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

Feb 2023

Project Reference Number

NIA_NGGT0208

Project Registration

Project Title

Common Planning Pathways

Project Reference Number

NIA_NGGT0208

Project Licensee(s)

National Gas Transmission PLC

Project Start

February 2023

Project Duration

0 years and 7 months

Nominated Project Contact(s)

Helen Dugdale, box.GT.innovation@nationalgrid.com

Project Budget

£308,661.00

Summary

It has been identified within FES that gas demand is being underestimated, risking underbuilding / undermaintaining a network which could be detrimental to UK plc, in the energy transition. A different approach is needed across methane, and hydrogen vectors going forward, to manage energy resilience, societal and commercial risks.

CPP will take a forward-looking approach to the medium-term (2030/40) to establish no regret peak capacity requirements across energy vectors to deliver resilient gas, hydrogen, and electricity networks. This will be achieved by examining the sensitivity of key scenario assumptions within FES and considering the impact of policy decisions. It is expected the output of the CPP project will enable the SOs to model network capability requirements and identify investments for the T3 period and beyond.

Third Party Collaborators

DNV

Nominated Contact Email Address(es)

Box.GT.Innovation@nationalgrid.com

Problem Being Solved

· Networks have used the ESO Future Energy Scenarios (FES) to test their investments under the current price control framework. However, when inspecting the data, it illustrates that certain scenarios (especially over the next 10 -20 years) are likely not credible and therefore using it for the purpose of planning inherently creates, or increases, GB energy security risk. The FES underestimates gas

demand, which is why we believe a different approach is needed across methane, and hydrogen vectors going forward, to manage energy resilience, societal and commercial risks.

· By using the FES scenarios, we risk underbuilding / undermaintaining a network which could be detrimental to UK plc, in the transition to net zero by 2050.

· Gas Networks (GT and GDNs) are preparing to develop its Business Plan in advance of the Ofgem regulatory price control draft submission by Summer 2024. The Gas Networks have an important role to play in achieving net zero by 2050, therefore a holistic long-term pathway plan is required to develop credible plans that protects a) society and its energy needs, b) supports an orderly transition to Hydrogen, and c) enables power networks to operate efficiently, in a way that enables Gas Networks to play an active role in decarbonisation and delivers on Regulatory and Governmental environmental policy

Method(s)

Phase 1

Task
Approach
Benchmark Global approaches
Carry out a literature review to compare various approaches to developing pathways. This will provide a benchmark for the pathway development methodology. This review will include the following models and scenarios, amongst others: The Climate Change Committee's 6th carbon budget, BEIS future end states and DNV's ETO[ET1] .
Stakeholder identification
A stakeholder engagement plan will be developed that will encompass all future phases of the project. Key stakeholders in National Grid (gas and electricity) will include members of the innovation teams, network modelling, FES team, as well as senior managers dealing with future scenarios including hydrogen, and similarly, their peers in the transmission and distribution networks (gas and electricity). It is unclear the level of input Ofgem will wish to provide at the early stages but as they are the regulator they are clearly a key stakeholder. At later stages of the project industry stakeholders will be consulted.
Identify key data points
Some of the key elements/considerations in a common pathway are as follows. More details will be added as part of Phase 1 research.

- Pace of emissions reduction and the year net zero is reached;

- Pace of uptake of new technologies such as heat pumps and EVs;

- Prevalence and locations of renewable power generation – including requirements for energy storage and transmission;

- Infrastructure buildout and investment requirements to accompany the above uptake (e.g., charging stations, residential insulation, renewable generation capacity, grid expansion and upgrades, industrial clusters, etc.);

- Gas infrastructure investment requirements during energy transition (e.g. additional local transmission system pipelines required during conversion to hydrogen);

- Role of hydrogen, and hydrogen blends, in the transition, in particular in uncertain sectors such as the heating of buildings;

- Prevalence and rate of uptake of carbon capture and storage, as well as the extent of requirement for carbon removal technologies (direct air capture);

- Assumptions regarding changes in consumer behaviour, e.g. in terms of recycling, travel or space heating;

- Requirements, options and cost for the upgrade or capacity increase of the electricity and gas networks.

