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Virtual Energy System

Workstream 2 - Common framework

Data standards, data portals, and data licensing applicable to the whole-systems flexibility use case

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nationalgridESO

Virtual Energy System
Powered by National Grid ESO

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Contents

Introduction

Purpose of this document

The Virtual Energy System (VirtualES) SIF Discovery highlighted several areas that would benefit from further investigation and enabling activities in advance of the proposed demonstrator project being initiated.

This document summarises the research, findings, and recommendations of three of those activities:

1. Identified data standards applicable to the whole-system flexibility use case.
2. Initial review of currently available public energy sector ‘data portals’.
3. Outline data licensing considerations for the whole-system flexibility use case.

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1

Identified data standards applicable to the whole-system flexibility use case

Data standards

The context of this section

Context

The energy data landscape is extensive, diverse and influenced by a high number of national and international standards, glossaries, and ontologies that are specific to energy sub-domains. There are also domain-agnostic data and digital standards that enable standards to be applied across sectors and disciplines.

'Data standards' does not refer to a single standard. It is a collection of core standards that link to others to ensure interoperability and adoption. Data standard development and adoption is a continuous process. Principles are required to keep guiding the effort and create alignment among various stakeholders.

As important as the data and data model itself is the metadata which describes the source, content, quality etc. It is critical that any users of the dataset are fully aware of this information in order to use the dataset appropriately.

Metadata records and a collection of standards

A metadata record is a structured or semi-structured record that describes information being held in a dataset, consisting of the following components.

- **Core attributes:** the minimum attributes required for each data record
- **Additional attributes:** attributes that enable extension flexibility, with varying requirement levels
- **Quality indicator:** providing annotations documenting any known data quality issues.
- **Scope notes:** providing definitions for metadata attributes and terms.
- **Glossaries / taxonomies / topic lists / controlled vocabularies:** providing definitions of terms, topics and subject within a domain.
- **Schemas / ontologies:** a structured document indicating the collection of attributes and any conformance of standards.

To support the whole-system flexibility use case by enabling the necessary data exchange, the data standards may need to include the following types:

- **Data-specific:** Domain-agnostic standards such as Dublin Core Metadata Initiatives (DCMI), Common Information Modelling (CIM), IETF RFC2119 requirement levels. Any metadata record needs to share a minimum set of information with the system to achieve interoperability and visibility.
- **Domain-specific:** Glossaries / vocabularies describing assets and various operations for each energy domain. These support accurate description of datasets within a domain and converge a common understanding across organisations.
- **Use case-specific:** Energy sources, assets, and data attributes that characterise flexibility, including:
  - **Assets:** generators, interconnectors, transmission and distribution networks require standards to describe asset types and asset attributes.
  - **Time shift:** batteries and smart chargers with longer duration storage require standards to describe asset types and asset attributes.
  - **Location shift:** interconnectors and greater grid integration require standards to describe geolocations, asset types and asset attributes.
  - **Vector shift:** energy source conversion and the use of low carbon fuel for electricity generation requires standards to describe energy sources.

A collection of standards

Research into data standards applicable to the whole-system flexibility use case

Below are indicative examples of data standards that are applicable to the whole-system flexibility use case.

The complete list of currently identified data standards can be found in Appendix A.1.

Data-specific (domain agnostic)

Examples of two data-specific standards are:

- IEC 61970-301:2020+AMD1:2022 - Common Information Model (CIM)
- Dublin Core Metadata Initiatives (DCMI)

Each has core and additional data attributes. The Energy Data Visibility Project (EDVP), commissioned to address Recommendation Three of the Energy Data Task Force (*to increase visibility of energy data by listing metadata*), highlighted 35 minimum metadata attributes.

This project created a spreadsheet of relevant standards used within the sector which has been provided alongside this document with those standards considered relevant to the flexibility use case highlighted in Appendix A.1

Domain-specific (e.g. renewable energy)

There are numerous domain-specific standards, as each domain has attempted to standardize within the domain. However, there is limited cross-domain working in the creation of these standards.

Example domain specific standards:

- Solar energy vocabulary: ISO 9488:1999
- Energy efficiency and renewable energy sources — Common international terminology
  - Part 1: Energy efficiency: ISO/IEC 13273-1:2015
  - Part 2: Renewable energy sources: ISO/IEC 13273-2:2015
- Additional vocabularies describing low carbon energy: The UK Low Carbon Environmental Goods and Services Analysis Report (LCEGS)

Use case specific (Whole-system flexibility)

Time shift

- IEC Common Information Model (CIM).
- IEC TS 62933-3-1:2018 - Part 3-1: Planning and performance assessment of electrical energy storage systems - General specification
- Additional asset glossaries to be identified from the existing codes e.g. distribution code, grid code.

