wind farms are updated by the forecast providers on a regular basis to take account of additional data as it is available.

The forecast providers then take outputs from mathematical Numerical Weather Prediction (NWP) models (which predict the future weather conditions based on current meteorological conditions) and perform proprietary modelling and processing to develop predicted wind speeds and directions to be used for each wind farm power forecast. The forecast wind power output is then developed by combining the forecast wind speeds and directions with the relevant power models for those weather conditions for each wind farm.

7 HOW THE FORECAST PROVIDERS CALCULATE THE SOLAR FORECASTS

Each forecast provider uses the standing data provided to develop power output models for varying meteorological conditions for each solar farm. The forecast providers then take outputs from mathematical Numerical Weather Prediction (NWP) models (which predict the future weather conditions based on current meteorological conditions) and perform proprietary modelling and processing to develop predicted meteorological conditions for each solar farm power forecast for the forecast period. The forecast solar power output is then developed by combining the forecast meteorological conditions with the relevant power output models for each solar farm.

8 OUTAGE ADJUSTED FORECASTS

The forecasts received by the TSOs from the forecast providers for each wind farm do not take wind farm outages into account. Although the forecast providers receive outage information for wind farms, this is used only for data quality checks for model training purposes.

The TSOs record wind farm outages, where the information is available, for the following situations:

(i) transmission outage disconnecting the wind farm;
(ii) distribution outage disconnecting the wind farm; or
(iii) the wind farm's own outage.

Information on relevant scheduled and forced transmission outages will be obtained as part of the TSOs outage planning and management processes. Where the DSOs provide information on planned or forced distribution outages disconnecting a wind farm, this information is also included. Each wind farm is obliged under the relevant Grid Code to provide notice of full or partial outages of their wind farm to the relevant TSO and where this information is made available, this will also be recorded.

The TSO recorded outage information is applied to the forecasts each time the relevant forecast is updated (every six hours), removing the forecast for any wind farm that is on an outage (or scaling appropriately for partial outages). This outage adjustment applies to the individual wind farm forecast and also to the aggregate forecast. The resultant outage adjusted forecasts are published in the Market Participant Interface (MPI). In the MPI, the published forecasts are raw data received from one forecast provider which has been subsequently adjusted for outages as outlined above. The MPI will publish one forecast provider's forecasts. If data is not available from one forecast provider, data from the other forecast provider will be published, to maximise availability of data for MPI.

The outage adjusted forecasts from both providers are used as the input to the Market Management System (MMS) for scheduling and dispatch.

The wind forecasts do not include constraint or curtailment forecasts as these are only implemented in real-time operation.

9 USE OF FORECASTS IN SCHEDULING AND DISPATCH

Generally, within the MMS, the Wind Predictor function calculates a weighted average of the two outage adjusted forecasts for each wind farm (one from each wind forecast provider) to produce a combined forecast. This combined forecast is typically then blended with current wind conditions on a continuous basis over a time period of up to four hours and interpolated to a 1 minute resolution for use in the scheduling and dispatch process. There may be periods where the TSOs manually adjust the forecasts e.g. for adverse weather events. Further information on the wind forecasting process and the Wind Predictor function within the MMS is available in the BP_SO_4.3_Wind Forecasting business process.

Note that while wind participants may submit PNs representing their forecast production, these are not as at the date of this document used in the scheduling and dispatch process. Solar forecasting is a relatively new process and continues to be developed.