

Power Available Signals, Zero-carbon ESO and New Revenue Streams

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Acknowledgements:

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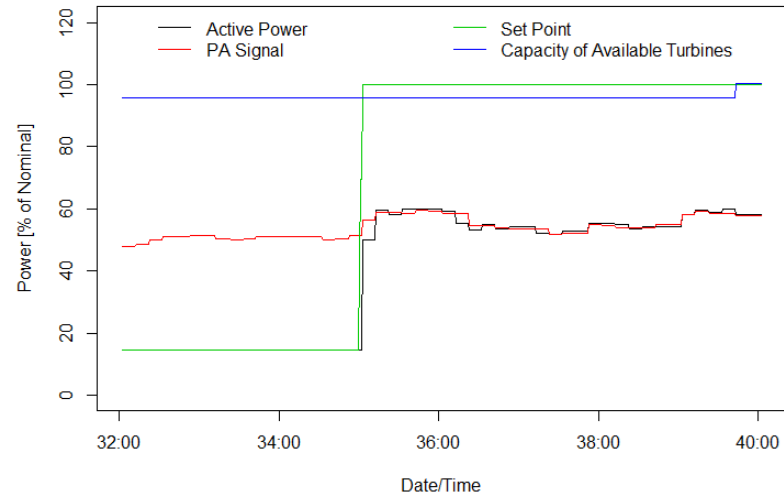
Contents

- Power Available
 - What is a power available signal?
 - What is it for?
- Wind Providing Frequency Response
 - Today and in the future...
- PA accuracy and proposed standard

Power Available Signals

- Estimate of power that could be produced if a wind farm is not constrained
- Required to:
 - Know how much power will be produced at the end of a constrained period
 - Know how much headroom is being held if providing a service, e.g. frequency response
 - Settle service provision and lost energy capture

A Power Available Signal



Production of PA Signals

Anemometer Method

- PA based on turbine anemometer measurement and power curve

Notes:

- Anemometer in wake
- Noisy point measurement
- Anemometers are prone to failure

Modern wind turbines come with this as standard, but it requires set-up/tuning!

Power Coefficient Method

- Rotor-effective wind speed estimated using *turbine as a sensor*

Notes:

- Requires multiple controller/SCADA feeds
- Aerodynamic and dynamic characteristics of turbines and farm
- Highly accurate provided SCADA is accurate and parameters are tuned correctly
- Included in modern OEM SCADA systems

Power Available: State of Play

- Part of NGESO pathway to zero-carbon operation in 2025
 - Six deliverables in 2019-2021 Forward Plan
 - Best Practice Guide v1.0 published
 - Various code mods
 - Accuracy standard proposed (more later...)
 - Compliance testing under development
- Zero-carbon system operation requires **zero-carbon ancillary services!**



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**Power Park Module
Signal Best Practice Guide**
for Intermittent Generation
Published July 2019
Version 1.0

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Our Forward Plan 2019-21
28 March 2019

CUSC Modification Proposal Form - Version 1.0 (31 August 2016)

CUSC Modification Proposal Form

At what stage is this document in the process?

CMP314:

Mod Title: Updating the CUSC to align Power Available with the Grid Code definition for Power Park Modules

01	Prepared Form
02	Workgroup Consultation
03	Workgroup Report
04	Code Administrator Consultation
05	Draft CUSC Modification Report
06	Final CUSC Modification Report

Purpose of Modification: To align the CUSC with the Grid Code on the use of Power Available in ESO headroom calculations for Power Park Modules. The definition of Maximum Export Limit (MEL) was changed in the Grid Code for Power Park Modules under GC0063 to be registered capacity less unavailable units and the Power Available signal introduced to replace MEL in ESO headroom calculations. This has not been reflected in the CUSC, which uses MEL in the De-load calculation

The Proposer recommends that this modification should be:

We believe that this is a consequential change to align the CUSC with the Grid Code definition of MEL agreed in GC0063

