Scottish & Southern Electricity Networks
TRANSMISSION

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

Oct 2026

Project Reference Number

NIA_SHET_0068

Project Registration

Project Title

STRATOS (Strategic Transition Analysis & Testing of Operational Systems) Phase 1

Project Reference Number

NIA_SHET_0068

Project Licensee(s)

Scottish and Southern Electricity Networks Transmission

Project Start

September 2026

Project Duration

0 years and 4 months

Nominated Project Contact(s)

transmissioninnovation@sse.com

Project Budget

£165,000.00

Summary

STRATOS Phase 1 is exploring whether advanced simulation techniques, including Agent-Based Modelling, can improve strategic network planning and investment decisions under uncertainty.

The project will identify priority planning challenges suitable for simulation, assess the feasibility of agent-based approaches, define data requirements, identify opportunities to leverage datasets and interfaces, and develop a specification and business case for a Phase 2 demonstrator project. The project will be delivered jointly by SSEN Transmission, Olsights, Smith School of Enterprise and the Environment (University of Oxford), and MapStand.

The project will not develop an operational simulation model. It will deliver problem definition, feasibility assessment, data assessment, 'flight simulator' architecture and user experience concepts, demonstrator specification and Phase 2 business case, allowing SSEN-T to make an informed decision on the need for future work.

Preceding Projects

NIA_SHET_0052 - Rapid Evaluation Areal Connection Tool (REACT)

Third Party Collaborators

Olsights

MapStand

Smith School of Enterprise and the Environment (University of Oxford)

Nominated Contact Email Address(es)

transmissioninnovation@sse.com

Problem Being Solved

Current network planning approaches rely heavily on static scenarios and deterministic analysis. These approaches are less suited to assessing how changes in markets, policy, technology and infrastructure interact over time. There is limited capability to explore these interdependencies interactively or test how different assumptions could lead to different system and network outcomes. STRATOS will investigate whether simulation techniques can improve understanding of future electricity system evolution and associated network planning requirements.

Method(s)

STRATOS will investigate whether advanced simulation techniques, including Agent-Based Modelling (ABM), can improve strategic network planning and investment decision-making under uncertainty.

The project will adopt a structured discovery and feasibility assessment approach to understand the planning challenges currently faced by networks and assess whether simulation-based methods could provide additional decision-support capability beyond existing planning approaches.

The project will:

1. Engage with key stakeholders to understand strategic network planning decisions and identify areas where uncertainty, behaviour and market dynamics present challenges to current planning approaches.
2. Assess the suitability of Agent-Based Modelling and related simulation techniques for representing the interactions between policy, markets, technology deployment and network development.
3. Review available data sources, identify critical data requirements and assess opportunities to utilise existing datasets and interfaces.
4. Investigate candidate modelling frameworks, validation approaches and methods for representing behavioural and market-driven decision-making.
5. Develop concepts for visualising simulation outputs through interactive user interfaces and assess how these could be integrated with existing innovation platforms such as REACT.
6. Define a potential future demonstrator architecture and produce a fully scoped Phase 2 proposal, including recommendations on feasibility, implementation approach and future development requirements.

The project will utilise stakeholder workshops, problem definition activities, modelling assessments, data assessments and concept development exercises to establish whether simulation-based approaches can provide meaningful insight into future electricity system evolution and associated network planning requirements.

Data Quality Statement (DQS):

The project will be delivered under the NIA framework in line with OFGEM, ENA and SSEN Transmission internal policy. Data produced as part of this project will be subject to quality assurance to ensure that the information produced with each deliverable is accurate to the best of our knowledge and sources of information are appropriately documented. All deliverables and project outputs will be stored on our internal SharePoint platform ensuring access control, backup, and version management. Deliverables will be shared with other network licensees through the closedown report on the Smarter Networks Portal.

Measurement Quality Statement (MQS):

The methodology used in this project will be subject to supplier's own quality assurance regime. Quality assurance processes and the source of data, measurement processes and equipment as well as data processing will be clearly documented and verifiable. The measurements, designs and economic assessments will also be clearly documented in the relevant deliverables and final project report and will be made available for review.

