Measuring and understanding the residual inertia of demand and embedded generation - The Great Britain case study

By: Dr. Sung Pil Oe, Head of Power Systems

About Reactive.

We enable grid operators to measure grid inertia to accelerate the transition to a low-carbon grid.

250+ patents globally

1st and only proven direct, real-time grid stability management service

ISO27001 certified

6-year commercial service contract underway

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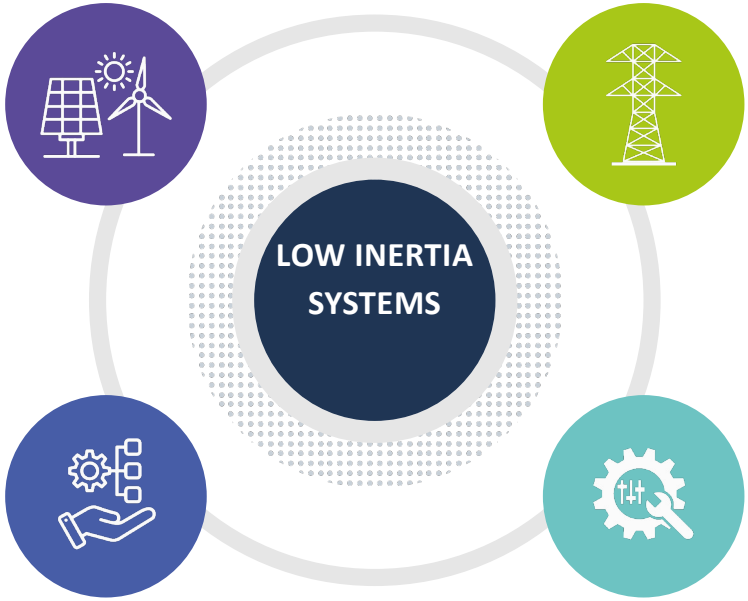
Context – Low-inertia Systems

Introduction of inverter-connected Renewable Energy Sources lowers system inertia.

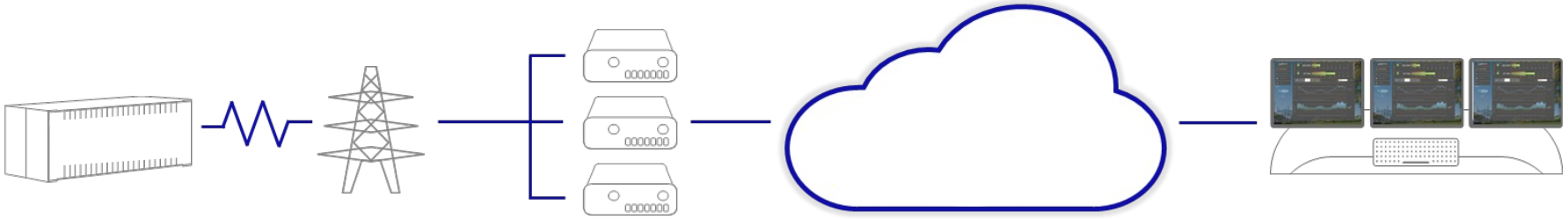


Transmission system operation becomes more challenging due to volatile frequency and RoCoF.

Increased visibility of system inertia levels is needed to safely and efficiently operate low-inertia systems.

Measuring inertia allows the optimization of inertia dispatch and frequency response procurement.

Inertia Measurement Methodology



A Modulator[1] injects a minute and controlled periodic power signal.

The power grid responds with imperceptible frequency movements.

