HEDGE-IoT

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

D3.1
HEDGE-IoT Interfaces and Tools for Interoperability

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DOCUMENT CONTROL SHEET

PROJECT INFORMATION

Project Number	101136216		
Project Acronym	HEDGE-IoT		
Project Full title	Holistic Approach towards Empowerment of the Digitalization of the Energy Ecosystem through adoption of IoT solutions		
Project Start Date	01 January 2024		
Project Duration	42 months		
Funding Instrument	Horizon Europe Framework Programme	Type of action	HORIZON-IA HORIZON Innovation Actions
Call	HORIZON-CL5-2023-D3-01-15		
Topic	Supporting the green and digital transformation of the energy ecosystem and enhancing its resilience through the development and piloting of AI-IoT Edge-cloud and platform solutions		
Coordinator	European Dynamics Luxembourg SA		

DELIVERABLE INFORMATION

Deliverable No.	D3.1							
Deliverable Title	HEDGE-IoT Interfaces and Tools for Interoperability							
Work-Package No.	WP3							
Work-Package Title	Technological Enablers Specification, Design And Development							
Lead Beneficiary	TNO							
Main Author	TNO							
Other Authors	TRIALOG, INESC, HENEX, TNO, KONC, VU, APIO, NESTER, ABB, TAU, ICCS, RWTH, ENERV, PPC, HEDNO, IPTO, ARETI, AB, DST							
Due date	M13							
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							

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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

DOCUMENT REVISION HISTORY

Version	Date	Description of change	List of contributor(s)
0.1	16-12-2024	Early Draft with Table of Contents	Laura Daniele (TNO)
0.2	10-01-2025	Methodology	Laura Daniele (TNO) Barry Nouwt (TNO)
0.3	13-01-2025	Survey structure and Survey results	Laura Daniele (TNO), Barry Nouwt (TNO)
0.4	14-01-2025	Review Survey structure and Survey results	Laura Daniele (TNO) Barry Nouwt (TNO)
0.5	16-01-2025	Introduction	Laura Daniele (TNO) Barry Nouwt (TNO)
0.6	17-01-2025	Discussion and Appendix A	Laura Daniele (TNO) Barry Nouwt (TNO)
0.7	20-01-2025	Incorporation of pilot responses to survey into Appendix B.	Barry Nouwt (TNO) Laura Daniele (TNO) Katharina W Vasco Campos (INESC TEC) Sotiris Filippou (HENEX) Wouter van den Berg (TNO) Josipa Stegić (KONC) Xander Wilcke (VU) Mattia Alfieri (APIO) Mateo Cardenas (NESTER) Anna Kulmala (ABB) Mehdi Attar (TAU) Nikos Dimitropoulos (ICCS)
0.8	21-01-2025	Finalisation for internal reviewers. Addition of Executive Summary.	Laura Daniele (TNO) Barry Nouwt (TNO) Gjalt Loots (TNO)
0.9	24-01-2025	Review by TRIALOG	Léo Cornec (TRIALOG)
0.10	28-01-2025	Review by INESC TEC	Vasco Campos (INESC TEC) Fábio Coelho (INESC TEC) Paulo Monteiro (INESC TEC)
0.11	29-01-2025	Processing of reviewers' comments	Laura Daniele (TNO)
0.9	30-01-2025	Full complete version	Laura Daniele (TNO)
1.0	03-02-2025	Final Review	Lenos Peratitis (ED) Nikos Bllidis (ED)

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PARTNERS

Participant number	Participant organisation name	Short name	Country
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4	EREVNITIKO PANEPISTIMIAKO INSTITOUTO SYSTIMATON EPIKOINONION KAI YPOLOGISTON	ICCS	EL
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7	TAMPEREEN KORKEAKOULUSAATIO SR	TAU	FI
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14	HRVATSKI OPERATOR PRIJENOSNOG SUSTAVA D.D.	HOPS	HR
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16	CLUSTER VIOOIKONOMIAS KAI PERIVALLONTOS DYTIKIS MAKEDONIAS	CLUBE	EL
17	F6S NETWORK IRELAND LIMITED	F6S	IE

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18	SOCIAL OPEN AND INCLUSIVE INNOVATION ASTIKI MI KERDOSKOPIKI ETAIREIA	INCL	EL
19	ABB OY	ABB	FI
20	ENERVA OY	ENERV	FI
21	JARVI-SUOMEN ENERGIA OY	JSE	FI
22	DIMOSIA EPICHEIRISI ILEKTRISMOU ANONYMI ETAIREIA	PPC	EL
23	DIACHEIRISTIS ELLINIKOU DIKTYOU DIANOMIS ELEKTRIKIS ENERGEIAS AE	HEDNO	EL
24	INDEPENDENT POWER TRANSMISSION OPERATOR SA	IPTO	EL
25	ELLINIKO HRIMATISTIRIO ENERGEIAS	HENEX	EL
26	HARDWARE AND SOFTWARE ENGINEERING EPE	HSE	EL
27	QUE TECHNOLOGIES KEFALAIOUCHIKI ETAIREIA	QUE	EL
28	ARETI S.P.A.	ARETI	IT
29	APIO S.R.L.	APIO	IT
30	ACEA ENERGIA SPA	AE	IT
~~31~~	~~VOLKERWESSELS ICITY B.V.~~	~~VWICI~~	~~NL~~
32	ARNHEMS BUITEN BV	AB	NL
33	STICHTING VU	VU	NL
34	COOPERATIVE ELECTRICA DO VALE DESTE CRL	CEVE	PT
35	REN - REDE ELECTRICA NACIONAL SA	REN	PT
36	MC SHARED SERVICES SA	SONAE	PT
37	ELES DOO SISTEMSKI OPERATER PRENOSNEGA ELEKTROENERGETSKEGA OMREZJA	ELES	SI
38	ELEKTRO GORENJSKA PODJETJE ZA DISTRIBUCIJO ELEKTRICNE ENERGIJE DD	EG	SI
39	OPERATO DOO	OPR	SI

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40	SVEUCILISTE U ZAGREBU FAKULTET ELEKTROTEHNIKE I RACUNARSTVA	UNIZG	HR
41	INSTITUT JOZEF STEFAN	JSI	SI
42	KONCAR - DIGITAL DOO ZA DIGITALNE USLUGE	KONC	HR
43	DS TECH SRL	DST	IT
44	CYBERSOCIAL LAB SRL IMPRESA SOCIALE	CSL	IT

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EXECUTIVE SUMMARY

HEDGE-IoT (Holistic Energy Decentralized Grid for Enhanced Iot) is a project funded by the European Union's Horizon Europe research and innovation program. The project aims to develop an interoperable digital framework for the energy ecosystem, focusing on the deployment of Internet-of-Things (IoT) assets at different levels of the energy system, from the Transmission System Operator (TSO) level to behind-the-meter.

The project team has conducted a survey among its partners to map the existing digital interfaces, platforms, and tools that will be used to deploy interoperable solutions in 6 pilot projects across Europe. The survey collected information on the platforms' purpose, origin, openness, license, owner, and Technology Readiness Level (TRL), as well as their use of Artificial Intelligence (AI) and compliance with relevant regulations.

The survey results show a variety of technologies that cover different parts of the energy value chain, from the TSO and Distribution System Operator (DSO) level to behind-the-meter at the home premises. Most of the platforms are provided by partners that directly participate in the HEDGE-IoT project and originated from previous European research projects. Some platforms are open source or are expected to become open source in the future. The rest are proprietary platforms.

The TRL of the identified platforms is rather high, with most of them being at least validated in a relevant environment. The use of AI is limited within the submitted platforms, and of those that do, most use machine learning techniques.

All HEDGE-IoT national pilot projects have submitted one or more platforms, and two platforms indicated they are expected to be used in more than one national pilot. Most platforms play a central role in their pilot architecture and are deployed either in the edge or the cloud. The examined platforms are fairly distributed over various parts of the energy value chain.

Out of the 12 platforms, seven plan to integrate with a data space connector, and those that do not have such a plan yet cite various reasons such as already conforming to existing domain-specific standards or requiring high-volume, real-time data exchange. Most platforms do not indicate a preference for a specific data space connector, and those that do, mostly prefer the Eclipse Dataspace Component (EDC) connector.

Most of the responses to the survey acknowledge the need for semantic interoperability, indicating that their platforms already support it or consider adding support for it in the future. The most used protocol by the platforms is the Representational State Transfer (REST), and the most used data format is the JavaScript Object Notation (JSON), aligning with de facto industry standards.

The 12 platforms together submitted about 40 interfaces and services, with most indicating that their platforms will be extended with additional interfaces, services, or tools during the project's lifetime.

Ultimately, the results of the survey conducted in Task 3.1 show a promising landscape of technologies for the HEDGE-IoT project, with high maturity, a distribution across the energy value chain and a fair presence on open source. The project aims to further leverage these technologies to develop an interoperable digital framework for the energy ecosystem, enabling the efficient integration of IoT assets and the transition towards a decentralised and sustainable energy future.

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ABBREVIATIONS

Abbreviation	Full description
AI	Artificial Intelligence
AIOTI	Alliance for AI, IoT and Edge Continuum Innovation
B2B	Business to Business
B2C	Business to Consumer
BUC	Business Use Case
BEMS	Building Energy Management System
CIM	Common Information Model
CM	Congestion Management
CSV	Comma Separated Values
DNP3	Distributed Network Protocol 3
DSO	Distribution System Operator
EC	European Commission
EDC	Eclipse Dataspace Component
EMS	Energy Management System
ETSI	European Telecommunication Standardization Institute
EU	European Union
HEDGE-IoT	Holistic Energy Decentralized Grid for Enhanced Iot
FSP	Flexibility Service Provider
GDPR	General Data Protection Regulation
HTTP	Hypertext Transfer Protocol
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers

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IoT	Internet of Things
IP	Intellectual Property
JSON	JavaScript Object Notation
LLM	Large Language Model
LFM	Local Flexibility Market
ML	Machine Learning
NEMO	Nominated Electricity Market Operator
MQTT	Message Queuing Telemetry Transport
RDF	Resource Description Framework
OCPP	Open Charge Point Protocol
OWL	Web Ontology Language
REST	Representational State Transfer
SHACL	Shapes Constraint Language
SME	Small and Medium-sized Enterprise
TRL	Technology Readiness Level
TSG	TNO Security Gateway
TSO	Transmission System Operator
SAREF	Smart Applications REFerence Ontology
SIF	Semantic Interoperability Framework
SOSA	Sensor, Observation, Sample and Actuator
SUC	System Use Case
WoT	Web of Things
WP	Work Package
XML	eXtensible Markup Language
YAML	Yet Another Markup Language

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1 INTRODUCTION

1.1 HEDGE-IOT PROJECT INTRODUCTION AND SUMMARY

The HEDGE-IoT (Holistic Energy Decentralized Grid for Enhanced IoT) project proposes a novel digital framework that aims to deploy IoT assets at multiple levels of the energy system (from behind-the-meter, up to the TSO level), to add intelligence to the edge and cloud layers through advanced AI/ML tools and to bridge the cloud/edge continuum introducing federated applications governed by advanced computational orchestration solutions. The HEDGE-IoT Framework will upgrade the RES-hosting capacity of the energy systems and unleash a previously untapped flexibility potential. It will increase the resilience of the grid, create new market opportunities and promote advances in IoT standardization, by introducing and managing a plethora of diversified, interoperable energy services over scalable and highly distributed data platforms and infrastructure. The multi-dimensional framework of HEDGE-IoT comprises the following pillars: (a) the Technology Facilitator pillar – it will exploit the computational sharing by offloading applications on the grid edge, towards providing a set of AI/ML federated learning and swarm computing applications; (b) the Interoperability pillar - leverages on leading-edge interoperable architectures, such as the data space architectures; (c) the Standardisation pillar – it will enable all involved platforms, systems, tools and actors to seamlessly communicate and exchange data in standardised formats using widely used standards, such as SAREF[1], etc.; (d) the Digital Energy Ecosystem enabling pillar – it will ensure the creation of an ecosystem facilitating the increased integration of RES and characterised by resilience. Liaisons with EU initiatives for IoT and digitalisation will be established (e.g., the AIOTI), and the engagement of stakeholders will be ensured by addressing IoT ethics and cultivating trust among end-users, thus promoting inclusivity. Scalability and replicability studies will be performed, and connections with innovators and SMEs will be established through the open call mechanism of the project.

1.2 SCOPE OF THE DOCUMENT

This document is the first deliverable from the Task 3.1 project, which aims to facilitate the integration of various digital interfaces, platforms and tools used in the various pilots into a digital interoperability framework across the entire project. The scope of this document is to provide an overview, at an early stage of the project, of the main technology (in terms of platforms, interfaces and tools) that will be deployed and eventually extended in the various pilots throughout the lifespan of the project. This overview is useful as general information for the project partners to learn about each other's pilots, but also for an external audience to learn about the starting point of the project in terms of the technology that is used. This overview is also instrumental for tracking progress over time and will guide the selection, in a subsequent phase of Task 3.1, of the (parts of the) platforms, interfaces and tools that will need to become interoperable via the common interoperability framework of the project. While this overview presents the main technology that is most relevant for the various pilots, it does not aim to provide an exhaustive picture of all the technology used in the project, as certain platforms, interfaces and tools that are instrumental (and vertical) for certain

[1] https://saref.etsi.org/

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parts of a pilot, may not be relevant in the broader scope of the horizontal common interoperability framework of the overall project.

1.3 INTENDED AUDIENCE OF THE DOCUMENT

This document is intended as a tool for the following audience:

- project partners of the HEDGE-IoT consortium, to learn about each other's pilots and main technologies.
- future project partners that will be appointed in later stage via open calls, enabling them to learn about the key technologies used in the pilots, and identify opportunities to build upon in their sub-projects.
- external stakeholders that are interested in:
    - Gaining insights into the key platforms, interfaces and tools used in the HEDGE-IoT project (state-of-the-art);
    - finding a reference about these state-of-the-art technologies, if interested in gathering further information and/or apply them in their own projects;
    - understanding the (initial steps of the) approach used in HEDGE-IoT to enable interoperability across the energy and IoT ecosystem via a digital framework that is common to the project.

As a guide to this intended audience, we refer to Section 0 the reader interested in getting acquainted with the context of this work and the methodology we have used, especially in relation to the other relevant tasks and work packages of the HEDGE-IoT project.

We suggest to the reader interested in the details of the main technologies deployed by the pilots to inspect directly Appendix B (Section 9), which contains the inventory of platforms, interfaces and tools that form the basis of this work.

We further refer to Appendix A (Section 8) the reader interested in inspecting the template that we distributed among the partners to compile the inventory presented in Appendix B (Section 9).

The reader eager to understand the rationale behind the survey's template and the specific questions designed to make our technology inventory, is referred to Section 3.

The reader interested in the presentation of the general results of our survey and the trends we observed across the various individual responses from the different pilots, is referred to Section 0.

We finally refer to Section 5 the reader interested in an elaborate discussion of the results observed in Section 0.

1.4 STRUCTURE OF THE DOCUMENT

This document structured as follows:

Section 0 presents the methodology followed in this work, positioning it in relation to the other relevant tasks of the HEDGE-IoT project.

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Section 3 details the survey distributed among project partners to catalogue the platforms, interfaces and tools deployed in the HEDGE-IoT pilots. It further provides the rationale beyond the survey's structure and its specific questions.

Section 0 consolidates the individual specific responses of the survey into general results, presenting an analysis of the main findings and trends that we have generally observed.

Section 5 proposes a discussion of the results analysed in Section 4, as a guideline for their interpretation and as basis for the continuation of the project.

Section 0 presents our conclusion and outlines the next steps.

Appendix A (Section 8) provides the template of the survey that we have distributed among the partners to take stock of the platforms, interfaces and tools available in the HEDGE-IoT project.

Appendix B (Section 9) presents the details of the 12 different responses that we have collected in our survey.

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2 METHODOLOGY

This document is the first deliverable of Task 3.1, which aims to facilitate the integration of various digital interfaces, platforms and tools used across the project's pilots into a common digital interoperability framework, to be developed in WP4.

Figure 1 illustrates the methodology adopted in Task 3.1 in relation to other relevant tasks and WPs in the project.

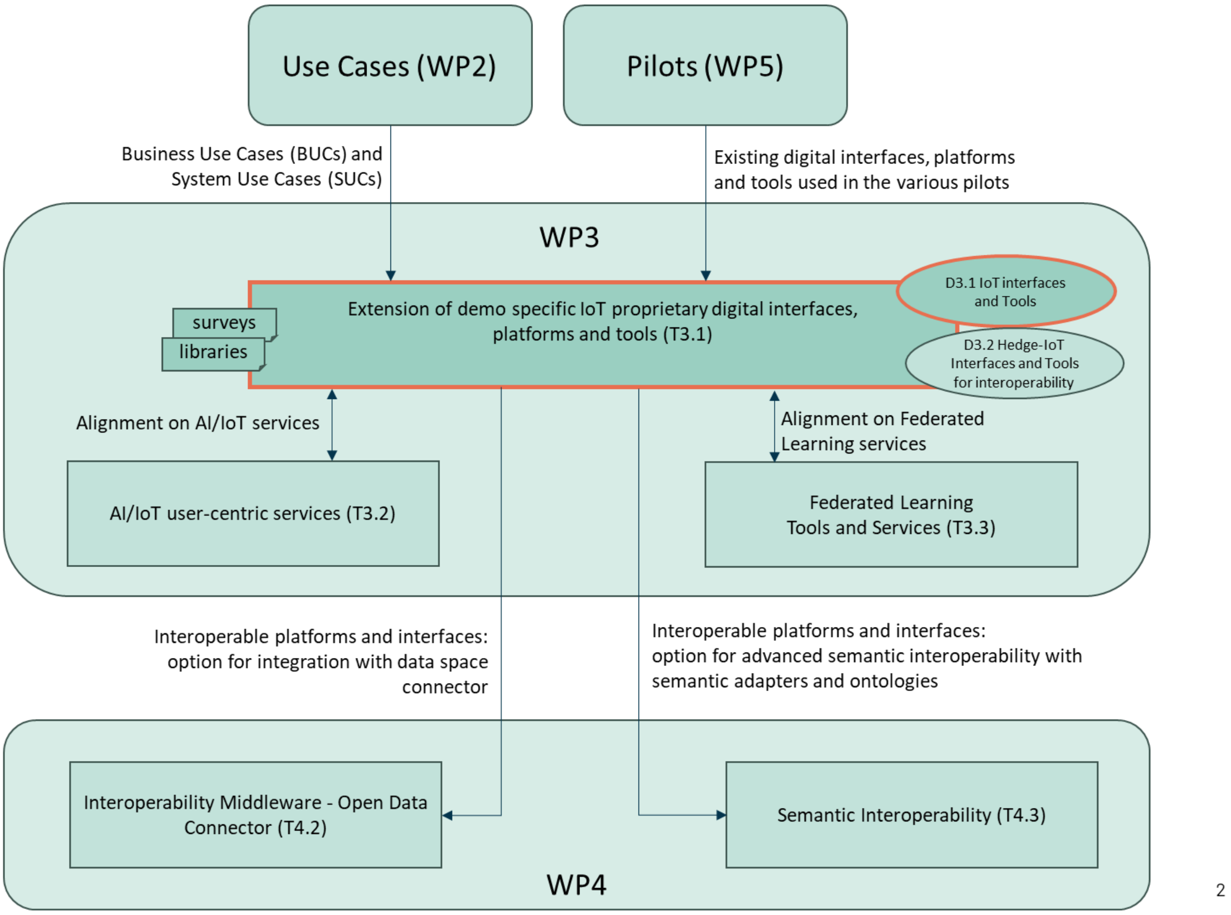

FIGURE 1. THE METHODOLOGY OF TASK 3.1 IN RELATION TO OTHER RELEVANT TASKS AND WPS OF THE PROJECT

The goal of this document (D3.1) is to catalogue the existing platforms, interfaces and tools that will be used as a foundation for deploying the HEDGE-IoT solutions in the six project pilots: Finland, Greece, Italy, Netherlands, Portugal and Slovenia. In this way, we can provide an overview of the main technologies relevant for each pilot in the initial phase of the project. This overview serves as a reference point to monitor technological evolution over time, particularly concerning technology maturity level. Moreover, it provides a foundation for identifying recurring components and fosters the reuse of (parts of) these platforms, interfaces and tools across pilots in the continuation of Task

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3.1. The results of this deliverable will inform the next phase of Task 3.1, where the required level of interoperability for each platform, interface and tool (ranging from an entry point interoperability for fast integration, to an advanced interoperability option with semantics and reasoning) will be assessed and included in the follow up deliverable D3.2 on "HEDGE-IoT interfaces and tools for interoperability", also depicted in Figure 1. This subset of interoperable components will be then integrated into the digital framework common to the project in Task 4.2 "Interoperability middleware - open data connector" (if an entry-point interoperability and data space connectors are required), and/or in the Task 4.3 "Semantic interoperability" (if advanced semantic interoperability enabled by semantic adapters as gateways to data exchange is required).