In line with ENA's ENIP document, the cumulative risk score is scored as 6 = LOW from the sum of the risk thresholds below:

TRL Steps – 2 TRL Steps – Medium (Score 1)
Cost – <£1m – Low (Score 1)
Number of suppliers – 3 – Low (Score 2)
Data – Assumptions known but will be defined within project – Medium (Score 2).

Scope

STRATOS is limited to assessing the feasibility and potential value of simulation-based approaches for strategic network planning.

The project will not develop or deploy an operational simulation tool during this phase. Instead, it will focus on understanding the problem space, assessing technical feasibility and defining the requirements for a potential follow-on demonstrator project.

The scope includes:

- Identification and prioritisation of strategic planning challenges that may benefit from simulation-based analysis.
- Investigation of how uncertainty, stakeholder behaviour, market incentives, policy interventions and technology deployment decisions influence transmission network requirements.
- Assessment of Agent-Based Modelling and other relevant simulation techniques.
- Review of available datasets and identification of critical data gaps and dependencies.
- Assessment of opportunities to leverage and extend outputs from the REACT project.
- Development of conceptual technical architecture and user experience designs for a future simulation environment.
- Definition of validation approaches and methods for assessing the credibility of future simulation outputs.
- Preparation of a demonstrator specification, implementation roadmap and business case for a potential Phase 2 project.

The project is intended to provide sufficient evidence for Network Licensees to make an informed decision regarding future investment in simulation-based planning capabilities. Project outputs will include a problem definition, feasibility assessment, data assessment, simulation architecture concepts, visualisation concepts, demonstrator specification and Phase 2 recommendation.

The planned delivery programme comprises:

- Month 1: Discovery workshops, stakeholder engagement and problem definition.
- Month 2: Modelling assessment, data assessment and review of REACT integration opportunities.
- Months 3 and 4: Prototype definition, Phase 2 planning and final recommendations.

Objective(s)

The objectives of STRATOS are to:

1. Understand the strategic network planning decisions currently facing networks and identify the areas where uncertainty, stakeholder behaviour and market dynamics present challenges to existing planning approaches.
2. Assess whether Agent-Based Modelling (ABM) and related simulation techniques could provide additional insight into future electricity system evolution and associated network planning requirements.
3. Identify and evaluate priority planning use cases that may be suitable for simulation-based analysis, including challenges associated with future generation deployment.
4. Assess available datasets, identify critical data requirements and determine the suitability of existing data sources to support future simulation and visualisation capabilities.
5. Investigate opportunities to leverage and extend outputs, datasets and interfaces developed through the REACT project.
6. Assess potential approaches for representing interactions between policy, market signals, stakeholder decisions, technology deployment and network investment requirements within a future simulation environment.
7. Define and assess potential validation approaches capable of providing confidence in future simulation outputs and decision-support capability.
8. Develop a conceptual technical architecture, user experience concepts and implementation roadmap for a future simulation demonstrator.
9. Produce a fully scoped Phase 2 proposal, including recommendations regarding technical feasibility, implementation approach, delivery requirements and future investment decisions.

Consumer Vulnerability Impact Assessment

An assessment of distributional impacts (technical, financial, and wellbeing related) for this project has been carried out using a bespoke assessment tool, which assesses the project as having a positive, negative, or neutral effect on consumers in vulnerable situations. To help inform the assessment, this tool considers the categories of consumers identified in the Priority Services Register. This project has been assessed as having a neutral impact. It does not have any effect on customers in vulnerable situations because it is a Transmission project.

Success Criteria

The STRATOS project will be considered successful if it delivers sufficient evidence for networks to make an informed decision regarding the development of a future simulation-based planning capability.

