

High Wind Speed Shutdown



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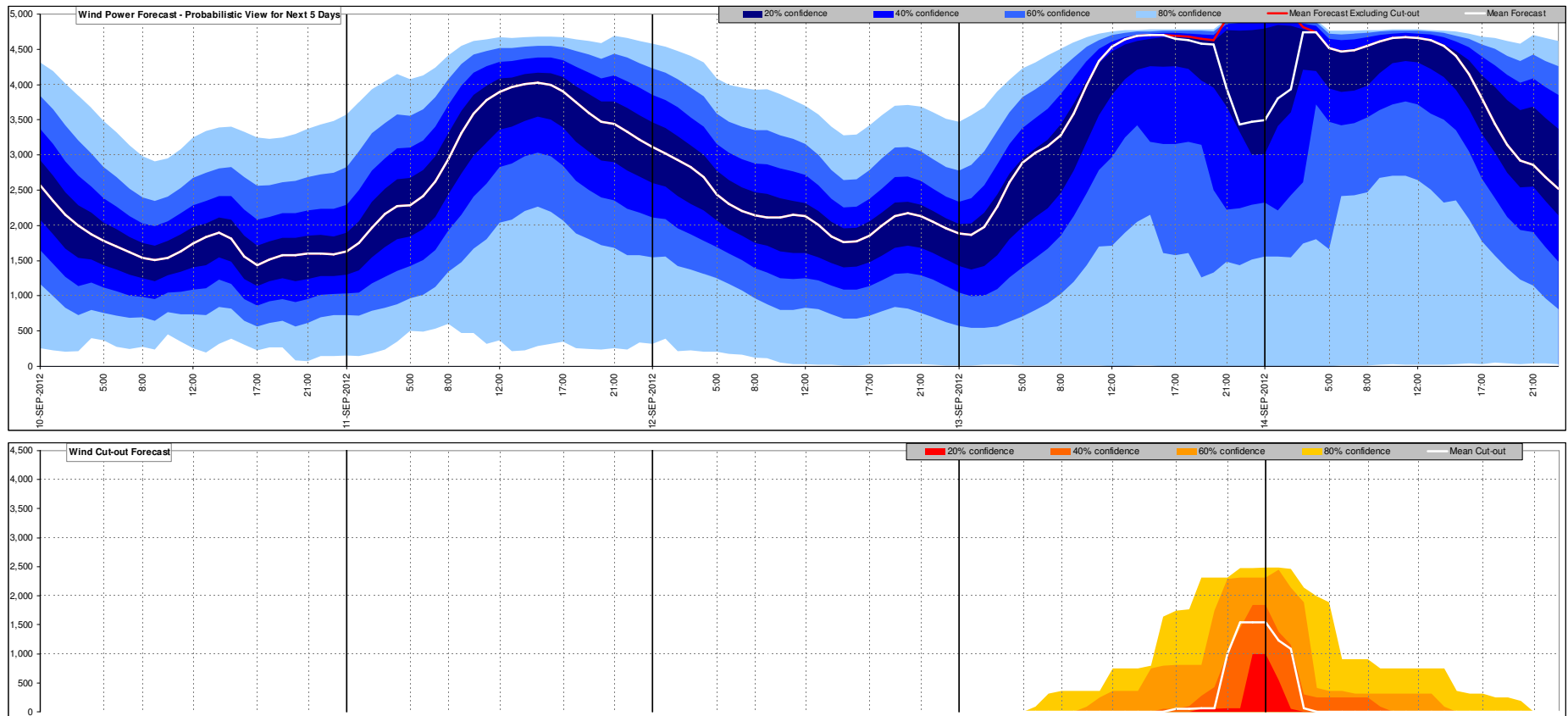
Why do we need to manage this better?

- Recent 1GW forecast errors have occurred when areas of Scotland and the South East have experienced high wind.
- This is either when shutdown of windfarms have been forecasted and not occurred or vice versa.
- Clearly techniques for forecasting high wind speed shut down need to be improved urgently.

