Notes on Completion: Please refer to the appropriate NIA Governance Document to assist in the completion of this form. The full completed submission should not exceed 6 pages in total.

NIA Project Registration and PEA Document

Date of Submission

Aug 2024

Project Reference Number

NIA2_NGET0069

Project Registration

Project Title

Sustainable Drainage Systems (SuDS) for Hydrocarbons

Project Reference Number

NIA2_NGET0069

Project Licensee(s)

National Grid Electricity Transmission

Project Start

September 2024

Project Duration

1 year and 7 months

Nominated Project Contact(s)

Muhammad Shaban

Project Budget

£306,000.00

Summary

National Grid (NG) manages many oil containing assets and oil storage is susceptible to leakages. The use of alternative insulating fluids in transformers has been studied by NG and synthetic esters are now considered where enhanced fire safety and a more environmentally friendly solution is required. NG currently uses Bund Water Control Units (BWCU) and oil separators to capture oil, both of which require maintenance and are less effective to ester and emulsified mixtures. However, the existing oil capturing techniques used for mineral oil are not 100% effective with newer alternatives. This project looks at alternative oil capturing and bioremediation techniques with or without existing oil interceptors, with respect to the potential environmental implications based on typical pollution scenarios at NG sites.

Nominated Contact Email Address(es)

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Problem Being Solved

NG manages numerous assets across its network that contain oil, necessitating maintenance, oil top-ups, and appropriate oil storage measures. Oil storage is susceptible to leakages which can have detrimental effect on the environment and financial implications due to contamination. The use of alternative insulating fluids in transformers has been studied by NG and synthetic esters are now considered where enhanced fire safety and a more environmentally friendly solution is required. NG currently uses Bund Water Control Units (BWCU) and oil separators to capture oil, both of which require maintenance and are less effective to ester and emulsified mixtures.

Some of the pitfalls of the existing oil interceptors include:

- Ineffective against certain types of solutions such as emulsified mixtures of hydrocarbons and detergents. For instance, this is an issue where site maintenance involves washdown of equipment or hardstanding areas which drains to the same network as hydrocarbon runoff.

- Reliance on operations teams actively responding to alarms which indicate the interceptor has failed or become overloaded. Where alarms are not fitted or are malfunctional, failure or overloading is not easy to detect. Incorporation of an interceptor requires a considered network design which makes early warning of maintenance easily observable.
- Introduction of synthetic ester oil has prompted wider discussions regarding the effectiveness of oil interceptors, as synthetic ester has higher specific gravity than traditional mineral oil, theoretically leading to longer settling times or larger settling chambers.
- Automatic closure devices fitted within oil separators may close off prematurely during heavy rainfall events as calibration tolerances are smaller with respect to synthetic ester oil compared to mineral oil.

With respect to use of synthetic ester oil, preliminary testing suggests that BWCU infrastructure is ineffective in distinguishing between synthetic ester oil and water. The higher specific gravity of synthetic ester also theoretically leads to longer settling times within a sump, which the BWCU relies upon to function.

Method(s)

The studies have been split into sections to reflect the scope of works as follows:

Phase 1- Discover & Design: Investigate feasibility of Sustainable Drainage Systems (SuDS) to treat hydrocarbons locally to substations (with or without interception integrated into the treatment chain). This desktop study will explore application of different SuDS, as advocated in national guidance documents and NG's Technical Specification, for their effectiveness in the containment and treatment of different types of oil used on NG sites, including mineral oil, synthetic ester and HVO. This will involve literature review of existing case studies. A criterion will be developed for different sites highlighting benefits of SuDS. Guidance will be provided on selection of SuDS most effective to meet site specific characteristics, including identification of sites likely to gain the most benefits by SuDS implementation.

Phase 2 - Design & Construction: Site specific SuDS appraisal(s), design, and construction of surface water treatment solution. Operational field trials will be undertaken by NG (the sites will be nominated by NG) to assess the effectiveness of SuDS in a substation environment. A site-specific strategy will be developed to determine the management according to the criterion set out in phase 1. The supplier will provide the site strategy and supervision during the design and construction.

Phase 3 – Monitoring and Review: Research institution led monitoring programme.
After completing Phase 2 & 3, a research institute will lead the monitoring programme of which the scope will be developed following completion of Phase 2 based on NG specifications and site requirements. The success of Phase 3 will be measured by the quantity of pollutants that are removed using SuDS and the biodiversity gain. The reduction in time and cost is also another requirement to measure success of the project. The conclusions of this phase of the work will be combined by NG with the findings from Phases 1 and 2 for review by / presentation to the NIA and NG stakeholders. A final NIA Project report will be compiled by the supplier based on the above study Sections 1, 2 and 3 together with the findings of the operational field trials undertaken by NG.

