

D5.3

**FINAL REPORT ON THE STATUS OF THE
INTEROPERABILITY NETWORK FOR THE ENERGY
TRANSITION AND DISSEMINATION AND
COMMUNICATION ACTIVITIES**



int:net

Interoperability Network for
the Energy Transition

DELIVERABLE INFORMATION

Project	int:net
Deliverable ID & title	D5.3 - Final report on the status of the Interoperability Network for the Energy Transition and dissemination and communication activities
Work package	WP5
Contractual delivery date	31.10.2025
Actual delivery date	31.10.2025
Lead organisation	B.A.U.M. Consult
Security	P = Public
Nature	Report
Version	v1
Total number of pages	41

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The research leading to these results has received funding from the European Union's Horizon Europe Research and Innovation Programme, under Grant Agreement no 101070086.

ABSTRACT

This document describes the past and ongoing attempts of int:net consortium members to establish a sound community that jointly drives interoperability in the energy system. This Interoperability Community can rely on a sound basis of interested members of the int:net Community which has been developed in the second half of the int:net project time. The community can also rely on a rich heritage of the project, i.e, a set of practical tools and guidelines. Looking ahead, the report outlines plans of each consortium member for the time after the end of the project, emphasizing the use of a newly established knowledge and collaboration platform.

KEYWORD LIST

interoperability, knowledge, governance, data space, community, test facilities, standards, ontologies, *maturity model*, IntMAS, IntPPC, EMINENT, IOP Compass, CEEDS

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EXECUTIVE SUMMARY

The document describes the exploitation strategy and long-term sustainability of the EU project int:net – Interoperability Network for the Energy Transition, which ran for 3.5 years as part of Horizon Europe. The aim was to create a comprehensive framework for interoperability in the European energy system and to build a lasting community to promote common standards, data spaces and test methods.

The exploitation strategy focuses on transforming interoperability from a research concept into a practical, widely applicable reality. Standardisation, testing procedures and governance approaches were integrated at several levels. A central element is the int:net community, which at the end of the project had 180 active members and has been finally transferred to the new platform IntPPC (Interoperability People and Project Connector). This platform provides long-term access to knowledge, tools and projects.

The project achieved high visibility through a comprehensive communication campaign, social media presence and events such as the Vienna Capacity Building Week and the Final Conference in Brussels (September 2025). In total, over 730 followers were reached on LinkedIn and more than 350 participants were involved in webinars and events.

Seven key results form the core legacy of int:net:

- IntPPC – an AI-supported platform for networking people, projects and knowledge.
- IOP Compass – a digital, interactive capacity building tool that brings together regulatory, technical and organisational information on interoperability.
- IntMAS (Interoperability Management and Audit System) – a management and certification system for assessing and improving the interoperability maturity of organisations.
- EMINENT – an open tool for assessing the maturity of interoperability communities, available on an open-source basis.
- CEEDS Blueprint (Common European Energy Data Space) – an architecture and governance concept for the European Energy Data Space, which serves the follow-up project INSIEME.
- Interoperability Test Facility Inventory – a directory of 30 European test facilities
- Ontology-Driven Constraints Tester – a tool for semantic interoperability testing.

In addition, the project initiated The Think Tank on Interoperability Governance, a high-level forum for the further development of policy and governance structures for energy interoperability in Europe.

All consortium partners developed their own follow-up strategies: research institutes (e.g. Fraunhofer, AIT, RWTH) are integrating tools and methods into future projects; industry associations (E.DSO, ENTSO-E) are promoting standardisation and regulatory coordination; consulting organisations (B.A.U.M., Trialog, Tecnalía) are expanding their service portfolios.

Overall, int:net has created a vibrant ecosystem that promotes interoperability across sectors, thereby supporting Europe's digital and green transformation. The consortium plans to continue its collaboration in future EU projects and to operate the community that has been created via the IntPPC platform in the long term.

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1 Introduction

For the energy transition to succeed, it's essential not only to establish connectivity within the energy sector but also to align energy-related processes and products across all sectors. To ensure widespread adoption, technology should be user-friendly, avoiding complex interfaces, costly adaptations, incomprehensible data sheets, and closed standards that hinder the implementation of advanced solutions. What's required is a coherent, resilient, and financially sustainable ecosystem of solutions. At the same time such an eco-system of solutions needs a community of stakeholders in the fields of governance, academia and product development. It has to be built on a trustworthy basis of knowledge and a reasonable amount of trust between the members of the community.

1.1 Objectives of the work reported

The Interoperability Network for the Energy Transition project (int:net) aimed at forming an inclusive cross-domain community that unites all relevant stakeholders in the European energy sector to collaboratively focus on creating, testing, and implementing interoperable energy services. This community's establishment has been formalized throughout the project; and tools, guidelines and a sound, AI-supported community platform have been implemented to ensure continuation beyond the project's duration.

1.2 How to read this document

With respect to the structure, it is recommended that parties interested in the past successful communication approaches of int:net read chapter 3. Experts interested in the well established and long-lasting offerings for the Interoperability Community should concentrate on chapter 2, which describe the tools and platform services.

1.3 Structure of the document

Chap. 2 describes the community approaches and mainly the tools that the members can use to get to a high level of maturity in questions of interoperability. It introduces capacity building tools (e.g. the IOP compass), tools to assess and improve the management of interoperability in organisations (EMINENT, IntMAS) and get certification with the int:net approved label. Last not least chap. 2.4 gives a sound introduction to the community and knowledge platform IntPPC (Interoperability Project and People Connector).

Chap. 3 gives an overview of the communication and dissemination activities that have been used to lay ground for a vivid community. Chap. 3.9 outlines the communication plans and refers to deliverable 5.4, "Exploitation and long-term sustainability of int:net", which describes the future interoperability pathways of the int:net consortium members.

2 Interoperability Network for the Energy Transition

The int:net project's objective was to establish a community of practice to ensure the continuity of ongoing interoperability efforts, while also facilitating the coordination and alignment of relevant projects and initiatives across various geographical levels. Without such a community, there is a risk that interoperability expertise will remain dispersed among a small group of technical experts, resulting in redundant and isolated initiatives. Additionally, changes in requirements, emerging use cases, test scenarios, and regulatory conditions may not be adequately considered, hindering the full achievement of interoperable energy services within a future integrated energy system. The establishment of the Interoperability Network for Energy Transition shall guarantee the sustainability of the int:net approach beyond the project's borders and its duration.

The int:net approach commenced with the collection and evaluation of existing frameworks and successful models (Cornerstone 1: Knowledge Base). This information then fed into the int:net maturity model (Cornerstone 2: Maturity Model). These components provided the means and metrics for assessing interoperability within an expanding network of testbeds and testing facilities (Cornerstone 3: Testing and Certification). Finally, these cornerstones have been discussed with framework setters for integration into their policies and support programs (Cornerstone 4: Standards and Governance). The insights gained from such assessments and the establishment of favourable frameworks have subsequently been incorporated into the knowledge base and made available with tools and an AI-based knowledge platform, thus closing the virtuous circle of interoperability.

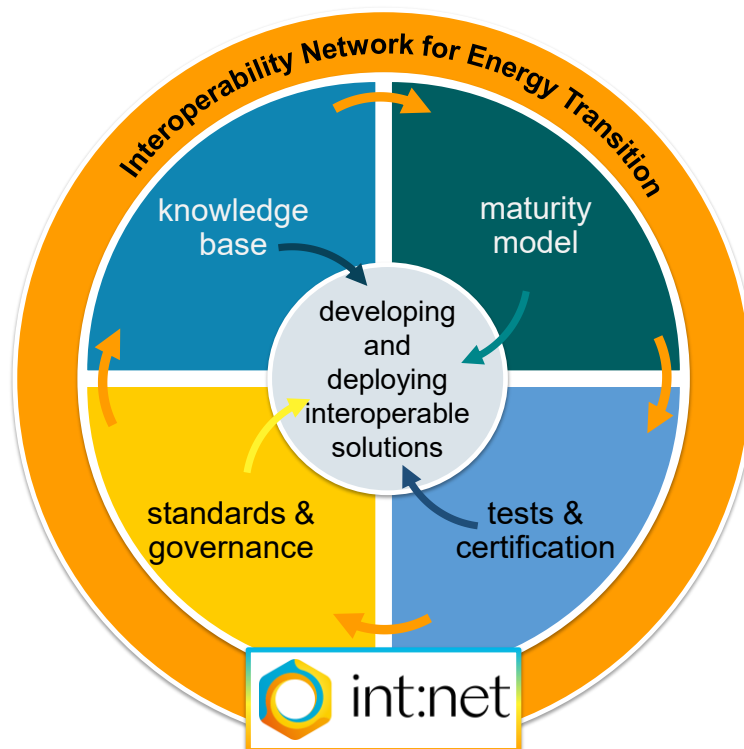


Fig. 1 Interoperability Network for Energy Transition approach with its cornerstones

