Ref. Ares(2026)3748832 - 10/04/2026

HEDGE-IoT

Holistic approach towards Empowerment of the Digitalization of the Energy Ecosystem through adoption of IoT solutions

D7.4
Dissemination, Exploitation and Market Exploration, Standardisation, and Community Building
(intermediate release)

Co-funded by the European Union

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

DOCUMENT CONTROL SHEET

PROJECT INFORMATION

Project Number	101136216		
Project Acronym	HEDGE-IoT		
Project Full title	Holistic Approach towards Empowerment of the Digitalisation of the Energy Ecosystem through adoption of IoT solutions		
Project Start Date	01 January 2024		
Project Duration	42 months		
Funding Instrument	HORIZON	Type of action	HORIZON Innovation Actions
Call	HORIZON-CL5-2023-D3-01		
Topic	HORIZON-CL5-2023-D3-01-15		
Coordinator	EUROPEAN DYNAMICS LUXEMBOURG SA (ED)		

DELIVERABLE INFORMATION

Deliverable No.	D7.4							
Deliverable Title	Dissemination, Exploitation and market exploration, standardisation, and community building (Intermediate release)							
Work-Package No.	WP7							
Work-Package Title	Dissemination, Exploitation, Standardisation							
Lead Beneficiary	F6S							
Main Author	F6S							
Other Authors	TRIALOG, ED, CLUBE							
Due date	M27							
Deliverable Type	X	Document, Report (R)		Data management plan (DMP)		Websites, press & media action (DEC)		Other
Dissemination Level	X	Public (PU)		Sensitive (SEN)		Classified		
	PU: Public, fully open SEN: Sensitive, limited under the conditions of the Grant Agreement Classified R-UE/EU-R – EU RESTRICTED under the Commission Decision No2015/444 Classified C-UE/EU-C – EU CONFIDENTIAL under the Commission Decision No2015/444 Classified S-UE/EU-S – EU SECRET under the Commission Decision No2015/444							

Co-funded by the European Union

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

Document Revision History

Version	Date	Description of change	List of contributor(s)
0.1	01/12/2025	Table of Contents	Danijel Pavlica (F6S), Vukašin Orsić (F6S)
0.2	19/12/2025	Section 1 Update	Danijel Pavlica (F6S)
0.3	15/02/2026	Chapter 2 Update	Danijel Pavlica (F6S), Vukašin Orsić (F6S)
0.4	11/03/2026	Chapter 3 Update	Athanasios Labropoulos (CLUBE) George Yiannakis (CLUBE)
0.5	15/03/2026	Chapter 4 Update	Léo Cornec (TRIALOG)
0.6	15/03/2026	Chapter 5 Update	Nikolaos Bilidis (ED) Lenos Peratitis (ED)
0.7	17/03/2026	Document Consolidation and Review	Danijel Pavlica (F6S), Vukašin Orsić (F6S)
0.8	23/03/2026	Ethics Review	Carmela Occhipinti (CSL) Katharina Wehrmeister (RWTH) Nikolaos Bilidis (ED) Nikos Dimitropoulos (ICCS)
0.9	30/03/2026	Deliverable Review	Antonis Papanakolaou (QUE), Dimitris Kranias (HSE), Georgios Mourkousis (HSE), Léo Cornec (TRIALOG) Matthew Protonotarios (HSE), Thanos Kalamaris (QUE)
1.0	31/03/2026	Document Finalisation	Danijel Pavlica (F6S), Vukašin Orsić (F6S)

Co-funded by the European Union

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

PARTNERS

Participant number	Participant organisation name	Short name	Country
1	EUROPEAN DYNAMICS LUXEMBOURG SA	ED	LU
2	RHEINISCH-WESTFAELISCHE TECHNISCHE HOCHSCHULE AACHEN	RWTH	DE
3	DS TECH SRL	DST	IT
4	EREVNITIKO PANEPISTIMIAKO INSTITOUTO SYSTIMATON EPIKOINONION KAI YPOLOGISTON	ICCS	EL
5	INESC TEC - INSTITUTO DE ENGENHARIADE SISTEMAS E COMPUTADORES, TECNOLOGIA E CIENCIA	INESC	PT
6	NEDERLANDSE ORGANISATIE VOOR TOEGEPAST NATUURWETENSCHAPPELIJK ONDERZOEK TNO	TNO	NL
7	TAMPEREEN KORKEAKOULUSAATIO SR	TAU	FI
8	TEKNOLOGIAN TUTKIMUSKESKUS VTT OY	VTT	FI
9	TRIALOG	TRIALOG	FR
10	CENTRO DE INVESTIGACAO EM ENERGIA REN - STATE GRID SA	NESTER	PT
11	INTERNATIONAL DATA SPACES EV	IDSA	DE
12	ELIA TRANSMISSION BELGIUM	ETB	BE
13	HRVATSKI OPERATOR PRIJENOSNOG SUSTAVA D.D.	HOPS	HR
14	UNIVERSITATEA TEHNICA CLUJ-NAPOCA	TUC	RO
15	CLUSTER VIOOIKONOMIAS KAI PERIVALLONTOS DYTIKIS MAKEDONIAS	CLUBE	EL
16	F6S NETWORK IRELAND LIMITED	F6S	IE
17	SOCIAL OPEN AND INCLUSIVE INNOVATION ASTIKI MI KERDOSKOPIKI ETAIREIA	INCL	EL
18	ABB OY	ABB	FI
19	ENERVA OY	ENERV	FI
20	JARVI-SUOMEN ENERGIA OY	JSE	FI

Co-funded by the European Union

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

21	DIMOSIA EPICHEIRISI ILEKTRISMOU ANONYMI ETAIREIA	PPC	EL
22	DIACHEIRISTIS ELLINIKOU DIKTYOU DIANOMIS ELEKTRIKIS ENERGEIAS AE	HEDNO	EL
23	INDEPENDENT POWER TRANSMISSION OPERATOR SA	IPTO	EL
24	ELLINIKO HRIMATISTIRIO ENERGEIAS	HENEX	EL
25	HARDWARE AND SOFTWARE ENGINEERING EPE	HSE	EL
26	QUE TECHNOLOGIES KEFALAIOUCHIKI ETAIREIA	QUE	EL
27	ARETI S.P.A.	ARETI	IT
28	APIO S.R.L.	APIO	IT
29	ACEA ENERGIA SPA	AE	IT
30	ARNHEMS BUITEN BV	AB	NL
31	STICHTING VU	VU	NL
32	COOPERATIVE ELECTRICA DO VALE DESTE CRL	CEVE	PT
33	REN - REDE ELECTRICA NACIONAL SA	REN	PT
34	MC SHARED SERVICES SA	SONAE	PT
35	ELES DOO SISTEMSKI OPERATER PRENOSNEGA ELEKTROENERGETSKEGA OMREZJA	ELES	SI
36	ELEKTRO GORENJSKA PODJETJE ZA DISTRIBUCIJO ELEKTRICNE ENERGIJE DD	EG	SI
37	OPERATO DOO	OPR	SI
38	SVEUCILISTE U ZAGREBU FAKULTET ELEKTROTEHNIKE I RACUNARSTVA	UNIZG	HR
39	INSTITUT JOZEF STEFAN	JSI	SI
40	KONCAR - DIGITAL DOO ZA DIGITALNE USLUGE	KONC	HR
41	CYBERSOCIAL LAB S.R.L.	CSL	IT

Co-funded by the European Union

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

Disclaimer

This deliverable is subject to final acceptance by the European Commission. The content and results of the publication herein are the sole responsibility of the publishers, it reflects only the contributors' view, and it does not necessarily represent the views expressed by the European Commission or its services, neither the European Commission is responsible for any use that may be made of the information it contains.

While the information contained in the documents is believed to be accurate, the contributor(s) or any other participant in the HEDGE-IoT Consortium make no warranty of any kind regarding this material including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. Neither the HEDGE-IoT Consortium nor any of its members, their officers, employees, or agents shall be responsible or liable in negligence or otherwise howsoever in respect of any inaccuracy or omission herein. Without derogating from the generality of the foregoing, neither the HEDGE-IoT Consortium nor any of its members, their officers, employees, or agents shall be liable for any direct or indirect or consequential loss or damage caused by or arising from any information advice or inaccuracy or omission herein.

Copyright notice

© HEDGE-IoT, 2024-2027

This deliverable and its content are the property of the HEDGE-IoT Consortium. This deliverable contains original unpublished work except where clearly indicated otherwise. Acknowledgement of previously published material and of the work of others has been made through appropriate citation, quotation, or both. Reproduction is authorised provided the source is acknowledged. The content of all or parts of these documents can be used and distributed provided that the HEDGE-IoT project and the document are properly referenced.

Co-funded by the European Union

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

EXECUTIVE SUMMARY

Deliverable 7.4 provides an **intermediate report** on the communication, dissemination, exploitation, standardisation, and community-building activities undertaken within the HEDGE-IoT project during the current reporting period. Building upon the foundations established in earlier activities, **this deliverable presents the progress achieved** in promoting the project, its results, and its alignment with EU priorities, while continuing to engage key stakeholders and explore market opportunities.

The document is **structured into six main chapters**, each addressing a specific dimension of the project's outreach and impact activities, including communication, dissemination, community engagement, standardisation contributions, and exploitation planning. Contributions from the consortium partners highlight the collective efforts to increase the visibility, accessibility, and potential uptake of HEDGE-IoT results.

The deliverable concludes with **updated recommendations** aimed at ensuring that ongoing and future activities remain aligned with the project's objectives and Key Performance Indicators (KPIs), while reinforcing the effectiveness and coherence of the communication, dissemination, and exploitation strategy.

Communication and dissemination efforts continue to promote the HEDGE-IoT project to a wide range of audiences, from the general public to specific stakeholder groups such as the scientific community, industry actors, and policymakers. Dissemination activities focus on publicly sharing project results to maximise their visibility, usability, and impact, while communication actions ensure that the project's objectives, achievements, and benefits are clearly conveyed to diverse audiences.

Exploitation activities continue to focus on strengthening the alignment between the project's technical developments and potential market opportunities, regulatory frameworks, and societal challenges. These efforts support the identification of promising Key Exploitable Results (KERs) and contribute to preparing the groundwork for the long-term utilisation and sustainability of the project's outcomes.

In parallel, the project monitors and contributes to relevant **standardisation activities**, identifying opportunities where HEDGE-IoT results can inform emerging standards and support interoperability within the evolving energy data ecosystem

The report also emphasises the importance of maintaining effective communication channels both within the consortium and with **external stakeholders**. Through targeted engagement activities, the project seeks to ensure that its results respond to societal needs and contribute to the broader goals of the sustainable and digital energy transition.

Co-funded by the European Union

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

TABLE OF CONTENTS

Co-funded by the European Union

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

LIST OF TABLES

Co-funded by the European Union

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

LIST OF FIGURES

Co-funded by the European Union

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

ABBREVIATIONS

aerOS	Autonomous, Scalable, Trustworthy, Intelligent European Meta Operating System
AI	Artificial Intelligence
AIOT	Artificial Intelligence of Things
AIOTI	The Alliance for IoT and Edge Computing Innovation
CEEDS	Common European Energy Data Space
CEF	Connecting Europe Facility
CEI	Cloud-Edge-IoT
CG	Coordination Group
CSAs	Coordination and Support Actions
CSI	Continuous Semantic Integration
DC	Dissemination and Communication
DSOs	Distribution System Operators
DT	Digital Twin
EU	European Union
FluiDOS	Flexible, Scalable, Secure, and Decentralised Operating System
HPC	High Performance Computing
IoT	Internet of Things
KOM	Kick-Off Meeting
LEC	Local Energy Community
ML	Machine Learning
NEMO	Next Generation Meta Operating System
ODPs	Operational Digital Platforms
SNN	Spiking Neural Network
SyC	System Committee
TaRDIS	Trustworthy and Resilient Decentralised Intelligence for Edge Systems
TC	Technical Committee
TEF	Testing and Experimentation Facility (AI)
WG	Working Group
WP	Work Package

Co-funded by the European Union

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

1 INTRODUCTION

Deliverable 7.4, "Dissemination, Exploitation and Market Exploration, Standardisation, and Community Building – Intermediate Report", provides an overview of the communication, dissemination, exploitation, standardisation, and community-building activities carried out within the HEDGE-IoT project during the reporting period (M13–M27; January 2025 – March 2026).

Building upon the foundations established in earlier project phases and deliverables (D7.1, D7.2, and D7.3), this deliverable presents the progress made in promoting the project's objectives and results, engaging relevant stakeholders, exploring market opportunities, and strengthening alignment with relevant standardisation initiatives.

As the project progresses and technical developments mature, these activities continue to support the visibility, accessibility, and future uptake of HEDGE-IoT results while contributing to the broader goals of the European digital and sustainable energy transition.

1.1 SCOPE OF THE REPORT

The scope of this deliverable is to report on the ongoing communication, dissemination, exploitation, standardisation, and stakeholder engagement activities implemented by the consortium. The report provides an overview of the strategies adopted, the actions carried out by the partners, and the progress achieved in relation to the project's Key Performance Indicators (KPIs).

In addition, the deliverable outlines the consortium's efforts to identify and develop Key Exploitable Results (KERs), explore potential market opportunities, and monitor relevant standardisation activities that could support the interoperability and long-term impact of the project outcomes.

The report also reflects the project's commitment to engaging relevant stakeholders, building synergies with related initiatives, and fostering a growing community around the HEDGE-IoT ecosystem.

1.2 STRUCTURE OF THE REPORT

This deliverable is organised into several chapters, each addressing a specific dimension of the project's outreach, engagement, and impact activities, and each led by the partner responsible for the respective area.

Chapter 2 – Communication and Dissemination (F6S). This chapter presents the communication and dissemination activities carried out within the project, including updates on dissemination channels, outreach activities, key performance indicators, and the overall communication strategy implemented to increase the visibility of HEDGE-IoT among relevant target audiences.

Chapter 3 – Exploitation and Market Exploration (CLUBE). This chapter outlines the project's approach to exploitation and market exploration, including the identification and analysis of KERs, the assessment of potential market opportunities, and the strategic planning of activities aimed at supporting the future uptake and sustainability of project outcomes.

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

Chapter 4 – Standardisation (TRIALOG). This chapter describes the project's strategy for engagement with relevant standardisation activities and organisations. It provides an overview of the targeted standardisation groups and identifies relevant standards that align with the scope and technological developments of the HEDGE-IoT project.

Chapter 5 – Community Building and Stakeholder Engagement (ED). This chapter focuses on the activities aimed at fostering collaboration with stakeholders, building synergies with related projects and initiatives, and developing a strong and engaged community around the project's objectives and results.

The deliverable concludes with the last chapter, a set of **conclusions and recommendations**, highlighting key observations from the reported activities and outlining considerations for the continued alignment and integration of communication, dissemination, exploitation, and standardisation efforts as the project progresses.

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

2 DISSEMINATION AND COMMUNICATION

2.1 STRATEGY FOR M13-M27

Dissemination and communication (DC) represent horizontal activities in HEDGE-IoT. Communication activities aim to promote the action and its results to multiple audiences, including the media and the broad public. Whilst dissemination activities aim to publicly disclose results to enable others to understand and use them.

During the period encompassed by this deliverable (M13–M27), the focus of Dissemination and Communication (D&C) activities evolved in line with the project's maturity and operational priorities. While the first year primarily concentrated on establishing HEDGE-IoT's brand identity and raising general awareness, the second reporting period shifted toward targeted engagement and stakeholder activation - most notably through the promotion of HEDGE-IoT Open Call 1, which ran from 22 July to 24 October 2025.

A significant share of communication efforts during this period was dedicated to attracting high-quality applicants to the Open Call. This included coordinated multi-channel promotion (website updates, social media campaigns, newsletters, partner networks, and ecosystem outreach), participation in relevant industry events, and direct engagement with SMEs and innovators within the IoT and energy domains.

In parallel, dissemination efforts increasingly highlighted the HEDGE-IoT demonstration sites, with the development of dedicated infographics for each demo site location to clearly communicate their technological scope, use cases, and expected impact. These visual assets strengthened the project's positioning within the IoT-enabled energy services ecosystem and supported clearer communication of the project's activities.

The reporting period also saw intensified promotion of project activities, including:

- Participation in international conferences and industry events
- Organisation of workshops and stakeholder engagement sessions
- Collaboration and clustering activities with related EU-funded projects and relevant initiatives
- Cross-project knowledge exchange and ecosystem building

While the focus shifted toward more targeted and impact-oriented activities, several communication campaigns launched during the first 12 months continued throughout this period. Notably, the "Meet Our Partners" and "Partners Articles" campaigns remained active, ensuring sustained visibility of consortium expertise and reinforcing the project's credibility within the broader European innovation landscape.

Given that core technical results are still under development and not yet publicly available, D&C activities during M13–M27 concentrated on strengthening HEDGE-IoT's positioning as a credible, innovation-driven initiative within the IoT and energy domains. Communication efforts targeted both specialised industry stakeholders (SMEs, technology providers, energy actors, digital innovators) and the broader innovation community.

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

All project partners continue to systematically report their dissemination and communication activities through the established monitoring tool. This structured monitoring framework ensures continuous collection of quantitative and qualitative indicators, facilitates performance tracking against KPIs, and supports transparent and evidence-based reporting within the project.

As outlined in the Communication and Dissemination Plan, activities during this period placed stronger emphasis on stakeholder activation and ecosystem engagement, complementing ongoing awareness-raising efforts. Through coordinated multi-channel communication and partners' engagement, HEDGE-IoT further consolidated its presence within relevant European IoT, data, and energy innovation ecosystems.

2.2 COMMUNICATION ACTIVITIES IMPLEMENTED FROM M13-M27

During M13–M27, HEDGE-IoT continued to implement proactive and strategically coordinated communication activities, building upon the foundations established in Year 1. The communication approach evolved toward more targeted engagement, with particular emphasis on promoting Open Call 1 (22 July – 24 October 2025), increasing visibility of the project's demonstration sites, and strengthening ecosystem collaboration.

Messaging during this period was tailored according to stakeholder profiles, with communication streams addressing SMEs, IoT innovators, energy stakeholders, digital solution providers, and the broader European innovation ecosystem. This approach ensured both wide visibility and targeted outreach, supporting high-quality Open Call participation and sustained stakeholder engagement.

The coherent visual identity developed in the first year served as a great example and template in all communication activities. During this reporting period, additional visual assets were produced - including dedicated infographics for each HEDGE-IoT demo site - to clearly communicate use cases, technical scope, and expected impact. These materials enhanced recognisability and supported clearer positioning of HEDGE-IoT within the IoT-enabled energy services landscape.

HEDGE-IoT maintained a multi-channel communication strategy, leveraging a broad mix of digital platforms to maximise outreach and stakeholder interaction. This approach proved particularly effective during the Open Call campaign, enabling coordinated promotional activities across consortium networks and relevant innovation ecosystems.

The project actively uses eight dissemination and communication channels to sustain and expand its visibility: **LinkedIn, Facebook, Instagram, Twitter/X, YouTube, the project website, and the F6S platform**. One change was implemented in this period – the consortium decided to switch from Mailchimp **newsletter** to LinkedIn newsletter which allows us to reach a significantly bigger audience – first HEDGE-IoT LinkedIn newsletter reached 311 recipients, while Mailchimp newsletter has only 69 recipients. During M13–M27, these channels were strategically aligned to support Open Call promotion, showcase participation in conferences and industry events, disseminate workshop outcomes, highlight collaborations with related EU initiatives, and continue ongoing campaigns such as *Meet Our Partners* and *Partners Articles*.

Overall, communication efforts in this period moved from primarily awareness-building toward ecosystem activation and opportunity-driven engagement, while maintaining consistent brand presence and stakeholder connectivity across all channels.

2.2.1 HEDGE-IoT Visual Tools

The core visual identity and branding assets of HEDGE-IoT were developed during the initial phase of the project (M1–M3), in full alignment with EU visibility requirements and detailed in the Communication and Dissemination Plan. These core visual elements continued to be used throughout M13–M27 to ensure consistency, recognisability, and professional representation across all communication outputs.

The main visual components established and continuously used include:

- **Project visual identity**: Development of a distinctive logo, typography, and defined colour palette, forming the basis of a coherent and recognisable brand across all dissemination and communication materials.
- **Branded templates**: Standardised Word and PowerPoint templates (Figure 1) ensuring unified representation of the project in internal and external presentations, reports, workshops, and stakeholder meetings.
- **Institutional presentation**: A structured project presentation containing key information on objectives, concept, consortium, demo sites, and expected impact. This presentation has been regularly updated and used during conferences, industry events, clustering meetings, and Open Call promotion activities. The presentation received a design update in M20.

FIGURE 1. SCREENSHOT OF THE HEDGE-IOT INSTITUTIONAL PRESENTATION

- **Promotional materials**: Communication assets such as leaflets, roll-ups, flyers, and posters, all compliant with EU visibility rules. These materials continued to support physical and hybrid dissemination activities during M13–M27, particularly at conferences, workshops, and ecosystem events. All of these materials are regularly updated according to partners' requirements.

In addition to these foundational tools, from M13-M27 a dedicated visual infographic for each HEDGE-IoT demonstration site was developed (Figure 2, Figure 3, Figure 4), enhancing clarity around use cases, technical scope, and expected outcomes. These visual assets strengthened the

Co-funded by the European Union
This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

project's positioning within the IoT-enabled energy services domain and supported more targeted stakeholder engagement.

FIGURE 2. FINNISH AND GREEK DEMOS INFOGRAPHICS

FIGURE 3. ITALIAN AND DUTCH DEMOS INFOGRAPHICS

FIGURE 4. PORTUGUESE AND SLOVENIAN DEMOS INFOGRAPHICS

Overall, the consistent use and regular updates of HEDGE-IoT's visual toolkit contributed to reinforcing brand credibility, improving message clarity, and ensuring professional visibility across all dissemination and communication activities

2.2.2 HEDGE-IoT Website

The HEDGE-IoT website (https://hedgeiot.eu/; Figure 5) continues to serve as the primary point for communication with external stakeholders and the wider public. Launched in March 2024, the website will remain active throughout the project's lifetime and for at least five years after its completion, ensuring long-term accessibility of public results and materials.

As a key communication and management tool, the website functions as a dynamic platform that evolves alongside project implementation. During the M13–M27 reporting period, the website was regularly updated by F6S based on contributions from consortium partners and ongoing project activities.