Scope

The Scope for the works covers the following services, divided into three phases:

Phase 1- Discover and Design
• Agree the strategic objectives of the research study and design guidelines. This will include a review of which SuDS best meet these objectives and what solutions are to be carried forward to the development of design guidelines.
• Concurrently, review the typical existing arrangements for surface water drainage and water quality treatment at transmission sites and evaluate the existing pollution loads.
• This phase will involve a literature review, including existing research, guidance, and case studies. The review will focus on the application of SuDS for the treatment of stormwater runoff from surfaces with the potential high levels of hydrocarbons. This will include a particular focus on the potential for different solutions to remove pollutants, long-term performance, and maintenance requirements.
• An assessment of the feasibility of the treatment of HVO and synthetic ester using SuDS, this review will be desk based and is dependent on existing research or studies.
• Criteria will be developed for the selection of sites which could gain the most benefit from implementation of SuDS for treatment of runoff. This considers spatial constraints, discharge location, geology, and hydrology.
• Guidance outlining the process for selection of SuDS will be developed. This will draw on the findings of the literature review and specifically address the strategic objectives and requirements of NG transmission sites.
• SuDS design guidelines will be developed, based on available guidance and best practice.
• Guidance on the typical maintenance requirements for the range of SuDS selected, including the associated indicative costs and timeframes.

Phase 2 – Design and Construction
• The guidance developed will be demonstrated on two NG Sites. These sites will be nominated by NG, following the completion of

Phase 1.
• For each of the selected Grid sites, a site-specific SuDS appraisal will be undertaken to determine the most suitable stormwater management strategy for the site in accordance with the strategic objectives set out in Phase 1 of the work.
• The supplier will provide a site supervision role during construction of the surface water drainage.
• The programme and fee for Phase 2 will be determined following the selection of the NG sites.

Phase 3 – Monitoring and Review
• A research-institution led monitoring programme will be implemented. The scope of this programme is to be developed following the completion of Phase 2 based on the NG specific criteria set out in Phase 1 and specific requirements of the site identified in Phase 2.
• The programme and fee for Phase 3 will be determined following the completion of Phase 2.
Key findings across all deliverables will be presented in a workshop with NGET staff. A discussion on implications of the project, opportunities to focus on will be presented and motivated by the results of the study.

Objective(s)

This project will help us in addressing the optimal whole life cycle criteria with the following objectives:

- Develop understanding on the possibility of implementation of SuDS.
- Understanding of specific assets degradation and risk characteristics.
- Design and construct SuDS in accordance with design principles on NG sites.
- Understand the possibility of biodiversity enhancement as compared to BAU.
- Ensure as a business we are adequately addressing environmental impacts of our proposed activities whilst enabling the transition to Net Zero.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

Financial distributional impact:

This project ensures that NGET and the UK energy industry are at the forefront of global developments in asset management of transmission system research, enabling the industry to make decisions that could reduce the carbon emissions and thus reduce OPEX expenditure and are supported by comprehensive research and experiments. The scale of substation development in terms of installation of oil containing assets is unprecedented and there is a concern that the understanding around ester capturing techniques is not mature enough for future decisions. With the access to the latest research development in SuDS, NGET will be able to manage the assets more efficiently and effectively which could deliver savings. Furthermore, the leveraged funding mechanism ensures that expensive research can be carried out at subsidised rates, thereby ensuring the best value for consumers' money. The project will not restrict benefits delivered to vulnerable consumers based on any vulnerability class.

Technical and wellbeing impact:

There are a range of documented benefits which can be gained from the management of surface water using SuDS. The potential benefits which could be seen through the implementation of the work presented in this research proposal are set out below.

There are four main categories of benefits that can be achieved by SuDS, known as the pillars of SuDS: water quantity, water quality, amenity, and biodiversity. The outcomes from this research will inform and enable the energy industry to take appropriate measures in the best interest of consumers, particularly in the vulnerable category, as the world transitions to a Net Zero future.

Success Criteria

This project will be successful if project provides the insights to the following measures from all three phases.

Measures of success for Phase 1:
- The ability to identify suitable NG sites for the implementation of SuDS.
- The number of SuDS identified which could theoretically mitigate pollution loading experienced at NG sites.
- The number of SuDS identified which could theoretically deliver the range of benefits identified during phase 1 as in line with NG strategic objectives.

