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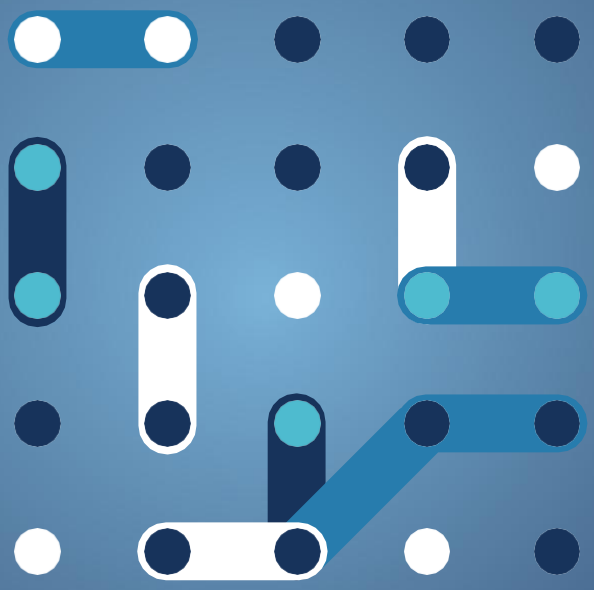
Standards User Group

version (2024)

Data Management Working Group



BRIDGE
Standards User Group (BSUG)

Data Management Working Group

October 2024

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List of Acronyms and Abbreviations

AMI	Advanced Metering Infrastructure
BESS	Battery Energy Storage System
BPMN	Business Process Model and Notation
BRP	Balance Responsible Party
CEMS	Customer Energy Management System
CEN	European Committee for Standardization
CENELEC	European Electrotechnical Committee for Standardisation
CIM	Common Information Model
DER	Distributed Energy Resources
DoEAP	Digitalisation of Energy Action Plan
DR	Demand Response
DSO	Distribution System Operator
ebIX	European forum for energy Business Information eXchange
EMS	Energy Management System
ESB	Enterprise Service Bus
ENTSO-E	European Network of Transmission System Operators for Electricity
ETIP SNET	European Technology and Innovation Platform Smart Networks for Energy Transition (ETIP SNET)
ETSI	European Telecommunications Standards Institute
EU.DSO	European Distribution System Operators
EV	Electrical Vehicle
FAQ	Frequently Asked Questions
FO	Flexibility Offer
FS	Fully Standard
GBP	Generic Business Process
HLUC	High-Level Use-Case
IEC	International Electrotechnical Commission
LEC	Local Energy Community
LV	Low Voltage
MES	Modified or Extended Standard
MO	Market Operator
MV	Medium Voltage
OCPP	Open Charge Point Protocol

OS	Open Specification
PUC	Primary Use-Case
SDO	Standards Development Organisation
SGAM	Smart Grid Architecture Model
SO	System Operator (i.e. TSO or DSO)
TSO	Transmission System Operator
UFTP	USEF Flex Trading Protocol
USEF	Universal Smart Energy Framework
WG	Working Group

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Executive Summary

After analysing Standard Development Organisations, standardisation topics, this report proposes a list of topics, findings and recommendations associated BRIDGE Standards User Group. This report has identified the following 4 main topics along with findings and associated recommendations.

- **Internal coordination**
- **External coordination**
- **Standardisation topics**
- **Standardisation topics management**

A BRIDGE Standards User Group was proposed in 2021, with the following objectives:

- **Establish internal coordination** with BRIDGE Regulation working group and other BRIDGE Data Management actions
- **Establish external coordination** with existing CEN/CLC/ETSI Coordination Group for Smart Grids (CG-SG), and also ENTSO-E CIM Expert Group
- **Disseminate internally/externally lessons learnt on standard implementation** from BRIDGE participating projects
- **Contribute** to the ICT standardisation roadmap[1] and standardisation strategy[2]
- **Establish** a dashboard and a list of resources to manage and support the above objectives
- **Establish** external coordination with ETIP-SNET WG4 "Digitalisation of the electricity system and customer application", PANTERA[3], JRC SG-DoIT[4], DERLab[5], and other relevant associations
- **Educate** about some (de-facto) standards, ontologies
- Contribute to **Digitalisation of Energy Action Plan[6]** (DoEAP)

Since then, a number of actions have been deployed:

- Liaison with CEN/CLC/ETSI Coordination Group for Smart Grids (CG-SG), as well as ENTSO-E CIM Expert Group
- Coordination between the BRIDGE standards user group and other actions of the Data Management Working Group
- The creation of a repository of code components
- The creation of a playlist of webinars

[1] https://digital-strategy.ec.europa.eu/en/policies/rolling-plan-ict-standardisation
[2] https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13099-Standardisation-strategy_en
[3] Home - PANTERA (pantera-platform.eu)
[4] https://ses.jrc.ec.europa.eu/sgdoit
[5] https://der-lab.net/
[6] Digitalising the energy sector – EU action plan (europa.eu)

1 Introduction

The Data Management Working Group aims to cover a wide range of aspects, from the technical means for exchanging and processing data between stakeholders to the definition of rules for exchanging data, including security issues and responsibility distribution. Accordingly, the WG has identified 3 areas of collaboration around which mutual exchange of views and discussions have been set:**Communication Infrastructure**, embracing the technical and non-technical aspects of the communication infrastructure needed to exchange data and the related requirements

Cybersecurity and Data Privacy, entailing data integrity, customer privacy and protection and general security of energy systems

Data Handling, including the framework for data exchange and related roles / responsibilities, together with the technical issues supporting the exchange of data in a secure and interoperable manner, and the data analytics techniques for data processing.

The last report from the BRIDGE Standard user group, published in 2022, included the results of a consultation of projects on their contribution to standardisation, and related recommendations.

This current report will focus on the exploitation of the collected inputs, as well as some additional project analysis, which has enabled the creation of a webinar playlist and a repository of code components, which have been initiated to disseminate the results of projects. They should improve the understanding of the standards ecosystems and facilitate the implementation of standards.

1.1 Key objectives and BRIDGE data management actions

Based on the conclusions of the 2023 BRIDGE General Assembly, the WG addressed **5 actions in 2023**:

- Extension and enhacement of the BRIDGE repository *(continuation and extension)*
- EU data exchange reference architecture *(continuation)*
- Reference Framework *(continuation)*
- Contribution from BRIDGE projects to standardisation *(continuation)*
- Interoperability of home appliances *(continuation)*

The 4th action is detailed in this document.

1.2 Review of previous recommendations

Topic	BRIDGE internal coordination
Recommendation	Establish close cooperation with the BRIDGE Regulation Working Group and other BRIDGE Data Management Working Group Actions in order to be consistent on standardisation issues

Results	On 11 December 2023 a joint workshop on the topic of data spaces was organised by BRIDGE Regulation and Data Management Working Groups with the help of CINEA and PwC. The Business Model WG also participated.
	
	The conclusions were :
	
	• The group agreed to organise a follow-up workshop between the end of February and the beginning of March.
	• The aim was to use these use cases as an overarching starting point, and from that, delve deeper in discussion of data spaces prioritisation, identifying the best practices as BRIDGE projects. A possible format proposed was to have five in-depth sessions during the workshop, tackling those priority use cases from the angle of data regulation business model, organised in short presentations followed by discussion time.
	• The use cases identified in the ETIP SNET WG4 Energy Data Space Policy Paper, published in 2024, were designated as a priority for discussion for the follow-up workshop.
	• These use cases could be clustered into five specific categories, from a different consumer perspective to organise the discussion during the workshop:
	  ○ Control room for system operators
	  ○ Grid flexibility
	  ○ Role of buildings in flexibility
	  ○ Residential energy optimisation & Smart Charging
	  ○ Smart sector integration
	• A follow-up workshop 6 months later was proposed . A clear plan with a timeline and recommendations should be identified, possibly before the General Assembly 2024.

Topic	BRIDGE external coordination
Recommendation	In order to facilitate CIM usage by EU R&I projects not involving ENTSO-E, establish a liaison agreement with ENTSO-E, which will include that an ENTSO-E representative who will join the BRIDGE UG. It could also involve a BRIDGE representative joining ENTSO-E expert groups. ENTSO-E and BRIDGE will share some documents: ENTSO-E CIM roadmap, EU regulation roadmap, draft specifications, UML models, CIM datasets, CIM issues …
Results	Liaison with ENTSO-E has been established. The ENTSO-E annual work programme[7] is a very interesting document in order to plan the cooperation every year.

[7] https://www.entsoe.eu/publications/general-publications/awp/

Recommendation	BRIDGE should use the European Standard Organisations as the main conduit to: firstly, propose new topics for standardisation or flagging existing standards that should be updated, and secondly reach out to the international arena (e.g. IEC). Establish a liaison between BRIDGE Standard User Group and CEN/CENELEC/ETSI Coordination Group on Smart Grids (CG-SG)
Results	Liaison with CEN/CENELEC/ETSI CG-SG has been established and BSUG contributes to standardisation gaps identification managed by CG-SG.
Recommendation	Identify if other association representatives, participating in BRIDGE funded projects need to be included (EU.DSO, USEF, …) or if these liaisons will be supported by Organisation experts participating in EU R&D projects. Organisation experts will be free to inform BRIDGE about these liaisons and inputs done.
Results	The following groups have been identified as interesting for future collaborations with the BRIDGE standards user group: • The joint working group between EU DSO entity and ENTSO-E • The Smart Energy Expert Group

Topic	Standardisation Topics
Recommendation	Monitor what PANTERA and ETIP-SNET WG4 are doing and use their conclusions to identify standardisation topics. Provide BRIDGE User Group standardisation results to PANTERA[8] and ETIP SNET WG4[9] to collect feedback.
Results	In November 2023, ETIP-SNET published "Energy Data Space" policy paper[10]. Its goal is to give a short technical introduction to the topic, providing references for a deeper analysis, and then to focus on the identified opportunities, challenges and necessary actions for a quick deployment of a common European energy data space. Another interesting input is the ETIP SNET R&I Implementation Plans 2025+.
Recommendation	Anticipate standardisation topics based on existing and yearly updated Rolling Plan for ICT Standardisation[11]. Contribute to Rolling Plan for ICT Standardisation update
Results	The 2024 rolling plan edition[12] has proposed several updates related to EU Data Strategy, Data Economy and Data interoperability, and new trends. The liaison established with CEN/CLC/ETSI CG-SG consolidates this participation as illustrated by the Smart grids and Smart Metering 2024 rolling plan section[13].
Recommendation	Question the BRIDGE projects each year to identify and prioritise topics
Results	A survey was issued to projects in 2022, with 9 answers from projects. Participants to the BRIDGE standards user group (BSUG) were, moreover, required to present and share information about their projects. In 2023, news projects contributed to BSUG.
Recommendation	Exchange information on standard implementation based on BRIDGE demonstrators, JRC SG-DoIT[14] and DERlab[15] in order to identify standard implementation issues, interoperability issues. Contribute to improve standards
Results	Information on standards and reports from SDOs have been shared through the BRIDGE standards user group.

[8] https://pantera-platform.eu/
[9] https://smart-networks-energy-transition.ec.europa.eu/working-groups/wg4
[10] https://smart-networks-energy-transition.ec.europa.eu/publications/etip-publications
[11] https://digital-strategy.ec.europa.eu/en/policies/rolling-plan-ict-standardisation
[12] https://joinup.ec.europa.eu/collection/rolling-plan-ict-standardisation/rolling-plan-2024
[13] https://joinup.ec.europa.eu/collection/rolling-plan-ict-standardisation/smart-grids-and-smart-metering-rp2024
[14] https://ses.jrc.ec.europa.eu/sgdoit
[15] https://der-lab.net/

	A repository of code components has been created in order to collect and share information on the implementation of standards.
Recommendation	Establish a list of standards of interest that the BRIDGE User Group will provide and explain to participating projects. The following list is not exhaustive but will at least include: • SGAM IEC 63200 • Harmonised Electricity Market Role Model (HEMRM) • Use cases : IEC 62559 & IEC 62913 series • Standardisation roadmap : IEC 63097, IEC 63268, IEC 63199 • Interface Reference Model : IEC 61968-1 • IEC TC57 Architecture : IEC 62357-1 • CIM: IEC 61970 & IEC 61968 & IEC 62325 • CIM profiles: CGMES profiles, ESMP profiles, utility integration profiles IEC 61968 series • Profile methodology: IEC 62361-103 • Harmonisation CIM/61850: IEC 62361-102 • Communication protocols: IEC 60870-104, TASE-2, MQTT, AMQP, … • OPC Unified Architecture: IEC 62541 series • Cyber-security: IEC 62351 series • De-Facto standards: UFTP, OCPP, FlexOffer, … • Ontologies : future IEC 63417 (Guide and plan to develop Smart energy Ontologies), SAREF
Results	Some standards have been presented in BSUG meetings, including the IEC 63097, whose presentation is available on the webinar playlist

In order to support above list of topics and recommendations, we conclude with a final topic, findings, and associated recommendations.

Topic	**Standardisation topics management**
Recommendation	Create a tool like a “standardisation cockpit”, helping monitoring and facilitating coordination with BRIDGE projects, CEN/CLC/ETSI CG-SG, or other external entities. This tool will have to be consistent with CEN/CLC/ETSI CG-SG ones, and with IEC 63097 SmartGrid Standardisation Roadmap structure.
Results	A repository of code components has been created to share reusable implementations of standards. A survey could be launched later on to assess if this tool is useful and how it could be improved.
Recommendation	Create a list of resources to support BRIDGE projects and make these resources accessible from BRIDGE website.
Results	A playlist of webinars has been created to share information related to standards. A repository of code components has been created to share reusable implementations of standards.

Last but not least, BRIDGE User group will contribute to **Digitalisation of energy Action Plan (**DoEAP) as illustrated hereafter:

Topic	**Contribution to DoEAP**
Recommendation	BRIDGE participating projects will have to be familiarised with DoEAP, and how standardisation can contribute to some of the five areas.
Results	This recommendation has not been addressed as such. It will have to be reassessed and potentially reconducted.

2 Contribution from BRIDGE projects to standardisation

2.1 Description and objectives

BRIDGE builds collective knowledge, at system level, including outcomes such as a catalogue of standards (existing solutions, identified gaps, …), practices related to standards (feedback, recommendations, proposed extensions, …), and possibly the feedback from the scale-up and roll-out following finished projects. This collective knowledge should contribute to European and international standardisation.