In the present document, to map the proprietary digital interfaces, platform, and tools to be engaged and deployed within the pilots, we created a survey that has been distributed among the partners. A standardized template, accompanied by example platforms, was provided to guide partners in completing the survey. The survey's template can be found in Section 8 – Appendix A of this document. Furthermore, we organized several sessions to support the partners with their questions and clarify their doubts. This structured approach has proven effective in collecting input from a large consortium with numerous pilots, keeping the partners engaged and motivated through focused and concise requests for contributions, while ensuring high visibility of results at any time during the process, guaranteeing a consistency of responses across different pilots and facilitating the analysis of the results. Each pilot had the option to submit the survey more than once, as needed, depending on the number of platforms planned to be used. Together with platforms, we have taken stock also of related interfaces, tools and interoperability plans. Therefore, a certain platform could also provide one or more related interfaces and tools. As a result, we collected twelve different responses to the survey, which are included in Section 9 - Appendix B of this deliverable.

3 SURVEY STRUCTURE

The survey was structured in several sections, clustering related topics to facilitate completion by partners and streamline analysis of results. The survey is composed of the following sections:

- **Platforms:** overview of the platform focused on its purpose, openness and TRL;
- **Legislation:** B2C platforms compliance with GDPR and the EU AI Act;
- **Pilot architecture:** platform's position on the pilot, reusability and deployment;
- **Dataspace connector:** plans to integrate a dataspace connector in the platform;
- **Semantic interoperability:** types of data models and ontologies used and further plans for semantic interoperability;
- **Interfaces, services and tools:** initial in-depth analysis of functionalities within the platforms.

The details and rationale for this structure are provided in the sub-sections hereafter.

3.1 PLATFORMS

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The first section concerns **platform details** and collects information such as the platform's name, purpose, a short description, provider(s), origin, openness, license, owner, and the Technology Readiness Level (TRL). An overview of platform purposes is instrumental in quickly assessing the scope of the different technologies used throughout the project and identifying commonalities. A short description is requested for reporting purposes. The platform provider(s) serve as a reference, allowing the reader to identify the appropriate contact for further information. The platform's origin provides insights into whether the technology has been developed in the context of a research project and/or through commercial funding. The question of openness is related to reusing and eventually extending the technology, as an open-source initiative facilitates, to a certain extent, these aspects. Clear license and Intellectual Property (IP) ownership are key aspects in pre-competitive research projects such as HEDGE-IoT, where multiple parties collaborate on innovations, re-using and/or extending existing platforms, interfaces and tools. TRL is an important concept introduced by the European Union's research framework program Horizon2020 [1]. It is used to assess the maturity of a certain technology, ranging from early formulation of the technology concept (low TRL) to complete systems proven in operational environments (high TRL). Assessing the TRL level of the platforms, interfaces and tools at the beginning of the project helps us to track their evolution throughout the lifespan of the project. In our survey, we asked the partners to assess their technology based on TRLs defined as follows:

- TRL 1 Basic principles observed
- TRL 2 Technology concept formulated
- TRL 3 Experimental proof of concept
- TRL 4 Technology validated in lab
- TRL 5 Technology validated in relevant environment
- TRL 6 Technology demonstrated in relevant environment
- TRL 7 System prototype demonstration in operational environment
- TRL 8 System complete and qualified
- TRL 9 Actual system proven in operational environment

3.2 LEGISLATION

The section concerning **legislation** examines regulatory aspects, particularly when surveyed platforms, interfaces and tools are used for a Business-to-Consumer (B2C) purpose, directly involving an individual end customers. In this case, it becomes even more important that the technology under consideration complies with the General Data Protection Regulation (GDPR) or relevant regulation for user privacy protection. Additionally, an assessment of whether the technology makes use of an Artificial Intelligence (AI) component, based on, for example, Machine Learning (ML) or Large Language Models (LLM) is conducted, and, if so, whether it complies with the EU AI Act[2].

3.3 PILOT ARCHITECTURE

[2] https://www.europarl.europa.eu/topics/en/article/20230601STO93804/eu-ai-act-first-regulation-on-artificial-intelligence

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A dedicated section investigates the available platforms, interfaces and tools in relation to the **pilot's architecture** in which they are used. The same platform (or interface or service) can be used by one or more pilots. Additionally, we assess whether the platform is deployed at the edge, fog or cloud level in the architecture. Since enabling interoperability is a key objective of the project, the direct reuse of (parts of) platforms in different pilots is beneficial. However, full reuse of one single platform (for a certain purpose) across all pilots is unrealistic, as the market is characterised by fragmentated solutions from multiple vendors, and there is no winning solution that could be used with general consensus. Therefore, while reuse is a best-practice that we encourage, the way we foresee interoperability is by creating a common interoperability framework to which different platforms (like the ones we collected in this survey, or any other from external parties that will be incorporated via open calls in a later stage of the project) can be connected. As a basis for such a framework, we requested an architectural diagram illustrating where the platform is positioned, in its main architectural building blocks. To better understand the application of the examined platforms, we further asked the partners to link their platform(s) to the Business Use Cases (BUCs) defined in D2.1 "Requirements on an IoT Could/Edge system for the Energy Ecosystem" [2] and the System Use Cases (SUCs) defined in D2.2 "Functional Specification of the HEDGE-IoT system" [3].

3.4 DATASPACE CONNECTOR

Given the importance of the **data space connector** in ensuring seamless and secure data exchange between devices on the edge and operational platforms, we included a dedicated section in the survey to investigate this aspect. While detailing the data space connector is outside the scope of this deliverable, the initial results from this survey can be used as input to Task 4.2, which focuses on deploying and integrating the data space connector into the HEDGE-IoT interoperability framework. To that end, we asked the partners whether they plan to have a data space connector in their platform and, if not, to justify their answer. For those platforms that plan to have a data space connector, we further requested to position it in the architectural diagram previously provided, and whether there is a preference for a specific connector (e.g., Eclipse Dataspace Component (EDC), OneNet True Connector, TNO Security Gateway (TSG), etc.) and the reason for this preference.

3.5 SEMANTIC INTEROPERABILITY

The section is central to the deliverable as it examines aspects concerning **semantic interoperability**, by investigating the landscape of the various protocols, data formats, data models and ontologies used in the pilots, as a foundation for integration into to the common interoperability layer in Task 4.3. To that end, we investigated whether the submitted platforms already provide (or consider soon) support for semantic interoperability and, if so, where in the architectural diagram previously provided such support is visible. We further enquired which ontologies and/or data models are currently used, if any, with special attention to the Smart Applications REFerence Ontology (SAREF)[3] standardised by the European Telecommunication Standardisation Institute (ETSI), which is used as main pilar for semantic interoperability in the HEDGE-IoT project, and will be eventually extended in Task 4.3, if needed, to accommodate new requirements from the pilots.

[3] https://saref.etsi.org/

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We also made an inventory of the main protocols and formats used by the submitted platforms and interfaces at the underlying communication level to exchange data.

3.6 INTERFACES, SERVICES AND TOOLS

The final section of the survey is designed to take stock of technological components at a fine-grained granularity level, such as the **interfaces, services and tools** that can be part of a certain platform. For this deliverable, we define a platform as a digital infrastructure on which some software is executed and that supports the exchange of information and data with external parties. Within the platform, services provide various types of functionalities to external parties, while interfaces are used to describe these services, i.e., they are the means through which a service can be accessed and utilised. In our survey, tools and wizards are intended to assist developers in certain tasks, e.g., development or configuration, and/or support end users to break complex processes into smaller and more manageable steps. Although an in-depth analysis of interfaces and services is the goal of parallel Tasks 3.2 and 3.3, our survey provides an initial assessment of existing interfaces, services, tools and wizards within the project. Additionally, we enquired whether there are plans to extend the platforms with new interfaces, services and/or tools during the lifespan of the project.

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4 SURVEY RESULTS

This section presents the survey results and the key observed trends, using charts to aid data visualization, This section follows the same sub-section structure as Section 3.

4.1 PLATFORMS

We have received a total of 12 individual responses from all 6 pilots within the project. The name and a short description of the platforms submitted via the survey are listed in Table 1.

Name	Description
Hedge IoT LFM Platform	The Hedge IoT LFM Platform is designed to enable and facilitate Local Flexibility Market (LFM) trading. It provides a digital marketplace where energy producers, consumers, and prosumers (those who both produce and consume energy) can trade energy flexibility in real time. By connecting IoT devices and smart meters, the platform gathers data on energy demand, supply, and flexibility needs. This information enables participants to offer flexibility services—such as adjusting energy consumption or production levels—which grid operators can purchase to balance the local grid.
Semantic Treehouse	Semantic Treehouse is an open-source web application created by TNO. In data spaces it plays the role of the Vocabulary Hub component. It is designed to boost adoption of semantic standards by facilitating open standardization.
PowerCIM	The PowerCIM platform enables grid model data persistence and exchange using the widely deployed IEC Common Information Model standards and data formats, enabling efficient versioned model data management and semantic enrichment of telemetry time series data. The platform components are: 1. Core repository server, 2. Model viewer front end, 3. Standard IEC 61970-552 CIM/XML adapter, 4. Generic SQL and CSV adapters, 5. CIM UML metamodel management, 6. Data flow orchestrator The platform currently supports network equipment data (CIM EQ profile), network state data (CIM SSH and SV profiles), geographic layout data (CIM GL profile). In the near future we envision support for topology processing data (CIM TP profile) and schematic diagram data (CIM DL profile).
AI services for local grid resilience	This platform will actively monitor the functioning of the grid and will detect (technical) anomalies within a series of measurements provided by devices hosted at Arnhems Buiten, aiming to report possible (future) irregularities within the system.
Apio Platform	The Apio Platform is a multi-tenant data-driven IoT platform that provides energy value chain stakeholders with the ability to connect and manage assets, ingest, analyze and export data and support data driven decision making. It features well-known standards, such as MQTTS and JSON REST APIs to interact with any of its functionalities and to integrate it with any other service as well as other well-known data formats such as Parquet and Arrow for time-series data. Supporting multiple stakeholder profiles, it features several modules, such as Renewable Assets Management, Flexibility Management, Virtual Power Plant Management and more.
Real-Time Reserve Market Simulator	The Real-Time Reserve Market Simulator (MS) is an in-house developed tool that evaluates the performance of a bid submitted for a particular time frame in comparison with historical bids retrieved from ENTSO-E Transparency Platform. The platform validates the structure of the bid, applies the necessary market rules for the selected Ancillary Service and determines if the bid could be accepted in the corresponding market clearing process. In addition, it can issue activation signals/messages and perform settlement calculations.
ABB edge platform	The platform enables sharing high volume data with strict real-time requirements between different applications that are executed on an edge server in a virtualization environment.
Dynamic and automated B2B energy data and flexibility service platform	The platform will include data sharing between different stakeholders including DSO, NEMO and flexibility service provider (FSP) to realize predictive congestion management (CM). In addition, the platform provides the possibility through eclipse dataspace connector to exchange data with real-time CM algorithms running on the edge.
EdgeConnect	EdgeConnect is a digital platform that provides stakeholders (i.e., consumers, service providers, aggregators, DSOs) along the value chain of flexibility provision with an integrated ecosystem to support all main activities in this value chain, to help identify, unlock and make use of all

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	available flexibility potential. As a multi-stakeholder platform, it comprehends several views, providing distinct value propositions for each stakeholder.
Semantic Interoperability Framework (SIF) (based on H2020 InterConnect)	SIF enables data exchange and reasoning based on semantically enriched information, providing distributed IoT EDGE/CLOUD/FOG support. The platform consists of two main components: (1) the Knowledge Engine (KE) for data exchange, and (2) the SAREF framework of ontologies as a common language. The platform's architecture supports semantic adapters for different protocols and data formats. It uses semantic adapters to map different data models to SAREF.
Home Management System (not a platform)	The solution requires installations of hardware components on the edge to track and monitor energy consumption dynamics. It can monitor the full electricity consumption and separate appliances, as well as small scale DERs (heat pumps, PVs and testing with BESS). The platform works as a unified solution, with advanced energy analytics, user interfaces and control mechanisms by users' input.
AI-library for energy applications	As part of numerous EU-funded projects, ICCS AI-based models and tools for smart building management and flexibility modelling algorithms have been developed by ICCS. Services such as demand and production forecasting, optimisation techniques in buildings, grids, energy communities, flexibility scenarios and assessment, building energy efficiency have been tested and validated both operationally and scientifically. The platform is an internal tool that is used to further test and deploy energy applications, as part of ICCS research activities.

TABLE 1. OVERVIEW OF THE PLATFORMS SUBMITTED THROUGH THE SURVEY

The responses show a wide range of platform purposes , including energy flexibility, congestion, analytics and market participation via data sharing and interoperability, as well as anomaly detection and prevention. Section 4.3 elaborates on these purposes with respect to the position of the platforms in the energy value chain.

Most platforms are developed by partners directly involved in the HEDGE-IoT project. The majority originated from previous European research projects, except for some cases that were funded internally. As shown in Figure 2, most of the submitted platforms (8 out of 12) are not open source, providing a realistic picture of a consortium that involves numerous industrial partners and grid operators. This does not hinder interoperability, as these platforms can still be integrated into the common digital middleware layer of the project with the use of software adapters. Some of the platforms have clear licensing and IP, while there are also platforms that are undetermined with respect to these topics.

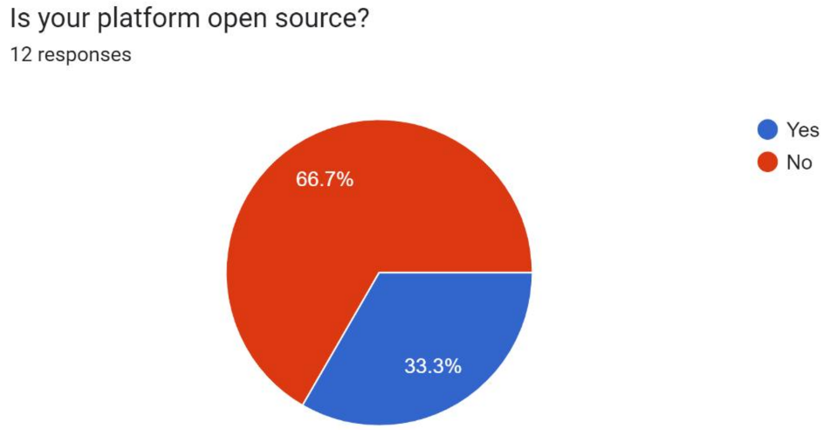

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FIGURE 2. CHART TO PRESENT SURVEY RESULTS ABOUT OPEN SOURCE

Regarding the maturity level of the platforms, the TRL is rather high, with most having been validated in relevant environments. As shown in Figure 3, three platforms are positioned at a low TRL (i.e., none at TRL 1, two at TRL 2, one at TRL 3, none at TRL 4); three platforms at TRL 5, two platforms at TRL 6, three platforms at TRL7, and one operates at the highest TRL 9.

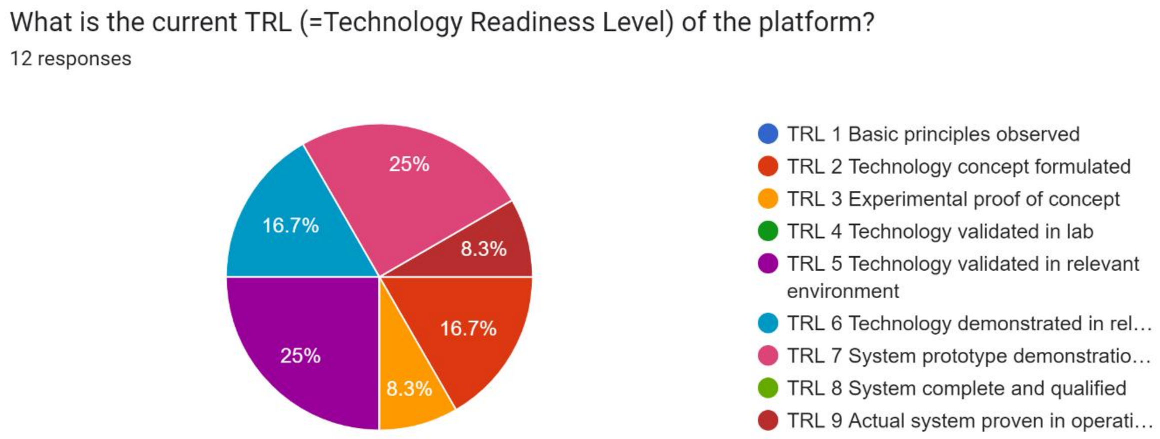

FIGURE 3. CHART TO PRESENT SURVEY RESULTS ABOUT MATURENESS

Table 2 summarizes the positioning of the various platforms in terms of TRL, from the lowest to the highest level.

