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## NIA Project Annual Progress Report Document

### Date of Submission

Jul 2023

### Project Reference Number

NIA2\_NGESO028

## Project Progress

### Project Title

Virtual Energy System – Common Framework Demonstrator

### Project Reference Number

NIA2\_NGESO028

### Funding Licensee(s)

National Grid - Gas Transmission (GB wide)

### Project Start Date

November 2022

### Project Duration

0 years and 9 months

### Nominated Project Contact(s)

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## Scope

- Identify range of assets to be represented
- Define parameters required for use case
- Use sample data from network partners to determine data availability and quality, available data standards, potential data licences, and relationships between objects.
- Agree a governance process with industry
- Iterate on the principles of the common framework with industry
- Propose technical stack required to share data
- Develop a scaled demonstrator in a confined geographical area
- Present demonstrator with example scenarios to show use and scalability
- Develop cost benefit analysis for the scaled demonstrator, including the benefits that the demonstrator hopes to achieve, and the estimated costs of the demonstrator
- Use experience from demonstrator and results of common framework development to perform a cost benefit analysis of wider system interoperability

## Objectives

The project has three objectives:

1. Design and wireframe the demonstrator to test core components needed to progress the use case and to show the key elements of the common framework in practice. This will stimulate discussion on future requirements for connected digital twins in the energy industry
2. Use the learning from the demonstrator use case and discussion through advisory groups to formulate and set out the first components of the common framework
3. Perform a cost benefit analysis of the interoperability provided by connected digital twins in energy sector. Present this cost benefit analysis in a way that it can be replicated for future use cases and to support investment in digitalisation

## Success Criteria

- Project is delivered on time, on budget with all milestones met, and clear and timely reporting provided.
- Data assessment and preparation work package (WP2) will result in greater knowledge in:
  - Which datasets are required within the demonstrator to meet the use case
  - The specifications and relationships between datasets which need to be addressed in the demonstrator
  - Any issues around licensing which needs to be addressed during the demonstrator
  - Agreement for how data will be best shared
- Suitable technology identified for the demonstrator activity which will enable the collaboration, data sharing and relationship development.
- The wider energy sector will be aware of the common framework demonstrator and its aims and will have had the opportunity to provide input and feedback following the engagement for this phase and the future of the VirtualES common framework.
- The benefits that the demonstrator hopes to achieve will be further developed and the likely costs of the demonstrator estimated in order to complete the Cost Benefit Analysis (CBA). A more quantitative analysis will have commenced which will have identified key value for each segment involved in the demonstrator allowing the costs and opportunities of connected digital twins in the VirtualES to be estimated.

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

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## Project Context

The ambition of the ESO's Virtual Energy System (VirtualES) programme is to enable a world's first – the creation of an ecosystem of connected digital twins of an entire energy system, which will represent both electricity and gas, and operate in synchronisation to the physical system. The ESO are leading this programme for the GB energy sector.

The created ecosystem of connected digital twins will enable the secure and resilient sharing of energy data across organisational and sector boundaries. This sharing of data will facilitate more complex scenario modelling to deliver optimal whole-system decision making. Whole system decisions will result in better outcomes for society, the economy, and environment by balancing the needs of users, electricity and gas systems and other sectors.

The Virtual Energy System programme is a portfolio of projects. The foundation stone project in the portfolio is the development of the socio-technical common framework that underpins the entire Virtual Energy System.

## Project Aims

This project will provide a greater understanding of the requirements from the common framework to support the overall VirtualES. This will be achieved through a small-scale demonstration of the priority key factors applied to a tangible use case centred on whole-system flexibility, and through development of best practice guidance for building a common framework.

## Initial Project Plan

The project was comprised of four work packages which deliverables aligned to each spread through the duration of the project.

- **Work Package 1** was to form a Project Management Office to manage the budget, deliverables, and reporting.
- **Work Package 2** was to demonstrate the common framework through the demonstrator use case. This had 3 workstreams; data assessment & preparation, technology and wireframe the demonstrator.
- **Work Package 3** was to develop the common framework best practice guidance. This had 2 workstreams; socio factors and

technical factors

- **Work Package 4** was to evaluate the benefits of the demonstrator use case and the common framework.

The project had a series of defined milestones in the initial plan. These milestones were completed as planned. A minor adjustment was made to combine the two Cost Benefit Analysis milestones (M6 & M14) into a single deliverable in between the original dates. This was changed when the detailed plan for this work identified that there were common steps which would be more efficiently delivered if combined.

