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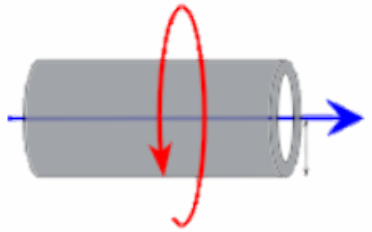
ETIP SNET
EUROPEAN TECHNOLOGY AND INNOVATION PLATFORM
SMART NETWORKS FOR ENERGY TRANSITION

Digitisation of the electricity system and Customer participation

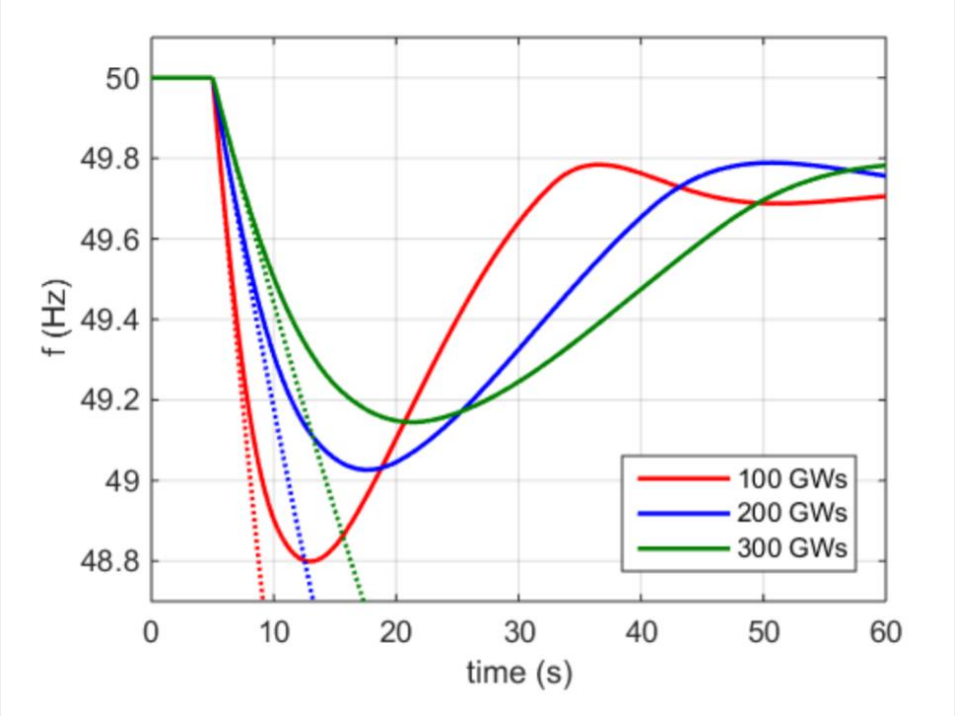
Project SIM: Moving from Inertia Estimates to Measurements

