Metering Of Embedded Generation – Operational Viewpoint

Operational metering obligations are placed on large embedded generators, defined in Scotland as greater than 5MW and 30MW in S&SE and Scottish Power areas respectively and defined in England & Wales as 100MW or greater.

Large embedded generators are obliged to provide operational metering due to their operational impact on the system; in Scotland this requirement is backed-off through STCP04-3.

In the Grid Code, operational metering is the real time measurements of voltage, current, frequency, active power, reactive power and wind speed indications of plant status and alarms. This requirement for operational metering is limited to real time measurements of power output and wind speed.

This information will enable the system operator to account for the generators output in the strategy for securing the system from real time, out to some appropriate time in the near future. For wind powered generation the expected output would be derived from the current output and the predicted wind-speed profile over the relevant time period. Predictions of output for non-wind powered generation would be based on historic running regimes and commercial information.

The generator would bear the cost of providing the measurement inputs to the data collection system which would be provided by the three TOs and located in a convenient DNO or TO substation. Within Scotland such data is forwarded to the GBSO through the SCADA systems. STCP18-1 requires that, for large embedded generators, the TO shall use reasonable endeavours to agree terms with the relevant distribution operator to facilitate the collection and transmission of SCADA data to National Grid; it may be beneficial if this were strengthened to become an obligation on the DNO.

Impact of Embedded Generation on the Transmission System

Embedded generation affects the following aspects system operation:

1. Flows across transmission constraint boundaries.
2. Demand forecasting.
    i. National,
    ii. GSP level.
3. SGT loading.
4. Response holding.
5. Reserve holding.

Flows across Transmission Constraint Boundaries

Embedded generation will contribute to power flows across import and export constraint boundaries. Where there is limited BM generation available to manage the constraint and the magnitude of the constraint is commensurate with the capacity of embedded generation, the system operator must know the current and future power output to ensure that pre and post-fault actions are not being taken unnecessarily. An example of this is the management of the South West of England Peninsula voltage constraint where embedded generation output could reduce the requirement to take demand management actions.

Demand Forecasting

National Demand Forecasting – Is derived from the summation of the output of BMUs measured in real time. Non-BM embedded generation (of which there is currently around 5GW of capacity) is not included in the derivation as it is assumed that the diversification of output and demand across the system results in the net effect being more or less constant across similar time periods. The assumption of diversity is applicable to embedded generation, hence operational metering is not necessarily required for producing national demand forecasts.

GSP Demand Forecasting – Accurate division of national demand between GSPs is required for off-line power system analysis and to enable SGT outages to be optimally placed in terms of GSP demand. When embedded generation is running it will effectively reduce the demand at the GSP hence a correction must be applied. Retrospective measurements of power output e.g. Settlement data can be used to for this correction and therefore operational metering on embedded generation is not necessarily required for GSP demand forecasting.

Managing SGT Loads

There are a number of substations where historic SGT loading profiles show limited capacity margin, i.e. firm capacity based on continuous rating less demand under outage conditions. Furthermore in some cases there is a reliance on embedded BM generation to secure the outage. Under these circumstances the output from embedded generation could make the difference between secure and insecure operation. Outages would be placed on the assumption of zero output from embedded generation. However, there will be occasions during the outage when the outturn demand is higher than expected or the output from BM generation is lower than expected. In order to maintain security the system operator will have to take mitigating actions, for example: -

Buy on embedded BM generation,
Arrange demand transfers / reductions,
Recall the outage.

Where the capacity of the embedded generation is sufficient to reduce the need for these actions knowing the real time output, and (from this) being able to predict the output will improve the management of an outage once it has started.

Real time measurement of power output and (if applicable) wind speed will be required where: -

The historic SGT loading profiles show expected demand be 90% or more of the continuous SGT capacity under outage or intact conditions

Or

There is reliance on an embedded generation to secure demand.

Reserve Requirements

The system operator needs to predict the expected plant margin from up to six hours ahead, down to real time. The prediction of national system demand will account for the embedded generation though the assumptions on diversity of output mentioned previously. Hence operational metering on embedded generation is not necessarily required for calculating reserve.

Response Holding

In some instances an embedded wind-farm may contribute to the largest system in-feed loss. Moreover for some connection configurations, the system operator will need to know the output of the embedded generator explicitly to determine the response holding. An example of this is North Hoyle Wind farm where due to a lack of fault ride through capability, the disconnection of Dinorwig and Wylfa power stations (under MIS outage conditions in North Wales) will also result in the loss of North Hoyle.