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POLICY BRIEF

Getting Our Act Together on the EU Interoperability Acts

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Highlights

- The recast of the Electricity Directive (EU) 2019/944 in the Clean Energy Package entitles the European Commission to adopt implementing acts specifying interoperability requirements and non-discriminatory and transparent procedures for access to data. Preparatory work is already ongoing. In this policy brief, we argue that the acts should be ambitious in addressing the multiple dimensions of interoperability and that we can draw inspiration from existing experience with interoperability in the electricity and the healthcare sectors. We also provide governance recommendations.
- First, different multi-dimensional interoperability frameworks exist. While they agree that full interoperability can only be achieved if all dimensions are addressed, they do not agree on either the number of dimensions or on labelling them. We do not propose an additional framework but identify commonalities across the frameworks that need to be addressed to achieve full interoperability of energy services within the Union.
- Second, experience shows that different use cases can inspire different solutions. We focus on the North American Green Button initiative for utility customer data and ENTSO-E's experience in supporting network code requirements for the exchange of market and network data. Moreover, experience with interoperability in healthcare is very advanced and can serve as an inspiration for energy, especially regarding interoperability testing and governance.
- Third, governance is a key issue in achieving interoperability. The existing governance mainly covers stakeholder dialogue and European standardisation. We provide ideas on how to use the EU interoperability acts to step up these efforts. In addition, we think governance should be extended to include formalisation of best practices, implementation monitoring and reporting, and interoperability testing. This governance could be taken on by a new EU entity.

Introduction

The original European Commission proposal for the recast of Electricity Directive (EU) 2019/944 in the Clean Energy Package included a requirement for Member States to define a common data format and a transparent procedure for eligible parties to have access to energy customer data. The European Commission was entitled to determine by means of implementing acts a common European data format and non-discriminatory and transparent procedures for accessing data that should replace the national data formats and procedures for access adopted by the Member States.[1]

In anticipation of these implementing acts, the European Smart Grids Task Force (ESGTF) was tasked by the European Commission with exploring the potential for an industrial initiative for and the possible scope of a common data format at the EU level.[2] It has been concluded that this format should be:

- compatible with what already exists in the Member States;
- adaptable to handle different time resolutions;
- flexible to support any type of variables and units and to address different use cases implemented in the Member States;
- scalable so as to incorporate new future variables or data; and
- easy to implement with the working knowledge already available in the Member States.

Most importantly, it should not be a single data format but an approach that would allow for compatibility or alignment with the existing systems already decided on in the Member States. The main argument against a single data format concerns the anticipated costs of moving from long-established business and IT processes which have been set up to handle traditional retail services such as change of supplier and billing to a new system. The ESGTF argues that even small changes to the existing systems would require dedicated projects and large investments, ultimately resulting in increased costs for consumers.

During the Trialogue negotiations, the national and the common EU data formats were removed from the directive. The final version of the Electricity Directive (EU) 2019/944 requires Member States to "*facilitate the full interoperability of energy services within the Union*" (Art.24(1)).[3] The European Commission is entitled to adopt by means of implementing acts interoperability requirements and non-discriminatory and transparent procedures for access to data that shall be based on existing national practices.

At the European Electricity Regulatory Forum (Florence Forum) in June 2019, the European Commission established interoperability as one of three legislative priorities.[4] It seems probable that multiple implementing acts will be adopted to cover existing retail processes, emerging services based on data sharing and emerging services related to demand side flexibility. Note that implementing acts on

1. 'Data' is understood to include metering and consumption data as well as data required for customer switching, demand response and other services in accordance with Article 23(1) of Directive (EU) 2019/944.
2. This paragraph relies on the findings in ESGTF (2016), My Energy Data and ESGTF (2019), Towards Interoperability within the EU for Electricity and Gas Data Access and Exchange.
3. In its report My Energy Data, the ESGTF (2016) describes service interoperability as follows: "*a service developed in one national market could easily be sold in other markets.*" An EU definition of 'energy services' is provided in Art. 2(7) of Directive 2012/27/EU on energy efficiency.
4. See European Commission (2019), 4.1_5.1_EC_NC update CACM, presentation at the European Electricity Regulatory Forum 2019.

interoperability will not be adopted as new network codes.