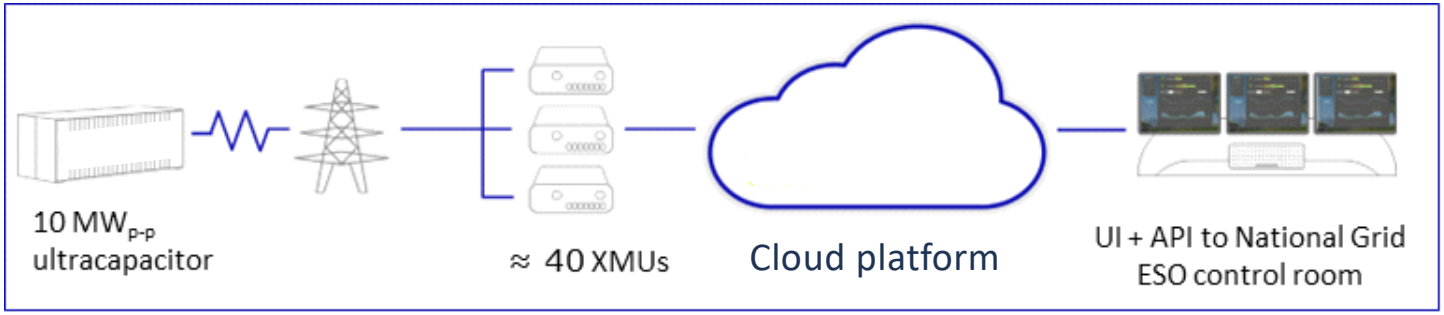
XMUs measure frequency and RoCoF across the whole grid.

A cloud platform computes the inertia measurement using the Swing Equation and advanced signal processing.

Inertia data is available from any internet connected device. The measurements can be streamed via an API to the Control Center to drive actions.

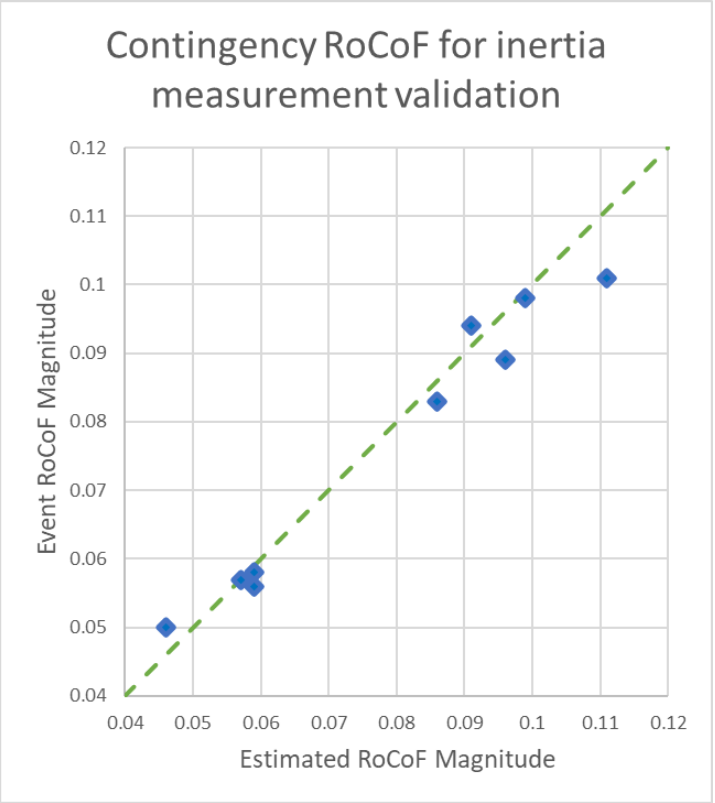
[1]*Modulator*: an asset such as a battery, ultracapacitor or load bank capable of generating a power signal
[2]*XMU*: eXtensible Measurement Unit, Reactive Technologies' GPS synchronized accurate measurement unit.