Platform	Technology Readiness Level (TRL)
AI Services for Local Grid Resilience	TRL 2 - Technology concept formulated
Dynamic and Automated B2B Energy Data and Flexibility Service	TRL 2 - Technology concept formulated
ABB Edge	TRL 3 - Experimental proof of concept
Real-Time Reserve Market Simulator	TRL 5 - Technology validated in relevant environment
HEDGE-IoT LFM	TRL 5 - Technology validated in relevant environment
Home Management System	TRL 5 - Technology validated in relevant environment
EdgeConnect	TRL 6 - Technology demonstrated in relevant environment

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AI-Library for Energy Applications	TRL 6 - Technology demonstrated in relevant environment
Semantic Treehouse	TRL 7 - System prototype demonstration in operational environment
Semantic Interoperability Framework (SIF)	TRL 7 - System prototype demonstration in operational environment
PowerCIM	TRL 7 - System prototype demonstration in operational environment
Apio	TRL 9 - Actual system proven in operational environment

TABLE 2. OVERVIEW OF THE PLATFORMS AND THEIR TRL

4.2 LEGISLATION

Most of the platforms are used in a Business-to-Business (B2B) context and are either non-compliant or uncertain regarding compliance with the General Data Protection Regulation (GDPR) or similar privacy legislation. The two platforms that are used in business to consumer comply with the GDPR, as that is mandatory.

The use of Artificial Intelligence (AI) is limited to four platforms that mainly use learning techniques like Machine, Deep or Federated Learning, as shown in Figure 4. Only one platform has confirmed compliance with the European AI Act.

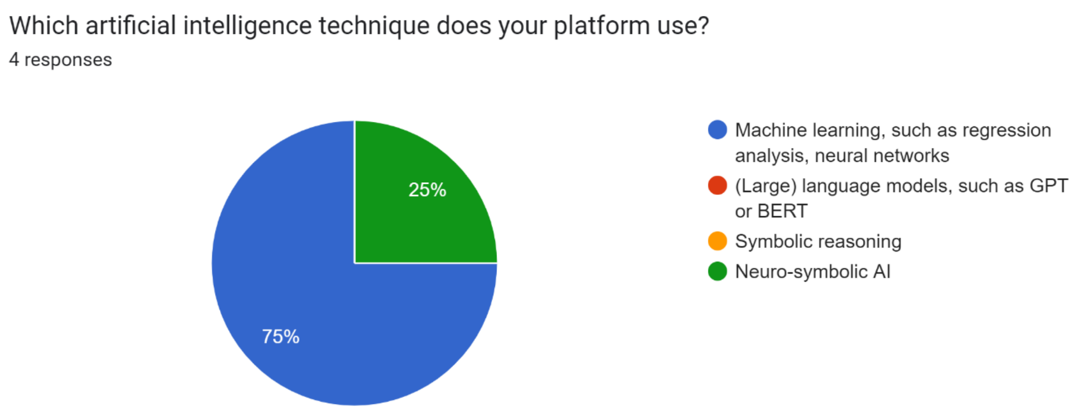

FIGURE 4. CHART TO PRESENT SURVEY RESULTS ABOUT ARTIFICIAL INTELLIGENCE

4.3 PILOT ARCHITECTURE

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All pilots have submitted one or more platforms (2 from Finland, 3 from Greece, 1 from Italy, 3 from Netherlands, 2 from Portugal, 1 from Slovenia). Two platforms indicated they can be used by more than one pilot (i.e., the Semantic Treehouse and the Semantic Interoperability Framework). Future developments in the project might increase the reuse of platforms.

In some cases, only a subset of platform functionalities will be utilised in the project.

Concerning use cases, each submitted platform is utilised in multiple (and in some cases, all) use cases of the corresponding pilot. This indicates that these are main technologies that play a central role within their pilots. The specific Business Use Cases (BUCs) and System Use Case (SUCs)[4] that apply to the various platforms can be found in Section 8 – Appendix A.

Figure 1 shows that the submitted platforms are deployed either in the edge, in which case they are mostly concerned with IoT assets, or, if they live in the cloud, are more concerned with the energy market. A few platforms support cloud, fog and edge deployment at the same time, and those are geared towards data exchange and AI services.

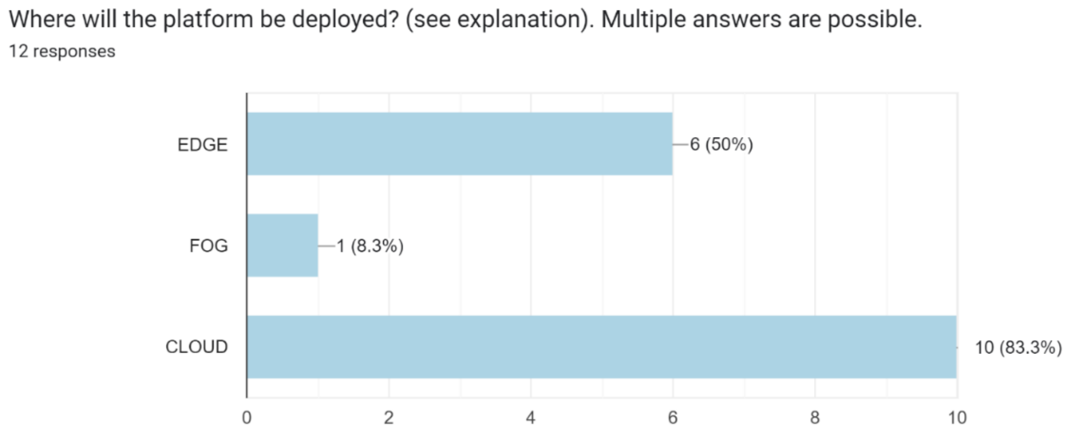

FIGURE 5. CHART TO PRESENT SURVEY RESULTS ABOUT EDGE AND CLOUD

As further shown in Figure 6, the platforms used in the project are fairly distributed over various parts of the energy value chain, from the TSO and DSO level to behind the meter at the home premises.

[4] As defined in D2.1 "Requirements on an IoT Could/Edge system for the Energy Ecosystem" [2] and D2.2 "Functional Specifications of the HEDGE-IoT system" [3]

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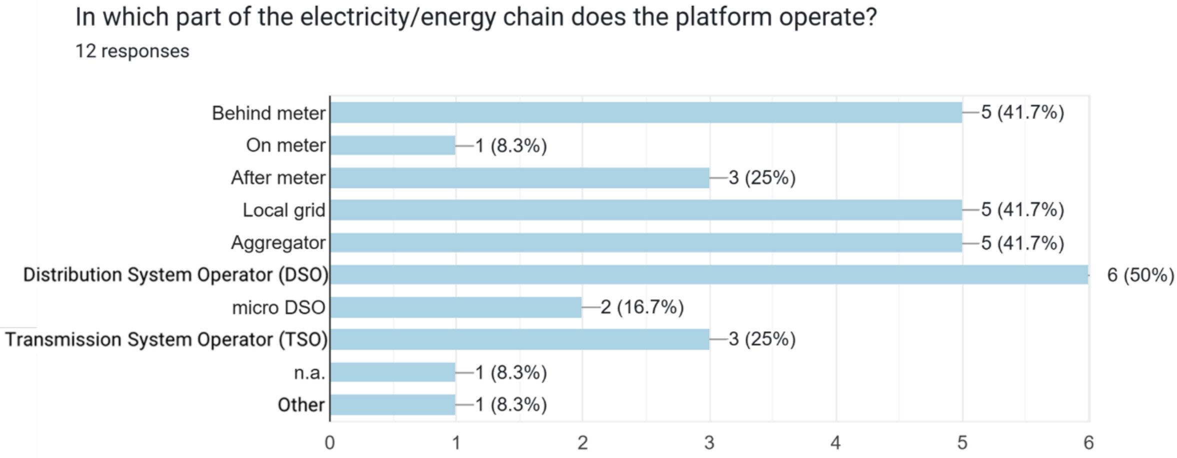

FIGURE 6. CHART TO PRESENT SURVEY RESULTS ABOUT POSITION IN THE ENERGY VALUE CHAIN

In particular, we can summarise the positioning across the energy value chain as follows:

2 platforms focus on the energy market:

- The **Real-Time Reserve Market Simulator** evaluates the performance of bids in reserve markets. Position in the energy value chain in Figure 6: TSO, Aggregator.
- The **HEDGE-IoT LFM Platform** enables trade energy flexibility in real time. Position in the energy value chain in Figure 6: Behind meter, Local grid, Aggregator, DSO.

2 platforms cover the TSO/ DSO level:

- The **PowerCIM**, enables grid model data persistence and exchange using IEC Common Information Model standards and data formats. Position in the energy value chain in Figure 6: DSO, TSO.
- The **ABB Edge Platform** focuses on the operational infrastructure to share high-volume data with strict real-time requirements. Position in the energy value chain in Figure 6: DSO.

3 platforms are multi-stakeholder platforms for energy flexibility:

- The **Dynamic and Automated B2B Energy Data and Flexibility Service Platform** for data sharing among DSO, Nominated Electricity Market Operator (NEMO) and flexibility service provider (FSP) to realise predictive congestion management (CM). Position in the energy value chain in Figure 6: DSO, Other (i.e., between substation edge and predictive congestion management, and between different energy stakeholders while trading energy flexibility).
- The **Apio platform** connects energy flexibility providers and DSO with BEMS/EMS and other edge devices/gateways. Position in the energy value chain in Figure 6: Behind meter, After meter, Local grid, Aggregator, DSO.
- The **EdgeConnect** platform provides stakeholders along the value chain of energy flexibility provision (i.e., consumers, service providers, aggregators, DSOs) with an integrated

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ecosystem to support their main activities. Position in the energy value chain in Figure 6Figure 6: after meter.

2 platforms are generic IT platforms for data sharing (not specific to the energy domain):

- The **Semantic Treehouse** is used as a vocabulary hub for data spaces. Position in the energy value chain in Figure 6: not applicable (N.A.).
- The **Semantic Interoperability Framework** enables semantically enriched data exchange and reasoning using ontologies. Position in the energy value chain in Figure 6: Behind meter, Local grid, micro DSO.

2 platforms are a collection of AI services:

- **AI services for local grid resilience** through detection and prevention of technical anomalies using knowledge graph data modelled in SAREF. Position in the energy value chain in Figure 6: Local grid.
- **AI-Library for Energy Applications** to develop, test and validate energy analytics applications (e.g., forecasting, flexibility management, load management and energy disaggregation). Position in the energy value chain in Figure 6: Behind meter, On meter, After meter, Local grid, Aggregator, DSO, micro DSO, TSO.

1 platform focuses on the home/building premises (behind the meter):

- **Home Management System** to extract data and insights from residential buildings. Position in the energy value chain in Figure 6: Behind meter, Aggregator.

4.4 DATASPACE CONNECTOR

Of the 12 platforms, 7 plan to integrate a data space connector, with the remaining ones citing three reasons for not doing so: 1) they already conform to existing domain specific standards, 2) they only use data space connectors for data exchange between legal entities which does not apply to their platform, or 3) their platform requires high-volume and strict real-time requirements that data space connectors cannot provide. Regarding the choice of data space connector, most do not indicate a preference, and if they do, they prefer the Eclipse Dataspace Component (EDC) connector, as shown in Figure 7.

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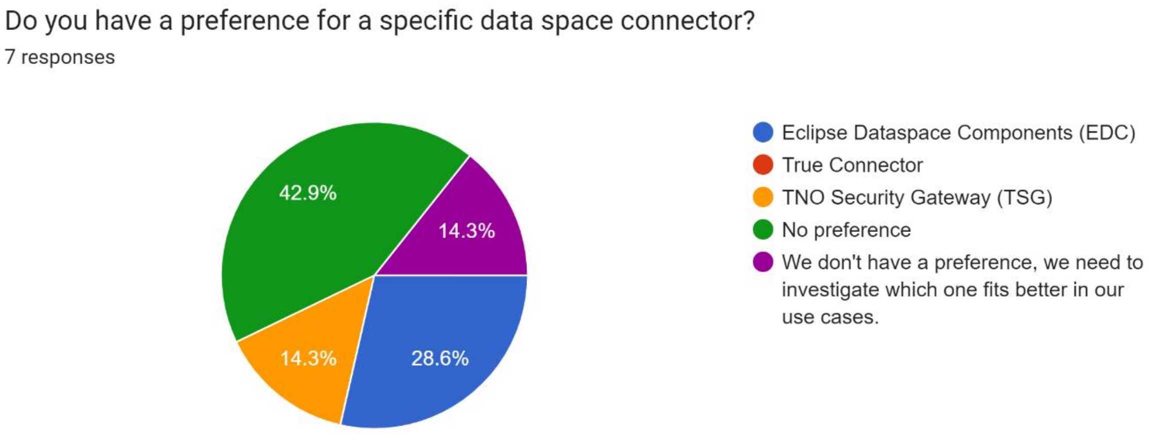

FIGURE 7. CHART TO PRESENT SURVEY RESULTS ABOUT DATASPACE CONNECTOR

4.5 SEMANTIC INTEROPERABILITY

As shown in Figure 8, most of the responses acknowledge the need for semantic interoperability indicating that their platforms already support it or consider adding support for it in the future. These platforms (with their interfaces and tools) are candidates for inclusion in the follow up deliverable D3.2 "HEDGE-IoT interfaces and tools for interoperability".

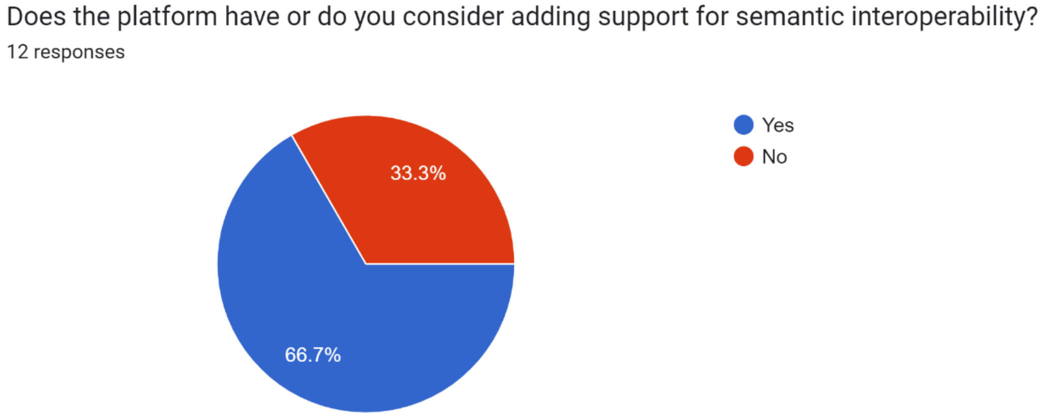

FIGURE 8. CHART TO PRESENT SURVEY RESULTS ABOUT SEMANTICS

The ETSI SAREF ontology [4] (e.g., SAREF core [5] and possible extensions, such as SAREF for energy [6]) is an important semantic model that is or will be supported by some platforms. Other

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ontologies like the Web of Things (WoT) [7, 8] and Sensor, Observation, Sample and Actuator (SOSA) [9] are also (considered to be) used.

The survey results indicate that examined platforms use a diverse (or fragmented) spectrum of data models to represent the information they are processing, often proprietary, but sometimes they use standard data models, such as the IEC CIM, as defined by the IEC 61968 [10] and 61970 [11] standards, or SPINE as defined by EN 50631 [12], or S2 as defined by EN 50491-12-2 [13].

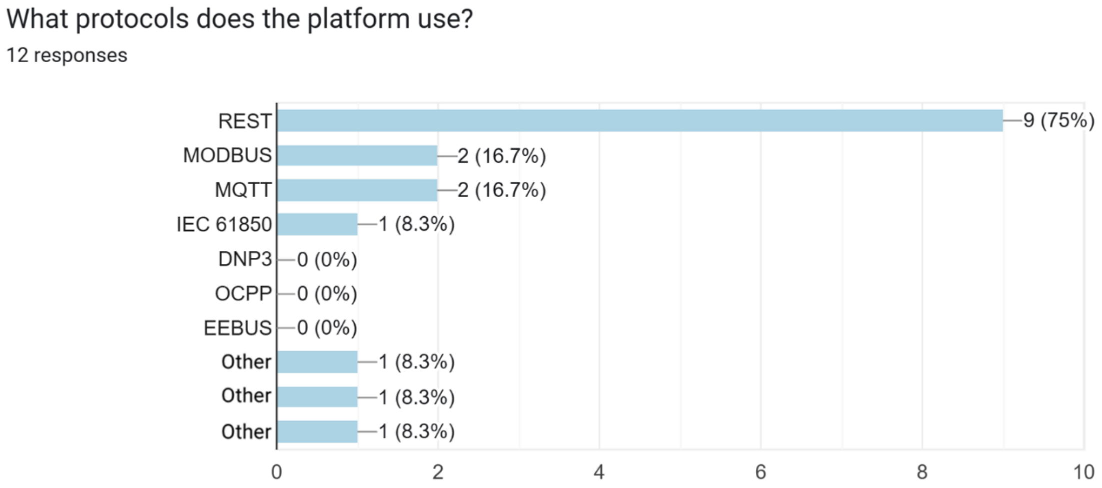

FIGURE 9. CHART TO PRESENT SURVEY RESULTS ABOUT PROTOCOLS

As shown in Figure 9, the most used protocol by the platforms is the Representational State Transfer (REST). This aligns with the de facto industry standards.

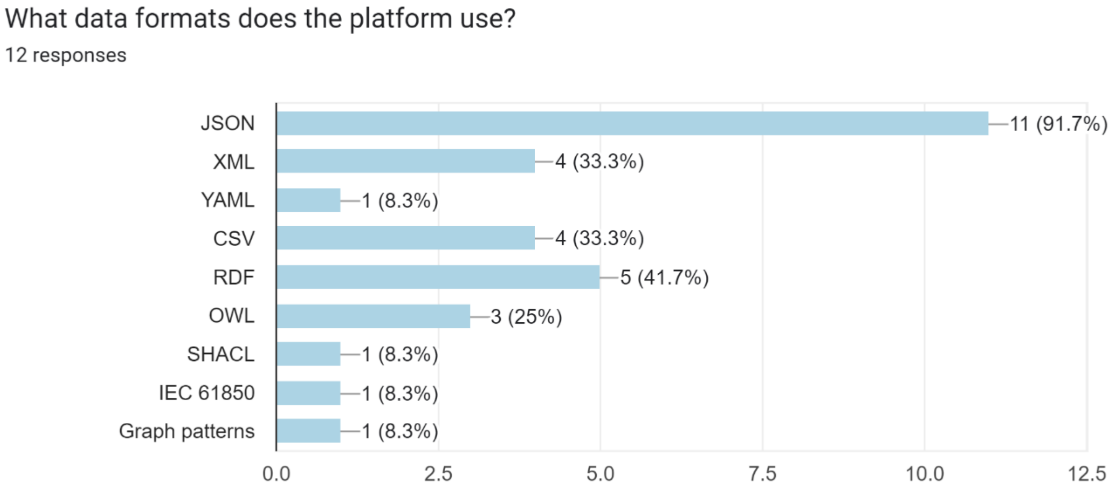

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FIGURE 10. CHART TO PRESENT SURVEY RESULTS ABOUT DATA FORMATS

As shown in Figure 10, the most used data format by the platforms is the JavaScript Object Notation (JSON). This aligns with the de facto industry standards.

