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NIA Project Annual Progress Report Document

Date of Submission

Jul 2023

Project Reference Number

NIA2_NGESO023

Project Progress

Project Title

Inertia Measurement Method Optimisation

Project Reference Number

NIA2_NGESO023

Project Start Date

September 2022

Project Duration

2 years and 1 month

Nominated Project Contact(s)

Anna Blackwell

Scope

- Understand the accuracy of the inertia monitoring systems and dependencies on different generation / demand profiles.
- Understand regional differences of inertia.
- Establish standardisation methodology for measuring inertia and RoCoF.
- Clarity on accuracy of inertia measurement will feed into specification for inertia products with both Control and planning timescales.

Objectives

Using the metering data from the two new inertia system tools developed following earlier innovation and IT projects, along with the existing NGESO inertia "estimate" and operational data, the project will:

- Analyse and verify the quality of the data from these new tools through comparisons to the existing NGESO estimation.
- Establish different scenarios / use cases for inertia and RoCoF, for example based around levels of synchronous and renewable generation and demand.
- Compare the different solutions based on the established use cases.
- Identify regional inertia variations and representations.
- Develop measurement parameters and specification for reference instrumentation.
- Build on data and use cases to establish standardisation for inertia measurement by comparing measured results to modelling.

Success Criteria

The following will be considered when assessing whether the project is successful:

- The project delivers against objectives, timescales and budgets as defined in the proposal
- Verification of the innovative real-time inertia monitoring solutions
- Deeper understanding of how different generation scenarios impact the inertia on the network

- Deeper understanding of regional inertia variations across GB
- Standard methodology developed and documented for assessing inertia measurements

Performance Compared to the Original Project Aims, Objectives and Success Criteria

National Grid Electricity System Operator (“NGESO”) has endeavoured to prepare the published report (“Report”) in respect of Inertia Measurement Method Optimisation, NIA2_NGESO023 (“Project”) in a manner which is, as far as possible, objective, using information collected and compiled by NG and its Project partners (“Publishers”). Any intellectual property rights developed in the course of the Project and used in the Report shall be owned by the Publishers (as agreed between NG and the Project partners).

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The following paragraphs describe the project progress to date, completed deliverables and next steps for each work package.

Work Package 1: Analysis and comparison of inertia measurements from commercial systems

Available data from the real-time commercial inertia measurement systems has been compared with ESO inertia estimations and other power system data to provide an initial plausibility assessment of the commercial products. The behaviour of the inertia monitoring systems during different power system conditions such as high/low wind scenarios and transitions in the level of inertia associated with transmission connected synchronous generation has been analysed. Two interim reviews have been completed with presentations of results to date. The analysis and comparison is ongoing as new measurement data becomes available.

Work Package 2: Assess regional differences in frequency and RoCoF for the GB power system

Using the reduced 36-bus model of the GB power system, simulation studies have been completed to evaluate the extent of regional differences in frequency and rate-of-change-of-frequency (RoCoF) in historical and future scenarios. The results indicate that under transient conditions, short-term (<1 second) differences may occur between frequency and RoCoF in different locations, and differences are significant with respect to measurement accuracy. Furthermore, the sensitivity of local RoCoF to variations in regional inertia has been studied and found to be significant over timescales less than 500 milliseconds based on the simulation outputs. Two interim reviews of results have been held and the final report is being written. Simulation results will be compared with field measurements when available.

Work Package 3: Development of reference framework for inertia measurement verification

A set of use cases and measurement requirements for frequency, RoCoF and inertia has been identified and documented. Based on the use cases, a validation methodology has been drafted. NPL is adapting its measurement methods in accordance with the identified use cases to provide robust reference values for frequency and RoCoF under transient system conditions. The next step is to finalise and collate the above content into a framework for submission to standards development organizations.

Work Package 4: Development of reference instrument for inertia measurement verification

Real-time implementation and testing of the measurement methods from WP3 on NPL's instruments is in progress. A technical specifications document has been drafted. The next step is completion of the algorithm implementation and calibration of instruments against national standards of AC voltage and current.

Work Package 5: Onsite demonstration of inertia measurement verification using NPL reference instruments

Contact has been made with Transmission Owners to arrange installation of NPL's instruments in several network locations. The next step is finalization of specific sites and installation dates.

Required Modifications to the Planned Approach During the Course of the Project

No modifications required to the planned approach.

Lessons Learnt for Future Projects

To date, the planned methodologies have been effective in completing project activities and deliverables. Therefore, there are currently no lessons to report.

Note: The following sections are only required for those projects which have been completed since 1st April 2013, or since the previous Project Progress information was reported.

The Outcomes of the Project

To date, the project has led to the following outcomes:

1. Initial assessment of the plausibility of results from installed inertia measurement systems with respect to existing inertia estimation.
2. Assessment of the extent and effect of regional differences in frequency, its rate of change and inertia in the GB power system. Once validated, the results may be used to plan regional inertia monitoring requirements and optimize local frequency management.
3. Use cases and measurement requirements for frequency, its rate of change and inertia have been documented. This information may be used to review existing and specify new requirements for response times of frequency services.

Data Access

Details on how network or consumption data arising in the course of NIA funded projects can be requested by interested parties, and the terms on which such data will be made available by National Grid can be found in our publicly available “Data sharing policy related to NIC/NIA projects” and www.nationalgrideso.com/innovation.

National Grid Electricity System Operator already publishes much of the data arising from our NIC/NIA/SIF projects on the Smarter Networks Portal (www.smarternetworks.org) and National Grid ESO Data Portal (data.nationalgrideso.com). You may wish to check these websites before making an application under this policy, in case the data which you are seeking has already been published.

Foreground IPR

The following Foreground IPR will be generated from the project:

- Methodology and interim presentation of analysis and comparison of inertia measurement results
- Methodology and presentation of investigation of regional differences in frequency, RoCoF and inertia
- Documented use cases and requirements for frequency, RoCoF and inertia measurement
- Proposed validation method for inertia measurement
- Technical specification for reference measurements