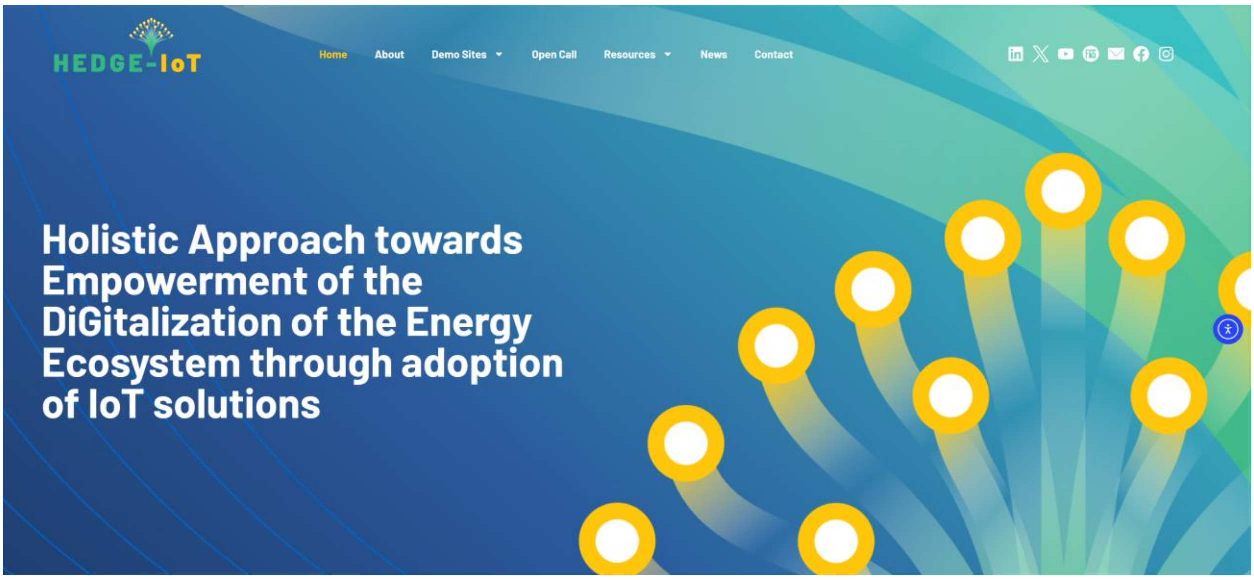

FIGURE 5. HEDGE-IOT WEBSITE HOMEPAGE

Throughout this period, emphasis was placed on publishing:

- News articles and blog posts covering project progress, conference participation, industry event attendance, workshop organisation, and clustering activities
- Announcements of new scientific publications and relevant project milestones
- Updates related to demo sites' activities

The Resources section was regularly maintained and updated with public deliverables, scientific publications, promotional materials, visual assets (including demo site infographics), videos, and other publicly available outputs. This structured, public repository ensures transparency, supports knowledge sharing, and facilitates access to HEDGE-IoT materials for the general public.

The most significant update during M13–M27 was the addition of a dedicated "Open Call" page, created to support the implementation of HEDGE-IoT Open Call 1 (22 July – 24 October 2025). This page served as a comprehensive information hub for applicants and included:

- Official Open Call documentation (Guide for Applicants, Declaration of Honour, etc.)
- Detailed description of Open Call topics and scope, evaluation criteria, etc.
- Key deadlines and timeline
- Access to Open Call info webinar recording and presentation materials
- Direct link to the application form hosted on the F6S platform
- Frequently Asked Questions (FAQ) and contact information for support

The introduction of this dedicated Open Call section significantly enhanced clarity, transparency, and accessibility of information for potential applicants, contributing to structured and effective outreach toward SMEs and innovators.

Another addition during this period was the development of a dedicated "Demo Sites" section on the website. This page includes six individual subpages, each dedicated to one of the HEDGE-IoT demo sites. Each subpage presents the specific use case, technological setup, objectives, and expected impact of the respective demo site.

The website continues to contain the following core sections and features:

- **Home page** – Overview of project scope and objectives, latest news highlights, links to social media channels, EU funding acknowledgement, and project branding elements.
- **About page** – Detailed description of project objectives, pilot areas, work plan, and consortium members.
- **Demo sites page** - With six subpages – each containing information about one of the HEDGE-IoT demo sites.
- **Open Call page** – containing all the relevant information regarding HEDGE-IoT Open Call 1.
- **Resources section** – Public deliverables, scientific publications, press materials, and communication assets.
- **News page** – Regular blog updates on project activities, events, milestones, and collaborations.
- **Contact page** – Contact form enabling direct communication via info@hedgeiot.eu.

The website remains fully compliant with relevant EU regulations. The **Privacy Policy, Cookies Policy, and Terms and Conditions** are accessible from the footer of each page, ensuring alignment with the General Data Protection Regulation (GDPR).

Additionally, the HEDGE-IoT website includes an accessibility tool that enhances usability for individuals with visual impairments or sensitivities to the standard layout and colour scheme, contributing to inclusive digital communication.

2.2.3 HEDGE-IoT Social Media Channels and Tools

Social media remained one of the most active and impactful dissemination and communication channels during the M13–M27 reporting period. HEDGE-IoT maintains an active presence across five platforms: LinkedIn, X/Twitter, Facebook, Instagram, and YouTube.

As of 3 March 2026, HEDGE-IoT has reached a total of **1,024 followers** across its five social media networks, representing a significant increase compared to **656 followers recorded in M12**. The strongest growth continues to be observed on LinkedIn, where the HEDGE-IoT page is currently followed by **930 users**, reflecting the project's strong positioning within the IoT, energy, and innovation ecosystems.

LinkedIn, X/Twitter, Facebook, and Instagram are actively used as interactive communication channels, enabling two-way engagement with stakeholders through regular posts, comments, shares, and discussions. Content published during this reporting period focused particularly on:

- Promotion of Open Call 1 (22 July – 24 October 2025)
- Announcement of information webinars and key deadlines
- Conference and industry event participation
- Workshop organisation and clustering activities
- Demo sites promotion
- Scientific publications promotion

The YouTube channel serves as a repository for audiovisual materials, including webinar recordings, presentations, and other video content supporting Open Call promotion and stakeholder engagement.

Co-funded by the European Union

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

Project-related news and updates are published on a regular basis, ensuring sustained visibility and consistent engagement with both specialised industry audiences and the broader innovation community.

To maximise reach and engagement, consortium partners are encouraged to engage with HEDGE-IoT's content by resharing and reposting project updates, particularly when their organisation is involved or featured. This strategy significantly enhances visibility, extends outreach beyond the project's direct audience, and strengthens ecosystem connectivity.

In addition, partners are expected to generate content related to HEDGE-IoT activities and disseminate it through their own institutional communication channels. Special emphasis is placed on promoting events, Open Call announcements, and conference participation. This approach contributes to broader project visibility and stakeholder engagement.

Overall, social media continues to function not only as an awareness-raising tool but as a strategic engagement mechanism supporting Open Call implementation, ecosystem building, and industry-oriented outreach.

LINKEDIN

The **LinkedIn** page serves as HEDGE-IoT's primary professional communication channel, strategically leveraged to reach targeted industry stakeholders, policymakers, SMEs, technology providers, research organisations, and innovation ecosystems relevant to IoT-enabled energy services. Given LinkedIn's professional orientation, it is particularly effective for connecting with specialised audiences and fostering meaningful networking opportunities.

From HEDGE-IoT's perspective, LinkedIn functions as an open and interactive space where stakeholders can learn about project developments, Open Call opportunities, demonstration infrastructures, and future services. It enables knowledge exchange, stakeholder dialogue, and increased engagement with the project's activities.

Content is typically published twice per week, ensuring regular visibility and sustained audience engagement. Posting frequency is strategically increased during high-activity phases, such as Open Call promotion periods, major events, workshops, or key milestone announcements. The channel is maintained by F6S, complemented by technical and activity-based contributions from consortium partners.

The LinkedIn communication strategy is designed not only to increase visibility but also to strengthen stakeholder relationships and ecosystem positioning. This is achieved through structured social media campaigns — such as highlighting consortium partners and their expertise — as well as through consistent promotion of project activities, Open Call updates, industry engagement, and collaboration initiatives. This approach contributes to enhanced brand credibility, stakeholder trust, and sustained professional outreach.

Co-funded by the European Union
This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

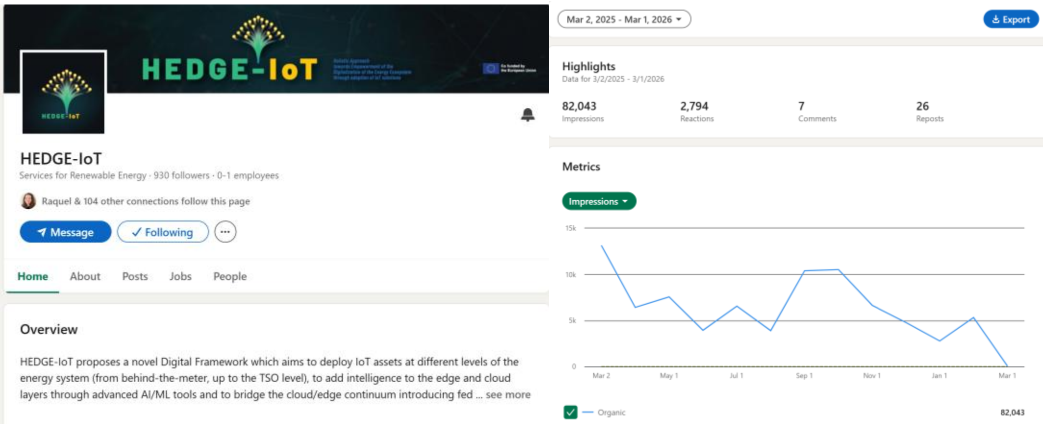

FIGURE 6. HEDGE-IOT LINKEDIN PAGE AND STATISTICS

The increase in activity on LinkedIn between M13 and M27 reflects intense periods of project activities, particularly during the Open Call 1 promotion phase (Figure 6). The number of published posts more than tripled compared to the first reporting period (173 posts by M27 vs. 54 by M12), indicating a significant scaling of communication efforts. In the last 12 months alone, LinkedIn posts generated 82,043 impressions and 2,794 reactions, demonstrating strong visibility and consistent engagement within the professional community. These metrics confirm LinkedIn's effectiveness as the project's primary professional dissemination channel and validate its strategic role in enhancing awareness, strengthening ecosystem positioning, and activating relevant industry stakeholders.

TWITTER/X

HEDGE-IoT's **X/Twitter** account functions as a complementary communication channel supporting outreach toward the broader public and the EU innovation ecosystem. The account currently counts 47 followers and is primarily used to share project news, Open Call updates, event participation, and collaboration activities (Figure 7).

FIGURE 7. HEDGE-IOT TWITTER/X PAGE

Co-funded by the European Union
This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

While LinkedIn remains the project's main professional dissemination platform, X/Twitter serves as an additional tool, particularly effective for connecting with other EU-funded projects, initiatives, and policy-related stakeholders. Its format enables rapid information exchange, tagging of relevant actors, and participation in wider European research and innovation conversations, thereby contributing to ecosystem visibility and cross-project engagement.

FACEBOOK & INSTAGRAM

Considering the diversity in age, expertise, geo location of HEDGE-IoT partners, stakeholders as well as the target audience, **Facebook** was chosen as a "supporting" channel. It provides a more personal approach to the target groups and covering the gap that might occur in case of LinkedIn – where not all the stakeholders have profiles on that network. In addition to Facebook, HEDGE-IoT also uses **Instagram** as an additional supporting social media channel to share news with the general public.

YOUTUBE

The HEDGE-IoT YouTube Channel (Figure 8), plays a pivotal role in facilitating communication and disseminating video materials generated by the project. It is utilised to promote the videos generated by the HEDGE-IoT demos, project partners, etc. YouTube channel currently contains a total of 17 videos - ranging from interviews with project partners, demo site videos, OC info webinar to video tutorials.

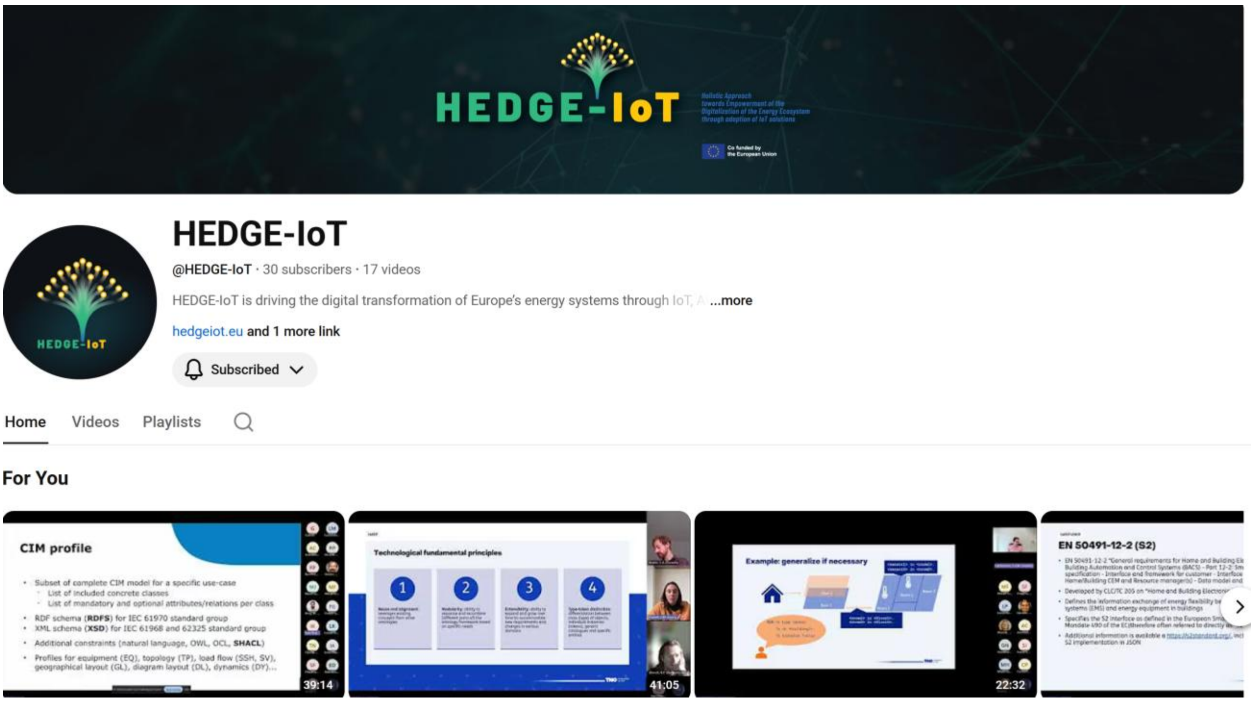

FIGURE 8. HEDGE-IOT YOUTUBE CHANNEL

PRESS RELEASES

From M13-M27 **one press release** was developed by the Communication Team and the project coordinator, to inform the general public that the HEDGE-IoT Open Call 1 is officially open, containing

Co-funded by the European Union

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

information about OC scope, deadlines, evaluation criteria, etc. This press release is available at the project website under the Resources section.

All HEDGE-IoT partners will actively collaborate with the press releases dissemination to relevant media in their own countries and regions.

2.2.4 HEDGE-IoT Communication Campaigns

During the M13–M27 reporting period, HEDGE-IoT's communication campaign strategy shifted from general awareness-building toward targeted stakeholder engagement, Open Call promotion, and demo sites promotion. The following structured campaigns were implemented:

OPEN CALL 1 PROMO CAMPAIGN

The Open Call 1 Promotional Campaign represented the most intensive and strategically coordinated communication effort during this reporting period.

A total of **30 social media posts per channel** were published across all HEDGE-IoT social media platforms, promoting:

- The launch of Open Call 1 (22 July – 24 October 2025)
- The 16 Business Use Cases (BUCs) available for applicants
- Open Call information webinars (including reminders and recordings)

The campaign ensured consistent, structured, and repeated visibility of the Open Call opportunity, targeting SMEs, startups, IoT innovators, and energy solution providers across Europe. The coordinated cross-channel approach maximised reach and stakeholder engagement throughout the Open Call lifecycle (Figure 9). The best proof of this campaign's success is a total of 147 received applications for the Open Call.

One example of this campaign can be seen in Figure 9 below.

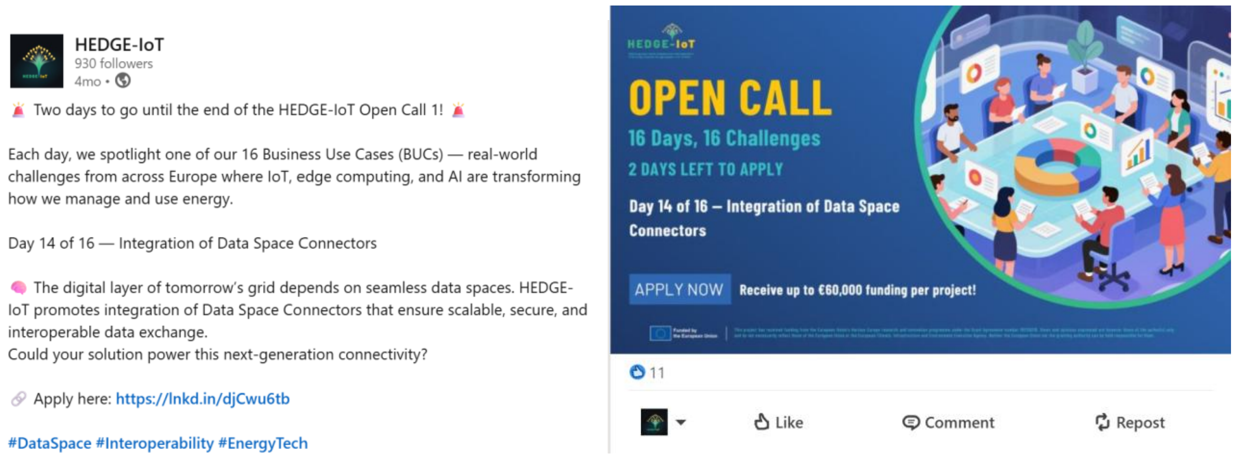

FIGURE 9. EXAMPLE OF A SOCIAL MEDIA POST PUBLISHED IN THE SCOPE OF THE "OPEN CALL 1 PROMO" CAMPAIGN

Co-funded by the European Union

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

HEDGE-IOT DEMO SITE INFOGRAPHICS CAMPAIGN

To enhance visibility of the project's demo sites activities, a dedicated campaign was launched to promote the **six HEDGE-IoT demo site infographics**.

Each infographic was presented through individual social media posts highlighting:

- The specific demo site use case, its location and partners involved
- Technological scope and objectives
- Expected impact and innovation dimension

This campaign contributed to clearer communication of the project's applied nature and strengthened engagement with industry stakeholders and potential adopters by presenting tangible implementation environments. An example of the "Meet our Partners" campaign is illustrated in Figure 10 below.

FIGURE 10. EXAMPLE OF SOCIAL MEDIA POSTS DEVELOPED IN THE SCOPE OF "HEDGE-IOT DEMO SITES INFOGRAPHICS" CAMPAIGN

Co-funded by the European Union
This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

“PARTNERS ARTICLES” CAMPAIGN

The “Partners Articles” campaign continued during M13–M27 as a structured knowledge-sharing initiative.

During this reporting period, **10 consortium partners** contributed technical and thematic articles related to project activities, domain expertise, and relevant innovation topics.

Each article was published on the HEDGE-IoT website and subsequently promoted across social media channels. This campaign supports:

- Dissemination of domain-specific knowledge
- Strengthening of the project’s technical credibility
- Increased website traffic and stakeholder engagement
- Visibility of consortium expertise

The campaign remains an important mechanism for structured content generation and sustained professional outreach.

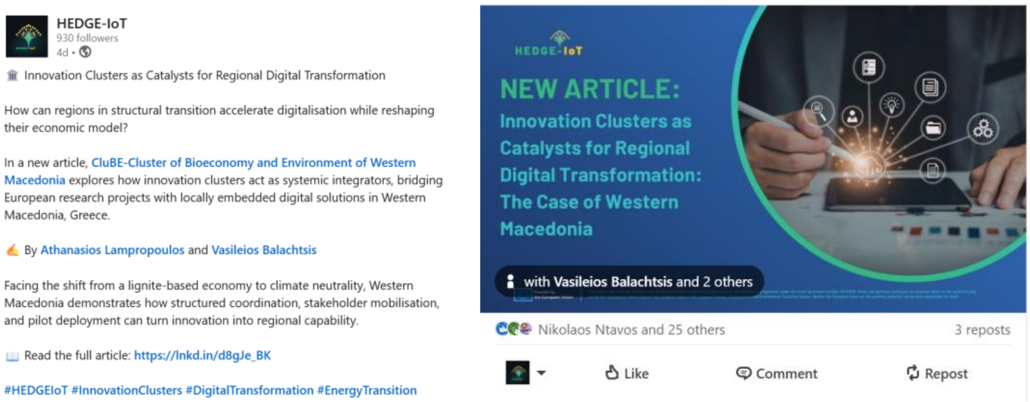

FIGURE 11. EXAMPLE OF A SOCIAL MEDIA POST PROMOTING THE ARTICLE WRITTEN BY CLUBE, ONE OF THE HEDGE-IOT PARTNERS, IN THE SCOPE OF “PARTNERS ARTICLES” CAMPAIGN

“MEET OUR PARTNERS” CAMPAIGN

The “Meet Our Partners” campaign also continued throughout M13–M27, aiming to highlight the organisations behind HEDGE-IoT and strengthen stakeholder familiarity with the consortium.

During this period, **17 consortium partners** were featured. Each post introduced:

- The partner’s role and expertise within HEDGE-IoT
- Their contribution to project objectives
- Key team members involved in the project

This campaign reinforces transparency, builds trust within the ecosystem, and humanises the project by showcasing the people and organisations driving its implementation.

Co-funded by the European Union
This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

FIGURE 12. EXAMPLE OF A SOCIAL MEDIA POST AS PART OF "MEET OUR PARTNERS" CAMPAIGN

Overall, during M13–M27, HEDGE-IoT's social media campaigns transitioned from introductory awareness-building activities toward structured, opportunity-driven, and implementation-focused communication. The coordinated execution of these campaigns significantly contributed to Open Call outreach, demonstration site visibility, and sustained ecosystem engagement.

