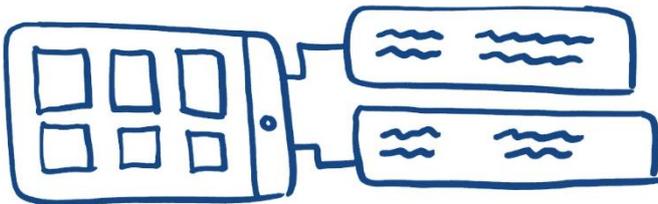


GRID MANAGEMENT PLATFORM



WHOLE SYSTEM COORDINATOR

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PEAK MANAGEMENT RULES

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ENERGY TRADING

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November 2019 | Version 1

High Level Solution Design Summary



Scottish & Southern Electricity Networks

CGI



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1. Executive Summary

1.1. Background to Project TRANSITION

Project TRANSITION is designed to help inform decisions on the future design of the GB electricity market. It will deliver an evidential base from a series of trials that address the key challenges of:

- Delivering visibility of actions by industry actors on the distribution infrastructure, enabling the DNO / DSO to operate their infrastructure efficiently.
- Enabling markets to work for flexibility by addressing barriers to distributed energy resources connected at the distribution level being able to access, and be accessed by, the different markets to which flexibility has value.

It will enable local distributed energy resources with flexibility to access value across different markets, both Local and National. TRANSITION is designed to inform the design of a well-functioning, non-discriminatory market mechanism that enables value stacking.

TRANSITION is funded through Ofgem's Network Innovation Competition. It has two participating DNOs; SSEN & ENWL. The first phase of the project has involved three partner organisations; Atkins, CGI & Origami.

TRANSITION falls under the T.E.F. joint governance arrangements with two other NIC funded innovation projects. These are WPD's EFFS (Electricity Flexibility and Forecasting System) & SPEN's FUSION project.

TRANSITION has delivered the requirements for:

- Neutral Market Facilitation
- Neutral Market Facilitation Data Exchange and Governance
- Whole System Coordination
- Services in a Facilitated Market

These requirements will be validated and developed through the TRANSITION trials phases.

1.2. Purpose and Scope of this Document

The purpose of this document is to provide an executive summary of the High Level Solution Design document, which provides an high level view of the components and interactions needed for the TRANSITION project (excluding physical infrastructure of the electricity networks and energy flexibility resources) to achieve its objectives and how the components will be used in the trials.

The information provided in the High Level Solution Design is not a detailed requirements specification of any of the components, but rather shows the major characteristics of each component and how they will interact with each other.

1.3. Information systems context

From the DSO system components identified in the Open Networks Project's Functional and System Requirements (May 2018), the following are in the current scope for high-level solution design: Forecasting, Whole System Coordination, Power System Analysis, Contractual Arrangements & Service Compliance and Settlement. The Neutral Market Facilitation component within TRANSITION is designed to fulfil the Service / Market Facilitation capability (represented as the Flexibility Platforms, Grid Services and Peer to Peer, in Ofgem's Future Insights - Flexibility Platforms in Electricity Markets paper September 2019) and is at arm's length to the core DSO system components. This enables

TRANSITION to trial market models where the DSO may not hold the obligation for neutral facilitation of markets for flexibility.

The following diagram was developed for the TRANSITION NIC funding request and illustrates the new DSO components (in blue) with existing DNO systems (in green), the NMF shown as an arm's length entity. Other industry actors that may use the NMF are also shown.