Location shift

- Open Geospatial Consortium (OGC)
- UK GEMINI 2.3
- Communication networks and systems in substations glossary DD IEC/TS 61850-2:2003
- Additional asset glossaries to be identified from the existing codes e.g. distribution code, grid code

Vector shift

- Energy domains and related assets to be adopted and identified from domain-specific standards.
- PD IEC TS 61850-2:2019 (Communication networks and systems for power utility automation. Glossary)

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Related projects

Ongoing projects considering whole-system flexibility

Related projects

The INTERRFACE, ENTSO-E, EU-SYSFLEX, BRIDGE and OneNet are example projects in the European Union developing system flexibility and adopting data standards including the Common Information Model and Dublin Core Metadata Initiatives. A combination of standards are planned to be adopted to meet data exchange requirements and system flexibility.

In these example projects, gap analyses were carried out to map layers of information within the system and identify gaps among standards and data exchange requirements to achieve flexibility.

Typically, the more mature and regulated the market, the better the data maturity and extent of data standardisation. There are energy sub-domains e.g. nuclear energy, regulated electricity and gas markets where glossaries or standard topic lists are more easily developed.

Legislation or governance frameworks are recommended to enforce data standards and exchange across parties.

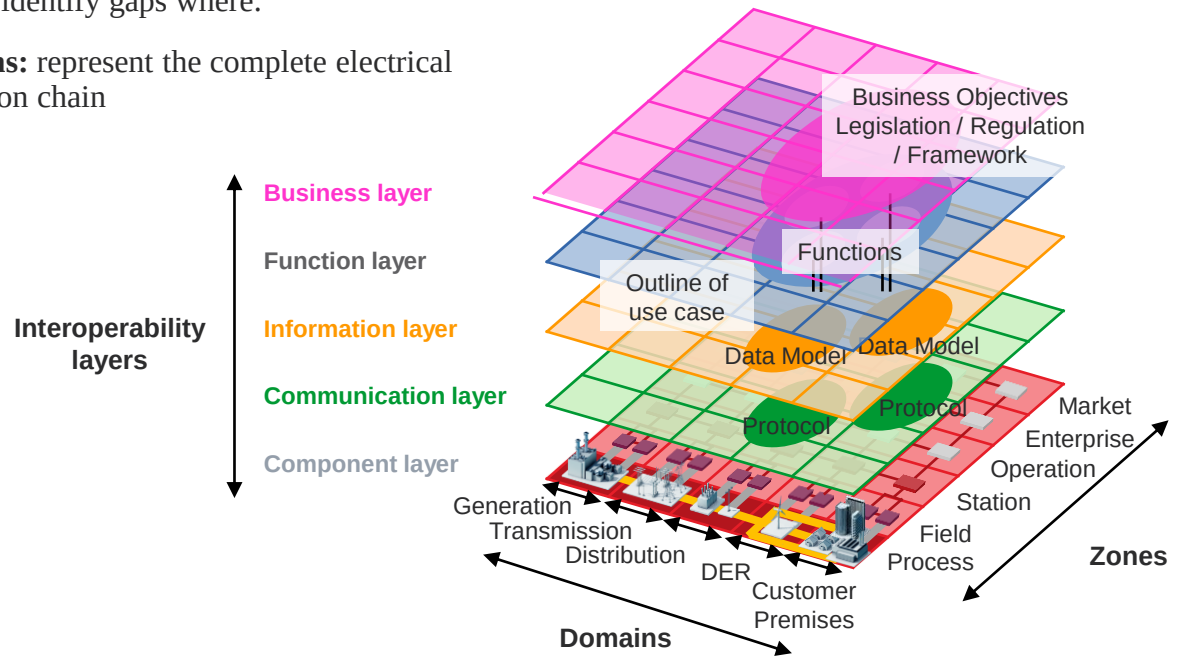
SGAM Framework

The smart grid requires interoperability between the various tiers of the energy sector. In order to incorporate each requirement a framework termed the Smart energy Grid Architecture Model (SGAM) was developed.