For information concerning standardisation benefits and how it is related to Regulation and Codes, please refer to PANTERA WG3 D3.2 deliverable[16]. More recently, in 2023 an implementing act related to Metering and Customer Data Access has been published[17] and two IEC standards are supporting the data format requirements (IEC 62325-451-10:2021 also named EUMED Market, IEC 61968-9:2024 Ed 3.0 also named EUMED Metering).

BRIDGE action #4 will contribute to standardisation:

- Based on BRIDGE collective knowledge;
- Contributions will be pushed:
  - (a) through project partners involved in standardisation;
  - (b) through a user group with official liaison with standardisation committees;
- Note: Some SDOs may also provide draft standards to R&I projects for free – the purpose for SDOs is to collect implementation feedback during the early phases of the standards development process.

Projects' reusable outputs contributing to standardisation will, moreover, be collected to be disseminated and easily accessible through:

- A playlist of webinars to facilitate knowledge sharing
- A repository of code components that make standards implementations or extensions available.

2.2 Workplan

1. Identify the topics and standardisation bodies to which BRIDGE will contribute
2. Set up a process to identify relevant contributions from projects and propose them to the selected SDOs
   a. Based on partners involved in standardisation committees
   b. Based on a user group with official liaison(s)
3. Make contributions from projects to standards available
4. Set up and run a BRIDGE Standards User Group to support **Action #4.**

[16] https://pantera-platform.eu/wp-content/uploads/2021/01/D3.2_Report-on-Regulations-Codes-and-Standards-in-EU-28.pdf

[17] Commission adopts new implementing act to improve access to metering and consumption data (europa.eu)

2.3 Link with other BRIDGE Working Groups and Data Management actions

The results from all the Data Management WG topics will be used to contribute to standardisation. For instance:

- The BRIDGE **Use Case repository**, described in **Action #1**, could interact with other use case repositories like the IEC one[18]. Some BRIDGE use cases could easily feed the IEC repository if repositories' interoperability is based on IEC 62559-2, IEC 62559-3. It has to be pointed out that several initiatives are developing use cases using different kinds of notations and tools. For instance SGTF EG1 wrote use cases related to metering and customer data access using BPMN notation. EbIX which is transferring its material to JWG ENTSO-E EUDOS entity is using UMM[19]. Another future input to consider will also be IEC SG12 Guide 125 (Use case methodology).
- The Reference Architecture described in **Action #2**, will contribute to propose an extension to the Harmonised Electricity Market Role Model managed by ENTSO-E, EFET, EbIX. With its proposal named **DERA 3.0**, it will also contribute to establish a reference architecture for **cross-sector integration**. Action #2 report will also contribute to the IEC System Committee Smart Energy which published IEC 63200 on Smart Grid Architecture Model. DERA 3.0 has been promoted in future IEC 63417 (Guide and plan to develop Smart energy Ontologies) which should be published in 2024.
- The Flexibility Asset developed by **Action #3**, will contribute to support future grid code on flexibility, but also on future standards supporting flexibility assets related business processes. This action has established generic business processes and specified generic interfaces. Action #3 has also produced a catalogue of standard related to the flexibility asset. The definition of the generic business processes has, moreover, a link to the activities of the IEC Strategic group 12, Task Force 2. And Action #3 is part of their stakeholder group. Additionally, a technical brochure to be published by the CIGRE in 2024 on DSO-TSO collaboration could be useful to update the generic processes from Action #3, and should be shared when available.
- In **Action #5**, a repository of components focusing on the interoperability of home appliances has been initiated. It covers the collection of outputs from projects, and the possibility for their dissemination. The development and governance of this repository will be coordinated with the **Action #4** in order to ensure the coherence, avoid overlaps and improve the efficiency of inputs collection, in particular on outputs related to the implementation of standards. It is planned to prepare coordinated activities towards collecting the details on the outcomes from the projects, e.g., by a joint survey, and then to analyse the data from the perspective of both actions.

The BRIDGE Working Group on Regulation is working on the following topics:

- As regards energy storage, the regulatory framework needs to provide clear rules and responsibilities concerning ownership, competition, technical modalities and financial conditions, for island and mainland cases;
- In terms of smart grids, regulatory challenges arise regarding the incentives for demand-side response, commercial arrangements, cooperation with TSO and DSO, smart meter date, etc.

The contribution to standardisation will also take into account the BRIDGE Regulation Working Group and its associated recommendations. In particular, the working group could have a link to the policies group of the IEC. Our recommendation is:

[18] The IEC Use Case Management Repository status is not known for now.
[19] https://mwgstorage1.blob.core.windows.net/public/Ebix/ebIX%20methodology%20Draft%202r0C%2020231211.pdf

Topic	BRIDGE internal Coordination
Findings	BRIDGE Regulation Working Group, and other BRIDGE Data Management Working Group's related actions can contribute to standardisation.
Recommendation	Establish close cooperation with BRIDGE Regulation Working Group and other BRIDGE Data Management Working Group Actions to be consistent on standardisation issues.
Finding	Coordination is needed between the Actions of the Data Management Working Group
Recommendation	Coordinate the development of repositories between the Action #4 and #5.

2.4 Standardisation overview

The following sections present relevant SDOs and some key principles. The BRIDGE Standards User Group indeed collaborates with several SDOs, as shown in the figure below (Figure 1: Collaboration between BRIDGE and SDOs).

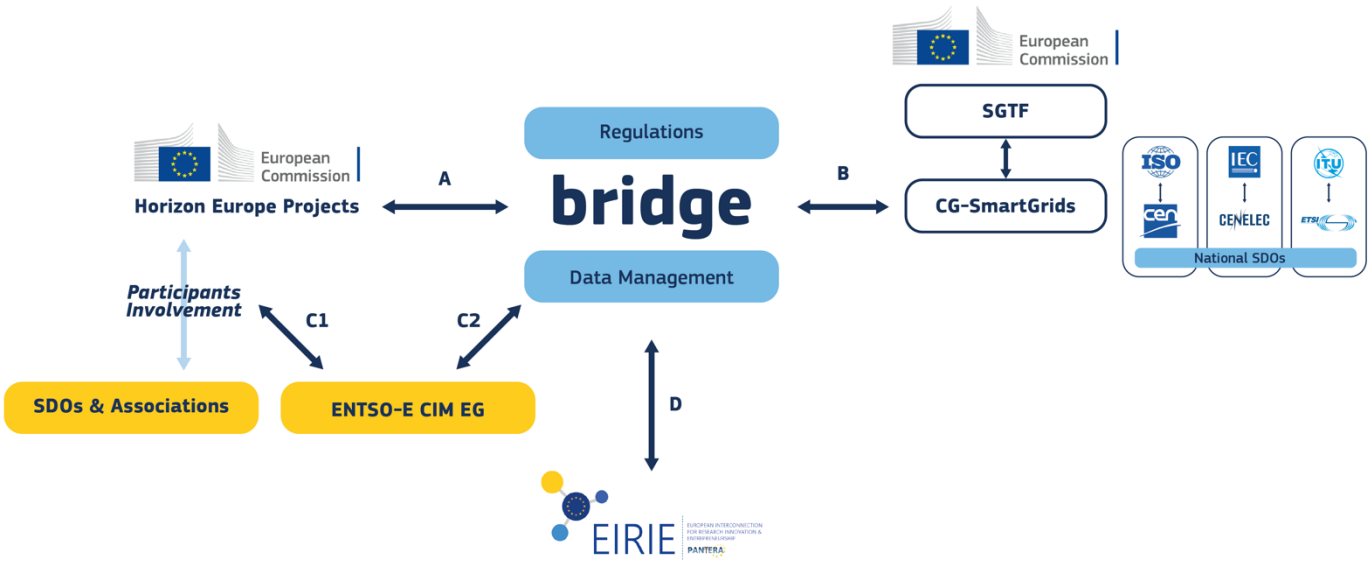

Figure 1: Collaboration between BRIDGE and SDOs

SGTF was replaced by SEEG end of 2023. JWG ENTSO-E EU DSO entity[20] was also set up to work on implementing acts (see more details in other sections of this report).

[20] Home | EU DSO Entity https://www.eudsoentity.eu/fr

2.4.1 SDOs overview and key methodology artefacts

The Figure 2 illustrates main Standard Development Organisations.

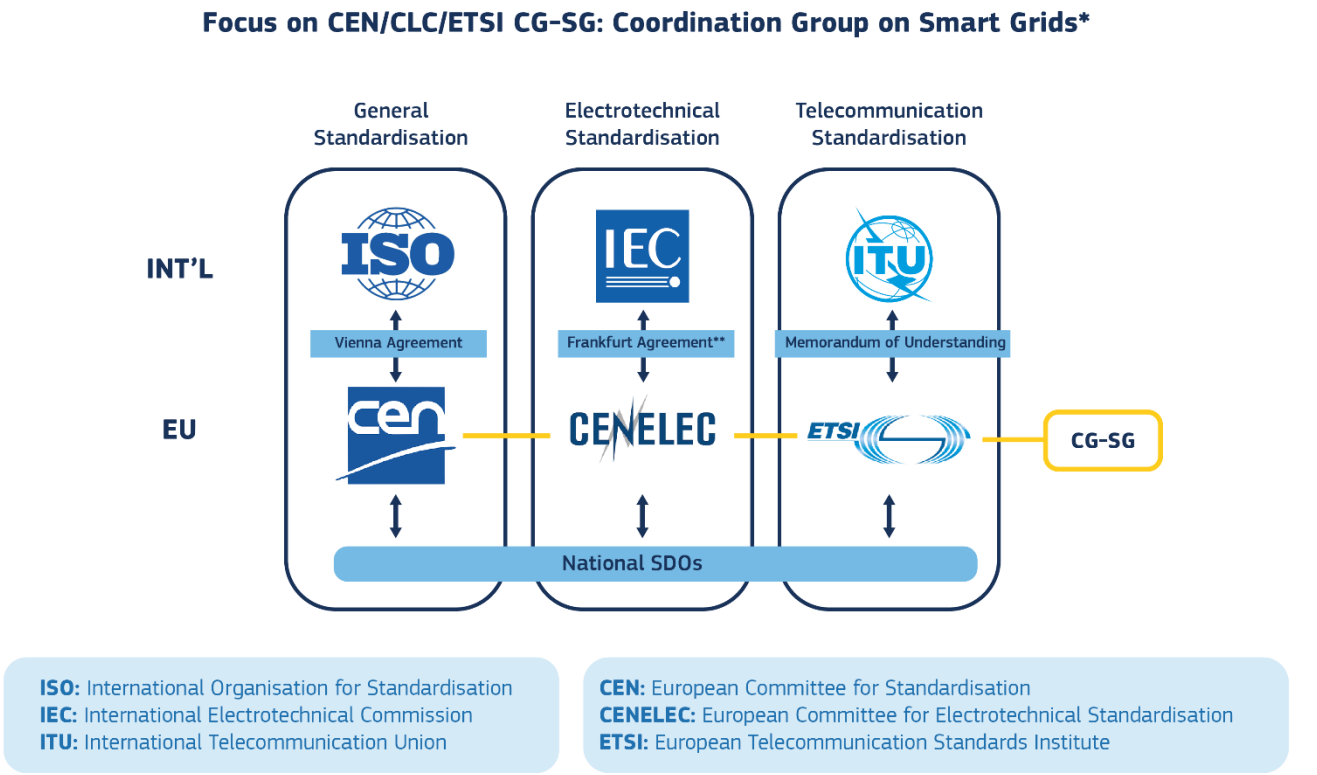

Figure 2: Standardisation Organisations

At the European level, CG-SG (Coordination Group on Smart Grids) was established in 2021 and is the merger of previous CEN/CLC/ETSI CG-SM (Coordination group on Smart Meters) and CG-SEG (Coordination Group on Smart Energy Grids). Regular liaison between the BSUG and the CG-SG was established, with the regular participation of members of the Action #4 to CG-SG meetings, enabling the results of projects to be shared. Another important topic is that IEC officialised in 2021 its digital transformation through the creation of Strategic Group 12, as illustrated by Figure 3.

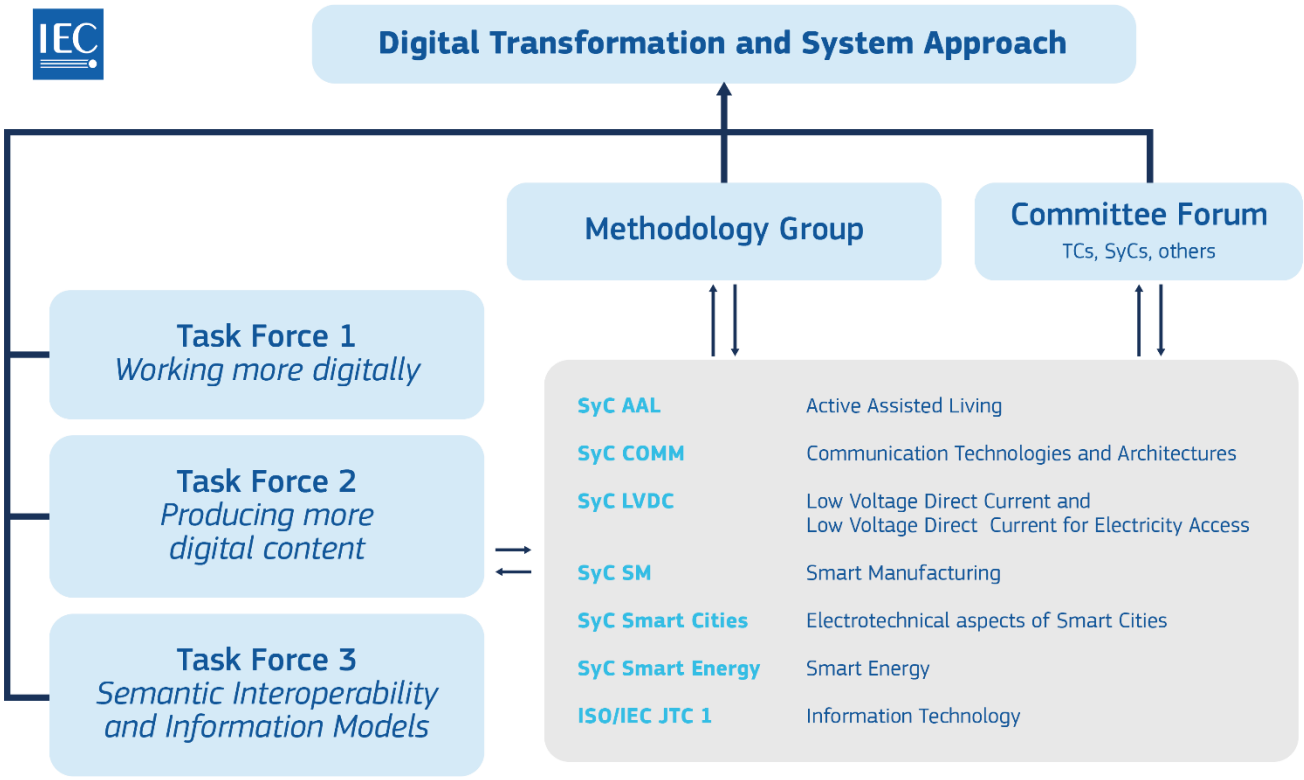

Figure 3: IEC Strategic Group on Digital Transformation and Systems Approach

As illustrated above, the systems approach is promoted in the different System Committees (a System Committee involves several Technical Committees and has the objective to better coordinate the work between committees). The systems approach is briefly reminded in Annexe 1 Systems approach.