2.1 Creating a vivid Community

The foundation of a strong community is its members. To reach as many members as possible, int:net partners presented int:net at as many occasions as possible. This included events and conferences such as Enlit, EUSEW and InnoGrid, to only name a few, which are organised by other institutions (for details see chap. 3. It also includes events organised by int:net such as one workshop on “General introduction to standardisation” and “Smart Energy Grid Data Modelling”, both reported as Milestones (MS1 and MS2). int:net closely worked together with other initiatives working on related topics, including the Data Space Support Centre (DSSC) and the International Data Spaces Association (IDSA). At all these occasions int:net invited experts to meet at its community which had been kicked off with a dedicated session at Enlit 2023. To further promote the community’s activities, thematic webinars and workshops have been organised.

2.1.1 The int:net Community and its platform

The project has provided a community platform for experts in interoperability, data spaces and digitalisation to continuously interact. The platform has been accessible directly with its URL <https://community.intnet.eu/> or via the int:net project website using the button “get connected”. Registration for the community platform was free and possible for everyone interested in the subject.

For registered users the network platform enabled a collaborative workflow including functionalities to share information, to communicate between the stakeholders and to organise tasks between the stakeholders.

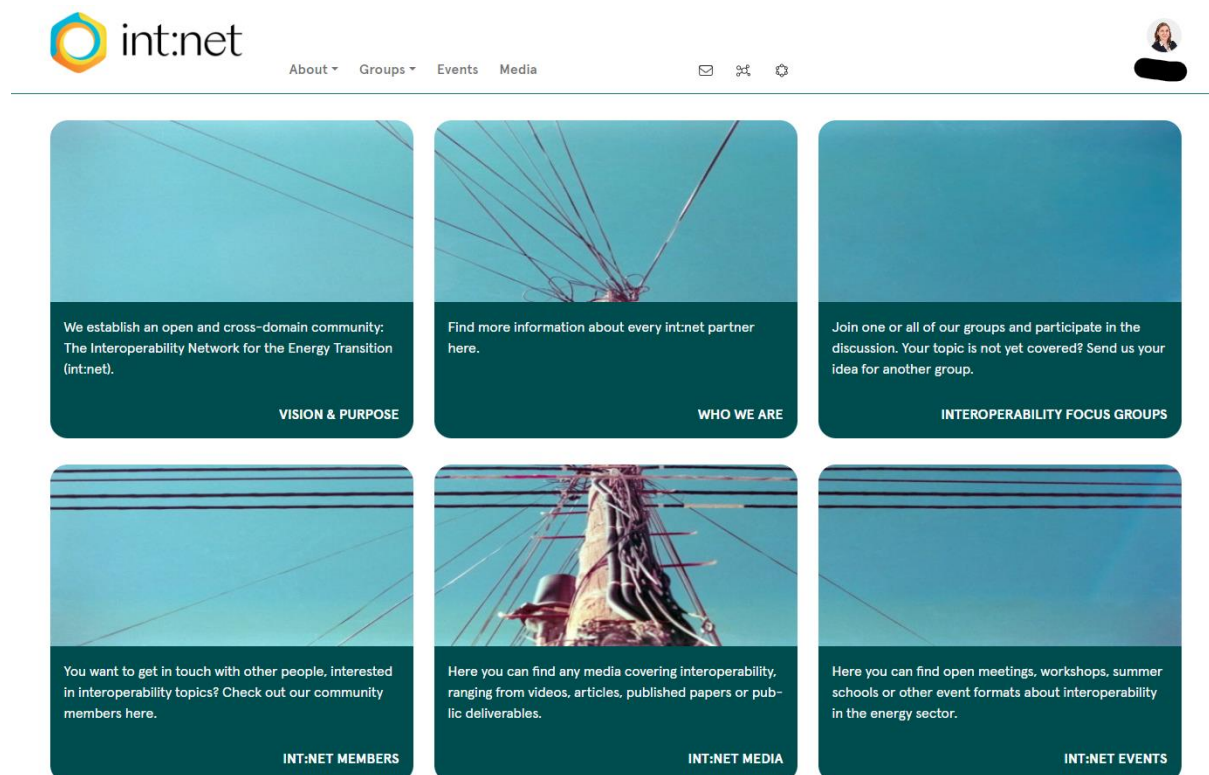


Fig. 2 The int:net community platform

Activities in the community have been organized in Interoperability Focus Groups (IFG) and taskforces. The IFGs been changed over time to always reflect thematic focus points members wanted to set. The latest set of working groups is the following:

- IFG-1: "Interoperability Profiles in Data Spaces"
- IFG-2: "Increasing Maturity in Interoperability"
- IFG-3: The Interoperability Regulatory Landscape
- IFG-4: Interoperability Testing Approaches, Test Cases and Test Facilities
- IFG-5: "Smart Grid related Use Cases and SGAM"

Each IFG has been guided by one or two moderator(s). The moderators ought to lead the discussion, initiate new topics and animate other participants to contribute content. Every member of an IFG has been encouraged to deliver input and ideate new topics. Topics to discuss in the groups could be freely chosen by the members but had to be approved by the leader of the IFG. Typical results were position papers, surveys or roadmaps.

Other sources of information and functionalities were for example the events section and the media section, which were only accessible for registered users. Within the events section, one could find interesting events that have been either organized by int:net or int:net community members. Within the media section, any media covering interoperability, ranging from videos, articles, published papers or public deliverables, have been made available.

In appearance, the community platform is very similar to the original int:net website, as we wanted to have a clear connection between the int:net project website and the community website.

2.1.2 Roadmap development workshops

The int:net project was supposed to develop a self-sufficient network capable of existing and prospering after the end of the project. To lay a solid foundation, a continuously updated roadmap guided the establishment, organisation and practices of the network / community. The int:net consortium conducted various workshops to develop this roadmap.

To link and learn from existing and successful communities, in June 2023 a memorable workshop was organised with the aim to collect best practice approaches from existing initiatives. The CEO of EEBUS e. V. and a representative ¹ from the Austrian Research Promotion Agency (FFG) / Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK) were invited to present the work done in their projects. In an interactive session the characteristics of the two communities were visually displayed (see Fig. 3)

A pivotal question raised during the workshop pertained to what the labelling mechanism of int:net should aim at. Notably, EEBUS does not currently employ labelling, opting instead for prequalification of interoperability. IHE employs a Connectathon Seal, which is valid for 3 years. Additionally, both provide a list of successfully tested devices on their websites. During the workshop, int:net participants

¹ Names removed due to data privacy requirements.

were surveyed to gauge their perspectives on the necessity of labelling. The results indicated that 50% were uncertain about the need for labelling, while 40% expressed the view that labelling was indeed necessary. Insights from the workshop were considered when developing the int:net quality label (cf. chap. 2.2.5).



Fig. 3 Documentation of joint discussion on a Miro board

2.1.3 Lunch Talks

In its application, int:net had promised to implement “thematic workshops”. It turned out that experts didn’t go for full day and not even multiple hour events. That led to the concept of “Lunch Talks”, short, interactive one-hour online sessions that addressed key interoperability and data space topics. Although initially planned for 10 editions, the series expanded to 14 Lunch Talks between August 2024 and July 2025, reaching more than 350 participants across Europe and worldwide.