Measures of success for Phase 2 (subject to change following the completion of phase 1):
- The completed design and construction of SuDS on NG sites.
- The adherence of the design with the principles and aims set out in phase 1 of the works.

Measures of success for Phase 3 (subject to change following the completion of phases 1 and 2):

- The removal of pollutants achieved compared to Business-As-Usual (BAU) arrangement, this can be tested for a range of parameters including
    - The increase in biodiversity/amenity value compared to BAU arrangement.
    - The reduction in time and cost required for maintenance required compared to BAU arrangement.
    - The change in time and cost required for installation required compared to BAU arrangement.

Project Partners and External Funding

The following project partners will be supporting the project:

- Arup will provide experience and expertise relating to feasibility, design, and construction of SuDS.
- NGET is providing all the funding for the project and is the lead project partner.
- A research institution will lead a monitoring programme, of which the institution will be nominated as project requirements develop.

Potential for New Learning

There is very limited amount of work being done in this area and especially the existing one focus on theoretical research. This work will provide the basis of our understanding of the capabilities of SuDS technology and its associated impact. The work will be valuable resource for NG and have immediate application in subsequent projects in development. The sustainability opportunities register will be used to seek our new ideas and areas of focus; these will help shape conversations with future suppliers.

In addition to potential for new learning outlined above, promotion of SuDS for substation sites will aid in facilitating compliance with legislative requirements and best practice guidance, more specifically:

- National Planning Policy Framework clause 175.
- Town and Country Planning Act 1990 requirements for delivering 10% bio-net gain (introduced 12/02/24).
- Schedule 3 of the Flood and Water Management Act, already in place in Wales and due to be implemented in England.
- Demonstrating pollution hazard indices for NG sites (reference CIRIA C753 Table 26.2 footnote 2) & conforming with best practice outlined in SEPA WAT-RM-08 (referenced in CIRIA C753 Table 26.3 footnote 6).

New learning will be shared and implemented via amendment to the existing Civils Technical Specification, TS 2.10.09 - Site Drainage.

Scale of Project

The first phase of the project will be delivered via desktop research with no site visits required. Any workshops or meetings will be via Microsoft Teams and these meetings are dependent on the availability of Arup and NG staff. In second and third phase of the study, some site visits will be arranged by NGET staff and Arup staff will visit depending on the availability of sites.

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL7 Inactive Commissioning

Geographical Area

Desktop studies will be performed remotely by Arup at various geographical locations. Two sites will be selected at the end of the study for design and construction phase.

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

£ 275,400

Project Eligibility Assessment Part 1

There are slightly differing requirements for RIIO-1 and RIIO-2 NIA projects. This is noted in each case, with the requirement numbers listed for both where they differ (shown as RIIO-2 / RIIO-1).

Requirement 1

Facilitate the energy system transition and/or benefit consumers in vulnerable situations (Please complete sections 3.1.1 and 3.1.2 for RIIO-2 projects only)

Please answer **at least one** of the following:

How the Project has the potential to facilitate the energy system transition:

The project facilitates energy system transition by helping NGET to understand the environmental impact, in terms of hydrocarbon pollution, associated with the oil used in our assets. Project will conduct a research study and develop understanding of various SuDS and will identify several clear opportunities for future focus to assist in commitments to reduce scope 3 emissions. We will be able to promote a consistent approach by sharing the data with other TOs (SPEN, SSEN) benefitting the customers with concise emissions calculations and clear reporting on emissions.

How the Project has potential to benefit consumer in vulnerable situations:

Developing an understanding regarding SuDS for hydrocarbons to reduce the negative impact of oil leakages. Better capturing techniques enhances environmental safety and contribute to biodiversity gain.

Requirement 2 / 2b

Has the potential to deliver net benefits to consumers

Project must have the potential to deliver a Solution that delivers a net benefit to consumers of the Gas Transporter and/or Electricity Transmission or Electricity Distribution licensee, as the context requires. This could include delivering a Solution at a lower cost than the most efficient Method currently in use on the GB Gas Transportation System, the Gas Transporter's and/or Electricity Transmission or Electricity Distribution licensee's network, or wider benefits, such as social or environmental.

Please provide an estimate of the saving if the Problem is solved (RIIO-1 projects only)

N/A

Please provide a calculation of the expected benefits the Solution

Not required. Feasibility study with starting TRL 3.

Please provide an estimate of how replicable the Method is across GB

Due to all TOs and DNOs using oil containing assets, new guidelines on SuDS will impact all other networks. All networks will be keen to learn about the findings and the main outcome of the project will be updates in the Civil Technical Specification relating to Site Drainage.

Please provide an outline of the costs of rolling out the Method across GB.