Finally, the Smart Energy Expert Group (SEEG), created in 2023 as a result of the Digitalisation of Energy Action Plan (DoEAP), covers the following topics:

- Data for Energy
- Consumer Empowerment and Protection
- Cybersecurity

Our findings and recommendation can be summarised as follows:

Topic	BRIDGE external coordination
Findings	The SEEG covers topics related to the projects involved in the BRIDGE Standards User Group. Its findings and reports should be disseminated to the projects.
Recommendation	The BRIDGE Standards User Group will follow the activities of the SEEG and disseminate its results to the BRIDGE projects. A link with this group may also be established in the future.

2.4.2 How standardisation supports regulation?

We can illustrate this topic through two concrete examples: ENTSO-E and CEN/CLC/ETSI CG-SG.

Standardisation plays a crucial role in supporting regulation within the European Union, in particular through the following actions:

- **Challenges identification**: standardisation bodies, in particular through transversal committees (System Committees in IEC; Coordination Groups in CEN/CENELEC), are constantly benchmarking the coverage of existing and coming standards and the needs from the industry to identify gaps and challenges. These are not only identified, but also properly characterised and defined.
- **Solutions development**: standardisation bodies develop standards to tackle the challenges and gaps identified. The solutions developed are based on contributions from many experts, enabling a high technical value.
- **Market harmonisation**: due to their consensus-based development process, standards are designed to be widely adopted, which will harmonise the markets and support the massive roll-out of new approaches.
- **Regulatory enforcement**: standardisation facilitates regulatory enforcement by providing clear benchmarks and criteria for compliance. Regulators can reference established standards to support their requirements and rely on associated certification schemes.

As an example, this opportunity within the energy domain had already been clearly identified by the European Commission many years ago, by establishing the M/441 mandate for smart meters[21] (2009) and the M/490 mandate for smart grids[22] (2011).

2.4.3 ENTSO-E contribution to regulation and standardisation

ENTSO-E is involved in European regulation drafting with ACER. The ENTSO-E standardisation approach is illutrated in Figure 4.

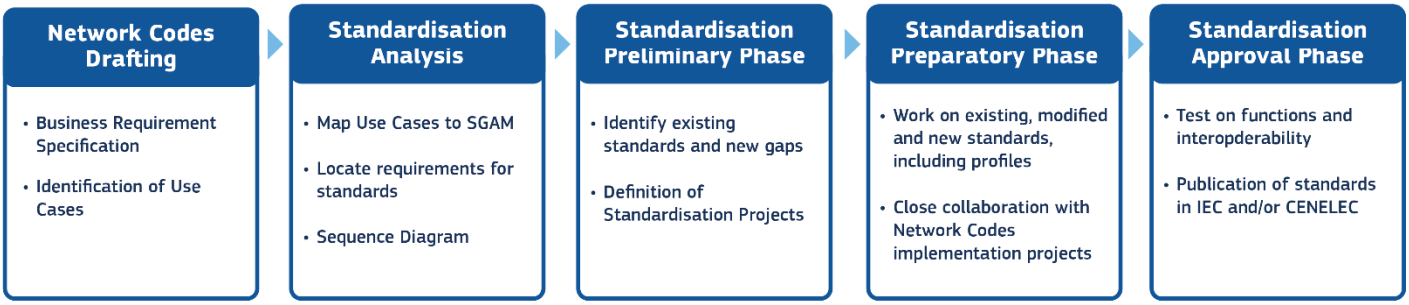

Figure 4 ENTSO-E standardisation approach

ENTSO-E decided to support European regulation requirements by using IEC CIM model and associated profiles from 2009. The CGMES standard series (IEC 61970-600-1, IEC 61970-600-2) is supporting Operation Codes, and ESMP standard series (European Style Market Profiles, IEC 62325-351, IEC 62325-45x) is supporting the European Market Codes and Guidelines. The following figure summarises ENTSO-E involvement concerning standardisation and regulation (Figure 5).

[21] cenclcetsi_smcg_end2012.pdf (cencenelec.eu)
[22] Standardisation Mandate Smart Grids (cencenelec.eu)

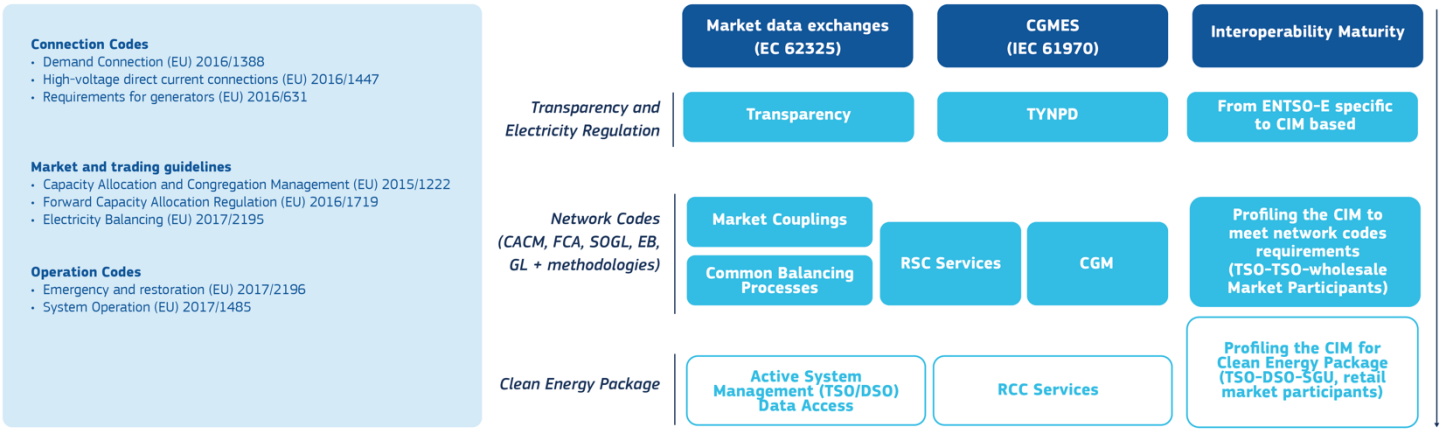

Figure 5 IEC standards series supporting European regulation

CIM expertise is provided by ENTSO-E CIM working group. The CIM working group has the following scope and liaisons with IEC (Figure 6).

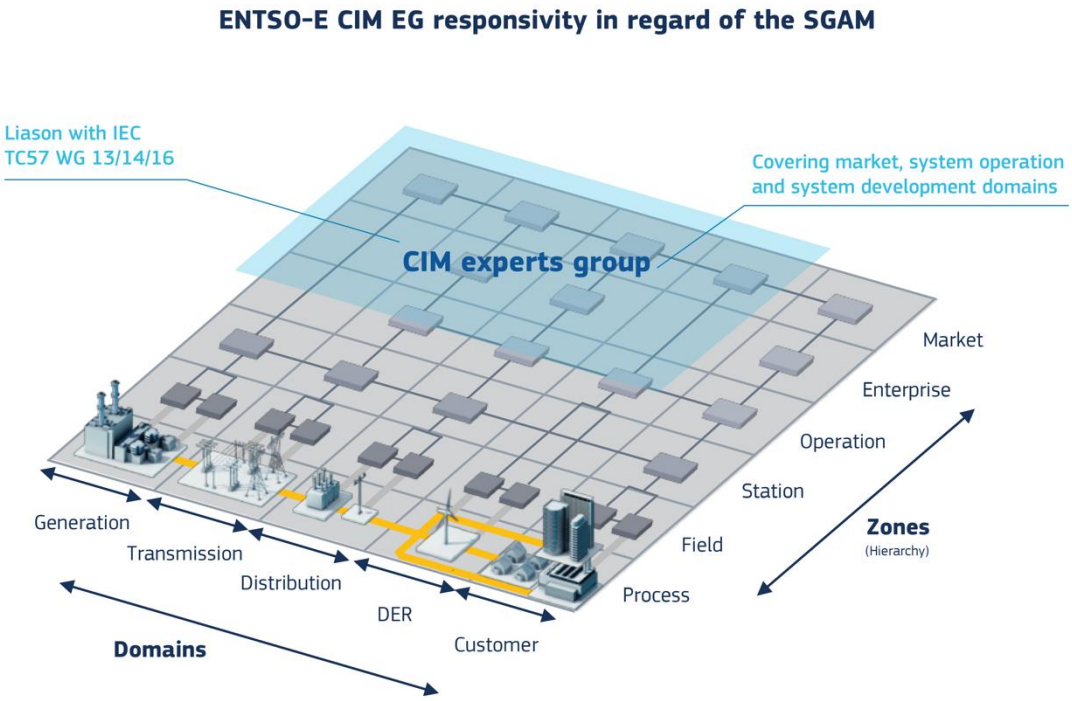

Figure 6 SGAM mapping of ENTSO-E CIM Work Group

The standardisation organisation within ENTSO-E is illustrated in Figure 7.

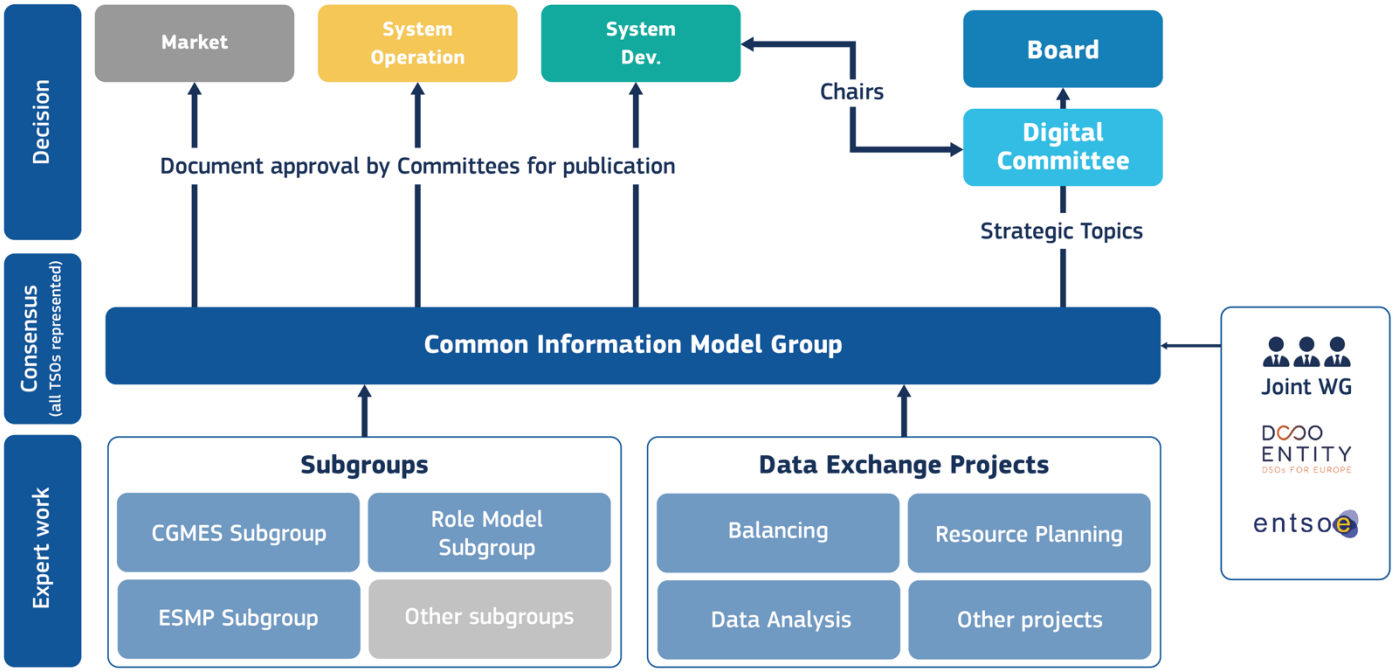

Figure 7 ENTSO-E CIM Work Group organisation

ENTSO-E manages CIM extensions by using a Maintenance request form which is shared with CIM working subgroups named Role Model subgroup (Role Model update is discussed among ENTSO-E, and EU DSO Entity in the JWG), ESMP subgroup and CGMES subgroup.

ENTSO-E has a CIM roadmap as illustrated in Figure 8 illustrating CGMES roadmap.

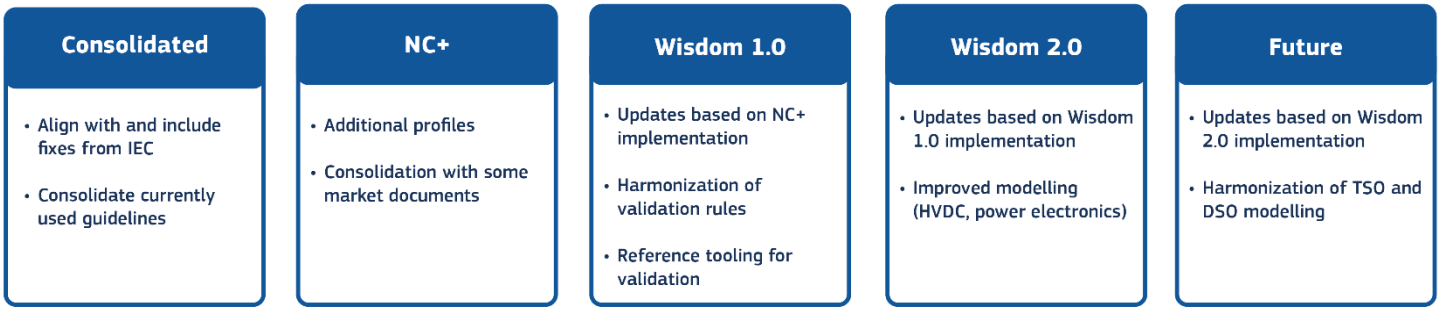

Figure 8 ENTSO-E CGMES roadmap

More information on ENTSO-E CGMES roadmap, CGMES Conformity Assessment Scheme can be found in Annex 1.

