Achieving Net Zero Safer and Faster with Real-Time Grid Stability Measurement

Reactive Technologies WECC Regional Grid Stability Measurement Project

> Jack Joyce Reactive Technologies Executive Director, Americas



Cleantech company directly enabling NET ZERO in power grids – real time grid stability analysis

1st World 1st Breakthrough Services

250+

granted patents across 34 countries

\$33M

USD capital raised for next 5 years of growth

Global presence with HUGE IMPACT

10-30%+

extra grid capacity for more renewables integration unlocked ~18M

tonnes of CO2 saved annually in UK alone



of total UK CO2 emissions eliminated annually











Supported by...









We enable transmission and distribution grid operators to measure grid stability to accelerate the transition to a lowcarbon grid.







"As the penetration of wind and solar on the system increases, operation of the system becomes significantly more complex. The power system is being operated closer to its known limits more frequently, with increasingly variable and uncertain supply and demand, and declines in system strength and inertia."

"Zero carbon operation of the electricity system means a fundamental change to how our system was designed to operate; integrating newer technologies right across the system... using new smart digital systems to manage and control the system in real-time."

"It is recommended that system operators perform inertial measurements to get an accurate, real-time view of inertia levels to replace guesswork and conservative estimates."

"Decreasing levels of inertia – as a result of the large-scale integration of renewable sources – **pose long-term challenges** to frequency stability of the transmission system, with possible impacts on the resilience of the future system."

To Tackle Global Grid Challenges







entsoe

What We Offer



High-Definition Grid Data Captured with High Accuracy





XMU – Grid IoT.

Unlocking the power of edge computing.









- High speed 48 kHz sample rate
- High resolution A/D conversion (16-bit)
- High Accuracy GPS time fleet sync (PPS)
- Adaptive sampling rate (edge comp.)
- Adaptive DSP filtering (edge comp.)

- Remote device management
- Low own cost / high performance
- Easy installation @ 'grid edge'
- 120 volts
- Designed by Reactive Technologies
- High performance data acquisition functionality
- Control functionality
- Low cost / high perf HW architecture
- Compact size 12.2 x 10.7 x 3.4 cm / 300 grams

A paradigm shift in the measurement & analytics of grid stability.







ISO27001 - certified Information Security Management System

Customer's control center

Highly accurate real-time data delivered to the control room



Inertia Measurement is core to NGESO's Zero Carbon Plan... Wish they had this 2-3 years ago!!

Inertia Measurement is saving ~10% of the cost of managing decreasing inertia in the UK



National Grid ESO's goal of zero carbon operation by 2025 requires direct inertia measurement being in place

- Results show:
- market for inertia in 2025
- NGESO ROI <1 year

"Inertia will become much more important in the years to come, I think today it is taken for granted... Inertia is at the heart of everything we do"

> Fintan Slye Director, UK System Operator at National Grid ESO

• **Commercial Services Operational** – exceeding expectations • Rapidly deployed, stand-alone secure IT service • Faster Renewable Integration

• Data now used in Control Room for real-time optimization

 ~80% time Measured inertia >10-30+% higher than estimates (minimize/optimize inertia procurement) • ~20% time measured inertia is lower than estimated inertia (evaluate system operational risk) • Reactive's inertia data to be used by NGESO to establish a



WECC Regional Grid Stability Measurement Project





Project Overview Minimal Input Required



Measurement Accuracy

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WECC Regional Grid Stability Measurement Project

- Initial XMU Deployment (10-13)
- Planned Collaborating Utilities Recommendation
 - Pacific Northwest: Portland Electric*/PacifiCorp*/BPA*
 - CA: SCE*/SDGE*/PG&E*
 - APS*/PacifiCorp*/Nevada Power/SRP
 - Canada: BC Hydro/AESO

New Mexico(PNM) – Montana(TBD) – Colorado(Xcel)
 (* attended CAISO workshop)

- ID BESS Modulation for sub-regional projects (TBD)
- Potential Impact Reports
 - Grid assessment
 - Market assessment
 - Asset Management Planning





Phase 2 - XMU Expansion - Draft



Pacific Northwest 49 XMU
19 x Washington
18 x Oregon
12 x Idaho

CA 30 XMU





Southwest 43 XMU
17 x Arizona
14 x Utah
12 x Nevada

Outcomes

Real-time, accurate, grid stability measurement and operational transparency enables:

- Maintain Safe and Reliable grid operations within actual frequency response & inertial limits in a coordinated approach across the western interconnect.
- Model validation & limits evaluation with real time grid data & event analytics
- V Planners can identify potential grid stability issues and provide asset recommendations (such as synchronous condensers and/or battery storage) as to size, locations, and effectiveness to maintain a strong and reliable grid.
- \checkmark Use services output to 'program' inverters for real-time grid-forming (FFR) support. Increase renewable penetration while minimizing curtailment and ancillary service cost. \checkmark
- Evaluate frequency oscillations across regions

Requested WECC Support

- Support the increase of monitoring and measurement for regional frequency, oscillation, & inertia performance with Reactive high-resolution Grid Edge IoT devices (XMUs) and Gridmetrix analytics to ensure safe and reliable system operation.
- WECC requested to collaborate with RT to introduce and invite utilities to host an XMU, provided by RT, at \mathbf{V} no cost to participating utilities. They are designed for simple installation at an office or depot location using a standard consumer power socket.
- WECC to facilitate the collaboration and coordination of the RCs in the WECC region and NERC for this project.
- For complete measurement coverage and analytical efforts, WECC is requested to encourage utilities to consider an investment in deploying additional XMUs in their service territory. RT will provide preferential \checkmark pricing for this effort.
- WECC to help identify and support collaborations with utilities interested in demonstrating full-system frequency performance and regional inertia measurement using a modulation source, such as a current utility owned battery or battery in development in partnership with Reactive Technologies.
- WECC requested to provide technical guidance and business case support throughout the development and implementation of the project, including grid assessments and recommendations. \checkmark

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