Fig. 4 Lunch talk series

The episodes of the Lunch Talk Series are the following:

Talk	Title
#1	SGAM Layer 6: a means to describe the governance for interoperability
#2	Overview of (interoperability) testing approaches and methods in the energy domain
#3	Ensuring interoperability of flexibility registers: what about stakeholders' incentives?"
#4	Use case interoperability analysis methodology
#5	Interoperability, what is it and how do we get good at it?
#6	Energy consumers data management: different pathways to reach the same destination?
#7	Power and energy testing facilities in Europe with a focus on interoperability
#8	Driving Interoperability: Breaking Barriers Between EVs and the Grid
#9	The hourglass model and MIMs (minimum interoperability mechanisms) for semantic interoperability
#10	Energy Data Spaces Cluster: Blueprint of the Common European Energy Data Space
#11	IntMAS: Moving forward to more interoperability in the energy system
#12	Ontologies Deep-dive: What are they and how can they help with interoperability?"
#13	Improving Interoperability for Integration of Distributed Flexibility – Mercury and Flexit
#14	From components to community: expanding the concept of interoperability

Recordings and presentations remain available in the int:net community repository at <https://community.intnet.eu/Media>. The recordings also serve as video tutorials, providing practical insights into key aspects of interoperability and data space development. At the end of the project, recordings will be moved to the IntPPC platform (cf. chap. 0).

2.2 Tools and Guidelines for the Interoperability Community

In its application, int:net had promised to develop “a portfolio of innovative and comprehensive service offerings that the community can provide”. While it took more time than expected and the project needed to be extended by 6 months, a reasonable set of tools could finally be created and tested in the field. All of them are in a status that they can be used beyond the end of int:net. The “one-stop-shop” for these offerings is the IntPPC platform (cf. chap. 2.3.1).

2.2.1 Use Case selection and governance entities for an SGAM Layer 6

The project developed a strong connection to the Smart Grid Architecture Model (SGAM). SGAM serves as a valuable framework for understanding the various aspects of interoperability in the energy domain. In the context of shedding light to interoperability governance, int:net worked on integrating a sixth layer (“framework layer”) into SGAM, which encompasses governance and framework-related aspects. For in-depth information on this development, see Deliverable D4.4., “Whitebook on engagement towards interoperability in Governance” ².

The whitebook contains another important result to describe the scopes of interoperability: the “Use Cases Collection and Analysis”. The repository aims to expand the knowledge base on interoperability. Use cases serve as real-world examples that help in identifying common challenges and best practices. They are a critical component of the project’s mission to promote interoperability in energy services.

While it served as a key basis to establish the int:net community, an “initiatives repository” catalogues various initiatives related to interoperability in relevant fields. It is accessible on the int:net website and will be transferred to the knowledge base on IntPPC. Deliverable D1.1 Repository of interoperability initiatives” gives a more detailed documentation and is an explanatory manual on this repository.

2.2.2 Capacity Building with the IOP Compass

The Interoperability Compass is a capacity building tool to raise awareness of interoperability across society. In a nutshell, it serves as a single point of access to key information on regulations, standards, actors & roles, interoperability communities and testing facilities in the interoperability world. By connecting these elements, it makes interoperability clear, practical, and actionable for stakeholders across sectors, while supporting better decision making and fostering end-user’s buy-in (i.e. choosing interoperable solutions over non-interoperable ones).

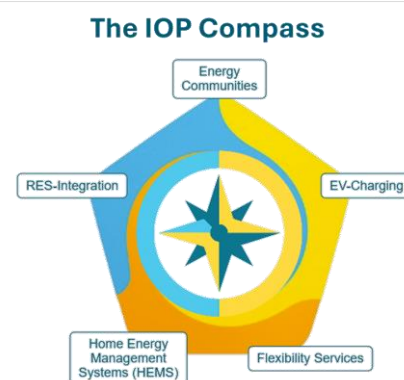


Fig. 5 The Interoperability Compass

² available on Zenodo with <https://doi.org/10.5281/zenodo.17486660>

2.2.3 Maturity Assessment with EMINENT

To ensure ongoing interoperability in European energy services and communities, int:net partners developed the Interoperability Maturity Model (IMM) and an assessment methodology. Initially, the project defined domains and characteristics for the IMM, spanning from initiating to pioneering maturity levels. Eventually partners developed the EMINENT tool which allows for doing what the acronym stands for: “Evaluating the Maturity of INTERoperability for the ENergy Transition”. It does so based on ten capabilities, where each capability is evaluated through the dimensions of process, resources, information and organisation.

D4.4., “White Book on engagement towards interoperability in Governance” gives more information. A detailed description of the IMM and EMINENT is contained in D2.2, “Assessment Tool, Users Guide and example applications”.

2.2.4 Interoperability Management and Audit System (IntMAS)

The *Interoperability Management and Audit System* (IntMAS) has been developed and validated *under Work Package 4 – Interoperability Frameworks and Tools*. It is a means to qualify and guide the members of the Interoperability Community in their daily businesses and in the establishment of favourable management practices. It supports organisations to build their own structured management framework and, in that sense, to support continuous improvement of interoperability across the European energy ecosystem. For details check deliverable D 5.4, “Exploitation and long-term sustainability of int:net” and the [IntMAS Platform](#).

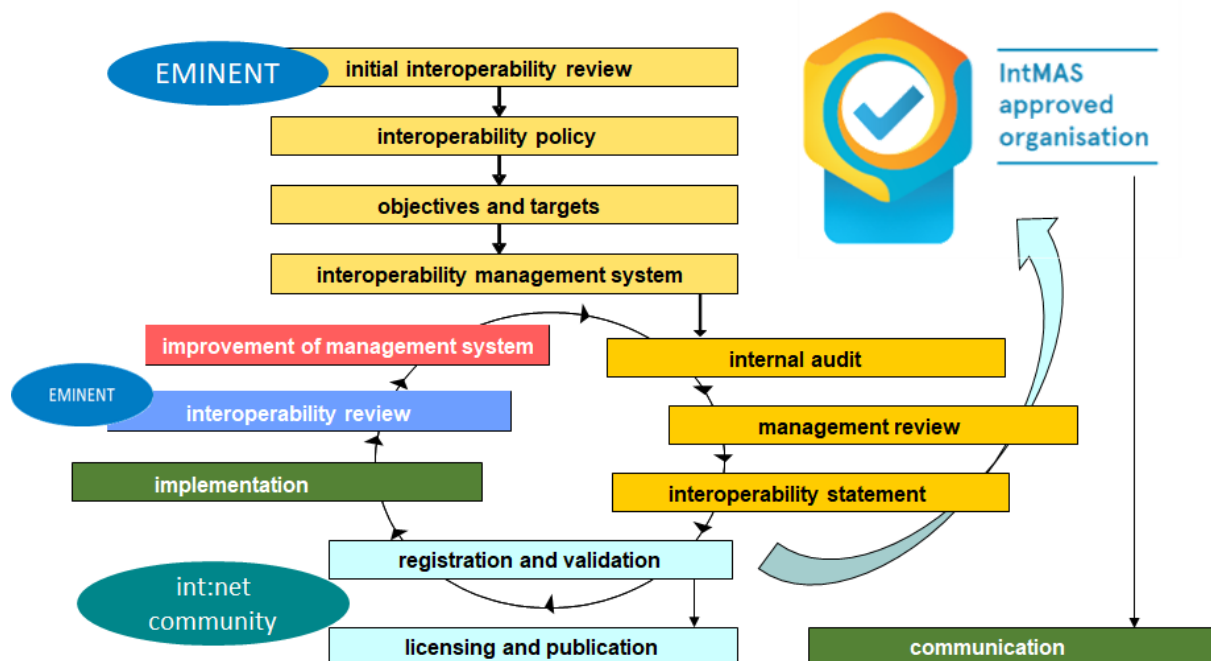


Fig. 6 IntMAS process for continuous improvement

IntMAS has been developed exploiting experience from other Plan-Do-Check-Act (PDCA) management systems such as ISO 5001 or EMAS. The process finds a detailed description in the IntMAS guideline. With respect to the Interoperability Community, the vision is that all “IntMAS approved” organizations form a strong entity inside the overall community and attract ever more members that implement serious measure to improve their interoperability contributions.

The IntMAS framework consists of three core components:

- a guideline describing processes and requirements for implementing interoperability management,
- a self-assessment and audit methodology for maturity evaluation, and
- a set of templates and tools supporting practical implementation.

In line with the int:net objective to ensure long-term impact, IntMAS awards the “IntMAS approved organisation” label — using a registered landmark (cf. 2.2.5). The labelling process has been piloted with selected organisations demonstrating their interoperability maturity.

By rewarding organisations that successfully apply interoperability principles, the label establishes trust and promotes a culture of quality and transparency in the energy transition ecosystem.