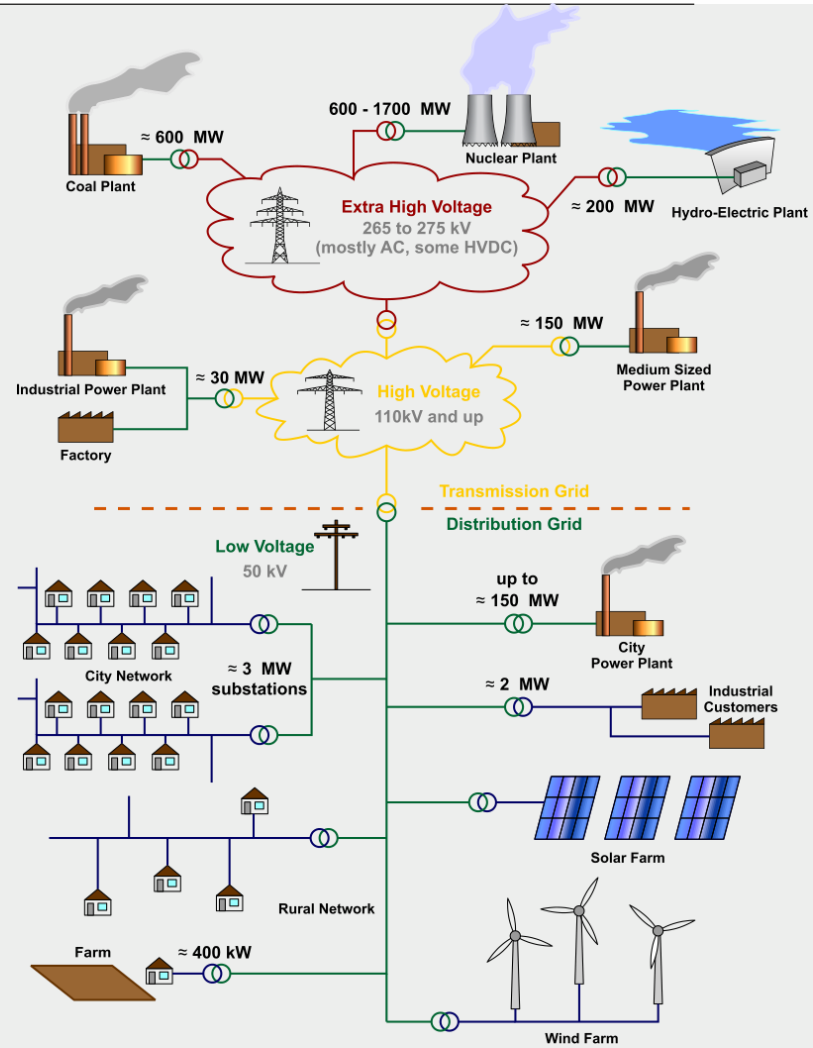
Inertia: The Unspoken Challenge



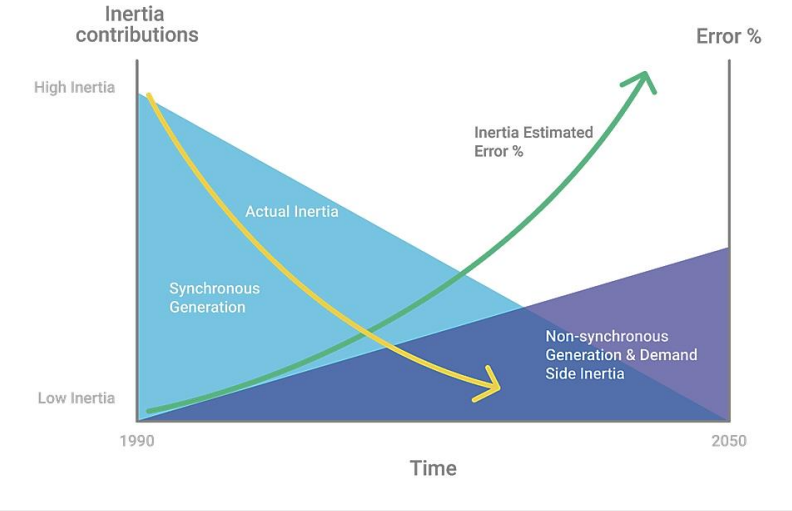
What is Inertia?

- Inertia is the resistance of any physical object to any change in its velocity
- In the grid it is the robustness of the system based on the kinetic rotating mass of generators





Inertia Situation today



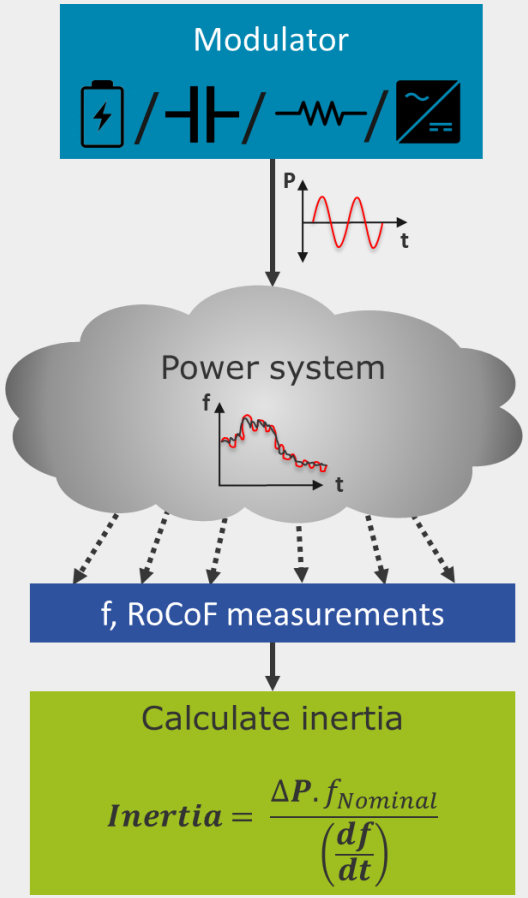
- Grid operators currently rely on models to estimate inertia
- Inertia models are becoming increasingly incorrect as they don't take into account inertia from the distribution network, where we're seeing significant uptake in intermittent generation.
- Grid operators currently need to cap usage of renewables and use fossil fuels instead because of their lack of inertia visibility.