- proceed straight to consultation and may be suitable for self-governance

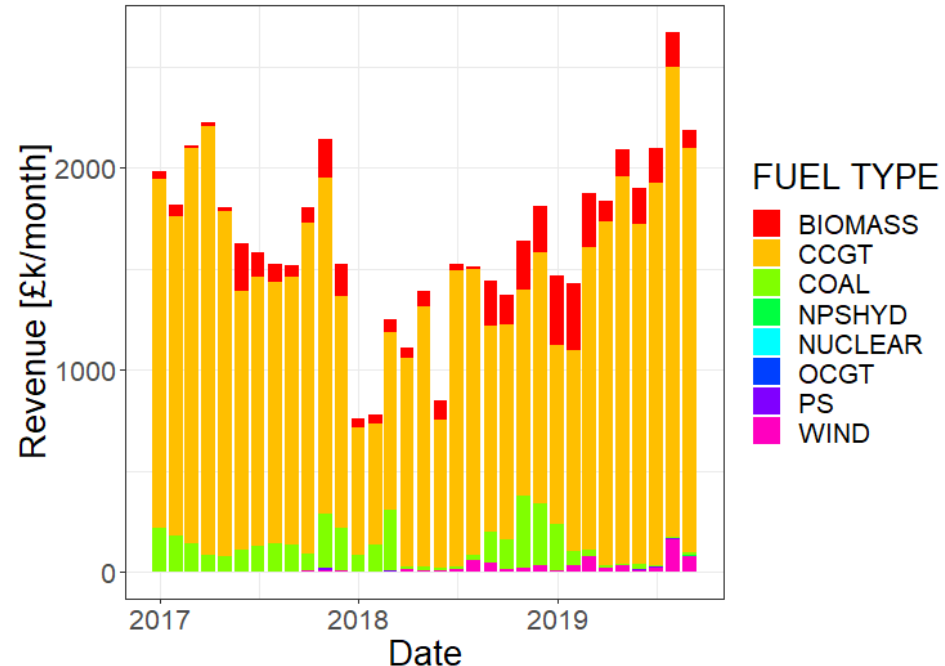
This modification was raised **21 March 2019** and will be presented by the Proposer to the Panel on **29 March 2019**. The Panel will consider the Proposer's recommendation and determine the appropriate route.

High Impact: N/A

Frequency Response from Wind

- Vary power output to maintain the system frequency at 50Hz
 - Wind can provide **very fast** response!
 - Opportunity cost if holding headroom for upward response
- £100m market and growing!
 - Incumbent fossil fuel generators being displaced...
- **Today**, wind can only access MFR
 - Month-ahead FFR tenders not practical
 - Auction trial products unfavourable

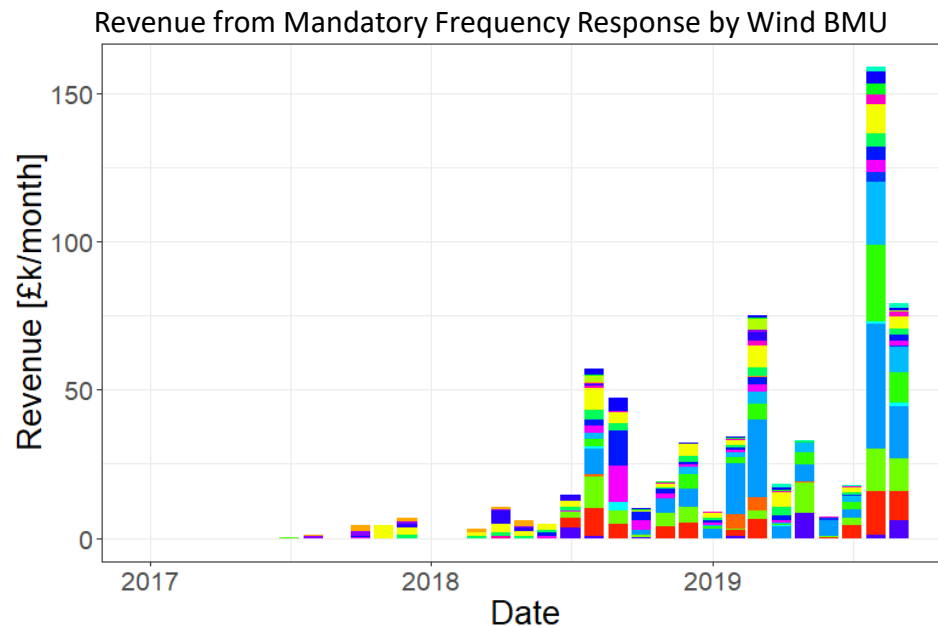
Revenue from Mandatory Frequency Response by Fuel Type