- **M1** – Data needs and gaps report (WP2.1)
- **M2** – Data relationships – delivered as part of Data needs and gaps report (WP2.1)
- **M3** – Technology needs report (WP2.2)
- **M4** – Interoperability report (WP2.3)
- **M5** – Data sharing framework – delivered as part of Interoperability report (WP2.3)
- **M6** – Benefits of the use case report – combined with benefits report on the common framework (WP4)
- **M7** – Data sharing framework assessment – delivered with demonstrator wireframe report (WP2.3)
- **M8** – Best practice guidance for ‘Raising Awareness and Fostering Culture’ (WP3.1)
- **M9** – Best practice guidance for ‘Engaging Stakeholders’ (WP3.1)
- **M10** – Best practice guidance for ‘Creating a governance framework’ (WP3.1)
- **M11** – Best practice guidance for ‘Aligning models and ontologies’ (WP3.2)
- **M12** – Best practice guidance for ‘Increasing visibility & enabling sharing’ (WP3.2)
- **M13** – Best practice guidance for ‘Creating interoperable tech-stack’ (WP3.2)
- **M14** – Benefits report on the common framework (WP4)

To evaluate and develop the requirements for the demonstrator data needs, relationships, interoperability, and data sharing framework the project team completed interviews with 16 individuals including DNOs, National Gas Transmission, and ESO.

To validate the best practice guidance with industry the project utilised advisory groups formed for the Virtual Energy System programme. These groups include both gas and electricity with representatives from industry bodies, networks, generators, suppliers, academia, and technology. There are two groups, aligned to WP3.1 is the people and process group and aligned to WP3.2 is the data and technology group. Each group met 3 times within the duration of this project, reviewing shared content and sharing their feedback. Summary notes from these meetings have been published on the Virtual Energy System programme webpage.

### **Success Criteria**

- Further defined the data needs and technology requirements of the demonstrator
- Developed visual and process wireframes of the demonstrator
- Produced a common methodology to determine the costs and benefits of and Virtual Energy System use case
- Developed best practice guidance notes on the six priority factors

To share the experience of the project and gather further input the project hosted two show and tells. There is also a plan for further communication of the best practice guidance following the completion of this stage which will include a further show and tell alongside wider communications.

The project is on track to achieve the aims and objectives while delivering the proposed success criteria.

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

The project delivery constitutes of work packages focusing on the demonstration of the common framework through the whole-system flexibility use case identified and developed in the previous phases of work. This use case is primarily an electricity system use case.

The intention in this phase was to identify a gas-equivalent scenario to this electricity use case, so that the electricity use case development and learning could be directly applied to accelerate the development of the gas use case. This would bring the maturity of the gas use case to the same level as the electricity use case was at the end of the previous phase of work, with only the electricity use case developed further in this phase. (i.e., the electricity use case would continue to be more developed at the completion of this phase).

During the project and following several interviews with SMEs in National Gas Transmission it became clear that the electricity use

case could not be replicated for gas as the processes are too different.

An alternative set of options for the gas use case were identified and documented, to develop these to a similar level of maturity as the electricity use case would require additional work outside of the scope of this project. A change request was not pursued for this additional work.

The technology (WP2.2), governance design (WP3) and benefits methodology (WP4) developed support all potential use cases (electricity or gas), and their applicability to the whole energy system has been explicitly documented in all outputs of the project.

The learning from gas use case discussions will be summarised in a report. This will be formed from a set of proposals and recommendations that were developed for National Gas Transmission.

## Lessons Learnt for Future Projects

- Strong stakeholder engagement is key to bringing co-ordination across the various data and digital twin initiatives currently in flight across the energy sector.
- As part of Governance model, a new independent Orchestrator entity for coordination and conflict resolution with clear government backing was recommended to provide oversight of implementation entities, public and private sector, promote and coordinate digitalisation across the sector and sharing of knowledge
- As part of the Governance model, a Common Infrastructure Operator Entity will be able to help manage and improve common energy digital tools or services created for public good.
- A proposed high level technology design has been shared through advisory groups and show and tells. This includes capabilities, for example, schema validation and access controls which could be applied across a wide range of use cases.

Note: The following sections are only required for those projects which have been completed since 1st April 2013, or since the previous Project Progress information was reported.