This is a three-dimensional framework (interoperability, domains and zones) that provides a structured description of a distributed Smart Grid System in order to identify gaps where:

- **SGAM Domains:** represent the complete electrical energy conversion chain
- **SGAM Zones:** represent the hierarchical levels of power system management
- **SGAM Interoperability:** layers represents the various tiers required for any energy system to operate effectively.

This framework is considered a useful way to review data standards at the information layer, to determine which areas of the energy sector are covered by that standard and its reach within each organisation.



Published gaps in the Common Information Model (CIM)

Understanding the current gaps in CIM

During the Discovery phase it was clear that implementation and extensions of the CIM were required and were being carried out by the DNOs. Other projects (mainly in the EU) have been looking at some of these areas which are critical to the flexibility use case and have identified the following gaps which should be assessed in the GB sector.

Project	Gap identified
EU-SysFlex	Current CIM coverage for flexibility services and products not sufficient for congestion management
	Location data of assets required for ensuring operational security of distribution system
	All data flows required for baseline (of flexibility service providers) not covered by CIM
	Energy data portability to move data between applications requires comprehensive CIM coverage
TDX-ASSIST	Insufficient classes and attributes for Business Objects in TSO/DSO data exchanges required for long term and operational planning purposes
OneNet	Current CIM CGMES header and metadata models not sufficient to cover all TSO/DSO needs

Source: A review on TSO-DSO Data Exchange, CIM Extensions and Interoperability Aspects, Bytyqi et al (2022)

Another assessment conducted for the EU-SysFlex project below highlights in a RAYG scale the coverage of data exchange systems in various use cases within the energy sector.

These assessments have highlighted that there are numerous gaps that need to be addressed in CIM to meet the requirements of a whole-system flexibility use case. Further discovery is recommended to understand whether these gaps are also applicable in a UK-context and for the VirtualES proposed whole-system flexibility use case.

USE CASE	Covered in existing standards and specifications?	Further CIM coverage needed?
Collect energy data		May be needed
Transfer energy data		Recommended
Provide a list of suppliers and ESCOs		Not needed
Manage flexibility bids		May be needed
Manage flexibility activations		May be needed
Verify and settle activated flexibilities		May be needed
Manage access permissions		Recommended
Authenticate data users		Recommended
Manage data logs		Recommended
Calculate flexibility baseline		Recommended
Predict flexibility availability		May be needed
Manage sub-meter data		Recommended
Exchange data between DER and SCADA		Recommended
Anonymize energy data		May be needed
Aggregate energy data		May be needed
Erase, restrict and rectify personal data		Recommended

SUMMARY OF COVERAGE OF DATA EXCHANGE SYSTEM USE CASES BY EXISTING STANDARDS AND SPECIFICATIONS

Source: Proposal for data exchange standards and protocols, EU-SysFlex

Summary

Conclusion of data standards applicable to the whole-system flexibility use case

Summary

In summary the situation with regards to data standards in the energy sector can be outlined as follows:

- There already exists a significant number of international standards covering many aspects of data exchange between the TSO/DSO and other actors in the energy sector.
- The predominant data standard structure is focussed predominantly on the use of the Common Information Model (CIM), but gaps have been identified before it can be fully interoperable in a flexibility use case.
- The Smart energy Grid Architecture Model (SGAM) has been widely used to illustrate interactions between assets and business needs via the information and functional layers.
- Typically, the more mature and regulated the market, the better the data maturity and extent of data standardisation.
- A significant body of research and demonstrators have been / are being completed, especially in various EU funded projects whose findings or output could greatly benefit this aspect of the VirtualES in the UK.

Recommended future work

Further work recommended for Alpha:

1. Engagement with both DSOs and TSOs to determine their common principles for data management and standards under flexibility use case, and the International data standards which have been adopted
2. Development of end requirements for sharing of data and whether existing standards fully meet these
3. Recommendation on data standards which should be adopted and the extensions required including SGAM as a model
4. Identify which international data standards may require adaptation to be of most use in the VirtualES, and whether this can be suggested through the appropriate standards committee / working groups, or as an addendum. Determine which are in place and where compliance is enforced.