Project SIM: Measuring Inertia for the First Time

Reactive Technologies partnered with **National Grid ESO** to demonstrate that **GridMetrix** can accurately measure power system inertia.

How is Inertia measurement done?

- Load banks were used to inject a power signal to the grid to stimulate minimal power changes
- The minimal RoCoF of these power changes can be measured by Reactive's Measurement Units (XMUs) ant any location in the grid
- By processing the raw data the Inertia can be determined directly
- By treating the grid infrastructure like a communications channel, GridMetrix was proven to be able to continuously and accurately measure system inertia for the **first time.**

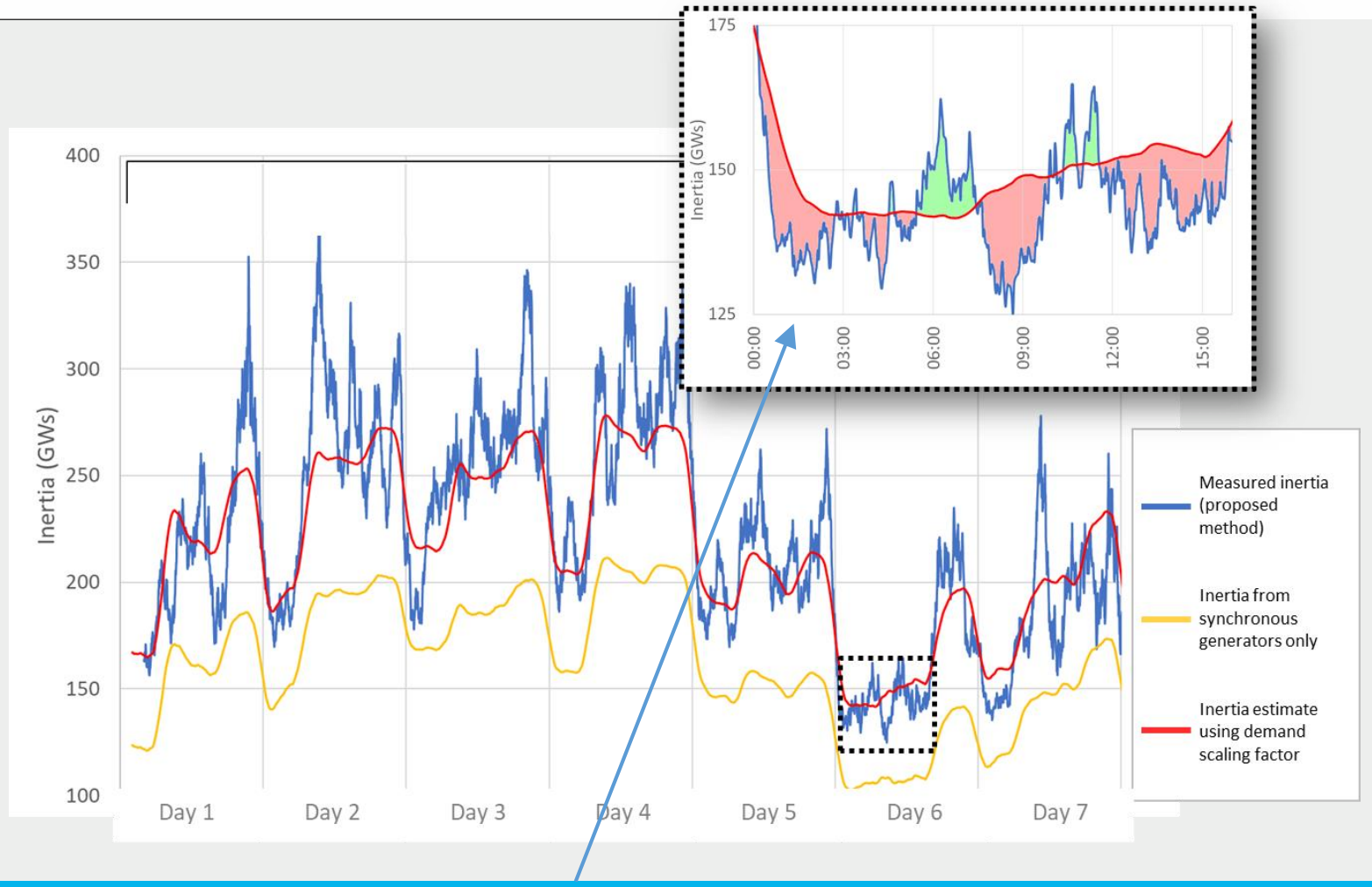


Project finalization date: **Q3 2017**

Project Budget: **£232K**

Project SIM Findings

- The measured inertia data are generally in line with current estimations and models
- Inertia was **directly measured** on the UK grid for the first time.
- The measurement prove to be more accurate that the models and estimations.
- On day 6 f.e. it was discovered that the real inertia level was significantly lower than estimated by the ESO and almost reached the critical limit of 130 GWs in UK.