Fig. 7 The first 3 community members to obtain the IntMAS approved certificates

After project completion, IntMAS will remain available through the IntMAS online platform (<https://intppc.eu/IntMAS>, for details see 2.4.4), integrating guidelines, templates, AI-supported self-assessment and certification functionalities to ensure sustainability and scalability. Mainly the owners of the label, B.A.U.M. and Fraunhofer FIT, will promote the IntMAS model and the label together with the first awarded organisations and the big European energy associations. It thus provides a lasting instrument for European organisations (and communities) to manage, audit, and continuously improve on their interoperability.



2.2.5 The int:net quality label

As described in chap. 2.2.4, a label has been established to be awarded to “IntMAS approved organisations”. This label is a nuanced application of the brandmark displayed in Fig. 8 . Intendedly, int:net has registered this brandmark as a figurative trademark without text. That opens opportunities for the Interoperability Community to add a yet specific text for various purpose but keep visual identity of the quality sign. Typical additions to the logo could be “approved validation lab” or “approved interoperable product”.



Fig. 8 The int:net approved label

After extensive discussions in the consortium, int:net partners Fraunhofer FIT and B.A.U.M. jointly registered the label and developed the legal framework for its use. While registration for other European and overseas countries is pending, registration for all EU countries has been published on <https://euipo.europa.eu/eSearch/#details/trademarks/019229037>. The opposition period for the registration ends on 28/11/2025.

The label is registered according to the “individual brand” model. In this model, detailed statutes are not required for registration. But the label can only be used after closure of a bilateral licensing contract which describes conditions and rules for using the brandmark. In any case, the brandmark can only be used for cases that meet the definition of the following classes (according to Nice Classification ³):

- 9:** Downloadable and recorded content; Testing and quality control equipment; Databases; Media content; Software; Recorded data files; Community software; Artificial intelligence software; Interactive software based on artificial intelligence; Artificial intelligence software for analysis; Scientific research and laboratory apparatus, educational apparatus and simulators; Application software; Virtual and augmented reality software; Software for monitoring, analysing, controlling and running physical world operations; Artificial intelligence and machine learning software; Electronic publications, downloadable; Downloadable media.
- 16:** Printed matter, and stationery and educational supplies; Printed books, magazines, newspapers, and other paper-based media; Manuals [handbooks].
- 35:** Advertising, marketing and promotional services; Business assistance, management and administrative services; Public relations services; Distribution of advertising, marketing and promotional material; Provision and rental of advertising space, time and media; Accountancy,

³ <https://tmclass.tmdn.org/ec2>

book keeping and auditing; Administrative support and data processing services; Data processing, systematisation and management; Human resources management and recruitment services; Business consultancy and advisory services; Business analysis and information services, and market research; Providing consumer information relating to goods and services.

- 36:** Fundraising and financial sponsorship; Financial, monetary and banking services; Financial information, data, advice and consultancy services; Financing and funding services; Financial planning and management; Crowdfunding.
- 41:** Publishing, reporting, and writing of texts; Education, entertainment and sport services; Organisation of conferences, exhibitions and competitions; Education and instruction services; Arranging and conducting of seminars; Arranging and conducting of workshops [training]; Arranging and conducting conferences and seminars.
- 42:** IT services; Science and technology services; Testing, authentication and quality control; Design services; Development of new products.
- 45:** Legal services; Political services; Licensing authority services; Legal administration of licences; Licensing industrial property rights; Political lobbying services.

A contract between the 2 original owners of the brandmark and the consortium members allows them to enter the owners' group and use the label for special, negotiable purposes that meet the requirements of the above listed classes. It is theoretically possible that other members of the interoperability community (as long as they are independent natural or legal persons residing in the EU) step in and define new applications of the figurative mark together with the trademark owners.

2.3 From int:net Community to Interoperability Community

From the beginning of the project, int:net strived to established strong links to experts and relevant organizations in the field. A preliminary platform, integrated in the int:net project website, served as a place to meet, discuss and store documents. In the flow of the project, various formats have been used to connect to new stakeholder groups. Finally a powerful ICT tool has been created that will serve as a meeting and knowledge sharing platform beyond the end of the project (see chap. 2.4 about the Interoperability People and Project Connector).

2.3.1 Systemic interoperability testing

Achieving interoperability involves principles like interoperability-by-design, reference architectures, and agreed standards. However, ensuring interoperability requires testing procedures and certificates to demonstrate successful interconnection. Existing interoperability testing approaches in smart grids and energy systems vary widely, and there is no comprehensive overview across EU research infrastructures. Current approaches are more advanced at the component / device level than at the system level, often still in the research stage, and diverse in its criteria.

int:net set out to create a pan-European community of interoperability testing facilities. It aimed to harmonize existing testing procedures, develop and integrate testing facilities, and form a cohesive pan-European network of testing facilities and certification centres. While the int:net consortium didn't come to a decision as to using the brandmark "int:net approved" for facilities or institutions that can offer

“systemic interoperability tests”, deliverables D3.1 (“Testing concepts and procedures harmonisation report”) and D3.2 (“Inventory of interoperability testing facilities”) describe the requirements and list capable facilities. These deliverables describe notable system-level interoperability testing approaches; for example, the Joint Research Centre’s “Smart Grid Interoperability Testing Methodology”, the Austrian initiative “IES – Integrating the Energy System”, the Interoperability Test “CIM for System Development and Operations”, and the “ERIGrid Holistic Test Description Approach”.

2.3.2 Linking to other networks

Mainly to learn, but also to connect existing networks to the Interoperability Community, int:net got in contact with various groups and associations. Due to their big relevance for the topics discussed in int:net, three of them shall be named and described here.

Integrating the Healthcare Enterprise (IHE)

The approaches in the healthcare sector often serve as a reference for the establishment of standards, profiles, implementation and test processes. Developed over more than 2 decades, the entire system to foster and guarantee interoperability of suppliers and products for the health sector has been standardised in ISO TR 28380.

The ‘Integrating the Healthcare Enterprise’ (IHE) is an international initiative of professional associations, manufacturers and healthcare institutions. The main goal of IHE is to enable IT systems from different manufacturers to communicate seamlessly with each other and exchange data securely. The so-called ‘IHE profiles’ make various standards (e.g. HL7, DICOM or FHIR) practically applicable. IHE has become famous for its sophisticated system for testing connectivity: at ‘Connectathon’ events, manufacturers meet and test their solutions not only against the standards and profiles, but also directly with each other. In this respect, it plays a central role in interoperability in the healthcare sector.

The major advantages of IHE are:

- Practical standardisation: IHE bridges the gap between standards and practical implementation.
- Guaranteed interoperability: IHE profiles enable devices and software from different manufacturers to work together seamlessly (e.g., radiology systems, hospital information systems, patient portals), considerably reducing integration costs.
- International comparability: IHE worldwide facilitates cross-border data exchange (e.g., in the context of eHealth initiatives in the EU), as well as national extensions to technical frameworks.

A **Connectathon** is a multi-day test event in which manufacturers and organisations test each other’s systems for interoperability based on IHE profiles. Both the technical equipment for such an event and the procedures are strictly regulated:

- Various companies bring their systems with them.
- They are tested according to fixed test cases (e.g., ‘Can your system receive and correctly display a radiological finding in IHE format XDS.b?’).
- Independent auditors monitor the tests.
- Systems that participate successfully receive a “seal” and an entry in the IHE product registry.

The int:net associated partner BMIMI (Austrian Bundesministerium für Innovation, Mobilität und Infrastruktur) has brought its experiences with a project called “Integrating the Energy System” (IES). This IES initiative tries to provide a common understanding and framework for developing and reusing data exchange solutions. It promotes interoperability profiles instead of proprietary solutions. Such interoperability profiles shall make it easier to develop and reuse solutions across different systems. The transparency of the process ensures sustainable investment protection for vendors and promotes competition, increasing product quality and performance at lower cost. With this approach the IES initiative taps into the proven success of the healthcare sector's interoperability systems as described above. IES strives to use the ISO/TR 28380 methodology, leveraging existing profiles, and utilizing the open-source Gazelle testing platform which IHE uses for their Connectathons.