2.3 DISSEMINATION ACTIVITIES IMPLEMENTED FROM M13-M27

Active engagement with HEDGE-IoT's target audiences remained a key priority during the M13–M27, as stakeholder engagement is essential for maximising long-term impact and ensuring effective dissemination of project activities and forthcoming results.

During this period, HEDGE-IoT systematically leveraged the extensive networks, ecosystems, and expertise of its consortium partners. Through participation in conferences, industry events, workshops, clustering initiatives, and cross-project collaborations, partners contributed to expanding the project's outreach across diverse stakeholder groups, including SMEs, IoT innovators, energy actors, research organisations, policymakers, and digital solution providers.

Dissemination efforts were continuously monitored and coordinated at consortium level. Partners regularly reported their activities through the established monitoring tool. This ensured alignment with the Communication and Dissemination Plan, facilitated performance tracking against KPIs, and enabled timely identification of new dissemination opportunities.

In a nutshell, dissemination activities during M13–M27 shifted toward more strategic ecosystem engagement and opportunity-driven outreach, complementing the project's Open Call implementation and strengthening HEDGE-IoT's positioning within the European IoT and energy innovation landscape.

2.3.1 Scientific Conferences and Events

During the M13–M27, HEDGE-IoT partners actively participated in a broad range of international and local conferences, workshops, industry fairs, and ecosystem events - both physical and hybrid - to strengthen dissemination, promote Open Call 1, other project activities and reinforce the project's positioning within the IoT and energy innovation landscape.

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

Compared to the initial awareness-building phase of the project, dissemination activities during this period increasingly focused on:

- Promoting HEDGE-IoT Open Call 1 and engaging SMEs and innovators
- Showcasing the project's demo sites and use cases
- Strengthening clustering and collaboration with related EU-funded initiatives
- Engaging with policymakers, standardisation bodies, and industry leaders

Participation included exhibition stands at innovation fairs, presentations at peer-reviewed scientific conferences, involvement in thematic workshops, and active engagement in European technology platforms and ecosystem forums. These events enabled direct interaction with industry professionals, policymakers, researchers, and innovators, providing valuable feedback, strengthening networking opportunities, and aligning HEDGE-IoT's activities with broader European and international developments in IoT, data, and energy systems.

Consortium partners strategically selected events of high relevance to the project's thematic focus and stakeholder targets. Particular emphasis was placed on events hosted in European innovation hubs and strong startup ecosystems, ensuring outreach to technology developers, digital SMEs, and potential Open Call applicants.

The following events were attended during M13–M27, where HEDGE-IoT was presented or promoted:

1. **EUSEW 2025** - HEDGE-IoT joined forces with other F6S energy projects and the European Sustainable Energy Week 2025 with a joint booth.
2. **MTSR Conference** – TNO participated in the MTSR Conference and presented the paper "Representation Learning on IoT Knowledge Graphs" written in the scope of the HEDGE-IoT project.
3. **Formal Ontology in Information Systems Conference (FOIS)** - TNO participated in the FOIS conference panel discussion where panellists discussed cases in which formal ontologies play a clearly visible role in making digital transformation successful.
4. **ICT.OPEN Conference** - TNO participated in the ICT.OPEN Conference to present how HEDGE-IoT is using semantic technologies to achieve energy flexibility in the Dutch pilot at Arnhems Buiten
5. **Conference of Electrical and Computer Engineering Students** – IPTO presented the project including general information about the project (e.g. budget, partners, coordinator) but also the vision, the objectives and the pilots of the project, which were presented in detail.
6. **10th HAEE Energy Transition Symposium** – HEDNO presented their work within HEDGE-IoT to determine a baseline for flexibility market participation by the side of the DSO
7. **International Conference on Electricity Distribution** (Croatian National Committee) - KONČAR presented one of the scientific papers written in collaboration with EG in the scope of the HEDGE-IoT project
8. **Smart Grid PCI Summit 2025** – TNO presented the project at the Smart Grid PCI Summit 2025. Gjalt Loots from TNO contributed to Panel 4: Unlocking the Future – Digitalisation and AI in the Energy System
9. **AIOTI Days** – TRIALOG held a presentation about the HEDGE-IoT hourglass model.
10. **Open Source Community Day** – TRIALOG held a presentation of the project, open-source objectives and standardisation activities.

Co-funded by the European Union

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

FIGURE 13. TRIALOG PRESENTING HEDGE-IOT AT OPEN SOURCE COMMUNITY DAY

11. **JRC CoC ESA Plenary** – TNO & TRIALOG presented the development progress of the tool ODC-T developed partly in the context of the HEDGE-IoT project at the event JRC CoC ESA plenary
12. **EBDVF 2025** - HEDGE-IoT joined forces with other F6S bid data and AI projects and attended the event with a joint booth.

FIGURE 14. F6S PRESENTING HEDGE-IOT AT EBDVF 2025

13. **ENLIT 2025** - HEDGE-IoT joined forces with other F6S energy efficiency projects and attended the event with a joint booth. Also, Lenos Peratitis from ED presented the project at the Digital Technologies Session.

Co-funded by the European Union
This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

FIGURE 15. HEDGE-IOT PRESENTATION AT ENLIT 2025

Through these dissemination efforts, HEDGE-IoT reinforced its visibility within key European digital, IoT, and energy communities, strengthened ecosystem linkages, and supported stakeholder engagement aligned with the project's implementation phase.

2.3.2 Thematic Workshops

HEDGE-IoT partners organised and participated in several thematic workshops from M13-M27:

1. DSS lab, EPU-NTUA organised **4th International Workshop on Data Analytics in the Energy Sector**
2. **Technical workshop** in Aachen, Germany, hosted by RWTH Aachen University
3. **Workshop on Data Spaces**, exploring key concepts and the Eclipse Data Space Framework - held during GA in Athens
4. Elergone Energia hosted the **HEDGE-IoT PT Pilot Workshop**

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

FIGURE 16. HEDGE-IOT PT PILOT WORKSHOP HOSTED BY ELERGONE ENERGIA

5. **K-NUMS Workshop** – VU participated in the K-NUMS Workshop and presented the paper "Updating Knowledge Graph Embeddings by Intermediate Estimations on Numerical Attributes" written in the scope of the HEDGE-IoT project.
6. Areti organised "**Engagement of Energy Communities in the HEDGE-IoT project**" workshop on November 28, 2025.
7. CEVE organised the **first dissemination workshop session of the Vale d'Este Living Lab** in collaboration with INESC TEC on November 27, 2025.

FIGURE 17. THE FIRST DISSEMINATION WORKSHOP SESSION OF THE VALE D'ESTE LIVING LAB

2.3.3 HEDGE-IoT Publications

Co-funded by the European Union
This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

HEDGE-IoT partners significantly strengthened its scientific dissemination activities, resulting in **more than 20 peer-reviewed publications**, which are listed in detail in the table below.

Throughout this period, the consortium continued to adhere to the **FAIR principles**, ensuring that research outputs are findable, accessible, interoperable, and reusable. These principles guided the management of scientific publications and associated research data, maximising the visibility, credibility, and long-term impact of HEDGE-IoT's research outcomes.

Key actions undertaken during this reporting period include:

- **Systematic assessment of research outputs**: The consortium regularly evaluated emerging results to determine the most appropriate dissemination pathway, including peer-reviewed journal publications, conference proceedings, datasets, and other scientific outputs.
- **Integration of open science practices**: Open science methodologies remained embedded in project coordination and research monitoring activities under WP1 (Project Management and Administration), ensuring transparency and structured knowledge sharing.
- **Open-access dissemination**: In line with Horizon Europe requirements, HEDGE-IoT prioritised publication in fully open-access journals and platforms, ensuring broad accessibility to the scientific and technological community.
- **Outreach to start-ups and SMEs**: Particular emphasis was placed on disseminating research findings relevant to startups, SMEs, and industrial stakeholders, thereby supporting innovation uptake and strengthening the link between scientific research and market-oriented applications.

The following table (Table 1) outlines the specific publications produced between M13 and M27 of the HEDGE-IoT project:

TABLE 1. SUMMARY OF THE HEDGE-IOT PUBLICATIONS PUBLISHED BETWEEN M13 AND M27

#	Partner	Title of the Journal	Publication title & Link
1	VU, TNO	Metadata and Semantic Research	Representation Learning on IoT Knowledge Graphs
2	TAU	/	Market-based congestion management in power systems, with a focus on distribution grids
3	VU, TNO, AB	Zenodo	Semantic Technologies for Flexible Energy Grids: the Arnhems Buiten demonstrator
4	TUC	Biomimetrics	Whale Optimisation for Cloud-Edge-Offloading Decision-Making for Smart Grid Services
5	TAU	International Journal of Electrical Power & Energy Systems	Congestion management in distribution grids using local flexibility markets: Investigating influential factors
6	HENEX	Sustainable Energy, Grids and Networks	Network-Aware Trading in Local Flexibility Markets

Co-funded by the European Union

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

7	TUC	Computers	Reinforcement-Learning-Based Edge Offloading Orchestration in Computing Continuum
8	TUC	Scientific Reports	Heuristic based federated learning with adaptive hyperparameter tuning for households energy prediction
9	IDSA	Zenodo	Data Spaces Standardisation Landscape – Europe and International
10	TAU, ABB, JSE	IET Conference Proceedings	Predictive and real-time congestion management to enhance grid hosting capacity
11	TAU	IET Conference Proceedings	Analysis and comparison of congestion management solutions of distribution grids
12	UNIZG	IEEE	Time and Frequency Domain-based Anomaly Detection in Smart Meter Data for Distribution Network Studies
13	JSI	IEEE	The Effect of High-Resolution Wind Speed and Wind Direction Measurements on Dynamic Thermal Rating
14	IDSA	Zenodo	Data Spaces Standardisation Landscape – Europe and International
15	TAU	International Journal of Electrical Power & Energy Systems	Data-driven emission analysis of on-board chargers and large AC charging sites of electric vehicles
16	HEDNO	IEEE	AI-Based Energy Forecasting at Different Distribution Grid Levels to Support Baseline Definition and DSO Participation in LFMs

2.4 DISSEMINATION AND COMMUNICATION MONITORING AND IMPACT

TABLE 2. COMMUNICATION ACTIVITIES KEY PERFORMANCE INDICATORS STATUS

KPI Type	Measurement	Target	M12 Status	M27 Status
Communication Activities				
Project website	Reports announcements, photos, news and links to downloads. An overall editorial plan, including the website, special articles and interviews.	1	1	**1**
Social media	Strictly authorised discussions/exchanges with online communities (LinkedIn, Twitter)	> 500	100	**977**
Brochure	Electronic and hard copies of the project brochure comprehending a general overview of the project, its challenges and expected impacts	4	1	**2**
Posters	A set of posters will be designed and printed to exhibit at partners' premises and use at events where the project takes presence.	> 4	1	**2**

Co-funded by the European Union

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

Institutional presentation	Project Presentation will be created at the beginning of the project, containing basic information about the project (activities, objectives, partnerships, events).	1	1	**1**
Trial videos	A set of videos will be orchestrated, describing the trials of HEDGE-IoT, their scope and the HEDGE-IoT technologies tested and evaluated.	>=4	0	**7**
Infographics	Production of infographics to show the results in a clear and simple way. It is foreseen that during the project implementation phase, 10 infographics presenting various outcomes will be produced.	10	0	**7**
Banner	An attractive large size banner and one stand-up presenting a general image of the project aiming to capture a first interest/attention.	1+1	1 (Roll-up)	**1** (Roll-up)
Final Publishable Report	A Final Publishable Report will be developed to summarise the project's objectives, activities, and achievements. This report will be result-oriented, it will present the tangible results of the project, lessons learnt, and impacts achieved, to convince and guide other regions and countries to engage in similar actions.	1	0	**0**
Articles	Tailor-made articles and interviews for publications and other targeted media channels (e.g. EC newsletters, specialised national magazines etc.). Focus will be on IoT- Cloud/Edge technologies and integration of such systems and trial results of AI/ML.	>= 5	2	**6**
Newsletter	Periodic newsletters development, publication, and distribution to all the participating partners, conference attendees, website visitors, and other perceived stakeholders.	>4	0	**2**
Press releases	Press releases will be issued to specialised and general media channels at key project milestones (kick-off, major achievements, etc.). A press/media kit will be developed containing detailed press releases, videos (e.g. of project demos), publishable images from the project, few short papers (devoted to some key theme/topic of the project).	>= 2	1	**2**
Talks in workshops	Invited talks in workshops and international events of reference as to communicate the project experimentation platform and solutions.	On invite	3	**3**
Innovation Events	Events in European cities with strong start-up community	>= 1	0	**0**
Market Uptake	Market Uptake Launch-Event, with guided presentation of selected results.	>= 1	0	**0**

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

TABLE 3. DISSEMINATION ACTIVITIES KEY PERFORMANCE INDICATORS STATUS

KPI TYPE	MEASUREMENT	TARGET	M12 STATUS	M27 STATUS
DISSEMINATION ACTIVITIES				
Exhibition stands in industry innovation fairs	BILT Europe (Digital Built Week Europe); European Sustainable Energy Week; ENLIT Europe; IDSA conferences; IoT conferences	> 5	3	**6**
Publication in international journals and magazines	Applied Energy; Energy; Energy Policy; IEEE Transactions on Smart Grid; IEEE Transactions on Power Systems; IEEE Transactions on Power Delivery, Energy Policy; IEEE Transactions on Industrial Informatics	> 15	7	**9**
Contributions in international peer- reviewed conferences	IEEE Innovative Smart Grid Technologies; Power Systems Computation Conference; IEEE Power and Energy Society for Innovative Smart Grid Technologies Conference; Conference on European Energy Market	> 10	3	**9**
Thematic Workshops	Organisation of dedicated workshops to engage specific target groups.	>= 4	2	**6**
Cluster of European projects and other initiatives	ENERTEF, WILSON, ODEON, TWIN EU; META OS: ICOS, NEMO, NEPHELE, NebulOus and AEROS; CEEDS: ENERSHARE, Int:Net, INTERCONNECT; INSIEME, BRIDGE, AIOTI, IDSA; WeForming, i-STENTORE, SNUG, TWAIN, DigiWind, EXIGENCE, INFERNO, HyLiST, HighMag, STREAM, S6G-LEADER, CLEANHYPRO.	> 20	8	**28**
Meetings with policy makers	Meetings with regional/national data and energy policy-makers and regulators.	> 6	4	**4**
Targeted Meetings with industry and society	Participation in industrial and trade events; press releases and articles in specialised trade newspapers & magazines; Organising focused workshops and public relations events, and inviting European/ international community	>5	4	**13**

2.5 DISSEMINATION AND COMMUNICATION PLANNING FOR YEAR 3

In the third year of the HEDGE-IoT project, dissemination and communication activities will focus on maximising the visibility, uptake, and impact of the project's results, building upon the strong dissemination foundations established during the first two years. As the project approaches its final phase, activities will increasingly highlight technical achievements, pilot outcomes, and exploitable results, targeting both scientific audiences and industry stakeholders who can benefit from the HEDGE-IoT edge-to-cloud solutions.

Co-funded by the European Union

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

Special emphasis will be placed on demonstrating project outcomes through events, visual materials, and targeted stakeholder engagement, ensuring that the project's technological innovations reach relevant audiences including policymakers, energy stakeholders, and technology providers.

WP7 will continue to coordinate closely with other work packages to ensure that technical results, demonstrations, and lessons learned are translated into accessible dissemination outputs, supporting both the scientific community and potential adopters of HEDGE-IoT technologies

2.5.1 Strengthening Communication Activities

The **project website and social media channels** have already achieved strong performance. In Year 3, they will be used intensively to promote key project results, publications, pilot outcomes, and final activities, including the final project event. Regular content updates will include, project news and milestones, demonstration videos, as well as event announcements and participation highlights, among others. Several **visual communication** KPIs remain below target. To address this, **additional brochures and posters** will be produced to present project results and demonstrators at events and conferences. **Infographics** will be developed to communicate complex technical results in a clear and accessible format, particularly for non-technical audiences and policymakers. These materials will be used both digitally and in physical events. The communication of **trial videos** remains a priority for Year 3. These videos showcase the pilot environments and experimentation infrastructure, explain the HEDGE-IoT architecture and key technological components, and highlight use cases and benefits for the energy sector. Video content will also support dissemination via social media and presentations.

Articles and interviews will continue to be produced for specialised media outlets, newsletters, and industry platforms, focusing on the technological innovations of HEDGE-IoT, pilot demonstrations and experimental results, and the project's contribution to digitalised energy systems. On the other hand, the **newsletter** KPI currently remains below target. In Year 3, additional newsletters will be issued, particularly to announce major milestones and results, promote publications and events, and communicate progress toward project completion. These newsletters will target the project's growing stakeholder community over LinkedIn. Furthermore, a **Final Publishable Report** will be produced in the final phase of the project. This report will summarise project objectives and achievements, key technological developments, lessons learned from pilots and experimentation, and expected long-term impact and exploitation potential. The report will be designed as a clear and accessible document aimed at policymakers, industry stakeholders, and the wider research community.

Already in the initial phases of organisation, with the aim of coordinating these efforts jointly with our sister projects, two key communication activities planned for Year 3 that will support the final dissemination of results.

1. **Innovation-focused events** will be organised or attended in cities with strong technology and start-up ecosystems to present HEDGE-IoT solutions and explore collaboration opportunities with innovators and SMEs.

Co-funded by the European Union

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

2. A **final uptake event** will present the project's most relevant technological outcomes and demonstrations, providing stakeholders with an overview of the project's achievements and the potential pathways for adoption and exploitation of HEDGE-IoT solutions.

2.5.2 Strengthening Dissemination Activities

Several dissemination KPIs have already been successfully achieved or exceeded; however, Year 3 will continue reinforcing these activities to further increase the project's visibility and outreach.

Although the KPI target has already been exceeded, the project will continue participating in relevant energy, IoT, and digital infrastructure **events to showcase** final results and demonstrators. Participation will focus on high-impact venues where the project can reach energy system stakeholders, DSOs, and digital infrastructure providers, while also exploring synergies with related European initiatives and clusters.

The number of **journal publications** remains below the final target. To address this, Year 3 will prioritise supporting consortium researchers in preparing additional high-quality journal submissions, particularly focusing on Edge-to-cloud architectures for smart grids, AI-driven energy optimisation and data processing, Interoperability and data spaces for energy systems, as well as results obtained from pilot deployments and experimentation Partners will be encouraged to target high-impact journals relevant to smart grids, industrial informatics, and energy systems. Furthermore, **conference publications and presentations** will be strengthened by encouraging partners to present technical and experimental results from pilots and trials, particularly at conferences related to smart grids and digital energy infrastructure, IoT and distributed computing, and AI-driven optimisation for energy systems. These contributions will ensure broader dissemination within the scientific and research communities.

The target for thematic workshops has already been achieved; however, if and when needed, partners will organise **additional targeted workshops or webinars** focused on presenting project outcomes and engaging stakeholders interested in adopting HEDGE-IoT technologies to energy sector stakeholders, digital infrastructure providers, and research communities working on IoT and smart energy systems.

While clustering activities have already reached the KPI target, Year 3 will further strengthen cooperation with **relevant European projects and initiatives** (see Section 5), including those focused on energy data spaces, smart grids, and IoT ecosystems. From the dissemination standpoint, the aim will be to exchange knowledge and best practices, promote interoperability approaches, and jointly communicate complementary project outcomes. Engagement with **policymakers** has almost reached the defined target; however, additional meetings can be pursued to ensure that HEDGE-IoT results contribute to ongoing discussions on digitalisation of the energy system, data governance, and interoperability frameworks at regional, national, and European levels. **Targeted meetings with Industry and Society** KPI has significantly exceeded expectations, reflecting strong engagement with those stakeholders. In Year 3, these efforts will continue with a focus on demonstrating the practical relevance and adoption potential of HEDGE-IoT technologies, particularly through industry events, and targeted presentations to energy companies and technology providers.

Co-funded by the European Union

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

3 EXPLOITATION AND MARKET EXPLORATION

3.1 STRATEGY FOR YEAR 2

3.1.1 Recap of Activities Implemented in Year 1 and Transition to Year 2 Strategy

During Year 1, the exploitation strategy focused on establishing the structural, organisational, and strategic foundations required for the future commercial and market uptake of HEDGE-IoT results. The approach was primarily preparatory, ensuring that the project's technical developments were aligned with market needs, regulatory conditions, and stakeholder expectations.

At the strategic level, Year 1 activities concentrated on **the identification and assessment of Key Exploitable Results** (KERs), ensuring their relevance to emerging market challenges in grid resilience, renewable integration, distributed energy resource (DER) management, and AI-enabled optimisation of energy systems. In parallel, the consortium initiated **stakeholder mapping and engagement** activities targeting key actors such as transmission system operators (TSOs), distribution system operators (DSOs), energy providers, pilot site stakeholders, and relevant European initiatives working on the digitalisation of the energy sector.

A structured **Intellectual Property Rights (IPR) framework** was also established to define ownership principles, protection pathways, and governance mechanisms in accordance with the Grant Agreement and the Consortium Agreement. In addition, preliminary market exploration activities were conducted to assess demand for interoperable, AI-driven, edge-enabled IoT platforms capable of supporting increasingly decentralised energy systems.

These actions ensured that exploitation considerations were embedded early in the project's technical development process, reducing risks related to market misalignment, regulatory incompatibility, and interoperability barriers.

To operationalise this strategy, consortium partners collaboratively identified and documented individual and joint KERs. Each partner provided preliminary information regarding exploitation intentions, target markets, expected impacts, and potential synergies within the consortium. This process enabled the initial positioning of core technological assets developed in the project, including IoT edge intelligence components, service orchestration mechanisms, AI and machine learning tools, and interoperable data governance solutions. At the same time, potential market barriers were identified, including regulatory complexity, interoperability constraints, and cost sensitivity associated with the adoption of advanced digital energy solutions.

Stakeholder engagement and ecosystem positioning also represented an important component of the Year 1 activities. The project actively connected with external initiatives and industry networks, including participation in the BRIDGE initiative and related working groups. Internal coordination through consortium meetings ensured alignment among partners regarding exploitation objectives and long-term perspectives. These activities strengthened the project's visibility and reinforced its positioning within the European energy digitalisation ecosystem.

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

The development of the IPR framework provided legal clarity regarding ownership allocation, management of individual and joint results, and potential protection mechanisms such as patents, copyrights, and open-source approaches where appropriate. Establishing these principles at an early stage reduced potential risks related to future commercialisation or joint exploitation.

