Dear Kersti and Ian

I have some serious comments relating to the correct modelling of Generation to Demand Balances and the resultant calculations of Heat consumption, fuel consumption and emissions. As the Power system is always is perfect balance, Generation has to be continuously matched closely and continuously to demand within very tight tolerances (+/- 1% statutory, +/- 3% to system shutdown).

Chapter 2 Question 7 - Modelling the Electricity System Supply/Demand balances and calculating fuel burn and emissions.

The proposed scenarios contain different combinations of conventional plant and renewables. The former are controllable assets with breakdown allowance while the latter will operate as 'Unpredictable Base Load'.

To correctly model the operation of fossil Power plant it is necessary to represent generation dynamics, heat rates vs output and heat for start up. All plant is then scheduled and dispatched to meet demand in time series. From this Power-time solution and the heat rate data is derived the heat input which, with the fuel CV and other Quality data (volatiles, carbon etc) is used to determine Fuel burnt and CO2 emissions. The correct modelling of heat consumption at all operating levels is crucial; CCGTs drop from 55% efficiency at full load to 40% at part load while large coal drops from 39% to 32% and you need to account for start up heat and that consumed while in standby mode. Using a simple merit order stack is not a valid way to model generation, consequent fuel consumption and emissions accurately.

With different levels of unpredictable renewables in each scenario, it will be necessary to run a nested commitment-schedule-dispatch-outturn model, rolling across time, with the uncertain variables (wind speed, plant failure etc) changing in a way representative of forecast scenarios. The extra part loading required on fossil plant to provide reserve and its utilisation can then be modelled correctly to give the fuel burn and emission patterns.

This is not an easy model to build as it simulates not just the system operating across time but also the decision processes from commitment to outturn. It also works just with the Generation to Demand match. In theory the rolling process should start with the Wholesale Electricity Market trading and then run into the Generating company and System Operator decisions as to what plant to run and what Ancillary services to purchase until we finally enter the dispatch stage (Balancing mechanism) and then simulate the outturn.

It may be that we have to use a set of short period simulations to correctly evaluate the different levels of plant commitment and output patterns pertaining to each scenario and then try and expand the results to cover each year.

Best Regards

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