Fig. 9 Cross-sectoral community around IHE and IES

IEA DHC Annex TS9

This initiative of the International Energy Agency (IEA) deals with challenges for data Access and data interoperability in district heating and cooling systems. On May 20, 2025, joint workshop of the int:net Community and the IEA DHC Annex TS9 group took place. As one of the results the following challenges were summarized:

- **Legacy Systems:** Outdated infrastructure and non-standardized data interfaces hinder integration and automation.
- **Data Quality & Organization:** Data is often fragmented (e.g., 1,300+ unstructured CSV files), with inconsistent timestamps, missing values, and questionable accuracy (e.g., wrong sensor units or locations).
- **Security & Real-time Access:** Many systems do not support real-time data access due to

cybersecurity concerns; data retrieval is often manual and delayed.

- Ownership Issues: Unclear data ownership and rights lead to conflicts, such as overridden or manipulated sensor data by different stakeholders.
- Inconsistent Interfaces: Many systems lack standardized APIs or interfaces; data integration often relies on “experimental” or improvised solutions.
- Lack of Standard Metadata: Different formats (PDF, CSV, SQL, NoSQL) and naming conventions make semantic linking difficult.
- Poor Device Identification: Devices often do not self-identify or provide information about their function or data mapping.
- GIS and Network Data Issues: Network maps are frequently outdated, inconsistent, and hard to match with other datasets, impairing device-to-location mapping.
- Semantic Interoperability: Even when structural data exchange exists (e.g., via FMI for co-simulation), the semantic meaning of data is often missing, preventing automation and scalability)
- Stakeholder Misalignment: Different interpretations of data requirements and lack of collaboration make coherent system integration difficult.

While issues in the heating sector need not necessarily fully match those for the power (grid) sector, most of them are relevant enough so to justify collaboration of the respective communities.

EEBUS

The EEBus initiative is an international technology supply association based in Germany. It was founded in 2012 and is mainly involved in the development of communication and information specifications that help different home energy devices, like kitchen appliances, EV chargers or heat pumps, talk to each other. In other words, the EEBus solution starts at the home energy management system and goes “inside the home”, including towards the electric vehicle charger.

EEBus Initiative e.V. was founded in 2012 following the German E-ENERGY “Smart Watts” project. It is a nonprofit association based in Cologne that develops, maintains and tests the EEBus specifications—a unified, IP-based interface (SHIP), a data model (SPINE) and the use cases describing the implementation of the data model for the delivery of specific energy management-related functions across domains (e.g. for EV charging, home appliances, HVAC, PV, storage, etc).

The main technical actors related to the EEBus specifications are the energy management system (EMS), as well as any high-energy consuming device located within a building (i.e. behind the meter). Additionally, EEBus provides functionality to enable for direct EMS to grid operator communication.

The EEBus mission is to enable interoperable, vendor-independent energy-relevant devices and systems to coordinate seamlessly within buildings—boosting efficiency, comfort, cost savings and grid stability through standardized use-cases and dynamic flexibility.

The organizational approach is member-driven and democratic: EEBus is governed by a board elected from its member companies, with working groups and task forces collaboratively defining and testing

specifications via events like the yearly Plugfests, hosted in their premises (i.e. the Living Lab Cologne). Their highest form of governance is the members' assembly, in which members have a vote according to the association's by-laws. The governance artifacts facilitating a transparent and trustworthy interaction are an application form for new members, contribution rules, by-laws and a code of conduct on cartel law.

The founding members came from key German energy-relevant sectors and device manufacturers who participated in the E-ENERGY project. Today, its board includes representatives from Bosch, Volkswagen, Schneider Electric, the German electrical and IT craftsmen association, and others. The initiative has over 70 members from around the globe – including automotive firms, energy companies, smart appliance and HVAC manufacturers, system integrators and grid operators.

The big aim of EEBUS is to introduce standardised communication interfaces between device manufacturers (device to device) as well as between DSOs and device manufacturers. EEBUS is also testing practical use case implementations and gathers input from regulatory and legislative authorities. Furthermore, test specifications and implementation instructions for bidirectional applications & processes are standardised and made public. int:net is pointing in a similar direction and that is why EEBUS can serve as a best practice example for the project.



Fig. 10 Successful community of EEBus

Mercury

The Mercury Consortium is a nonprofit organization formed in 2024, jointly initiated by EPRI (Electric Power Research Institute) and Kraken (the Octopus Energy platform), to foster energy flexibility, and interoperability for clean energy technologies by defining guidelines for devices that integrate with the grid and the energy markets.

A nascent initiative, the Mercury Consortium has recently released Electric Vehicle Supply Equipment (EVSE)-related guidelines as the first-addressed use case. Not aiming at developing new standards, but at ensuring specific EV ecosystem functionality, current guidelines specify the use of the OCPP standard (i.e. the Open Charge Alliance's 'Open Charge Point Protocol'), which enables EVSE to Charge Point Operator (CPO) communication. The guidelines include application guides (i.e. context), functional requirements (i.e. implementation instructions) and testing specifications; and are to be expanded to account for further EV ecosystem requirements. Hence, Mercury guidelines will cover additional standards, currently envisioning to incorporate grid operator signals, original equipment manufacturers' back-end behaviour and performance, and potentially various energy management system standards.

Its mission is to ensure that low-carbon devices such as EV chargers, heat pumps, solar inverters, smart thermostats, and home batteries are "grid-ready by design", enabling seamless communication, flexibility, and demand response functionality across technology and service suppliers. Hence, its relevance goes beyond the EV charging use case.

Founding members number close to 40 organisations, and include utilities (e.g. Con Edison, Octopus Energy, PG&E, EDF Energy, E.ON Next, Tokyo Gas), manufacturers (e.g. Daikin, easese, Enphase Energy, Mobilize/Renault), and technology providers (e.g. Amazon Web Services, Oracle, gridX, Kraken); all working together to define and adopt Mercury guidelines.

The organization's management is realised by the int:net project partner Electric Power Research Institute (EPRI) Europe, and draws on industry collaboration across manufacturers, utilities, tech providers, and regulators. Membership is open and can be obtained through a membership application, which includes fees according to the revenue of the applying member.

2.3.3 The Think Tank on Interoperability Governance

The Think Tank (TTT) on Energy Interoperability Governance was designed as a high-level expert forum to discuss governance models, coordination mechanisms, and policy frameworks required to enable a sustainable and interoperable European energy system. The first TTT session took place in Vienna in July 2025 as part of the "Vienna Week on Interoperability." Special attention was given to developing recommendations for European and national policy frameworks supporting cross-sector collaboration. For more information on TTT check deliverable D5.4 ("D5.4 Exploitation and long-term sustainability of int:net") and the results of the Vienna TTT meeting, which are attached as "Annex B: Position Paper of The Think Tank on Interoperability Governance" to deliverable D4.4 ("Whitebook on engagement towards interoperability in governance"). They shall serve as a basis for further developing the direction of interoperability governance.

Results from The Think Tank contribute directly to the project's long-term objective of establishing a European Interoperability Network for the Energy Transition. The format has demonstrated its effectiveness as a structured co-creation and policy dialogue instrument. Future Think Tank editions are planned to continue the exchange beyond the project duration through the IntPPC community (cf. chap. 2.3.3). When registered and logged into IntPPC, the link to the respective page is [IntPPC Expert Circles](#).

2.4 The Interoperability People and Project Connector (IntPPC)

At the heart of int:net lied the int:net Community: an open, cross-domain network uniting more than 180 members. For details see chap. 2.1.1. Through five Interoperability Focus Groups (IFGs) – covering data spaces, interoperability maturity, regulatory landscape, testing facilities, and smart grid use cases – the community fosters collaborative work and knowledge exchange.



Building on this foundation, the project implemented and launched **IntPPC** – the Interoperability People and Project Connector (<https://intppc.eu>).



Fig. 11 From int:net community to IntPPC

In a nutshell, IntPPC provides a combination of multiple services:

- Knowledge Hub – access to all types of studies and papers with smart filtering, tagging, and assessment to ensure knowledge is trustworthy, FAIR, and aligned with European priorities
- People Connector – AI supported matchmaking for collaboration, expert discovery, and building diverse, pan-European networks.
- Expert Circles – AI-powered facilitation of groups, topic generation, and interactive assistance to drive engagement and innovation with automated creation of high-quality summaries, briefs, and actionable insights from research outputs and community discussions
- IntMAS Platform – repository of guidelines and tools and AI assisted certification
- Link Lists – approved links to int:net and other tools

2.4.1 A common knowledge base

The int:net project aimed to enhance interoperability in energy services, data, and platforms, addressing both functional and business layers of the SGAM model. This has been pursued through several measures, one being the establishment and maintenance of a knowledge base following FAIR principles (Findability, Accessibility, Interoperability, and Reusability). The knowledge base aimed to go beyond being a mere repository; it always wanted to encourage collaboration on selected documents and existing initiatives, connecting to established platforms.