Option 1 : Stay as we are

- We currently receive MW, MVA_r, Windspeed and Wind Direction data from many of the BMU wind farms.
- Forecast Wind speed and wind direction is provided by Meteogroup.
- Forecasting shutdown is currently done using a dual model.

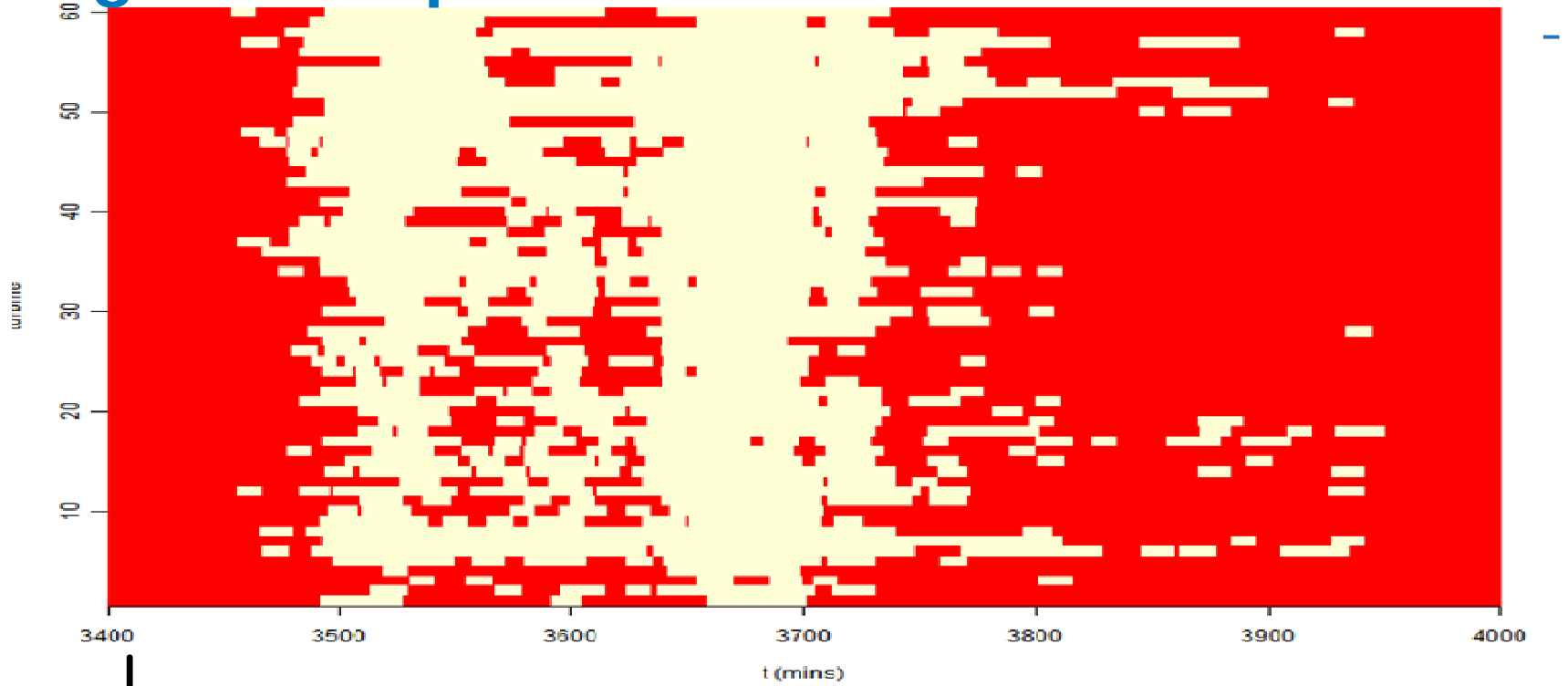
Example of forecasted shutdown



Option 2 : More data : Shutdown alarms

- Wind farm control systems provide alarm signals to the second for many parameters.
- Shutdown alarms show when a turbine entered the shutdown state and when it returned to normal operation.
- This can be used to develop a “shutdown progression fingerprint” which in turn could be used for short term forecasting.