To get our act together on the EU interoperability acts, this policy brief: argues that the acts should be ambitious in addressing the multiple dimensions of interoperability for electricity and gas customer data (section 1); refers to relevant experiences with interoperability, i.e. the North American Green Button initiative for utility customer data, the ENTSO-E initiative in Europe for electricity market and network data and interoperability experience in the healthcare sector (section 2); identifies governance as a key issue in achieving interoperability of energy services; and provides low and high ambition policy recommendations (section 3).

1. The EU Interoperability Acts Should be Ambitious in Addressing the Multiple Dimensions of Interoperability

Interoperability frameworks help to describe the way in which organisations have agreed to interact and exchange information with each other.[5] Such frameworks have not only been developed in the electricity sector but also in other sectors like public administration and healthcare, as is illustrated in Figure 1. While there is no agreement on the exact number of interoperability categories, all frameworks recognise that interoperable implementation can only be successful when agreement is reached across all layers of concern and all the relevant stakeholders are involved in the process. We do not propose an additional framework but identify commonalities across frameworks that need to be addressed to achieve a full interoperability of energy services.

Regulation and policy. Regulatory and/or policy alignment is needed at different geographical levels from the European to the regional, national and local to provide incentives and remove impediments to structures that facilitate interoperability.

Roles and responsibilities. Responsibilities, i.e. tasks, services and functions, should be allocated to harmonised roles independent of real-world parties and physical implementation in applications, systems and components. This helps to standardise and harmonise information exchange, avoid a lock-in of responsibilities by specific parties and ensures flexibility concerning national implementation and future requirements. Depending on the national context, a role may be allocated to a specific party.

Business processes. Organisations wishing to work together and exchange information are likely to have different internal structures and processes, in terms of both business and IT. They are also likely to use different languages. In addition, the objects of interest, the parties involved in the discussion and the language they use may be very different from layer to layer. For example, while there are policy-makers and regulators involved in the highest layer, there are system engineers and developers involved in discussing software artefacts and information modelling in the more technical layer.

Therefore, in a first step and as a fundamental basis for reaching interoperability, terms and definitions need to be agreed upon to reach a 'common language' and thereby the basis for common understanding. In a second step, methodologies are needed to define business goals and align existing business processes or establish new ones across organisational boundaries.

Aligning business processes requires documenting them in an agreed standardised way with commonly accepted modelling techniques, including the associated information to be exchanged. Together, these steps establish a common ground for comparison and ensure that all the parties involved can under-

5. Note that both narrow and broad understandings of interoperability exist. A narrow understanding only covers interoperability among information and communication technology (ICT) systems, while in a broader understanding interoperability of ICT systems is the means to the end of enabling organisations to work together more efficiently and effectively. We adopt the latter understanding of interoperability in this paper.

