

NIA Project Registration and PEA Document

Date of Submission

Jul 2026

Project Reference Number

NIA3_NGET0013

Project Registration

Project Title

Horse mussel Ecosystem Restoration for Offshore infrastructure - HERO

Project Reference Number

NIA3_NGET0013

Project Licensee(s)

National Grid Electricity Transmission

Project Start

July 2026

Project Duration

1 year and 1 month

Nominated Project Contact(s)

box.ng.etinnovation@nationalgrid.com

Project Budget

£316,167.00

Summary

The marine environment is in decline, with only 19% of England's estuaries and 45% of coastal waters achieving good ecological status, alongside significant losses of habitats such as oyster reefs, seagrass beds and horse mussel beds. As National Grid expands its offshore electricity transmission network, understanding and mitigating the impacts of subsea cable infrastructure on marine ecosystems is increasingly important.

To address this, National Grid proposes a one-year feasibility study to assess whether restoring horse mussel beds could provide a viable nature-based solution to compensate for impacts associated with offshore cable routes. As a promising but unproven approach in the UK, the project will evaluate practical and scalable restoration methods that support biodiversity recovery, meet environmental obligations and align with emerging marine policy. The study aims to enable sustainable offshore network expansion while enhancing marine ecosystem resilience.

Third Party Collaborators

Bangor University

Nominated Contact Email Address(es)

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Problem Being Solved

Our marine environment is in a poor state, with increasing recognition of the need for urgent action to reverse continued biodiversity decline. Just 19% of England's estuaries and 45% of coastal waterbodies achieve good ecological status, reflecting the overall health

of the inshore marine environment. Additionally, the UK has lost significant areas of vital marine habitats over the last 150 years, including 95% of oyster reefs, up to 90% of seagrass beds, and a most of the horse mussel beds in England.

Marine biodiversity and its recovery are therefore a critical priority for National Grid as it significantly expands offshore electricity transmission infrastructure over the next five years, including reinforcement between Scotland and England/Wales. This expansion will increase the company's long-term interaction with, and impact on, the marine environment. In response, National Grid's RII0-T3 plan includes a clear commitment (B4.8) to deliver marine restoration across its projects.

Offshore cable infrastructure contributes to seabed disturbance, through the impact of rock protection and crossings causing habitat loss. Additional impacts arise from Distribution cables, NGV interconnectors, and future projects identified in the tCNSP / tCSNP2 refresh.

Regulatory and policy requirements further reinforce the need for action. National Grid has a statutory obligation under the Electricity Act to mitigate against biodiversity loss, alongside policy drivers encouraging marine restoration through the National Policy Statements (NPS EN-1) and Marine Plans. Emerging legislation including Marine Net Gain (England) and Marine Net Benefit (Wales) is expected within the next five years, that may require restoration equivalent to project footprints plus at least 10%.

There are also specific obligations relating to impacts on protected sites. Several projects (e.g. EGL1, EGL4, EGL5, and future developments) intersect with marine protected areas, requiring compensation for adverse effects. As part of the Development Consent Order (DCO) process, National Grid must present viable compensation options to regulators. Restoration of horse mussel beds has been repeatedly identified by consultants as a leading option.

However, horse mussel restoration has never been undertaken in the UK, creating a significant barrier to its adoption due to uncertainty and risk of failure. To enable this approach as a credible solution for both statutory compensation and voluntary biodiversity enhancement (including opportunities linked to cable protection), there is a need to establish feasibility. This includes trialling hatchery techniques and developing scalable methods for restoring horse mussel beds with sufficient confidence to support implementation at the scale required for offshore projects.

Method(s)

A literature review will be undertaken to collate existing knowledge on the reproductive biology, larval development and behavioural ecology of *M. modiolus*. This review will also include documented hatchery and culture techniques for *M. modiolus* and closely related species such as *M. barbatus* and *M. capax* to inform the experimental design of the proposed *M. modiolus* culture approach.

The hatchery equipment required for the conditioning, spawning and settlement of *M. modiolus* will be established within the School of Ocean Sciences shellfish research hatchery.

M. modiolus broodstock will be ethically and legally sourced in consultation with relevant regulatory authorities including the Environment and Fisheries Advisory Service (EFAS), Natural Resources Wales (NRW), and Natural England. All collection, transport and holding procedures will conform to biosecurity and movement regulations.

Following acquisition, broodstock will undergo an initial domestication phase within the hatchery to acclimate individuals to controlled conditions. Spawning trials will then be conducted with conditioned adults. Where spawning is successful, subsequent larval rearing and settlement trials will be undertaken to identify optimal conditions.