4.6 INTERFACES, SERVICES AND TOOLS

The 12 platforms together submitted in total around 40 interfaces and services, of which 18 can be characterised as business services, 5 as graphical interfaces and 17 as technical interfaces or services. Moreover, 16 are related to the energy domain, by explicitly mentioning energy flexibility or energy market, while the rest are more geared towards domain independent topics, like data exchange, dashboards and analytics. Regarding tooling, the focus seems to lie on graphical interfaces, but also additional endpoint and data modelling tools are mentioned. Most responses indicate that platforms will be extended with additional interfaces, services or tools, over the course of the project.

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5 DISCUSSION

This section proposes a discussion of the results presented in Section 0, as a guideline for their interpretation and as basis for the continuation of the project.

The results concerning platform purposes indicate a diverse range of technologies that cover the energy value chain, in line with the goal of the project to deploy IoT assets at different levels of the energy system (from the TSO level to behind-the-meter). To that end, some platforms focus on the flexibility energy market, some others are dedicated to the TSO/DSO level, while a number is dedicated to data sharing across multiple stakeholders for energy flexibility, including building managers and end-users (or prosumers). Therefore, none of the relevant stakeholders is neglected. The majority of these platforms have been specifically conceived for the energy domain, while two of them, i.e., the Semantic Treehouse and the Semantic Interoperability Framework, are generic IT platforms that can be applied to various domains. This demonstrates a well-distributed yet comprehensive landscape across the pilots, providing solutions to all stakeholders along the value chain. Some platforms offer alternative solutions from different providers, sometimes complementing each other in different parts of the end-to-end flow.

Notably, most of the technologies presented in this document originate from previous European research projects, demonstrating continuity and exploitability of the results across multiple projects and initiatives over time. At the same time, since the HEDGE-IoT consortium involves numerous industrial partners and grid operators, it could be expected that certain technology also originated from private investments and will get the opportunity in this project to be tested and deployed in a pre-competitive environment. While these proprietary platforms are not open source, interoperability is not hindered, as they can be integrated into the common digital layer of the project through software adapters. It is promising, however, that some of the platforms are open source, as this will facilitate the reuse and evolution of software, algorithms and models in a collaborative environment, during and beyond the HEDGE-IoT project. It is also encouraging that the surveyed platforms often use open standards, such as IEC CIM for grid operators and ETSI SAREF for IoT applications, showing involvement in and support by standardisation bodies.

The Survey results further exhibit a high maturity level of the various technologies, which have been previously validated, demonstrated or prototyped in operational environments. This is in line with the fact that HEDGE-IoT is conceived as a project focused on innovation at high TRL levels and that most of the platforms used are the result of previous projects and investments (in existing pilots' sites, not created from scratch). It also has to do with the fact that we requested the partners to submit the already existing technologies that they will use in the pilots (therefore not tools that will be developed from scratch in the project), which excluded responses containing technologies at a very basic stage of research and development. The presence of 3 responses at TRL 2 and 3 (i.e., technology concept formulated and experimental proof of concept, respectively) presents an opportunity in the project for some early-stage innovations to be further validated in relevant environments. In general, the TRL scale provides a useful tool for qualitatively assessing technological progress throughout the project and will be used to measure the change between the

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starting TRL levels presented in this deliverable, and the final levels reached at the end of the project.

While the specifics of AI/ML and federated learning techniques used in the project fall outside the scope of this deliverable, they will be further investigated in Tasks T3.2 "AI/IoT enabled user-centric services" and T3.3 "Federated Learning Tools and Services". However, our results indicate the following initial insights aligning with the project's goal of integrating intelligence into edge and cloud layers via advanced AI/ML tools and to bridging the cloud/edge continuum through federated applications governed advanced computational orchestration solutions:

- the submitted platforms will be deployed directly at the edge, or on the cloud, or both at the edge and on the cloud, and
- a subset of these platforms will use AI techniques such as Machine Learning, Deep Learning and Federated Learning
- no responses specifically indicated the use of LLMs and generative AI.

The survey results highlight the critical role of the data space connector in managing interoperable and secure access to data across different actors and external platforms/services. The data space connector, which is the focus of the parallel Task 4.2 "Interoperability Middleware – Open Data Connector", will be deployable and integrable in any of the existing platforms presented in this document. As shown in Section 4, most of the platforms already consider integrating a data space connector. The minority of responses that do not plan the usage of a data space connector relate to AI services (i.e., AI services for local grid resilience and AI-library for energy applications) that do not require a data space connector for their operation, or relate to a platform that deals with data exchange of high volume and strict real-time requirements not compatible with data spaces, or a platform that already conforms to existing IEC domain specific standards. For those responses that specified a preference for a specific data space connector, the results are compatible with the choice made in Task 4.2, in collaboration with the Technical Board of the project, to use the Eclipse Dataspace Connector (EDC).

Survey results also indicate fragmentation with respect to data models (and protocols and data formats) used by the different platforms. This reiterates the project's goal that increasing (semantic) interoperability within the IoT and energy sectors is of utmost importance to face the many challenges that lie ahead in the digital energy transition. To that end, it is promising that our initial investigation resulted in 8 out of 12 responses that already support or plan to support semantic interoperability (e.g., by using an ontology) in their pilots. The SAREF ontology standardized by ETSI has been repetitively mentioned in the results, together with some other standardized ontologies like the Web of Things (WoT) and Sensor, Observation, Sample and Actuator (SOSA) recommended by the W3C. It can be expected that not all the platforms, interfaces nor services in the project will need to become fully semantically interoperable, as this requires the development of additional software adapters on top of the existing platforms that is not always essential, for example, when a limited number of actors exchange data in the same environment based on some commonly agreed protocol or standard (e.g., as part of a specific pilot). However, semantic technology becomes essential in large ecosystems for a meaningful and unambiguous exchange of information, and it will be pivotal in the HEDGE-IoT project when different pilots are to become interoperable with each other concerning cross-cutting use cases, or reuse of platforms or services across pilots. Additional guidance will be provided in Task 4.3 “Semantic Interoperability” to partners planning to implement semantic interoperability within their platforms.

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6 CONCLUSIONS

This document described the initial results of the Task 3.1 of the HEDGE-IoT project, which made use of a survey distributed among the project's partners to gather insights into the existing digital interfaces, platforms, and tools that will be deployed in the project's six pilots across Europe, more precisely, in Finland, Greece, Italy, Netherlands, Portugal and Slovenia.

Via the survey, we collected a total of 12 platforms and about 40 related interfaces and services. Key conclusions from the survey include the following:

Variety of Technologies: The platforms cover different parts of the energy value chain, including market participation, TSO/DSO level, congestion management, energy flexibility, end-users (e.g., consumers, producers and prosumers). Some platforms are generic IT platforms that are multi-stakeholders, i.e., they can be used for data sharing among various stakeholders in the energy value chain. This landscape of technologies ensures that all relevant stakeholders are addressed in our project.

High Maturity Level: Most platforms have a high TRL, indicating that they have been validated or demonstrated in relevant environments.

Open Source and Standards: A fair number of platforms are open source and use open standards, facilitating reuse and evolution in a collaborative environment.

AI: Some platforms use AI techniques for energy analytics.

Data Space Connectors: Various platforms plan to integrate data space connectors for secure data exchange.

Semantic Interoperability: There is a recognised need for semantic interoperability, with several platforms already supporting or planning to support semantic models like ETSI SAREF or IEC CIM.

Towards the creation of a robust and interoperable digital framework capable of supporting the digital energy transition and enhance the resilience and efficiency of the energy ecosystem, the following next steps will be taken in the continuation of the project:

- **Interoperability Framework Development**: The next phase involves identifying which platforms, interfaces, and tools require interoperability (Task 3.1) and integrating them into the common interoperability framework (to be developed in WP4).
- **Data Space Connector Integration:** A sub-set of the platforms presented in this document will be integrated with data space connectors, focusing on the Eclipse Dataspace Components (EDC) to ensure seamless and secure data exchange (Task 4.2).
- **Semantic Interoperability Enhancement:** Further guidance will be provided to partners to support semantic interoperability, including the use of standardised ontologies and data models like ETSI SAREF and IEC CIM (Task 4.3).

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- **AI/ML Tools and Services**: Detailed investigation and development of AI/ML tools and services will continue, focusing on adding intelligence to the edge and cloud layers (Tasks 3.2 and 3.3).
- **Monitoring and Evaluation:** The progress of the platforms will be monitored, and their TRL levels will be reassessed towards the end of the project to measure the advancements made (WP5).

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7 REFERENCES

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[2] HEDGE-IoT Deliverable 2.1 "Requirements on an IoT Could/Edge system for the Energy Ecosystem" (2024).

[3] HEDGE-IoT Deliverable 2.2 "Functional Specifications of the HEDGE-IoT System" (2024).

[4] EN 303 760 V1.1.1 (2024-10) SmartM2M; SAREF Guidelines for IoT Semantic Interoperability; Develop, apply and evolve Smart Applications ontologies (produced by ETSI).

[5] ETSI TS 103 410-1 V3.2.1 (2024-01) SmartM2M; Smart Applications; Reference Ontology and oneM2M Mapping.

[6] ETSI TS 103 410-1 V2.1.0 (2024-10) SmartM2M; Extension to SAREF; Part 1: Energy Domain.

[7] W3C Recommendation (05 December 2023) Web of Things (WoT) Architecture 1.1 https://www.w3.org/TR/wot-architecture/

[8] W3C Recommendation (05 December 2023) Web of Things (WoT) Thing Description 1.1 https://www.w3.org/TR/wot-thing-description/

[9] W3C Recommendation (19 October 2017) Semantic Sensor Network Ontology https://www.w3.org/TR/vocab-ssn/

[10] International Electrotechnical Commission (IEC) TC 57 WG14, IEC 61968 Common Information Model (CIM) .

[11] International Electrotechnical Commission (IEC) TC 57 WG14, IEC 61970 Common Information Model (CIM) .

[12] EN 50631, parts 1-4: "Household appliances network and grid connectivity" (produced by CENELEC)

[13] EN 50491-12-2: "General requirements for Home and Building Electronic Systems (HBES) and Building Automation and Control Systems (BACS) - Part 12-2: Smart grid - Application specification - Interface and framework for customer - Interface between the Home / Building CEM and Resource manager(s) - Data model and messaging" (produced by CENELEC).

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8 APPENDIX A – SURVEY TEMPLATE

This section presents the template of the survey that we have distributed among the partners to take stock of their platforms, interfaces and tools.

Task 3.1: Survey on IoT Platforms, interfaces and tools

Guidelines:

- Please first have a look at the example forms filled in by the Dutch and the Portuguese pilots.
- If needed, some timeslots are available to provide support in filling in the form. Each
- pilot can have more than one platform. Therefore, we expect a certain pilot to fill in this form more than once, if there are more platforms.
- A platform can be used in one or more pilots. Therefore, the same platform can appear in more than one form, as long as the pilot is different.
- Together with platforms, we are taking stock of related interfaces and tools. A certain platform can provide one or more related interfaces and tools. Therefore, one form (for a certain platform) can contain information about several related interfaces and tools.

* Indicates required question

1. Email *

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Platform details

This section collects details about the platform, such as name, purpose, a short description, provider(s), origin, openness, license, owner, and TRL.

2. What is the name of the platform? *

3. What is the purpose of the platform? *

4. What is the description of the platform (max. 200 words)? *

5. Which partner(s)/vendor(s) provide(s) the platform? It is possible to mention also external partners that are not part of the HEDGE-IoT project.*

6. Where did the platform originate? Please provide a link, if possible. *

7. Is your platform open source? *

Mark only one oval.

- Yes
- No

8. What is the license of the platform? *

Tick all that apply.

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- [ ] Apache License 2.0 (https://www.apache.org/licenses/LICENSE-2.0)
- [ ] MIT License (https://opensource.org/license/mit)
- [ ] GNU GPLv3 License (https://www.gnu.org/licenses/gpl-3.0.html)
- [ ] BSD-3-Clause License (https://opensource.org/license/BSD-3-Clause)
- [ ] Proprietary License
- [ ] Other:

____

9. Comments about the license (optional)

____

10. Who owns the IP (if registered)? *

____

11. What is the current TRL (=Technology Readiness Level) of the platform? *

Mark only one oval.

- ◯ TRL 1 Basic principles observed
- ◯ TRL 2 Technology concept formulated
- ◯ TRL 3 Experimental proof of concept
- ◯ TRL 4 Technology validated in lab
- ◯ TRL 5 Technology validated in relevant environment
- ◯ TRL 6 Technology demonstrated in relevant environment
- ◯ TRL 7 System prototype demonstration in operational environment
- ◯ TRL 8 System complete and qualified
- ◯ TRL 9 Actual system proven in operational environment

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Legislation

12. Is the platform used in B2B or B2C? *

Tick all that apply.

- [ ] B2B (Business to business)
- [ ] B2C (Business to consumer)

B2B and B2C follow-up

13. If B2C, do you comply with the GDPR or relevant regulation for user privacy protection?*

Mark only one oval.

- Yes
- No
- I don't know

Legislation continued

14. Does the platform use an AI (Artificial Intelligence) component? *

Mark only one oval.

- Yes *Skip to question 15*
- No *Skip to question 19*

Artificial Intelligence follow-up

15. Is the platform compliant with the European AI Act? *

Mark only one oval.

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Yes

No

I don't know

Other:

16. Please explain your answer about whether your platform is compliant with the AI Act*

17. Which artificial intelligence technique does your platform use? *

Mark only one oval.

Machine learning, such as regression analysis, neural networks

(Large) language models, such as GPT or BERT

Symbolic reasoning

Other:

18. Please elaborate on which AI technique you use and on which problem you apply it.

Pilot

19. In which pilot(s) will the platform be used? It is possible to select more than one pilot. *

Tick all that apply.

- ☐ Finland
- ☐ Greece
- ☐ Italy
- ☐ Netherlands
- ☐ Portugal
- ☐ Slovenia

20. Concerning use cases, in which of your pilots BUCs and SUCs is your platform used? Please use the BUC/SUC naming convention, like BUC-NL-01 *

21. Is the platform being fully provided/used in the pilot or only parts? *

Mark only one oval.

- ◯ Fully provided/used Partially
- ◯ provided/used
- ◯ Other: ________

22. In case only partially provided/used, please elaborate why

23. What is the architecture of the pilot where your platform will be used? Please provide a simple component diagram with main building blocks.*

24. Where in the pilot architecture is your platform positioned? *

Mark only one oval.

- ◯ Platform position is visible in architecture image uploaded.
- ◯ Other: ________

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25. Where will the platform be deployed? (see explanation). Multiple answers are * possible.

Tick all that apply.

- [ ] EDGE
- [ ] FOG
- [ ] CLOUD
- [ ] Other: ____________________

26. Do you plan to have a Data Space Connector in your platform? *

Mark only one oval.

- ( ) Yes *Skip to question 28*
- ( ) No *Skip to question 31*

27. If you do NOT plan to have a Data Space Connector in your platform, please motivate your choice

____

Data space connector follow-up

28. Where in the pilot picture is/are your data space connector(s) positioned? *

Mark only one oval.

- ( ) Data space connector is visible in architecture figure uploaded.
- ( ) Not yet visible, architecture with data space connector is still to be defined Other:
- ( ) ____________________

29. Do you have a preference for a specific data space connector? *

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Mark only one oval.

- [ ] Eclipse Dataspace Components (EDC)
- [ ] True Connector
- [ ] TNO Security Gateway (TSG) Other:
- [ ] ______________________

30. Please explain your preference on the data space connector

____

Pilot continued

31. In which part of the electricity/energy chain does the platform operate? *

Tick all that apply.

- [ ] Behind meter
- [ ] On meter
- [ ] After meter
- [ ] Local grid
- [ ] Aggregator
- [ ] Distribution System Operator (DSO) micro
- [ ] DSO
- [ ] Transmission System Operator (TSO) Other:
- [ ] ______________________

32. Does the platform have or do you consider adding support for semantic interoperability? *

Mark only one oval.

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- Yes *Skip to question 33*
- No *Skip to question 36*

Semantic Interoperability follow-up

33. Where in the previously uploaded pilot picture is the platform using Semantic Interoperability?*

Mark only one oval.

- Semantic Interoperability is visible in the architecture figure uploaded
- Other: ____________________

34. What semantic models/ontologies does the platform use? *

Tick all that apply.

- [ ] None
- [ ] ETSI SAREF (Smart Applications REFerence ontology) framework
- [ ] W3C SOSA (Sensor, Observation, Sample, and Actuator)
- [ ] Other: ____________________

35. If other, please provide a short description and a link to the semantic model/ontology used by your platform

____

Platform protocols, data formats and data models

36. What protocols does the platform use? *

Tick all that apply.

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- [ ] REST
- [ ] MODBUS
- [ ] MQTT
- [ ] IEC 61850
- [ ] DNP3
- [ ] OCPP
- [ ] EEBUS
- [ ] Other: ______________________

37. What data formats does the platform use? *

Tick all that apply.

- [ ] JSON
- [ ] XML
- [ ] YAML
- [ ] CSV
- [ ] RDF
- [ ] OWL
- [ ] Other: ______________________

38. What data models does the platform use? *

Tick all that apply.

- [ ] IEC CIM
- [ ] DLMS-COSEM
- [ ] Matter
- [ ] EN 50491-12 (S2)
- [ ] EN 50631 (SPINE/SPINE-IoT)
- [ ] KNX
- [ ] Proprietary
- [ ] Other:

39. Please provide any additional remarks on protocols, data formats and data models, if needed

40. What specific interface(s)/service(s) does your platform provide? *

41. What additional tooling/wizards does your platform currently provide? *

42. Do you plan to extend the platform with additional tooling/interfaces/services during the project?*

9 APPENDIX B – INDIVIDUAL SURVEY RESPONSES

The following sub-sections present the 12 individual survey responses as they were submitted by the partners[5]. Each sub-section consists of a table, followed by a figure that shows the architecture of the pilot in which the platform is deployed. The Business Use Cases (BUCs) and System Use Case (SUCs) mentioned in the tables are defined in D2.2 "Functional Specifications of the HEDGE-IoT System".

9.1 HEDGE-IOT LFM PLATFORM

Question	Answer
What is the name of the platform?	HedgeIot LFM Platform
What is the purpose of the platform?	Local Flexibility Market
What is the description of the platform (max. 200 words)?	The Hedge Iot LFM Platform is designed to enable and facilitate Local Flexibility Market (LFM) trading. It provides a digital marketplace where energy producers, consumers, and prosumers (those who both produce and consume energy) can trade energy flexibility in real time. By connecting IoT devices and smart meters, the platform gathers data on energy demand, supply, and flexibility needs. This information enables participants to offer flexibility services—such as adjusting energy consumption or production levels—which grid operators can purchase to balance the local grid.
Which partner/vendor provides the platform?	HEnEx
Where did the platform originate?	
Is your platform open source?	No
What is the license of the platform?	Proprietary License
Comments about the license (optional)	
Who owns the IP (if registered)?	Not Registered
What is the current TRL (=Technology Readiness Level) of the platform?	TRL 5 Technology validated in relevant environment
Is the platform used in B2B or B2C?	B2B (Business to business)
If B2C, do you comply with the GDPR or relevant regulation for user privacy protection?	
Does the platform use an AI (Artificial Intelligence) component?	No
Is the platform compliant with the European AI Act?	