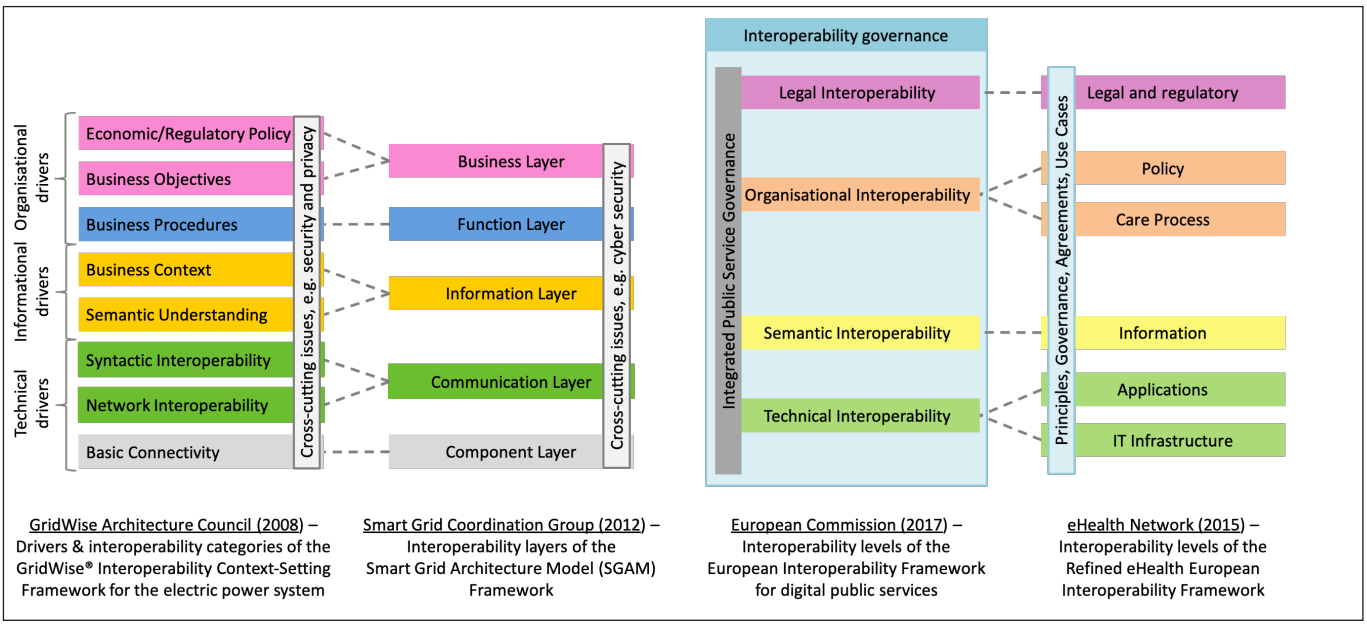
stand the processes and their role(s) in them. A use-case-driven approach is often adopted. This involves the definition of business use cases at a higher level and system use cases at a more technical level.

Information model, data format and communication protocol. Once the business processes are documented, the focus can shift to the content and structure of the information that is exchanged. Interoperability frameworks typically include the use of common descriptions, i.e. agreed processes and methodologies, to make sure that the format and the precise meaning of exchanged data and information is preserved and understood throughout the exchange process. They also include details of the technology involved in linking systems together, for example how information is transported across multiple communication networks and agreements on the data-transmission medium and the rules for accessing it.

Use of standards. Standards support and help to improve interoperability as they essentially specify an agreement between interacting parties. Since no single standard product will be able to cover all different viewpoints and layers of interoperability, a set or portfolio of standards is typically needed to address well-defined use cases. It is important for frameworks not to mandate or endorse the use of any specific (set of) standards. Priority should be given to open international standards instead of proprietary ones to guarantee the inclusion of all stakeholders in their development, enable their re-use and encourage innovation and supplier competition. Standardisation is not a one-off task and standards are likely to be adapted or substituted as technology changes and evolves.

Interoperability testing. Although they are necessary, standards are not sufficient to achieve interoperability. A framework to test and certify how standards are implemented in devices, systems and processes is fundamental to ensure interoperability and security under realistic operating conditions. Note that conformity with communication standards does not necessarily translate into interoperability among communicating devices and systems due to

Figure 1: Selection of interoperability frameworks across sectors



Sources (from left to right): GridWise Architecture Council (2008), GridWise® Interoperability Context-Setting Framework; Smart Grid Coordination Group (2012), Smart Grid Reference Architecture; European Commission (2017), New European Interoperability Framework; eHealth Network (2015), Refined eHealth European Interoperability Framework.

certain degrees of freedom that developers typically face in implementing a communication standard. Testing therefore needs to cover conformity assessments to meet the requirements of standards and interoperability tests among devices and systems.

2. Experiences with Interoperability in Electricity and Healthcare

Different use cases can inspire different solutions. In North America the Green Button standard has been used for newly emerging services based on data-sharing and could inspire solutions for these kinds of services in Europe. The ENTSO-E approach has been applied to existing services provided by European TSOs with many legacy systems and might inspire the approach for existing retail services. What has been achieved in the healthcare sector is also a source of inspiration.