- Gas and power demand on a regional basis.
Wireframe model
In summary, the overall approach revolves around designing a new Common Pathway to Net Zero (CPNZ) following the critical assessment of FES as well as stakeholder engagement session(s), followed by further refining of assumptions in an iterative manner. The approach initially identifies a set of pathways, and subsequently identifies the common ground amongst those in terms of medium-term no-regret infrastructure investments.
Review regulatory requirements

Carry out a review of published documents to provide an overview of the policy landscape and regulatory support framework. Reviewed documents will include, e.g. the British Energy Security Strategy, the UK Hydrogen Strategy and the 'Ten point plan', which provide various commitments and ambitions to areas such as hydrogen production, carbon capture and storage, offshore wind, water supplies (for hydrogen electrolysers) and nuclear energy.

Assess risks and assumptions

Understand the fundamental importance of a secure energy system to GB, and that the approach adopted by FES, which is historically geared towards serving the needs of electricity transmission planning, should not result in risks of underinvestment in the gas networks that may leave supply at risk, and/or consumers exposed to unaffordable energy costs. Prepare a risk assessment to outline the risks to society of underinvestment in gas networks (including both methane and hydrogen). The outputs of this exercise will be used to inform the sensitivity analysis in the scenario framework in Phase 2.

Review data sources

Carry out a review of the FES and other models to establish the key areas for development.

Phase 2

Task

Approach

FES Scenario Framework

Using the FES 2022 'gas outputs' from the scenario framework as a base, overlay GTYS historical data and extrapolate out the gas demand profile to 2050. Carry out analysis to understand the sensitivity of the current pathway to key policy variables, such as carbon price, bans/mandates (e.g., in hydrogen blending, in internal combustion vehicles, or in CCS) and taxes and subsidies (e.g., for heat pumps). Gauge the sensitivity on variations in key outputs and indicators, including, but not limited to:

• Extent of roll out of heat pumps;

• Abundance and location of renewable energy production;

• Level of investment in gas network.

Map these sensitivities to the current pathway to 2050 to broadly understand the requirements for investment in the short to medium term. This exercise will be informed by outputs of exercises in Phase 1.

Identify key assumptions within FES and validate sensitivity of outcomes

Building on the outcomes of the task above, provide an independent viewpoint of the key variables that underpin the trajectory of FES scenarios that achieve net zero. Sensitivity analysis will be conducted to establish the risks to achieving net zero, and perceived 'optimistic bias' within the FES scenarios will be identified. A pathway for how these risks can be mitigated using methane and hydrogen networks will be proposed, as part of the CPNZ introduced above.

FES critical assessment

For this task, a critical assessment of FES assumptions and implications will be carried out against competing forecasts, in particular DNV's ETO, which reflects our latest views regarding the most likely energy transition trajectory in the UK under present conditions, where macroeconomic and global, as well as UK-level market developments are taken into account. In particular, the UK ETO forecast includes long-term forecast for electricity, gas, and hydrogen prices broken down by demand sector. The forecast is primarily driven by probabilistic cost competition structures where more economically efficient technologies are likely to take a larger share of the market in each sub-sector. This approach will highlight any unrealistic assumptions in terms of technology uptake (e.g., heat pumps, hydrogen boilers, or EVs) given cost trajectories.

Development of common pathway

In the recent UK ETO report (2022), it has been shown that the UK, on its current trajectory, is not set to reach its net zero by 2050 target. For this task it is proposed to use the existing ETO model to develop a Common Pathway to Net Zero scenario for the UK, as previously done for other regions of the world for the Pathway to Net Zero (2021) and Energy Transition Outlook (2022) reports. This exercise will be informed by insights generated in Phase 1, and in particular the critical assessment of FES. The starting point will be a gap analysis identifying the sub-sectors where emissions are forecast to remain by 2050, and the different pathways available for closing this gap, e.g., with different levels of emphasis on electrification, hydrogen and CO2 removal technologies. This scenario will be developed in consultation with subject matter experts from NGGT and other relevant stakeholders identified by NGGT and in an iterative manner, where input assumptions are agreed in a participatory workshop, initial results are reviewed in a later workshop where assumptions are further refined. The focus will be on designing a most plausible trajectory to net zero which addresses the key issues with FES previously identified. This trajectory will highlight the short to medium-term investment requirements which emerge as the common denominator between all plausible pathways to Net Zero. The complete results of the CPNZ scenario (but not the proprietary ETO model) will be provided in a PowerBI interface and an Excel datasheet. In the interest of transparency, we will compile a data library of all sources considered in the development of the CPNZ and a critique of FES to underpin the credibility of the 'no regret' outputs.