High Wind Speed Shutdown



MW un-available



Option 3 : More data : MW from each turbine

- Windfarms have output data from each individual turbine.
- MW output can be used to indicate whether a turbine is in a shutdown state.
- Although $MW = 0$ could be for other reasons also.
 - No wind
 - Plant maintenance
 - BOA
 - Trade
- MW data would need to be used in conjunction with other data.

Option 4 : More data : Rotational Speed

- Windfarms have data for the rpm of the blades.
- Stationary blades either indicates no wind or shutdown.
- The no wind scenario could easily be discounted by using windspeed measurements.

Option 5 : More data : Blade Pitch Angle

- The control systems control the pitch angle of the blades in response to the wind.
- This is to maintain a consistent power output as the wind speed increases between 16 m/s and 20 m/s.
- This angle is another indicator of how near a turbine is getting to the cutoff zone in addition to wind speed itself.

Options for Controllability

- If a generator is controllable then this can compensate for shortcomings in forecasting quality.
- The following options are
 - Suggestions to increase the predictability of wind power generators by adjusting control arrangements.
 - While allowing as much environmentally friendly electrical energy to be produced as practically possible.

Option 1 : Demand side response

- Contractual arrangements could be made with local controllable demand so that the demand is temporarily reduced when shutdown occurs.
- This is likely to be with demand from large industrial consumers with processes that do not require continuous running.

Option 2 : Wind Farm Pairing

- Two windfarms could be paired together from a control system point of view.
- Both farms would be part loaded.
- When one experiences cut-out then a signal is sent to the other wind farm to pickup the shortfall.
- This could be arranged using the respective MW output of each farm or managed on a turbine by turbine basis.
- This arrangement could be extended to more than one wind farm.
- Care would need to be taken to ensure constraint issues are not worsened by the action of the wind pair.

Option 3 : Pre-emptive shutdown

- When stormy conditions are present then windfarms could be instructed off before they experience shutdown due to high wind.
- This would remove the uncertainty and forecast error.
- This would be quite expensive depending on the cost of bids available.
- This is already possible with the current market arrangements and IT systems.

Option 4 : Change of cut-off ramp rates

- Some manufacturers of wind turbines are actively experimenting with adjusting the control systems so that the reduction in MW output as the wind increases beyond the cut-off speed is more gradual.
- This is partly to increase the amount of energy that the turbines produce in high wind scenarios but will also have the benefit of making the behavior of the turbines more predictable.
- Work is ongoing in this area with manufacturers and the main consideration is to enable greater energy production while maintaining the required 20 year lifespan of the turbines.

Option 5 : Restricting re-connection time

- It is common practice in the industry for wind farms to automatically re connect and commence generation after a high wind speed event.
- This can cause problems in the control room because of the rapid fluctuations in power output that this causes and is especially an issue over night when there is a lack of flexible plant available.
- It is proposed here that if a generator experiences a high wind event which causes partial or complete shutdown the generator should not increase output unless permission has been granted by the Electricity Control Centre. This would be normal operation for BMU wind farms.
- This notification could be done via an EDL link rather than by telephone.

Option 6 : Ramp rate restrictions

- Currently the grid code applies limits to ramp rates on a per BMU basis.
- The danger is that a number of windfarms (BMU's) all acting in response to atmospheric conditions may exceed this ramp rate simultaneously.
- There are currently no clauses in the Grid code that apply to a group of BMUs acting together.
- It is proposed that this should be changed and that any group of BMUs can be informed by National Grid that they are acting in concert to exceed a GB ramp rate restriction and can be instructed in equally at the same time to safeguard the frequency.
- These instructions should be emergency instructions and be at no cost to National Grid.

Summary

- Installed capacity of wind power will increase over the coming years.
- This will require increased measures to ensure secure and economic operation of the National Grid going forward.
- The two areas of forecast accuracy and controllability will become increasingly important as a result.