The North American Green Button. The Green Button initiative is an industry-led effort launched in the US in January 2012, and it has since been expanded to Canada. The initiative was a response to a White House call-to-action to provide utility customers with easy and secure access to their energy usage information in a consumer-friendly and computer-friendly format via a green button on the websites of utilities for electricity, natural gas and water. Green Button currently essentially covers two capabilities which relate to different parts of the standards it is based on. First, the 'Green Button Download My Data' capability allows customers to download their data in a common XML format that is defined in the ESPI standard for energy usage information communicated from back-end utility data systems. Second, the 'Green Button Connect My Data' capability is based on a data-exchange protocol defined in the ESPI standard for the automatic transfer of data from the utility to a third party based on customer consent.

ENTSO-E. In the implementation of data exchange requirements related to the ENTSO-E Transparency Platform, the Ten-Year Network Development Plan and the electricity network codes and guidelines, ENTSO-E has gained experience with interoperability. For the purpose of this paper, we refer to coordinated capacity calculation, which is a challenging task for three main reasons. It is based on data exchanges among all European TSOs, Regional Security Centres (soon Regional Coordination Centres) and ENTSO-E. It is a cross-domain business process covering both the market and the network domain. Additionally, different Capacity Calculation Regions (CCR) follow different calculation methods (Flow-based and Net Transfer Capacity), which come with different data exchange requirements.

Fundamental to the methodology applied by ENTSO-E is the aim to define a 'common language' as the basic building block for achieving interoperability across CCRs. An 'implementation guide' lists agreed terms and definitions and documents the coordinated capacity calculation business process in a standardised way by means of use case diagrams, roles and their descriptions, activity diagrams and sequence diagrams. Together, these build a generic framework that can accommodate specific local or regional needs, for example by including optional sequences in the sequence diagram to account for data exchanges only required in certain CCRs. Building on these elements, the specific data exchanges are defined in more detail using techniques based on Unified Modelling Language (UML). ENTSO-E uses international and European standards but has also been engaged in standardisation activities to develop technical specifications and standards tailored to the needs of European TSOs.[6]

Table 1 maps the Green Button and the ENTSO-E experience onto the common aspects of interoperability frameworks introduced in the previous section of this paper.

6. The Implementation Guide for Coordinated Capacity Calculation is available on the ENTSO-E website.

Table 1: Mapping of selected experiences with interoperability in the electricity sector onto common aspects of interoperability frameworks introduced in the previous section of this paper

	North American Green Button	ENTSO-E[7]
Regulation/policy	U.S. states including California, Illinois, Colorado, Texas, New Hampshire and New York have Green Button data access and sharing policies in place. Several other states are in the process of reviewing data access policies.	EU Electricity Network Codes and Guidelines
Roles and responsibilities	Covered in the NAESB REQ.21 - Energy Services Provider Interface Model Business Practices standard[8]	Harmonised Electricity Market Role Model
Business process	The model for business practices and use cases part of the Green Button standard	Business Process Implementation Guides incl. terms and definitions, business process description, use case diagram, sequence diagrams, etc.
Information model, data format and communication protocol	Common XML format and data exchange protocol as specified in the Green Button standard	Common Information Model (CIM) families of profiles: Common Grid Model Exchange Specification (CGMES) and European Style Market Profile (ESMP), 'harmonised data format' CIMXML and XML, Secure Advanced Message Queuing Protocol
Use of standards	The Green Button standard is based on the North American Energy Standards Board's Energy Services Provider Interface (NAESB ESPI) data standard and its underlying energy usage information model seed standard, the NAESB "PAP10" REQ 18/WEQ19 standard	International and European standards and technical specifications
Interoperability testing	Yes, conformance testing and Green Button certification via the Green Button Alliance Testing & Certification Program	Yes, CGMES conformity assessments and CIM interoperability tests

7. Some elements of ENTSO-E's approach to support network code requirements are described in more depth in Chapter 9 of Schittekatte, T., Reif, V. & Meeus, L. (2020), The EU electricity network codes (2020 ed.).

