QUEST
An overarching control system

electricity north west
Bringing energy to your door

QUEST IT Lessons Learned

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Project Partners

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Contents

Glossary

Acronym	Description
ADMS	Advanced Distribution Management System
ANM	Active Network Management
AVC	Automatic Voltage Control – the systems that regulate system voltage at the transforming points on ENWL network
BaU	Business as Usual – refers either to business-as-usual deployment of QUEST following successful trials or current process impacted by QUEST
CAF	Cyber Assessment Framework
CB	Circuit Breaker
CI	Customer Interruptions
CID	Curtailment InDex- Refers to the permissible amount of curtailment applied to a DER before DNO incurs penalty, the exact amount of which is laid out in the connection agreement.
CML	Customer Minutes Lost
CT	Current Transformer
DER	Distributed Energy Resource
DERMS	Distributed Energy Resources Management System
DG	Distributed Generation
DBF	Demand Boost Full (CLASS Function)
DMZ	Demilitarised Zone (IT secure design)
DRF	Demand Reduction Full (CLASS Function)
DNO	Distribution Network Operator
DNP3	Distributed Network Protocol 3
EMS	Energy Management System
ENWL	Electricity North West Ltd.
FAT	Factory Acceptance Test
GSP	Grid Supply Point
ICCP	Inter-Control Centre Communications Protocol

Acronym	Description
IEC	International Electrotechnical Commission standards
IED	Intelligent Electronic Device
IIS	Interruption Incentive Scheme - regulatory performance incentive scheme based on CI and CML
ISMS	Information Security Management System
IT	Information Technology (Responsible for all ENWL IT excluding OT)
LCT	Low Carbon Technologies
LL	Load limiting (CLASS Function)
LOM	Loss of Mains
MOL	Merit Order List
MOMS	Merit Order Management System
NIST	National Institute of Standards and Technology
NMS	Network Management System
OLTC	On-load Tap Changing
OT (OpIT)	Operational Technology (Responsible for NMS inc. SCADA and associated systems)
PFR	Primary Frequency Response (CLASS Function)
RBAC	Role Based Access Control
RTS	Real Time Systems
RTU	Remote Terminal Unit
SCADA	Supervisory Control and Data Acquisition
SE	Schneider Electric
SFR	Secondary Frequency Response (CLASS Function)
SGS	Smarter Grid Solutions
SIEM	Security and Information Event Management
SWBD	Switch Board
TSF	Tap Stagger Function (CLASS Function)
UI	User Interface
VT	Voltage Transformer

1 Executive Summary

This report is an additional document supporting the lessons learnt during the QUEST Implementation phase of the project.

It describes the reasons for, and the implications of, the changes made to the supporting IT infrastructure of the QUEST project, which has resulted in delays and costs in the delivery of the overall project.

The original bid assumptions were based on the experience in developing CLASS and Smart Street within the core operational IT NMS product. The expectation was that QUEST would be developed in the same manner.

Post bid, ENWL IT organisational changes resulted not only in a change of roles and personnel but more importantly changes in processes including risk management.

During the system design phase, the original IT assumptions were challenged including building QUEST directly within the core system, and the risks that ensued should the project not be successful, and the integrated software must be extracted.

The QUEST design was modified to have the QUEST software to be developed as a “mini” NMS, that sat outside of the core system, and therefore simpler to remove, but built in the same application for easy transfer into the core system when successful. This change also had infrastructure and internal IT ownership impacts that were thought to be minimal at the time of the change assessment.

There has also been a global transformation in risk assessments relating to cyber security. All GB DNO’s have responded to these significant changes and new industry deliverables such as the Cyber Assessment Framework. To support this the organisation has experienced, and continues to experience, further organisational, personal and system process changes.

These have significantly impacted the delivery of the infrastructure needed for QUEST resulting in the project experiencing additional cost and delay.

Within ENWL the Operational IT (OT or OpIT) department are responsible for the real-time control systems in use for the day-to-day management of the electricity network, including telemetry, control systems and immediate infrastructure. The Information Technology (IT) department is responsible for the remaining IT estate, including data centres that may house OT equipment. These departments can be loosely or closely affiliated depending on the organisational structure at the time.

2 QUEST general background

QUEST is Network Innovation Competition Project scheduled to run from April 2021 to April 2025.

The aim of the project is to prove the concept of overarching voltage control across a DNO network and utilise previously developed voltage control software (CLASS & Smart Street). In addition to the QUEST overarching software the project is also delivering additional and enhanced voltage control devices at several substations in the Whitegate network area, which communicate through the existing SCADA system.

For QUEST to be an innovation project there must be a risk that the concept will be unsuccessful and so the solution must be removeable from BaU systems should that risk come to fruition.

The IT element of the QUEST bid was put together in collaboration with the then NMS system architect, expert on ENWL previous OT systems and key to the development of CLASS and Smart Street in the new NMS system ENWL was transitioning to. This approach built on the learning to date of this NMS transition.