Balance sheets
In light of the project engagements and findings so far, conduct a review of current FES balance sheets and propose any updates to the methodology needed for the operational implementation of the CPNZ. Annual gas demand forecasts by demand sector from the ETO will be profiled using seasonal normal demand profiles to give daily forecasts. This will be done in consideration and conversation with the existing NGT balance sheet methodologies. We propose an illustration of energy balance sheets in this way, which also shows energy transformations (oil refinery, electricity generation, hydrogen production) as well as any losses during the process, and is broken down by end use sector and sub-sector. Quantitative inputs and outputs of any energy carrier can also be given over each year (till 2050) in Excel format.
Pathway milestones
Required capital infrastructure investments will be calculated using ETO model outputs based on the CPNZ set of assumptions, which will inform the investment costs associated with different investment scenarios, including the no-regret pathway for methane/hydrogen infrastructure. Across scenarios, compare the cost of investment in methane/hydrogen networks (including a focus on the near term to inform RIIO3 business plans) against the monetised risk to resilience (a riskweighted analysis of the Value of Lost Load (VOLL)) for electricity networks to determine the economic net benefit to UK Plc. This allows identification of the delta investment costs across all networks against monetised resilience risk, to legitimise the role of methane/hydrogen. This will then inform what investments in methane/hydrogen networks need to happen now (over the next 10 years) to deliver the long term no-regret trajectory. The milestones include, for instance, oil/gas peaks, wind-powered electricity overtaking gas-fired generation, half/all passenger vehicle sales electric, hydrogen reaching 5% final energy demand, doubling of electricity demand, etc.

Phase 3

Task
Approach
Stakeholder engagement
Hold up to two stakeholder engagement sessions with key stakeholders from across the energy industry, including ESO and Ofgem, in order to test the common pathway outputs and listen to feedback.
Identify next steps
Consult with stakeholders on key aspects of the model where changes may be desirable to e.g. improve the input data, assumptions or otherwise demonstratively reduce uncertainty. This will inform a discussion of next steps to ensure the scenario modelling approach remains relevant during the energy transition
Industry seminar / play back
Prepare a PowerPoint slide deck describing the modelling approach, assumptions, and pathways to achieve net-zero. Deliver the presentation orally in a single webinar session using Microsoft Teams (or similar).
Measure consensus
Use engagement tools such as Slido to test consensus and acceptance of key points during the webinar presentation. The approach will be use votes on key questions to efficiently quantify the opinions of participants.

Phase 4

Task
Approach
Report
Prepare a draft report for comment and a final report addressing these comments. The report will describe the work completed in the project.
Technical Summary
Prepare an executive summary of the report.
Draft Standard update
Completed by NGT
Closure Report
Complete NIA project closure report

Measurement Quality Statement

The measurement approach used to meet Data Quality objectives will be through the identification of high calibre project partners who are experts in their given field. The methodology used in this project will be subject to our supplier’s own ISO 9001 certified quality

assurance regime and the source of data, measurement process 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 made available for review.

Data Quality Statement (DQS)

The project will be delivered under the NIA framework in line with the agreed Energy Networks Innovation Process document NGGT / NGET internal policies. 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 backup and version management. Relevant project documentation and reports will also be made available on the ENA Smarter Networks Portal and dissemination material will be shared with the relevant stakeholders.

Scope

In Scope:

· Whole systems approach to forecasting short and medium infrastructure investment in order to meet Net Zero, that complements the existing FES scenarios

· Forecast of the peak demands each energy vector should be planning for and the changes that could be driven by upcoming key policy decisions across the decades

· Potential supply and demand for each sector based on known /assumed challenge points over the next decade and up to 2050

· All aspects of energy security to be considered: affordability, availability and acceptability

· Use of multiple credible scenarios / data sources: Ten Year statement, Anker, BEIS Use Case scenarios

Out of Scope:

· Development of additional FES scenario

· Decision points beyond 2050

Objective(s)

· To develop a clear whole energy system view of what the peak demands each energy vector should be planning for and the changes that could be driven by upcoming key policy decisions across the decades.