Relevant papers, projects and organisation

Identified papers, projects and organisations considering a whole-system flexibility data standards

Project	URL	Resources	URL
ENTSO-E	https://www.entsoe.eu/	TSO-DSO Data Management Report	https://eepublicdownloads.entsoe.eu/clean-documents/Publications/Position papers and reports/entsoe_TSO-DSO_DMR_web.pdf
OneNet Project Business Use Cases	https://onenet-project.eu	Specification and Guidelines for Western Cluster Demos: • WECL-FR-02 - Improved TSO-DSO information exchange for DER activation • WECL-PT-01 - Exchange of Information for Congestion Management – Short term • WECL-PT-02 - Exchange of Information for Congestion Management – Long term • WECL-PT-03 - Exchange of information for operational planning	https://eui1-my.sharepoint.com/:b:/g/personal/chiara_canestrini_eui_eu/EQfTM9oevEVJhNWCGiPPb68BhltU96nM4lNMMQO_qFfKWA?e=jvMT3e
EU-SysFlex	https://eu-sysflex.com/	Proposal for data exchange standards and protocols	https://eu-sysflex.com/wp-content/uploads/2021/05/Deliverable-5.5-report-FINAL-2021.04.29.pdf
		Data Demonstrator	https://eu-sysflex.com/wp-content/uploads/2022/02/WP9-Demo-Fact-Sheet_Estonian_Final.pdf
TDX-ASSIST	http://www.tdx-assist.eu/index.php	CIM CGMES-Extensions for the TSO- DSO Data Exchange in the EU-Project 'TDX-ASSIST', Marten et al (2019)	https://publica.fraunhofer.de/entities/publication/62bbdf40-1c2d-4f94-aa57-fab852619234/details
		Design and Development of Enhanced Data Exchange to Enable Future TSO-DSO Interoperability	https://bura.brunel.ac.uk/handle/2438/18595
		Standards Assessment of Business Use Cases Proposed in TDX-ASSIST	https://www.cired-repository.org/bitstream/handle/20.500.12455/153/CIRED 2019 - 798.pdf?sequence=1&isAllowed=y

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Relevant papers, projects and organisation

Identified papers, projects and organisations considering a whole-system flexibility data standards

Project	URL	Resources	URL
INTERRFACE	http://www.interrface.eu/	A Review on TSO-DSO Data Exchange, CIM Extensions and Interoperability Aspects	https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=9744632
		Spatial Aggregation of Local Flexibility – Horizon 2020 project experiences poster EA4EPO	http://interrface.eu/sites/default/files/Spatial_Aggregation of Local Flexibility - Horizon2020 project experiences - Poster.pdf
SyC Smart Energy	https://syc-se.iec.ch/		
BRIDGE	https://bridge-smart-grid-storage-systems-digital-projects.ec.europa.eu/	Data management working group review of Interoperability of Flexibility Assets	https://ec.europa.eu/energy/sites/default/files/documents/bridge_wg_data_management_interoperability_of_flexibility_assets_report_2020-2021.pdf
		Data exchange reference architecture review	https://ec.europa.eu/energy/sites/default/files/documents/bridge_wg_data_management_eu_reference_architcture_report_2020-2021.pdf
		Use Case repository	https://ec.europa.eu/energy/sites/default/files/documents/bridge_wg_data_management_use_case_repository_report_2020-2021.pdf
		Xflex Review of Data Standards and Models for Interoperability	http://xflexproject.eu/wp-content/uploads/2021/07/XFLEX_D6.1-Standards-and-data-models.pdf
E.DSO	https://www.edsoforsmartgrids.eu/	The value of the digital transformation – opportunities for Distribution System Operators	https://www.edsoforsmartgrids.eu/wp-content/uploads/FINAL_Digital-transformation-position-paper.pdf

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2

Initial review of currently available public energy sector ‘data portals’

Data portals

The context of this section and key findings and recommendations

Context

The Virtual Energy System (VirtualES) common framework will enable the secure and resilient sharing of energy data across organisational and sector boundaries.

Access to, and the use of, already available and accessible data will benefit the development of the proposed common framework demonstrator project which is considering a use case of whole-system flexibility.

It is acknowledge that '*data portals*' has various definitions across the energy sector. For the purposes of this report a 'data portal' is broadly defined as any web-based location where data and datasets specific to an organisation are aggregated and published in any variety of machine and non-machine readable formats.

The intention of establishing energy data portals is to make it easy for data consumers to search, discover, access and securely share energy data. The expectation from the recommendations of the Energy Data Task Force is that energy data sharing covers both open data and shared data where access requires control.

The initial review the identified energy data portals is given in Appendix A.2.