Finally, **preliminary market exploration confirmed a strong demand for AI-enabled and interoperable IoT platforms** capable of supporting energy system management in decentralised environments. The analysis also highlighted existing gaps related to advanced architectures based on edge computing and federated learning, while emphasising the importance of localisation strategies aligned with regional regulatory and infrastructure conditions across pilot sites. These findings confirmed the strategic relevance of HEDGE-IoT technologies and informed the prioritisation of Key Exploitable Results for further development.

Building on the structured foundations established during the first year, the strategy for Year 2 marks the **transition from preparatory alignment to the validation**, refinement, and progressive consolidation of exploitation activities. While Year 1 focused on identifying Key Exploitable Results, establishing governance frameworks, and exploring initial market opportunities, the second year places stronger emphasis on operationalising these elements and advancing the project towards tangible exploitation pathways.

In this phase, particular attention is given to consolidating potential joint exploitation routes among consortium partners, while further clarifying individual partner strategies where appropriate. At the same time, the implementation of pilot activities provides an important opportunity to validate the identified Key Exploitable Results under real operational conditions. These demonstrations allow the consortium to assess technical performance, identify potential deployment challenges, and collect feedback from relevant stakeholders.

In parallel, Year 2 activities contribute to refining the positioning of the project's solutions within the evolving energy and digital technology markets. This includes a deeper analysis of potential value propositions, target customer segments, and market entry strategies for the most promising results. Additional efforts are also dedicated to strengthening the project's integration within relevant standardisation and industry ecosystems, ensuring alignment with ongoing European initiatives and regulatory developments.

3.2 ACTIVITIES IMPLEMENTED IN YEAR 2

3.2.1 KER Update and Validation Based on Demo Site Progress

During Year 2, the exploitation activities moved from structured identification to refinement, validation, and strategic consolidation of KERs, directly informed by the preparation and initial operational phases of the six demo sites (Deliverables 5.1 and 5.2). The process became increasingly evidence-based, incorporating technical, operational, and stakeholder feedback generated through real deployment environments.

Building upon the comprehensive identification exercise conducted in Year 1, partners systematically revisited and refined their KERs. These updates were not conceptual; they were grounded in technical integration results emerging from demo preparation, early operational findings from pilot environments, identified interoperability constraints and performance bottlenecks, and feedback from local system operators and site managers. As a result, the structured KER table was updated to provide clearer definitions of the tools, technologies, and system components, alongside refined value propositions linked to demonstrable pilot evidence. In parallel, target audiences were specified more concretely (e.g., TSOs, DSOs, aggregators, and technology providers), future exploitation pathways were described with greater clarity, and synergies were articulated more strongly both within HEDGE-IoT and with external EU initiatives. This iterative refinement ensured that exploitation planning evolved in parallel with technical maturation rather than remaining static.

A key Year 2 activity was the systematic transfer of knowledge from the six demo sites into the exploitation framework. This mechanism ensured that operational lessons learned were translated into improvements in commercial positioning, while technical constraints observed during deployment directly informed risk reassessment. In addition, market assumptions defined in Year 1 were validated or adjusted based on pilot-derived evidence, and regional regulatory and infrastructural conditions were explicitly embedded into the exploitation narratives for each KER. This dynamic feedback loop strengthened the credibility of each KER's market relevance and reduced uncertainty regarding scalability and replicability.

Stakeholder engagement also progressed from exploratory interactions to structured validation discussions. Engagement activities focused on collecting feedback from pilot stakeholders regarding usability, integration feasibility, and operational added value, while also aligning KER positioning with real procurement practices of energy operators. At the same time, monitoring of regulatory and standardisation developments relevant to IoT interoperability and AI-driven energy optimisation continued, ensuring that exploitation planning remains consistent with the evolving policy and standardisation landscape. Overall, the engagement process remained continuous, embedding exploitation considerations into ongoing technical development cycles and supporting a smoother transition from demonstration to post-project uptake.

3.2.2 Integration of the IPR Framework into the KER Governance Structure

The second Year activity concerned the operationalisation of the IPR strategy through direct integration with the updated KER table, ensuring full alignment between IPR management, exploitation planning, and the concrete tools/services deployed and validated through the six demo sites. While the IPR strategy had already been established and explained across Deliverables D7.1–D7.3, Year 2 focused on embedding these principles into the project's day-to-day exploitation governance, using the KER table as the single structured reference point for ownership, partner involvement, and intended exploitation pathways.

The project already maintains a Key Exploitable Results (KER) table that is updated annually by all partners. In Year 2, this table was strengthened as an exploitation and IPR alignment instrument by extending it with dedicated IPR-related fields. This extension is designed to ensure that each partner's position is declared consistently and transparently across all KERs, in a way that reflects actual technical contributions and the evolving pilot implementation reality. The objective is to

Co-funded by the European Union
This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

ensure that exploitation pathways are supported by a clear and traceable IPR logic, rather than being treated as a parallel process.

To strengthen IPR management and reduce the risk of potential conflicts, partners are required to explicitly declare, for each KER: (i) whether their contribution constitutes background or foreground; (ii) the intended use of the KER, using a structured typology (research, operational, commercial, policy/standardisation); and (iii) the access and licensing conditions granted to other consortium partners, using predefined categories (e.g., open-source for research purposes, not open-source for commercial purposes, dual licensing, proprietary/closed access, or other defined conditions). This structured, partner-driven declaration mechanism enables early identification of overlapping exploitation intentions, supports clear differentiation between background and foreground IP, and provides a practical basis to prevent and manage potential IPR conflicts in line with the Consortium Agreement.

Overall, the approach builds on existing project processes and maintains responsibility at partner level, while providing a stronger governance mechanism for aligning exploitation ambitions with IPR constraints and opportunities. The extended IPR layer within the KER table will be refined and updated throughout the project lifecycle, synchronised with the annual KER update cycle, ensuring that IPR and exploitation planning remain consistently aligned as KERs mature through demonstration, validation, and market exploration.

3.2.3 Blueprints and Guidelines for Demo-Specific Exploitation Plans

In Year 2, beyond the refinement of KERs and the integration of the IPR framework, a third key activity was the development and consolidation of structured blueprints for Demo-specific exploitation plans. These blueprints were directly connected to the overall exploitation strategy and the evolving market analysis, with the clear objective of leading each Demo toward a coherent and final Business Model Canvas (BMC).

Each Demo exploitation plan follows a common blueprint designed to ensure consistency across the project while supporting the development of concrete market uptake pathways.

First, each plan defines the **objective and strategic positioning of the Demo**, clarifying the role of the demonstrator in validating specific solutions and supporting the progression of relevant Key Exploitable Results (KERs). The plans also describe the expected Technology Readiness Level (TRL) advancement and the Demo's contribution to broader EU priorities in digitalised and resilient energy systems.

Second, a **stakeholder mapping** is conducted to identify the actors involved in the demonstration activities, including technology providers, research organisations, distribution system operators (DSOs), and other relevant stakeholders. For each actor, their role in the Demo, their contribution to specific KERs, and their intended exploitation pathway are outlined.

Third, the plans establish a **clear link between use cases and technical solutions**, connecting the general Demo objectives with the corresponding business and system use cases. This mapping ensures that technological components are directly linked to operational value creation and potential market applications.

Co-funded by the European Union

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

Fourth, each plan includes a **structured overview of the tools and technologies deployed within the Demo**, indicating their current and target TRL levels, their relation to specific KERs, and their potential exploitation pathways. This allows the consortium to align technical validation activities with future commercialisation opportunities.

Fifth, the plans provide a **partner-level synthesis of exploitation intentions**, highlighting how individual partners contribute to the development of KERs, define their value propositions, and address potential market barriers while ensuring alignment with the project's IPR framework.

In addition, each plan identifies **potential market barriers and exploitation risks**, such as regulatory uncertainty, integration challenges with legacy energy infrastructure, or interoperability constraints. Where relevant, mitigation strategies are proposed to ensure that exploitation pathways remain realistic and feasible.

Finally, each Demo plan is complemented by the development of a **Business Model Canvas**, outlining the key partners, value propositions, customer segments, channels, cost structure, and potential revenue streams associated with the solutions validated within the demonstrator.

3.3 PLANNING FOR YEAR 3

The planning for Year 3 builds on the progress achieved in Year 2 and shifts the focus toward the consolidation of exploitation activities based on operational evidence from the project demonstrations. At this stage, the objective is to move from preparatory and pilot-validation planning toward more evidence-based exploitation structuring, strengthened intellectual property management, and clearer market positioning of the project's Key Exploitable Results (KERs).

A central activity in Year 3 will be **the continuous update of the KER table**, which remains the main governance instrument for exploitation management. Unlike previous phases, updates will rely on consolidated results emerging from the operation of the project demonstrations. These updates will incorporate measurable performance indicators generated during the pilots, enabling the consortium to reassess value propositions, refine target markets and stakeholders, and adjust exploitation pathways where necessary. In addition, potential risks and barriers identified during real deployment—such as integration complexity, regulatory constraints, or procurement challenges—will be reassessed to ensure that exploitation planning reflects realistic operational conditions.

Year 3 will also represent the first stage in which **validated results will systematically inform the project's intellectual property strategy**. Based on operational experience, partners will revisit the classification of background and foreground knowledge, clarify ownership boundaries where joint developments have emerged, and refine intended exploitation uses for specific results. Where appropriate, partners may also explore strengthened protection or licensing approaches, ensuring that intellectual property governance remains aligned with the project's evolving market ambitions.

Another important activity will involve the **identification of a limited number of high-potential KERs** that demonstrate strong exploitation prospects and clear market differentiation. These selected results may be submitted to the Horizon Results Booster service in order to receive specialised

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

support in areas such as exploitation strategy refinement, business modelling, market positioning, and intellectual property structuring. This targeted approach ensures that external advisory support is focused on results with the highest potential for post-project impact.

In parallel, **Demo-specific exploitation plans will be further refined** using the operational findings obtained from the project demonstrations. This process will include updating the definition of use cases, revising tool portfolios and TRL assessments, integrating quantified operational results into value propositions, and refining partner-specific exploitation pathways. Market barriers and mitigation strategies will also be reassessed based on real deployment experience and feedback from stakeholders involved in the demonstrations.

By the end of Year 3, the project aims to achieve a more mature and operationally validated positioning of its Key Exploitable Results, accompanied by updated intellectual property declarations and refined exploitation plans for each demonstration site. These plans will incorporate initial operational evidence and clearer market positioning, supported by updated Business Model Canvases and targeted advisory support where relevant. Through this progression, HEDGE-IoT will advance from pilot validation toward structured market readiness and a coherent strategy for the future uptake of its technological solutions.

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

4 STANDARDISATION

This chapter outlines the standardisation activities ongoing or planned within the project. It also already highlights specific contributions done to standardisation with a high impact or directly related to the 2025 ICT Rolling plan for standardisation.[1]

The standardisation-related activities were initiated on M12. Standardisation is one of the HEDGE-IoT pillars. This specific pillar focuses its efforts on contributing to standardisation and making sure that the project is aligned with standards (i.e., published, under development) by following them. For this, the project will identify the relevant results and patterns that respond to actual needs and create added value.

4.1 STANDARDISATION STRATEGY

Building upon D7.3 standardisation strategy, this first phase has focused on positioning HEDGE-IoT within the standardisation landscape, identifying the priorities, identifying the partners standardisation involvements, and start contributing to standardisation. The project's technical content and results are still under development and maturation. For this reason, this task is preparing the field for the upcoming results-related contributions when not already suitable.

HEDGE-IoT scope is very large in terms of technical topics, the following ecosystems were identified as relevant to be considered within our activities:

- Energy and Smart Grid
- Artificial intelligence
- Edge/cloud computing
- Data spaces
- Interoperability
- Data
- IoT
- Digital twin
- Privacy
- Security
- Trustworthiness
- Architecture

Considering the expected technical outcomes the following main targets (see Figure 18) for standardisation contribution were identified to drive our activities:

- Standards related to dataspace, IoT, interoperability, digital twin, edge/cloud continuum, trustworthiness and AI
- Standards related to semantic interoperability (including SAREF and its extensions)

[1] "Data Interoperability (RP 2025)." *Interoperable Europe Portal*, 2025, interoperable-europe.ec.europa.eu/collection/rolling-plan-ict-standardisation/data-interoperability-rp-2025.

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

- Standards related to smart energy and smart grid domain

FIGURE 18. OVERVIEW OF STANDARDISATION CONTRIBUTIONS MAIN TARGETS

To foster HEDGE-IoT contributions to standardisation, regular topic-related presentations (e.g., dataspace, AI, energy, etc.) are organised regularly. The 2025 ICT Rolling plan for standardisation is one of the inputs considered to structure and identify the relevant contributions to standardisation.

4.1.1 Standards and groups relevant to HEDGE-IoT contribution and alignment with standardisation

Following the identification of the technical scope and main targets for standardisation contributions, Table 4 details the targeted SDOs, and the involved partners.

TABLE 4. MAIN TARGETED STANDARDISATION GROUPS BY HEDGE-IOT

SDO	Specific group	Active member(s)
CEN/CENELEC	JTC21 Artificial Intelligence	Trialog, CSL
	JTC 25 Data management, Dataspaces, Cloud and Edge (DDCE)	IDSA, TNO, Trialog
	CG on Smart Grids (SG)	Trialog
ETSI	TC DATA (SAREF)	TNO, INESC, Trialog
CENELEC	TC 205 Home and Building Electronic Systems (HBES)	TNO
IEC	SyC Smart Energy	Trialog
	IEC SyC Smart Cities	Trialog
	TC 57 Power systems management and associated information exchange	ABB, Trialog
ISO/IEC	JTC1 SC42 Artificial Intelligence	Trialog, CSL
	JTC1 SC41 Internet of Things and digital twin	Trialog
	JTC1 SC32 Data management and interchange	Trialog

Co-funded by the European Union
This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

	JTC1 SC38 Cloud computing and distributed platforms	Trialog, IDSA
	JTC1 SC27 Information security, cybersecurity and privacy protection	Trialog
	JTC 1 WG 13 Trustworthiness	Trialog
W3C	Web Standards	VUA
	Knowledge Graph Construction Community Group	VUA
Other body		
AIOTI	Standardisation	Trialog, TNO
BDVA	Standardisation group	Trialog, TNO, F6S
BRIDGE	Standards user group	Trialog
ECLIPSE	Dataspace working group	IDSA
JRC CoC	JRC CoC Energy Smart Appliances (ESA)	Trialog, TNO, INESC
JRC	Setup of interoperability testing at JRC Petten	INESC

4.1.2 Update of the Standards Overview by Topics

A first standardisation overview was presented in D7.3. This section provides an update. It focuses on: Dataspaces, AI, and Internet of Things and digital twin.

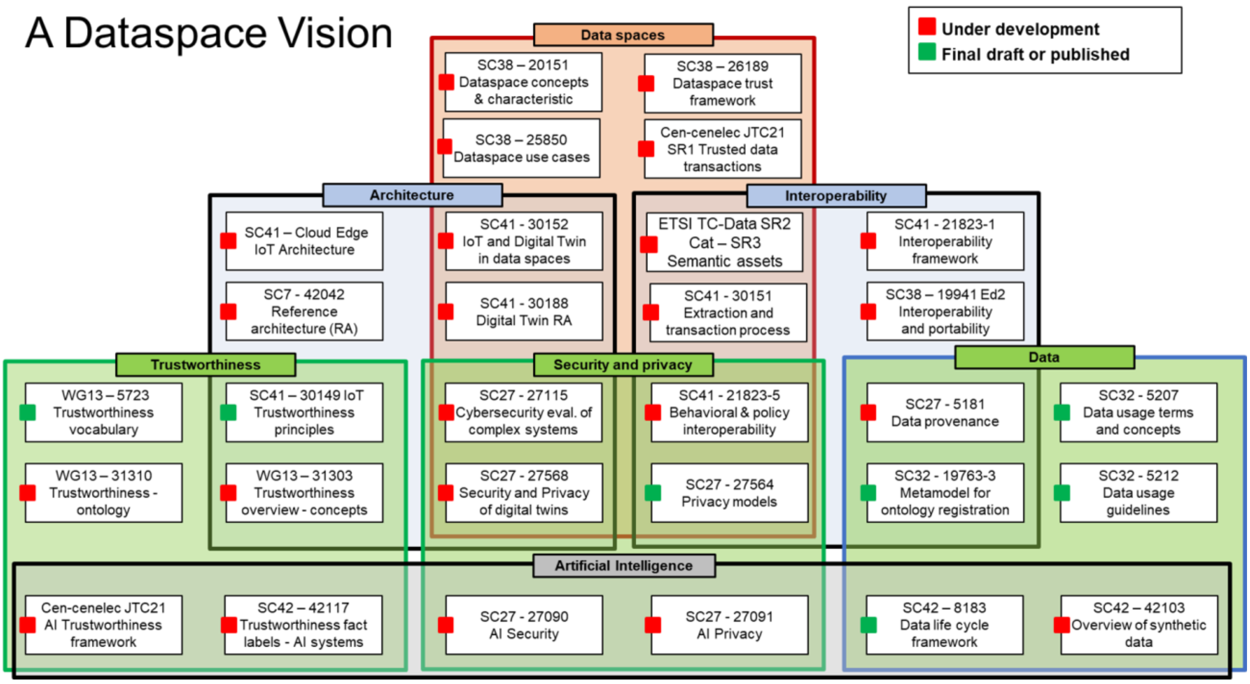

FIGURE 19. STANDARDISATION PERSPECTIVE ON THE DATA ECOSYSTEM (PREPARED BY ANTONIO KUNG (TRIALOG) IN THE CONTEXT OF A STANDARDISATION MEETING)

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

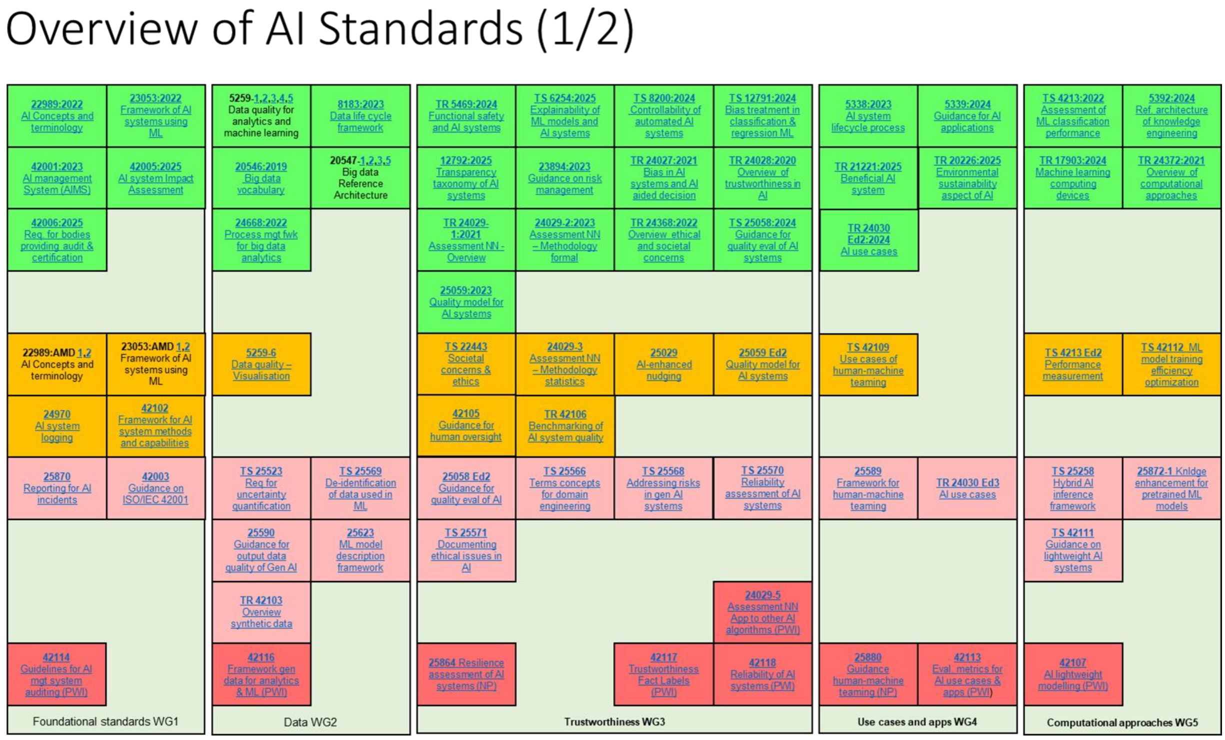

FIGURE 20. STANDARDISATION PERSPECTIVE ON THE AI ECOSYSTEM (PREPARED BY ANTONIO KUNG (TRIALOG) IN THE CONTEXT OF A STANDARDISATION MEETING)

FIGURE 21. STANDARDISATION PERSPECTIVE ON THE AI ECOSYSTEM (PREPARED BY ANTONIO KUNG (TRIALOG) IN THE CONTEXT OF A STANDARDISATION MEETING)

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

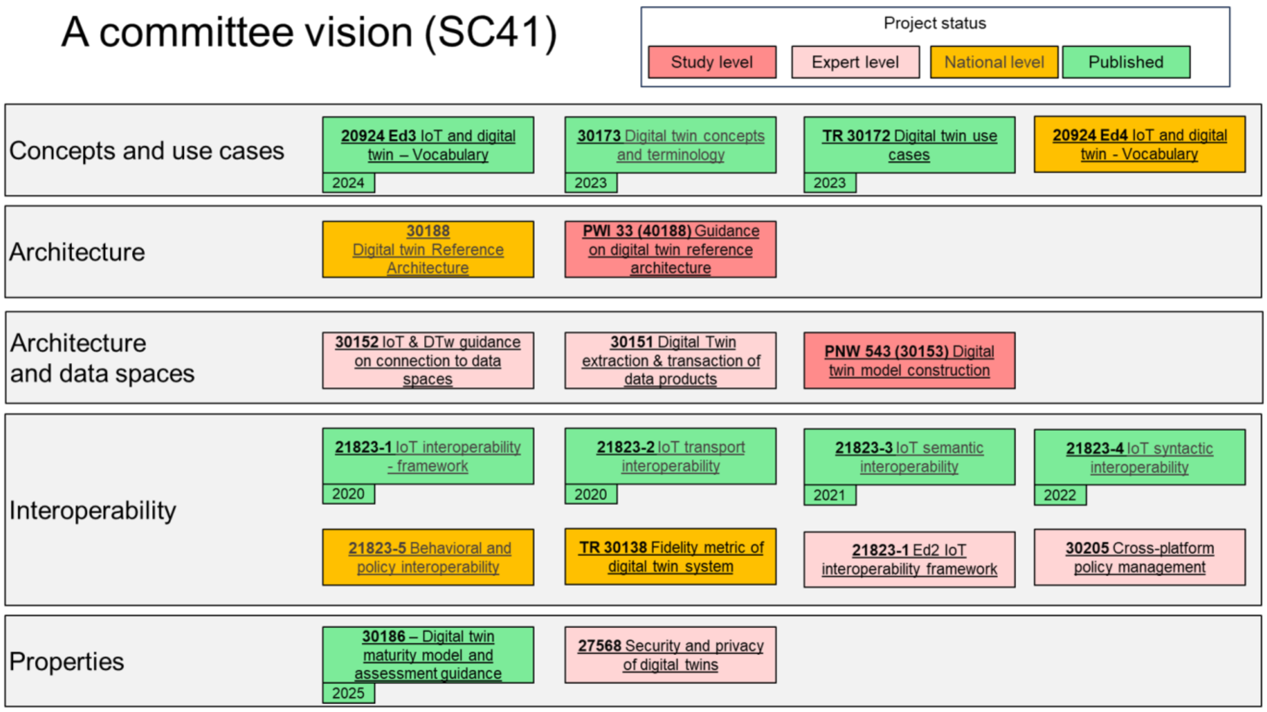

FIGURE 22. STANDARDISATION PERSPECTIVE ON SC 41 (PREPARED BY ANTONIO KUNG (TRIALOG) IN THE CONTEXT OF A STANDARDISATION MEETING)

4.2 ONGOING AND PLANNED STANDARDISATION ACTIVITIES

This section presents an overview of the standardisation contributions done by the partners in the context of the HEDGE-IoT project. These contributions could be already done, ongoing, or planned. The following sub-section describes some specific contributions, however most of the partners contributions are listed in **Appendix A.**

4.2.1 Standardisation Contributions

This section highlights some of the main partners' contributions as well as the identified impact.