While all deliverables and relevant artefacts created in int:net have been made available in the resource section of the website (<https://intnet.eu/resources/technical-resources>), all academic papers and studies have been uploaded to the Zenodo platform. While future versions shall integrate other information databases to allow to compare (project) results from multiple trustable sources, the actual of IntPPC integrates seamlessly with Zenodo as a proven, open-access repository for energy interoperability knowledge. This empowers users to:

- Search, filter, access and address trusted documents, datasets, standards, and code with DOIs.
- Contribute new knowledge directly to a European community repository.
- Benefit from persistent identifiers and open science best practices, supporting FAIR and EC open data mandates.

As figures Fig. 12 and Fig. 13 show, artefacts can be selected by tags and a search function and finally displayed directly (cf. Fig. 14). Additionally, registered users can deposit their documents in Zenodo right from the IntPPC platform.

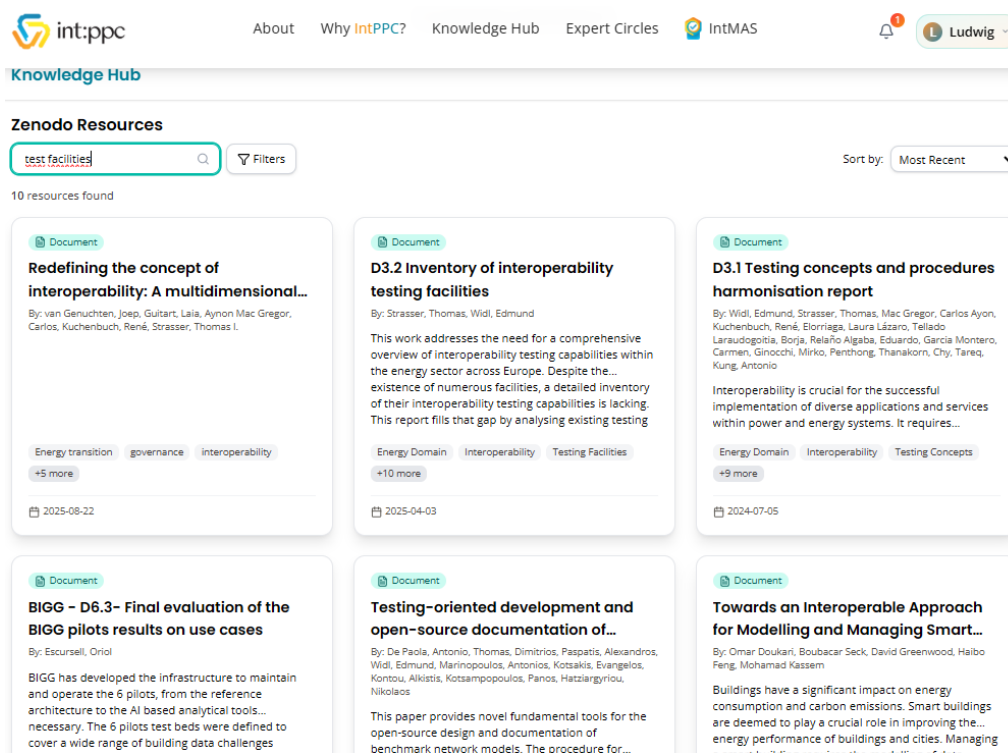


Fig. 12 Overview of selected documents in the IntPPC Knowledge Hub

Document

Published: 2025-04-03 DOI: 10.5281/zenodo.15084185

D3.2 Inventory of interoperability testing facilities

This work addresses the need for a comprehensive overview of interoperability testing capabilities within the energy sector across Europe. Despite the existence of numerous facilities, a detailed inventory of their interoperability testing capabilities is lacking. This report fills that gap by analysing existing testing facilities, including both virtual/digital and physical setups, to assess their interoperability testing capabilities. The inventory provides valuable insights into the interoperability testing possibilities available within these facilities. It includes detailed information on facility names, organisations in charge, locations, years established, legal statuses, fields of expertise, offered services, types of facilities, and whether or not they perform interoperability tests. Additionally, it provides details on the testing approaches used and includes website links as well as comments for further information. This inventory serves as a valuable resource for researchers, developers, and companies involved in the European energy sector, offering a clear overview of the available interoperability testing facilities and their capabilities. The methodology employed in this work involves a four-step approach: data collection through a detailed survey, analysis and categorisation of the collected data, development and provision of additional testing tools, and the creation of a blueprint for new interoperability testing facilities. The survey results, which form the basis of the inventory, provide a comprehensive overview of the current landscape of interoperability testing facilities in Europe.

Authors

-  Strasser, Thomas
Austrian Institute of Technology
-  Widl, Edmund
Austrian Institute of Technology

Tags

Energy Domain Interoperability Testing Facilities Inventory Testing Approaches and Tools
Test Cases and Profiles Deliverable European Union (EU) HORIZON Europe Project int:net
GA 101070086




Resource Details

Source	Zenodo
Format	xlsx
File Size	4.0 MB
Downloads	156
Views	103
Zenodo ID	15084185

Download Resource



View on Zenodo

Fig. 13 Detailed view for a selected document



Interoperability Network for the Energy Transition (int:net) 
 Part of EU Open Research Repository

Published April 3, 2025 | Version v1
 Project deliverable
Open

D3.2 Inventory of interoperability testing facilities

Strasser, Thomas¹ ; Widl, Edmund¹ 

Show affiliations

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Files

D3.2 Inventory of interoperability testing facilities.pdf

Fig. 14 Displaying a knowledge artefact (here: a deliverable from int:net)

2.4.2 Getting to more knowledge

IntPPC foresees two ways to get to further knowledge about energy interoperability, standards or technical guidance:

- matchmaking with proven experts
- searching the internet with AI.

While the „people connector“ is still under development at the end of the int:net project, the targeted AI search machine is functioning. Fig. 15 shows the result of a prompt asking for information about “CEEDS”.

