

Non-intrusive and cost-effective method for corrosion measurement

The following problem statement has been developed by the innovation teams within the UK's Gas and Electricity Networks for the 2024 Energy Innovation Basecamp.

Theme: Maximising Existing Use of Infrastructure

Network Areas: Electricity Distribution, Electricity Transmission, Electricity System Operator, Gas Distribution, Gas Transmission (Delete as Appropriate)

What is the problem?

Monitoring through bolt corrosion in concrete structures, gantries, and switchgear requires either physically removing and replacing the bolts or using the Ultrasonic method. Replacing through bolts, even if they are found to be healthy, incurs an additional cost once they are removed. This results in an economic loss as the healthy bolts are unnecessarily replaced. The condition of through bolts in substations cannot be accurately determined through visual inspection alone. Diagnostic testing is necessary, and while ultrasonic field measurements are a practical option, they have proven to be unreliable and time-consuming due to inadequate procedures and calibration standards. Steel bolts supporting insulators and live conductors have been found suffering severe wastage. Additionally, conducting inspections and repairs for through bolt corrosion currently requires electrical outages.

What are we looking for?

Implementing a cost-effective and non-intrusive method to measure and identify corrosion on through bolts in grid substation concrete structures by avoiding unnecessary bolt removal and replacement. This approach improves asset health, reduces labour costs, minimises outages, and enables timely maintenance. Additionally, successful implementation opens possibilities for wider industry adoption, providing an efficient and cost-effective solution for corrosion detection and maintenance.

What are the constraints?

Existing methods –

- Ultrasonic method – ultrasonic transducers: split pin cause multiple reflection, also need to connect to the bolts. (Unreliable, time-consuming due to inadequate procedures and calibration standards issues, reflection is low amplitude)
- Inspections – Currently requires electrical outages.
- Magnetic Induction measurement- Even if it's an external intrusive method, need sensors to install outside Laboratory tests failed to record any repeatable linearity.
- Micro-Ohmmeter measurement - Need to clean carefully using rotary abrasive pad. Insufficient space at each end of the bolt to locate 4 measurement connectors (2 to pass current and 2 to measure voltage)

Who are the key players?

Identifying a non-intrusive method for corrosion inspection would benefit Electricity Distribution, Electricity Transmission, Electricity System Operator, Gas Distribution, Gas Transmission. Corrosion is a significant issue across various industries, leading to economic losses. It would be valuable to explore innovative methods used in other industries, particularly in offshore oil and gas sectors, considering the importance of achieving net-zero goals and the influence of future offshore technologies. Additionally, this problem is specific to NGET, and key stakeholders have shown interest in finding a solution.

- Asset Operations Team
- Health and safety officers
- Maintenance Team
- Electrical Engineers

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- Civil structure engineers
- Substation Engineers

Does this problem statement build on existing or anticipated infrastructure, policy decisions, or previous innovation projects?

Yes, this problem statement builds on existing infrastructure and anticipated policy decisions related to asset management and maintenance practices. It connects to previous innovation projects focused on non-intrusive monitoring and corrosion management. Current dependencies include the need for reliable diagnostic testing methods and compliance with safety regulations. Innovators should reference ongoing initiatives in corrosion monitoring and asset integrity management, as well as relevant industry standards. While solutions like ultrasonic testing have been trialled, their effectiveness has been limited, indicating a need for improved methodologies. Exploring successful case studies in related sectors may also provide valuable insights for new proposals.

What else do you need to know?

To submit a proposal for this problem statement, innovators should understand the challenges of through bolt corrosion, including the economic impact of unnecessary replacements and the limitations of current monitoring methods. They should review relevant literature, familiarize themselves with the network's asset management processes, and identify any technological advancements or funding opportunities. Engaging with key stakeholders will also provide valuable insights to support their proposals.

Innovator submissions to this problem statement will be open [here](#) during March and April, but we encourage you to submit your response as early as possible, as networks will be able to review submissions as soon as they come in.

You can also use the virtual Q&A on the Smarter Networks Portal to ask for more information about this problem statement. Questions may be answered online or at the ENA Problem Statement Launch in March 2024. More information on last year's Basecamp programme can be found [here](#).