The highlighted contributions will follow the model below:

- Highlight ID and title
- Name of the targeted body
- Short description of the targeted body
- Partner(s) involved
- Partner role (i.e., monitoring, participating, managing, leading)
- Additional function: (chair, rapporteur, other)
- Contribution description
- Link with 2025 ICT Rolling plan for standardisation
- Impact

The following Table 5 presents the highlights.

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

TABLE 5. LIST OF THE HIGHLIGHTED STANDARDISATION CONTRIBUTION

Highlight ID	Title
1	Contribution to a new SAREF version
2	Development and governance of SAREF
3	Initiation of an SAREF-based ontology extension on AI and edge-fog-cloud computing
4	Shaping the semantic part of the European standard for Data Spaces
5	Editor of ISO/IEC 21823-5 and –1 on semantic interoperability
6	Request of a liaison between ETSI TC DATA and SC41
7	Contribution to Trusted Data Transaction (TDT) Standards
8	Contributing to ISO/IEC JTC1/SC38 20151-1 on Dataspace concepts
9	Active contribution to CEN-CENELEC-ETSI CoG on SG
10	Convenor of IEC SC Smart Energy WG3 supporting smart energy roadmaps
11	Definition of common practice on the development on smart energy ontology
12	Contribution to the development of ISO/IEC 15118 series enabling standardised smart charging and V2G
13	Active contribution to ISO/IEC JTC1 SC27
14	Contribution to the development of a guide for Flexibility
15	Contributing and guiding the main JRC CoC ESA building block (ontology approach)
16	Supporting JRC CoC ESA with a potential tool
17	Organisation and contribution to the BRIDGE Standard user group
18	Publication of a data space standardisation landscape paper

DETAILED STANDARDISATION CONTRIBUTIONS

This section aims to introduce standardisation contributions done by the partners in the context of the HEDGE-IoT project. These contributions could be already done, ongoing, and planned. The full list of contributions can be found detailed below.

Highlight n°1: Contribution to a new SAREF version
SDO: ETSI TC Smart Machine-to-Machine Communications (SmartM2M), moved to ETSI TC DATA as of April 2025 **SDO's description:** The SmartM2M Technical Committee creates standards to support M2M services, applications, and key aspects of the Internet of Things (IoT). As a partner in oneM2M, the Committee helps develop specifications that allow users to build platforms connecting devices and services, independent of the underlying technology. It enables connected devices to share information using the Smart Applications REFerence (SAREF) ontologies, which operate on oneM2M-compliant communication platforms. **Partners involved:** TNO **Role:** Main contributor to the ETSI experts' discussions that led to the updated SAREF core ontology and main contributor to the new Technical Specification document TS 103 264 v4.1.1 (March 2025) **Additional function:** Delegate

Contribution: Publication of SAREF 4.1.1.
Publication of new major SAREF release (see TS 103 264 v4.1.1 at https://www.etsi.org/deliver/etsi_ts/103200_103299/103264/04.01.01_60/ts_103264v040101p.pdf).
The main changes compared to the previous SAREF versions are contained in "Annex A (informative): Change history" of the TS document. TNO also provided the "Annex B (informative): Migration guide from SAREF V3.1.1 to SAREF V4.1.1". SAREF V4.1.1 introduces substantial updates compared to the previous major release, SAREF V3.1.1. A key change is the removal of the saref:Measurement class, which has been replaced by the new saref:Observation class and an updated modelling approach for related properties. To support organisations that previously relied on the SAREF V3.1.1 measurement pattern, TNO has developed Annex A, which provides practical migration guidance. Using a running example, the annex explains step by step how existing implementations based on saref:Measurement can be transformed to align with the new SAREF V4.1.1 observation model.
Link with 2025 ICT Rolling plan for standardisation:

- Internet of Things – Requested action n°2.1 - "Special focus should be put on further extending the SAREF ontology"
- Smart grids and smart metering - Requested action n°2 - "to further enrich and extend the SAREF4ENER extension as well as the main SAREF ontology"

Impact: SAREF planned to be the reference in the future on interoperability.
Work beyond the project: Maintenance and governance

Highlight n°2: Development and governance of SAREF

SDO: ETSI TC DATA
SDO's description: The ETSI TC DATA standardises data solutions for interoperability, integration, and secure management across distributed systems. It ensures seamless data handling (e.g., connectivity, storage, and processing) for both machines and users. TC DATA aligns with EU policies, supporting the European Data Act and AI Act, and fosters semantic interoperability through models like SAREF. It collaborates with regulatory bodies and open-source initiatives, transposing global standards (e.g., oneM2M) into ETSI frameworks.
Partners involved: TNO
Role: Leading expert on SAREF in TC DATA, monitoring and active contribution
Additional function: TC DATA delegate
Contribution: Leading SAREF development in TC DATA. TNO played a key role in the development and governance of SAREF within ETSI TC DATA. TNO involvement included active participation in all TC DATA plenary sessions, committee work, SAREF-specific meetings, and new proposals for future SAREF specialist task forces in ETSI.
TNO also facilitated the liaison of TC DATA with the JRC and DG ENER on the European Code of Conduct for Energy Smart Appliances (CoC ESA). TNO plays a key role by advising JRC and DG ENER on SAREF use and future roadmap, presenting SAREF to stakeholders, and establishing key liaisons. These include creating formal links between IEC TC59 and TC DATA for EEBUS/SPINE mappings to SAREF/SAREF4ENER, as well as a liaison with the DLMS User Association for DLMS/COSEM mappings.
Link with 2025 ICT Rolling plan for standardisation:

- Internet of Things – Requested action n°2.1 - "Special focus should be put on further extending the SAREF ontology"
- Internet of Things – Requested action n° 10: "Increased collaboration/synchronisation between standardisation bodies (ETSI SAREF etc.)"

Co-funded by the European Union
This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

• Smart grids and smart metering - Requested action n°2 - "to further enrich and extend the SAREF4ENER extension as well as the main SAREF ontology" **Impact:** SAREF planned to be the reference in the future on interoperability. **Work beyond the project:** Maintenance and governance

Highlight n°3: Initiation of an SAREF-based ontology extension on AI and edge-fog-cloud computing
SDO: ETSI TC DATA **SDO's description:** See the previous description. **Partners involved:** TNO, TUC **Role:** monitoring and active contribution **Additional function:** TC DATA delegate **Contribution:** Ongoing design of a novel SAREF-based extension (particularly extending SAREF4SYSTEM) focused on modeling the execution of AI jobs in distributed edge-fog-cloud computing environments. **Link with 2025 ICT Rolling plan for standardisation:** Internet of Things – Requested Action 2.3 – "SAREF should also be adapted for new realities such as edge computing, (federated) machine learning and (Generative) AI" **Impact:** This new extension will fill an existing gap in SAREF allowing further features, use cases cross-domains, including energy and smart grid. This extension will be used in HEDGE-IoT.

Highlight n°4: Shaping the semantic part of the European standard for Data Spaces
SDO: ETSI TC DATA **SDO's description:** See the previous description. **Partners involved:** TNO **Role:** monitoring, and active contribution **Additional function:** TC DATA delegate **Contribution:** Active contribution to support the European Commission's Standardisation Request C (2025) 4135, for Data Act (Article 33) - European Trusted Data Framework. Especially to: • Deliverable 4: EN 304 199 — Data Solutions (DATA): Guidelines for Data Catalogue Framework • Deliverable 5: EN 303 760 — Data Solutions (DATA): Guidelines for Semantic Interoperability • Active participation in all rapporteurs calls for above mentioned standards (EN 304 199 and EN 303 760) • Contribution to EN 304 199 with the addition in ANNEX A of the Use Case for interoperability of Energy Smart Appliances (Contribution Number: DATA (25)000127) TNO contributed to the European Commission's Standardisation Request C(2025) 4135 related to the Data Act (European Trusted Data Framework), taking part in all rapporteur calls and supporting the development of EN 304 199 (Data Catalogue Framework). A notable contribution of TNO to the EN 304 199 is the addition of an Energy Smart Appliance interoperability use case in Annex A of EN 304 199. The activities for the EN 303 760 (Semantic Assets) will start in March 2026 and TNO will take part in the rapporteur calls and support the development of the new release v2 of the EN 303 760. **Link with 2025 ICT Rolling plan for standardisation:** • Data interoperability – Requested action n°1 - "SDOs to support the work on a European trusted data framework"

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

• Internet of Things – Requested Action 2.1 "Further evolve SAREF towards the requirements of the common European Data Spaces."   **Impact:** Shaping the semantic part of the European standard for Data Spaces (European Trusted Data Framework).

Highlight n°5: Editor of ISO/IEC 21823-5 and –1 on semantic interoperability
SDO: ISO/IEC JTC1 SC41 Internet of things and digital twin   **SDO's description:** SC41 develops global standards for Internet of Things (IoT) and Digital Twin, ensuring devices and digital models work together seamlessly across different industries.   **Partners involved:** Trialog   **Role:** Editor   **Additional function:** Editor   **Contribution:**   • Trialog is editor and participating to the standard revision project of ISO/IEC JTC1/SC41 ISO/IEC 21823-5 (behavioural and policy interoperability)   • Trialog co-editor of ISO/IEC 21823-1 Internet of Things (IoT) - Interoperability for IoT systems - Part 1: Framework   **Link with 2025 ICT Rolling plan for standardisation:** Internet of Things – Requested action n°2.2 - "contribute to ISO/IEC 21823-5 IoT Behaviour and Policy Interoperability"   **Impact:** Alignment of SAREF semantic interoperability framework with ISO.

Highlight n°6: Request of a liaison between ETSI TC DATA and SC41
SDO: ETSI and IEC SC 41 Internet of things and digital twin   **SDO's description:** See the previous descriptions.   **Partners involved:** Trialog   **Role:** Initiator on behalf of the French national body   **Contribution**: En behalf of the French national body Trialog initiated in December 2025 the request of a liaison between ETSI TGs (MEC being the initiator) and ISO/IEC SC41   **Link with 2025 ICT Rolling plan for standardisation:** Internet of Things – Requested action n° 10: "Increased collaboration/synchronisation between standardisation bodies (ETSI SAREF etc.)"   **Impact:** Seeking alignment on SAREF ontology and ISO ontologies.

Highlight n°7: Contribution to Trusted Data Transaction (TDT) Standards
SDO: CEN-CENELEC JTC 25 Data management, Dataspaces, Cloud and Edge   **SDO's description:** CEN-CENELEC JTC 25 is focused on data management, dataspaces, cloud and edge, established to develop European harmonised standards supporting the EU Data Act and trusted data sharing. It drives interoperability, data governance, and innovation across data spaces, cloud, and edge technologies, ensuring secure and efficient data exchange in Europe.   **Partners involved:** IDSA   **Role:** monitoring, and active contribution   **Additional function:** Chair and liaison agreement   **Contribution:** Active contribution to the Trusted Data Transaction (TDT) Standards Part 1, 2, and 3, and the technical specifications of maturity model of common European data space   **Link with 2025 ICT Rolling plan for standardisation:**   • Data interoperability – Requested action n°7: "SDOs to define standards for data governance"   • Smart grids and smart metering – Requested action n°5: "ETSI, CEN & CENELEC should collaborate with (or participate in) the Horizon Europe projects, which will establish the

foundations for a Common European Energy Dataspace, and help identify, develop and standardise a set of common technical specifications for it"   **Impact:** Compliance with future European harmonised standards.

Highlight n°8: Contributing to ISO/IEC JTC1/SC38 20151-1 on Dataspace concepts
SDO: JTC 1 SC38 Cloud computing and distributed platforms   **SDO's description:** International subcommittee responsible for standardisation in cloud computing and distributed platforms, developing foundational standards, reference architectures, and guidelines for interoperability and system integration.   **Partners involved:** IDSA   **Role:** monitoring, and active contribution   **Additional function:** /   **Contribution:** Actively contributing to ISO/IEC JTC1/SC38 20151-1 Information technology — Cloud computing and distributed platforms — Dataspace concepts and characteristics.   **Link with 2025 ICT Rolling plan for standardisation:** Data interoperability – Requested action n°7: "SDOs to define standards for data governance"   **Impact:** Alignment with ISO standards on dataspace

Highlight n°9: Active contribution to CEN-CENELEC-ETSI CoG on SG
SDO: CEN-CENELEC-ETSI CoG (Coordination Group) on SG (Smart Grids)   **SDO's description:** It coordinates activities among CEN, CENELEC, and ETSI, developing reference architectures (such as SGAM) and addressing standardisation gaps to ensure interoperability and innovation across Europe's energy systems.   **Partners involved:** Trialog   **Role:** Contributor   **Additional function:** /   **Contribution:** Contribution to the "Set of standards" WG: SAREF workshop (2024), gap description (information models coordination), report on the available standards for demand-response. Representation of CEN/CENELEC in SEEG/D4E (Smart Energy Expert Group / Data 4 Energy WG).   **Link with 2025 ICT Rolling plan for standardisation:**   • Smart grids and smart metering – Requested action n°1: "Active involvement and participation of CEN & CENELEC CG-SG experts in the ongoing work of the Smart Grids Task Force, including regarding the activity on interoperability for access to data in a smart grid environment"   • Internet of Things – Requested action n° 10: "Increased collaboration/synchronisation between standardisation bodies (ETSI SAREF etc.)"   • Smart grids and smart metering – Requested action n°6: "SDOs and related stakeholders and initiatives should work towards cross-sector interoperability, in particular for data exchange between grid, building and mobility domains."   **Impact:** Addressing standardisation gaps identified in the CG.

Highlight n°10: Convenor of IEC SC Smart Energy WG3 supporting smart energy roadmaps
SDO: IEC System Committee (SC) Smart Energy WG3 Smart Energy Roadmap   **SDO's description:** WG3 is responsible for developing and maintaining the Smart Energy Roadmap, mapping key use cases to relevant system architectures and identifying standard gaps, overlaps, and recommendations. Its mission is to guide stakeholders in selecting the most appropriate standards and specifications, ensuring coherent and interoperable smart energy solutions across the industry.

Co-funded by the European Union
This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

Partners involved: Trialog
Role: Lead and monitoring
Additional function: Convenor of WG3
Contribution: Iterative update of the Smart Energy Roadmap and web-publication. Development of IEC SRD 63460 "Architecture and use-cases for EVs to provide grid-support functions" (published in 2025). Digital Twins for the electrical energy system: Organisation of a workshop (120+ participants); Creation and animation of two thematic groups on "Data Harmonisation" and "Governance".
Link with 2025 ICT Rolling plan for standardisation: Smart grids and smart metering – Requested action n°6: "SDOs and related stakeholders and initiatives should work towards cross-sector interoperability, in particular for data exchange between grid, building and mobility domains."
Impact: Paving the way to standards supporting Digital Twins for the electrical energy system Coordination at worldwide level on the identified gaps and the existing standards. Paving the way to EVs as "Distributed Energy Resources".

Highlight n°11: Definition of common practice on the development on smart energy ontology

SDO: IEC System Committee (SC) Smart Energy WG6 generic smart grid requirements
SDO's description: WG6 focuses on defining generic smart grid requirements, providing a collaborative platform for ontology development, use case methodologies, and the management of standardised profiles. Its work supports interoperability and system integration across smart energy domains, ensuring alignment with broader IEC standards and frameworks.
Partners involved: Trialog
Role: Contributor
Additional function: /
Contribution: Contribution to numerous sections to IEC SRD 63417:2025 Guide and plan to develop a unified IEC Smart Energy Ontology
Link with 2025 ICT Rolling plan for standardisation: Smart grids and smart metering – Requested action n°6: "SDOs and related stakeholders and initiatives should work towards cross-sector interoperability, in particular for data exchange between grid, building and mobility domains."
Impact: Common practice on the development on smart energy ontology.
Guiding the development of smart energy ontologies and other domain-based ontologies within smart energy to achieve semantic interoperability through various standards, generic and specific ontologies projects.

Highlight n°12: Contribution to the development of ISO/IEC 15118 series enabling standardised smart charging and V2G

SDO: IEC Technical Committee (TC) 69 Electrical power/energy transfer systems for electrically propelled road vehicles and industrial trucks
SDO's description: TC 69 develops international standards for electrical power and energy transfer systems used in electrically propelled road vehicles and industrial trucks. Its scope covers a wide range ensuring safe, efficient, and interoperable energy transfer solutions.
Partners involved: Trialog
Role: Contributor
Additional function: Member of JWG1, JWG15
Contribution: Contribution to the development of ISO/IEC 15118 series. Follow-up of IEC 63382 technical development.

Co-funded by the European Union
This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

Link with 2025 ICT Rolling plan for standardisation: Smart grids and smart metering – Requested action n°6: "SDOs and related stakeholders and initiatives should work towards cross-sector interoperability, in particular for data exchange between grid, building and mobility domains."
Impact: Enabling standardised smart charging and V2G.

Highlight n°13: Active contribution to ISO/IEC JTC1 SC27

SDO: ISO/IEC JTC1 SC27 Information security, cybersecurity and privacy protection
SDO's description: *I*nternational standards subcommittee responsible for developing globally recognised standards, technical reports, and guidelines in information security, cybersecurity, and privacy protection. Its work addresses critical challenges such as cyber risks, data breaches, and identity theft, with landmark standards like ISO/IEC 27001 and 27002 shaping best practices worldwide.
Partners involved: Trialog
Role: Contributor
Additional function: /
Contribution: Alignment and contribution in ISO standards
Contribution of the security of substation edge devices and applications and orchestration services through the following standards: ISO/IEC 27568 (Security and privacy of digital twins)

- ISO/IEC 27090 (AI security)
- ISO/IEC 27115 (Cybersecurity evaluation of complex systems)
- ISO/IEC 27116 (Customised or multipurpose evaluation)
- ISO/IEC 26245 (Best practices on reuse of single evaluations for multipurpose usage)
- ISO/IEC 27404 (Cybersecurity labelling framework for consumer IoT)
- ISO/IEC 26601 (Guidance on cybersecurity of systems of systems)

Contribution to new standardisation projects:

- ISO/IEC 27091 (AI privacy protection) co-editor
- ISO/IEC 27116 (Support for customised or multipurpose evaluation) ??XX?

Link with 2025 ICT Rolling plan for standardisation: /
Impact: Ensuring synergy with the standardisation landscape.

Highlight n°14: Contribution to the development of a guide for Flexibility

SDO: IEC Standardisation Management Board (SMB) Strategic Group (SG) 12 WG5
SDO's description: The IEC SMB/SG12/WG5 is a working group under the IEC's Strategic Group 12, focusing on digital transformation in international standardisation, particularly on semantic interoperability, data governance, and digital methodologies to support IEC's strategic digital initiatives. Its activities include developing guidelines, frameworks, and best practices to ensure coherent digital standardisation across IEC technical committees.
Partners involved: Trialog
Role: Contributor
Additional function: Member of JWG1, JWG15
Contribution: Contribution to the development of a guide for Flexibility.
Link with 2025 ICT Rolling plan for standardisation: /
Impact: Coordination at worldwide level on the definition of flexibility and its characteristics, for reuse within each energy vertical.

Highlight n°15: Contributing and guiding the main JRC CoC ESA building block (ontology approach)

Body: JRC Code of Conduct (CoC) Energy Smart Appliances (ESA)
Body's description: The JRC CoC ESA is a collaborative and voluntary initiative led by the European Commission's Directorate-General for Energy (DG ENER) and the Joint Research Centre (JRC). Its primary objective is to establish a voluntary Code of Conduct (CoC) for manufacturers of Energy Smart Appliances (ESA), aiming to ensure interoperability and seamless data sharing among appliances, home automation systems, electric vehicle chargers, aggregators, and DSOs. Unlike traditional energy efficiency regulations, this initiative focuses on certifying the "energy-smart" behavior of products, fostering a cohesive and open ecosystem that prevents market fragmentation and proprietary incompatibilities. The scope of the CoC ESA encompasses defining principles for data exchange and developing interoperability requirements, with a strong emphasis on leveraging open standards such as the Smart Appliances REFerence (SAREF) ontology. The initiative involves a wide range of stakeholders, including industry representatives, NGOs, academia, and Member State authorities, through workshops, surveys, and collaborative working groups.
Partners involved: TNO and Trialog
Role: monitoring, and active contribution
Contribution:

- (TNO) Regular meetings with JRC and DG ENER to advice on SAREF use and roadmap in the CoC ESA; Presentation on SAREF to CoC ESA stakeholders at plenary yearly meeting in Brussels; Establishing a liaison of IEC TC59 with TC DATA for the EU Code of Conduct Energy Smart Appliances on EEBUS/SPINE mappings into SAREF and SAREF4ENER
- (TNO) Establishing a liaison of DLMS User Association with TC DATA for the EU Code of Conduct Energy Smart Appliances on DLMS/COSEM mappings into SAREF and SAREF4ENER
- (TNO and Trialog) In the context of JRC CoC ESA, Trialog and TNO especially expressed the need of a clear SAREF governance and maintenance approach, citing the ISO maintenance agencies.