The seasonality of *M. modiolus* will be taken into consideration to obtain the best results. As with many other long-lived bivalve molluscs, *M. modiolus* is known to release gametes throughout the year with peak spawning in spring and summer (March to September). By commencing the project in the summer of 2026 this has the advantage of incorporating two peak spawning periods into the project timescale, reducing the inherent risks associated with working with a species that is known to be challenging to culture, with limited information on the culture of this species available. In essence, this provides at least two attempts in the 12-month project period to successfully culture this species, potentially enabling some refinement of early findings.

Scope

The aim of this study is to assess the feasibility of Horse Mussel (*Modiolus modiolus*) production in a hatchery setting for potential future restoration and biodiversity enhancement. Research activity will include all aspects of hatchery production such as broodstock conditioning and spawning, and subsequent larval rearing and settlement, through a series of rigorous hatchery-based experiments. The project will assess the potential for the mass hatchery production of *M. modiolus* to support UK wide restoration and biodiversity enhancement efforts over the longer term.

The key deliverables of this project are:

Literature review of reproductive and larval biology and behaviour as well as any published culture techniques for *M. modiolus* as well as closely related species.

Report on *M. modiolus* hatchery culture and potential for scale.

Scale-up strategy and roadmap to BAU deployment.

Objective(s)

The goal of this project is to determine if horse mussel restoration is a viable option for compensating for adverse impacts from cable routes on marine protected areas and for voluntary marine restoration. On completion of this project NGET & the team will be able to determine whether large-scale hatchery production is achievable and will be able to determine the requirements to scale-up and apply the developed technique.

Consumer Vulnerability Impact Assessment

This project is not specifically targeted at consumers in vulnerable situations. However, it has the potential to deliver indirect benefits by supporting the efficient and sustainable expansion of offshore electricity infrastructure required for the energy transition. By assessing the feasibility of horse mussel restoration as a viable compensation measure for future offshore projects, the project could help reduce consenting delays, compliance costs, regulatory risk and help develop offshore infrastructure more efficiently. In the longer term, this could help lower project delivery and compliance costs, protecting consumer value. These outcomes have the potential to support an energy system that benefits all consumers, including those in vulnerable situations.

Success Criteria

The project will be considered successful if the following is achieved:

Completion of a literature review of reproductive and larval biology and behaviour as well as any published culture techniques for *M. modiolus* and closely related species.

Establishment of experimental-scale culture system for *M. modiolus*

Successful sourcing and introduction of *M. modiolus* to the BU research hatchery

Maintenance of *M. modiolus* in the research hatchery with minimal losses and subsequent spawning of viable larva

Completion of controlled spawning of *M. modiolus* resulting in the production of viable larvae

Completion of trials that lead to the successful rearing of larvae through to the settlement stage

Successful settlement of *M. modiolus* larvae

Completion of a hatchery report

NGET scale-up strategy and roadmap to BAU deployment

NGET Offshore, project teams and regulatory roll-out stakeholder engagements

Development of BAU monitoring frameworks, maintenance and associated training requirements

Project Partners and External Funding

Bangor University will be the academic partner.

Potential for New Learning

Restoration approaches for horse mussel (*Modiolus modiolus*) have not previously been trialled at scale, and the techniques explored in this project will generate new learning. The findings will be relevant to other Transmission Owners (TOs), particularly as similar restoration initiatives could be undertaken in Scottish waters. In addition, there is likely to be wider interest from other marine developers, such as offshore wind farm operators, who may be required to implement habitat restoration as part of their offshore project mitigation measures.

Scale of Project

The project is a 12-month assessment designed to determine the feasibility of horse mussel (*Modiolus modiolus*) production in a hatchery setting, with the aim of supporting future restoration and biodiversity enhancement. The study will be laboratory-based, focusing on evaluating the effectiveness of the approach and developing and optimising conditions for *M. modiolus* conditioning and spawning.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL4 Bench Scale Research

Geographical Area

M. modiolus broodstock will be sourced from shores of which the location will be dependent on project timings. The work will be carried out in laboratories and facilities within the School of Ocean Sciences shellfish research hatchery.

Revenue Allowed for the RII Settlement

None

Indicative Total NIA Project Expenditure

£284,550

Project Eligibility Assessment Part 1

Requirement 1

Facilitate the energy system transition and/or benefit consumers in vulnerable situations

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

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

As National Grid develops new subsea cable routes and associated infrastructure, environmental constraints, including impacts on sensitive habitats and Marine Protected Areas (MPAs), present a key barrier to consent and delivery. By advancing scientifically robust and scalable restoration techniques for horse mussel (*Modiolus modiolus*) beds, a priority habitat known to enhance biodiversity, improve ecosystem resilience, and support nutrient cycling, this project helps address these constraints.