- Test robustness of FES scenarios, especially the trajectories, against the energy security criteria, as prudent Operator(s) from a ‘whole systems’ perspective.

- Capture the uncertainty across the energy sector but not let it impact doing the right thing for the Whole GB energy landscape, placing consumer needs and affordability at the centre (linked to whole system)/ UK PLC

- Understand FES risks, assumptions, and options to understand how we build and pivot from there, to enable us to produce something we have confidence in to achieve net zero, whilst maintaining security of supply.

- Establish a robust, fair, affordable, achievable, credible, and broad pathway to net zero recognising the credible peak demands that should be planned for.

Reflect the critical role of molecules to support the energy transition by providing needed resilience with the growth in RES

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

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 on customers in vulnerable situations. This is because it is a transmission project.

Success Criteria

Success criteria for the project can be broken down into acceptance criteria for each of the phases, as follows:

· Phase 1 (Functional Requirements)

- Proposal for CPP model and approach
- Pros and Cons identified
- Identify data flows to support FES Balance Sheet inputs

· Phase 2 (Concept Development)

- Data library setting out key sources
- Pathway mapping for peak load energy vectors across the Net Zero timeframe
- Risks and issue aligned to key policy decisions and potential impacts to the CPP

· Phase 3 (Concept Outputs and Validation)

- A report setting out the CPP approach, model outputs and insights
- Seek feedback from Ofgem, ESO, and Industry on the approach to pathways
- Data and insights that can be used with ESO FES approach
- Provide a clear road map across vectors to achieving Net-Zero, setting out risk and key pivot points

· Phase 4 (Standards and Reporting)

- Technical report is delivered from supplier.
- GT&M review and accept technical report.
- ENA Project Closure form is also populated by supplier.
- Project is then registered as complete.

Project Partners and External Funding

National Gas Transmission (NGT)

DNV

Potential for New Learning

The following key deliverables relate to new learning obtained from the project:

· Credible pathway(s) to achieve net zero that gas networks and Ofgem recognise that fulfils the energy security requirements and meets the energy trilemma

· Identification of short, medium, and long-term investment plan options:

- Outputs able to provide complimentary alternative to current FES scenarios in demand space modelling

- Including:

- Demand ranges (Max, min and average) by site type and location

- Supply ranges (Max, min and average) by type and location

- PowerStation demand data, merit order, new/retired sites

- Sufficient duration of weather data

- Outputs which are:

- Reflective forward looking consumer behaviour

- Able to demonstrate variation in supply distribution consistent with both historic and event driven behaviour

· A plan for resilience to ensure energy security

· Quantification of the investment uncertainty vs the energy security risk

· Development of a package of pathway investment options to manage FES optimism risks, such as with heat pump projections and future of heat

· Understanding of pathway risks to quantify risk / reward and consumer and industry value proposition

· Calculation of the value to consumers of the 'insurance policy'

· Representation of all £ metrics as a cost to the typical consumer bill, or possibly relate savings to a comparison to the HMG support this winter

· Enabling of more robust modelling of future gas networks for hydrogen transition projects

Facilitation of the forecasting of CO2 impact of investment pathways

Scale of Project

The project is a desktop study and modelling activity that will provide the transmission networks in the UK a view of the optimum method for interaction and development. The benefits of the project will be through the developed understanding of each company in how best to progress to a whole systems approach.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL4 Bench Scale Research

Geographical Area

United Kingdom

Revenue Allowed for the RIIO Settlement

None – Energy transitional project not allocated for in RIIO settlement

Indicative Total NIA Project Expenditure

The supplier has quoted a total cost of £231,496.00. With a standard 25% internal cost (£77,165.00) this results in a total expenditure of £308,661.00

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:

· Credible pathway(s) to achieve net zero that gas networks and Ofgem recognise that fulfils the energy security requirements and meets the energy trilemma