Inertia Measurement Methodology – GB deployment

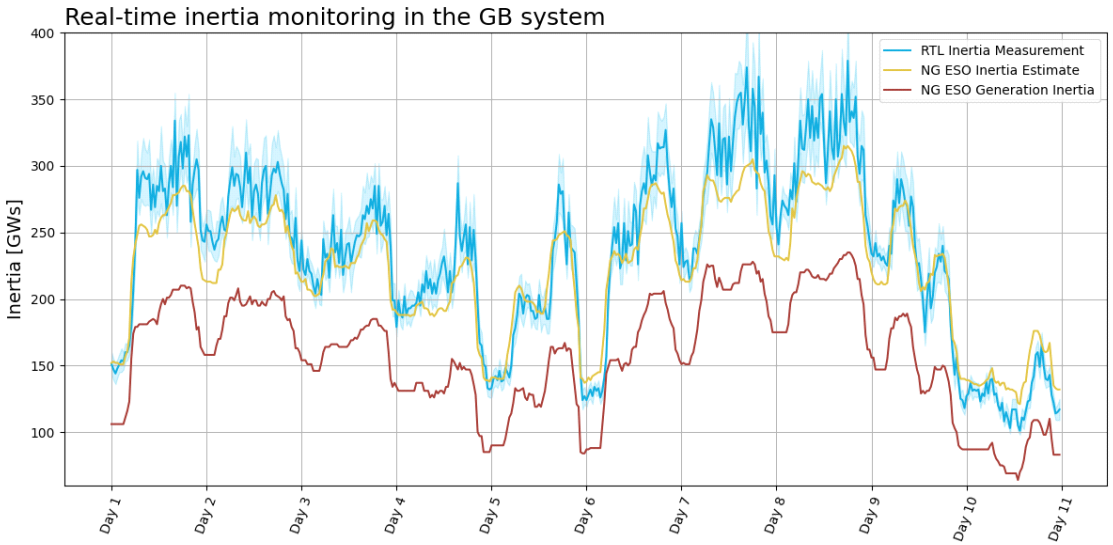


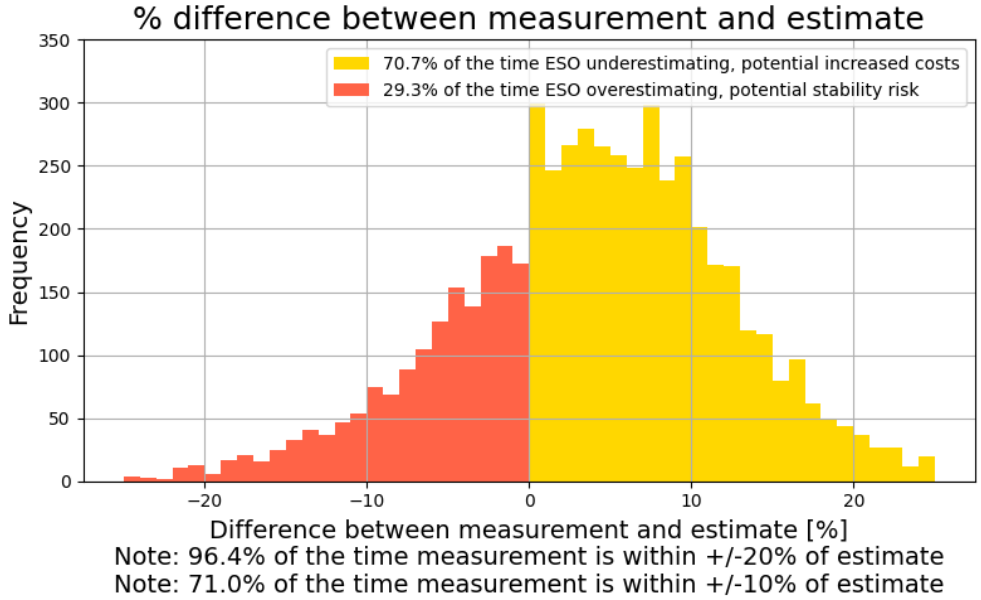
GB Inertia Measurement – Event Based Validation

Date	Power Imbalance [MW]	Inertia Measurement [GWs]	Inertia Estimation [GWs]	Percentage difference [%]
29/04/22	1028	308	321	-4,05
30/04/22	1028	298	308	-3,25
19/07/22	1027	260	262	-0,69
19/07/22	1027	266	288	-7,47
20/08/22	646	177	172	3,26
22/08/22	490	208	210	-1,00
05/09/22	1031	233	255	-8,56
05/09/22	-642	283	281	0,64
07/10/22	-400	216	209	3,74
16/11/22	-418	177	185	-4,42