N/A

Requirement 3 / 1

Involve Research, Development or Demonstration

A RIIO-1 NIA Project must have the potential to have a Direct Impact on a Network Licensee's network or the operations of the System Operator and involve the Research, Development, or Demonstration of at least one of the following (please tick which applies):

☐ A specific piece of new (i.e. unproven in GB, or where a method has been trialled outside GB the Network Licensee must justify repeating it as part of a project) equipment (including control and communications system software).

☐ A specific novel arrangement or application of existing licensee equipment (including control and/or communications systems and/or software)

☐ A specific novel operational practice directly related to the operation of the Network Licensees system

☐ A specific novel commercial arrangement

RIIO-2 Projects

☐ A specific piece of new equipment (including monitoring, control and communications systems and software)

☐ A specific piece of new technology (including analysis and modelling systems or software), in relation to which the Method is unproven

☐ A new methodology (including the identification of specific new procedures or techniques used to identify, select, process, and analyse information)

☐ A specific novel arrangement or application of existing gas transportation, electricity transmission or electricity distribution equipment, technology or methodology

☑ A specific novel operational practice directly related to the operation of the GB Gas Transportation System, electricity transmission or electricity distribution

☐ A specific novel commercial arrangement

Specific Requirements 4 / 2a

Please explain how the learning that will be generated could be used by the relevant Network Licensees

This research proposal has the potential to influencing change to the NG 'Business as Usual' as well as other networks using oil containing assets.

Or, please describe what specific challenge identified in the Network Licensee's innovation strategy that is being addressed by the project (RIIO-1 only)

N/A

Is the default IPR position being applied?

☑ Yes

Project Eligibility Assessment Part 2

Not lead to unnecessary duplication

A Project must not lead to unnecessary duplication of any other Project, including but not limited to IFI, LCNF, NIA, NIC or SIF projects already registered, being carried out or completed.

Please demonstrate below that no unnecessary duplication will occur as a result of the Project.

There is no overlapping between this work and any other study. There are no other projects in development looking at SuDS or other options for capture oil leaks. The risk of duplication will be addressed through dissemination of progress with other licensees and being open to co-operate with licensees working in this space

If applicable, justify why you are undertaking a Project similar to those being carried out by any other Network Licensees.

N/A

Additional Governance And Document Upload

Please identify why the project is innovative and has not been tried before

There are currently no NIA/SIF projects looking at the SuDS with potential trials within the UK. There are significant knowledge gaps around the SuDS in energy sectors for hydrocarbon treatment due to reliance on existing oil interceptor technology, however, we need to develop our understanding in alternative oil capturing options due to potential change of mineral oil to ester. As a responsible business, NG need to cover the knowledge gap to address the issue and manage the expectation to meet the commitments of reducing the scope 3 emissions and obtain 10% biodiversity gain. There is no overlap between this work focusing on SuDS and the work currently under way in different trials and studies.

Relevant Foreground IPR

The foreground IPR will be the knowledge gained about the SuDS effectiveness for hydrocarbons. The learning will be brought together in a structured report followed by a design, construction, and monitoring process to form part of the foreground IPR.

Data Access Details

Data for this project and all other projects funded under the Network Innovation Allowance (NIA), Network Innovation Competition (NIC) or the new Strategic Innovation Fund (SIF) can be found or requested in a number of ways:

- A request for information via the Smarter Networks Portal at https://smarter.energynetworks.org, to contact select a project and click 'Contact Lead Network'. National Grid already publishes much of the data arising from our innovation projects here so you may wish to check this website before making an application.
- Via our Innovation website at https://www.nationalgrid.com/uk/electricity-transmission/innovation
- Via our managed mailbox box.NG.ETInnovation@nationalgrid.com

Please identify why the Network Licensees will not fund the project as apart of it's business and usual activities

The nature of a research programme means it inherently carries a risk that the research may be unsuccessful and/or identify unforeseen barriers to implementation and NG is unable to consider research of this scale as business-as-usual. The NIA funding offers the most appropriate route for NGET to design experiments, review existing techniques, and perform well designs experiments on certain species. As relatively little is known about the technology and its low TRL level, this justifies the use of NIA.

Please identify why the project can only be undertaken with the support of the NIA, including reference to the specific risks(e.g. commercial, technical, operational or regulatory) associated with the project

The technology is a low TRL level and there is currently little information available without carrying out a proper feasibility study. The work has not been undertaken elsewhere before and the results could have significant impact on business planning. The results will benefit other energy networks making NIA the most appropriate route.

This project has been approved by a senior member of staff

☑ Yes