The Voice of the Networks

Energy Networks Association

Open Networks Project

Proposals for Implementation of Electronic Exchange of Network Planning Data

January 2020

WS & Product Ref: ON WS1B P4 Report 2

Restriction: Public

Document Control

Version Control

Version	Issue Date	Author	Comments
D001	October 2019	Ian Povey	Initial Draft
D002	November 2019	Ian Povey	Draft
D003	December 2019	Ian Povey	Draft
V001	January 2020	Ian Povey	Version 1
V001.1	January 2020	Ian Povey	Version 1.1

Table of Contents

Executive Summary

The visibility and availability of data is crucial to building a smart energy system that supports achieving decarbonisation objectives and creates significant opportunities. The Energy Data Taskforce (EDTF) report set out a number of recommendations that aim to accelerate a transformation from today's analogue system to a modern digitalised one.

The focus of this Product has been the exchange of planning data between network companies and the mechanisms for this data exchange. However, the Product' proposals are made recognising the wider data requirements.

The first part of the Product's activities has proposed an increased scope and frequency of data exchange. This is the second part of the Product's activity and addresses the requirement to exchange data in a frequent and efficient manner.

The Product has established that there is currently little capability with the distribution network operators (DNO) to transfer planning data electronically, other than by email. The transmission system operator (NGESO) does exchange planning data on a pan-European level but not with UK DNOs.

The Product proposes the adoption of the IEC Common Information Model (CIM) standard as the appropriate data exchange format for the planning data exchange. This standard has been adopted by the European Network of Transmission System Operators for Electricity (ENTSO-e) data exchanges for the Ten-Year Network Development Plans and Regional Investment Plans so is well understood by NGESO. Some DNOs have developed CIM capability for internal data exchanges or as part of innovation projects.

To assist the Product's understanding of the digital technologies and standard associated with data exchange and the likely costs and timescales to implement, the Product membership was augmented with IS expert members. Indicative costs of £10.5m for industry implementation of CIM compliant data exchange mechanisms and an annual industry maintenance cost of circa £1.2m have been proposed. Timescale to implement CIM across the industry has been estimated at 39 months. However, significant more work is required to validate these costs and timescales.

An important element to establishing industry wide CIM data exchange is the UK governance of the development of the standard. Several organisations have been proposed to administer the UK governance through an industry working group. Furthermore, it is proposed that the UK governance organisation represent the UK at international working groups, ensuring that there is no divergence between the international, IEC, standard and the standard developed to meet UK needs.

1 Introduction

1.1 About ENA and our members

Energy Networks Association (ENA) represents the "wires and pipes" transmission and distribution network operators for gas and electricity in the UK and Ireland. Our members control and maintain the critical national infrastructure that delivers these vital services into customers' homes and businesses.

1.2 WS1B Product 4 – Data Exchange in Planning Timescales

This Product is a continuation of the work of the 2018 WS1 Product 12 (TSO/DSO & DER Data Requirements). It takes a wider approach to look at the scope and mechanisms of planning data exchange between network companies against a backdrop of an electricity system that is more decentralised, smarter and lower carbon.

The Product will propose an enhanced scope of data exchange between network companies that will better facilitate a coordinated and efficient approach to whole electricity system planning.

It is anticipated that both the scope and frequency of planning data will be significantly increased beyond that presently required by the network codes. The Product will review the current methods of planning data exchange, the existing capability to transfer the data electronically and, investigate and propose an industry standard for electronic data exchange.

The final element of the Product's work is to propose network code modifications that enable the introduction of the proposed scope and mechanisms for planning data exchange.

1.3 Scope of Report

This report details the delivery of the following sub-products:

- Sub-deliverable (b)(i) - Review the mechanisms currently used to share planning data between network companies. This should include the extent to which on-line web-portals are used and whether the current mechanisms are adequate or whether more widespread use of on-line data transfer would be beneficial.
- Sub-deliverable (b)(ii) – Identify what analysis software is used by network companies and how network models are transferred between companies. Identify how the volume and complexity of the network models to be transferred is likely to change going forward.
- Sub-deliverable (b)(iii) - Consider and recommend improvements to the mechanisms used to share data between network companies and from customers to network companies. This should include the wider and more consistent use of data transfer via on-line web portals. It should also consider the use of the Common Information Model (CIM) or similar to share more extensive network data models between network companies.