According to the ENTSO-E R&D Roadmap[23], ENTSO-E participates in several European funded R&D projects, and this helps to consolidate the IEC CIM standard as described in Figure 9.

[23] https://www.entsoe.eu/2020/10/14/entso-e-research-development-innovation-roadmap-2020-2030/

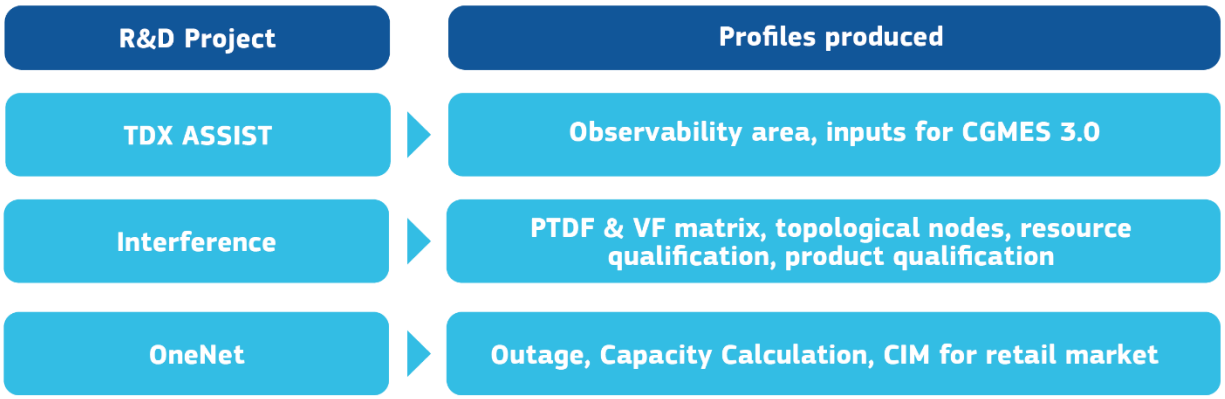

Figure 9 ENTSO-E involvement in European R&D projects

ENTSO-E also participated in the European Smart Grid Task Force which develops implementing acts.

Additionally, a group for the collaboration between the ENTSO-E and the EU DSO entity has been created end of 2023. The BRIDGE Standards User Group will follow the activities of this coordination group and disseminate its results to the BRIDGE projects. A liaison with the group may also be formed in the future.

Our findings and recommendation can be summarised as follows:

Topic	BRIDGE external coordination
Findings	The ENTSO-E CIM related story is rich and well explained in the CGMES roadmap. Some EU funded R&D projects do not have ENTSO-E as a participant, and these projects must benefit from CIM expertise and be able to use the CIM model in its UML format, and derivatives (associated profiles)
Recommendation	The link established with ENTSO-E CIM Work Group will be reinforced. ENTSO-E and BRIDGE will share some documents: ENTSO-E CIM roadmap, EU regulation roadmap, draft specifications, UML models, CIM datasets, CIM issues …

2.4.4 CEN/CLC/ETSI CG-SG contribution to regulation and standardisation

The CEN/CLC/ETSI publishes every year its work programme[24] that can be used as a basis for reviewing the topics relevant for the collaboration with the BRIDGE Standards User Group.

Two working groups were established within CEN/CLC/ETSI CG-SG named WG-EUPOL and WG-STD. WG-EUPOL analysed Clean Energy Package and identified standardisation gaps. The Standard Working Group (WG-STD) analysed the standard gaps and classified them. Some of them were forwarded to CENELEC committees as they had been solved, others were proposed to the IEC System Committee Smart Energy, and contributed to **IEC 63199** which identifies gaps that have to be solved by IEC Technical Committees. All standards relevant to smart grids are listed in **IEC 63097 Smart Grid Standardisation Roadmap**.

[24] https://www.cencenelec.eu/news-and-events/news/2024/publications/2024-01-26-work-programme-2024/

Until end of 2023, CG-CG had also contributed to European Smart Grid Task Force and some of its expert groups (EG1 Data Access and Interoperability, EG2 Cyber Security, EG3 Flexibility). SGTF developed implementing acts associated to the following European regulation (Figure 10).

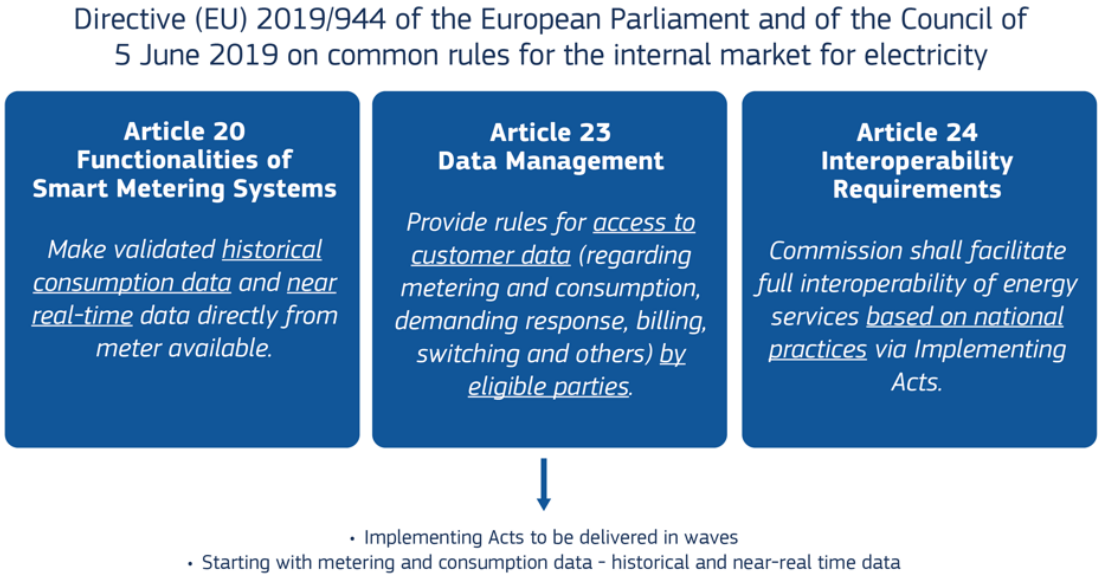

Figure 10 European Commission implementing acts

At the end of 2023, SGTF was replaced by SEEG, and work related to the implementing act work was transferred to JWG ENTSO-E EU DSO-Entity.

Our findings and recommendation can be summarised as follows:

Topic	BRIDGE external coordination
Findings	CEN/CLC/ETSI Coordination Group on Smart Grids is well positioned to analyse regulation requirements, and identify standardisation gaps. CEN/CLC/ETSI is also participating in SGTF Expert groups. As the ESOs are working closely with the int'l standardisation organisations it would make sense for BRIDGE to use the establishing cooperation mechanisms.
Recommendation	BRIDGE should use the European Standard Organisations as the main conduit to: firstly proposing new topics for standardisation or flagging existing standards that should be updated, and secondly reaching out to the international arena (e.g. IEC). The existing liaison with CEN/CLC/ETSI CG-SG will be continued.

ETIP-SNET and JRC

The JRC code of conduct draws a set of rules for the design of future energy smart appliances. These include a set of use cases to be implemented, associated with the relevant parameters from SAREF and SAREF4x. Moreover the SAREF triples are mapped to the EN50631 data elements.

The selected use cases are:

- Flexible Start
- Monitoring of Power Consumption
- Limitation of Power Consumption
- Incentive Table based Power Consumption Management
- Manual operation

The Code of Conduct is meant to be signed by manufacturers, in order to improve the interoperability of energy smart appliances.

The ETIP-SNET initiative in parallel identified a set of high-level use-cases relevant for the future of the energy sector in the R&I implementation plan 2022-2025. The use cases developed by JRC, listed above, would fall into HLUC 9: Flexibility provision by Building, Districts and Industrial Processes.

The ETIP-SNET Energy data space policy paper[25], moreover, provides recommendations on the implementation of energy data spaces. It identifies relevant reference architectures and use cases, as well as critical data flows for the implementation of demand-side flexibility in data spaces. In particular, communication protocols are identified for each of these data flows.

Moreover, this paper identifies key challenges and recommendations, in particular related to standards and interoperability. One of the main challenges is related to semantic interoperability, as the range of available ontologies needs to be aligned.

2.4.5 Interaction with other associations

Besides European and International Standard Organisations (SAREF, IEC, …), several other associations, SDOs or para-normative associations exist like USEF[26], OCA[27], DLMS-UA[28], UCAIUg[29], CIRED[30], CIGRE[31], W3C[32], IETF[33], EU.DSO[34],…

It would be interesting to identify these other sources of potential coordination (at least by identifying standards or studies of interest). Our findings and recommendation are:

Topic	BRIDGE external coordination
Findings	Besides European and International Standard Organisations, several other associations, SDOs or para-normative associations exist like USEF, OCA, DLMS-UA, UCAIUg, CIRED, CIGRE, W3C, IETF, EU.DSO, …
Recommendation	Identify if other association representatives participating in BRIDGE funded projects need to be included (EU.DSO, USEF, …) or if these liaisons will be supported by Organisation experts participating in EU R&D projects. Organisation experts will be free to inform BRIDGE about these liaisons and the inputs achieved.

[25] European Commission, Directorate-General for Energy, Monti, A., Schmitt, L., Dognini, A. et al., *Energy Data Space policy paper – ETIP SNET, European Technology and Innovation Platform Smart Networks for Energy Transition*, Monti, A.(editor), Schmitt, L.(editor), Dognini, A.(editor), Publications Office of the European Union, 2023, https://data.europa.eu/doi/10.2833/586947
[26] Usef Energy – Universal Smart Energy Framework
[27] Home - Open Charge Alliance
[28] Who we are | dlms
[29] Home - UCAIug
[30] CIRED • International Conference on Electricity Distribution
[31] CIGRE > Home
[32] CIRED • International Conference on Electricity Distribution
[33] IETF | Internet Engineering Task Force
[34] Home | EU DSO Entity

2.5 Standardisation topics

2.5.1 Topics impacting standardisation

The topics of interest for standardisation are numerous. Utilities nowadays have to adapt their business processes to global warming stakes, digital stakes (including cybersecurity and privacy), customer and citizen empowerment trends. The following figure based on SGAM illustrates the topics associated to these stakes (Figure 11).

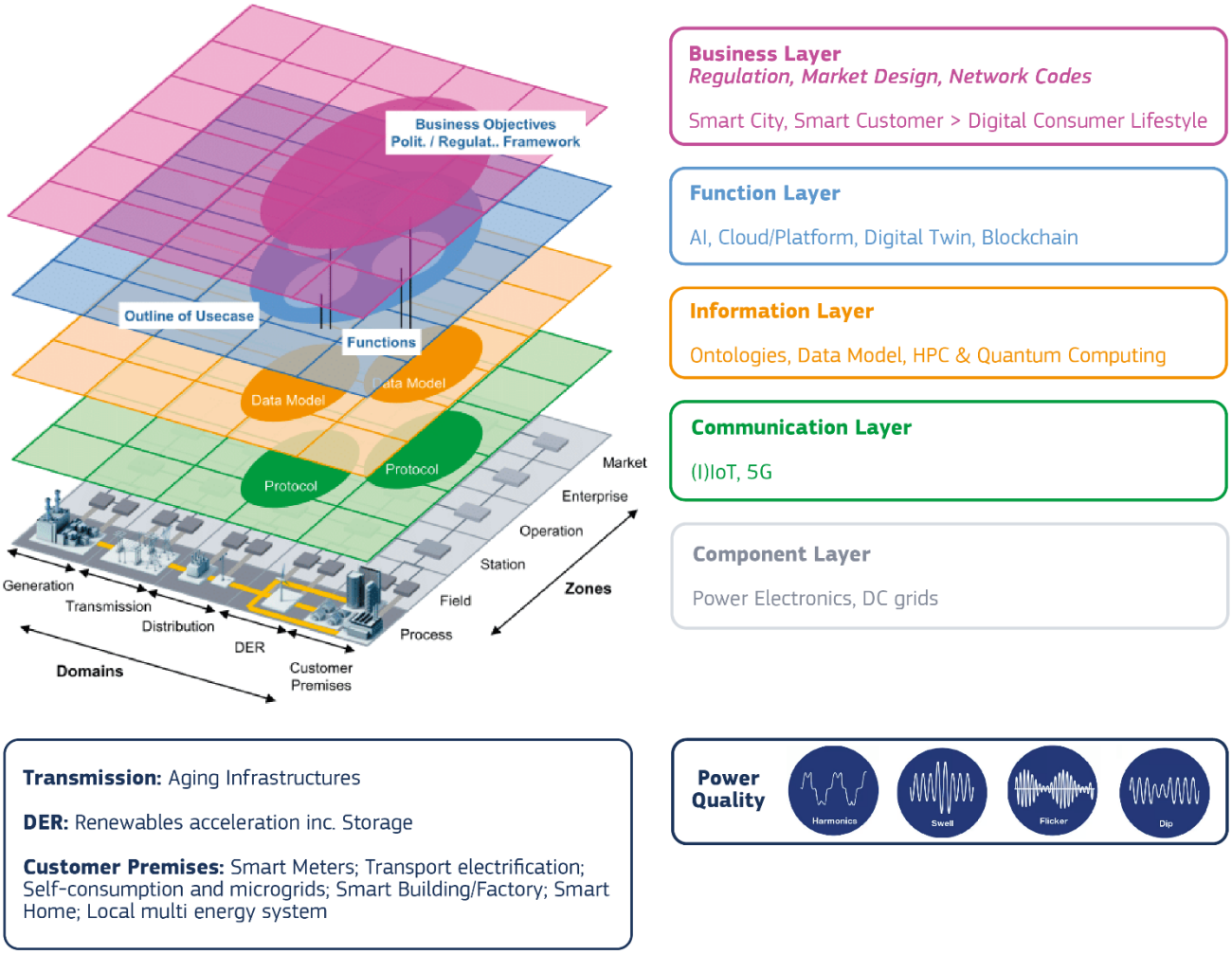

Figure 11 Topics of interest for utilities

ETIP-SNET also defined 12 functionalities of interest as illustrated in the following figure:

Building blocks	Functionality full name	Short name
The efficient organisation of energy systems	**F1** Cooperation between system operators **F2** Cross-sector integration **F3** Integrating the subsidiarity principle - The customer at the centre, at the heart of the Integrated Energy System	**F1** Cooperation **F2** Cross-sector **F3** Subsidiarity
Markets as key enablers of the energy transition	**F4** Pan-European wholesale markets **F5** Integrating local markets (enabling citizen involvement)	**F4** Wholesale **F5** Retail
Digitalisation enables new services for Integrated Energy Systems	**F6** Integrating digitalisation services (including data privacy, cyber security)	**F6** Digitalisation
Infrastructure for Integrated Energy Systems as key enablers of energy transition	**F7** Upgraded electricity networks, integrated components and systems **F8** Energy System Business (incl. models, regulatory) **F9** Simulation tools for electricity and energy systems (Software)	**F7** Electricity Systems and Networks **F8** Business **F9** Simulation
Efficient energy use	**F10** Integrating flexibility in generation, demand, conversion and storage technologies **F11** Efficient heating and cooling for buildings and industries in view of system integration of flexibilities **F12** Efficient carbon-neutral liquid fuels & electricity for transport in view of system integration of flexibilities	**F10** Flexibility **F11** Heating & Cooling **F12** Transport

Figure 12 ETIP-SNET functionalities

The PANTERA project linked the ETIP-SNET functionalities and technologies with the relevant committees of the main standardisation bodies (CEN, CENELEC, ETSI, IEC and ISO) as illustrated in the following figure, which proposes an interface through EIRIE platform database (Figure 13).