Link with 2025 ICT Rolling plan for standardisation:

- Internet of Things – Requested action n° 10: "Increased collaboration/synchronisation between standardisation bodies (ETSI SAREF etc.)"
- Smart grids and smart metering – Requested action n°6: "SDOs and related stakeholders and initiatives should work towards cross-sector interoperability, in particular for data exchange between grid, building and mobility domains."

Impact: Guiding the main building block (ontology approach) for the JRC CoC ESA.

Highlight n°16: Supporting JRC CoC ESA with a potential tool

Body: Joint Research Centre (JRC) Code of Conduct (CoC) Energy Smart Appliances (ESA)
Body's description: See description above.
Partners involved: Trialog and TNO
Role: monitoring, and active contribution
Contribution:

- Presentation and demonstration on a proof of concepts and specifications of the requirements for a testing tool.

Link with 2025 ICT Rolling plan for standardisation:

- Data interoperability – Requested action n°5 - Develop standard methods for the automated testing of ontologies
- Internet of Things – Requested action n°2.2 - "contribute to ISO/IEC 21823-5 IoT Behaviour and Policy Interoperability"

Impact: Supporting JRC CoC ESA with a potential tool

Co-funded by the European Union
This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

Highlight n°17: Organisation and contribution to the BRIDGE Standard user group
Body: BRIDGE Standard user group **Body's description:** The BRIDGE initiative is a European Commission program that unites Horizon Europe projects focused on smart energy systems. It fosters collaboration and knowledge sharing among projects to address cross-cutting challenges and accelerate the deployment of innovative energy solutions. Through structured working groups, BRIDGE delivers recommendations and best practices to shape Europe's sustainable energy future. **Partners involved:** Trialog **Role:** Chair of Data Management WG **Additional function:** / **Contribution:** Organisation and provision of webinars. Liaison with CEN/CLC/ETSI CoG-SG then CoG-AES. **Link with 2025 ICT Rolling plan for standardisation:** / **Impact:** Link between EU R&I and standardisation bodies

Highlight n°18: Publication of a data space standardisation landscape paper
Body: International Data Spaces Association (IDSA) **Body's description:** IDSA is a global non-profit association that develops and promotes secure, sovereign data exchange standards, enabling organisations to share and monetize data while retaining full control. IDSA fosters international data spaces through open architecture, certification, and collaboration, driving innovation and trust in the digital economy. **Partners involved:** IDSA **Role:** Lead and main contributor **Additional function:** / **Contribution:** Publication of a standardisation paper. The Data Spaces Standardisation Landscape paper provides a comprehensive overview of the current standardisation activities related to data spaces within the consortium and across the broader ecosystem. It maps relevant initiatives, standards, and technical committees involved in the development of the data spaces framework, helping stakeholders understand the evolving standardisation landscape. An updated version of the paper will be published next month to reflect the latest developments and newly emerging standards and activities from different standardisation bodies. This new edition will also introduce an international chapter, expanding the scope of the analysis to include key data space initiatives and standardisation efforts taking place globally. **Link with 2025 ICT Rolling plan for standardisation:** / **Impact: Standardisation gap identification**

4.3 SMART READINESS INDICATOR (SRI)

4.3.1 SRI Introduction

The Smart Readiness Indicator (SRI[2]) is the official EU framework for assessing how "smart-ready" a building is, by evaluating the presence and sophistication of smart services across multiple technical domains (e.g., heating, cooling, domestic hot water, ventilation, lighting, dynamic envelope, electricity, EV charging, and monitoring/control). Each service is assessed using a service-level functionality level L_s, where higher levels correspond to increasing sophistication in automation, coordination, reporting maturity, and grid interaction.

2 https://energy.ec.europa.eu/topics/energy-efficiency/energy-performance-buildings/smart-readiness-indicator_en

A key motivation for this work is that, while SRI includes an "Energy flexibility and storage" impact criterion[3], the underlying SRI scoring is primarily designed to assess the existence and sophistication of smart services, not to provide a directly operational or engineering-level flexibility quantification. SRI services differ substantially in how directly they enable flexibility: grid-interactive services (such as controlled EV charging, storage export, or coordinated DSM) have a more direct relationship to flexibility provision, whereas enabling services (such as reporting, monitoring, or sub-metering) support flexibility indirectly by improving observability and decision-making.

As a result, a straightforward logical mapping (e.g., "if any of these services exist, then the Flex capability is present") is insufficient and can be misleading: it can (i) ignore the simultaneous contribution of multiple services, (ii) overstate capability due to a single low-impact service, or (iii) treat services from very different domains as equivalent. This observation motivates the need for a structured flexibility quantification methodology that remains compatible with the SRI structure while producing a flexibility-relevant representation.

Recent research has also explored SRI-inspired approaches for evaluating flexibility potential at the device level. For example, Parada et al.[4] proposed a methodology for assessing the flexibility potential of electrical assets using functionality levels and weighted aggregation across electrical characteristics, observability, and controllability dimensions. While their approach focuses on device-level flexibility evaluation, the methodology developed in this work extends the concept to the building level by directly mapping official SRI services to flexibility-relevant indicators.

4.3.2 HEDGE-IoT SRI Activities and Objectives

The objective of the HEDGE-IoT SRI activity is to derive a static, SRI-based flexibility readiness representation from the official EU Smart Readiness Indicator (SRI) assessment, while remaining fully compatible with the SRI structure (i.e., the official domains, service codes, and service-level functionality levels). In practical terms, the methodology uses as input the SRI services that the assessor marks as applicable to a given building, together with their assessed functionality levels L_s, and translates them into a set of flexibility-relevant ("Flex") service indicators that describe the building's capability to observe, control, and interact with energy flows in ways that are relevant for demand response, storage utilisation, and grid-supportive operation. The output can be used either as a vector of Flex indicators (to highlight strengths and gaps across flexibility dimensions) or as an aggregated SRI-derived flexibility representation (to support benchmarking and comparison across buildings).

The methodology is structured to preserve the distinction between:

i. what SRI can credibly support as a static readiness signal derived purely from assessed service levels (e.g., whether storage exists, whether EV charging is controlled, whether a platform enables coordinated control, or whether monitoring/reporting reaches advanced levels), and
ii. what cannot be derived from SRI alone because it depends on engineering specifications, operational constraints, or behavioural context (e.g., true response time in seconds, ramping capability, controllable fraction of load, comfort constraints, availability windows, user override behaviour, tariff exposure, or the actual activation of flexibility in day-to-day operation).

[3] https://eur-lex.europa.eu/eli/reg_del/2020/2155
[4] https://zenodo.org/records/18700608

Co-funded by the European Union

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

Accordingly, the methodology is designed for the following use cases:

i. Static flexibility readiness assessment directly computable from SRI: The primary output is a reproducible and comparable representation of flexibility-related capabilities that can be calculated from SRI assessments without requiring additional monitoring data, simulations, or proprietary asset models. This supports early-stage screening, benchmarking, and policy-oriented comparison.
ii. Transparent identification of gaps and non-derivable parameters: The mapping explicitly highlights which flexibility-relevant attributes are captured by existing SRI services and which remain outside the SRI scope. This provides a structured way to document gaps (e.g., lack of explicit response time, ramp limits, phase balancing capability) and to specify what additional data would be needed in subsequent layers of flexibility assessment.

Finally, by using an explicit weighting mechanism (implemented through AHP in the following sections), the methodology remains configurable: stakeholders can adopt different priority profiles (e.g., grid-support vs. building-operator priorities) without changing the underlying mapping logic, only the weighting layer. This makes the approach suitable both for standardised assessments (with fixed weights) and for scenario-based analyses where weights reflect a specific application context.

4.3.3 HEDGE-IoT Work Performed, Results and Recommendations

During Year 2, ICCS developed and specified a complete methodology for deriving a static flexibility readiness representation directly from the official EU SRI assessment output, while preserving full compatibility with the official SRI structure (domains, service codes, and service-level functionality levels). The methodological work progressed from the review of the SRI framework and identification of flexibility-relevant gaps to the definition of Flex services and a formal mapping architecture, and finally to the implementation of a multi-criteria weighting approach to avoid oversimplified logical aggregation.

Detailed information on work performed, results and recommendations can be found in **Appendix B.**

4.4 CONCLUSION AND PLANNING FOR YEAR 3

4.4.1 Standardisation Contributions Planning

Through their collaborative efforts, HEDGE-IoT partners already made significant contributions in the second year of the project to the advancement of standardisation. The efforts were mainly focused on standards related to (1) dataspace, IoT, interoperability, digital twin, edge/cloud continuum, trustworthiness and AI; (2) semantic interoperability (including SAREF and its extensions); (3) smart energy and smart grid domain.

The year 3 plan is to continue the contribution efforts on the targeted SDOs with a specific focus on the dissemination of the results of the project. To complete this, standardisation gaps will be identified to support policy stakeholders.

Table 6 provides an overview of the task KPIs status based on all the activities described in this chapter. In March 2026, the 3 KPIs related to the task are already surpassed.

Co-funded by the European Union

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

TABLE 6. KPIS STATUS (MARCH 2026)

KPI	Expectation	Status
KPI 14 – Number of participations to new standardisation projects	4	5
KPI 15 – Number of participations to standards revision projects	2	3
KPI 16 – Number of participations to standardisation groups (WG, AG)	10	47

4.4.2 Smart Readiness Indicator Planning

In conclusion, Year 2 delivered a complete and implementable methodology that extends the SRI toward flexibility assessment by transforming SRI service-level functionality assessments into ten flexibility-relevant indicators (Flex services). The key methodological contribution is the combination of deterministic mapping functions g_(k,s) (L_s) with AHP-derived weights w_(k,s), enabling a transparent, reproducible, and configurable approach that captures simultaneous contributions across domains without collapsing them through simplistic logical rules.

Beyond the individual Flex services, the methodology introduces a second aggregation layer that structures flexibility readiness along three core dimensions: observability, controllability, and storage/grid-interaction readiness and combines them into a final SFI. This structure allows flexibility readiness to be represented both as a single scalar indicator and as a multidimensional flexibility profile, enabling clearer benchmarking and interpretation across buildings.

The Year 3 plan is centred on validation, calibration, and application. First, the methodology will be applied to representative building cases (including pilot-relevant building types) in order to analyse the resulting Z_k distributions and assess the robustness of the discretisation thresholds and SFI aggregation. Second, the AHP matrices and weight sets may be reviewed with stakeholder input to confirm that the current grid-oriented flexibility prioritisation is appropriate for the targeted assessment use cases, while also enabling the definition of alternative weighting profiles if needed. Third, the mapping will be used to systematically document which flexibility attributes remain non-derivable from SRI and to specify the minimum additional data required to extend the methodology into a second (dynamic or contextual) flexibility layer, without compromising the strictly SRI-based nature of the static readiness layer.

Co-funded by the European Union

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

5 COMMUNITY BUILDING AND STAKEHOLDER ENGAGEMENT

This section details the concrete engagement activities, collaborations, and knowledge-exchange initiatives implemented by the HEDGE-IoT project during its second year. Building upon the ecosystem mapping established in Year 1, the focus during Year 2 shifted towards more actionable collaboration, joint dissemination, and active participation in relevant European working groups and project-level exchanges.

During Year 1, HEDGE-IoT focused on identifying the most relevant European projects and initiatives and establishing the first collaboration channels with sister and complementary actions. These first activities included the establishment of links with ODEON, participation in BRIDGE and AIOTI-related activities, engagement with CEEDS and Energy Data Space cluster actions, first contact with the META-OS cluster, initial exchanges with TwinEU, and early synergies with CEF Digital-related initiatives, notably through EnerTEF. Building on this foundation, Year 2 moved beyond ecosystem mapping and into more operational cooperation.

5.1 ACTIVITIES IMPLEMENTED IN YEAR 2

5.1.1 Partnerships and Collaborations with Projects

ODEON: Collaboration with the sister project ODEON was significantly strengthened during Year 2 through regular bilateral calls. The main objective of these exchanges was to jointly address the recommendations of the first review meeting, with particular emphasis on strengthening the interoperability narrative and practical alignment between the two projects, as well as on collaboration within the scope of the open calls organised by both. In this context, preparatory work was initiated towards the definition of a common open call topic linking the upcoming HEDGE-IoT Open Call 2 with ODEON Open Call, as a concrete response to the recommendation concerning interoperability between the two sister projects. In parallel, preparations were launched for a joint workshop planned for late May, while a cross-promotion strategy was activated through the social media channels of both projects, significantly amplifying the visibility and combined outreach of the two initiatives.

CEEDS projects: HEDGE-IoT maintained active communication channels with projects and stakeholders related to the Common European Energy Data Space ecosystem, building on the contacts established during Year 1 through ENLIT and related cluster exchanges. In particular, the project continued knowledge exchange with relevant CEEDS-related initiatives such as Int:NET, OMEGA-X and ENERSHARE, focusing on federated energy data spaces, governance approaches, and interoperability developments of direct relevance to HEDGE-IoT. Partners of the HEDGE-IoT consortium participate in CEEDS project as well, providing direct links for knowledge exchange and common activities.

TwinEU: Leveraging the participation of common partners across the two consortia, HEDGE-IoT and TwinEU maintained continuous knowledge exchange during Year 2, ensuring alignment on topics related to digital twins, interoperability, and data sharing. These exchanges also laid the groundwork for future joint workshop activities, with the aim of connecting HEDGE-IoT's IoT, cloud-edge and interoperability work with TwinEU's broader federated digital twin ecosystem and future replication discussions.

Co-funded by the European Union
This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

ENERTEF: The participation of common partners in both HEDGE-IoT and EnerTEF enabled continuous informal coordination and effective knowledge transfer during the reporting period. These exchanges supported alignment on testing and experimentation environments, digital platform deployment, and interoperability considerations that are of strategic relevance to both projects. HEDGE-IoT is now a member of the Smart Energy Cluster, an initiative organised by ICCS which brings together many EU projects working on Smart Grids. Through participation in the Smart Energy Cluster HEDGE-IoT has established an even closer connection with EnerTEF (part of the cluster as well), as well as many other participating projects. HEDGE-IoT took part in the Smart Energy Cluster session (5th International Workshop on AI & Data Analytics in the Energy Sector) held at IISA 2025 conference in Lesvos Greece on July 2025.

META-OS cluster: During Year 2, operational constraints and diverging short-term priorities did not allow the execution of direct joint activities with the META-OS cluster. Nevertheless, HEDGE-IoT continued to monitor the developments and outputs of relevant META-OS projects, with a view to identifying opportunities for targeted alignment in the final phase of the project.

5.1.2 Partnerships and Collaborations with Initiatives

BRIDGE: HEDGE-IoT strengthened its involvement in the BRIDGE ecosystem during Year 2. Project representatives actively participated in all four WGs with particular emphasis on the Data Management and Business Models Working Groups, contributing to relevant BRIDGE questionnaires, and engaging in ongoing discussions around the development of the Data Exchange Reference Architecture (DERA). In addition, HEDGE-IoT was selected under BRIDGE Case Study 14 on Grid Resilience and Cybersecurity for analysis in the context of an upcoming BRIDGE paper, opening an additional and more focused channel of interaction with the BRIDGE Secretariat and the other selected projects. HEDGE-IoT is currently preparing a mapping of its Final Reference Architecture to the BRIDGE DERA. This will become available to the BRIDGE Community and will contribute to dissemination purposes of the project.

AIOTI: HEDGE-IoT also maintained active visibility within the AIOTI ecosystem through the participation of consortium partners and targeted dissemination actions. In particular, the project was presented at a recent AIOTI event, where the HEDGE-IoT vision, reference architecture, pilots, and business use cases were introduced to the wider IoT community. The discussion confirmed the strong relevance of the project's focus on the digitalisation of the energy sector through the wide deployment and orchestration of IoT solutions, highlighted interoperability as one of its core challenges and expected outcomes and acknowledged the importance of the synergies already established with the ODEON sister project[5]. It also opened the way for exploring broader replication synergies with relevant projects from other domains.

Participation in ENLIT Europe 2025: During Year 2, HEDGE-IoT participated in Enlit Europe 2025, held in Bilbao, Spain during November 2025, using the event as a valuable platform for dissemination, visibility and targeted networking within the European energy innovation ecosystem. The event brought together many energy stakeholders and featured a strong EU Projects Zone, creating a relevant space for exchanges with Horizon Europe projects, industrial actors, and policy-oriented initiatives active in digitalisation, interoperability, data spaces, AI, and

[5] https://aioti.eu/wp-content/uploads/AIOTI-Days-2025-HEDGE-IoT.pdf

Co-funded by the European Union
This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

smart energy systems[6]. In this context, HEDGE-IoT used its participation to reinforce existing contacts, support knowledge exchange with related projects and initiatives, and further position its work on IoT-enabled digitalisation of the energy ecosystem, cloud-edge integration, and federated interoperability within the broader European discussion on the energy transition. HEDGE-IoT was also presented at ENLIT at a dedicated session on projects relevant to Digitalisation.

5.1.3 Engagement Activities and Platforms

Synergies with CEF Digital Operational Digital Platforms: During Year 2, HEDGE-IoT maintained active synergies with the CEF Digital Operational Digital Platforms ecosystem, primarily through its links with EnerTEF. By leveraging the participation of common consortium members, the project sustained a continuous channel for knowledge exchange on digital energy infrastructures, interoperability requirements, testing and experimentation environments, and the practical deployment of digital energy platforms. These interactions supported the strategic alignment of HEDGE-IoT with broader European efforts towards secure, interoperable and scalable cross-border digital energy infrastructures.

Overall, Year 2 marked a clear transition from initial ecosystem mapping to more concrete and structured engagement. HEDGE-IoT's community-building activities increasingly focused on actionable collaboration, targeted working-group participation, and the preparation of joint dissemination and open-call related actions that will further reinforce the project's position within the European digital energy and IoT landscape.

5.2 PLANNING FOR THE FINAL PROJECT PERIOD

During the final phase of the project, HEDGE-IoT will focus on consolidating the collaboration channels established during the previous reporting periods and on strengthening the engagement with the European projects and initiatives identified as most relevant to the project's technological and ecosystem objectives. While the first phase of the project concentrated on ecosystem mapping and the second phase on operational collaboration, the final project period focuses on the presentation, validation, and cross-project exploitation of concrete project results.

Emphasis will be placed on showcasing the HEDGE-IoT reference architecture, interoperability framework, technological enablers and pilot demonstrations, and on positioning these results within the broader European landscape of initiatives addressing digitalisation of the energy system, IoT deployment, data spaces, and cloud-edge integration.

5.2.1 Continued collaboration with sister and complementary projects

The collaboration with the sister project ODEON will remain a central element of the project's liaison strategy. Building on the coordination activities implemented during Year 2, both projects will continue to strengthen interoperability alignment and dissemination synergies. Planned actions include the organisation of joint workshops, cross-participation in dissemination events, and coordinated promotion of the respective open-call results and demonstrator outcomes. These activities will allow both projects to jointly showcase their complementary approaches to digitalisation and interoperability in the energy domain.

[6] https://www.enlit.world/projects/hedge-iot

Co-funded by the European Union

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

In parallel, HEDGE-IoT will maintain and further develop exchanges with projects related to the CEEDS ecosystem, including initiatives such as Int:NET, OMEGA-X and ENERSHARE. These interactions will focus on aligning approaches to federated data governance, interoperability mechanisms, and trusted data exchange infrastructures, enabling HEDGE-IoT to contribute practical insights derived from its pilots and technological framework to the ongoing European work on energy data spaces.
Knowledge exchange with TwinEU will also continue, particularly in relation to interoperability between IoT infrastructures, cloud-edge architectures, and federated digital-twin environments. Through these exchanges, HEDGE-IoT will explore opportunities to position its technological outcomes as enabling components for future digital-twin-based energy ecosystems.

5.2.2 Strengthening engagement with European initiatives

The project will continue its active participation in the BRIDGE initiative, maintaining engagement in the relevant Working Groups and contributing to ongoing discussions on interoperability, data exchange, and business models for the digitalisation of the energy sector. Attention will be given to the alignment of the HEDGE-IoT architecture with the BRIDGE DERA, ensuring that the project's technological outcomes are positioned within the broader European framework for energy data interoperability.

Engagement within the AIOTI ecosystem will also be maintained during the final phase of the project, allowing HEDGE-IoT to further disseminate its results to the wider IoT innovation community and explore potential replication pathways across domains where IoT orchestration and edge-cloud integration are relevant.

5.2.3 Dissemination and ecosystem positioning

In the final phase of the project, HEDGE-IoT will intensify its presence in key European innovation and energy events, leveraging major conferences and cluster meetings as platforms to present the project's demonstrators, technological solutions, and interoperability framework. Events such as ENLIT Europe, European Sustainable Energy Week and relevant cluster workshops will be used to strengthen links with EU projects, industry stakeholders, and policy initiatives active in the field of digital energy systems.

In addition, the project will seek to reinforce synergies with initiatives related to CEF Digital Operational Digital Platforms and Testing and Experimentation Facilities, ensuring that the technological developments of HEDGE-IoT remain aligned with broader European efforts aimed at deploying secure, interoperable and scalable digital infrastructures for the energy sector.

Furthermore, the consortium aims to organise **a joint final uptake event in collaboration with sister projects** and relevant European initiatives, with the objective of maximising visibility, fostering cross-project synergies, and strengthening the overall impact of project results. This event will be designed as a platform to showcase validated solutions, share lessons learned, and engage key stakeholders from industry, policy, and research communities. One of the options currently being explored is to organise the event co-located with Enlit Europe 2027, leveraging its strong presence of energy sector stakeholders, including DSOs, TSOs, technology providers, and policymakers. Such an approach would enable broader outreach, increased participation, and more effective positioning of HEDGE-IoT results within the European energy ecosystem, while also creating opportunities for joint demonstrations, panel discussions, and coordinated dissemination activities with related projects.