The report focuses on mechanisms for the exchange of planning data. The mechanisms for exchanging and providing data in an open manner is a much larger issue and network companies are developing their strategies and planning data exchange is forming just one element of these strategies. To assist the Product's understanding of the digital technologies and standard associated with data exchange and the likely costs and timescales to implement, the Product membership was augmented with IS expert members.

The ENA' Data Working Group is seeking to establish a digitisation strategy, across the gas and electricity sectors, that will deliver the recommendations of the Ofgem/BEIS Energy Data Taskforce (EDTF). This report is intended to provide input to that working group.

2 The Vision

2.1 Existing Methods of Planning Data Exchange

2.1.1 Existing DNO Planning Data Exchange Methods

DNOs are currently required to provide planning data to NGESO when making a Request for a Statement of Works and twice annually to fulfil the requirements of the Grid Code (Week 24 & 50 submissions).

In both instances the data is provided in the form of Microsoft Excel workbooks and spreadsheets.

Detailed preparation of the data and completion of the workbooks/spreadsheets varies by DNO and within multi-licence DNOs. However, the nature of data preparation is consistent across DNOs in that it is characterised by a manual manipulation of source data collected from disparate corporate IT systems.

Much of the data (network connectivity, equipment impedance etc) is found within the DNO's network power flow analysis software tool and/or associated databases; though this may not be the original source of the data. The power flow analysis software also generates some of the required data.

DNOs submit the workbooks/spreadsheets in one of two methods; either by email or via a restricted SharePoint Site called External Data Exchange (EDE).

It is noteworthy, that NGESO converts the Schedule 5 spreadsheet to a Common Information Model (CIM) format using a converter tool produced by Digsilent. The CIM data can then be imported into the Digsilent's Power Factory power flow analysis software used by NGESO.

2.1.2 Existing NGESO Planning Data Exchange Methods

Similarly, NGESO is required to provide planning data to each DNO annually to fulfil the requirements of the Grid Code.

Again, the data is provided in the form of Microsoft Excel workbooks and spreadsheets.

The ESO annually creates a forecast Winter Peak model that is used as the base for all Week 42 calculations.
Network reduction, load flow, fault analysis and other standard tools within NGESO's modelling tool (Digsilent) are used to produce the parameters for the Week 42 submissions in the different formats available within the Grid Code. These different parameters are then exported, by the Digsilent software, into Excel workbooks and sent via email to the DNOs.

Upon receipt of data from NGESO, it is a manual task for each DNO to incorporate it into their power flow analysis software.

Sub-deliverable (b)(i) requires the Product team to review the current methods of data exchange mechanisms. The review has only identified the two above detailed methods of email or the EDE data sharing portal.

2.2 Network Operators Analysis Tools and CIM capability

Sub-deliverable (b)(ii) requires the Product team to identify the power flow analysis software employed by each of the network companies.

Sub-deliverable (b)(iii) requires the Product team to consider the use of the Common Information Model (CIM) or similar to share more extensive network data models between network companies.

Table 1 below details the results of a survey of the power flow analysis software used by each of the distribution and transmission system companies, together with analysis of the software's CIM capabilities.

DNO	Area	Analysis Software	CIM Compliant I/E	Comment
ENWL	Norweb	IPSA-1[1]	None	Planned CIM capability as part of new NMS system that incorporates analysis software
NPg	North East	IPSA-2	None	Data transfer capability through SQL only
	Yorkshire	DINIS	None	
SPEN	SPD	DigSILENT PowerFactory v15.2	Import & Export Capability	PowerFactory version 2018 compliant with ENTSO-E 2009 profile, CGMES v2.4.15
	SPM	IPSA-2	None	
SSEN	SHEPD	PSSE v33[2]	No CIM Module	Planned CIM capability as part of introduction of new GIS system
	SEPD	PSSE v34	No CIM Module	Planned CIM capability as part of introduction of new GIS system
UKPN	LPN	DigSILENT Power Factory v15.2	Import & Export Capability	CIM tool used on KASM project. Difficulties experienced, mainly due to model construction
	EPN			
	SPN			
WPD	SWa & SWe	PSSE-v32.2, PSSE-v34.5 and PSSE-v34.6	None	Planned CIM format capability as part of Integrated Network Model project to create network single truth or master data set
	E&W Mid	IPSA-1	None	
NGET	ESO	DigSILENT PowerFactory	Import & Export Capability	CIM capable. Currently being used to transfer files for ENTSO-e studies.
NGET	TO	DigSILENT PowerFactory	Import & Export Capability	