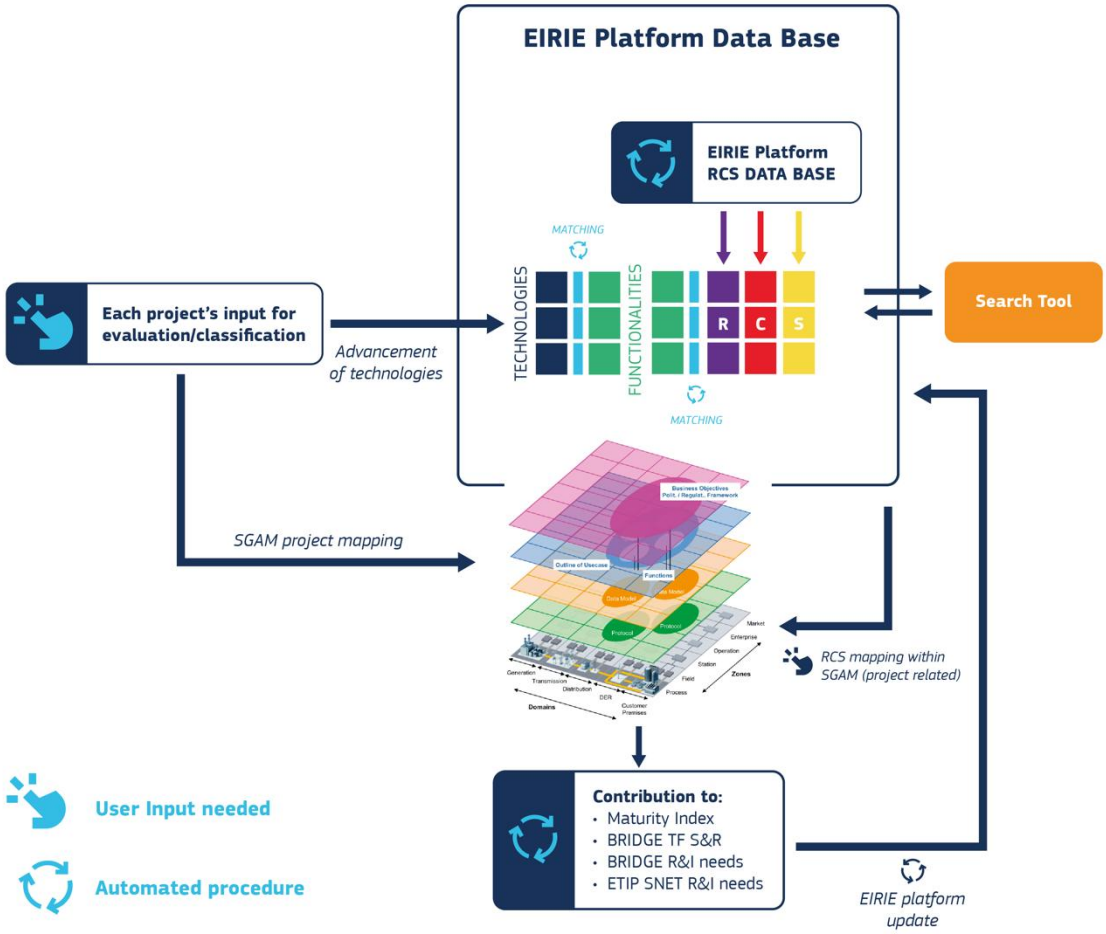

Figure 13 EIRIE platform

The other topics of interest are well described in the 2021 rolling plan for ICT standardisation. For each domain identified in the report, related standardisation activities are listed.

As a reminder, here is the objective of this document: "The Rolling Plan for ICT Standardisation provides a unique bridge between EU policies and standardisation activities in the field of information and communication technologies (ICT). This allows for increased convergence of standardisation makers' efforts towards achieving EU policy goals. This document is the result of an annual dialogue involving a wide range of interested parties as represented by the European multi-stakeholder platform on ICT standardisation (MSP). The Rolling Plan focuses on actions that can support EU policies and does not claim to be as complete as the work programmes of the various standardisation bodies. Standardisation actions identified in this document to support EU policies are complementary to other instruments, in particular the Annual Union Work Programme (AUWP). The Rolling Plan attempts to list all known areas where ICT standardisation could support EU policy objectives. It also details the requirements for ICT standardisation, translates them into actions and provides a follow-up mechanism for the actions."

Additionally, GRIFOn[35], an initiative created within the OneNet project to facilitate TSO-DSO collaboration, presented the challenges for the future of TSO-DSO collaboration in a workshop in 2023. In particular, standardisation issues around cybersecurity were considered to be a major challenge.

[35] The Grid Forum (GRIFOn) is shaping European Electricity Markets (onenet-project.eu)

The Int:Net project also identified a topic of interest in interoperability testing. Several actions have been realised within this project to facilitate the implementation of interoperability testing, such as the definition of the Int:net Interoperability Model (EMINENT), or the development of a semantic interoperability tester based on SAREF.

Our findings and recommendations can be summarised as follows:

Topic	Standardisation Topics
Findings	Other European initiatives like ETIP-SNET have worked on related smart energy topics which require standardisation, in order to improve interoperability.
Recommendation	Monitor what ETIP-SNET WG4 (Digitalisation of the electricity system and customer participation) are doing[36] and use their conclusions to identify standardisation topics. Provide BRIDGE User Group standardisation results to ETIP SNET WG4 to collect feedback.
Findings	ICT standardisation topics are well described in European "Rolling Plan for ICT Standardisation", which is a living document.
Recommendation	Anticipate standardisation topics based on existing and yearly updated Rolling Plan for ICT Standardisation. Contribute to Rolling Plan for ICT Standardisation updates.

2.5.2 Contribution by projects

Projects involved in BRIDGE Data Management Action #4

The following table summarises the inputs of BRIDGE Action #4 participating projects on their potential standardisation topics and associated SDOs or associations (

[36] European Commission, Directorate-General for Energy, Monti, A., Schmitt, L., Dognini, A. et al., *Energy Data Space policy paper – ETIP SNET, European Technology and Innovation Platform Smart Networks for Energy Transition*, Monti, A.(editor), Schmitt, L.(editor), Dognini, A.(editor), Publications Office of the European Union, 2023, https://data.europa.eu/doi/10.2833/586947

Table 1: Projects contributing to the BRIDGE Standards User Group).

Table 1: Projects contributing to the BRIDGE Standards User Group

Project	Project objectives	Which topics	Which SDOs
Interconnect	Interoperable smart homes, smart buildings and smart grids	Semantic interoperability, Ontologies (incl SAREF), Protocols & data models for flexibility & smart grid, Trustworthiness, IoT & digital twin	IEC SyC Smart Energy ISO/IEC JTC1/SC27 Trustworthiness ISO/IEC TC1/SC41 Internet of Things & Digital Twins ISO/IEC TC1/SC42 Artificial Intelligence ETSI SmartM2M
EU-SysFlex	Pan-European system with an efficient coordinated use of flexibilities for the integration of a large share of RES. Provides new types of services that will meet the needs of the system with more than 50% of renewable energy sources. Right blend of flexibility and system services to support secure and resilient transmission system operation	Market Flexibility, with some « CIMification » information exchanges	NA
XFLEX	Create a capacity market platform for DSO and aggregators on LV level for congestion management (MARKETFLEX tool)	Flexibility Trading Capacity Market Congestion Management	USEF (Universal Smart Energy Framework) à UFTP (USEF Flexibility Trading Protocol)
SMILE	Demonstrate 9 different innovative technological solutions in large-scale smart grid demonstration projects in three island locations: Orkneys (UK), Samsø (DK) and Madeira (PT).	Smart energy systems, demand-side-management, thermal and electrical storage, electric vehicles	Danish Standard Deliverable 7.5
FEVER	Increase distribution grid security and resilience by leveraging energy flexibility towards supporting grid operation under normal, critical and emergency conditions	Data Handling – core data models used are based on CIM standards and FlexOffer specification	NA

BD4OPEM	Design, develop and deploy a marketplace for innovative energy services targeting the reliable operation of the smart grid – leveraging a modular data analysis toolbox and data exchange solutions	Data Handling –models used for the data modelling analysis are CIM, SAREF4ENER and FIWARE-NGSI-LD. Role Model : IDSA (adapted)	NA. BD4OPEM results will be leveraged by Horizon Europe OMEGA-X project
OneNet	Open and flexible architecture to transform the current European electricity system, which is often managed in a fragmented country- or area-level way, into a pan-European smarter and more efficient one, where market and network technical operations are reciprocally coordinated closer to real time i) among them, ii) across different countries iii) while maximising the consumer capabilities to participate in an open market structure	Flexibility Products and Services Flexibility Markets Coordination and Integration. Integrated System operation – TSO/DSO coordination OneNet Framework architecture and implementation. Link with FIWARE and IDSA architecture. Data Modelling, AI, Big Data, IoT Enablers, Cybersecurity	Links foreseen via consortium members with IEC Data Modelling (CIM) Development of new CIM based Flexibility Market API for baseline nomination, bidding, activation and ex-post settlement / End to end test through the Northern scenario with Elering TSO
Coordinet	DSO and TSO interactions for new products	Market communications, processes, harmonised data models, pan-European Data Management	IEC, partly ISO. Use Cases
Maesha	Decarbonise the energy system of geographical islands	Protocols & data models for flexibility, smart grid and electric vehicles	IEC SyC Smart Energy ISO/IEC JTC1/SC27 Trustworthiness
Parmenides	PARMENIDES project focuses on ontologies that provide an opportunity to address cross-platform interoperability. Specifically, it extends existing ontologies to develop a new ontology and provide a knowledge base focusing on hybrid energy storage systems and energy communities.	Semantic interoperability, Ontologies (incl SAREF), Protocols & data models for flexibility & smart grid (in particular in energy communities), Trustworthiness	IEC SyC Smart Energy ISO/IEC JTC1/SC27 Trustworthiness

COMMUNITAS	COMMUNITAS principal goal is to pave the way for the empowerment and engagement of different types of consumers and prosumers, placing them at the heart of energy markets. It will do so by boosting the creation and exploiting the potentialities of ECs as hubs for innovative energy services, integrated with non-energy benefits, co-created together with citizens and other stakeholders. The project will put consumers organised in ECs at the forefront of the digitalisation, decentralisation, decarbonisation, and democratisation of the energy sector.	Ontologies (incl SAREF), protocols & data models for P2P energy trading	NA
LocalRES	The EU-funded LocalRES project deploys innovative local energy systems to put renewable energy into the hands of communities and people. The project boosts structural changes in the current energy system at different levels: generation, market, distribution and consumers. To this aim, the project develops a planning tool to enable citizen participation in the renewable energy communities' planning and decision-making processes, and a Multi-Energy Virtual Power Plant (MEVPP) approach for optimising in real-time different energy vectors (electricity, heating, mobility) and different energy and flexibility services.	Data requirements (latency, sampling frequency, data quality, missing data treatment) storage, communication for ancillary services and peak shaving, cybersecurity	NA
FlexCHESS	FlexCHESS project proposes cutting-edge solutions based on the digital twin concept, Virtual Energy Storage Systems (VESS) and Distributed Ledger Technology (DLT) to revolutionise the existing practices. Based on the aggregation of Connected Hybrid Energy Storage System (CHESS),	Digital twin standards – Common data dictionary and digital product passport (DPP) harmonisation	IEC CDD CEN/CLC JTC24
Platone	Defining new approaches to increase the observability of renewable energy resources and of the less predictable loads while exploiting their flexibility. Platone project provides a unique mapping based on the Platone Open Framework architecture.		
Omega-X	The aim of OMEGA-X is to implement a data space (based on European common standards), including federated infrastructure, data marketplace and service marketplace, involving data sharing between different stakeholders and demonstrating its value for real and concrete energy use cases and needs, while guaranteeing scaleability and interoperability with other data space initiatives, not just for energy but also cross-sector.	Data Space technical and semantic interoperability.	IEC, CEN/CLC, ETSI

Eddie	Eddie aims to create a pan European federated energy dataspace for the sharing of Residential and C&I Building energy and flexibility data integrating data from Smart Meter datahubs across Europe as well as offering new interfaces for Dedicated Measurements Devices and Residential Control Unit activation.	The Eddie framework is based on the Smart grid architecture models expanding it with new open-source data exchange infrastructure for real-time data streaming (based on Kafka) and expanding the CIM Model ontology to integrate new Flexibility Service Provider – Control Unit Operator data exchange leveraging new IEC62746-4 and OpenADR3.0 developments from the Working 21 of IEC TC57.	First exchanges have been initiated with the Working Group 21 of TC57 to integrate the Eddie residential energy management use case to the reference use case documents. Ongoing exchanges are happening with the modelling team of the working group as well as the Joint Working Group of ENTSO-E and the DSO entity working for the implementation of Demand side flexibility data interoperability act.
Data Cellar	DATA CELLAR aims to create a federated energy dataspace that will support the creation, development, and management of local energy communities in the EU. The data space population will be facilitated via an innovative rewarded private metering approach, with a focus on an easy onboarding and interaction, guaranteeing a smooth integration with other EU energy data spaces, providing to LEC stakeholders services and tools for developing their activities.	Data Space technical and semantic interoperability.	
Enershare	The aim is to develop and demonstrate a European Common Energy Data Space which will deploy an 'intra-energy' and 'cross-sector' interoperable and trusted Energy Data Ecosystem where private consumers, business (energy and non-energy) stakeholders and regulated operators will be able to access, share and reuse, based upon voluntary agreements (or legal obligations where such obligations are in force): (i) Large sources of currently fragmented and dispersed data; (ii) Data-driven cross-value chain (energy and non-energy) services and Digital Twins for various purposes.	Data Space technical and semantic interoperability.	ETSI, ...
Int:net	We establish an open and cross-domain community: The Interoperability Network for the Energy Transition (int:net). Within the int:net - interoperability network we bring together all stakeholders relevant for the European energy sector to jointly work on developing, testing and deploying interoperable energy services.	Data Space support action. Focus on technical and semantic interoperability.	
BRIGHT	A participatory process to bring individual consumers centre stage to deliver community-centred DR, combining social-science-driven user experience design with innovative technologies.		

