Date of Submission

Apr 2021

Network Innovation Allowance Progress Report

Notes on Completion: Please refer to the appropriate NIA Governance Document to assist in the completion of this form.

Network Licensees must publish the required Project Progress information on the Smarter Networks Portal by 31st July 2014 and each year thereafter. The Network Licensee(s) must publish Project Progress information for each NIA Project that has developed new learning in the preceding relevant year.

Project Progress

Project Title

11kV power electronics providing reactive compensation for voltage control

Project Reference

NIA_SSEPD_0029

Funding Licensee(s)

Scottish Hydro Electric Power Distribution, Southern Electric Power Distribution

Project Start Date

June 2016

Project Duration

3 years and 6 months

Nominated Project Contact(s)

SSEN Future Networks Team

Scope

To show that the new power electronic reactive compensation unit can be deployed across a range of locations and to deal with a range of potential voltage problems.
To show over a period of between 18 months and 2 years of on site operation that the new units reliably improve the voltage profile seen by our customers both in terms of absolute voltage, and the magnitude of apparent voltage changes.
The device will be tested at the Power Networks Demonstration Centre (PNDC) in Cumbernauld. This will ensure that it can operate over the full voltage, and frequency envelope it is designed for. This testing is important as these extreme events are unlikely to occur very often, if at all, on our normal network. However the capability of the electronic reactive compensation unit to operate under these unusual conditions to maintain voltage is very important. The equipment supplier has developed the device and will own all the associated Intellectual Property. Scottish and Southern Energy plc will develop installation methods and the communications required to allow the device to be integrated into our overall voltage control system. All development carried out by SSEPD will be shared with other DNOs

Power quality monitoring will be carried out at each site before and after installation, to ensure that harmonic emissions are within acceptable limits. We will also check that the device does not result in noticeable flicker due to rapid voltage changes.

We will deploy three units on different network types to tackle different problems.

1. A network with a large wind turbine and several smaller wind turbines where there are problems with the voltage rising too high at times of low load and high wind output.
2. A network where the existing voltage control methods, result in a large range of voltages presented to customers. For the particular circuit where a trial unit is to be installed, these are automatic tap changers on 132/33kV transformers, fixed tap 33/11kV transformer, and an 11kV voltage regulator several miles away from the fixed tap transformer. The overall source impedance of the network is so high that step changes in load result in large changes in voltage. The high speed operation of the device should result in smaller apparent voltage changes to customers.
3. A network with a large PV farm and several smaller PV installations where there are potential problems with the voltage rising too high at times of low load and high PV output.

Objectives(s)

1. Determine the operational requirements of the device and the standards that it should be constructed to.
2. Confirm that the device meets the construction standards.
3. Establish a safe connection methodology for both overhead line, and ground mounted variants of the device.
4. Determine, by testing, that the device meets the operational specifications.
5. Install two pole mounted and one ground mounted device on the distribution network.
6. Monitor the effects on the network by comparing voltage profiles from before and after the installation of the devices.
7. Confirm that the device is reliable in service, and across a range of weather conditions, and determine the cost of maintenance.
8. Determine the suitability of the method for business as usual deployment

Success Criteria

This project will be successful if we are able to determine the ability of the devices to maintain the voltage within statutory limits and to reduce apparent step changes in voltage.

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

Objective 1: Determine the operational requirements of the device and standards it should be constructed to
The first network installation site is expected to be on the Isle of Lewis, to replace a failed statcom which provided voltage regulation for a small community-owned wind farm. The rated VAR capacity and response time of the device are sufficient to meet the operational requirements for this application. The second installation is expected to be on Orkney, where voltage regulation has been a long-standing problem and the cost of maintaining alternative reactive compensation devices has proved to be high. The third installation is planned to be in the southern region where solar PV connections have caused voltage issues, and the operational requirements will include sufficient reactive power output with a smaller land footprint than conventional statcoms.
Objective 2: Confirm that the device meets the construction standards
On paper, the device conforms to relevant standards for insulation, electrical performance, control integration and weather resistance. These characteristics will be tested, initially at the Power Networks Demonstration Centre and subsequently in the field.
Objective 3: Establish a safe connection methodology for overhead line and ground mounted variants
A pole structure has been selected for the pole mounted variant, which has been used before for other voltage regulator devices of similar size and weight. An electrical protection scheme is being designed and will be validated at the PNDC through a series of connection and interruption tests.
The further objectives of the project will be addressed once the devices are installed and operational.

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

N/A

Lessons Learnt for Future Projects

N/A

The Outcomes of the Project

N/A

Data Access

N/A

Foreground IPR

N/A