Table 1

In conclusion, with the exception of the transmission network operators, there is little CIM capability across the UK network operators.

2.3 Where do we want to be

The primary focus of this product is data exchange for network planning purposes. Deliverable (a) of the product has proposed a significant increase in the volume and frequency of data exchange between network companies (see report; ON WS1B P4 Data Scope – Final Report V001).

The majority of T-D planning data exchange, although not all, facilitates the construction of network models within power flow analysis software tools. Assimilation of exchanged data into power flow analysis software is currently a time consuming and resource intensive process because of the differing software tools employed by the network companies. The proposed enhanced level of data exchange will only exacerbate the process.

To facilitate efficient planning of networks, data will need to be exchanged in a standard electronic format such that it can be quickly and automatically incorporated into existing network models, creating a whole system model that can be executed within any of the standard power flow analysis software tools.

The process of data exchange will need to be scalable; to allow larger network models (ie geographically or voltage level) of greater detail (ie protection information) to be exchanged should they be required in the future. Furthermore, it should be possible to exchange and or make visible other network data sets ie asset condition data, demand forecast data, connected DER data etc.

One of the recommendations from the EDTF report, 'A Strategy for a Modern Digitalised Energy System', is that data needs to be made available in an open and interoperable format. It is therefore a requirement that planning data exchanged between network companies is in an interoperable format and is made available to third party stakeholders.

[1] IPSA does not have CIM capability for any version however, a company called ZIV Automation has produced a tool that will deliver this functionality

[2] It is unclear whether PSSE's CIM tool is import only or both import/export. PSS-ODMS may be required for full import/export CIM functionality

3 Industry Standard for Data Exchange

Using an industry standard or an approach based on extending current industry standards to define the prototype of a future new standard, promotes the required interoperability between different organisations and products, and ultimately improves the efficiency of markets and choice of software product vendors.

The Product has identified the Common Information Model (CIM XML) as the widely preferred industry standard for data exchange. Many network companies have already adopted the standard as the means to exchange data between corporate systems and, to a limited extent, exchange data between companies.

The European Network of Transmission System Operators for Electricity (ENTSO-e) has adopted the IEC CIM standard for data exchanges such as Ten-Year Network Development Plans and Regional Investment Plans amongst other exchanges. This data is submitted by European transmission companies including NGESO (on behalf of all UK transmission companies).

Utilising the CIM, NGESO submits operational planning data on a daily basis 24 hourly scenarios to deliver a D-1 model, in a single block. This has estimated generation and demand for the time stamps, which are all based on CET time. The model is a full switch model of GB system, including OFTO and DNO networks, along with SPT, SHE-T and National Grid ET transmission systems. The CIM file sets contain Equipment underlying data, network Topology, State Variable – Voltage set points and Steady State Hypothesis – Switch status, TX tap positions, Gen dispatch and Load values.

At DNO level, Western Power Distribution (WPD) is currently implementing Integrated Network Model (INM), which will combine HV, EHV & 132kV asset data from their graphical information system (GIS), enterprise asset management (EAM) system and operational management system (OMS) to generate a digital twin of the distribution network and export data in CIM format. In addition to being a building block for WPD's distribution system operation and digitalisation strategies, INM and CIM will facilitate future interoperability with power system analysis packages and when WPD wish to share with third parties.