IANOS	IANOS aims to demonstrate and replicate the symbiotic operation of various energy streams in EU islands, unlocking their great potential to act as Lighthouses of pan-European decarbonization.		
VPP4ISLANDS	VPP4Islands project proposes disruptive solutions based on digital twin concept, Virtual Energy Storage Systems (VESS) and Distributed Ledger technology (DLT) to revolutionise the existing VPP and build smart energy communities. Based on aggregation and smart management of distributed energy resources (DERs), VPP4Islands increases the flexibility and profitability of energy systems while providing novel services.		
Ebalance-plus	Develops an energy management platform equipped with balancing and resilience services which increase and unlock the electric flexibility by means of generation and storage solutions, power electronics and grid control technologies, to provide ancillary services for new markets.	Smart energy systems, demand-side-management, electrical storage, electric vehicles, data handling, security and privacy, digital services	NA
Re-empowered	The “RE-EMPOWERED” project aims to develop and demonstrate novel tools to provide a complete solution for all stages of a Microgrid / Energy Island and Multi-Microgrid applications. The tools include energy planning ranging from the design of Microgrids from scratch to the upgrade of existing installation to high RES systems. The tools and solutions will be demonstrated in four demo sites with weak or non-existing grid, two in Europe, (Denmark and Greece), and two in India.		
iFlex	The project aims at developing the iFLEX Assistant, a novel software agent that acts between consumer(s), and their energy systems, various stakeholders and external systems helping them to achieve mutual benefits through local energy management and Demand Response.		
ROBINSON	ROBINSON aims to develop an integrated energy system to help decarbonise (industrialised) islands. To this end, the project develops and deploys an integrated, smart and cost-efficient energy system that couples thermal, electrical and gas networks, which will optimise the utilisation of local renewable energy sources.	Energy Management Systems, flexibility, cybersecurity, integration	Since the demo site is under development, the involved standards will be considered in the next steps

TwinERGY	TwinERGY will introduce a first-of-a-kind Digital Twin framework that will incorporate the required intelligence for optimising demand response at the local level without compromising the well-being of consumers and their daily schedules and operations		
NEON	Enable integration of energy efficiency services for multi-measure building efficiency improvement; optimal energy asset scheduling for improved self-sufficiency, virtual power plant/virtual energy storage; advanced building control for optimal operation of heating/cooling systems, lighting, smart appliances, etc.; demand response services for grid flexibility improvement via explicit and implicit mechanisms; and use-tailored services for ensuring comfort, health and safety requirements.		

Besides contributing projects to BRIDGE, others projects of interest have been identified (see Annex).

It is expected to have concrete feedback from participating projects based on their demonstrator implementation. These lessons learnt by these demonstrators are essential and should be shared with other initiatives like JRC SG-DoIT or DERLab.

Topic	Standardisation Topics
Findings	BRIDGE participating projects represent a source of knowledge on standard usage and associated implementation. They can provide inputs for the webinar playlist and the repository of code components.
Recommendation	Question the BRIDGE projects each year to identify and prioritise topics

Standards related to Energy Data Space projects

Standards are key to support the development of data spaces, especially in the energy domain. CENECLEC published its 2024 work programme[37] which gives an overview of the main standardisation developments and strategic priorities areas CEN and CENELEC are ready to implement in 2024. Several business sectors are addressed like Digital Society, Electrotechnology, Energy and Utilities.

A document named “Landscape report on Energy and flexibility and interoperability across the sectors of energy, mobility and building Data Models” was published in 2023 by European Commission. Some workshops were also organised in 2023/2024 between SDOs concerning data models supporting interoperability. For instance, during a 2024 workshop organised by CEN/CLC CG-SG concerning SAREF and IEC data models landscape, the following figure was provided by IEC experts.

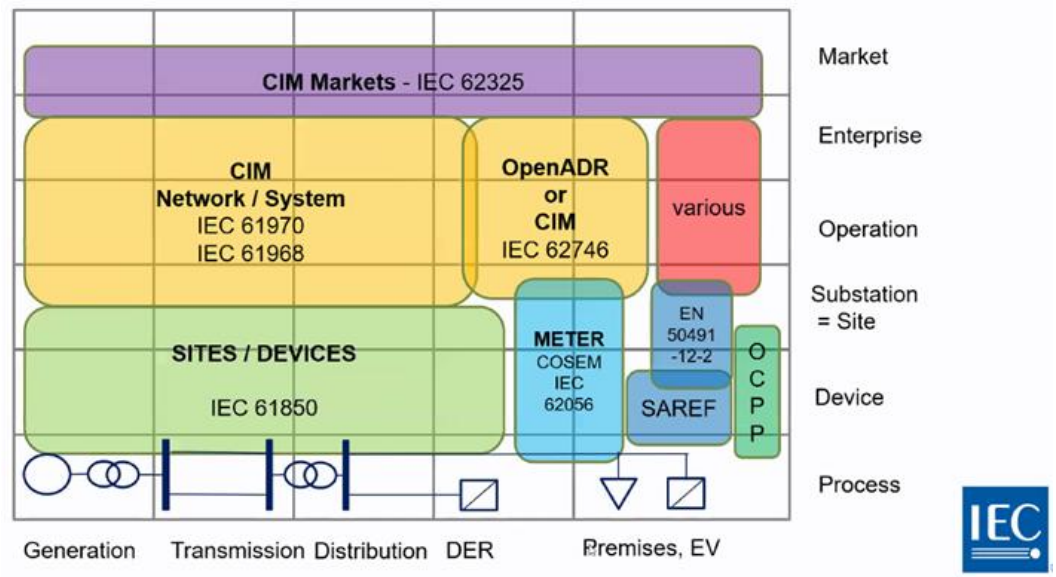

Figure 14: Electricity Data Models landscape

Based on SGAM, it shows the actual scope of each relevant data model in the electricity domain. It is a reminder that three core data models exist, as identified in IEC 63097 smart grid standardisation roadmap. This figure is consistent with the list of relevant data models listed in the 2023 Landscape Report on Data Models.

[37] Work Programme 2024 (cencenelec.eu) https://wp2024.cencenelec.eu/?Sectors[]=6789

Indeed, the essence of data spaces is to harmonise the procedures, functions and formats for data exchange between parties. Currently, data spaces developed within the energy domain mostly rely on domain-specific standards such as CIM, SAREF4ENER, etc. However, wider approaches are necessary when considering cross-domain data exchange.

Within the energy R&I ecosystem, a coordination and support action called “int:net” is supporting interoperability within this sector and facilitating the cluster of the five “energy data space” projects, namely DATA CELLAR, EDDIE, ENERSHARE, OMEGA-X and SYNERGIES. All these projects contributed to the IDSA paper published in 2023 about the “interoperability framework in Energy Data Spaces”. Relevant standards were identified and listed in the document, coming from transversal (e.g. ISO) and domain-specific (e.g. IEC) standardisation bodies.

At a broader level but still within the R&I ecosystem, the Data Spaces Support Centre (DSSC) aims to support the Horizon projects developing data spaces by offering a reference framework made of numerous assets such as “starter kit”, “glossary”, “conceptual model”, etc. It also includes a “collection of standards and technologies landscape”, published in 2023.

Finally, international standardisation bodies such as ISO are working on the development of data spaces specific standards, such as:

- PWI JTC1-SC41-17 Guidance on the integration of IoT and digital twins in data spaces (under development in ISO/IEC JTC1/SC41 “Internet of Things and Digital Twins)
- ISO/IEC 20151 Dataspace concepts and characteristics (under development in ISO/IEC JTC1/SC38 “Cloud Computing”

These standards are complemented with more generic standards on interoperability, data format, data usage, data protection, data provenance, etc.

Islands projects

Islands have specific needs and opportunities, both in terms of renewable energies and grid operation. We look here into the standards used and use cases of a few island-based projects to find commonalities and good practices.

Energy islands and geographical islands are both included to this study, as they have strong ties.

Standards used in Islands projects

Below is the list of projects (Table 2) considered in this study, and the communication standards used by each of them.

Table 2: use of standards in island projects

Project	Standards used	Type of islands
MAESHA	On System Operator level, use of a CIM-based communication On Asset level, use of specific standards (e.g., OCPP for EVs) MQTT	Geographical island, energy island
Re-empowered	CIM DNP3, OPC, Modbus, IEC61850, ICCP	Energy island

ROBINSON	IEEE802.3	Geographical island
LocalRES	OpenAPI	Energy island
GIFT	FlexOffer	Geographical island
SERENE		Geographical island
NESOI	CCS	Geographical island
IANOS	Explored, but may not be used: OpenADR, USEF, EN 50491-12-2 SAREF, MQTT IEC 61850 CHAdeMO	Geographical island
ISLANDER	Explored, but may not be used: OpenADR MQTT, AMQP, RESTFul OCPP Fiware	Geographical island
VPP4Islands	SAPL Modbus, IEC 870-5-101/104, IEC 61850-based protocols HTTP, MQTT, TCP/IP IEEE Standard 830-1984 (to help write specifications)	Geographical island
CREATORS	MQTT	Energy island
ENeuron	IEEE 802.15.4, Zigbee, Z-Wave, Bluetooth Low Energy, 868 MHz RF modules, wireless M-bus OMS, wireless M-bus R4, LTE-V2V	Energy island
RENergetic		Energy island
SUSTENANCE	OCPP ModBus, BACnet USEF IEC 61850	Energy island

This table shows that the protocols used vary widely between the different projects. It can be noted that a range of protocols dedicated to the communication with local assets have been identified, more often than protocols dedicated to aggregation of assets and their integration in the grid (11 projects versus 4 projects).

However, the identification and choice of the communication protocols, as documented in the projects' deliverables, is generally based on the use cases and the system to be developed, and not on the fact that the demonstration site is an island. Therefore, we will look into the use cases from the same projects in the next section.

Use-cases from island projects

The use cases from the different island projects studied are listed below (Table 3).

Table 3: use cases in island projects

Project	Use-cases
MAESHA	Frequency control Voltage control Minimization of the consumption peak Maximization of the use of Renewable Energy Sources Energy Access
Re-empowered	Real time monitoring and system data visualization Forecasts, Unit Commitment, Economic Dispatch, Multi-energy optimisation Microgrid monitoring Microgrid optimal management of operation 7-Year Energy Planning RES Hosting Capacity Interconnections Multienergy vectors Increased energy monitoring at demand side Integration Interfaces for Load Management Microgrid data acquisition Platform as a service for dependent tools integration Data storage and cloud server Drinking water quality surveillance Dynamic pricing of electricity Scheduling and Coordination Outreach forum Guidance and Training

	Passive resilient support structure for solar photovoltaic system and its optimisation Resilient tower and a passive mechanism for the wind turbine blades WT Local Manufacturing and Testing
ROBINSON	Use-case to be discussed after the component installation
LocalRES	Blackout strategies Building energy management and optimisation Capitalisation of monitored data Demand response End-user engagement Prefeasibility assessment P2H Public EV charging points Smart energy storage management Support on technical execution Aggregated (REC-level) energy trading Collective peak shaving Legal advice Optimisation of electric flows within the REC P2P energy trading Prefeasibility assessment REC-level/collective self-consumption V2G services Anomalies detection at REC-level Congestion management Heating/cooling as a service Operation of a DHN with RES (these are services which constitute the core of the use cases)
GIFT	Congestion avoidance

	Fish Farms LEC Smart Harstad LEC Procida LEC
SERENE	Framework for Flexible Operation of Heat Pump Integration of EVs in Local Energy Systems
NESOI	No use-cases available
IANOS	Community demand-side driven self- consumption maximisation Community supply-side optimal dispatch and intra-day services provision Island-wide, any-scale storage utilisation for fast response ancillary services DSM and Smart Grid methods to support Power quality and congestion management services Decarbonisation of transport and the role of electric mobility in stabilising the energy system Decarbonising large industrial continuous loads through electrification and locally induced generation Circular economy, utilisation of waste streams and gas grid decarbonization Decarbonisation of heating network Active Citizen and LEC Engagement into Decarbonisation Transition
ISLANDER	Self-consumption (BTM) Energy arbitrage (BTM) Peak limitation (BTM) Optimal EV charge (BTM) Power limitation (BTM) Aggregation (FTM) Energy services (FTM) Demand Response (FTM)
VPP4Islands	No use-cases available
CREATORS	No use-cases available

ENeuron	Maximisation of RES (Renewable Energy Sources) share and air quality improvement in the EH (Energy Hub) Maximisation of micro energy hubs efficiency and reduction of the imported energy Increase the flexibility from load and generation of micro-energy hubs High Reliability of Supply Green EV charging Contribution with ancillary services to the local distribution grid and at the customer point e.g., by solving voltage problems or congestion Peer-to-peer energy and flexibility trading Minimisation of users' energy costs within ILEC Minimisszation of ILEC's OPEX and reduction of carbon emissions for environmental benefits of ILEC Investigating environmental/economic trade-off solutions for long-term planning of ILEC Investigating the introduction/replacement of new energy carriers in the ILEC through economic and environmental criteria Identification of possible local energy sources investment, optimally exploited (optimal sizing and location) for CAPEX minimisation and CO2 emissions of the ILEC
RENergetic	No use-cases available
SUSTENANCE	Danish demonstrator (Integrated local energy systems) Indian demonstrator: Sustainable islanded local energy system at Barubeda Indian demonstrator: Weak grid connected Energy system at Borakhai Indian demonstrator: Smart energy system at IIT Bombay campus Netherlands demonstrator – Vriendenerf (smart grid Energy Management System, soft-islanded mode, high congestion or grid failure) Netherlands demonstrator – SlimPark (living lab for electric vehicle charging) Polish demonstrator: community-based integrated energy system model

These use-cases can be categorised under the 9 HLUCs defined by the ETIP-SNET, in order to map out the most important ones for island projects. This mapping is done in the table below (Table 4).