Frequency Response from Wind

In the future:

- New procurement mechanisms:
 - Day-ahead auction (trial underway)
 - Portfolio participation (on the horizon)
- New products:
 - Unbundled up- and downward response
 - Faster response times (<1 second)
 - Aggregate response, e.g. EFCC



PA Signal Accuracy

- **Accuracy standard as pre-requisite for market access**
 - National Grid ESO commissioned a report from the University of Strathclyde to advise on accuracy assessment methodology
 - Evaluation of historic PA and related data from over 40 diverse wind farms
- **Setting accuracy threshold is a trade-off between:**
 - Maximising competition, and
 - Additional spend to secure against possible error
- **Evaluation should reflect operational requirement and experience:**
 - **Requirement:** identify problems quickly
 - **Observation:** accuracy is generally high until a problem manifests
 - **Operational experience:** on its way...

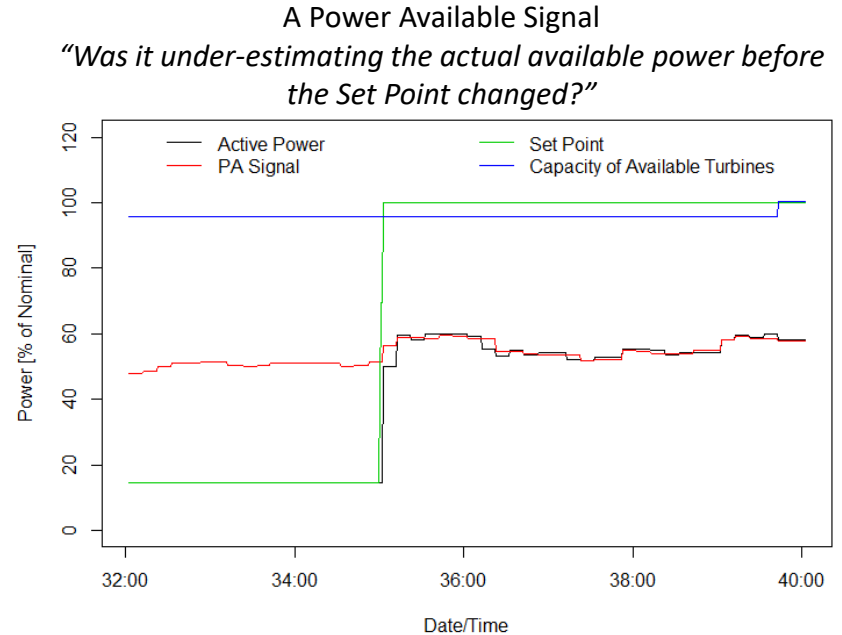
PA Signal Accuracy Challenge

Problem:

- When accuracy really matters no “ground truth” is available
- Easy to *fake* accuracy during normal operation

Solution:

- Inspect behaviour around beginning and end of constrained operation
- Initially manual task, automation possible later



NGESO Proposal

A wind farm is flagged as inaccurate if:

1. Absolute error **exceeds 1.5%** of installed capacity **continuously for 5 minutes**
2. Indicators of inaccuracy are observed in any of the following manual checks:
 - a) Evidence of inaccuracy at the **beginning or end of constrained operation**
 - b) Volatile PA accuracy that does not fail test (1)

A wind farm has flag removed once above test is passed, e.g. error is below 1.5% of installed capacity continuously for 5 minutes or accuracy demonstrated w.r.t. (2)

Strathclyde Analysis:

- A median of **5 flags-per-year**, i.e. half of wind farms we flagged 5 times or fewer
- 10% were flagged frequently (>30 times per year)
- Duration of flag: **less than 2 hours in 80% of cases**, less than 24hours in 95% of cases

NB: data from a period where PA accuracy was not an operational priority!