Co-funded by the European Union

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

5.2.4 Preparing the ground for sustainability and future collaboration

Finally, the last project phase will also focus on preparing the ground for post-project collaboration and sustainability of the established ecosystem links. The objective is to ensure that the connections established with projects, initiatives and stakeholder communities continue beyond the project lifetime and contribute to the long-term uptake and replication of HEDGE-IoT results.

Through these activities, HEDGE-IoT aims to position its outcomes as practical contributions to the ongoing European efforts on digitalisation of the energy system, while reinforcing its role within the broader innovation ecosystem connecting IoT, cloud-edge infrastructures, interoperability frameworks and energy data spaces.

Co-funded by the European Union

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

6 CONCLUSIONS AND RECOMMENDATIONS

This deliverable has presented the progress and evolution of activities related to communication, dissemination, exploitation, standardisation, and community building within the HEDGE-IoT project. The findings highlight a structured transition from foundational planning in the early stages of the project toward validation, consolidation, and preparation for market uptake in the later phases. The following conclusions and recommendations are drawn from each chapter.

Communication and Dissemination activities have successfully established a solid visibility baseline for the project, supported by a functional digital presence, initial campaigns, and participation in relevant events. Progress against Key Performance Indicators demonstrates positive momentum, particularly in digital outreach and stakeholder engagement. However, certain targets—such as multimedia production, newsletters, and innovation-oriented events—require additional focus. For the final phase of the project, it is recommended to prioritise high-impact, result-oriented communication, including the promotion of validated outcomes, demonstration results, and success stories. Increased use of visual and easily accessible formats, such as videos and infographics, as well as stronger alignment with major industry events, will be essential to maximise outreach and stakeholder understanding.

Dissemination activities have effectively supported engagement with the scientific and technical community, although further effort is required to increase contributions to high-impact journals and international conferences. It is recommended to intensify support for scientific publications based on validated results and to strategically target key events where the project can maximise both visibility and credibility. Participation in flagship European events and clustering initiatives should be further strengthened to ensure alignment with broader EU priorities and to enhance cross-project collaboration.

Exploitation and Market Exploration has evolved from a preparatory phase in Year 1 to a more structured and evidence-driven approach in subsequent phases. The establishment of Key Exploitable Results, the development of an Intellectual Property Rights framework, and the creation of Demo-specific exploitation plans provide a strong basis for future market uptake. As the project progresses, it is recommended to focus on the consolidation of exploitation pathways based on operational evidence, the refinement of business models, and the prioritisation of high-potential results. Greater emphasis should be placed on aligning technical validation with concrete market needs, addressing identified barriers, and preparing credible replication strategies beyond the project lifetime.

Standardisation activities have laid the groundwork for aligning HEDGE-IoT outcomes with relevant European and international frameworks. Continued engagement with standardisation bodies and initiatives is essential to ensure that project results contribute to and benefit from evolving standards in areas such as data interoperability, IoT architectures, and energy systems integration. It is recommended to further strengthen participation in targeted working groups and to translate project findings into concrete contributions, such as patterns or inputs to standards.

Community Building and Stakeholder Engagement efforts have successfully initiated connections with key stakeholders and relevant ecosystems, including European initiatives and industry networks. The establishment of these relationships is critical for ensuring the uptake and long-term sustainability of project results. In the final phase, it is recommended to deepen engagement with priority stakeholder groups—particularly policymakers, DSOs, and technology providers—through

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

targeted interactions, joint activities, and demonstration-oriented events. The organisation of a final uptake event, potentially in collaboration with sister projects and co-located with major industry events, will play a key role in consolidating these efforts.

To conclude, **the project has developed a comprehensive and coherent framework across all WP7 activities.** Moving forward, success will depend on the ability to integrate communication, dissemination, exploitation, and standardisation efforts into a unified, results-driven strategy. This includes focusing on validated outcomes, strengthening market positioning, and ensuring that HEDGE-IoT results are effectively communicated, adopted, and sustained beyond the project's duration.

Co-funded by the European Union

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

DELIVERABLE 7.4 APPENDICES

HEDGE-IoT

Holistic approach towards Empowerment of the Digitalization of the Energy Ecosystem through adoption of IoT solutions

Co-funded by the European Union

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

APPENDIX A: STANDARDISATION CONTRIBUTIONS OVERVIEW

TABLE 7. PARTNERS' CONTRIBUTIONS TO STANDARDISATION OVERVIEW

SDOs/Activity		Focus	Partners	Contribution(s)/Planned contribution(s)	Relevance for Hedge-IoT
CEN/ CENELEC	JTC21 Artificial Intelligence	Artificial Intelligence (AI)	Trialog	Monitoring harmonised standards on AI act. Focus on: • prEN 18229-1 AI trustworthiness framework – Part 1: Logging, transparency and human oversight • prEN 18229-2 AI trustworthiness framework - Part 2: Accuracy and robustness	HEDGE-IoT should align with these standard(s)
	JTC21 Artificial Intelligence WG3	Artificial Intelligence (AI)	CSL	Monitoring harmonised standards on AI Act. Focus on: • prEN 18286 "Artificial Intelligence – Quality Management System for EU AI Act Regulatory Purposes" • TR18115 "Data governance and quality for AI within the European context"	HEDGE-IoT should align with these standard(s) and possibly contribute (Assessment Templates and procedures)
	JTC13 WG9	Cybersecurity, Privacy	Trialog	Monitoring harmonised standards on CRA	HEDGE-IoT should align with these standard(s)
	JTC24 Digital Product Passport (DPP)	Digital Product Passport	Trialog	Monitoring harmonised standards on ESPR	HEDGE-IoT should align with these standard(s)
	JTC25 Data management, Dataspaces, Cloud and Edge (DDCE)	Data management, Dataspaces, Cloud and Edge	Trialog	Monitoring harmonised standards on Data act	HEDGE-IoT should align with these standard(s)
			IDSA	Trusted Data Transaction (TDT) Standards Progress: Part 1: Formal vote successfully closed with approval (editorial comments addressed). Part 2: Currently in Enquiry phase. Part 3 – Interoperability Requirements: Successfully passed CCMC Quality Check and will be submitted to the European Commission for HAS Assessment. • Technical Specification (TS) on Maturity Assessment for CEDS currently in Enquiry phase. • Internal Data Governance for Data Space Participants in final editing stage. • New PWI in CEN-CLC JTC25 WG2 on Data Space Trust Frameworks currently under ballot.	HEDGE-IoT should align with these standard(s)

				• New projects in CEN-CLC JTC 25 WG 3 launched on: ○ Data Quality ○ Overview of Data Space Standards (in preparation)	
			TNO	Data space standardisation activities	HEDGE-IoT should align with these standard(s)
CEN-CENELEC-ETSI	CoG (Coordination Group) on SG (Smart Grids) – Disbanded in August 2025	Smart Grids and Meters	Trialog	Contribution to the "Set of standards" WG: SAREF workshop (2024), gap description (information models coordination), report on the available standards for demand-response Representation of CEN/CENELEC in SEEG/D4E (Smart Energy Expert Group / Data 4 Energy WG)	Inform the EU community on the orientation of the CoG
	CoG (Coordination Group) on AES (All Electric Society) – Launched in December 2025	Smart Grids and Meters	Trialog	Contribution to the CoG-AES work definition (December 2025) Representation of CEN/CENELEC in SEEG/D4E (Smart Energy Expert Group / Data 4 Energy WG) Planned in 2026: update of the report on the available standards for demand-response	Inform the EU community on the orientation of the CoG
CENELEC	TC (Technical Committee) 205 WG 19 Ad-hoc group on Energy management ontology	Ontology management	TNO	Monitoring ad-hoc group activities and provide updates on SAREF4ENER evolution	HEDGE-IoT should align with these specifications and possibly contribute
ETSI	TC (Technical Committee) DATA (previously TC SmartM2M)	Data solutions and related interoperability services	Trialog	Monitoring harmonised standards on Data act (data catalogue and semantic asset)	HEDGE-IoT will align and contribute
			TNO	Leading SAREF development in TC DATA (previously, before April 2025, in TC SmartM2M) Active participation in all TC DATA plenary meetings (4x year) and the committee activities Active participation in all TC DATA SAREF related meetings and ad-hoc calls European Commission's Standardisation Request C(2025) 4135, for Data Act (Article 33) - European Trusted Data Framework • Deliverable 4: EN 304 199 — Data Solutions (DATA): Guidelines for Data Catalogue Framework • Deliverable 5: EN 303 760 — Data Solutions (DATA): Guidelines for Semantic Interoperability	HEDGE-IoT will align and contribute SAREF planned to be the reference in the future on interoperability.

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

				• Active participation in all rapporteurs calls for above mentioned standards (EN 304 199 and EN 303 760) • Contribution to EN 304 199 with the addition in ANNEX A of the Use Case for interoperability of Energy Smart Appliances (Contribution Number: DATA (25)000127) European Code of Conduct for Energy Smart Appliance (ESA): • Regular meetings with JRC and DG ENER to advice on SAREF use and roadmap in the CoC ESA • Presentation on SAREF to CoC ESA stakeholders at plenary yearly meeting in Brussels • Establishing a liaison of IEC TC59 with TC DATA for the EU Code of Conduct Energy Smart Appliances on EEBUS/SPINE mappings into SAREF and SAREF4ENER • Establishing a liaison of DLMS User Association with TC DATA for the EU Code of Conduct Energy Smart Appliances on DLMS/COSEM mappings into SAREF and SAREF4ENER	
	TC (Technical Committee) CYBER	Cybersecurity	Trialog	Monitoring harmonised standards on CRA ETSI - EN 304 635 (Cybersecurity requirements for hypervisors)	HEDGE-IoT should align with these standard(s)
	AI WG	Artificial Intelligence (AI)	CSL	Monitoring harmonised standards on AI Act: • ETSI TS 104 008 V1.1.1	HEDGE-IoT should align with these standard(s) (Assessment procedure and templates)
IEC	SyC (System Committee) Smart Energy WG3	Use cases, standard gaps and recommendations, roadmap	Trialog: Convenor of WG3	WG3 (smart energy roadmap): • Iterative update of the Smart Energy Roadmap and web-publication • Development of IEC SRD 63460 "Architecture and use-cases for EVs to provide grid-support functions" (published in 2025) • Digital Twins for the electrical energy system: Organisation of a workshop (120+ participants); Creation and animation of two thematic groups on "Data Harmonisation" and "Governance"	HEDGE-IoT should align with these standard(s) and possibly contribute Coordination at worldwide level on the identified gaps and the existing standards. Paving the way to EVs as "Distributed Energy Ressources" Paving the way to standards supporting Digital Twins for the electrical energy system

Co-funded by the European Union

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

	SyC Smart Energy ahG11	Energy flexibility	Trialog	ahG11 (residential demand-response): Contribution to the identification of relevant standards and implementations of residential demand-response. Contribution to ahG11 report.	HEDGE-IoT should align with these standard(s) Coordination at worldwide level on the identified gaps and the existing standards for residential flexibility.
	SyC Smart Energy WG6 Generic smart grid requirements	Generic smart grid requirements	Trialog	Contribution to numerous sections to IEC SRD 63417:2025 Guide and plan to develop a unified IEC Smart Energy Ontology	HEDGE-IoT should align with these standard(s) Guiding the development of smart energy ontologies and other domain-based ontologies within smart energy to achieve semantic interoperability through various standards, generic and specific ontologies projects
	SyC Smart Cities	Smart cities	Trialog	Contribution done on: • IEC SRD 63476-1:2024 ED1 Smart city system Ontology - Part 1: Gap Analysis • IEC SyC Smart Cities, WG 1 (Terminology): Technology Report - Ontology standards in Smart Cities (Published in 2023) • IEC SRD 63273-2: Smart city use case collection and analysis - City information modelling - Part 2: Use case analysis	HEDGE-IoT should align with these standard(s)
	TC (Technical Committee) 69	Management of Electric Vehicles charging and discharging infrastructures linked	Trialog: Member of JWG1, JWG15	Contribution to the development of ISO/IEC 15118 series Follow-up of IEC 63382 technical development	Enabling standardised smart charging and V2G. HEDGE-IoT should align with these standard(s)
	TC (Technical Committee) 57 / WG21	Use cases, interfaces and protocol profiles for systems connected to the electrical grid	Trialog	Contribution to IEC 62746-4 (data exchange for demand-response); Consistency with TC69 standards (in particular OCPP).	Alignment on data models to describe and exchange flexibility.
	TC (Technical Committee) 57 / WG10	IED communications and associated data models in power systems (IEC 61850 standard)	ABB	Attending meetings and monitoring projects	HEDGE-IoT should align with these standard(s) and possibly contribute

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216.
Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

	Standardisation Management Board (SMB) /Strategic Group (SG) 12 /WG5 SMB/SG12/WG5	Semantic interoperability in standardisation	Trialog	Contribution to the development of a guide for Flexibility	Coordination at worldwide level on the definition of flexibility and its characteristics, for reuse within each energy vertical.
ISO	TC268 Sustainable cities and communities	Sustainable cities and communities	Trialog	Attending meetings and monitoring projects	HEDGE-IoT should align with these standard(s)
ISO/IEC	JTC1 SC42 Artificial Intelligence WG1	Foundational standards	Trialog	Contribution underway • 42102 (Framework for AI system methods and capabilities)	HEDGE-IoT will align and contribute
	JTC1 SC42 Artificial Intelligence WG2	Data	Trialog	Contribution underway • 25565 De-identification of data used in machine learning	HEDGE-IoT will align
	JTC1 SC42 Artificial Intelligence WG3	Trustworthiness	Trialog	Contribution underway • 25566 Terms and concepts for domain engineering • 42117 Trustworthiness fact labels	HEDGE-IoT will align
	JTC1 SC42 Artificial Intelligence WG4	Use cases	Trialog	Contribution underway - Alignment and contribution to standards on architecture of agentic AI based on digital twin: • 42109 (Use cases of human-machine teaming) • 25589 (Framework for human-machine teaming) • PWI 25580 (Guidance for organisational implementation of human-machine teaming concept)	HEDGE-IoT will align
	JTC1 SC42 Artificial Intelligence WG5	Computational approaches and computational characteristics of AI systems	Trialog	Contribution done on: • ISO/IEC 5392:2024 Information technology - Artificial intelligence - Reference Architecture of Knowledge Engineering (KERA)	HEDGE-IoT will align
	JTC1 SC42 Artificial Intelligence Joint Advisory Group (JAG)	Technical advisory group	CSL	Participation to JAG meetings. Contributions to be considered.	HEDGE-IoT will align
	JTC1 SC41 Internet of Things and digital twin WG3	IoT Foundational Standards	Trialog	Contribution underway • 30141 (IoT Reference architecture) • 40141 (Guidance on reference architecture) Edition underway • PWI22 Architecture considerations for IoT, edge and cloud Participation to standards revision project: • ISO/IEC 30141 (3rd edition) IoT reference architecture Co-Editor	HEDGE-IoT will align

	JTC1 SC41 Internet of Things and digital twin WG4	IoT Interoperability	Trialog	Contribution of use cases and exchange profiles for the energy data spaces: • ISO/IEC 21823-5 (Behavioral and IoT interoperability) Edition underway: • 21823-1 Ed2 (Interoperability framework) Participation to standards revision project: • ISO/IEC 21823-1 Internet of things (IoT) — Interoperability for IoT systems Part 1: Framework	HEDGE-IoT will ensure alignment with SAREF
	JTC1 SC41 Internet of Things and digital twin WG6	Digital twins	Trialog	Alignment and contribution on architecture and use cases: • 30151 (digital twin extraction of data product), • 30152 (guidance to connection to data spaces), • 30153 (guidance for digital twin model construction), • 30138 (Fidelity metric of digital twin system) Edition underway • 30188 (digital twin reference architecture) • 40188 (guidance on reference architecture)	HEDGE-IoT will align
	JTC1 SC32 Data management and interchange	Data exchange, metadata	Trialog	Attending meetings and monitoring projects	HEDGE-IoT will align
	JTC1 SC38 Cloud computing and distributed platforms WG6	Data, interoperability and portability	Trialog	Contribution underway • 19941-1 (Interoperability and portability) • 20151-1 (Dataspace concepts and characteristics) • 20151-2 (dataspace trust framework) • 25850 (Dataspace use cases) [New standardisation project] • 26189 (Dataspace trust framework) • 26450 (Eclipse Dataspace Protocol) • 26451 (Eclipse decentralised claims protocol) → Contribution of use cases and exchange profiles for the energy data spaces	HEDGE-IoT will align
	JTC 1 SC38 Cloud computing and distributed platforms		IDSA	• ISO/IEC 20151 remains active in the Committee Review Meeting (CRM) phase, with the next meeting scheduled for early February. • ISO/IEC Technical Report on Use Cases for Data Spaces expanded with new use cases, including agriculture, strengthening sectoral relevance.	HEDGE-IoT will align

Co-funded by the European Union
This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

				• ISO/IEC Preliminary Work Item (PWI) on Data Space Trust Frameworks initiated, marking early groundwork on trust standardisation.	
	JTC1 SC27 Information security, cybersecurity and privacy protection		Trialog	Contribution of the security of substation edge devices and applications and orchestration services: • ISO/IEC 27568 (Security and privacy of digital twins) • ISO/IEC 27090 (AI security) • ISO/IEC 27115 (Cybersecurity evaluation of complex systems) • ISO/IEC 27116 (Customised or multipurpose evaluation) • ISO/IEC 26245 (Best practices on reuse of single evaluations for multipurpose usage) • ISO/IEC 27404 (Cybersecurity labelling framework for consumer IoT) • ISO/IEC 26601 (Guidance on cybersecurity of systems of systems) New standardisation projects: • ISO/IEC 27091 (AI privacy protection) co-editor • ISO/IEC 27116 (Support for customised or multipurpose evaluation) ??XX?	HEDGE-IoT will align
	JTC1 SC44 Iot and digital twin WG1	High level requirements and foundational concepts	Trialog	Edition underway • 26226 Usage of PETS • 31700-3 Audits • 27503 (privacy and security for intelligent travel services) New standardisation projects: • ISO/IEC 31700-2 Consumer protection — Privacy by design for consumer goods and services — Part 2: Use cases	HEDGE-IoT will align
	JTC1 WG11	Smart cities	Trialog	Attending meetings and monitoring projects	HEDGE-IoT will align
	JTC1 WG13 Trustworthiness	Trustworthiness	Trialog	Contribution underway • 31303 (Trustworthiness overview and concepts) • 31310-1 (Trustworthiness ontology (part 1: framework)	HEDGE-IoT will align
W3C	Web Standards	Advisory Committee	VUA	• Participation in discussions about roadmap W3C • Reviewing of proposed standards and recommendations	Targeted topics (semantics, interoperability, standards)

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

				• Involved in board members selection • Dissemination of news on standardisation efforts	
	Knowledge Graph Construction Community Group	Knowledge engineering and modelling	VUA	• Participation in meetings	Targeted topics (semantics, interoperability, knowledge modelling)
UNINFO	CT 533	Italian mirror group of Cen-Cenelec JTC 21 AI	CSL	Contributions to • AI Explainability (DTS 6254) • AI Impact Assessment (FDIS 42005) • SQUARE AI (DIS 42029)	Targeted topics on ethics applied to AI standardisation aspects
	CT526/GL 08	Italian group working on Professional profiles linked to artificial intelligence	CSL	Monitoring activities for ethics profiles in AI development process	Targeted topics on ethics applied to AI standardisation aspects
Other groups relevant for standardisation					
AIOTI	Standardisation WG	Standardisation	Trialog: Chair	Lead of the BRIDGE Standardisation WG	HEDGE-IoT should align with these standard(s) and possibly contribute
	Standardisation WG – Semantic Interoperability Expert Group	Semantic Interoperability	TNO: chair	Lead of the Semantic Interoperability Expert Group: • Coordination and participation in regular bi-weekly calls • Coordination of group activities • Editor and contributor of white paper on "Data to Ontology Mapping Tools " https://aioti.eu/wp-content/uploads/Data-to-Ontology-Mapping-Whitepaper-Final.pdf (September 2025) • Editor and contributor of upcoming white paper on "Language models for the engineering and application of ontologies" (Q3/4 2026) • Organisation and participation in yearly workshop on AIOTI Workshop on Semantic Interoperability s: ○ 1st AIOTI Annual Workshop on Semantic Interoperability for Digital Twins (February 2025) https://www.ercim.eu/events/aioti-workshop-on-semantic-interoperability-for-digital-twins ○ 2nd AIOTI Annual Workshop on Semantic Interoperability for Digital Twins (March 2026) https://aioti.eu/event/2nd-aioti-workshop-on-semantic-interoperability-for-digital-twins/	HEDGE-IoT should align with these standard(s) and possibly contribute

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

	Standardisation WG - Semantic Interoperability Expert Group	Semantic Interoperability	VUA	• Contribution to survey on tools for mapping to SAREF • Contribution to white paper on “Data to Ontology Mapping Tools ” https://aioti.eu/wp-content/uploads/Data-to-Ontology-Mapping-Whitepaper-Final.pdf (September 2025) • Contribution to survey on vocabularies for IoT • Contribution to investigation into use of GenAI for SAREF conversion pipeline	Targeted topics (semantics, interoperability, SAREF, smart grid)
BDVA	Task force on Data and AI Technologies	Semantic Interoperability	TNO, INESC TEC	Contribution to semantic interoperability based on the semantic energy framework/ Knowledge Engine (https://lfenergy.org/projects/semantic-energy-framework-sef/) that is also used and further developed in Hedge-IoT Connection to task force Data and AI Technologies which deals with, in the context of AI, the lack of interoperability of data and formats as well as between AI models themselves. The SIF (Semantic Interoperability Framework), as derived from the InterConnect project (TNO and INESC TEC are primarily involved) was being discussed with respect to further adoption by the BDVA.	Sustainability of open solution which is also the cornerstone of HEDGE IoT's semantic interoperability strategy.
	Task force standardisation	Standardisation	Trialog	Chair of the standardisation task force.	HEDGE-IoT should share insights to find synergies
EEBUS	Working Group	Semantic Interoperability	INESC TEC	Participation in the Spine IOT EEBUS working group: Regular meetings to support JRC’c Code of Cconduct initiative to align to operation of semantic exchange fabrics.	Hedge-.IoT pilot’s experience on applicability of semantic technologies.
			Trialog	Participation in the Spine IoT EEBUS working group: to exchange with smart appliance manufacturers, JRC CoC ESA use cases and datasets	Contribution to JRC CoC ESA.
BRIDGE	Standardisation user group	Standardisation	Trialog Chair of Data Management WG	Organisation and provision of webinars: https://www.youtube.com/playlist?list=PLbOXprZa0an2aPvjwVMNWzk_eDK9-LpAe Liaison with CEN/CLC/ETSI CoG-SG then CoG-AES	Link between EU R&I and standardisation bodies
			INESC TEC participant to the Data Management WG	Experts on Data Space reference schemes and software solutions and impacts on data management for UC adoption	Link between EU R&I and standardisation bodies Adoption of best practices and requirements for Data Management in Data Spaces

Co-funded by the European Union

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

IDSA	/	/	IDSA	Standardisation paper (to be completed https://internationaldataspaces.org/wp-content/uploads/dlm_uploads/IDSA-Position-Paper-Data-Spaces-Standardisation-Landscape-Europe-and-international-2.pdf)	The IDSA position paper outlines the current standardisation landscape for data spaces in Europe and internationally, emphasising the need for interoperable, secure, and sovereign data exchange. It positions IDSA as a key bridge between practical data space implementations and formal standardisation bodies. The HEDGE-IoT project applies these principles in the energy and IoT domain, enabling secure edge-to-cloud data sharing. In doing so, it demonstrates how standards-based data spaces can work in real industrial environments.