Table 4: Categorisation of island projects within ETIP-SNEP HLUCs

HLUC from ETIP-SNET	Island Project
HLUC 1: Optimal Cross sector Integration and Grid Scale Storage	Re-empowered LocalRES IANOS ROBINSON
HLUC 2: Market-driven TSO–DSO–System User interactions	
HLUC 3: Pan European Wholesale Markets, Regional and Local Markets	LocalRES GIFT
HLUC 4: Massive Penetration of RES into the transmission and distribution grid	MAESHA Re-empowered LocalRES ENeuron
HLUC 5: One stop shop and Digital Technologies for market participation of consumers (citizens) at the centre	
HLUC 6: Secure operation of widespread use of power electronics at all systems levels	
HLUC 7: Enhance System Supervision and Control including Cyber Security	Re-empowered LocalRES ROBINSON

HLUC 8: Transportation Integration & Storage	LocalRES SERENE IANOS ISLANDER ENeuron SUSTENANCE
HLUC 9: Flexibility provision by Building, Districts and Industrial Processes	MAESHA LocalRES GIFT SERENE IANOS ISLANDER ENeuron SUSTENANCE ROBINSON

This shows that three main high-level use cases are the focus of island projects: HLUC4 on the penetration of renewable energy sources, HLUC8 on transportation integration and storage and HLUC 9 on flexibility provision.

2.5.3 BSUG webinars

In order to disseminate the experience of the participating projects, the BRIDGE Standards User Group created a playlist of webinars. Indeed, several projects organise and record webinars, which are not necessarily well disseminated. In this playlist, 13 webinars can currently be accessed, and the playlist is regularly updated. Here is the list of topics currently covered (Table 5).

Table 5: Topics in the webinar playlist

Topic	Author
IEC 63097 Smart Energy Standardisation Roadmap	IEC 63097
EUMED Metering	OMEGA-X
Open Entrance results and their use in Data Cellar	Data Cellar

EUMED Market	OMEGA-X
OMEGA-X Standardisation and profiling workshops	OMEGA-X
OneNet presentation	OneNet

The playlist can be accessed here.

IEC 63097 is a key document for any smart grid project, as it identifies for each smart grid system the relevant use cases and standards that can be used, or which are in preparation.

2.5.4 Projects' code components

According to IEC[38], a code component is “Any piece of information, intended to be directly processed by a computer and encoded in accordance with specific software code language rules (typically XML, XSD, Java, C, …)."

A repository of projects' code components has been initiated within the BRIDGE Standards User Group. Its aim is to collect the reusable results from projects and gather them in a common place to improve their dissemination and reusability. In particular, the repository focus on the implementation of standards.

Governance of the code components repository

Good practices for the governance of the repository needs to be discussed:

- What format should the repository take?
- Should the repository be managed in open source?
- How can projects add to the repository?
- How should the repository be used by standardisation bodies?

These questions need to be answered in order to build a long-lasting and useful repository. They will be covered in the next year as the repository is developed and consolidated.

Moreover, reusable sets of data that could be shared between projects could be added to the repository, as test datasets. However, any new additions should be checked for compliance with the RGPD.

Available components

So far, 56 projects have been reviewed to search for code components. Below are the main code components identified (Table 6).

Table 6: Main code components identified

Project	Code components
Interconnect	Semantic Interoperability Framework, Distribution System Operator Interface, Interconnect ontology, Adapters, service store, knowledge engine, P2P marketplace, Interoperable Recommender TSO Code components are available here: (https://gitlab.inesctec.pt/interconnect-public)

[38] Handling of Code Components v8.0 2019-08-29.pdf (https://www.iec.ch/public/tc57/Handling%20of%20Code%20Components%20v8.0%202019-08-29.pdf)

OneNet	FIWARE connector : (https://fiware-true-connector.readthedocs.io/en/latest/)
X-FLEX	Extensions of CIM, SAREF, UFTP/USEF and some custom data models are described in D6.1 (https://xflexproject.eu/wp-content/uploads/2021/07/XFLEX_D6.1-Standards-and-data-models.pdf)
GoFlex	Aggregation platform implementing FlexOffer, with available API https://github.com/aau-daisy/flexoffer_manager
Flexigrid	Data model described in D5.8: http://www.flexigrid-h2020.eu/wp-content/uploads/2023/10/D5.8-Publishable-report-on-FLEXIGRID-interoperability-environment.pdf
PLATOON	Data Space Connector: https://gitlab.cc-asp.fraunhofer.de/eis-ids/platoon-dsc/-/tree/mainPlatoon
BD4NRG	Smart Data Models: https://github.com/smart-data-models/ ; relevant items are detailed in D4.2: https://www.bd4nrg.eu/sites/default/files/2023-06/D4.2%20Report%20on%20Existing%20Methods%20Tools%20and%20Prototype%20Implementations%20to%20realize%20the%20Semantic%20Interoperability%20Toolbox%2C%20Framework%20and%20Platform%201.0_0.pdf
INT:NET	Data model, reporting tool, int:net Interoperability Model (EMINENT) https://github.com/int-net
IANOS	Data model described here (annexe): https://ianos.eu/wp-content/uploads/2024/01/D2.15_IANOS.pdf
VPP4Islands	Description of SAPL : https://vpp4islands.eu/wp-content/uploads/2022/06/aai_infrastructure.pdf

The code components include APIs, data models, ontologies, and any reusable components related to the implementation of standards.

The following components from ENTSO-E have, moreover, been identified as relevant for the repository of code components:

- Network Code profiles for Coordinated Security Analysis (CSA)
- Electricity Balancing Processes
- Common Grid Model Alignment (CGMA) Data Exchanges
- Pan European Verification Function (PEVF)
- Coordinated Capacity Calculation
- Short Term Adequacy Forecasts (STA)
- CACM List of Information To ACER
- Common Grid Model Exchange Standard (CGMES)
- System Development TYNDP

These can be found in the following links:

- https://www.entsoe.eu/publications/electronic-data-interchange-edi-library/
- https://www.entsoe.eu/data/cim/cim-for-grid-models-exchange/
- https://www.entsoe.eu/data/cim/role-models/

Planned outcomes from unfinished projects

In addition to the list mentioned above, many projects have planned to create code components, but have not developed them yet. These planned outcomes have also been reported in the repository for future follow-up. The planned outcomes identified are listed in the table below (Table 7).

Table 7: Code components planned for the future

Project	Planned code components
INTERSTORE	Recommendations to standardisation bodies in link with IEEE 2030,5 planned
Parmenides	The ontology is planned to be available once developed
EDDIE	The architecture and connectors open-source and connects to already developed services.

Our findings and recommendations regarding the repository of code components are:

Topic	Standardisation Topics
Findings	The code components from projects are not easily findable.
Recommendation	A survey should be issued to participating projects to get their inputs and include them in the repository.
Findings	The projects code components are not reused enough.
Recommendation	Improve the reusability of code components by sharing them through the liaisons established with SDOs.
Findings	Several projects develop ontology profiles. There is a need for coordination in order to share what can be reused, and to identify gaps in ontologies.
Recommendation	Define an action to facilitate the development of a vocabulary hub for collecting ontologies from projects.

2.6 Outcome of liaisons

2.6.1 CEN/CLC/ETSI CG-SG liaison

The liaison between the BRIDGE Standards User Group (BSUG) and the CEN-CENELEC-ETSI CG-SG was established in 2022 to share knowledge with BRIDGE about ongoing and future standards and to collect experience from BRIDGE about identified gaps and feedback on standards.

The following cooperation has been achieved since then:

- **Participation of BRIDGE representatives to CG-SG meetings**: CG-SG plenary meetings are organised twice per year. BRIDGE representatives participated first to present and establish the proposed liaison. Then, they contributed to the meetings by providing a summary of ongoing BRIDGE activities and proposing topics to be discussed, such as the Generic Actor List.
- **Circulation of IEC Guide 125 on use cases to collect feedback from BRIDGE projects**: In 2023, IEC SMB/SG12 developed a guide on use-case definition, called “IEC Guide 125”. This was circulated to IEC SyC Smart Energy who then circulated it to CEN-CLC-ETSI CG-SG as part of their liaison, finally circulating it to the BRIDGE Standards User Group. Finally, useful feedback from BRIDGE was collected and sent back to IEC SMB/SG12.
- **Launch of a work item on the update of the Generic Actor List**: As part of its activities, the BRIDGE Data Management WG is developing a use-cases repository for all BRIDGE projects. In order to harmonise the definition of the use cases, BRIDGE is willing to rely on a list of generic actors (“Generic Actors List” as defined by IEC 62559). A first “Generic Actor List” was developed in 2012 by CEN/CLC/ETSI CG-SEG, published in the “Sustainable Processes” report. BRIDGE proposed to CG-SG to update this list and make it a new reference for Europe. BRIDGE and CG-SG agreed to cooperate with the following terms: BRIDGE projects willprovid experts to work on the update of the Generic Actor List and CG-SG will perform the official review of the updated list before its publication. This work has just started and should be completed by the end of 2024.
- **Participation in an IEC/CEN/CLC/ETSI workshop on SAREF**: In early 2024, the CG-SG organised, together with IEC TC57, a workshop on SAREF and its extensions. BRIDGE representatives participated in this workshop to convey the experience and results of BRIDGE projects, in particular InterConnect (interoperability smart home, building and grids) and OMEGA-X (energy data space).

2.6.2 ENTSO-E liaison

The liaison between the BRIDGE Standards User Group (BSUG) and the ENTSO-E CIM Expert Group was established in 2022, to share knowledge with BRIDGE about ongoing and future CIM development and to collect experience from BRIDGE about identified gaps and proposed CIM extensions.

BRIDGE representatives were invited to several CIM EG meetings to present BRIDGE activities and highlight potential synergies. Also, CIM EG representatives were invited to BRIDGE Data Management WG to share the CIM EG roadmap.

However, so far, no concrete cooperation has been launched. The BRIDGE Standards User Group has started to collect CIM contributions from projects, in the form of extensions or profiles. This is meant to be a useful input for a future work item.

3 Conclusion and perspectives

3.1 Main topics

The BRIDGE Standardisation User Group has the following objectives:

- educate projects on CEN/CLC/ETSI and IEC relevant standards
- cooperate bi-directionnally with existing CEN/CLC/ETSI CG-SG, the ENTSO-E CIM Work Group, and other SDOs

Liaison with the CEN/CLC/ETSI CG-SG has been established, with the participation of members of the BRIDGE Standards User Group in regular CG-SG meetings. A relation with the ENTSO-E CIM Work Group has, moreover, been developed, and more common activities could be continued in the future.

Moreover, a repository of code components is being created. Its governance will be defined in 2024. It will be continuously improved and fed by projects to disseminate and provide access to the code components developed by projects. This should facilitate the implementation of standards by projects.

A playlist of webinars has also been created to disseminate the projects' knowledge and results.

3.2 Findings and recommendations

This section describes the main findings and recommendations regarding the contribution from BRIDGE projects to standardisation. Our findings and recommendations are:

Topic	BRIDGE internal Coordination
Findings	BRIDGE Regulation Working Group, and other BRIDGE Data Management Working Groups can contribute to standardisation.
Recommendation	Establish a close cooperation with BRIDGE Regulation Working Group and other BRIDGE Data Management Working Group actions in order to be consistent on standardisation issues.
Finding	Coordination is needed between the actions of the Data Management Working Group.
Recommendation	Coordinate the development of repositories between the Action #4 and #5.

Topic	BRIDGE external coordination
Findings	The SEEG covers topics related to the projects involved in the BRIDGE Standards User Group. Its findings and reports should be shared with the projects.
Recommendation	The BRIDGEStandards User Group will follow the activities of the SEEG and share its results with the BRIDGE projects. Liaison with this group may also be formed in the future.

Findings	The ENTSO-E CIM related story is rich and well explained in the CGMES roadmap. Some EU-funded R&D projects do not have ENTSO-E as a participant, and these projects must benefit from CIM expertise, and be able to use the CIM model in its UML format, and derivatives (associated profiles).
Recommendation	The liaison established with ENTSO-E CIM Work Group will be reinforced. ENTSO-E and BRIDGE will share some documents: ENTSO-E CIM roadmap, EU regulation roadmap, draft specifications, UML models, CIM datasets, CIM issues …
Findings	The CEN/CLC/ETSI Coordination Group on Smart Grids is well positioned to analyse regulation requirements, and identify standardisation gaps. CEN/CLC/ETSI is also participating in SGTF Expert Groups. As the ESOs are working closely with the int'l standardisation organisations it would make sense for BRIDGE to use the established cooperation mechanisms.
Recommendation	BRIDGE should use the European Standard Organisations as the main conduit to: firstly proposing new topics for standardisation or flagging existing standards that should be updated, and secondly reaching out to the international arena (e.g. IEC). The existing liaison with CEN/CLC/ETSI CG-SG will be continued.
Findings	Besides European and International Standard Organisations, several other associations, SDOs or para-normative associations exist like USEF, OCA, DLMS-UA, UCAIUg, CIRED, CIGRE, W3C, IETF, EU.DSO, …
Recommendation	Identify if other association representatives, participating in BRIDGE projects need to be included (EU.DSO, USEF, …) or if these liaisons will be supported by organisation experts participating in EU R&D projects. Organisation experts will be free to inform BRIDGE about these liaisons and inputs achieved.