[5] All responses are inserted in this Annex as they were submitted, without modification,.

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Please explain your answer about whether your platform is compliant with the AI Act?	
Which artificial intelligence technique does your platform use?	
Please elaborate on which AI technique you use and on which problem you apply it.	
In which pilot(s) will the platform be used?	Greece
Concerning use cases, in which of your pilots BUCs and SUCs is your platform used? Please use the BUC/SUC naming convention, like BUC-NL-01	BUC-GR-03 , SUC-GR-03.01 & SUC-GR-03.02
Is the platform being fully provided/used in the pilot or only parts?	Fully provided/used
In case only partially provided/used, please elaborate	
What is the architecture of the pilot where your platform will be used? (only main building blocks/components)	See FIGURE 11
Where in the pilot architecture is your platform positioned?	Platform position is visible in the architecture in FIGURE 11
Where will the platform be deployed?	CLOUD
Do you plan to have a Data Space Connector in your platform?	No
If you do NOT plan to have a Data Space Connector in your platform, please motivate your choice	
Where in the pilot picture is/are your data space connector(s) positioned?	
Do you have a preference for a specific data space connector?	
Please explain your answer on your preference on the data space connector	
In which part of the electricity/energy chain does the platform operate?	Behind meter, Local grid, Aggregator, Distribution System Operator (DSO)
Does the platform have or do you consider adding support for semantic interoperability?	Yes
Where in the previously uploaded pilot picture is the platform using Semantic Interoperability?	DSO/TSO Coordination
What semantic models/ontologies does the platform use?	None
If other, please provide a short description and a link to the semantic model/ontology used by your platform	

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What protocols does the platform use?	REST
What data formats does the platform use?	JSON, XML
What data models does the platform use?	Proprietary
Please provide any additional remarks on your protocols, data formats and data models, if needed	
What specific interface(s)/service(s) does your platform provide?	Trading Interface, Registration Interface, User Notification and Alert Service, Analytics and Reporting Interface
What additional tooling/wizards does your platform currently provide?	None
Do you plan to extend the platform with additional tooling/interfaces/services during the project?	Yes

TABLE 3. SURVEY RESPONSE FOR THE HEDGE-IOT LFM PLATFORM

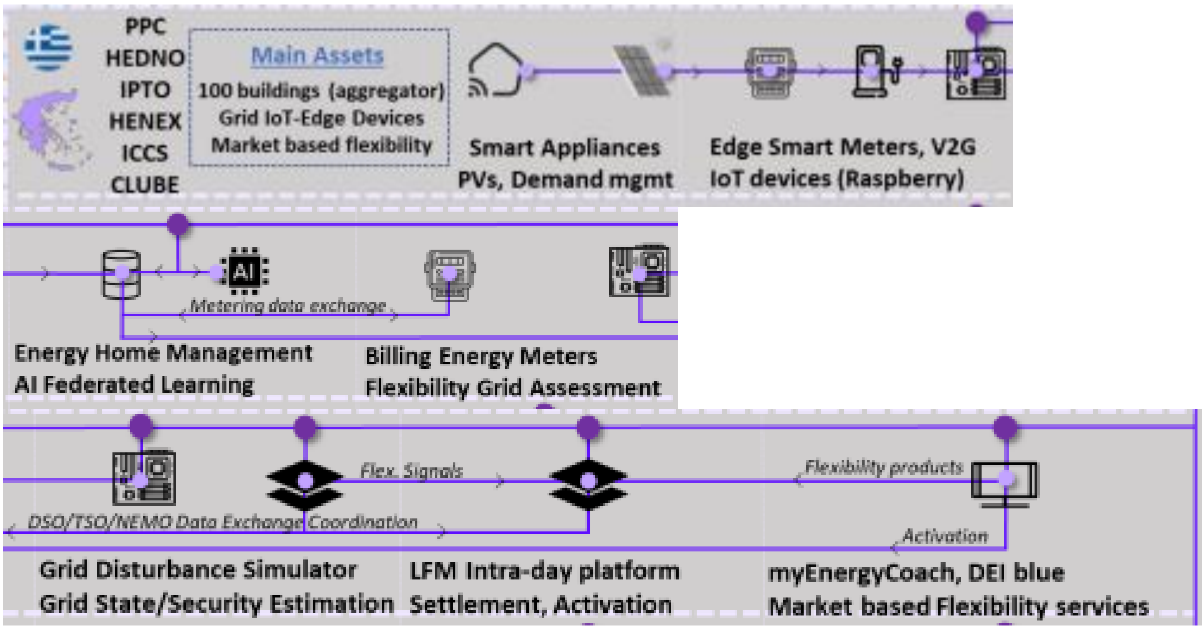

FIGURE 11. ARCHITECTURE FIGURE FOR HEDGE-IOT LFM PLATFORM

9.2 SEMANTIC TREEHOUSE

Question	Answer
What is the name of the platform?	Semantic Treehouse
What is the purpose of the platform?	Semantic Treehouse helps participants in data ecosystems to agree on, define and improve common data models and semantics.
What is the description of the platform (max. 200 words)?	Semantic Treehouse is an open-source web application created by TNO. In data spaces it plays the role of the Vocabulary Hub component. It is designed to boost adoption of semantic standards by facilitating open standardization.
Which partner/vendor provides the platform?	TNO
Where did the platform originate?	TNO
Is your platform open source?	Yes
What is the license of the platform?	Apache License 2.0 (https://www.apache.org/licenses/LICENSE-2.0)
Comments about the license (optional)	
Who owns the IP (if registered)?	TNO
What is the current TRL (=Technology Readiness Level) of the platform?	TRL 7 System prototype demonstration in operational environment
Is the platform used in B2B or B2C?	B2B (Business to business)
If B2C, do you comply with the GDPR or relevant regulation for user privacy protection?	
Does the platform use an AI (Artificial Intelligence) component?	No
Is the platform compliant with the European AI Act?	
Please explain your answer about whether your platform is compliant with the AI Act?	
Which artificial intelligence technique does your platform use?	
Please elaborate on which AI technique you use and on which problem you apply it.	
In which pilot(s) will the platform be used?	Finland, Greece, Italy, Netherlands, Portugal, Slovenia
Concerning use cases, in which of your pilots BUCs and SUCs is your platform used? Please use the BUC/SUC naming convention, like BUC-NL-01	Since Semantic Treehouse is an implementation of the Vocabulary Hub, and the Vocabulary Hub is a central Data Space service, any pilot BUC or SUC that involves information exchange via a data space connector will have a link with the Vocabulary Hub service.
Is the platform being fully provided/used in the pilot or only parts?	Partially provided/used

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In case only partially provided/used, please elaborate	n.a.
What is the architecture of the pilot where your platform will be used? (only main building blocks/components)	See FIGURE 12
Where in the pilot architecture is your platform positioned?	Like the data space connector, metadata broker and clearing house, the vocabulary hub is a central data space component, which means it is not part of the pilot architecture.
Where will the platform be deployed?	CLOUD
Do you plan to have a Data Space Connector in your platform?	Yes
If you do NOT plan to have a Data Space Connector in your platform, please motivate your choice	
Where in the pilot picture is/are your data space connector(s) positioned?	n.a.
Do you have a preference for a specific data space connector?	TNO Security Gateway (TSG)
Please explain your answer on your preference on the data space connector	It's partially implemented. But EDC is fine, too.
In which part of the electricity/energy chain does the platform operate?	n.a.
Does the platform have or do you consider adding support for semantic interoperability?	Yes
Where in the previously uploaded pilot picture is the platform using Semantic Interoperability?	Semantic Interoperability is visible in the architecture figure uploaded
What semantic models/ontologies does the platform use?	ETSI SAREF (Smart Applications REFerence ontology) framework, W3C SOSA (Sensor, Observation, Sample, and Actuator)
If other, please provide a short description and a link to the semantic model/ontology used by your platform	SEAS
What protocols does the platform use?	REST
What data formats does the platform use?	JSON, XML, YAML, CSV, RDF, OWL, SHACL
What data models does the platform use?	n.a.
Please provide any additional remarks on your protocols, data formats and data models, if needed	
What specific interface(s)/service(s) does your platform provide?	– data validator based on schema (XSD, JSON Schema, SHACL) – data model issue management – viewing semantic models / data models in browser

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What additional tooling/wizards does your platform currently provide?	creation of application profile from semantic models and data models
Do you plan to extend the platform with additional tooling/interfaces/services during the project?	1. Graph pattern generation 2. mapping recommendation service

TABLE 4. SURVEY RESPONSE FOR THE SEMANTIC TREEHOUSE

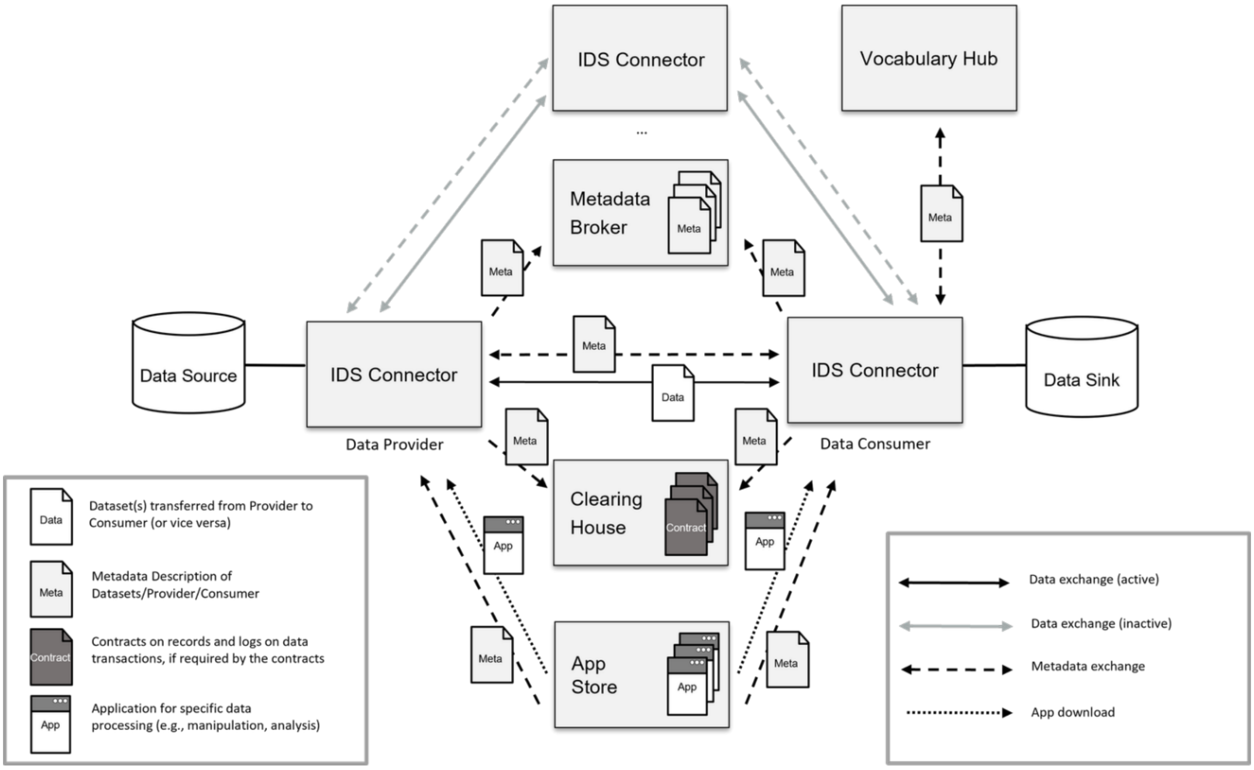

FIGURE 12. ARCHITECTURE FIGURE FOR SEMANTIC TREEHOUSE

9.3 POWERCIM

Question	Answer
What is the name of the platform?	PowerCIM
What is the purpose of the platform?	A repository platform for application integration and storage of IEC Common Information Model electrical grid model data
What is the description of the platform (max. 200 words)?	The PowerCIM platform enables grid model data persistence and exchange using the widely deployed IEC Common Information Model standards and data formats, enabling efficient versioned model data management and semantic enrichment of telemetry time series data. The platform components are: 1. Core repository server, 2. Model viewer front end, 3. Standard IEC 61970-552 CIM/XML adapter, 4. Generic SQL and CSV adapters, 5. CIM UML metamodel management, 6. Data flow orchestrator. The platform currently supports network equipment data (CIM EQ profile), network state data (CIM SSH and SV profiles), geographic layout data (CIM GL profile). In the near future we envision support for topology processing data (CIM TP profile) and schematic diagram data (CIM DL profile).
Which partner/vendor provides the platform?	KONČAR Digital Ltd.
Where did the platform originate?	Internally financed development
Is your platform open source?	No
What is the license of the platform?	Proprietary License
Comments about the license (optional)	
Who owns the IP (if registered)?	KONČAR Digital Ltd.
What is the current TRL (=Technology Readiness Level) of the platform?	TRL 7 System prototype demonstration in operational environment
Is the platform used in B2B or B2C?	B2B (Business to business)
If B2C, do you comply with the GDPR or relevant regulation for user privacy protection?	No
Does the platform use an AI (Artificial Intelligence) component?	No
Is the platform compliant with the European AI Act?	
Please explain your answer about whether your platform is compliant with the AI Act?	
Which artificial intelligence technique does your platform use?	

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Please elaborate on which AI technique you use and on which problem you apply it.	
In which pilot(s) will the platform be used?	Slovenia
Concerning use cases, in which of your pilots BUCs and SUCs is your platform used? Please use the BUC/SUC naming convention, like BUC-NL-01	BUC-SI-02, SUC-SI-02.1, SUC-SI-02.2
Is the platform being fully provided/used in the pilot or only parts?	Partially provided/used
In case only partially provided/used, please elaborate	The PowerCIM core system is provided fully, but only necessary standard data adapters and specialized adapters developed for HEDGE-IoT will be provided
What is the architecture of the pilot where your platform will be used? (only main building blocks/components)	See FIGURE 13
Where in the pilot architecture is your platform positioned?	Platform position is visible in the architecture image in FIGURE 13
Where will the platform be deployed?	CLOUD
Do you plan to have a Data Space Connector in your platform?	No
If you do NOT plan to have a Data Space Connector in your platform, please motivate your choice	Our platform is IEC standardized according to the standards relevant to the field of the electric power system that we work with.
Where in the pilot picture is/are your data space connector(s) positioned?	
Do you have a preference for a specific data space connector?	
Please explain your answer on your preference on the data space connector	
In which part of the electricity/energy chain does the platform operate?	Distribution System Operator (DSO), Transmission System Operator (TSO)
Does the platform have or do you consider adding support for semantic interoperability?	Yes
Where in the previously uploaded pilot picture is the platform using Semantic Interoperability?	We can semantically interoperate using the IEC 61968 and 61970 standards (which use common UML and RDF frameworks). It is also visible in FIGURE 13
What semantic models/ontologies does the platform use?	Common Information Model framework as defined by IEC 61968 and 61970 standards
If other, please provide a short description and a link to the semantic model/ontology used by your platform	Common Information Model framework as defined by IEC 61968 and 61970 standards
What protocols does the platform use?	REST
What data formats does the platform use?	JSON, XML, RDF

What data models does the platform use?	IEC CIM, Common Information Model as defined by IEC 61970-301 and 61968-11
Please provide any additional remarks on your protocols, data formats and data models, if needed	The platform natively supports REST API access and CIM/XML file import/export as defined by IEC 61970-552. Other protocols and import/export data formats can be supported via adapters.
What specific interface(s)/service(s) does your platform provide?	PowerCIM model query REST service, PowerCIM CIM/XML import/export service
What additional tooling/wizards does your platform currently provide?	A frontend app
Do you plan to extend the platform with additional tooling/interfaces/services during the project?	We plan to extend the platform with specialized additional adapters to integrate with systems not supporting a standardized CIM data exchange (metering model, Dynamic Thermal Rating).

TABLE 5. SURVEY RESPONSE FOR POWERCIM

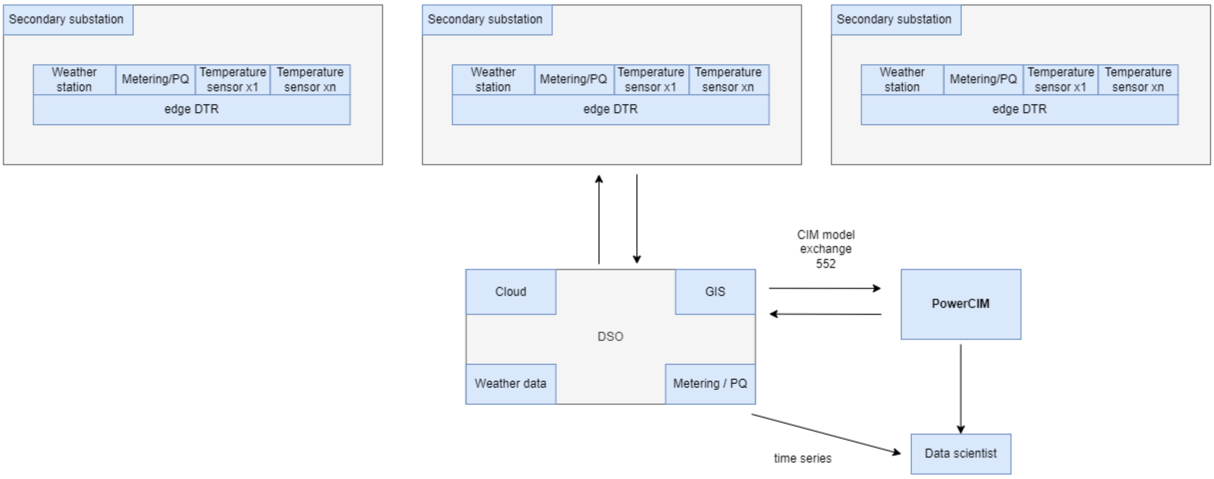

FIGURE 13. ARCHITECTURE FIGURE FOR POWERCIM

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9.4 AI SERVICES FOR LOCAL GRID RESILIENCE