Key findings

1. There is no industry standard adhered to, or requirement for consistent presentation, for the publication of data across the energy sector.
2. The visual appearance, accessibility, and availability of data varied significantly between portals – with most portals having an inadequate user experience. Some organisations have more than one data portal which made navigating and data visibility harder.
3. Metadata was not always accessible in the portal which presented challenges in understanding the content without, for example, downloading and analysing datasets individually.
4. Data sets within each data portal have a range of different formats. Well-developed portals present data sets in several consistent formats (e.g., csv, GeoJSON, xlsx, pdf, png). Less developed portals have greater variability of formats. Similar data sets available across multiple portals are often in different formats.
5. Open Energy has the most comprehensive list of metadata on different data sets. However, as the portal is still in development it does not include all data sets found in the all of the data portals provided by the TNOs, DNOs, and ESO.

Recommendations

Following this initial research, it is recommended:

1. Continue engagement with Ofgem and the ENA to support the Common Information Model (CIM) regulatory approach and long term development statement for licensed organisations to publish a standardised and consistent set of data sets, and encourage other energy data owners to also comply.
2. Contact the organisations with data portals categorised as accessibility types B, C and D, (i.e. data is only available by request) to determine access conditions for datasets understood to be required for the whole-system flexibility use case.
3. Maintain an open dialog with Open Energy to understand their roadmap for energy data search, and how this could support the development of the VirtualES.

Guidance of data portals requirements

Guidance from the Energy Data Task Force on the requirements of data portals

Data sharing best practice guidance

One of the five key recommendations from the Energy Data Task Force was for Energy sector data to be '*Discoverable, Searchable, Understandable*', with common '*Structures, Interfaces and Standards*', and is '*Secure and Resilient*'. This provides a high-level definition of the requirements of data sharing portals.

Ofgem's Data Best Practice Guidance and Supporting Information sets out the data best practice principles for sharing data and making data assets discoverable and usable by potential data users. This guidance can equally be applied to licensees and non-licensee energy organisations which own energy data.

The guidance includes what is considered the ideal functions of energy data portals:

- *Ensuring that any potential data users can identify the data assets of data custodians, and pursue access to these data assets.*
- *Data custodians must ensure that the metadata associated to data assets is discoverable to data users, subject to the outcome of an open data triage process.*
- *Data owners must ensure that data assets are interoperable with data assets from other data and digital services.*
- *The licensees must make data available in such a way that it is reasonably easy for data users to:*
  - *Exchange data assets between systems;*
  - *Interface with data assets held in the licensees systems; and*
  - *Join data assets with other data assets, such as by using standard interfaces, standard data structures and/or common reference data.*

It is important to recognise that establishing data portals is an evolving process, with the energy data landscape only recently opening up.

There are several factors which can support the sharing of energy data. These include:

- Understand stakeholders (internal users, local government, businesses, consumers and the energy industry) and their needs.
- Implement strong data governance and clear data ethics policies.
- Continually develop the organisation's data strategy and the data portal.
- Engage in sharing best practices across the wider sector.

Data Portals and the VirtualES

The VirtualES common framework will rely on the visibility, accessibility, interoperability and security of data exchange across the energy network to enable the VirtualES to ultimately facilitate the energy system moving towards a fully autonomous operation mode with right-time decision making.

A service such as Open Energy can provide a service to make it easier to search, discover, access and securely share energy data across both open data and commercial shared data where access requires control. Any such service relies on that data being made available by the data providers.

Data best practices, metadata, and the ability for some level of machine-to-machine integration are essential to support the interoperability required for the VirtualES.

Approach

Approach used to review the identifiable data portals

Organisations & data portals

This initial research considered gas and electricity transmission network operators, distribution network operators, system operators, regulators, governmental bodies, private sector, and non-profit organisations.

Data portals were assessed on data accessibility, data formats, interoperability, and metadata, with other parameters such a number of data sets also recorded. Due to the variation in types of data portals available, for this exercise a data portal has been considered as any web-based location where data and datasets specific to an organisation are aggregated and published.

Accessibility and requesting

It was found that within any given data portal there can be data sets with different levels of accessibility.

This has been identified in the review at a portal level by categorising each portal into one or more of the following categories:

A. All data is openly accessible

B. The type of data set and group is visible, but an application to obtain access is required.

C. Little information about the type of data is available. There is a data request tool or form available to request data sets within the portal.