· Identification of short, medium, and long-term investment plan options:

- Outputs able to provide complimentary alternative to current FES scenarios in demand space modelling

- Including:

- Demand ranges (Max, min and average) by site type and location

- Supply ranges (Max, min and average) by type and location

- PowerStation demand data, merit order, new/retired sites

- Sufficient duration of weather data

- Outputs which are:

- Reflective forward looking consumer behaviour

- Able to demonstrate variation in supply distribution consistent with both historic and event driven behaviour

· A plan for resilience to ensure energy security

· Quantification of the investment uncertainty vs the energy security risk

· Development of a package of pathway investment options to manage FES optimism risks, such as with heat pump projections and future of heat

· Understanding of pathway risks to quantify risk / reward and consumer and industry value proposition

· Calculation of the value to consumers of the ‘insurance policy’

· Representation of all £ metrics as a cost to the typical consumer bill, or possibly relate savings to a comparison to the HMG support this winter

· Enabling of more robust modelling of future gas networks for hydrogen transition projects

· Facilitation of the forecasting of CO2 impact of investment pathways

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 (RIIO-1 projects only)

RIIO-1 Question N/A

Please provide a calculation of the expected benefits the Solution

There will be no direct benefits from this project. The project results will enable us to develop robust strategic plans for the whole systems approach and identify the most efficient route to net zero

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

The findings will be relevant to other transmission networks and also may impact the distribution networks and other customers. The engagement sessions throughout the project will take these views into account and ensure they play a part in the final report

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

· The project will help identify short, medium and long-term investment options for the networks, fulfilling energy security requirements as well as meeting the energy trilemma

· Development of a package of pathway investment options to manage FES optimism risks, such as with heat pump projections and future of heat

· Understanding of pathway risks to quantify risk / reward and consumer and industry value proposition

· Enabling of more robust modelling of future gas networks for hydrogen transition projects

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

RIIO-1 Question 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.

The project constitutes an alternate novel approach to modelling energy requirements across the transition, which differs from other work in this field such as FES, avoiding duplication. Additionally, through engagement with stakeholders (DNs, SOs) visibility of the work will be present across industry, ensuring no similar projects are instigated.

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

N/A – Not similar

Additional Governance And Document Upload

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

The project is innovative as it provides alternate but complimentary insight to other energy scenario models (FES). While FES visualises scenarios working back from the 2050 net-zero target, the CPP approach takes a forward-look to the medium term (2030/40) to establish no regret peak capacity requirements across energy vectors to deliver resilient gas, hydrogen, and electricity

networks. This method constitutes an innovative approach to developing a common planning pathway that is complementary to existing FES scenarios, attaining and assessing the data required to enable energy wide planning assumptions through the energy transition. This approach will be through collaboration with GDNs and the wider sector, which will help to support and shape the scope of the FSO.

Relevant Foreground IPR

The results of the project will create knowledge in the transmission approach to whole systems that can be utilised as appropriate by UK networks to determine future strategies and approaches. It may also benefit interconnecting networks and systems

Data Access Details

Data for this project, and all other projects funded under the Network Innovation Allowance (NIA) funding scheme, can be found or requested in a number of ways:

A request for information (RFI) via the Smarter Networks Portal at https://smarter.energynetworks.org. National Grid Gas Transmission regularly publishes much of the data arising from our innovation projects on the ENA portal, before submitting a RFI check this website.

Via our managed mailbox box.GT.Innovation@nationalgrid.com. Further data can be shared upon request through the innovation mailbox. Each request will be assessed by the GT Innovation Team for its merits and viability.

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

Energy transition projects are not catered for in the RIIO settlements and the project is high risk and low TRL which would not be considered for BAU funding. However, this is an important piece of work that encourages collaboration across the energy networks. Additionally, BAU requires consideration of FES in development of the needs case, but the nature of this project means this is not possible.

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

NIA enables collaboration and in this case provides a base from which multiple energy networks can work from which can be difficult when they are working as separately regulated businesses. The whole systems approach is unknown and there are many routes that could be taken, there is a risk that without this work the different energy networks would spend time and money on contradicting systems.

This project has been approved by a senior member of staff

☑ Yes