Question	Answer
What is the name of the platform?	AI services for local grid resilience
What is the purpose of the platform?	To enhance local grid resilience through detection and prevention
What is the description of the platform (max. 200 words)?	This platform will actively monitor the functioning of the grid and will detect (technical) anomalies within a series of measurements provided by devices hosted at Arnhems Buiten, aiming to report possible (future) irregularities within the system.
Which partner/vendor provides the platform?	VU and Arnhems Buiten
Where did the platform originate?	The platform was conceptualized during the Interconnect project (https://interconnectproject.eu, https://zenodo.org/records/10566775)
Is your platform open source?	Yes
What is the license of the platform?	Other: To be determined at a later moment
Comments about the license (optional)	Depends on the software and/or libraries that will be included in the future
Who owns the IP (if registered)?	Not applicable
What is the current TRL (=Technology Readiness Level) of the platform?	TRL 2 Technology concept formulated
Is the platform used in B2B or B2C?	B2B (Business to business)
If B2C, do you comply with the GDPR or relevant regulation for user privacy protection?	I don't know
Does the platform use an AI (Artificial Intelligence) component?	Yes
Is the platform compliant with the European AI Act?	Yes
Please explain your answer about whether your platform is compliant with the AI Act?	The service provides a low-risk and non-general purpose AI system that ingests and yields non-sensitive data, owned by the same agent.
Which artificial intelligence technique does your platform use?	Neuro-symbolic AI
Please elaborate on which AI technique you use and on which problem you apply it.	The service will employ a combination of graph-learning techniques, outlier detection, and time-series analysis to timely detect anomalies in SAREF-encoded graph data from connected energy nodes.
In which pilot(s) will the platform be used?	Netherlands
Concerning use cases, in which of your pilots BUCs and SUCs is your platform used? Please use the BUC/SUC naming convention, like BUC-NL-01	Fully provided/used

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Is the platform being fully provided/used in the pilot or only parts?	Fully provided/used
In case only partially provided/used, please elaborate	
What is the architecture of the pilot where your platform will be used? (only main building blocks/components)	See FIGURE 14
Where in the pilot architecture is your platform positioned?	Platform position is visible in the architecture in FIGURE 14
Where will the platform be deployed?	EDGE
Do you plan to have a Data Space Connector in your platform?	No
If you do NOT plan to have a Data Space Connector in your platform, please motivate your choice	At present, our platform solely relies on the data provided by the Knowledge Engine. This might be extended to include a Data Space Connector in the future, depending on the developments within HEDGE-IoT.
Where in the pilot picture is/are your data space connector(s) positioned?	
Do you have a preference for a specific data space connector?	
Please explain your answer on your preference on the data space connector	
In which part of the electricity/energy chain does the platform operate?	Local grid
Does the platform have or do you consider adding support for semantic interoperability?	Yes
Where in the previously uploaded pilot picture is the platform using Semantic Interoperability?	Semantic Interoperability is visible in the architecture in FIGURE 14
What semantic models/ontologies does the platform use?	ETSI SAREF (Smart Applications REFerence ontology) framework
If other, please provide a short description and a link to the semantic model/ontology used by your platform	
What protocols does the platform use?	REST
What data formats does the platform use?	JSON, RDF, OWL, Graph patterns
What data models does the platform use?	Other: Not applicable
Please provide any additional remarks on your protocols, data formats and data models, if needed	Our platform operates on graph data modelled in SAREF
What specific interface(s)/service(s) does your platform provide?	Jupyter Notebooks

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What additional tooling/wizards does your platform currently provide?	A custom Grafana dashboard
Do you plan to extend the platform with additional tooling/interfaces/services during the project?	Likely

TABLE 6. SURVEY RESPONSE FOR AI SERVICES FOR LOCAL GRID RESILIENCE

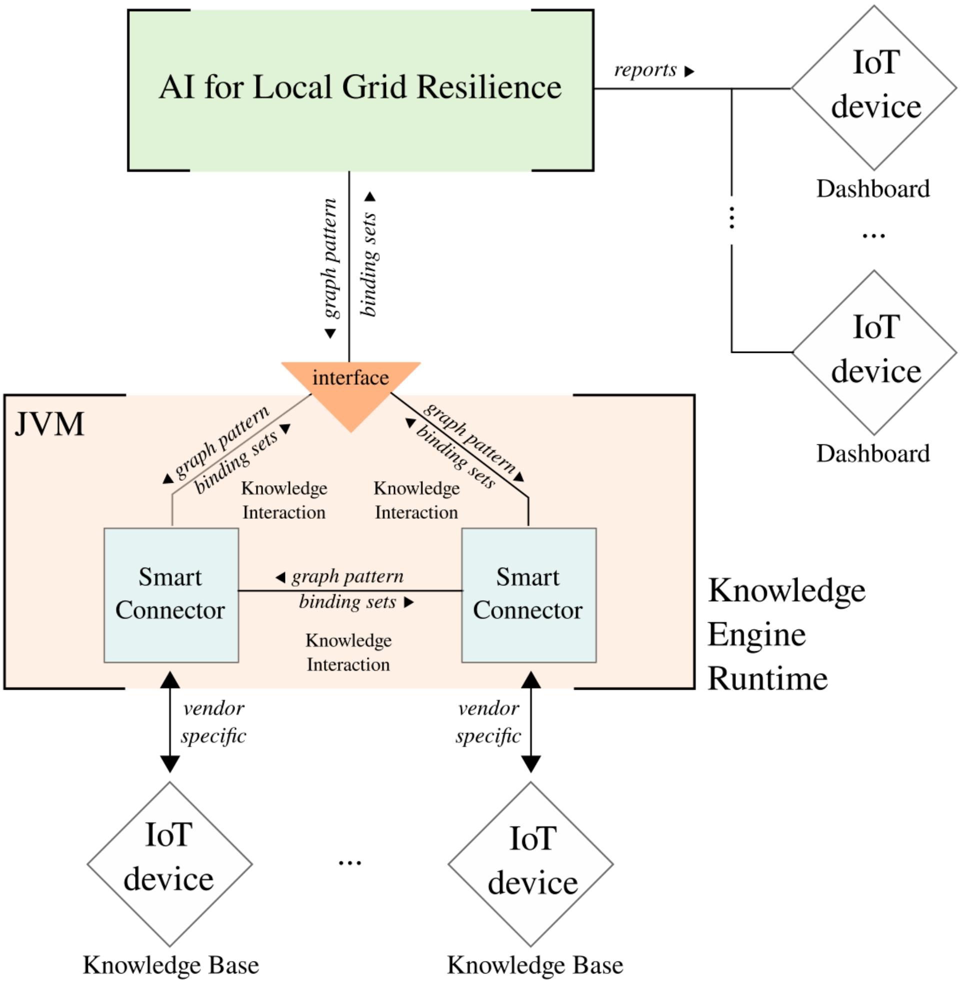

FIGURE 14. ARCHITECTURE FIGURE FOR AI SERVICES FOR LOCAL GRID RESILIENCE

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9.5 APIO PLATFORM

Question	Answer
What is the name of the platform?	Apio Platform
What is the purpose of the platform?	Enable DERs participation in Flexibility Market
What is the description of the platform (max. 200 words)?	The Apio Platform is a multi-tenant data-driven IoT platform that provides energy value chain stakeholders with the ability to connect and manage assets, ingest, analyze and export data and support data driven decision making. It features well known standards, such as MQTTS and JSON REST APIs to interact with any of its functionalities and to integrate it with any other service as well as other well-known data formats such as Parquet and Arrow for time-series data Supporting multiple stakeholder profiles, it features several modules, such as Renewable Assets Management, Flexibility Management, Virtual Power Plant Management and more.
Which partner/vendor provides the platform?	Apio
Where did the platform originate?	The Apio Platform originated from the company experience, the Blockchain Access Layer originated in H2020 project Platone. https://www.platone-h2020.eu/
Is your platform open source?	No
What is the license of the platform?	Proprietary License
Comments about the license (optional)	We are in the process of open-sourcing the core of the platform, pursuing a "Open Core" model.
Who owns the IP (if registered)?	Not Registered, but owned by Apio
What is the current TRL (=Technology Readiness Level) of the platform?	TRL 9 Actual system proven in operational environment
Is the platform used in B2B or B2C?	B2B (Business to business)
If B2C, do you comply with the GDPR or relevant regulation for user privacy protection?	Yes
Does the platform use an AI (Artificial Intelligence) component?	Yes
Is the platform compliant with the European AI Act?	I don't know
Please explain your answer about whether your platform is compliant with the AI Act?	Our usage of "AI" within our platform is in the form of Machine Learning algorithms for time series data prediction. These forecasts are used as "Decisional Support" to the stakeholder rather than as automated action.
Which artificial intelligence technique does your platform use?	Machine learning, such as regression analysis, neural networks

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Please elaborate on which AI technique you use and on which problem you apply it.	We apply ML algorithms and techniques to energy related time series data for forecasting, outlier detection and anomaly detection.
In which pilot(s) will the platform be used?	Italy
Concerning use cases, in which of your pilots BUCs and SUCs is your platform used? Please use the BUC/SUC naming convention, like BUC-NL-01	SUC-IT-01.1 SUC-IT-01.2 SUC-IT-02.1
Is the platform being fully provided/used in the pilot or only parts?	Fully provided/used
In case only partially provided/used, please elaborate	
What is the architecture of the pilot where your platform will be used? (only main building blocks/components)	See FIGURE 15
Where in the pilot architecture is your platform positioned?	Platform position is visible in the architecture in FIGURE 15
Where will the platform be deployed?	EDGE, CLOUD
Do you plan to have a Data Space Connector in your platform?	Yes
If you do NOT plan to have a Data Space Connector in your platform, please motivate your choice	
Where in the pilot picture is/are your data space connector(s) positioned?	Not yet visible, architecture with data space connector is still to be defined
Do you have a preference for a specific data space connector?	Other: We don't have a preference, we need to investigate which one fits better in our use cases.
Please explain your answer on your preference on the data space connector	We do not have a lot of experience with data space connectors, only with True Connector in project Platoon
In which part of the electricity/energy chain does the platform operate?	Behind meter, After meter, Local grid, Aggregator, Distribution System Operator (DSO)
Does the platform have or do you consider adding support for semantic interoperability?	Yes
Where in the previously uploaded pilot picture is the platform using Semantic Interoperability?	Other: In exchanges with Stakeholders
What semantic models/ontologies does the platform use?	Other: We will adopt SAREF, we are working on WoT integration for another project
If other, please provide a short description and a link to the semantic model/ontology used by your platform	https://www.w3.org/WoT/
What protocols does the platform use?	REST, MODBUS, MQTT, CHAIN2 protocol from Main Meters, HTTPS (REST on HTTPS)
What data formats does the platform use?	JSON, CSV

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What data models does the platform use?	EN 50631 (SPINE/SPINE-IoT), KNX, Proprietary
Please provide any additional remarks on your protocols, data formats and data models, if needed	Our platform exposes all the capabilities via REST JSON APIs, we have an OpenApi Specification at https://documentation.apio.network/api/
What specific interface(s)/service(s) does your platform provide?	- IoT Asset Management - Renewable Asset Management - Energy Community Management (To be developed withing the project) - Flexible Assets Management - Smart Energy Analytics - Smart Home Analytics - Smart Building Analytics - Rule Engine Interface - Reports Generation Interface - Time Series Data Explorer and Dashboarding - Anomaly detection and visualization - User management with Role Based and Resource Based access controls
What additional tooling/wizards does your platform currently provide?	- Actionable Documentation (OpenAPI) - SDKs - Grafana Connector
Do you plan to extend the platform with additional tooling/interfaces/services during the project?	We will build the Energy Community Management and Virtual Power Plant Management capabilities

TABLE 7. SURVEY RESPONSE FOR AI SERVICES FOR THE APIO PLATFORM

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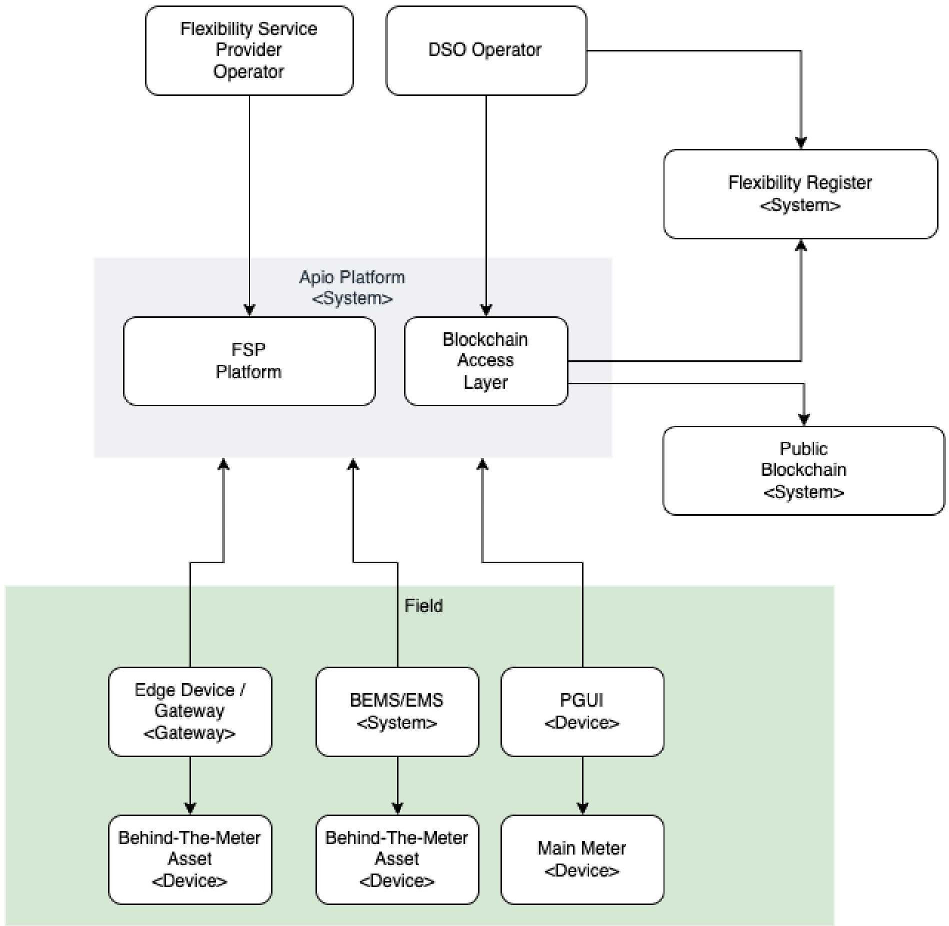

FIGURE 15. ARCHITECTURE FIGURE FOR APIO PLATFORM

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9.6 REAL-TIME RESERVE MARKET SIMULATOR

Question	Answer
What is the name of the platform?	Real-Time Reserve Market Simulator
What is the purpose of the platform?	Simulate Reserve Market participation
What is the description of the platform (max. 200 words)?	The Real-Time Reserve Market Simulator (MS) is an in-house developed tool that evaluates the performance of a bid submitted for a particular time frame in comparison with historical bids retrieved from ENTSO-E Transparency Platform. The platform validates the structure of the bid, applies the necessary market rules for the selected Ancillary Service and determines if the bid could be accepted in the corresponding market clearing process. In addition, it can issue activation signals/messages and perform settlement calculations.
Which partner/vendor provides the platform?	R&D Nester
Where did the platform originate?	European project FlexUnity
Is your platform open source?	No
What is the license of the platform?	Other: No license
Comments about the license (optional)	No license considered at the moment
Who owns the IP (if registered)?	R&D Nester (IP not registered)
What is the current TRL (=Technology Readiness Level) of the platform?	TRL 5 Technology validated in relevant environment
Is the platform used in B2B or B2C?	B2B (Business to business)
If B2C, do you comply with the GDPR or relevant regulation for user privacy protection?	I don't know
Does the platform use an AI (Artificial Intelligence) component?	No
Is the platform compliant with the European AI Act?	
Please explain your answer about whether your platform is compliant with the AI Act?	
Which artificial intelligence technique does your platform use?	
Please elaborate on which AI technique you use and on which problem you apply it.	
In which pilot(s) will the platform be used?	Portugal
Concerning use cases, in which of your pilots BUCs and SUCs is your platform used? Please use the BUC/SUC naming convention, like BUC-NL-01	BUC-PT-02 and respective SUCs

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Is the platform being fully provided/used in the pilot or only parts?	Partially provided/used
In case only partially provided/used, please elaborate	Some developments (Replacement Reserve Product) are deprecated but kept in the platform
What is the architecture of the pilot where your platform will be used? (only main building blocks/components)	See FIGURE 16
Where in the pilot architecture is your platform positioned?	Platform position is visible in the architecture in FIGURE 16
Where will the platform be deployed?	CLOUD
Do you plan to have a Data Space Connector in your platform?	Yes
If you do NOT plan to have a Data Space Connector in your platform, please motivate your choice	
Where in the pilot picture is/are your data space connector(s) positioned?	Data space connector is visible in the architecture in FIGURE 16
Do you have a preference for a specific data space connector?	Other: No preference
Please explain your answer on your preference on the data space connector	No preference
In which part of the electricity/energy chain does the platform operate?	Aggregator, Transmission System Operator (TSO)
Does the platform have or do you consider adding support for semantic interoperability?	No
Where in the previously uploaded pilot picture is the platform using Semantic Interoperability?	
What semantic models/ontologies does the platform use?	
If other, please provide a short description and a link to the semantic model/ontology used by your platform	
What protocols does the platform use?	REST
What data formats does the platform use?	JSON, XML
What data models does the platform use?	IEC CIM
Please provide any additional remarks on your protocols, data formats and data models, if needed	We use standard IEC 62325-351 as a requirement to submit files into the service. The standard is incorporated and nothing is built on top of it.
What specific interface(s)/service(s) does your platform provide?	Receive bids Provide Bid validation Provide Selection notification Provide Activation signal Receive metering data Provide Settlement notification

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What additional tooling/wizards does your platform currently provide?	API Endpoints
Do you plan to extend the platform with additional tooling/interfaces/services during the project?	Front-end