8. See the website of the North American Energy Standards Board.

Healthcare.[9] Interoperability is recognised as being at the same time one of the key drivers of eHealth and one of the greatest challenges in healthcare IT. What has proven successful in the health sector can be described as a multi-step use-case-driven profile-based test-oriented approach to achieving interoperability. A unique element in healthcare interoperability is how testing is carried out. Large-scale international test events are organised on a regular basis and they provide implementers with the possibility of demonstrating component interoperability and compliance with standards or profiles. Testing typically takes place in a neutral environment with the activities covered by a non-disclosure agreement, which allows for cross-vendor collaboration and the removal of barriers to integration that might otherwise need to be addressed ex-post, on site and at the customer's expense already during the product development phase.[10] Note that research has been done that includes a proof-of-concept for transferring the healthcare approach to the energy sector.[11] Note also that we are already experienced in drawing inspiration from the healthcare sector as the Green Button initiative was inspired by the Blue Button, which enables people to access and download their own health information.[12]

3. Governance Recommendations

We have an existing EU governance for interoperability in energy that covers stakeholder dialogue and standardisation. We could increase the ambition in these two activities, and in addition consider the creation of an EU entity for interoperability management that takes on ownership of the improvement process by formalising best practices and taking responsibilities in terms of implementation monitoring and reporting.

Stakeholder Dialogue. Since its foundation in 2009, the European Smart Grids Task Force (ESGTF) has been the main body for formalised stakeholder dialogue with the European Commission and for sharing national experiences in the area of smart grids. In a low ambition scenario, the European Commission would renew the mandate of the Task Force to advise on emerging topics (e.g. demand side flexibility) and share experiences in Member States.

In a high ambition scenario, the European Commission could aim to centralise the discussion at the EU level by setting up an 'interoperability stakeholder committee' to be co-organised by ACER, the EU DSO entity, ENTSO-E and ENTSOG following the example of the electricity network codes and guidelines. Given the scope of the complex challenge involved in achieving full interoperability of energy

9. We mostly base this paragraph on the Interoperability Guideline for eHealth Deployment Projects, a deliverable of the eStandards project under call H2020-PHC-2014 that provides a comprehensive summary of the approach followed in healthcare. How this approach is implemented in practice can be seen in the example of Integrating the Healthcare Enterprise (IHE). IHE is an international non-profit organisation that is active worldwide to bring together healthcare IT system users and developers to address interoperability issues that impact clinical care. The term electronic health services ('eHealth') describes the use of information and communication technologies (ICT) in health-related products, services and processes, for example e-prescriptions and electronic health records.

10. These international test events are the annual IHE Connectathons. Other test events are, for example, Connectathons, organised by the standard-developing organisation High Level Seven International (HL7), and plugtest events, organised by the European Standards Organisation ETSI.

11. The 'Integrating the Energy System (IES)' research project successfully demonstrated that it is possible to apply methods from healthcare in the energy sector. See also Gottschalk et al. (2018), *From Integration Profiles to Interoperability Testing for Smart Energy Systems at Connectathon Energy*. Energies 2018, 11(12), 3375. https://doi.org/10.3390/en11123375.

12. See former U.S. CTO Aneesh Chopra's blog post 'Modelling a Green Energy Challenge after a Blue Button.'

services within the Union and the vast differences that currently exist between Member States, it is not unreasonable to assume that the implementing acts will require stakeholder coordination during the implementation phase, or even the development of so-called terms and conditions or methodologies as we have seen with network codes.

The interoperability stakeholder committee would ensure that relevant stakeholders are kept up to date with developments and provided with a forum in which to express their views and feedback throughout the implementation phase. As with the operations network code family, the committee could consist of various technical expert groups that are dedicated to groups of use cases, e.g. existing retail processes, emerging use cases based on data sharing or related to demand side flexibility. The working groups could be tasked with developing and documenting formal rules governing the related data exchanges using commonly agreed methods and tools. Such rules can include common terms and definitions, harmonised roles and responsibilities, generic use cases, activity and sequence diagrams, commonly agreed information standards, data models, profiles and specifications for data exchange and rules and architectures for data aggregation.

European standardisation.[13] For the application of Union harmonisation legislation, the European Commission is entitled to request the European Standardisation Organisations (ESOs) CEN-CENELEC-ETSI to develop harmonised standards. Examples of relevant mandates given to ESOs in the past are M/490 to support smart grid deployment, M/441 in the field of smart metering and M/468 concerning the charging of electric vehicles. ESOs are required to encourage and facilitate appropriate representation of all relevant stakeholders and their effective participation.