Topic	**Standardisation Topics**
Findings	Other European initiatives like ETIP-SNET have worked on related smart energy topics which require standardisation, in order to improve interoperability.
Recommendation	Monitor what ETIP-SNET WG4 are doing and use their conclusions to identify standardisation topics. Provide BRIDGE User Group standardisation results to ETIP SNET WG4 to collect feedback.
Findings	ICT standardisation topics are well described in the European "Rolling Plan for ICT Standardisation", which is a living document.
Recommendation	Anticipate standardisation topics based on the existing and yearly updated Rolling Plan for ICT Standardisation. Contribute to the plan's updates
Findings	BRIDGE participating projects represent a source of knowledge on standard usage and associated implementation. They can provide inputs for the webinar playlist and the repository of code components.
Recommendation	Question the BRIDGE projects each year to identify and prioritise topics
Findings	The code components from projects are not easy to find.
Recommendation	A survey should be issued to participating projects to get their inputs and include them in the repository.
Findings	The projects' code components are not reused enough.

Recommendation	Improve the reusability of code components by sharing them through the liaisons established with SDOs.
Findings	Several projects develop ontology profiles. There is a need for coordination, to share what can be reused, and to identify gaps in ontologies.
Recommendation	Define an action to facilitate the development of a vocabulary hub for collecting ontologies from projects

3.3 Next steps

The repository of code components will be consolidated and fed by projects. Its will be developed in coordination with the development of the repository of products from Action #5. Common collection of information from projects is planned.

The webinar list will be continuously updated.

Existing liaisons with SDOs will be consolidated, and new liaisons will be explored. In particular:

- Liaison will CEN/CLC/ETSI CG-SG will be continued
- Liaison with ENTSO-E CIM work group will be reinforced
- Liaison with the coordination group between EU DSO entity and ENTSO-E will be explored

Liaison with the Smart Energy Expert Group will be explored.

Annexe 1 Systems approach

The system approach is illustrated in the Figure 15 IEC Systems approach

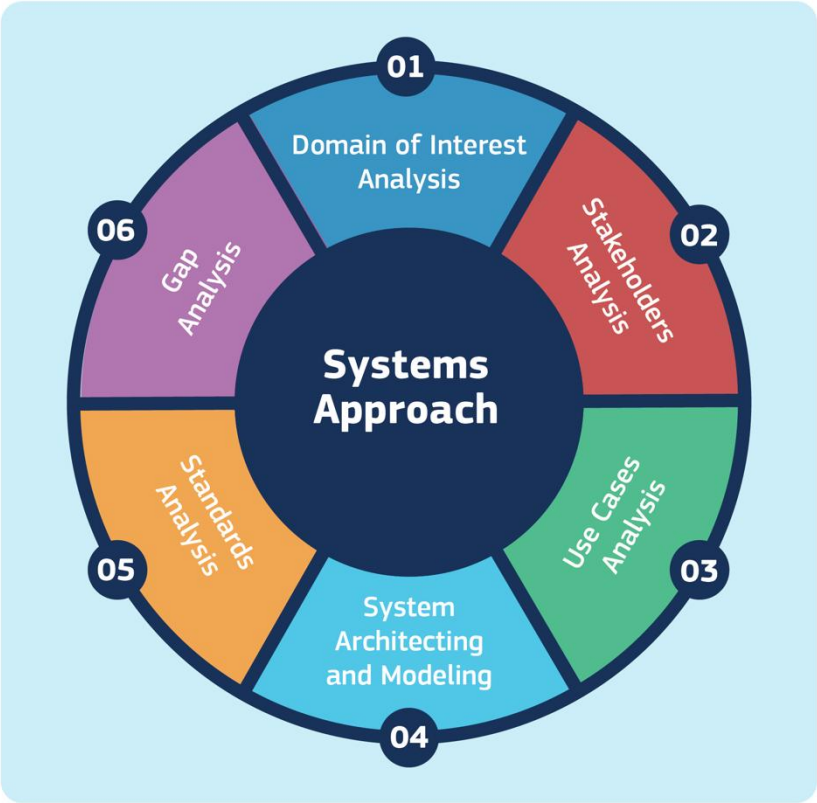

Figure 15 IEC Systems approach

The systems approach[39] includes a use-case analysis (step 3) per domain of interest. IEC System Committee Smart Energy is promoting this system approach and makes available several resources[40].

This use-case analysis helps to identify standard gaps. What has been done in BRIDGE Data Management Action #3 is fully aligned with this methodology.

Concerning step 4, as a reminder, the Smart Grid Architecture Model was created by CEN/CLC/ETSI under M/490 Smart Grid Mandate. It was promoted internationally, and IEC 63200 explains how SGAM can be used in the smart grid context. As a reminder, the SGAM is illustrated in the following figure (Figure 16 the Smart Grid Architecture Model).

[39] A systems approach | IEC
[40] Home - SyC Smart Energy (iec.ch)

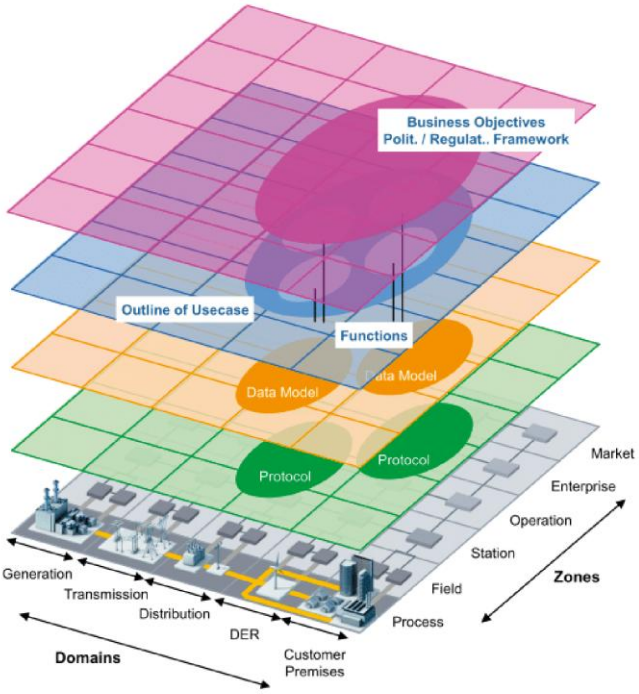

Figure 16 the Smart Grid Architecture Model

BRIDGE Data Management Working Group Action #2 has extended the SGAM concept and is proposing DERA 2.0 Reference Architecture which could help to support cross-sector interactions, and energy sector interactions. We can expect to promote and challenge DERA 2.0 at the international level too if some R&D European funded projects are using it.

The use cases are decomposed in Business Use Cases (BUC), and System Use Cases (SUC), as explained in IEC 62913-1 and the following figure illustrates use cases and SGAM mapping (Figure 17 Use cases and Architecture Mapping on SGAM).

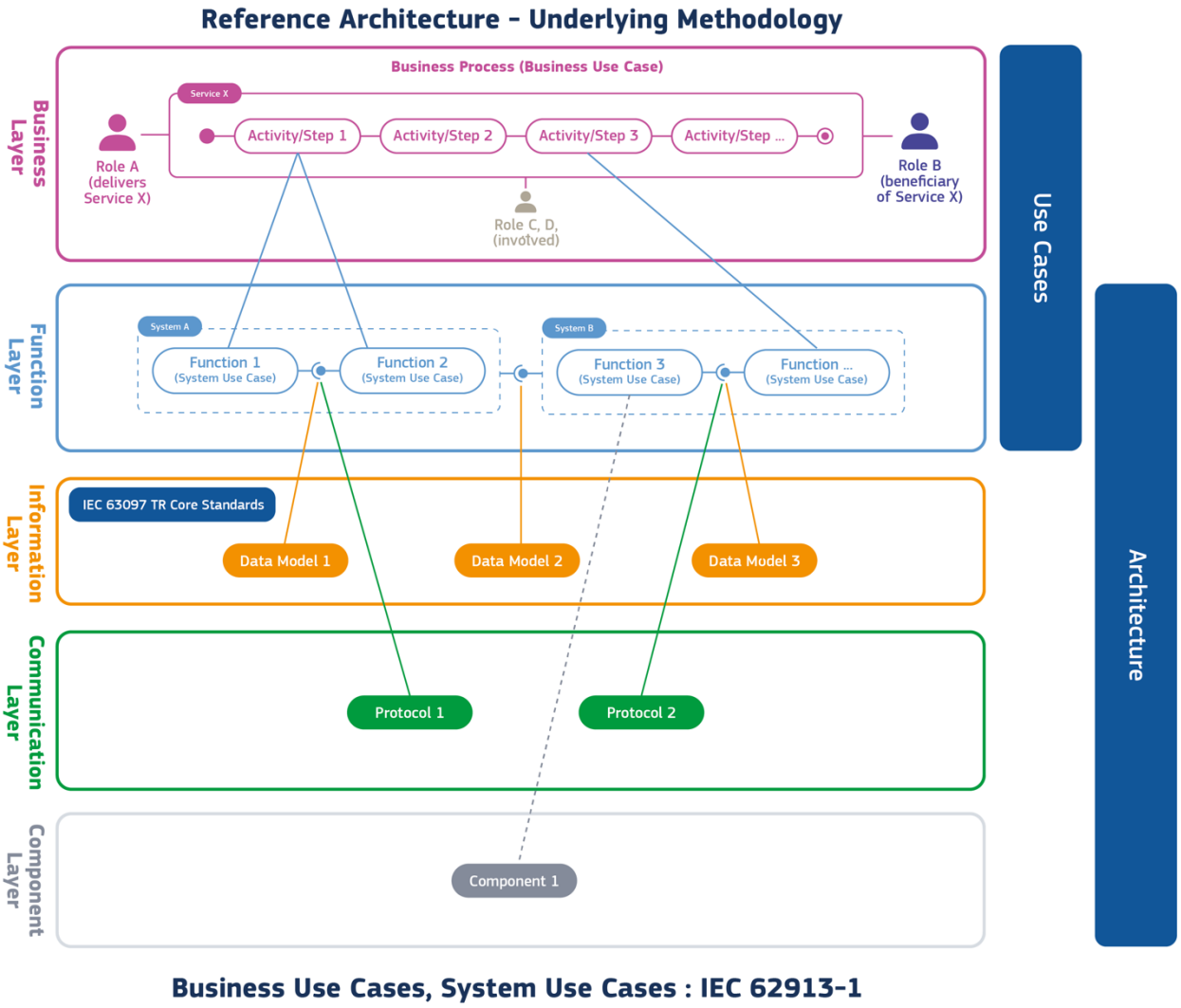

Figure 17 Use cases and Architecture Mapping on SGAM

IEC 63097 Smart Grid Standardisation Roadmap has identified the information models IEC CIM, IEC 61850 and IEC COSEM as core standards for the electricity information layer. These information models are establishing a common understanding between applications, and therefore contribute to interoperability. BRIDGE Data Management Working Group Action #2 has extended the SGAM information layer to consider other information models and ontologies used in the energy sector or other sectors.

List of references

_CEN/CLC/ETSI CG-SEG – CEN/CLC/ETSI CG-SEG – Final Report of the Working Group Clean Energy Package (WG-CEP) - v04.03 Date: 2019-10-22. Ref : CENCLCETSI_SEG-CG/Sec/00115/DC

_CEN/CLC/ETSI CG-SEG – Set of Standards v4.1 – Jan 6th 2017. It proposes an updated framework of standards which can support Smart Grids deployment in Europe.

_CEN/CLC/ETSI CG-SEG – Cyber Security & Privacy – 2016-12 : security standardisation specific to Smart Energy Grid and security standardisation targeting generic standards are further monitored and analysed.

_European Commission Rolling Plan for ICT Standardisation – 2021. https://ec.europa.eu/docsroom/documents/44998

_ENTSO-E, ENTSO-E Research, Development & Innovation Roadmap 2020–2030
https://www.entsoe.eu/2020/10/14/entso-e-research-development-innovation-roadmap-2020-2030/

_DSO priorities for Smart Grid Standardisation – Eurelectric & EDSO for Smart Grid.

https://www.edsoforsmartgrids.eu/wp-content/uploads/public/DSO-Priorities-Smart-Gird-Standardisation.pdf

_IEC SyC Smart Energy website and resources Home - SyC Smart Energy (iec.ch), and its delivery folder.

_CEN/CENELEC work program: https://www.cencenelec.eu/media/CEN-CENELEC/Publications/workprogramme2021.pdf

_OPEN DEI Energy pilots explorer : http://interrface.eu/sites/default/files/OPENDEI-Energy%20Booklet_for%20website.pdf

_ETIP-SNET Working Group 4 : Digitalisation of the Electricity System and Customer Participation. Terms of Reference. https://www.etip-snet.eu/wp-content/uploads/2017/03/ETIP-SNET-WG4-Terms-of-Reference-March-2021_FV1.pdf (March 2021)

_Joint Research Centre SGDoIT : https://ec.europa.eu/jrc/en/science-update/sg-doit

Access to portal (restricted) : https://smart-interoperability.jrc.ec.europa.eu/index.php/home

_ PANTERA (GA 824389) : https://pantera-platform.eu/resources/) .

PANTERA (GA 824389) WG3 “The state of R&I, standardisation and regulation” report D3.2, 01/12/2020 https://pantera-platform.eu/wp-content/uploads/2021/01/D3.2_Report-on-Regulations-Codes-and-Standards-in-EU-28.pdf.

_ BD4NGR – GA 872613: *http://*www.bd4nrg.eu

_ inteGRIDy – GA 731268: http://www.integridy.eu

_inteGRIDy – GA 731268 relevant standards available at:
https://www.integridy.eu/sites/default/files/integridy/public/content-files/article/integridy_whitepapers.v1.1.pdf

_ i3-MARKET – GA 871754: https://www.i3-market.eu

_ DIH4AI (GA 101017057): https://www.dih4ai.eu/project

_ Smart5Grid (GA 10101

6912) - Demonstration of 5G Solutions for SMART energy GRIDS of the future: https://smart5grid.eu/

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