TABLE 8. SURVEY RESPONSE FOR THE REAL-TIME RESERVE MARKET SIMULATOR

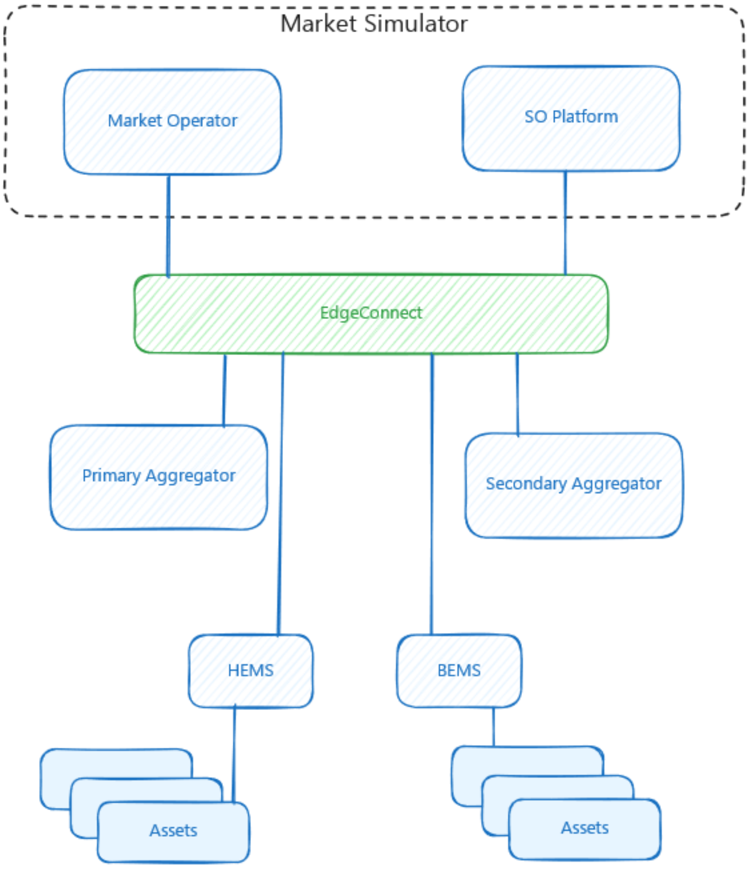

FIGURE 16. ARCHITECTURE FIGURE FOR REAL-TIME RESERVE MARKET SIMULATOR

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9.7 ABB EDGE PLATFORM

Question	Answer
What is the name of the platform?	ABB edge platform
What is the purpose of the platform?	Share real-time data between different applications in an efficient way
What is the description of the platform (max. 200 words)?	The platform enables sharing high volume data with strict real-time requirements between different applications that are executed on an edge server in a virtualization environment.
Which partner/vendor provides the platform?	ABB
Where did the platform originate?	ABB
Is your platform open source?	No
What is the license of the platform?	Proprietary License
Comments about the license (optional)	
Who owns the IP (if registered)?	ABB
What is the current TRL (=Technology Readiness Level) of the platform?	TRL 3 Experimental proof of concept
Is the platform used in B2B or B2C?	B2B (Business to business)
If B2C, do you comply with the GDPR or relevant regulation for user privacy protection?	I don't know
Does the platform use an AI (Artificial Intelligence) component?	No
Is the platform compliant with the European AI Act?	
Please explain your answer about whether your platform is compliant with the AI Act?	
Which artificial intelligence technique does your platform use?	
Please elaborate on which AI technique you use and on which problem you apply it.	
In which pilot(s) will the platform be used?	Finland
Concerning use cases, in which of your pilots BUCs and SUCs is your platform used? Please use the BUC/SUC naming convention, like BUC-NL-01	All Finnish pilot use cases
Is the platform being fully provided/used in the pilot or only parts?	Fully provided/used
In case only partially provided/used, please elaborate	

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What is the architecture of the pilot where your platform will be used? (only main building blocks/components)	See below
Where in the pilot architecture is your platform positioned?	Platform position is visible in the architecture in FIGURE 17
Where will the platform be deployed?	EDGE
Do you plan to have a Data Space Connector in your platform?	No
If you do NOT plan to have a Data Space Connector in your platform, please motivate your choice	Data space connectors are not applicable for data exchange that has high volume and strict real-time requirements.
Where in the pilot picture is/are your data space connector(s) positioned?	
Do you have a preference for a specific data space connector?	
Please explain your answer on your preference on the data space connector	
In which part of the electricity/energy chain does the platform operate?	Distribution System Operator (DSO)
Does the platform have or do you consider adding support for semantic interoperability?	No
Where in the previously uploaded pilot picture is the platform using Semantic Interoperability?	
What semantic models/ontologies does the platform use?	
If other, please provide a short description and a link to the semantic model/ontology used by your platform	
What protocols does the platform use?	IEC 61850
What data formats does the platform use?	Other: IEC 60870-5-104 and IEEE 1588 v2
What data models does the platform use?	Other: IEC 61850
Please provide any additional remarks on your protocols, data formats and data models, if needed	Other: IEC 61850, Comtrade
What specific interface(s)/service(s) does your platform provide?	The edge platform has the capability to communicate with components outside the server using 61850 SV, GOOSE and MMS, IEC 60870-5-104 and IEEE 1588 v2 (Precision Time Protocol). The platform internal communication between the different applications is still under development.
What additional tooling/wizards does your platform currently provide?	The platform enables sharing data from IEC 61850 data model to third party applications within the edge server.

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Do you plan to extend the platform with additional tooling/interfaces/services during the project?	Tools for configuring the platform internal services will be documented and standard editing tools will be used.

TABLE 9. SURVEY RESPONSE FOR THE ABB EDGE PLATFORM

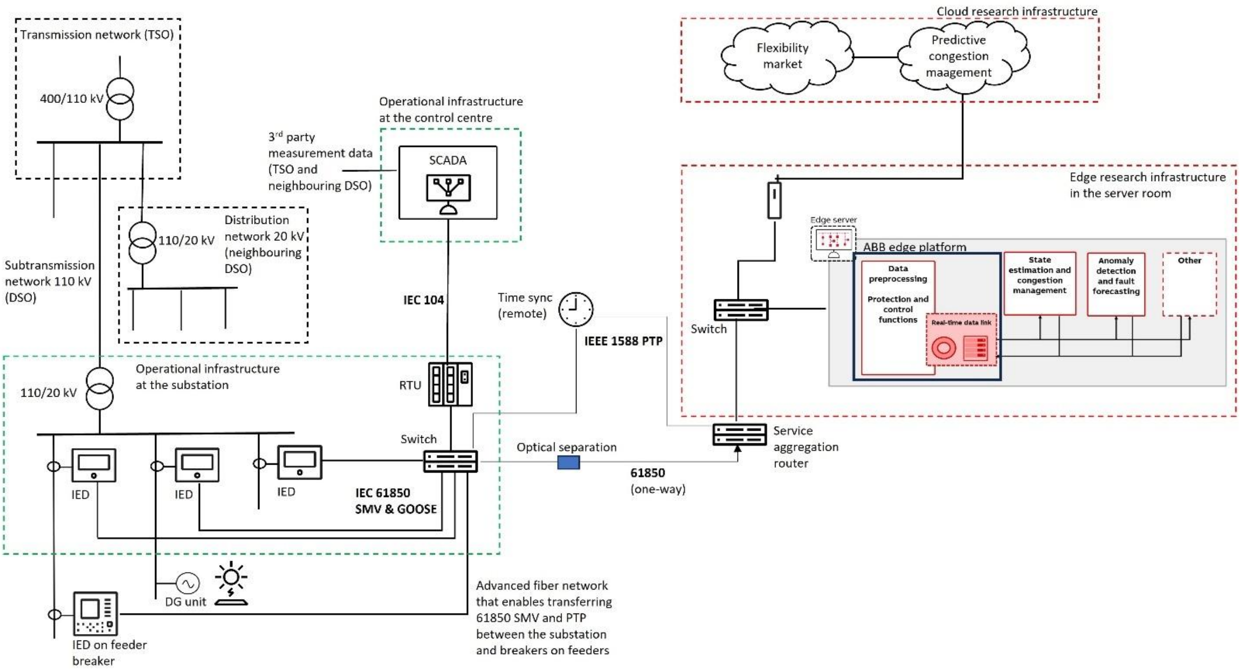

FIGURE 17. ARCHITECTURE FIGURE FOR ABB EDGE PLATFORM

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9.8 DYNAMIC AND AUTOMATED B2B ENERGY DATA AND FLEXIBILITY SERVICE PLATFORM

Question	Answer
What is the name of the platform?	Dynamic and automated B2B energy data and flexibility service platform
What is the purpose of the platform?	Data-sharing services and operation services
What is the description of the platform (max. 200 words)?	The platform will include data sharing between different stakeholders including DSO, NEMO and flexibility service provider (FSP) to realize predictive congestion management (CM). In addition, the platform provides possibility through eclipse dataspace connector to exchange data with real-time CM algorithms running on the edge.
Which partner/vendor provides the platform?	TAU
Where did the platform originate?	Research project
Is your platform open source?	Yes
What is the license of the platform?	MIT License (https://opensource.org/license/mit) Other: No license defined yet
Comments about the license (optional)	
Who owns the IP (if registered)?	No
What is the current TRL (=Technology Readiness Level) of the platform?	TRL 2 Technology concept formulated
Is the platform used in B2B or B2C?	B2B (Business to business)
If B2C, do you comply with the GDPR or relevant regulation for user privacy protection?	Yes
Does the platform use an AI (Artificial Intelligence) component?	No
Is the platform compliant with the European AI Act?	
Please explain your answer about whether your platform is compliant with the AI Act?	
Which artificial intelligence technique does your platform use?	
Please elaborate on which AI technique you use and on which problem you apply it.	
In which pilot(s) will the platform be used?	Finland
Concerning use cases, in which of your pilots BUCs and SUCs is your platform used? Please use the BUC/SUC naming convention, like BUC-NL-01	All congestion management use cases
Is the platform being fully provided/used in the pilot or only parts?	Partially provided/used

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In case only partially provided/used, please elaborate	
What is the architecture of the pilot where your platform will be used? (only main building blocks/components)	See FIGURE 18
Where in the pilot architecture is your platform positioned?	Platform position is visible in architecture image uploaded.
Where will the platform be deployed?	FOG, CLOUD
Do you plan to have a Data Space Connector in your platform?	Yes
If you do NOT plan to have a Data Space Connector in your platform, please motivate your choice	
Where in the pilot picture is/are your data space connector(s) positioned?	Data space connector is visible in the architecture in FIGURE 18
Do you have a preference for a specific data space connector?	Eclipse Dataspace Components (EDC)
Please explain your answer on your preference on the data space connector	
In which part of the electricity/energy chain does the platform operate?	Distribution System Operator (DSO), Other: Between substation edge and predictive congestion management, and between different energy stakeholders while trading of energy flexibility
Does the platform have or do you consider adding support for semantic interoperability?	Yes
If other, please provide a short description and a link to the semantic model/ontology used by your platform	
Where in the previously uploaded pilot picture is the platform using Semantic Interoperability?	Other: Between different data sources, improving interoperability between data formats
What semantic models/ontologies does the platform use?	Other: Not defined yet
If other, please provide a short description and a link to the semantic model/ontology used by your platform	-
What protocols does the platform use?	HTTP
What data formats does the platform use?	JSON
What data models does the platform use?	Other: Not defined yet
Please provide any additional remarks on your protocols, data formats and data models, if needed	
What specific interface(s)/service(s) does your platform provide?	-

What additional tooling/wizards does your platform currently provide?	–
Do you plan to extend the platform with additional tooling/interfaces/services during the project?	–

TABLE 10. SURVEY RESPONSE FOR THE DYNAMIC AND AUTOMATED ENERGY DATA AND FLEXIBILITY SERVICE PLATFORM

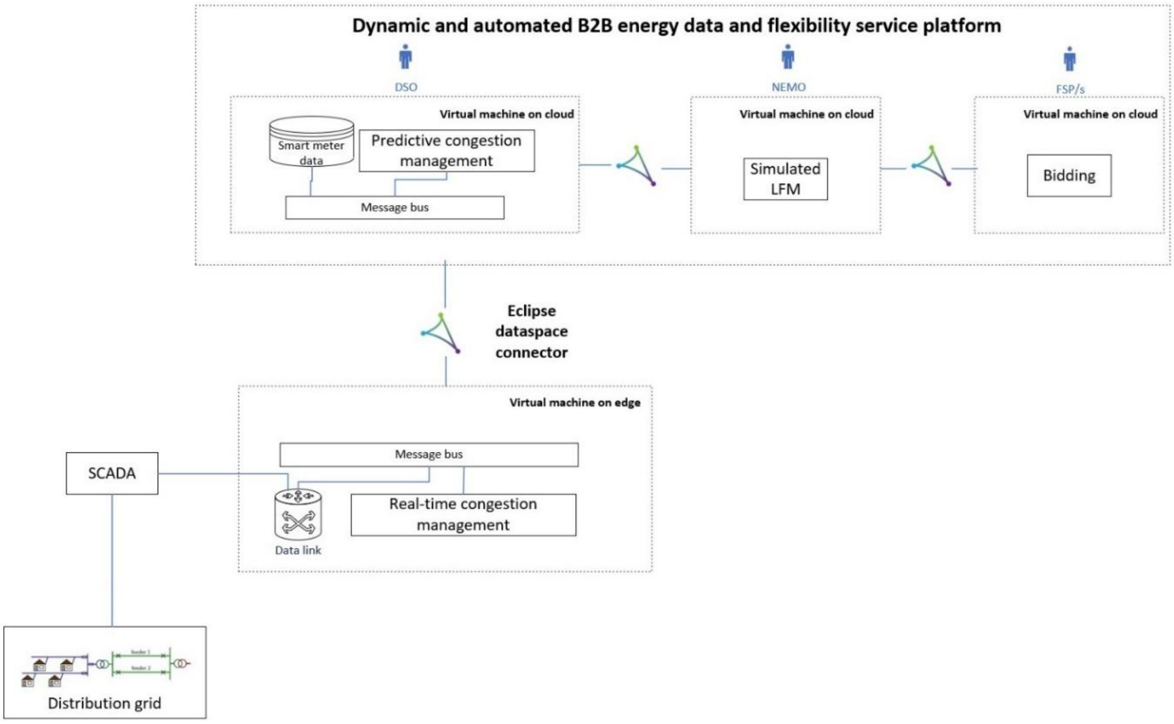

FIGURE 18. ARCHITECTURE FIGURE FOR DYNAMIC AND AUTOMATED ENERGY DATA AND FLEXIBILITY SERVICE PLATFORM

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9.9 EDGECONNECT

Question	Answer
What is the name of the platform?	EdgeConnect
What is the purpose of the platform?	Enable the energy flexibility value chain
What is the description of the platform (max. 200 words)?	EdgeConnect is a digital platform that provides stakeholders (i.e., consumers, service providers, aggregators, DSOs) along the value chain of flexibility provision with an integrated ecosystem to support all main activities in this value chain, to help identify, unlock and make use of all available flexibility potential. As a multi-stakeholder platform, it comprehends several views, providing distinct value propositions for each stakeholder.
Which partner/vendor provides the platform?	INESC TEC
Where did the platform originate?	The European Project BeFlexible (https://beflexible.eu/)
Is your platform open source?	No
What is the license of the platform?	Other: No License
Comments about the license (optional)	
Who owns the IP (if registered)?	INESC TEC
What is the current TRL (=Technology Readiness Level) of the platform?	TRL 6 Technology demonstrated in relevant environment
Is the platform used in B2B or B2C?	B2B (Business to business)
If B2C, do you comply with the GDPR or relevant regulation for user privacy protection?	I don't know
Does the platform use an AI (Artificial Intelligence) component?	No
Is the platform compliant with the European AI Act?	
Please explain your answer about whether your platform is compliant with the AI Act?	
Which artificial intelligence technique does your platform use?	
Please elaborate on which AI technique you use and on which problem you apply it.	
In which pilot(s) will the platform be used?	Portugal
Concerning use cases, in which of your pilots BUCs and SUCs is your platform used? Please use the BUC/SUC naming convention, like BUC-NL-01	BUC-PT-01, BUC-PT-02 and BUC-PT-03
Is the platform being fully provided/used in the pilot or only parts?	Partially provided/used

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In case only partially provided/used, please elaborate	
What is the architecture of the pilot where your platform will be used? (only main building blocks/components)	See FIGURE 19
Where in the pilot architecture is your platform positioned?	Platform position is visible in the architecture in FIGURE 19
Where will the platform be deployed?	CLOUD
Do you plan to have a Data Space Connector in your platform?	Yes
If you do NOT plan to have a Data Space Connector in your platform, please motivate your choice	
Where in the pilot picture is/are your data space connector(s) positioned?	Not yet visible, architecture with data space connector is still to be defined
Do you have a preference for a specific data space connector?	Other: No preference
Please explain your answer on your preference on the data space connector	
In which part of the electricity/energy chain does the platform operate?	After meter
Does the platform have or do you consider adding support for semantic interoperability?	Yes
Where in the previously uploaded pilot picture is the platform using Semantic Interoperability?	Other: During any interaction with stakeholders related to the flexibility value chain
What semantic models/ontologies does the platform use?	None
If other, please provide a short description and a link to the semantic model/ontology used by your platform	
What protocols does the platform use?	REST
What data formats does the platform use?	JSON
What data models does the platform use?	Other: User defined models
Please provide any additional remarks on your protocols, data formats and data models, if needed	
What specific interface(s)/service(s) does your platform provide?	EdgeConnect provides services for: – Onboarding and characterizing consumer assets, giving them a flexibility profile – Pairing flexibility service providers with consumers with flexible assets – Proxy and integration of flexibility services between providers, the market and DSOs, such as bid qualification, bid negotiation, market clearing and settlement.

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What additional tooling/wizards does your platform currently provide?	There is a wizard to help onboard stakeholders on the platform, as well as to help consumers register their assets.
Do you plan to extend the platform with additional tooling/interfaces/services during the project?	Yes, we plan to create a new interface to allow two or more aggregators to take their bids together to market using a procedure called a "bilateral agreement". Furthermore, we plan to extend the platform using data connectors to enable interoperable data exchange between the platform and its stakeholders.

TABLE 11. SURVEY RESPONSE FOR THE EDGECONNECT PLATFORM

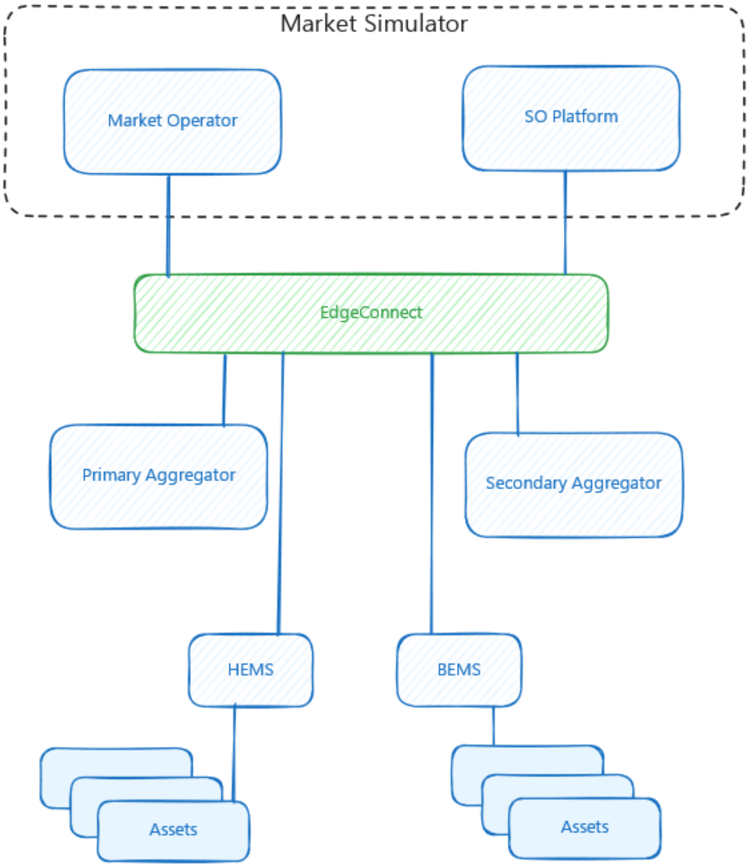

FIGURE 19. ARCHITECTURE FIGURE FOR EDGECONNECT

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9.10 SEMANTIC INTEROPERABILITY FRAMEWORK (SIF)

Question	Answer
What is the name of the platform?	Semantic Interoperability Framework (SIF) (based on H2020 InterConnect)
What is the purpose of the platform?	Semantically interoperable data exchange and reasoning using ontologies (e.g., SAREF)
What is the description of the platform (max. 200 words)?	The SIF enables data exchange and reasoning based on semantically enriched information, providing distributed IoT EDGE/CLOUD/FOG support. The platform consists of two main components: (1) the Knowledge Engine (KE) for data exchange, and (2) the SAREF framework of ontologies as a common language. The platform's architecture supports semantic adapters for different protocols and data formats. It uses semantic adapters to map different data models to SAREF.
Which partner/vendor provides the platform?	TNO , INESC TEC, VizLore (NOTE: VizLore is not partner in HEDGE-IoT)
Where did the platform originate?	The European Project H2020 InterConnect (https://interconnectproject.eu/)
Is your platform open source?	Yes
What is the license of the platform?	Apache License 2.0 (https://www.apache.org/licenses/LICENSE-2.0) BSD-3-Clause License (https://opensource.org/license/BSD-3-Clause)
Comments about the license (optional)	- Knowledge Engine under Apache License 2.0 - SAREF framework at ETSI forge under BSD-3-Clause License
Who owns the IP (if registered)?	SIF IP owned by TNO, INESC TEC, VizLore (note: SAREF framework under ETSI IP)
What is the current TRL (=Technology Readiness Level) of the platform?	TRL 7 System prototype demonstration in operational environment
Is the platform used in B2B or B2C?	B2B (Business to business)
If B2C, do you comply with the GDPR or relevant regulation for user privacy protection?	I don't know
Does the platform use an AI (Artificial Intelligence) component?	No
Is the platform compliant with the European AI Act?	