In a low ambition scenario, the European Commission could integrate customer data exchange and access into the annual Union work programme on European standardisation. The European Commission may request one or several ESOs to draft a relevant European standard or European standardisation deliverable. An example of an existing standardisation gap seems to be customer consent management and customer authentication.

In a high ambition scenario, the European Commission could formally require ENTSO-E, ENTSOG and the new EU DSO Entity to contribute to standardisation activities relevant to their formal tasks and responsibilities. In addition to standardisation, formal requirements for European associations to contribute to interoperability testing and profiling could also be considered in the future.

An EU entity for interoperability management. Experience with interoperability in the healthcare sector has shown that reaching and maintaining interoperability requires a continual improvement process due to changing policies and regulations, emerging use cases and new requirements, the continual development of IT and ICT, rapid changes in the application of components, interfaces and software and continual developments in standardisation. Standardised processes and methods are needed as is described throughout this paper. An entity is needed that takes on the ownership of this improvement process and ensures comprehensive stakeholder participation, including the provision of non-discriminatory access to its results to all relevant stakeholders in the form of, for example, standards, documents or tools. The entity would need to be cross-domain in nature to integrate at least electricity and gas but should also remain open at the frontiers of the traditional energy sector in the light of trends like the internet of things and electric vehicles.

Three groups of tasks can be envisaged. First, formalisation of best practices. We need to re-use and extend best practices with interoperability. The EU entity could be charged with creating and main-

13. European standardisation is governed by Regulation (EU) No 1025/2012.

taining an 'interoperability repository' as a reference point for national implementation.[14] The repository would serve as a collection of all documents specifying the formal rules governing customer data exchange developed by the working groups of the 'interoperability stakeholder committee' described above. Non-discriminatory access to the repository would need to be ensured for all relevant stakeholders. With increasing use cases that span domains, e.g. flexibility services offered by a (group of) customer(s) to a network operator, the repository could be integrated with similar ones (e.g. ENTSO-E's CIM library) at a later stage.

It could be worth considering H2020 research projects as a multiplier of best practices and a facilitator for the identification of standardisation gaps. As they naturally deal with innovative practices, H2020 consortia could be well-suited to suggest expansions of existing methodologies and models according to the requirements of new use cases, for example the Harmonised Electricity/Gas Market Role Model and the Common Information Model.

Second, implementation monitoring and reporting. It can be assumed that progress towards commonly defined interoperability targets for energy services will advance at varying speeds, given the existing differences at the national level regarding customer data management, access and exchange. With multiple implementing acts being probable, implementation speeds might also differ according to the type of service, i.e. existing, emerging based on data-sharing or emerging related to demand side flexibility. Member States could be required to draft national interoperability action plans defining their pathways towards the interoperability target model and to update them on a regular basis. The European Commission could require the EU entity for managing interoperability to administer and maintain an integrated framework for monitoring, assessing and reporting on progress in implementing the national interoperability action plans using key performance indicators and measurable targets.[15]

Third, interoperability testing. The example of the healthcare sector shows the importance of well-structured easily accessible recurrent testing events for component interoperability and standard/profile conformity. An EU entity for interoperability management would be well-placed to provide the necessary neutral environment for large-scale testing events.

Note that in the case of healthcare, the entity that takes on some of these tasks is the non-profit initiative Integrating the Healthcare Enterprise (IHE), which consists of vendors and users of healthcare devices. We are not certain about the feasibility of such an approach for electricity and gas customer data in Europe. However, there are other candidates that could be responsible for all or some of the above-mentioned tasks, for example the Joint Research Centre (JRC), ACER, the EU DSO Entity, ENTSO-E and ENTSOG.

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14. Some repositories already exist but do not cover the whole spectrum of formal rules suggested here. We know of the ENTSO-E CIM libraries, and the EPRI Use Case Repository.

15. Similar efforts have been made in the area of public administration to foster interoperability of digital public services across Europe. See, for example, the website of the National Interoperability Framework Observatory (NIFO) set up to help share and reuse national experiences. Note also that monitoring the gap between national practices and a reference model was recommended by the ESGTF (2019).

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