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

APPENDIX B: SRI WORK PERFORMED, RESULTS AND RECOMMENDATIONS

A key activity was the definition of the input-output transformation chain that ensures traceability from SRI assessment results to flexibility indicators. The mapping is structured as:

$$(S_{\text{app}}, L_s) \longrightarrow g_{k,s}(L_s) \longrightarrow Z_k \longrightarrow F_k \longrightarrow \text{Aggregated Smartness Flexibility Indicator (SFI)}$$

where $S_{\text{app}} \subseteq S$ is the set of SRI services that the assessor marks as applicable for the building and L_s is the assessed functionality level for each applicable service.

To formalise the mapping, ICCS introduced a set of ten Flex services indexed by $k \in \{1, \ldots, 10\}$. For each Flex service k, a subset $S_k \subseteq S$ of contributing SRI services is defined. Each contributing service $s \in S_k$ is assigned a normalised contribution function $g_{k,s}(L_s) \in [0,1]$, derived from its functionality level L_s, and a weight $w_{k,s} \geq 0$ such that $\sum_{s \in S_k} w_{k,s} = 1$.

The continuous Flex score is computed as:

$$Z_k = \sum_{s \in S_k} w_{k,s} \; g_{k,s}(L_s), Z_k \in [0,1].$$

Flex services are then discretised into interpretable Flex levels according to capability type:

Binary Flex (0/1):

$$F_k = \begin{cases} 1, & Z_k \geq 0.50 \\ 0, & \text{otherwise} \end{cases}$$

Three-level Flex (0/1/2):

$$F_k = \begin{cases} 0, & Z_k < 0.33 \\ 1, & 0.33 \leq Z_k < 0.67 \\ 2, & Z_k \geq 0.67 \end{cases}$$

Four-level Flex (0/1/2/3):

$$F_k = \begin{cases} 0, & Z_k < 0.20 \\ 1, & 0.20 \leq Z_k < 0.45 \\ 2, & 0.45 \leq Z_k < 0.75 \\ 3, & Z_k \geq 0.75 \end{cases}$$

These thresholds were adopted as consistent default breakpoints (and remain subject to refinement during validation).

A major methodological contribution was the replacement of "OR/ANY-of" logic with multi-criteria weighting. For every Flex service F_k, a pairwise comparison matrix $A^{(k)}$ is constructed using the Saaty 1–9 scale[7]. The matrix expresses the relative importance of service i over service j with respect

[7] https://doi.org/10.1504/IJSSCI.2008.017590

Co-funded by the European Union

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

to the Flex capability represented by F_k. From this matrix, the priority vector (weight vector) is derived from the principal eigenvector and normalised such that:

$$\sum_{s \in S_k} w_{k,s} = 1$$

Consistency of the pairwise comparisons is verified using the Consistency Ratio (CR), which is accepted when:

$$CR \leq 0.10$$

The resulting weight vectors are used in the Flex service aggregation equations:

$$Z_k = \sum_{s \in S_k} w_{k,s}\, g_{k,s}(L_s)$$

The AHP-derived weight sets used in the present implementation are summarized in the next subsection. Finally, ten Flex services $F_1, \dots, F_{10}$ were specified and completed their mapping definitions, including (i) contributing sets S_k, (ii) normalised contribution functions $g_{k,s}$, (iii) AHP-derived weights $w_{k,s}$, and (iv) the aggregation and discretisation rules.

In addition, a second-layer aggregation methodology was defined to combine the Flex services into three flexibility dimensions: observability, controllability, and storage/grid-interaction readiness and into a final Smartness Flexibility Indicator (SFI).

RESULTS AND RECOMMENDATIONS

The main result is a fully specified and implementable methodology that produces:

i. **Ten Flex services** $F_1, \dots, F_{10}$ (binary or ordinal),
ii. **Continuous intermediate scores** $Z_1, \dots, Z_{10} \in [0,1]$,
iii. A transparent separation between (a) flexibility readiness derivable from SRI and (b) flexibility attributes not derivable from SRI.

The Flex services are computed using the equations in Section 4.5.3 and the following mapping specifications (Table 8).

TABLE 8. OVERVIEW OF FLEX SERVICES USED IN THE SRI-BASED FLEXIBILITY MAPPING.

Flex Service	Name	Description
F_1	Two-way power flow	Capability of the building to export electricity back to the grid through distributed energy resources or bidirectional EV charging.
F_2	Energy storage capability	Presence of electrical and/or thermal energy storage systems that can support flexible operation.
F_3	Active power management	Capability to actively manage loads and energy flows through demand-side management (DSM), coordinated control, or optimisation platforms.
F_4	Usage detection	Ability to detect occupancy or usage patterns that enable responsive and adaptive building operation.
F_5	Reporting information	Availability and maturity of reporting functionality providing information on energy performance and system operation.

Co-funded by the European Union

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

F_6	Real-time monitoring	Capability for real-time monitoring of energy consumption, generation, environmental conditions, and system status.
F_7	Control location	Extent to which control capabilities are distributed locally (e.g., room-level or device-level) rather than only centrally implemented.
F_8	Operation type	Level of operational sophistication, ranging from scheduled operation to predictive or grid-responsive control strategies.
F_9	Response time proxy	Proxy indicator representing the responsiveness of building systems to control signals or grid interaction capabilities.
F_{10}	Control type	Degree of automation and coordination of control mechanisms relevant for flexible building operation.

This section defines the ten Flex services and their formal mapping from SRI functionality levels. The AHP-derived weights reflect the relative importance of the contributing services under a grid-flexibility prioritisation perspective.

TABLE 9: F_1 – TWO-WAY POWER FLOW (BINARY: 0/1)

Element	Specification
Contributing services S_1	{E-3, EV-16}
Normalisation	$g_{1,E3}(L) = \mathbb{I}(L = 4)$; $g_{1,EV16}(L) = \mathbb{I}(L = 2)$
Weights	$w_{1,E3} = 0.45$; $w_{1,EV16} = 0.55$
Aggregation	$Z_1 = 0.45\ \mathbb{I}(E3 = 4) + 0.55\ \mathbb{I}(EV16 = 2)$
Flex level	$F_1 = \mathbb{I}(Z_1 \geq 0.50)$

F_1 (Table 9) represents the capability of the building to export electricity back to the grid through either distributed energy resource storage or bidirectional EV charging.

TABLE 10: F_2 – ENERGY STORAGE CAPABILITY (BINARY: 0/1)

Element	Specification
Contributing services S_2	{E-3, H-1f, C-1g, DHW-1a, DHW-1b, DHW-1d}
Normalisation	$g_{2,s}(L) = \mathbb{I}(L > 0)$
Weights	E-3: 0.35; H-1f: 0.20; C-1g: 0.15; DHW-1a: 0.10; DHW-1b: 0.10; DHW-1d: 0.10
Aggregation	$Z_2 = \sum_{s \in S_2} w_{2,s}\ \mathbb{I}(L_s > 0)$
Flex level	$F_2 = \mathbb{I}(Z_2 \geq 0.50)$

F_2 (Table 10) captures the presence of electrical and/or thermal storage relevant to flexibility provision.

TABLE 11: F_3 — ACTIVE POWER MANAGEMENT (BINARY: 0/1)

Element	Specification

Co-funded by the European Union

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

Contributing services S_3	{E-4, E-8, MC-25, MC-30}
Normalisation	For E-4, E-8, MC-25: $g(L) = \mathbb{I}(L > 0)$. For MC-30: 0 if $L \in \{0,1\}$, 0.5 if $L = 2$, 1 if $L = 3$.
Weights	MC-25: 0.30; MC-30: 0.25; E-8: 0.25; E-4: 0.20
Aggregation	$Z_3 = \sum_{s \in S_3} w_{3,s}\, g_{3,s}(L_s)$
Flex level	$F_3 = \mathbb{I}(Z_3 \geq 0.50)$

F_3 (Table 11) represents the capability to actively manage energy flows through DSM, coordinated control, or optimisation platforms.

TABLE 12: F_4 — USAGE DETECTION (0/1/2)

Element	Specification
Contributing services S_4	{L-1a, MC-9, V-1a, DE-2}
Normalisation	$g_{4,L1a} = L/3$; $g_{4,MC9} = L/2$; $g_{4,V1a} = L/4$; $g_{4,DE2} = L/3$
Weights	MC-9: 0.35; V-1a: 0.25; L-1a: 0.20; DE-2: 0.20
Aggregation	$Z_4 = \sum w_{4,s} g_{4,s}(L_s)$
Flex level	0 if $Z_4 < 0.33$; 1 if $0.33 \leq Z_4 < 0.67$; 2 if $Z_4 \geq 0.67$

F_4 (Table 12) captures the maturity of occupancy and usage detection enabling responsive operation.

TABLE 13: F_5 — REPORTING INFORMATION (0/1/2)

Element	Specification
Contributing services S_5	{H-3, C-3, DHW-3, V-6, DE-4, E-2, E-11, E-12, MC-13, MC-28, EV-17}
Normalisation	For max≥3 services: 0 (L=0), 0.5 (L=1-2), 1 (L≥3). For EV-17: L/2.
Weights	MC-13: 0.18; E-12: 0.15; MC-28: 0.12; EV-17: 0.10; E-2: 0.08; E-11: 0.08; H-3: 0.07; C-3: 0.07; DHW-3: 0.06; V-6: 0.05; DE-4: 0.04
Aggregation	$Z_5 = \sum w_{5,s} g_{5,s}(L_s)$
Flex level	0 if $Z_5 < 0.33$; 1 if $0.33 \leq Z_5 < 0.67$; 2 if $Z_5 \geq 0.67$

F_5 (Table 13) measures the maturity of reporting functionality across energy and technical systems.

TABLE 14: F_6 — REAL-TIME MONITORING (0/1/2)

Element	Specification
Contributing services S_6	{E-12, MC-13, MC-28, V-6, DE-4, H-3, C-3, DHW-3, E-2, E-11, EV-17}
Normalisation	Same as F5 except DE-4 reaches full score only at level 4; EV-17 and MC-28 normalised by L/2
Weights	E-12: 0.18; MC-13: 0.16; MC-28: 0.12; EV-17: 0.10; V-6: 0.08; E-2: 0.07; E-11: 0.07; H-3: 0.06; C-3: 0.06; DHW-3: 0.05; DE-4: 0.05
Aggregation	$Z_6 = \sum w_{6,s} g_{6,s}(L_s)$
Flex level	0 if $Z_6 < 0.33$; 1 if $0.33 \leq Z_6 < 0.67$; 2 if $Z_6 \geq 0.67$

Co-funded by the European Union

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

F_6 (Table 14) reflects the capability for real-time and predictive monitoring across relevant building systems.

TABLE 15: F_7 — CONTROL LOCATION (BINARY: 0/1)

Element	Specification
Contributing services S_7	{H-1a, C-1a, L-2, V-1a, V-1c, DE-1}
Normalisation	$g_{7,s} = L/L_{max,s}$
Weights	V-1c: 0.18; V-1a: 0.18; H-1a: 0.18; DE-1: 0.18; C-1a: 0.16; L-2: 0.12
Aggregation	$Z_7 = \sum w_{7,s}(L_s/L_{max,s})$
Flex level	$F_7 = \mathbb{I}(Z_7 \geq 0.50)$

F_7 (Table 15) represents the extent to which control is distributed and locally implemented.

TABLE 16: F_8 — OPERATION TYPE (0/1/2/3)

Element	Specification
Contributing services S_8	{H-4, C-4, MC-3, E-4, E-8, DHW-1a, DHW-1b, EV-16}
Normalisation	$g_{8,s} = L/L_{max,s}$; for EV-16: L/2
Weights	EV-16: 0.18; E-8: 0.16; E-4: 0.14; MC-3: 0.14; H-4: 0.12; C-4: 0.12; DHW-1a: 0.07; DHW-1b: 0.07
Aggregation	$Z_8 = \sum w_{8,s} g_{8,s}(L_s)$
Flex level	0 if $Z_8 < 0.20$; 1 if $0.20 \leq Z_8 < 0.45$; 2 if $0.45 \leq Z_8 < 0.75$; 3 if $Z_8 \geq 0.75$

F_8 (Table 16) reflects the progression from scheduled operation to predictive, grid-responsive control.

TABLE 17: F_9 — RESPONSE TIME PROXY (0/1/2)

Element	Specification
Contributing services S_9	{EV-16, MC-25, H-4, C-4}
Normalisation	EV-16: L/2; MC-25: L/2; H-4: L/4; C-4: L/4
Weights	EV-16: 0.35; MC-25: 0.35; H-4: 0.15; C-4: 0.15
Aggregation	$Z_9 = \sum w_{9,s} g_{9,s}(L_s)$
Flex level	0 if $Z_9 < 0.33$; 1 if $0.33 \leq Z_9 < 0.67$; 2 if $Z_9 \geq 0.67$

F_9 (Table 17) represents relative responsiveness inferred from grid-interactive control maturity. It is a proxy indicator and does not measure physical response time.

TABLE 18: F_{10} — CONTROL TYPE (0/1/2)

Element	Specification
Contributing services S_{10}	{H-1c, H-1d, C-1c, C-1d, H-4, C-4, MC-25, MC-30, E-4, E-8, EV-16}
Normalisation	0 (L=0); 0.5 (L=1); 1 (L≥2); EV-16 normalised as L/2

Co-funded by the European Union

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

Weights	MC-25: 0.16; EV-16: 0.14; MC-30: 0.14; E-8: 0.12; E-4: 0.12; H-4: 0.08; C-4: 0.08; H-1d: 0.06; C-1d: 0.06; H-1c: 0.02; C-1c: 0.02
Aggregation	$Z_{10} = \sum w_{10,s} g_{10,s}(L_s)$
Flex level	0 if $Z_{10} < 0.33$; 1 if $0.33 \leq Z_{10} < 0.67$; 2 if $Z_{10} \geq 0.67$

F_{10} (Table 18) reflects the degree of automation and coordination of control mechanisms relevant for flexibility.

The Flex services defined above represent distinct flexibility-relevant capabilities of the building. In order to provide a compact and interpretable representation of overall flexibility readiness, these services are aggregated into three higher-level dimensions and subsequently into a single Smartness Flexibility Indicator (SFI). The purpose of this aggregation is to translate the detailed Flex-service representation into a compact indicator that directly reflects the three core flexibility dimensions targeted by the methodology, namely observability, controllability, and storage/grid-interaction readiness.

To preserve the full information content of the mapping, the aggregation is performed on the continuous Flex scores $Z_k \in [0,1]$, rather than on the discretised levels F_k. This avoids additional information loss due to thresholding and allows the final SFI to capture partial readiness and intermediate maturity levels.

The ten Flex services are grouped into the three dimensions. The observability dimension captures the extent to which the building can observe, detect, and report relevant conditions and energy-related states. It is therefore constructed from:

- F_4: Usage detection,
- F_5: Reporting information,
- F_6: Real-time monitoring.

The controllability dimension captures the extent to which the building can apply control actions in a coordinated, responsive, and increasingly sophisticated way. It is constructed from:

- F_7: Control location,
- F_8: Operation type,
- F_9: Response time proxy,
- F_{10}: Control type.

The storage and grid-interaction readiness dimension captures the building's readiness to store energy, manage power flows, and interact with the electricity grid. It is constructed from:

- F_1: Two-way power flow,
- F_2: Energy storage capability,
- F_3: Active power management.

Formally, the three-dimension sets are:

$$D_O = \{4,5,6\}$$
$$D_C = \{7,8,9,10\}$$
$$D_G = \{1,2,3\}$$

where D_O, D_C, and D_G denote the sets of Flex services assigned to Observability, Controllability, and Grid/Storage Readiness, respectively.

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

For each dimension, a dimension score is computed as a weighted sum of the relevant continuous Flex scores:

$$O = \sum_{k \in D_O} \alpha_k^{(O)} Z_k$$
$$C = \sum_{k \in D_C} \alpha_k^{(C)} Z_k$$
$$G = \sum_{k \in D_G} \alpha_k^{(G)} Z_k$$

with:

$$\sum_{k \in D_O} \alpha_k^{(O)} = 1, \sum_{k \in D_C} \alpha_k^{(C)} = 1, \sum_{k \in D_G} \alpha_k^{(G)} = 1$$

In the default implementation, equal weights are assigned within each dimension, since a first weighting layer has already been introduced through the AHP-derived service weights $w_{k,s}$ used in the computation of the Flex scores Z_k. Under this default assumption, the three-dimension scores become:

$$O = \frac{Z_4 + Z_5 + Z_6}{3}$$
$$C = \frac{Z_7 + Z_8 + Z_9 + Z_{10}}{4}$$
$$G = \frac{Z_1 + Z_2 + Z_3}{3}$$

Since the final reporting is expressed in percentage terms, the dimension scores are converted as:

$$O_{\%} = 100 \cdot O$$
$$C_{\%} = 100 \cdot C$$
$$G_{\%} = 100 \cdot G$$

This choice ensures that the second-layer aggregation remains transparent and does not introduce unnecessary additional subjectivity. Nevertheless, if required, the coefficients $\alpha_k^{(O)}$, $\alpha_k^{(C)}$, and $\alpha_k^{(G)}$can also be calibrated in future work, for example through expert judgment or stakeholder-oriented weighting profiles.

The overall Smartness Flexibility Indicator (SFI) is then defined as a weighted combination of the three-dimension scores:

$$SFI = \beta_O O + \beta_C C + \beta_G G$$

subject to:

$$\beta_O + \beta_C + \beta_G = 1$$

where:

- β_O is the weight assigned to observability,
- β_C is the weight assigned to controllability,
- β_G is the weight assigned to storage and grid-interaction readiness.

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

In the default formulation, equal weights are assigned to the three dimensions:

$$\beta_O = \beta_C = \beta_G = \frac{1}{3}$$

which gives:

$$SFI = \frac{O + C + G}{3}$$

Substituting the previous equations, the full default formulation becomes:

$$SFI = \frac{1}{3}\left(\frac{Z_4 + Z_5 + Z_6}{3} + \frac{Z_7 + Z_8 + Z_9 + Z_{10}}{4} + \frac{Z_1 + Z_2 + Z_3}{3}\right)$$

To express the final indicator in percentage form, the SFI is reported as:

$$SFI_{\%} = 100 \cdot SFI$$

Equivalently,

$$SFI_{\%} = \frac{100}{3}\left(\frac{Z_4 + Z_5 + Z_6}{3} + \frac{Z_7 + Z_8 + Z_9 + Z_{10}}{4} + \frac{Z_1 + Z_2 + Z_3}{3}\right)$$

This scalar $SFI_{\%}$ provides a single normalised flexibility-readiness value in the interval [0, 100], while still allowing full decomposition into the three dimension scores $O_{\%}$, $C_{\%}$, and $G_{\%}$.

The resulting SFI can be interpreted as follows:

$$SFI_{\%} \in [0,100]$$

with values closer to 0% indicating very limited flexibility readiness and values closer to 100% indicating high static flexibility readiness as captured by the SRI-based methodology.
For communication and benchmarking purposes, the final SFI may also be interpreted through qualitative SFI classes.

$$SFI_{\text{class}} = \begin{cases} \text{Low} & \text{if } SFI_{\%} < 33\% \\ \text{Medium} & \text{if } 33\% \leq SFI_{\%} < 67\% \\ \text{High} & \text{if } SFI_{\%} \geq 67\% \end{cases}$$

A similar qualitative interpretation may also be assigned separately to the three dimension scores $O_{\%}$, $C_{\%}$, and $G_{\%}$, enabling the final result to be presented both as a single scalar indicator and as a three-dimensional flexibility profile. In this representation, the three dimension scores correspond respectively to the observability, controllability, and storage/grid-interaction readiness capabilities of the building. This allows the flexibility readiness of a building to be analysed along three complementary axes rather than only through a single aggregated value. Such a representation supports clearer benchmarking across buildings and facilitates the identification of strengths and gaps in specific flexibility dimensions.

In addition to the technical implementation of the methodology, the results are also relevant for dissemination and knowledge exchange with ongoing European initiatives related to smart buildings, flexibility, and the SRI. In particular, the outcomes of this work may be disseminated and discussed with relevant European initiatives and expert groups, including the Smart Readiness Indicator (SRI) Platform[8], the Concerted Action on the Energy Performance of Buildings Directive

[8] https://energy.ec.europa.eu/topics/energy-efficiency/energy-performance-buildings/smart-readiness-indicator_en

Co-funded by the European Union

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

(CA EPBD)[9], the BRIDGE initiative[10], the Smart Energy Expert Group (SEEG)[11], and the European Technology and Innovation Platform on Smart Networks for Energy Transition (ETIP SNET)[12]. Disseminating the results through these initiatives can support alignment with ongoing European policy developments, facilitate knowledge exchange with other research and innovation projects, and contribute to the broader discussion on how SRI-based assessments can support grid-interactive and flexibility-ready buildings.

[9] https://www.ca-epbd.eu/
[10] https://bridge-smart-grid-storage-systems-digital-projects.ec.europa.eu/
[11] https://energy.ec.europa.eu/topics/eus-energy-system/digitalisation-energy-system_en#smart-energy-expert-group
[12] https://smart-networks-energy-transition.ec.europa.eu/

Co-funded by the European Union

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Grant Agreement number 101136216. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

HEDGE-IoT