Success will be demonstrated through delivery of the following outputs:

1. **Strategic Planning Challenge Assessment**
   A documented assessment of the strategic planning challenges faced by SSEN Transmission, including identification of priority

use cases where uncertainty, behavioural factors and market dynamics may limit the effectiveness of current planning approaches.
2. **Feasibility Assessment**
   A completed assessment of the applicability of Agent-Based Modelling and related simulation techniques to the identified planning challenges, including an evaluation of opportunities, limitations, risks and implementation considerations.
3. **Data Assessment**
   A documented review of available datasets, critical data requirements, data dependencies and data gaps required to support future simulation activities.
4. **REACT Integration Assessment**
   A completed assessment of opportunities to utilise or extend existing REACT datasets, interfaces and visualisation capabilities within a future simulation environment.
5. **Validation Framework**
   Identification of potential methodologies for validating future simulation outputs, including approaches for calibration, sensitivity testing, benchmarking and stakeholder review.
6. **Demonstrator Specification**
   Development of a high-level specification for a Phase 2 demonstrator, including scope, functionality, technical architecture concepts and user requirements.
7. **Delivery Roadmap**
   Production of an implementation roadmap outlining the activities, resources, risks and dependencies associated with progressing to a Phase 2 project.
8. **Business Case and Recommendation**
   Completion of an evidence-based recommendation regarding whether a Phase 2 project should proceed, including justification of the proposed approach and identification of expected areas of value and learning.
9. **Final Report**
   Submission of a final project report summarising findings, conclusions, recommendations, key learning and next steps.

Project Partners and External Funding

The project will be undertaken using NIA funding by Scottish Hydro Electric Transmission supported by collaborators:

- SSEN Transmission
- Olsights
- Smith School of Enterprise and the Environment, University of Oxford
- MapStand

There are no additional external funding arrangements.

Potential for New Learning

The Project will improve understanding of whether simulation-based approaches can provide additional insight into strategic transmission network planning under conditions of uncertainty.

Current planning processes are primarily based on scenario-led analysis and deterministic assessments. STRATOS will explore the extent to which behavioural and agent-based simulation techniques can be applied within transmission planning to improve understanding of how future infrastructure, policy, market and technology developments may influence network requirements.

The Project is expected to generate learning in several areas, including:

- The applicability of Agent-Based Modelling and related simulation techniques to strategic electricity network planning.
- The value of incorporating behavioural responses, market dynamics and stakeholder interactions into long-term planning assessments.
- The data requirements, limitations and dependencies associated with simulation-based planning approaches.
- Suitable approaches for validating future-looking simulation environments.
- Methods for identifying key sources of uncertainty, planning sensitivities and system tipping points.
- The practical challenges and opportunities associated with integrating simulation outputs into existing planning and visualisation environments.

The Project will also establish whether there is a credible pathway towards developing a simulation-based planning capability that could support future transmission network decision-making. The findings will provide evidence on the technical feasibility, potential value and implementation considerations associated with progressing to a future demonstrator project.

As an early-stage feasibility study, the primary value of STRATOS is the generation of knowledge and evidence that will inform future investment decisions and reduce uncertainty regarding the applicability of simulation-based approaches within the transmission sector.

Scale of Project

STRATOS is a four-month project designed to assess feasibility before any further development investment is committed. The project is not intended to build a production solution or deploy an operational simulation model. Instead, it will define priority planning use cases, explore appropriate modelling approaches, identify technical and data constraints, and produce a scoped proposal for a potential second-phase prototype project.

The work is limited to stakeholder engagement, problem definition, modelling assessment, data assessment, data integration review, prototype definition, Phase 2 planning and final recommendations. This approach allows networks to assess whether simulation-based approaches are technically feasible and potentially valuable before progressing to any larger-scale demonstrator or implementation activity.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL4 Bench Scale Research

Geographical Area

The project will be delivered collaboratively across GB by SSEN Transmission and its project partners. Project activities will be undertaken from the respective locations of the delivery partners, including SSEN Transmission, Olsights, the Smith School of Enterprise and the Environment at the University of Oxford, and MapStand.

Revenue Allowed for the RIIO Settlement

No allowance has been made for this type of development within the RIIO-T3 settlement. No savings are expected during project implementation; future savings may be possible depending on the outcomes of the project and the future adoption of the learnings.

Indicative Total NIA Project Expenditure

The total expenditure for the project is expected to be £165,000,90% of whichis allowable NIA expenditure (£148,500).

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:

The electricity transmission system is required to accommodate increasing levels of generation, storage and demand connections whilst operating under uncertainty, evolving market signals and changing policy requirements. Current planning approaches rely heavily on static scenarios and deterministic analysis and are less well suited to assessing how interacting changes in markets, policy, technology and infrastructure may influence the evolution of the energy system over time. There is limited capability to explore these interdependencies interactively or to assess how different assumptions could lead to materially different system and network outcomes.