Post the bid phase, ENWL IT organisation changes resulted in a change of IT resources allocated to the project and changes to other roles, personnel and processes.

The project commenced in 2021, in February 2022 Russia invaded Ukraine. Cyber security concerns had been rising and subsequently the Electricity Industry has been responding in detail to additional requirements from UK Govt, Industry Regulators and other key security players.

These changes have had significant consequences for the QUEST project which could not have been foreseen at the bid stage.

3 QUEST project IT deliverables

The delivery of the QUEST capability relied on Operational Technology (OT) expertise for the following tasks:

- Installation of new software in the CLASS relays that added new analogue data points and control functionality
- Configuration of the new data points for the CLASS relays into the operational NMS SCADA system

This scope and approach for OT didn't change throughout the project.

From an IT (non-OT) perspective, the initial approach for the project was just to add the QUEST application module, developed by Schneider Electric, to the operational deployment of the existing NMS system. This would be achieved through the existing IT Release-To-Production service management process. The only other responsibility for IT, in the initial approach, would be to configure new ICCP connections to SGS D-ANM and C-ANM systems. This represented a minor role for IT within the overall project and didn't justify the establishment of full IT project governance.

Two significant changes impacted the role of IT in the project.

Firstly, it was decided that adding an innovation module into the core NMS system would introduce unacceptable IT/OT operational risk and would prove expensive and be technically difficult to remove, if required, after project closure. The IT decision was therefore taken to deploy QUEST and all the required NMS services, separately on its own IT infrastructure and to build a complex ICCP based integration between the two. Initially it was assumed that the project could deliver on a single production QUEST environment, but after additional input from IT, it was agreed to build an additional test QUEST environment in order to reduce operational risk.

Secondly, due to external global security events, the ENWL security capability had to mature very quickly, which had a significant impact on IT in several ways:

- The security delivery projects were of the highest priority and placed a huge demand on existing IT resources. This resulted in a re-prioritisation of other projects, including QUEST, which then impacted the ability to meet deadlines for the QUEST project
- The new IT infrastructure had to be designed and built incorporating additional security controls and enhanced IT governance related policies. These policies and controls were also

being reviewed and amended where required by the Cyber review, resulting in additional impact on the QUEST project.
- The focus on security and the additional expertise brought into the business modified the culture and approach towards Innovation projects that were deliberately trying to deliver new, previously untested, and possibly temporary changes to process and systems.

Once these two changes had been considered, the role of IT in the project grew significantly. This impacted the way the project had to be managed as the mix of OT and IT participation changed and organisational interfaces and differences in processes had to be managed. This resulted in significant impacts on QUEST timelines.

3 Project Impacts

The risk reduction decision to separate the innovation project systems from the core NMS system, resulted in new hardware being installed into a secure datacentre, housing other secure ENWL systems. Ensuring the project had access to this hardware for build, configuration, use, support and modification purposes, and that the system could interface with other systems, including the operational NMS system, required support from a series of specialist IT teams and individuals each responsible for their element in a chain of processes required to deliver the secure access. Many of these resources were unfamiliar to requirements of an Innovation project and dealing with 3rd parties (project partners) including those outside of the UK.

An impact from requirement to have several process chains is that for end-to-end testing and issue identification and resolution it was often required to collate these resources for a common call. As most of these resources (internal to ENWL and with Project partners) where from small teams/individuals with other priorities it often took time to arrange required calls, and to rearrange where necessary. This led to elements of work of perhaps a few hours, requiring multiple weeks to complete successfully.

Many of these process chains were built from elements of business-as-usual systems. The project found these systems developed for internal use, often needed adapting to allow 3rd party and non-UK project partner use.

These established systems also included a series of predetermined SLAs and timeframes optimised for routine use, rather than that for innovation projects which could identify urgent requests at short notice.

The revised infrastructure relied more heavily on several ICCP links, which ENWL have previously built in their previous control room management system. However, the routing of these links, the systems being connected, and the tools being used by all parties where new to many. The post security review processes for ICCP were also new, resulting work taking much longer than anticipated, and several reworks to get security and reliability to that required for the project. On initial production use of the tested system several data points were identified as missing from one of the ICCPs. From an IT perspective the process to modify an ICCP is slightly different to the creation of one

In summary, certain themes developed during the build and commissioning:

- The required change of approach at the start of the project resulted in an alternative approach having a wider impact across ENWLs IT estate
- The expectation was that this would have limited impact on that estate and those that support it.