The Project identified savings and key risk areas to optimise balancing spend

The service measured inertia more accurately than their model

Lessons Learned From Project SIM
The Benefit to Grid Operators Globally

GridMetrix was proven as part of Project SIM to successfully measure grid inertia and is a technological step change that has global ramifications as it enables grid operators, and countries, to deliver on their decarbonisation targets which they would otherwise struggle to reach.

Benefits for System Operation

- **Increased Renewables Integration**: Allow grid operators to decrease curtailment of intermittent generation. By moving from models to measurements, grid operators can increase their usage of renewable generation by 8% by 2020.

- **Decrease or Deferred spend**: Enable grid operators to make more informed procurement decisions. To manage risk of low inertia, grids can purchase new balancing services or invest in, costs which can be optimized through better measurement. For example, National Grid spend >£100m p.a. managing inertia.

- **Maintain Security of Supply**: Empower grid operators to make optimal mitigation/recovery decisions during an event. Outages cause considerable reputational and financial damage however their impact can often be mitigated/lessened with accurate network visibility.

Barriers to Market

- Conservative mindset of ESOs concerning their Inertia management
- HW investment in the measurement system
- Geography and interconnectivity

Deployment Prospect:
Inertia Measurement, Innovation to Business as Usual

nationalgridESO

- 6-year contract signed.
- Inertia measurement data to be delivered to National Grid ESO's control room starting next year.
- Accurate visibility of inertia will support National Grid ESO's ambitious 2025 decarbonisation objectives.
- One of the largest super caps in the world to be built to stimulate the network.
- Discussions with many grid operators globally to apply this learning to their networks.
- Accurate visibility of inertia will support National Grid ESO's ambitious 2025 decarbonisation objectives.


the energyst

Reactive Technologies signs commercial deal with National Grid to measure inertia

AUGUST 5, 2019 BY BRENDAN COYNE — 1 COMMENT

Reactive Technologies has signed a commercial deal with National Grid ESO to measure inertia on the UK power system, providing a clearer picture of real-time grid stability.

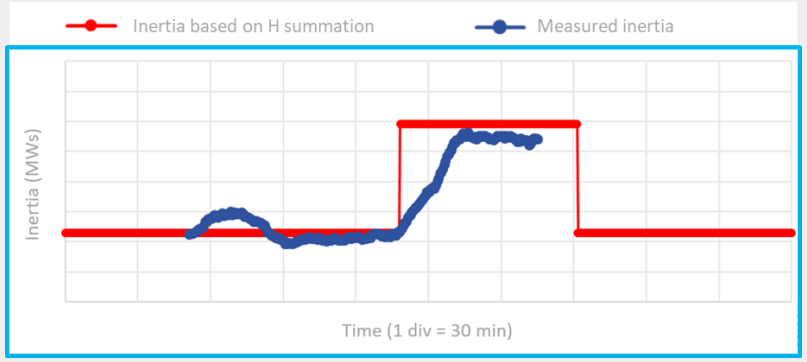
The six-year agreement will see Reactive initially build out hardware and software, then provide commercial inertia measurement services for five years.

The company said hardware includes one of the world's largest ultracapacitors, used to 'inject power' into the grid, while proprietary measurement units directly measure the response.

Reactive said by measuring rather than estimating inertia, National Grid ESO can better transition to a system that can, at times, run on zero carbon power, by enabling a greater penetration of

- Inertia was successfully measured on Niijima Island and was independently measured by TEPCO.

TEPCO Power Grid



Generator	Utility-supplied Inertia (MWs)	RTL measured Inertia (MWs)	Difference %
1	Confidential	Confidential	0%
2			0%
3			-20%
4			-6%
5			0%
TOTALS			-4%

Inertia Measurement
R&I Needs

Research and Innovation focus may be put on the further development of …

- **The Modulator technology to improve performance, lifetime & cost of this device**
  - f.e. Energy Storage and Inverter Technology
- **The measurement algorithm**
  - to increase accuracy
  - explore other data services that add value
- **The Cloud based SW platform to add features and services to the ESOs**

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