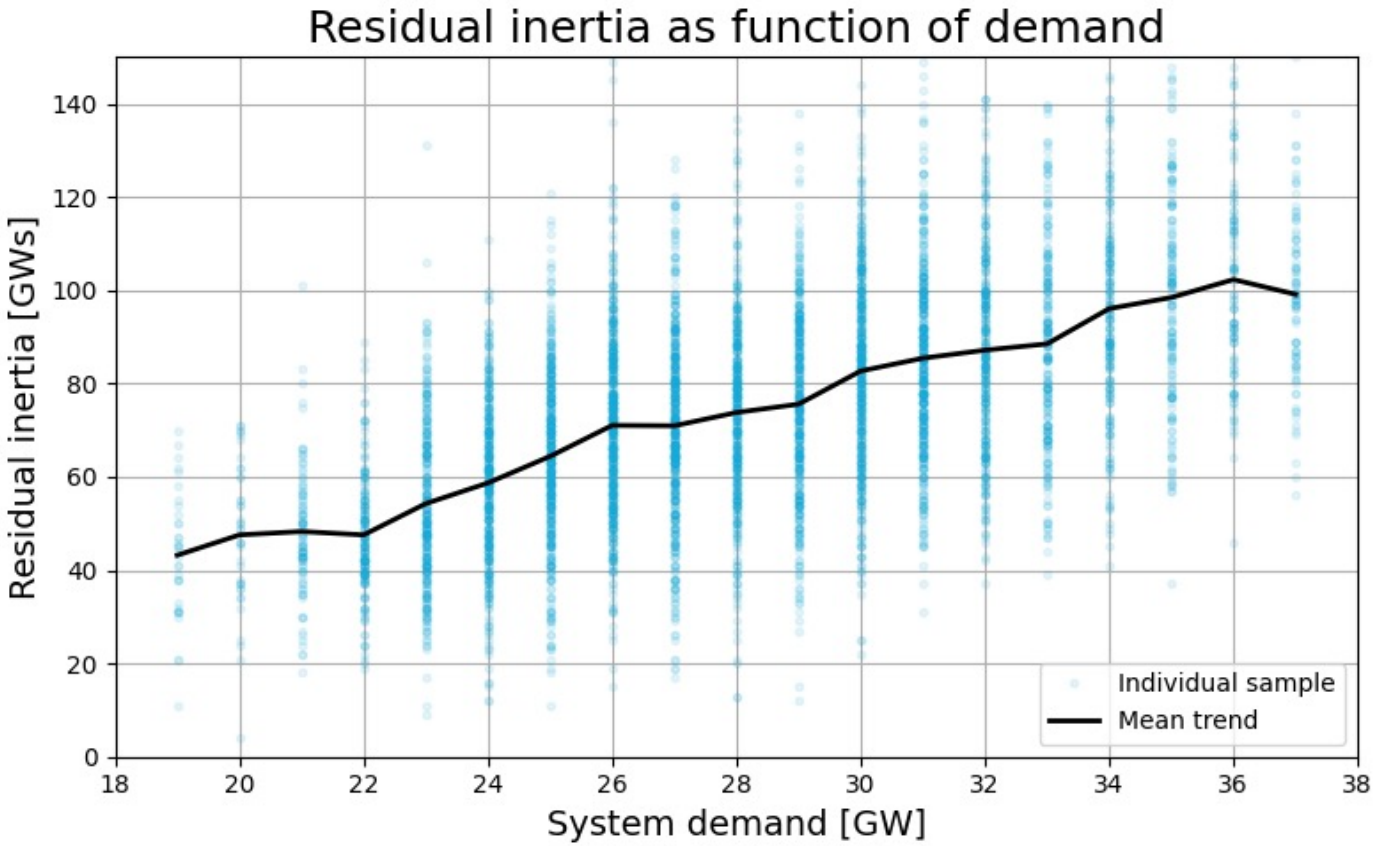


GB Inertia Measurements dataset overview





Residual Inertia General Trend



Thank You!

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