Horse mussel reefs are recognised as an OSPAR threatened and declining habitat, and play a critical role in supporting diverse marine communities and enhancing local productivity. Their restoration has the potential to offset ecological impacts from offshore infrastructure, thereby supporting compliance with UK marine policy frameworks such as the Environment Act 2021, Marine Strategy Regulations, and Biodiversity Net Gain principles in marine contexts.

The project is strongly aligned with the UK Government's emerging Marine Net Gain (MNG) policy, which seeks to ensure that marine development leaves the environment in a measurably better state. The consultation outcomes emphasise that MNG should adopt a whole-ecosystem approach, assessing impacts on both habitats and species, and delivering measurable biodiversity enhancement outcomes. Horse mussel beds are a priority habitat that supports high biodiversity and ecosystem functioning; therefore, their restoration directly contributes to delivering these MNG principles. By generating the scientific evidence required to restore such habitats, the project enables National Grid to move beyond mitigation toward demonstrable biodiversity gain, which is expected to become a requirement for offshore developments.

The project also directly supports compliance with the UK marine licensing regime. Offshore transmission infrastructure requires consent through the Marine Management Organisation (MMO), which assesses applications against the Marine Policy Statement, environmental protection requirements, and relevant impact assessments (e.g. EIA, Habitats Regulations, Water Framework Directive). Demonstrating robust, evidence-based mitigation and compensation strategies such as the restoration approaches being developed in this project is critical to securing marine licences and reducing delays. The MMO also applies the precautionary principle where scientific uncertainty exists, meaning that the current lack of proven restoration techniques for horse mussel beds could otherwise act as a constraint on consenting. By closing this evidence gap, the project reduces uncertainty and regulatory risk, facilitating smoother and faster approval of offshore projects.

Ultimately, the project underpins the delivery of a resilient, low-carbon energy system by ensuring that the physical infrastructure required for renewable energy expansion can be deployed at scale while safeguarding and enhancing marine ecosystems.

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

n/a

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

n/a

Please provide a calculation and/or description of the expected benefits of the solution

A CBA has not been carried out as the project is at a low level TRL (2). The project focuses on early-stage horse mussel restoration approaches to proactively deliver biodiversity compensation measures. The project directly addresses increasing regulatory and environmental pressures associated with offshore development. Marine licensing requirements are becoming more stringent, with

developers expected to provide robust environmental evidence and effective mitigation or compensation strategies to avoid biodiversity loss and comply with evolving marine policy.

As these restoration approaches have not yet been trialled at scale, the project represents a significant opportunity for innovation and industry learning. It has the potential to establish a viable and repeatable compensation mechanism for future offshore projects.

The project has the potential to generate wider socio-economic benefits, particularly in coastal communities affected by offshore infrastructure development. By exploring the feasibility of hatchery-based production and large-scale restoration, it could support the development of new aquaculture and marine restoration which will inform the development of long-term onshore aquaculture facilities and offshore marine recovery zones funded through our Offshore portfolio.

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

Horse mussel habitats are found widely across (and are declining in) waters in all four UK nations, so the approach could be used in multiple regions. Once proven, the restoration and hatchery methods can be reused by other Network Licensees. This approach can be applied to different offshore projects, including transmission, interconnectors, and wind farms, meaning the overall potential for replication across GB is high.

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

As this is novel research project, it is difficult to estimate the costs of rolling out the approach to the UK. There would be significant further studies required that would enable to delivery of restoration at scale. We have estimated that this would cost £3M to develop this.

We have assumed that once a final method (including follow up studies trialling horse mussel restoration in situ) is developed that costs will be equivalent to the upper end of costs to restore UK subtidal native oyster beds; estimated at £200,000 per hectare.

Horse mussel restoration could be an option to any subsea cable project that has a requirement to offset its permanent seabed impacts through marine restoration, including offshore wind array and export cables, intra-GB interconnectors, and international interconnectors. There may be additional application for renewables and oil and gas infrastructure.

Based on the current cable projects identified in the NOA 2021-22 Refresh, tCSNP and tCSNP2, we estimate that in GB, there could be in the region of 800+ hectares of seabed restoration required to offset proposed subsea cable impacts and deliver a marine net gain (should it be legislated), as well as intertidal requirements at landfall sites.

Horse mussel restoration would be delivered in cooler, deeper waters off Scotland, northern England and north Wales. An estimated 20 ha of restoration would cost £4M.