- During delivery of the QUEST infrastructure, several issues arose that required either to process a change, or additional support systems to deliver the project & partner requirements.
- The IT element of the QUEST project would be considered a very small project in pure IT project terms with the associated prioritisation.
- The change in the cyber environment
    - Focussed IT resources onto business critical, and nationally important tasks.
        - Thereby resources for QUEST became limited and time constrained
    - Reviewed and changed many internal systems and process, that QUEST was to rely on
        - Causing additional work and delay to deploy QUEST system, and the amendments identified during deliver
    - Cultural change in approach to Risk
        - Wider and deeper review of any change proposed, resulting in an increase in volume in suggested enhancements and additional time to approval
- QUEST has developed some novel infrastructure, processes and support arrangements
    - This has generated several internal "first of" system and processes
    - This has challenged pre-existing processes, for adaption to revised requirements
- Project changes impacting on IT, regularly had a serial cascade impact for IT process chains
    - Resulting in multiple design, implement, test cycles along the process chain with resultant time impact
- User access to QUEST via multiple secure layers and systems
    - Security processes having multiple secure gateways with bespoke accounts and passwords, with different reset periods and processes
        - This has resulted in delays, especially for 3rd Parties, in reactivating access to perform their necessary actions

During the project, in response to the delay impacts from the above:

- Standard issue escalation processes have been utilised regularly
- Non-standard cross business escalation has been utilised
- Different delivery models adopted, to match responsibilities to available resources
- A formal IT lessons learnt review, following established ENWL project management methodology led by a senior IT representative

The results of the lessons learnt are described below.

4 IT Project lessons learnt

This is one of the key areas identified during the formal project lessons learned.

At the time of the proposal submission, IT involvement was at an appropriate level for the expected IT scope at the time. As the IT scope grew, IT was not sufficiently involved to ensure that the IT project approach and the IT project scope were clearly defined. This resulted in:

- the need for an IT Project Manager was not identified
- the required degree of collaboration was mis-judged
- the key testing environment was not included in the scope.

During the delivery of the QUEST project, ENWL IT has added a new role to its organisation, the IT Business Partner, whos' job it is to work with the business early in the project lifecycle and ensure the right people are involved to scope and structure the project.

An IT Business Partner for the Innovation team was quickly co-opted to support the project during the most difficult IT development period. Dedicated IT project management resources have also been allocated to the portfolio of innovation projects.

ENWL IT has established a role called the Technical Implementation Manager (TIM) to co-ordinate IT tasks and escalate any technical and resourcing issues within the Project Delivery phase. A TIM was assigned to the QUEST project and contributed well to the resolution of technical issues. At the time the TIM role was focused only on delivery of IT Servers and associated system software. As a result of the lessons learned, the role of the TIM evolved to include security, network and management tools.

5 IT Change processes and Request for Change (RfC) workflow.

All IT systems that are deployed in ENWL are governed by a range of IT Policies, one of the which concerns IT changes. At the start of the QUEST project there was a single RfC workflow that governed changes to both Test and Production systems and as such struggled to flex to the needs of an innovation project. As a result of feedback, the RfC workflow was enhanced to take into account the reduced risks associated with changes to Test systems. This resulted in shorter approval timelines for changes to Test systems.

A QUEST specific change requirement was to add new RTU points to the CLASS relays. The normal BAU change process for this is managed by the ENWL Telemetry team, outside of the IT Change process. Due to the change of approach of building a separate QUEST system, these points now had to be published to the QUEST system by the existing SCADA system using ICCP. This is potentially problematic as changes to ICCP are an IT responsibility. It was agreed to extend the existing Telemetry process for these changes to include ICCP rather than try and combine the Telemetry change process and the IT change process.

6 Escalation process

The formal escalation process was found to improve speed of response; however, the process was very heavily used, especially during periods of other conflicting demands on IT resources. QUEST specific temporary collaboration capabilities were set up and managed to expedite escalated tasks.

It's clear that these escalations would have been less frequent if the IT project approach had been set up more robustly

7 Documentation

Partly due to the number of changes required through detailed design and configuration complexity, the IT documentation from 3rd party suppliers was not always complete and unambiguous, which occasionally resulted in errors being repeated and having to be re resolved across environments. Improvements are an ongoing piece of work with our IT suppliers.

The QUEST IT Low Level Design document was regularly updated because of significant additional detail (systems, processes, and configuration work) being identified during the project. This was particularly the case for the final ICCP elements of the IT build.

8 Remote Access

The QUEST project required selected partners to have remote access into ENWL infrastructure where QUEST environment had been built. Provision for access relied on a number of supplementary tools (including internal IT systems) and process that partners did not have access to, resulting in modifications and adaption to ENWL systems and established BaU processes.

This resulted in a complex set of steps that individual partner staff had to undertake to gain access to individual systems.

A document was created that provided a step by step guide for partners to access the system, but even this had issues.

The lessons learned resulted in a recommendation that a specific workshop be developed to aid the mobilisation of partners into the project.

9 Enduring Concerns

The QUEST project remains time limited, and the systems and processes developed may be removed at the end of the project.

The project IT infrastructure is therefore not subject to business-as-usual IT adoption processes, and will require project IT support throughout its lifetime

The challenges on the IT environment are expected to remain throughout the QUEST project life, therefore any IT changes identified during the projects Trial and Analysis phase may still result in additional IT related delays.