Digital Commissioning of Large-Scale Equipment

Decarbonising Network Operations
The National Transmission System (NTS)

The role of gas:

- **23m** gas customers across the UK
- **85%** households using gas for heat
- **881 TWh** of energy is delivered by NTS

UK gas demand:

- **39%** Power Generation
- **38%** Domestic Use
- **23%** Industrial & Commercial

- **7,600km** high-pressure pipe
- **94 bar** maximum pressure on the network
- **24** compressor stations
- **504** above-ground installations
- **8** connected distribution networks

The role of gas:

- **IMechE Engineering Challenges in a Hydrogen Economy | 6 March 2024**

Map key:

- Red triangle: Compressor station
- Blue triangle: Beach Reception Terminal
- Blue square: LNG Importation Terminal
- Red line: Interconnector

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Continued Use of Natural Gas
Some users in the UK are hard to electrify, natural gas with carbon capture could support

Greening Natural Gas
Renewable Bio-gas or synthetic fuels for hard to electrify options could be used in the transition

Hydrogen
Green and Blue hydrogen along with Pink, Yellow etc... will have a role in the future decarbonisation

CCUS
Alongside the use of Natural Gas and its derivatives this could enable us to be Net Zero

Electrification
Power generation using gas (natural gas or hydrogen) is required to fill the gap when renewables are not available

Net Zero Opportunities for the NTS
Pathways to Net Zero are expected to require a combination of approaches and technologies
Large Scale Equipment on the National Transmission System such as Compressor units.
The Problem

Limited simulation of Commissioning
Today we use our Building Information Models (BIM) to support construction. This however cannot extend to commissioning the equipment on sites or the digital communication elements. We are looking for a solution that will focus on the digital commissioning elements but also support the wider asset commission.

Safety, Quality and Functionality
During design and validation studies for future net-zero transition infrastructure projects, a significant amount of time is spent on completing multiple investigations both desktop studies and physical tests to understand large scale equipment safety, quality assessments and functionality of the system. This adds significant cost and duplication of effort. e.g. compressor design and upgrades.

OT & IT Capability
The UK energy and utility networks heavily rely on automation to operate their networks safely and securely to deliver essential services to the consumer. The resilience of the energy systems, that all industrial customers and consumers rely upon depends on robustly designed, operated, and secured automation systems. These systems have been installed over several decades and need modernisations to enable secure operation.
The Digital Twin enables movement of data across all layers whilst providing an interface that can provide contextual direction to key datasets.

**Analytical Layer**
This layer consists of network modelling, Stress analysis and vibration monitoring alongside ML/AI data analytics which are fed into the digital twin to provide insights into the network system.

**Virtual Layer**
National Gas utilise BIM models and 2D drawings in construction and engineering applications, alongside this a GIS system has been developed. The virtual models have limited data sets associated and a consideration for the digital twin is in enabling access to key datasets through these visual models.

**Data Layer**
National Gas utilise an azure cloud based data lake to store their network information, data is currently being collated from across the business into this system to ensure a consistent approach.

**Physical System**
These are our assets, equipment and people. These exist today but may be bolstered by additional sensing and IOT equipment required to manage the network of the future.
The Required Solution

Increase software in the loop capability to reduce physical testing

Virtual Twin to enable design and construction planning (BIM)

Reduce the scale of this work by using digital tools to improve commissioning output and enable accelerated acceptance on site

Delivered and Commissioned equipment on site approved for use

Hardware & Software in the loop linked to Digital Twin solution for both hardware and software
Thank you