Requirement 3 / 1

Involve Research, Development or Demonstration

Projects 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

Involve Research, Development or Demonstration - Please select all that apply

- ☐ 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

The learning generated from this project would be highly valuable to Network Licensees (including other Transmission Owners) by providing a proven, practical approach to managing environmental impacts from offshore infrastructure. The outputs from this study such as hatchery techniques, survival rates, and restoration methods will give other Network Licensees a clear, evidence-based solution they can adopt or adapt for their own projects.

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. Networks must explicitly mention similar projects that they have considered and how these differ.

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

Horse mussel restoration has not previously been undertaken in the UK at large scale, and therefore this project does not duplicate existing work. While related early research has been carried out in Denmark to develop restoration methods for European flat oysters and horse mussels, the environmental conditions of UK marine ecosystems differ substantially. Hence there is a need to identify suitable UK-specific approaches for scalable horse mussel production and deployment under these distinct conditions.

In the wider marine restoration context, innovation activity such as the SIF Alpha AMPERES project (submitted under SIF C5) focuses on the automation of seagrass restoration.

A search on the Smarts Networks portal has not identified similar projects. Therefore, we conclude that this project represents novel work within the UK and will not result in unnecessary duplication.

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

Not Applicable.

Additional Governance And Document Upload

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

A promising but currently unproven solution is the restoration of horse mussel beds, identified as a potential environmental compensation measure for offshore infrastructure impacts. However, this approach is highly innovative in the UK context, as horse mussel restoration at scale has not previously been undertaken or demonstrated. This project is at a low TRL as further feasibility studies need to be conducted, specifically whether horse mussel beds can be successfully restored in UK waters and how such approaches could be scaled.

This project will also build knowledge on the reproductive and larval biology of Horse mussel and culture techniques of *Modiolus modiolus* as there is currently limited existing research and no precedent for applying techniques in the UK.

Relevant Foreground IPR

Background IPR relevant to this project is all the know-how associated with the production of multiple bivalve species accumulated over the last 20 years, as well as other marine organisms. In terms of bivalves this includes the Native Oyster *Ostrea edulis*, as well as the mussels *Mytilus edulis* and *M. galloprovincialis* and the Scallop *Pecten maximus*, all of which have been the focus of extensive

research and several grants (European Maritime and Fisheries Fund to develop native oyster hatchery, European Funded REPROSEED and BLUESEED projects). The related background IPR includes culture and life support systems required for all hatchery activities, as well as the associated methodologies, protocols, animal husbandry techniques, and technical know-how developed as part of the research.

Foreground IPR relevant to this project will include all adaptations, refinements, methodologies and technical know-how that are specifically developed during the HERO project in order to produce the reef forming horse mussel, *Modiolus modiolus*. This includes system requirements, protocols, and animal husbandry techniques.

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 a part of it's business and usual activities

This project supports the energy transition by enabling National Grid to expand offshore infrastructure required for renewable energy generation while minimising environmental impacts. It does so by exploring marine restoration techniques that could facilitate sustainable network development alongside biodiversity enhancement. However, the restoration of horse mussel beds at scale remains unproven in the UK and presents significant technical and environmental uncertainty. The feasibility of this approach is currently unknown, and it requires exploratory research, trials, and evidence gathering to determine whether it can be successfully implemented under UK marine conditions. Given this uncertainty, the project cannot be progressed as a business-as-usual activity. Without NIA funding, this work would not be undertaken, as there is currently no commercial or operational case for investing in an unproven solution. In addition, innovation funding cannot be recovered as CAPEX from consumers through our RIIIO-T3 business without first determining the feasibility of this approach. The NIA mechanism is therefore essential to enable this early-stage investigation and to de-risk the potential application of marine restoration techniques for future network development. This aligns with our commitment to protecting consumers' interests and ensure that, where viable, cost-efficient solutions are adopted into BAU practices.

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

This project can only be funded with the support of the NIA due to the significant technical and commercial risks associated with the development of horse mussel restoration approaches, which require further research and validation.

The primary technical risk relates to hatchery production of horse mussels (*Modiolus modiolus*). There is a high level of uncertainty as to whether broodstock will successfully spawn and produce viable eggs, whether larvae will survive through development, and whether sufficient numbers will reach successful settlement. These risks are compounded by the limited availability of published scientific research and established methodologies for this species, particularly within UK marine conditions.

While a potential value case has been identified, the benefits remain uncertain and cannot currently justify the level of investment required under business-as-usual funding. Without NIA funding, the business would not be able to justify investment in this promising but unproven solution, and as a result, the opportunity to explore and potentially realise the associated environmental benefits would not be pursued. The NIA framework is therefore critical to enable this exploratory work and to de-risk future application at National Grid as well as other TOs and developers such as wind farm companies.

This project has been approved by a senior member of staff

☒ Yes