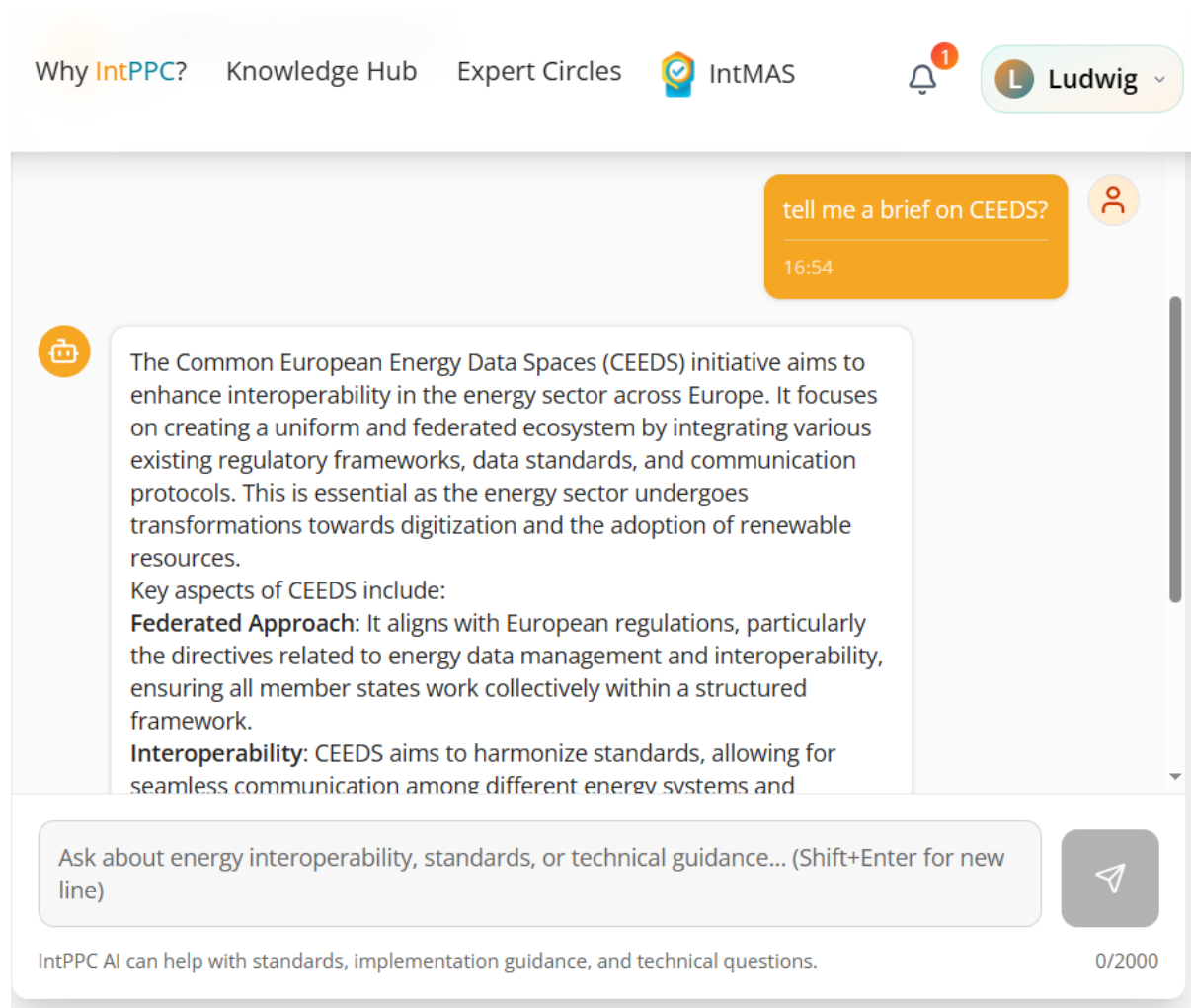


Fig. 15 Investigating with the IntPPC AI

The full blown “people connector” is under development. But the general AI for interoperability search delivers reasonable results already, as Fig. 16 proves.

give me names of 2 prominent persons working on the topic SGAM

14:49



Two prominent individuals working on the Smart Grid Architecture Model (SGAM) are:

Ferdinanda Ponci: She is a professor at RWTH Aachen University, where she focuses on monitoring and distributed control for power systems. Her research interests include advanced measurement and automation of active distribution systems.

Antonello Monti: He is the Director of the E.ON Energy Research Center at RWTH Aachen University and has contributed significantly to the development of SGAM and its applications in smart grid technologies.

14:50



give me examples of the work of Ludwig Karg related to interoperability

14:56

Examples of Ludwig Karg's work related to interoperability include:

Interoperability Management and Audit System (IntMAS): Karg authored the guidelines for the step-by-step implementation of IntMAS, which aims to enhance interoperability in the energy sector through a systematic approach. This work is part of the int:net project intended to unify interoperability standards across various stakeholders.

IEC 61850-Based Protection Scheme: He contributed to the development of an IEC 61850-based protection scheme and a Hardware-in-the-Loop (HiL) platform for testing interoperability among multiple vendor Intelligent Electronic Devices (IEDs) at the bay level. This work is crucial for ensuring that different systems can communicate effectively in modern digital substations.

Interoperability Maturity Model (IMM): Karg has been involved in creating the IMM, which is designed to assess the maturity of interoperability solutions in energy systems. This model helps organizations evaluate their ability to achieve effective interoperability. These efforts reflect his substantial contributions to advancing interoperability frameworks and standards within the energy sector.

14:56



Fig. 16 Searching for experts in the interoperability for energy systems domain

2.4.3 Exchanging and generating new knowledge in expert circles

Every ordinary member of the IntPPC community can establish an expert circle and add or invite members to it. Typical activities in such online groupings are:

- Knowledge exchange and best practice sharing
- Development of recommendations for action or guidelines
- Analysis of current problems or trends
- Preparation of training and knowledge transfer activities
- Networking and preparation of cooperation (e.g., for joint projects)


Expert circles exist in 3 flavours:

- Public: all registered members of the community can participate.
- Connected: members can apply to join, on approval by the owner of the circle.
- Private: members are invited by the owner and other members cannot see the circle.



Work is organized in “discussion”, i.e. topics which can be defined by either the owner or proposed by members of the circle. All members can at any time request an AI generated summary of the ongoing discussion.

At the end of int:net, all Interoperability Focus Groups (IFG, cf. chap. 2.1.1) will become Expert Circles on IntPPC. Registered members of the int:net community will automatically get access to IntPPC (and can of course leave the IntPPC community at any time). They will be allocated to the respective IntPPC Expert Circle and can seamlessly continue their collaboration. For new members, IntPPC registration has been opened at the final event in Brussels.

As another example, The Think Tank for Interoperability Governance (cf. chap. 2.3.3) has been implemented as an Expert Circle on IntPPC (see Fig. 17) and will keep collaborating on this platform after the end of int:net.




[About](#)
[Why IntPPC?](#)
[Knowledge Hub](#)
[Expert Circles](#)
[IntMAS](#)



Ludwig


Expert Circles

Public
Connections
Private


All


The Think Tank for Interoperability Governance


A collaborative forum for invited experts, practitioners, and thought leaders addressing the critical challenges of interoperability governance across technical, organizational, and policy domains. This think tank focuses on developing frameworks, standards, and best practices that enable seamless integration and coordination between diverse systems, platforms, and stakeholder ecosystems.


No activity

Prev
Page 1 of 1
Next



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Hide Members

Members (1)
Add Member

Joined


Ludwig
owner

Discussions (7)


A common knowledge base and community network are needed
5 minutes ago

To what end can power infrastructure determine defence?
2 minutes ago


Expert Circles

Public
Connections
Private


All


The Think Tank for Interoperability Governance


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23 minutes ago

Prev
Page 1 of 1
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The Think Tank for Interoperability Governance

A collaborative forum for invited experts, practitioners, and thought leaders addressing the critical challenges of interoperability governance across technical, organizational, and policy domains. This think tank focuses on developing frameworks, standards, and best practices that enable seamless integration and coordination between diverse systems, platforms, and stakeholder ecosystems.



Members (1)

Current Discussion:
To what end can power infrastructure determine defence?


[Back to Discussions](#)
To what end can power infrastructure determine defence?


Ludwig
23 minutes ago

Decisions on power and energy infrastructure including heat determine the way we need to think about European and national military defence. Investments into the energy sector as such conclude early on in necessary equipment and costs of military defence. Decentralized energy supplies based on energy of two thirds plus from the environment - as with heat pumps, geothermal (up to factor 35), photovoltaics or wind - request different, localized defence while energy imports from countries around the globe force our military into global obligations. With this, the dependency of reoccurring technology imports (pv, pumps, metals, etc...) differs from dependency on daily energy resource imports like fossil or renewable gases, oils and solids. Eu-rope needs to incorporate this awareness into joint efforts on the European Green Deal and European Industrial Deal as well as their financial setups AND the security debate. This reaches out into sectors like agriculture and chemistry as we consider feedstocks imported for these industries, generally energy intensive themselves. Also, a resilient defence infrastructure needs to integrate energy supply of defence infra-structure, armed forces and their support.


Knowledge Artifact Suggestion

Generate



Ludwig discusses the interconnection between energy infrastructure and military defense in Europe. They emphasize that investments in energy—particularly decentralized sources like heat pumps, geothermal, photovoltaics, and wind—necessitate localized defense strategies. Conversely, reliance on global energy imports implicates the military in broader international responsibilities. Ludwig underscores the importance of recognizing these dynamics in the context of the European Green Deal and Industrial Deal, particularly regarding financial structures and security debates. Additionally, they highlight that the defense infrastructure must integrate resilient energy supplies to support military operations and related sectors such as agriculture and chemistry.

