

National Grid Electricity NIC 2015 Project Proposal

Project title

Risk Evaluation for Live Environment Circuit Testing (REFLECT)

Project Summary

The proposed project will develop a transmission voltage off-grid Centre based at a substation (up to 400kV) to further develop technologies and to integrate, apply and demonstrate them.

This will support the de-risking and commercialisation of novel primary and secondary components and systems with existing and novel suppliers and vendors. It will also support improvement of our asset management and maintenance practices by allowing us to trial existing and novel automation techniques.

Estimated Project funding

Total Project Cost

£175k to develop full submission

Specific Requirements

A specific piece of new (i.e. unproven in GB) equipment (including control and communications systems and/or software)	X
A specific novel arrangement or application of existing electricity transmission (including control and communications systems software)	X
A specific novel operational practice directly related to the operation of the GB Transportation System	X
A specific novel commercial arrangement	

About the Project

This project and its enduring legacy will deliver value for money for the customer and environmental benefits on an ongoing basis, whilst accelerating the development of a low carbon energy sector.

The proposed project will deliver an off-line substation in a central location for the utilisation of all GB Transmission Owner's and Operator's. The substation will allow the short and long term testing, development and demonstration of new technologies and techniques, whether in terms of primary or secondary assets.

It is envisaged that this substation will become an enduring platform for future testing of substation activities and ultimately a tool to demonstrate innovative projects going forwards. This facility will not only provide shared learning through outputs captured by testing, but the techniques could also be utilised and demonstrated within the facility to assist other parties. It is imagined that the substation would be shared with other parties for their testing, which would save the customer money as there will be no requirement for a duplicate facility, optimising overhead costs and lead times for delivery.

A testbed substation for transmission voltages up to 400kV will allow its Users to have increased control of the environment in which they are working. This will allow assets to be tested to their full potential in a safe environment, without any risk to the system. Testing the assets could entail overstressing them or accelerating the aging of them and could include electrical, thermal and mechanical tests. This arrangement is not only safer for Users as there will be no network fault current, but will increase Users understanding of asset failure mechanisms and predictive failure detection methods, providing greater knowledge about likely 'true' asset life, deterioration speeds and the ability of existing and novel condition monitoring techniques to detect impending failure.

This project will allow new technologies to be delivered in shorter timescales than they are currently delivered as testing will be able to be carried out more efficiently and without causing network constraints. Network constraints can be created through the need to isolate a circuit in order to introduce proven technologies onto the system or reducing the load capability of a circuit due to testing. This will improve lead time from trial into embedding into the system, increasing value to the customer.

New technologies and techniques that reduce environmental impacts will be able to be fully tested in a safe setting, allowing for a quicker delivery on to the actual system. Currently system outages and system events are relied upon for new technologies and techniques to be tested. This can create delays to the rollout of these new practices as outages can be postponed and cancelled owing to system constraints. Equally, system events prolong a rollout, as an event cannot be expedited on a live system, whereas it can on a test system.

As an example a new technique that is currently being examined is a reduction in SF6 usage within substation assets. SF6 is a powerful greenhouse gas (23,000 times greater effect than CO²), and by utilising this new facility we can see the effectiveness of leak repair techniques and find the balance between network constraints, environmental impact and cost to deliver. Currently, in order to test this technique outages have to be planned in advance, and testing is constrained by the time within that outage. By having a facility that is standalone, testing can be conducted without impacting the system, and without being constrained by timescales, multiple outages and network availability. Similarly the SF6 alternative as needs to be thoroughly tested and tried before it is used within a substation. Using novel insulation technologies in the live network can impact the risk of failure, which may impact reliability.

Assets will be able to be tested to and in excess of their full capability in terms of age and ability, and therefore, the results from this testing will be able to be captured and analysed. Once analysed a decision model can be created to confirm whether the lives of assets can be extended. If asset life is extended this will not only deliver environmental benefits but also financial benefits. By having a facility that is standalone not only can multiple systems can be tested in parallel but novel techniques can be adopted earlier, for instance cost-effective refurbishment techniques. Novel low carbon technologies which enable reduced carbon footprint are vital for the development and implementation of a low carbon smarter grid.

The biggest barrier to adoption of new technologies and operating methodologies is the unknown risk in the understanding of these novel methods from solely traditional laboratory testing and the interaction of multiple assets within a single circuit. New materials and techniques will be able to be tested by all Transmission Owner's and Operator's in a safe environment that doesn't currently exist. This is an exciting opportunity as Users will be able to investigate technologies that previously have not been utilised. In order to maintain system reliability currently, new technologies are only investigated when already proven successful. This testbed substation will allow innovative techniques and technologies to be tested, whilst ensuring that the network is not put at risk, prior to be putting onto the live network. Other opportunities through this new facility will be to look at the inter-operability of telecommunications and protection and control systems, whilst also exploring cyber security.