## The Outcomes of the Project

The following deliverables have been produced to date:

### Work Packages (WP)

#### WP2.1: Data assessment & preparation

- Data needs and gaps report
- Data relationships developed & tested

This report creates the link between the functional activities required to implement the demonstrator and the data that will enable them. The report identified several recommendations that will enable and enhance the demonstrator's impact. It has also identified broader recommendations outside of the demonstrator's role; but should be considered by sector.

Interviews were conducted with 16 key stakeholders in the development of this demonstrator data needs and gaps assessment. This included data governance leads, architects and planning roles across both electricity and gas networks.

#### WP2.2: Technology

- Technology review report

This report assesses, evaluates, and proposes data sharing solutions for the demonstrator. This was derived through desk-based research, stakeholder interviews, and discussions with platform providers - both within the energy sector and cross-sector. It considers the various technology options and their combination and provides recommendations on the technology architecture for both the demonstrator and the future VirtualES vision.

#### WP2.3: Wireframe the demonstrator

- Interoperability report
- Data licensing template
- Data sharing assessment demonstration

This report identifies the key interactions between users, data and technology and the processes for enabling the use case; it reviews the technology required to enable the use case; and sets out a data sharing framework that can be adopted for the demonstrator.

#### WP2.4: Gas use case proposal

This document summarises the learning from interviews with gas SMEs and provides potential use case options that can be used to demonstrate the common framework of the Virtual Energy System (VirtualES) in the gas network.

#### WP3.1: Best practice guidance for Social Factors

The reports delivered in WP3.1 will describe the identified best practice in the priority social factors. In developing these reports, the proposals have been validated with industry through advisory groups and targeted engagement. The priority Social Factors include 'Raising awareness and fostering culture', 'Engaging stakeholders' and 'Creating a governance framework'. Initial thinking in these areas was shared through the show and tells and the final reports will be shared on Smarter Networks Portal.

#### WP3.2: Best practice guidance for Technical Factors

The reports delivered in WP3.2 will describe the identified best practice in the priority technical factors. In developing these reports, the proposals have been validated with industry through advisory groups and targeted engagement. The priority Technical Factors include 'Aligning models & taxonomies', 'Increasing visibility and enabling sharing' and 'Creating an interoperable tech-stack'. Initial thinking in these areas was shared through the show and tells and the final reports will be shared on Smarter Networks Portal.

#### WP4: Benefits

This work package has developed proposed a framework for assessing benefits of the demonstrator and of the wider framework. The methodology links the benefits to the components that make up consumer energy bills. The methodology will also help to identify where projects are targeting the same benefits and where there is an opportunity for collaboration.

### Advisory Group Meetings

- Data and Technology – 08-March 2023, 03-May 2023, 28-June 2023
- People and Process (Regulation & Governance) – 10-March 2023, 10-May 2023, 05-July 2023
- Summary minutes from these discussions are published on the [nationalgrideso.com](http://nationalgrideso.com) website.

#### Show and Tell engagement sessions

Two show and tell online events were held (30-March 2023 and 25-May 2023), each of these had an audience from across the energy sector with 40+ attendees at each event. The slides from these have been shared on the smarter networks portal.

Further communications are planned at the conclusion of the project to share the best practice guidance that has been developed.

### Data Access

Details on how network or consumption data arising in the course of NIA funded projects can be requested by interested parties, and the terms on which such data will be made available by National Grid can be found in our publicly available "Data sharing policy related to NIC/NIA projects" and [www.nationalgrideso.com/innovation](http://www.nationalgrideso.com/innovation).

National Grid Electricity System Operator already publishes much of the data arising from our NIC/NIA/SIF projects on the Smarter Networks Portal ([www.smarternetworks.org](http://www.smarternetworks.org)) and National Grid ESO Data Portal ([data.nationalgrideso.com](http://data.nationalgrideso.com)). You may wish to check these websites before making an application under this policy, in case the data which you are seeking has already been published.

### Foreground IPR

The following Foreground IPR will be generated from the project:

- WP2.1 – Data needs & gaps report
- WP2.2 – Technology review report.
- WP2.3 – Interoperability report, data licensing template, and data sharing assessment demonstration
- WP3/4 – Benefits report on the use case, and Benefits report on the common framework

All relevant reports and presentations will be published on the Smarter Networks Portal.