STRATOS will investigate whether advanced simulation techniques, including Agent-Based Modelling (ABM), can improve strategic network planning and investment decisions under uncertainty. The project will assess whether simulation approaches can provide improved insight into long-term electricity system evolution and associated network planning requirements. Candidate use cases include reinforcement timing, offshore wind deployment pathways, flexible demand growth, energy storage deployment, hydrogen development and data-centre location decisions.

The project will explore how market incentives, technology costs, stakeholder behaviours and policy interventions influence future infrastructure development and reinforcement requirements. It will also investigate methods for identifying critical sensitivities and planning tipping points which may materially influence future network investment decisions.

By improving understanding of uncertainty and the interactions between future energy system developments and network investment requirements, the project has the potential to support more informed strategic planning decisions and improve understanding of plausible future pathways required to enable the transition to a low-carbon energy system.

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

Not applicable

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

The project is a discovery and feasibility study and does not seek to develop an operational simulation model during this phase. As stated within the project documentation, the Cost Benefit Analysis will be developed at the end of the project and therefore quantified benefits are not available at this stage. Benefits identified to date are qualitative.

The anticipated benefits being assessed through the project include:

- Improved understanding of long-term uncertainty and its impact on transmission network investment requirements.
- Enhanced ability to explore multiple future pathways and assess how different assumptions may influence network development needs.
- Better alignment between future network reinforcement and likely system requirements, reducing the risk of over- or under-investment.

- Improved understanding of how market incentives, policy changes and technology deployment decisions may affect future infrastructure requirements.
- Earlier identification of emerging trends, risks and planning sensitivities that could materially influence network development decisions.
- Enhanced communication and visualisation of complex planning scenarios, supporting more effective stakeholder engagement and decision-making.
- Improved evidence to support strategic planning activities and future investment decisions.
- Potential support for more efficient deployment of low-carbon infrastructure through improved understanding of future system evolution.

The project will determine whether advanced simulation approaches can provide additional decision-support capability beyond existing planning approaches and produce a recommendation on whether a Phase 2 demonstrator should be progressed.

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

The method being assessed through STRATOS is not linked to a specific transmission asset or physical network location. It is focused on strategic planning challenges associated with uncertainty, market behaviour, technology deployment, policy influences and infrastructure investment requirements. The project will assess whether simulation-based approaches, including Agent-Based Modelling, can provide useful insight into these types of planning decisions.

The potential for replication across GB cannot be quantified at this stage. However, the learning generated on modelling approaches, data requirements, validation methods, use case selection and data integration may be relevant to other Network Licensees considering similar strategic planning challenges. The extent of replicability should be assessed further through the outputs and a Phase 2 demonstrator specification.

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

The costs of rolling out the method across GB cannot be quantified at this stage because STRATOS will not deliver a deployable operational solution. The project is specifically intended to define the technical requirements, data requirements, validation approach, implementation pathway, risks and business case for a potential future project demonstrator.

Any future GB rollout costs would depend on the findings of the project, including the recommended simulation framework, data architecture, integration approach, user requirements and scope of any subsequent demonstrator. These costs should therefore be developed as part of the Phase 2 business case and delivery roadmap.

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 project will generate learning on whether advanced simulation techniques, including Agent-Based Modelling, can provide additional insight into strategic network planning decisions under uncertainty. The learning will include the applicability of simulation-based approaches, potential planning use cases, data requirements, modelling assumptions, validation approaches, and opportunities to visualise simulation outputs.

Relevant Network Licensees could use this learning to assess whether similar simulation-based planning approaches may be suitable for their own strategic planning activities. The learning could also help Network Licensees understand the practical opportunities, limitations and evidence requirements associated with applying behavioural and simulation-based methods to long-term network planning decisions.

The project will provide findings on feasibility, data dependencies, validation considerations and implementation requirements. These outputs can help inform whether further innovation activity, such as a Phase 2 demonstrator, would be justified.

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.

A review of the ENA Smarter Networks portal has concluded that there is no duplication with existing or past completed projects.