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Please explain your answer about whether your platform is compliant with the AI Act?	
Which artificial intelligence technique does your platform use?	
Please elaborate on which AI technique you use and on which problem you apply it.	
In which pilot(s) will the platform be used?	Netherlands, Portugal
Concerning use cases, in which of your pilots BUCs and SUCs is your platform used? Please use the BUC/SUC naming convention, like BUC-NL-01	BUC-NL-01, BUC-NL-02 SUC-NL-01.1, SUC-NL-01.2, SUC-NL-01.3 SUC-NL-02.1, SUC-NL-02.2
Is the platform being fully provided/used in the pilot or only parts?	Partially provided/used
In case only partially provided/used, please elaborate	The SIF, as originally developed in the H2020 InterConnect project, comprises a set of components. In the Dutch pilot of HEDGE-IoT we reuse a subset of these components, namely (1) the Knowledge Engine with the Generic Adapter, and (2) the SAREF ontologies framework
What is the architecture of the pilot where your platform will be used? (only main building blocks/components)	See FIGURE 20
Where in the pilot architecture is your platform positioned?	Platform position is visible in the architecture in FIGURE 20
Where will the platform be deployed?	EDGE, CLOUD
Do you plan to have a Data Space Connector in your platform?	Yes
If you do NOT plan to have a Data Space Connector in your platform, please motivate your choice	
Where in the pilot picture is/are your data space connector(s) positioned?	Data space connector is visible in the architecture in FIGURE 20
Do you have a preference for a specific data space connector?	Eclipse Dataspace Components (EDC)
Please explain your answer on your preference on the data space connector	We are in favor of a connector that supports the Data Space protocol. Our preference goes specifically towards the Eclipse Dataspace Components (EDC).
In which part of the electricity/energy chain does the platform operate?	Behind meter, Local grid, micro DSO
Does the platform have or do you consider adding support for semantic interoperability?	Yes
Where in the previously uploaded pilot picture is the platform using Semantic Interoperability?	Semantic Interoperability is visible in the architecture figure uploaded

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What semantic models/ontologies does the platform use?	ETSI SAREF (Smart Applications REFerence ontology) framework
If other, please provide a short description and a link to the semantic model/ontology used by your platform	
What protocols does the platform use?	REST
What data formats does the platform use?	JSON, RDF, OWL
What data models does the platform use?	EN 50491-12 (S2), EN 50631 (SPINE/SPINE-IoT)
Please provide any additional remarks on your protocols, data formats and data models, if needed	Concerning protocols, the SIF platform natively supports REST, but other protocols (like MODBUS, MQTT) are supported via semantic adapters. Concerning data models, in principle it could support any data model via semantic adapters, but EN 50491-12 (S2) and EN 50631 (SPINE/SPINE-IoT) have been already largely tested and deployed in the InterConnect project.
What specific interface(s)/service(s) does your platform provide?	- Knowledge Engine Dev REST/Java interface - Generic Adapter REST service
What additional tooling/wizards does your platform currently provide?	There is a wizard to help developers to edit and visualize RDF graph patterns (https://interconnect-dev.inesctec.pt/graph/)
Do you plan to extend the platform with additional tooling/interfaces/services during the project?	Yes. We plan to extend the platform with some additional services for anomaly detection and predictive maintenance of the local grid. Furthermore, we plan to extend the platform with some additional tooling for: - SemanticTreeHouse (STH) as vocabulary Hub - pipeline to create mappings to SAREF - validation of SAREF mappings (in collaboration with Trialog)

TABLE 12. SURVEY RESPONSE FOR THE SEMANTIC INTEROPERABILITY FRAMEWORK

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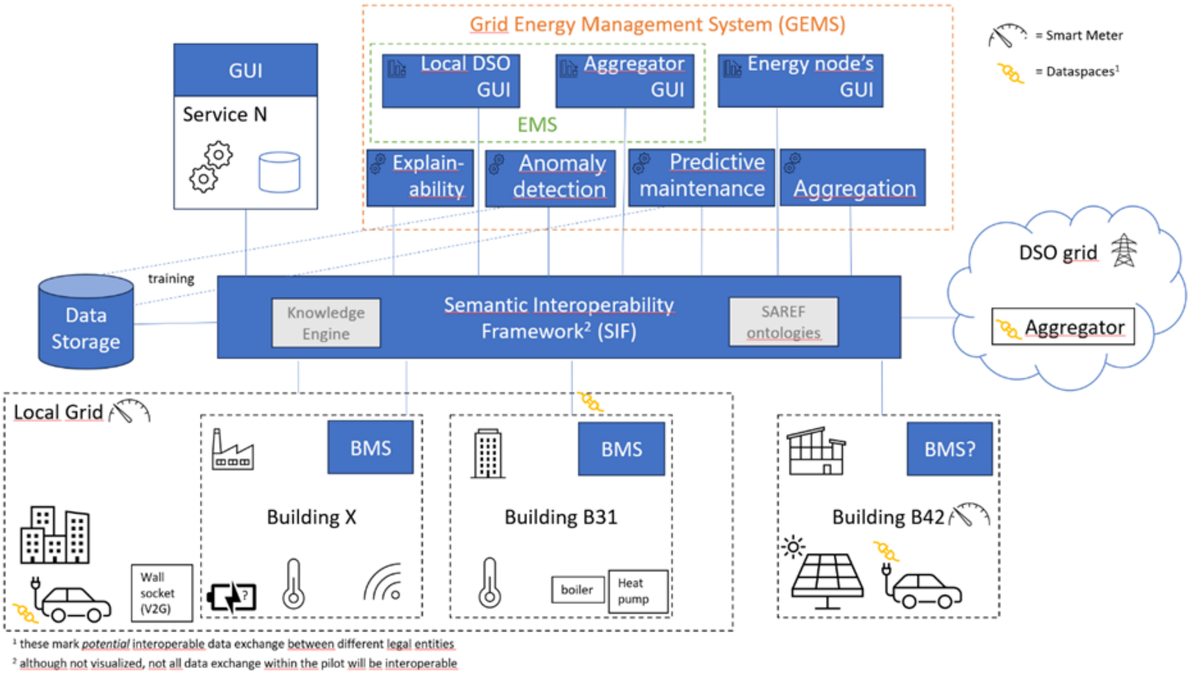

FIGURE 20. ARCHITECTURE FIGURE FOR SEMANTIC INTEROPERABILITY FRAMEWORK

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9.11 HOME MANAGEMENT SYSTEM

Question	Answer
What is the name of the platform?	Home Management System (not a platform)
What is the purpose of the platform?	To extract data and insights from residential buildings using edge and cloud operations
What is the description of the platform (max. 200 words)?	The solution requires installations of hardware components on the edge to track and monitor energy consumption dynamics. It can monitor the full electricity consumption and separate appliances, as well as small scale DERs (heat pumps, PVs and testing with BESS). The platform works as a unified solution, with advanced energy analytics, user interfaces and control mechanisms by users' input.
Which partner/vendor provides the platform?	ICCS
Where did the platform originate?	Internal development
Is your platform open source?	No
What is the license of the platform?	Proprietary License
Comments about the license (optional)	
Who owns the IP (if registered)?	ICCS
What is the current TRL (=Technology Readiness Level) of the platform?	TRL 5 Technology validated in relevant environment
Is the platform used in B2B or B2C?	B2C (Business to consumer)
If B2C, do you comply with the GDPR or relevant regulation for user privacy protection?	Yes
Does the platform use an AI (Artificial Intelligence) component?	Yes
Is the platform compliant with the European AI Act?	Other: Under development
Please explain your answer about whether your platform is compliant with the AI Act?	As a research project, it complies with all regulations. Right now, we are testing the technologies, and we are in consultation with the internal departments to identify any potential risks and obligations.
Which artificial intelligence technique does your platform use?	Machine learning, such as regression analysis, neural networks
Please elaborate on which AI technique you use and on which problem you apply it.	Machine, Deep, Federated, Reinforcement Learning, for residential energy analytics, flexibility provision, load demand and energy generation forecasts, energy efficiency analytics
In which pilot(s) will the platform be used?	Greece
Concerning use cases, in which of your pilots BUCs and SUCs is your platform used? Please use the BUC/SUC naming convention, like BUC-NL-01	SUC-GR-01, SUC-GR-02, SUC-GR-03, SUC-GR-04, SUC-GR-05

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Is the platform being fully provided/used in the pilot or only parts?	Fully provided/used
In case only partially provided/used, please elaborate	
What is the architecture of the pilot where your platform will be used? (only main building blocks/components)	See FIGURE 21
Where in the pilot architecture is your platform positioned?	Platform position is visible in the architecture in FIGURE 21
Where will the platform be deployed?	EDGE, CLOUD
Do you plan to have a Data Space Connector in your platform?	Yes
If you do NOT plan to have a Data Space Connector in your platform, please motivate your choice	
Where in the pilot picture is/are your data space connector(s) positioned?	Not yet visible, architecture with data space connector is still to be defined
Do you have a preference for a specific data space connector?	Other: No preference
Please explain your answer on your preference on the data space connector	No preference, a stable implementation is needed as we are dealing with consumers' consumption data
In which part of the electricity/energy chain does the platform operate?	Behind meter, Aggregator
Does the platform have or do you consider adding support for semantic interoperability?	No
Where in the previously uploaded pilot picture is the platform using Semantic Interoperability?	
What semantic models/ontologies does the platform use?	
If other, please provide a short description and a link to the semantic model/ontology used by your platform	
What protocols does the platform use?	MODBUS, MQTT
What data formats does the platform use?	JSON, CSV, RDF
What data models does the platform use?	Proprietary
Please provide any additional remarks on your protocols, data formats and data models, if needed	
What specific interface(s)/service(s) does your platform provide?	UIs (mobile app and desktop/web) for end users (residential and aggregator), backend interfaces for system monitoring, docker components for analytics, data pipelines for monitoring and provisioning

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What additional tooling/wizards does your platform currently provide?	n/a
Do you plan to extend the platform with additional tooling/interfaces/services during the project?	Yes

TABLE 13. SURVEY RESPONSE FOR THE HOME MANAGEMENT SYSTEM

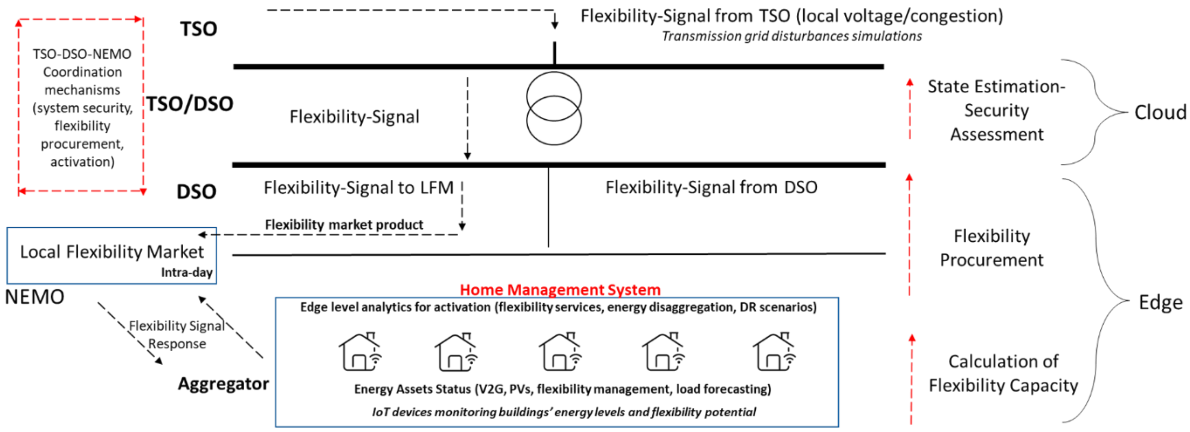

FIGURE 21. ARCHITECTURE FIGURE FOR HOME MANAGEMENT SYSTEM

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9.12 AI-LIBRARY FOR ENERGY APPLICATIONS

Question	Answer
What is the name of the platform?	AI-library for energy applications
What is the purpose of the platform?	To develop, test and validate energy analytics applications
What is the description of the platform (max. 200 words)?	As part of numerous EU-funded projects, ICCS AI-based models and tools for smart building management and flexibility modelling algorithms has been developed by ICCS. Services such as demand and production forecasting, optimisation techniques in buildings, grids, energy communities, flexibility scenarios and assessment, building energy efficiency have been tested and validated both operationally and scientifically. The platform is an internal tool that is used to further test and deploy energy applications, as part of ICCS research activities.
Which partner/vendor provides the platform?	ICCS
Where did the platform originate?	Internal development (part of MATRYCS, BD4NRG, I-NERGY, DEDALUS, DIGIBUILD, BUILD-ON, ENERSHARE projects)
Is your platform open source?	No
What is the license of the platform?	MIT License (https://opensource.org/license/mit)
Comments about the license (optional)	
Who owns the IP (if registered)?	ICCS (not registered)
What is the current TRL (=Technology Readiness Level) of the platform?	TRL 6 Technology demonstrated in relevant environment
Is the platform used in B2B or B2C?	B2B (Business to business), B2C (Business to consumer)
If B2C, do you comply with the GDPR or relevant regulation for user privacy protection?	Yes
Does the platform use an AI (Artificial Intelligence) component?	Yes
Is the platform compliant with the European AI Act?	Other: Under review
Please explain your answer about whether your platform is compliant with the AI Act?	Ongoing review and developments to comply with necessary regulation
Which artificial intelligence technique does your platform use?	Machine learning, such as regression analysis, neural networks
Please elaborate on which AI technique you use and on which problem you apply it.	Machine Learning, Deep Learning, Federated Learning, Heuristics, Optimization techniques. Energy applications across the energy value chain
In which pilot(s) will the platform be used?	Greece

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Concerning use cases, in which of your pilots BUCs and SUCs is your platform used? Please use the BUC/SUC naming convention, like BUC-NL-01	SUC-GR-01, SUC-GR-02, SUC-GR-03, SUC-GR-04, SUC-GR-05
Is the platform being fully provided/used in the pilot or only parts?	Partially provided/used
In case only partially provided/used, please elaborate	Pending of the specific Use Cases
What is the architecture of the pilot where your platform will be used? (only main building blocks/components)	See FIGURE 22
Where in the pilot architecture is your platform positioned?	Platform position is visible in the architecture in FIGURE 22
Where will the platform be deployed?	EDGE, CLOUD
Do you plan to have a Data Space Connector in your platform?	No
If you do NOT plan to have a Data Space Connector in your platform, please motivate your choice	The platform does not require a Data Space Connector in its operation
Where in the pilot picture is/are your data space connector(s) positioned?	
Do you have a preference for a specific data space connector?	
Please explain your answer on your preference on the data space connector	
In which part of the electricity/energy chain does the platform operate?	Behind meter, On meter, After meter, Local grid, Aggregator, Distribution System Operator (DSO), micro DSO, Transmission System Operator (TSO)
Does the platform have or do you consider adding support for semantic interoperability?	No
Where in the previously uploaded pilot picture is the platform using Semantic Interoperability?	
What semantic models/ontologies does the platform use?	
If other, please provide a short description and a link to the semantic model/ontology used by your platform	
What protocols does the platform use?	REST
What data formats does the platform use?	JSON, CSV
What data models does the platform use?	Proprietary
Please provide any additional remarks on your protocols, data formats and data models, if needed	

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What specific interface(s)/service(s) does your platform provide?	Developer interfaces for model development
What additional tooling/wizards does your platform currently provide?	n/a
Do you plan to extend the platform with additional tooling/interfaces/services during the project?	Yes

TABLE 14. SURVEY RESPONSE FOR THE AI-LIBRARY FOR ENERGY APPLICATIONS

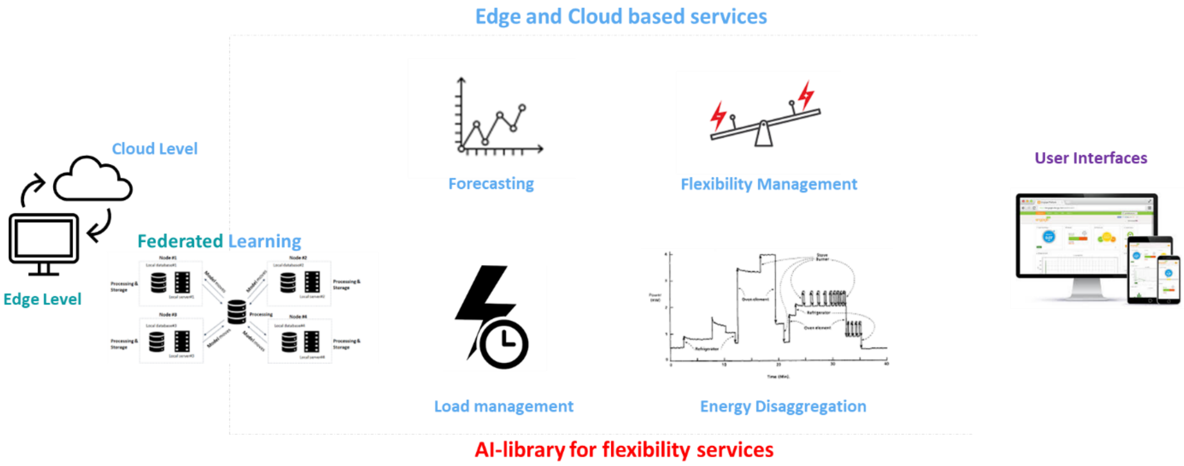

FIGURE 22. ARCHITECTURE FIGURE FOR AI-LIBRARY FOR ENERGY APPLICATIONS

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