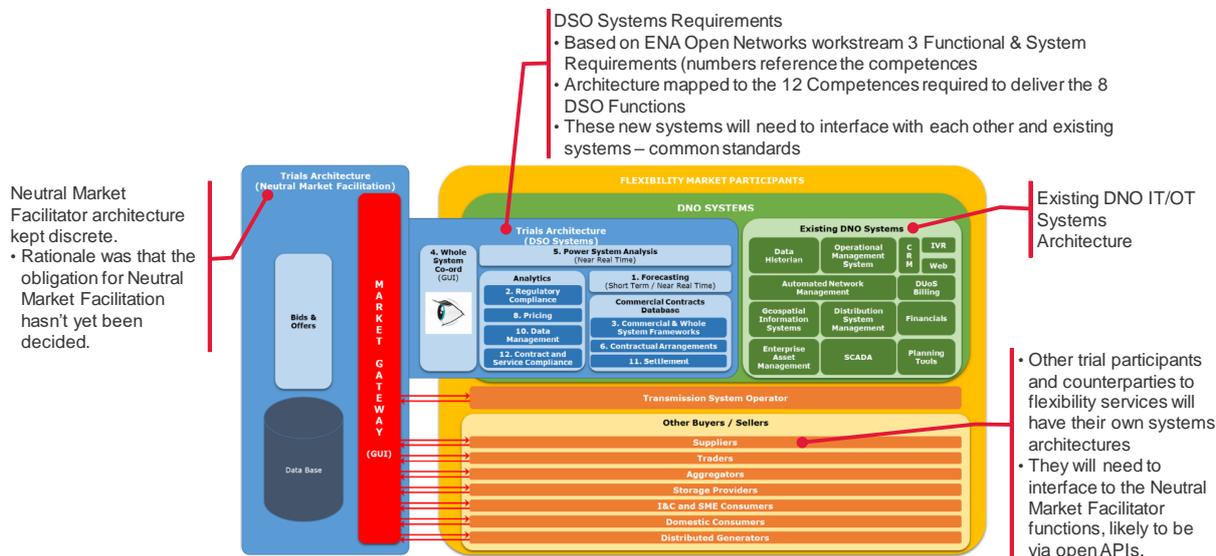


Figure 1: TRANSITION Bid project context diagram with annotations

1.4. Technology context

The requirements have been developed to be generic and to be useable by any DNO as the basis for their procurements of such components. The TRANSITION project is to be delivered within SSEN, therefore the components delivered to support the TRANSITION trials will conform to SSEN IT and OT system design principles, wherever feasible. However, TRANSITION is an innovation project with limited scope, so systems that in the long term might be considered as OT systems may be instead implemented as IT systems for the trials based on risk, timescale and budgetary considerations.

1.5. TRANSITION Solution Components

1.5.1. Neutral Market Facilitator (NMF)

The Neutral Market Facilitator (NMF) is a major new component. The NMF requirements described for the TRANSITION trials are intended to be a template for how flexible energy resources connected at the distribution level will be able to access, and be accessed by, the different markets to which flexibility has value at regional or national level.

The NMF is also intended to provide a mechanism by which industry actors (such as, DSO, ESO and Balance Responsible Parties) that are not commercial counterparties to the dispatch of flexibility can have visibility of such dispatches when a dispatch could affect them. Specifically this relates to a DSO having visibility of actions by industry actors on the distribution infrastructure, enabling the DSO to factor such dispatches into operational decisions and to operate their infrastructure efficiently.

The NMF will be open to external parties, including flexibility providers such as aggregators, the ESO, at least one DSO in a DNO region, IDNOs/IDSOs, local energy markets, and potentially DSOs and similar parties from other DNO regions.

A DSO identified within the TRANSITION NMF may operate with or without a WSC. Some of the learning outcomes of the trials will include interaction between the NMF and WSC; however, use of an

NMF without a WSC may provide useful learning outcomes regarding the importance of a WSC function.

1.5.2. Whole (electricity) System Coordination (WSC)

The Whole System Coordination (WSC) component for TRANSITION will be the DSO's point of interaction with the NMF.

Where the DSO has identified a constraint, the WSC provides the assessment of the mitigation options. These can include use of Active Network Management or Distribution Management Systems where available, calling off from existing contracted options for the use of suitably located flexible energy resources or contracting for additional flexibility via the NMF.

The purposes of a DSO's WSC include coordination with the ESO and other DSO's to enhance reliability and effectiveness of electricity networks as a 'whole electricity system'.

1.5.3. Other TRANSITION components

These are the other major new components in the scope of TRANSITION:

- **Forecasting:** this is a new component. TRANSITION will make use of the forecasting algorithms developed by EFFS project, where practicable;
- **Power Systems Analysis:** SSEN has existing Power Systems Analysis capabilities. These will require adaptation to support TRANSITION and meet the response times required to support the decision making timescales for a WSC operator;
- **Contracts and Settlements** (grouped as commercial systems in the NMF and WSC requirements specifications): although nothing exists that directly correspond to this, relatively manual approaches using the SSEN existing systems can fulfil the trial requirements.

1.5.4. Other systems within the DSO

TRANSITION will need to make use of existing DNO systems and their planned adaptations, such as the DMS (e.g. GE's PowerOn, Schneider's equivalent system), asset systems, the GIS for network topology, etc..