D. No information about the type of data is available but there is a request form or contact details to request data.

The presence and availability of a clearly visible data request tool on the data portal has been recorded.

The availability within the data portal of any API endpoints for machine-to-machine interaction for data exchange is also recorded.

Data licenses, metadata, volume of data & data type

Data licenses have been detailed where they either explicitly exist or are considered as relevant but not stated.

The presence of metadata and its format have been recorded, where it explicitly exist.

The number of data sets and group have been recorded where possible, either as an absolute number (if easily provided) or an approximation.

For simplicity, the types of data available has been categorised as either operational**,** asset, or other data.

A short comment has also been given, if appropriate, to provide further context and description about the data portals.

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Outline data licensing considerations for the whole-system flexibility use case

Data licensing

Outline considerations for the whole-system flexibility use case

Context

It is considered that the VirtualES common framework demonstrator will be able to directly apply lessons from the data licensing practices of the National Digital Twin programme Climate Resilience Demonstrator (CReDo).

A key lesson from CReDo was the need for early engagement with the legal teams of the partners involved in the project. At this stage of the common framework demonstrator the partners are are yet to be fully confirmed. Therefore this activities' focus was to:

- Establish strong relationships with the CReDo project team and exchange key best practices.
- Conduct an initial assessment of the legal outputs and conclusions shared and published by CReDo to understand resources and assets that can be re-used.

Lessons from CReDo

Through conversations with the CReDo project the following outline considerations were identified as applicable to the VirtualES common framework demonstrator:

The use of a data exploration licenses:
These are temporary data licenses which grant access to data to appropriate people for the purposes of the demonstrator only. They sets out conditions which data providers require the data holder to maintain.

For example, the common framework demonstrator will need to consider the following, which will require addressing early in the demonstrator progression.

- What data will be shared
- Where data will be securely held for the purposes of the demonstrator and what security measures will need to be in place e.g. multi-factor authentication, not disclosing locations of assets, etc.
- Who has access to the data and for what purposes

With this structure, the liability for unauthorised access or use of the data was with the data holder, not the data provider, if they are different entities. For CReDo, the data was held on the DAFNI platform.

For the common framework, and its demonstrator, a more decentralised model of data sharing might be considered more appropriate.

Consider the use of a data trust:
The Open Data Institute (ODI) defines a data trust as:

> *"a legal structure that provides independent stewardship of data"*

The application of data trust is an evolving field. Their applicability to the common framework should be considered in more detail, however the data trusts legal and governance consideration, states:

> *"[…] each data trust will need its own, individually designed, legal structure. It is not possible to recommend any single form of legal structure or even to produce a set of templates from which data trusts could choose."*

Therefore, data trusts should be considered in the context of the wider VirtualES and common framework, rather than specifically for this demonstrator.

Recommended next steps

Once the demonstrator partners are identified their legal teams should be immediately engaged. The outline data to be shared and the access requirements agreed, alongside the most appropriate location for data to be held to enable the demonstrator. The use of data exploitation licenses, data trusts, or other methods then considered, discussed, and progressed.

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Appendix

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A.1
Data standards initial review

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Data standards initial review appendix is provided as a separate document.

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A.2
Data portal initial review