UK Power Networks (UKPN) are using the CIM to deliver functions within their Power Potential innovation project and their 'Enterprise' active network management (ANM) system as follows:

- Power Potential innovation project is using the network management system (NMS, PowerOn) to export CIM for use by the distributed energy resource management system (DERMS) software with the objective of dispatching DER Active (P) and Reactive (Q) power to resolve transmission constraints. There is development of dynamic CIM export capability in NMS (PowerOn).
- Enterprise ANM system rollout: UKPN are implementing a CIM driven design to carry out dynamic load flow and perform real time network control decisions.

There is also a lack of viable alternatives to CIM and it is not considered appropriate for network companies to develop alternative standards.

ENTSO-e is actively engaged with the IEC to ensure development of the CIM standard that meets their requirements. Similarly, UK network companies will need to establish governance processes to ensure that initial and future requirements for a UK

transmission/distribution standard are consistent across the industry and, preferably incorporated into the IEC standard.

This governance process could be administered through a standing working group within the ENA. In addition, such a working group could be established to oversee the introduction of CIM.

4 Roadmap

Having decided upon the use of the IEC CIM standard as the basis for T-D, D-D, ID-D data exchange and also the basis for providing stakeholder visibility of data in a standard format; there are a number of fundamental steps that need to be undertaken. These steps are illustrated in Figure 1.

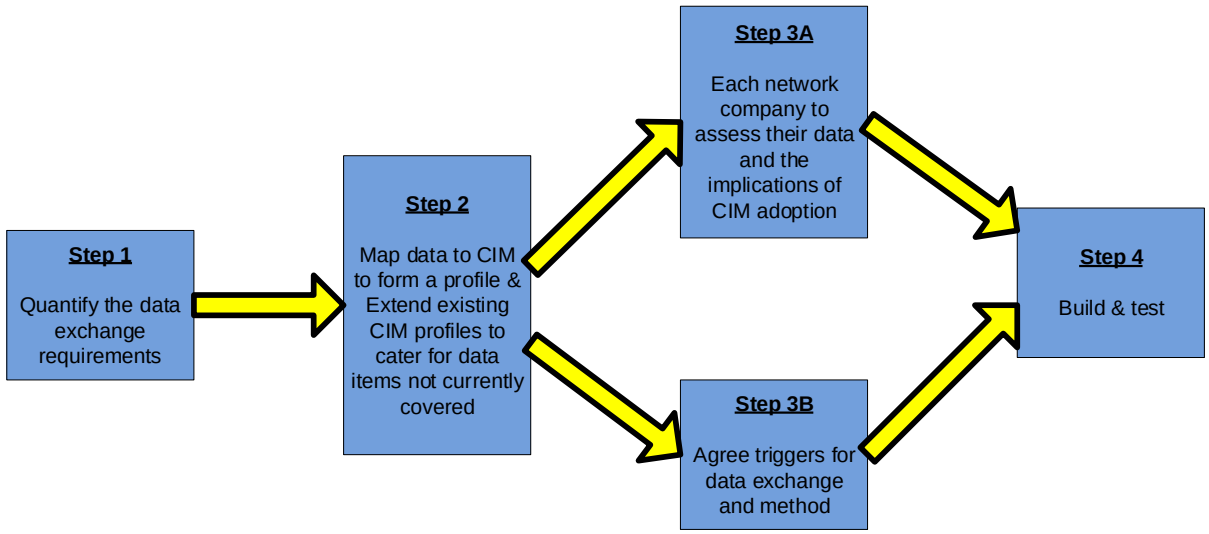

Figure 1 – Steps to Establishing Industry CIM

4.1 Step 1

Deliverable (a) of this Product has proposed a scope for exchange of data in planning timescales (see report; ON WS1B P4 Data Scope – Final Report V001). This scope shall form the basis of the data fields, or keys, to be included in the profile of CIM standard. The timescale for this step assumes that the proposals of the Final Report V001 have been incorporated into the Grid and Distribution Codes through appropriate code modification processes.

Timescale:

The data scope proposals of this Product (4) to be incorporated into the Grid Code and Distribution Code – 3 months

Indicative Cost:

£50k – includes ENA and network company costs.

4.2 Step 2

It is proposed that the ENTSO-e CIM model is used as the base profile to begin with.

A subset of members of the governance group will select the elements of CIM to form a profile of the set of data to be exchanged for planning purposes.