1.6. Scope of the TRANSITION trials

Scope restrictions:

- Voltage levels:
 - 11kV, 33kV & 132kV are in scope;
 - LV out of scope. (Note: LV-connected energy resources may be used because of the value they provide in aggregated supply and demand at higher voltage levels, rather than to solve problems with LV feeder circuits themselves).
- Timescales:
 - Weeks/days/hours ahead are in scope for the trading of energy flexibility on NMF;
 - Years/months ahead not in scope of TRANSITION, i.e. the trials are not intended for long-term planning.

1.7. Functional Processes

The High Level Solution Design document includes a description of the significant functional processes the solution has to support. TRANSITION end-to-end business processes will be implemented across a number of the new components, including the NMF and WSC. These are illustrative of how the TRANSITION components will be used during the trials and include:

- **Process initiated by new forecast:** triggered by the release of a new calculation of supply and demand at individual network nodes made by the TRANSITION Forecasting component, which will be made available to the Power Systems Analysis (PSA) component to recalculate load flow analysis.
- **Process initiated by a third party Request on the NMF:** This process starts with Industry Actors (other than the DSO) using the NMF to generate Requests and agree contracts, rather than the DSO making a Request, i.e. a peer-to-peer trade.
- **New registration of a DER on the NMF:** this would include use of NMF registration processes and manual checks for information about the DER in SSEN systems;
- **Inability of DER provider to fulfil contract;**
- **Settlement process:** this includes the issuing of a proof of dispatch notification for the flexibility provider, and for the DSO use of the Contracts and Settlements components;
- **Significant change to the network:** reinforcement may trigger the need for new load flow analysis in PSA and corresponding reassessment using the WSC;
- **Changes to ANM configuration:** thresholds to trigger ANM action, notified to the WSC via the DMS.

1.8. Other Areas

1.8.1. System Interfaces

The High Level Solution Design outlines the approach to internal and external interfaces as well as manual interfaces. Manual interfaces are expected to be used within the TRANSITION trials and as a practical means to enable smaller providers of flexibility to access the markets.

The approach to implementation of interfaces between TRANSITION components is addressed. Point-to-point interfaces, use of enterprise service bus tools, interfaces via air gap interfaces between IT & OT environments, web services within or outside the DSO/DNO are covered.

Messages between the WSC and NMF are expected to be in XML based on the CIM energy market communications standard IEC 62325.

For messages between the WSC and other systems within the DNO/DSO it is expected that CIM-based XML (where used) is likely to be based on CIM standards IEC 61968 (DMS) & IEC 61970 (EMS), which are commonly used in DNO systems.

Detail on the approach to system interfaces can be found in Section 8 of the full High Level Solution Design. Figure 2 shows the groupings of interfaces for TRANSITION. The full High Level Solution Design provides a component view and system & manual interface diagrams.