Organisation name	Data Portal (Y/N)	Data portals (Y/N)	Accessibility				Data request tool / form (Y/N)	Endpoints available Note: for any/ some datasets	License	Metadata		Data present			Type of data	Comment
			A	B	C	D				Y/N	Format	Data Format	Approx. number of datasets	Approx. number of groups		
Gas Transmission Network Operator																
National Grid Gas Transmission NGGT	Y	Gas Transmission Open Data Requests	Y	N	N	Y	Y	N	They are owned by National Grid and users are required to acknowledge National Grid in any product or application using "© National Grid UK".	Y	Gemini 2.2 metadata	xslx, ESRI Shapefiles (shp)	80	20	Operational, Assets	List of links to documents and data sets with little information describing the data.
		Data and operations (National Transmission System (NTS)						N								
		Transmission operational data - with links to various data						Y								
		Data Item Explorer Index						N								
		Network route maps (electricity)						N								
Electricity System Operator																
National Grid Electricity System Operator ESO	Y	National Grid ESO Data Portal	Y	N	N	N	N*	Y	NG ESO open data licence, creative commons attribution 4.0	Y	Provided with data	csv, GeoJSON, xlsx, pdf, png, cURL	91	12	Operational	Well organised data portal with consistent data formats.
Electricity Transmission Network Operators																
National Grid Electricity Transmission NGET	Y	NGET Network Route Maps	Y	N	N	N	N	N	-	Y	Gemini 2.2 metadata	ESRI Shapefile	4	1	Asset	One page of data files on the network route maps.
Scottish Power Transmission (SP Transission)	Y	SP data hub	Y	N	N	Y	N	N	OS licence required for Utility Map Viewer	N	N/A	xlsx, map viewer only on request	10	4	Operational, Assets	Data mainly in the form of interactive maps with an email provided to request raw data.
Scottish and Southern Electrictricity Networks Transmission	Y	SSEN Network Maps	Y	N	N	N	N	N	-	N	N/A	xlsx	6	2	Operational	Network maps for generation availability and network capacity, with selected files downloadable.
Gas Distribution Network Operators																
Cadent	Y	Downloadable Maps Viewer (by 3rd party provider)	N	Y	N	N	N*	N	No details available	N	N/A	-	-	-	Asset	Mention of plans for open data and a Data Catalogue in DSAP, however no Data Portal or Catalogue is discoverable online
Northern Gas Networks (NGN)	N	-	-	-	-	-	N*	-	-	-	-	-	-	-	-	Mention of plans for open data and a Data Catalogue in DSAP, however no Data Portal or Catalogue is discoverable online
Scotia Gas Networks (SGN)	Y	Scotia Gas Networks: Pipes	N	Y	N	N	N*	N	Not open	Unknown	N/A	WFS, only available on request to SGN	4	1	Asset	Authorisation key needed for access.
Wales and West Utilities (WWU)	N	-	-	-	-	-	N*	-	-	-	-	-	-	-	-	Mention of plans for open data and a Data Catalogue in DSAP, however no Data Portal or Catalogue is discoverable online
Electricity Distribution Network Operators																
Western Power Distribution (WPD)	Y	Connected Data Portal (also see FAQ page)	Y	Y	N	N	Y*	Y	-	N	N/A	Csv, gpkg, GeoJSON, dBase, SQL	87	6	Operational, asset	There are several locations with different levels of accessibility. The Connected Data Portal will act as a centralised repository for all data that can be shared openly (initially) to drive further forwards WPDs Presumed Open data culture and wider Energy Data Taskforce Report recommendation. The benefits of the Portal include offering powerful ways to easily search our data without the need for download, consume data via Application Programming
		Data hub						Y								
		DataPortal2						-								
UK Power Networks (UKPN)	Y	UK Power Networks Data Portal	Y	N	Y	N	Y*	Y	Creative commons license 4.0	Y	JSON	Csv, xls, JSON, GeoJSON, shapefile, KML	48	8	Operational, asset	Whole dataset download formats listed- some can be consumed as an API, table or map. Open ended data request form.
Electricity Northwest (ENWL)	Y	Electricity Northwest Data Portal	Y	Y	N	N	N*	N	-	Y	Webpage, xlsx	Xlsx, xlsm, gpkg	Not possible to determine	6	Operational, asset	4 open data sets- access required to see most datasets.
Scottish and Southern Energy Networks (SSE Networks)	Y	Network maps	Y	N	N	N	N*	N	-	N	N/A	Interactive map	9	3	Asset	Interactive map showing grid supply points and substations for Scotland and England, bulk supply points for England.
Scottish Power Energy Networks (SP Energy Networks)	Y	SP data hub	Y	N	N	N	N*	N	OS licence for one map	N	N/A	xslx, interactive map	10	4	Operational, asset	No clear data catalogue, a tiled format for different data groups providing links to alternative sources where some data can eb found.