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

Current transmission network planning approaches are described in the project documents as relying heavily on static scenarios and deterministic analysis. The documents state that these approaches are less suited to assessing how interacting changes in markets, policy, technology and infrastructure may influence system evolution over time, and that there is limited capability to interactively explore these interdependencies or test how different assumptions could lead to materially different system and network outcomes.

STRATOS is innovative because it will assess whether advanced simulation techniques, including Agent-Based Modelling, can provide additional insight into strategic transmission planning and investment decisions under uncertainty. The project will investigate whether simulation methods can represent interactions between market incentives, technology cost trajectories, investor behaviour, policy interventions and future infrastructure development.

The innovation is focused on the application of simulation-based and behavioural modelling approaches to strategic transmission network planning, supported by assessment of data requirements, validation approaches, integration opportunities and future Phase 2 demonstrator requirements.

Relevant Foreground IPR

Relevant Foreground Intellectual Property is expected to comprise the simulation methodologies, validation approaches, architectural concepts, data frameworks, specifications, reports and recommendations developed during the project. The project is intended to develop technology-neutral and platform-agnostic outputs that can be implemented independently of any specific software platform.

Existing software platforms, datasets, tools and methodologies contributed by project partners will remain Background Intellectual Property of the relevant owner.

Data Access Details

For information on how to request data gathered in the course of this project, see Strategic Innovation Fund (SIF) and Network Innovation Allowance (NIA) Data Sharing Procedure at https://www.ssen-transmission.co.uk/about-us/innovation/.

Additionally, data from this project and all other projects funded under the Network Innovation Allowance (NIA), Network Innovation Competition (NIC) or the Strategic Innovation Fund (SIF) can be found or requested in the ways listed below:

- Via the Smarter Networks Portal at: https://smarter.energynetworks.org. To contact select a project and click 'Contact Lead Network'. SSEN Transmission 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: Innovation - SSEN Transmission (ssen-transmission.co.uk)
- Via our managed mailbox: transmissioninnovation@sse.com

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

NIA has been deemed the best method of supporting the delivery of this project. Development projects funded by NIA give suitable financial support to investigate areas for potential development that could not be funded by BAU as no allowance was made in the RIIO-T3 settlement.

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

STRATOS is exploratory and seeks to assess the feasibility and potential value of applying advanced simulation techniques, including Agent-Based Modelling, to strategic transmission network planning. The project will not deliver an operational simulation model. Instead, it will assess whether the proposed approach can provide useful decision-support insight and whether a Phase 2 demonstrator should be progressed.

NIA support is appropriate because the project carries uncertainty and risk that make it unsuitable for business-as-usual funding:

Technical
The uncertainty associated with applying Agent-Based Modelling and related simulation methods to strategic transmission planning. While such techniques have been used in academic and research environments, the Project will assess whether they can provide reliable, meaningful and actionable insights within a network planning context. There is a risk that the proposed modelling approaches may not prove sufficiently accurate, practical or valuable to support future deployment.

Data and implementation
The data requirements, data availability, integration requirements and validation methodologies required for a future simulation environment have not yet been established. A key objective of the project is to identify critical data dependencies, assess available datasets and determine whether a viable implementation pathway exists.

Operational risk
There is uncertainty surrounding the adoption and use of simulation-based approaches within existing planning processes. The Project will investigate whether the outputs can be interpreted, validated and utilised in a manner that supports decision-making and complements established planning methodologies.

Commercial risk
There is currently no proven business case for developing a simulation-based planning capability. The Project is intended to establish whether sufficient value could be realised from a future demonstrator and to identify the costs, implementation requirements and potential benefits associated with further development. There is a possibility that the project will conclude that progression to a future project is not justified.

In addition, the Project adopts a "fail fast, fail cheap" approach by undertaking a time-limited feasibility assessment before committing significant resources to development activities. Without NIA support, it would be difficult to justify investment in a project with uncertain outcomes, unproven benefits and no guaranteed route to operational implementation.

NIA support enables SSEN Transmission to undertake a proportionate project to generate evidence, test feasibility, assess risks and determine whether further development is justified before committing to larger-scale investment.

This project has been approved by a senior member of staff

☑ Yes