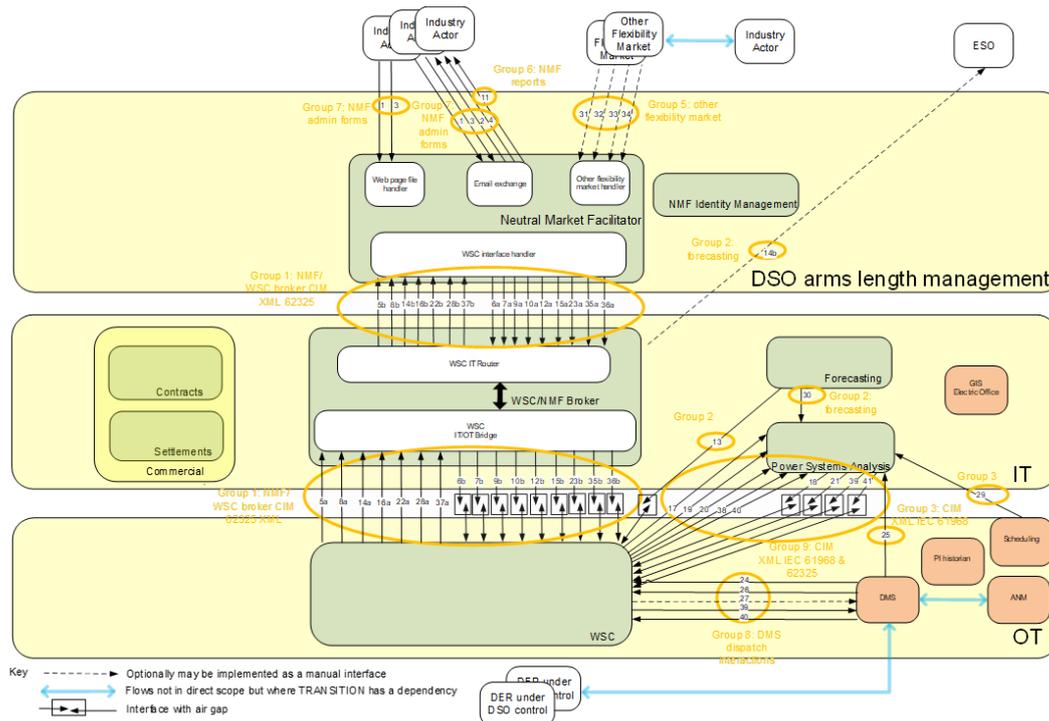


Figure 2: TRANSITION Interface Groups

1.8.2. Data architecture and governance

The High Level Solution Design outlines the data architecture for TRANSITION components at a conceptual level rather than logical or physical data models. Detailed domain models are provided for the NMF and the WSC.

The High Level Solution Design outlines the approach to data governance requirements.

1.8.3. Security

The NIST Cyber Security Framework (CSF) will be used as the basis for identifying, assessing and managing cyber security risk associated with information systems.

Where assets are to operate and managed within an Operational Technology environment, the controls defined in NIST 800-53 will be enhanced by using NIST 800-82.

In line with the principles defined in NIST 800-53/82, the impact of a cyber-security event is assumed to be MODERATE and the security controls selected accordingly.

1.8.4. Legal and Regulatory Constraints

Although the High Level Solution Design is not primarily aimed at legal and regulatory issues, issues that make a significant difference to the solution may be addressed.

1.8.4.1. Code Review

ElectraLink have been engaged to undertake a review of industry codes relevant to TRANSITION and identify potential code changes that could be informed by TRANSITION in alignment with the work conducted by Open Networks in 2019. This is expected to be delivered in Spring 2020 with any further analysis to be first considered by the T.E.F. Delivery Board and agreed with the appropriate Open Networks Workstream(s).

1.8.4.2. Notification of flexible energy resources

TRANSITION has a dependency on some details of DERs being recorded, e.g. ensuring that a DER registered on the NMF corresponds to an identified generation capacity at a specific point on the distribution network.

For the purposes of the TRANSITION trials any generation or supply point on the network which is going to be used as a DER for flexibility trading on the NMF must be registered on the NMF.

1.8.5. Outline Code of Connection (CoCo) for NMF users

A Code of Connection (CoCo) will describe requirements to which NMF users will need to agree to in order to use the NMF. The High Level Solution Design provides a summary of the approach that will be adopted for the TRANSITION trials. Development of a full CoCo for the NMF will follow the procurement and implementation of the NMF, in conjunction with the successful bidder.

1.8.6. Hosting

The High Level Solution Design provides an overview of the preferred approaches for IaaS, PaaS and SaaS for different TRANSITION components.

2. References

Industry references:

1. Ofgem Future Insights - Flexibility Platforms in Electricity Markets (September 2019)
2. Open Networks Workstream 3: Product 2 [DSO Functional and System Requirements](#) (May 2018)
3. Open Networks Workstream 3: Product 3 [Least Regrets](#)
4. Open Networks Workstream 3: [Future Worlds consultation](#) (July 2018)
5. ENA [119560 Open Networks Models User Guide](#)
6. Low Carbon London Learning Report [D2: DNO tools and systems learning](#) (2014)
7. Smart Grid Architecture Model (SGAM) modelling from the Future Worlds consultation, including the modelling toolkit published for use with the Enterprise Architect UML modelling tool
8. ENA Open Networks Workstream 1 is relevant, for interaction between Transmission and Distribution networks, with regards to WSC functionality

TRANSITION references:

1. TRANSITION Request for Proposal.
2. SSEN-NMF-REQ01-14 Neutral Market Facilitator Requirement Specification (Oct 2019)
3. SSEN-WSC-REQ01-10 Whole System Coordination Requirement Specification (Oct 2019)

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