Organisation name	Data Portal (Y/N)	Data portals (Y/N)	Accessibility				Data request tool / form (Y/N)	Endpoints available Note: for any/ some datasets	License	Metadata		Data present			Type of data	Comment
			A	B	C	D				Y/N	Format	Data Format	Approx. number of datasets	Approx. number of groups		
Northern Power Grid (NPG)	Y	Demand heat map Generation Heat Map	Y	N	N	N	N*	N N	-	N	N/A	xlsx, interactive map with option to download xlsx file containing data	2	2	Operational, asset	No clear data portal-random pieces of data can be found throughout the site.
Regulator																
Ofgem	Y	Ofgem Data Portal	N	N	Y	N	N	N	-	N	N/A	Images of graphs	169	4	Operational, other	Graphs look like they have been made on excel so may be able to request data in xlsx format.
Government																
UK Government Data Portal	Y	Data.gov.uk	Y	Y	N	N	N	Y	UK open government license, other	Y	Varies by dataset provided by 3rd parties	csv, pdf, html, ods, xls, xlsx, zip	516	-	Operational, asset	Many datasets in one location with varying levels of accessibility. No grouping of data making it hard to see what is available. E.g. 516 results returned on key word search for "energy" in the data portal.
Scottish Government	Y	Scottish Government Spatial Data Scotland Energy Statistics Scotland Heat Map	Y	N	N	N	Y	N Y N	-	Y	Varies by dataset provided by 3rd parties	ESRI shapefile, GML, KML, MapInfo MIF/MID, SHP, WFS, WMS	950	26	Operational, asset	Government spatial datasets include the windfarm proposals for Scotland. Energy statistics Scotland has a user interface with interactive graphs and fugures displaying the data with an option to download the data in csv/xlsx format.
Welsh Government	Y	Welsh Government Stats Wales Lle Geoportal for Wales Spatial data	Y	N	N	N	Y	Y N	UK open government license	Y	Varies by dataset provided by 3rd parties	Shapefile, GeoJSON, KML, GML	12	-	Asset, other	The welsh government's data portals consist mainly of datasets unrelated to energy. Most energy datasets consist of low carbon and renewables data.
Low Carbon Contracts Company (LCCC)	Y	LCCC Data Portal	Y	N	N	N	N	Y	UK open government license	Y	Varies by dataset provided by 3rd parties	csv, JSON, xlsx	31	5	Operational	Well organised data portal- most data on CfDs.
Industry / private bodies																
Energy Networks Association (ENA)	Y	ENA Databases *Energy Data Request Tool	Y	Y	N	Y	Y*	N -	-	N	N/A	xlsx	-	-	Asset, other	Innovation portal is s collection of TNs and DNs data. Data bases webpage has links to multiple sources of data with- payment is required for access to some documents/data.
Icebreaker One / Open Energy	Y	Open Energy	Y	Y	N	N	N	-	Different licenses depending on owner of dataset	Y	Open standards	Csv, png, doc, JSON, xlsx, dbase, kml, GPKG, xml	233	-	Operational, asset, other	Open energy search system gathering metadata on existing datasets in many locations. Some restricted data sets.
Elexon	Y	Electricity industry Data	Y	N	Y	N	Y	Y	BMRS open data license	N	N/A	csv	-	-	Operational, other	Little open data- most data is behind a wall that requires a login. Access can be requested.
Energy Systems Catapult (ESC)	Y	Energy Systems Catapult Datsets	Y	Y	N	N	N	Y	Energy systems catapult data sharing license	Y	JSON	XML, JSON, CSV, XLSX	70	-	Operational, asset, other	Mixture of open data and description of data with a request option. Easy to navigate- description of datasets on tiles. Information on most views datasets available.
Improvement Service. Scottish Local Government Spatial Data. Reference to SGN Gas Network - Scotland (not open data)	Y	Spatial Hub for Scottsh Local Government Data SGN geospatial data (not open data)	N	Y	N	N	N	N	-	Y	Description of the data on webpage only	WFS, GeoJSON, Shapefile	-	-	Asset	Information Services portal provides a description of the data, and signposts the user to request the data from SGN. Other datasets available in other locations on ths IS website e.g. wind turbine spatial framework.
The Crown Estate Scotland	Y	CES Spatial Hub	Y	N	N	N	N	Y	Open Government License version 3	Y	ISO-19139 Metadata	PDF, CSV, KML, Shapefile, GeoJSON, File Geodatabase	40	-	Operational, asset, other	Datasets are searchable, grouped by categories, and presentable as featured layers on interactive maps.
Crown Estate	Y	Crown Estate Open Data Portal	Y	N	N	N	N	Y	The crown estate open data license (GIS)- version 1.1	Y	ISO-19139 Metadata	CSV, KML, Shapefile, GeoJSON, File Geodatabase	20	-	Operational, asset, other	Datasets are presented as featured layers on interactive maps.

** The Energy Data Request Tool from the ENA is an online form that can be used to request any type of data from GB mainland energy network operators. It requires prior knowledge of the data name, type and description. There is no data catalogue, nor any data search*

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