

Network Innovation Allowance Closedown 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 Closedown

Project Title

400kV Synthetic Ester Filled Transformer Pilot Project

Project Reference

NIA_NGET0080

Project Licensee(s)

National Grid Electricity Transmission

Project Start Date

Jul 2013

Project Duration

12 Months

Nominated Project Contact(s)

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Scope

The risk of transformers filled with mineral oil catching fire as a result of failure is mitigated in line with TS 3.1.3, incurring extra costs in the civil engineering design and construction phases.

Synthetic esters such as Midel 7131 pose fewer issues regarding environmental and fire consequences, whilst offering similar insulating performance. Midel 7131 is biodegradable to IEC 61039 and offers a reduced fire hazard compared to mineral oil (Midel has a flash point of 260°C and a fire point of 316°C compared with a flash point of around 150°C and a fire point below 300°C for mineral oil). It has an IEC fire class K3 rating and a well documented fire safety record over 30 years. Therefore the use of Midel may result in reduced civil design and construction costs along with reduced maintenance costs (i.e. fire protection scheme).

Objective(s)

The objective is for this project to give proof of concept on the use of synthetic ester, rather than mineral oil, in a 400kV application. It will deliver a transformer test rig consisting of a representative sample of a full size winding and filled with synthetic ester which will be subject to HV testing in line with National Grid and IEC specifications (specifically Lightning Impulse Test but other tests may be carried out). The scope of the research scheme shall be sufficient to give Alstom whatever confidence it needs to supply National Grid with a standard size 400/132kV 240MVA transformer to the usual specifications on a standard contractual arrangement, subject to the usual procurement exercise, with the normal guarantees and liabilities.

The project will give confidence that synthetic ester can be specified for application in National Grid transformers up to 400kV. In achieving this National Grid will then have an option to deploy a low flammable liquid transformer to sites where this would provide business benefit e.g. remove the requirement for extensive fire protection; enhanced low-fire risk to address planning issues.

Success Criteria

This project is successful if we improve the knowledge around the construction and HV testing of a Transformer rig.

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

The objectives have been met and the project has been successfully completed. A more detailed technical report and slide pack has been written/agreed between the collaboration partners.

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

Whilst project dates moved from the originally envisaged plan, the project completed on time.

Lessons Learnt for Future Projects

Collaboration partners found it helpful to agree the format of their final report before completion of testing – it made the final drafting simpler; provided an opportunity for the team to meet and have detailed discussions pre-testing and so eased the delivery of the final stages of the project.

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

This project was undertaken by National Grid, Alstom Grid and M&I Materials. All three parties were signatories to a Network Innovation Allowance (NIA) funding agreement that established clear project goals. These goals have now been achieved, namely:

- Design and manufacture of a representative 400kV test winding.
- Winding immersed in MIDEL 7131.
- Winding subjected to a typical suite of tests that National Grid would require of its 400kV transformers.

The test rig passed the 1300kV impulse test. A breakdown occurred during the 1425kV impulse level test sequence however the tests have supplied sufficient data to Alstom Grid and it is confident that transformers immersed in MIDEL 7131 can be supplied for 400kV applications.

Key outcomes:

- Alstom Grid will use these test results to review its existing design criteria with respect to Midel use as insulation liquid and to make any necessary adjustments to design margin safety factors in insulation design at 420 kV.
- M&I Materials has empirical evidence of MIDEL 7131 performance in HV application which demonstrates the potential of MIDEL 7131 for use in transmission transformers in the future.
- The project was established to give proof of concept of the use of MIDEL 7131 (a synthetic ester), rather than mineral oil, in a 400kV application. It has done this by delivering a transformer test rig consisting of a representative sample of a full size winding filled with MIDEL 7131 which was subjected to HV testing in line with National Grid and IEC specifications (specifically Lightning Impulse Testing).
- The scope of the project has been sufficient to give the research partners confidence that a standard 400/132kV 240MVA transformer may, in future, be procured/supplied to the usual specifications, on a standard contractual arrangement (subject to the usual procurement exercise), with the normal guarantees and liabilities.

Planned Implementation

A tender process was recently completed and awarded for the supply of three 240MVA, 400/132kV transformers with an option to supply these with an alternative to mineral oil. This contract was awarded under National Grid's usual commercial terms. The final decision on whether these transformers will be Midel filled will be made at an internal governance meeting in late May but it is likely that we will have deployed our first 400kV Midel 7131 filled transformers by 2016.

Other Comments

National Grid acknowledges, with thanks, the efforts of M&I Materials and Alstom Grid in completing this project