From this base select a subset of the CIM to form a profile of the set of data to be exchanged.

The governance group will establish the extent to which the CIM profile needs to be customised to meet the requirements for planning data exchange. It is anticipated that this will build on the work that NGESO have already done with ID profiling of different DNOs elements in the week 24 data exchange process. These customisations can be adopted in the UK ahead of formal engagement with the CIM working group and ultimate incorporation into the IEC CIM standard. It is envisaged that this step will incorporate a formal workshop of network companies and interested stakeholders.

Timescale:

Establish CIM profile for UK use: 6 months

Further work to incorporate into IEC CIM standard: 12months+

Indicative Cost:

UK CIM profile: £150k total

Engagement with IEC: £20k/year per network company to fund ENA. Total cost ~ £160k/year

4.3 Step 3A

Here each network company will have to review the data requirements of the agreed CIM profile standard, assess where the source of this data is within their portfolio of IT systems and how the data can be efficiently collated and imported into the CIM file.

Each network company has developed their own suite of IT systems over many years. Some of the companies have developed a level of CIM capability. Therefore the costs and timescales of this activity will vary by company.

Timescale:

CIM implication assessment: 3 months for your company

Indicative Cost:

CIM implication assessment: £25k per company

4.4 Step 3B

Based on the process proposals contained in ON WS1B P4 Data Scope – Final Report V001, the triggers for data exchange to be agreed.

The method of exchange of the CIM files will need to be agreed. This could be a portal or a cloud based sharepoint etc.

Timescale:

Agree triggers and exchange method: 6 months

Indicative Cost:

Agree triggers and exchange method: £100k industry total

4.5 Step 4

The final stage is to deliver a fully tested IT solution. There will be three elements to this step; the establishment of an appropriate portal to host the data, the system build within each network company to provide data to the portal and testing of the end to end solution across the network companies and the portal.

For the establishment of the portal, the activities will be:

- Document and agree the functional and non-functional requirements

- Complete design decisions on how the portal will be hosted (e.g. cloud), the security classification of the data (including any GDPR implications) and how it will ingest data from the network companies (e.g. file transfer, web service)
- Design and build the portal solution
- Testing of the solution; this will include unit and system testing of the solution, performance testing, security penetration testing and disaster recovery testing.

For system build in each network company, the activities will be:

- Document and agree the functional and non-functional requirements
- Design and build a solution to extract data from existing sources, transform to the CIM format, and load to the agreed output that can be provided to the portal
- Testing of the solution; this will include unit and system testing of the solution and, if deemed required by the network company, performance testing, security penetration testing and disaster recovery testing.

For testing of the end to end solution, the activities will be:

- A system integration test to ensure that data is received from the network companies and processed in the portal as expected
- A user acceptance test to confirm that the solution meets the user requirements

Timescale:

Build & Test Solution: 2 years

Indicative Cost:

Build & Test Solution: £10m industry cost

Annual operating cost

4.6 Roadmap Summary

Table 2 below provides a summary of the steps to deliver CIM planning data exchange.

	Step 1	Step 2	Step 3A	Step 3B	Step4	
Description	Quantify data exchange requirements	Create CIM profile	Company' data assessment	Agree data exchange triggers	Build, Test & Maintain	**TOTAL**
Build Cost £,k[2]	50	150	200	100	10,000	10,500
Annual Costs £,k		160			1,000	1,160
Step Duration, months	3	6	6		24	
Project Timeline, months	3	9	15		39	

Table 2

[2] All costs are indicative only.

5 Governance

It is proposed that a UK CIM working group is established with an appropriate body providing governance of the standards development within the UK. Several organisations have been identified as potential governance bodies as follows:

- The Institution of Engineering and Technology (IET)
- The British Standards Institution (BSI)
- The Energy Networks Association (ENA)

This does not represent an exhaustive list but does identify the main organisations capable of delivering the governance function.

The working group should consist, as a minimum, of representatives from each of the network companies and be chaired by a representative of the governance body.

It is further proposed that the working group chair represents the UK network companies at the IEC CIM User's Group and also the UCAI User's Group to ensure that CIM is developed in line with the requirements of the UK CIM working group.