Copy

Fig. 17 The Think Tank as an Expert Circle on IntPPC

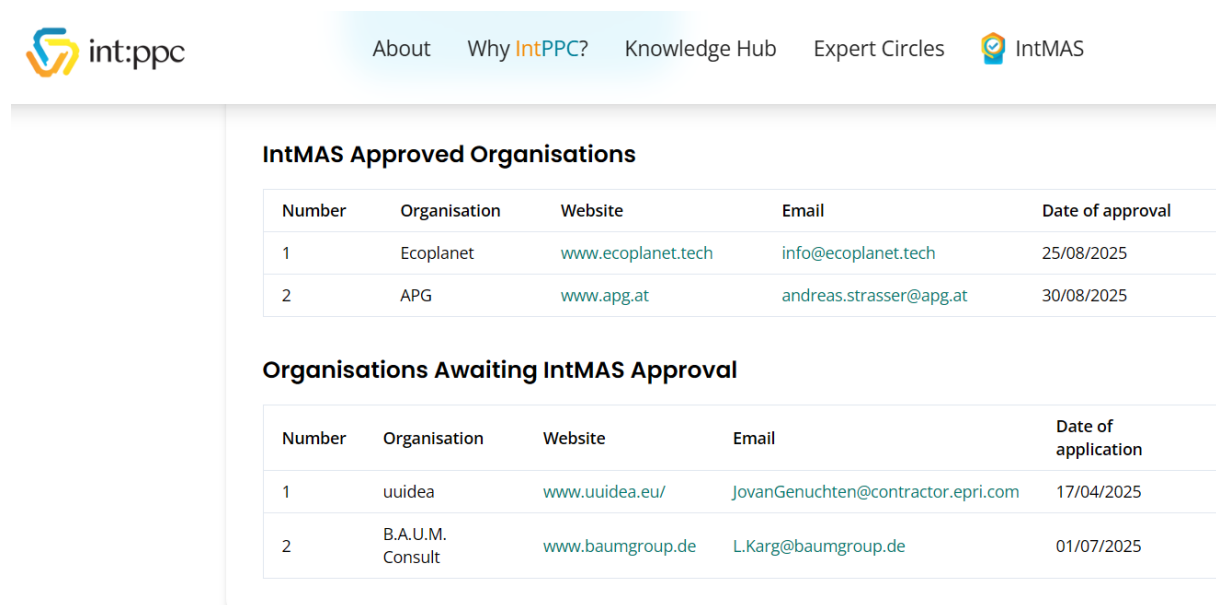
Deliverable D5.3

29

2.4.4 Home of IntMAS

IntPPC includes the IntMAS platform which empowers organisations to assess, benchmark, and certify their interoperability maturity. IntMAS results are transparently displayed in IntPPC profiles, supporting continuous improvement of an organization and recognition across Europe. In that sense, the integrated platform fosters collaboration and knowledge exchange between organisation that implement this Plan-Do-Check-Act management system for continuous improvement.

Above all, the IntMAS sub-site of IntPPC holds the list of approved organisations (Fig. 18).



IntMAS Approved Organisations


Number	Organisation	Website	Email	Date of approval
1	Ecoplanet	www.ecoplanet.tech	info@ecoplanet.tech	25/08/2025
2	APG	www.apg.at	andreas.strasser@apg.at	30/08/2025

Organisations Awaiting IntMAS Approval



Number	Organisation	Website	Email	Date of application
1	uuidea	www.uuidea.eu/	JovanGenuchten@contractor.epri.com	17/04/2025
2	B.A.U.M. Consult	www.baumgroup.de	L.Karg@baumgroup.de	01/07/2025

Fig. 18 IntMAS approved organization on IntPPC

For organizations interested in implementing IntMAS (chap. 2.2.4), the platform gives access to relevant resources (the guideline, templates) and allows to submit the IntMAS artefacts for evaluation (Fig. 19). Since the evaluation criteria consider the type of applying organization, its size has to be selected before uploading the documentation. After submission, the AI-based evaluator checks the contents of the IntMAS documentation and delivers its results (see example in Fig. 21). As the example shows, this micro-organization passed the evaluation with a lot of warnings. In case of critical faults, the organisation would have been rejected. For the warnings it is up to the decision makers if they want to improve their management system (with respect to interoperability) and resubmit to achieve a better score.


int:ppc

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[IntMAS](#)



Ludwig

Resources

Download the assessment template and official guidelines to get started.

[Download Template](#)
[IntMAS Guidelines](#)

Submit Your Assessment Artifact

Upload your IntMAS artifact (.docx). We will validate it and show the processing status.

Organisation Type *


Select organisation type
Large Enterprise
Micro Enterprise
Small or Medium Enterprise

Assessment Artifact *

Keine Dat...usgewählt

Your Submissions

Fig. 19 Doing IntMAS on the IntPPC platform



Submit Your Assessment Artifact

Upload your IntMAS artifact (.docx). We will validate it and show the processing status.

Organisation Type *

Assessment Artifact *

IntMAS Ar...idea.docx

Submission Status

Submission ID:
3c380654-da79-424c-92a7-6f03d9a9de0b

Submission Status: SUBMISSION Processing

Validation Passed: Yes

Warnings: 24

Your Submissions

IntMAS Artifacts V 0.9.5-uuidea.docx
Validation Assessing
Assessment Pending
Approval Pending
Created: 28.10.2025, 16:16:05

IntMAS Artifacts APG V 0.9_v3 LK.docx
Validation Rejected
Assessment Rejected
Approval Pending
Created: 17.9.2025, 13:17:41

Fig. 20 Submitting IntMAS artefacts for evaluation

Submission Detail

Created 28.10.2025, 16:16:05

SUBMISSION Accepted

FILE NAME

IntMAS Artifacts V 0.9.5-uuidea.docx

Validation

Assessment

Approval

VALIDATION Accepted

Accepted (with warnings)

Passed: Yes

Warnings: 24

Critical Faults: 0

Warnings

- short_section:MAIN - MOTIVATION
- short_section:ORG - External verification
- missing_section:ORG - Date and statement of validation
- missing_section:ORG - IntMAS validation result
- missing_section:ORG - Date of next validation planned
- missing_section:ORG - Registration certificate
- short_section:ORG - Contacts
- short_section:ORG - List of Tables
- missing_section:ORG - ANNEX: RESULTS OF ASSESSMENT 2025
- short_section:INTEROPERABILITY PERFORMANCE PROGRAM - Summary
- short_section:INTEROPERABILITY MANAGEMENT SYSTEM - Introduction
- short_section:INTEROPERABILITY MANAGEMENT SYSTEM - Organisation

Fig. 21 Results of AI based IntMAS evaluation

2.4.5 Linking to tools and guidelines

The IntPPC platform allows its users to easily navigate through the website and access relevant tools for capacity building and interoperability management. Above all it guides the community members, that trust their platform, to trustworthy sources of information and knowledge. Buttons in the top navigation link directly to IntMAS (cf. chap. 2.2.4) and the IOP Compass (see chap. 2.2.2):



About Why IntPPC? Knowledge Hub Expert Circles  IntMAS  IOP Compass

Other tools and guidelines are described or contained in documents available on the knowledge hub.

2.4.6 Maintenance and terms of use

The platform refers to a set of rules for the use of its services:

- Each user may have only one active account.
- It is not allowed to gain unlawful access to other accounts or to try to do so.
- Inactive accounts will not be deleted automatically, for deletion a short mail with indication of e-mail address and full name to community@intnet.eu is sufficient.
- Insults, disparagement, or other questionable statements about other users in any form will not be tolerated and will be deleted.
- Advertising of any kind, spam and chain letters are not allowed.
- The imitation of official institutions, as well as the use of morally or politically incorrect names is prohibited and will be sanctioned with account deletion.
- It is not allowed to distribute copyrighted media such as documents or videos.

These terms are subject to change with the further development of the platform.

For a period of 3 years, B.A.U.M. guarantees the hosting and maintenance of the community platform. During this timeframe, B.A.U.M. and interested partners in the existing community will try to find support for the further development of the platform and the community as such. They will investigate – amongst others – the following opportunities throughout their long-term exploitation activities (cf. chap. 3.9):

- invite users of IntMAS and the IOP Compass to become ordinary members of the community
- offer IntMAS (and adaptations) to other projects and networks (e.g. INSIEME, Crete Valley, CETP)
- get public or private funds to add new functionalities
- get public or private funds to add and maintain the contents in the knowledge hub and manage the Interoperability Community
- advertise the Community and the platform and consider pay by use or a membership fee.

3 Dissemination and communication activities

Over the three-year runtime of int:net, a comprehensive set of communication, dissemination and community-building activities has been implemented to create visibility, attract engagement, and ensure long-term exploitation of project results. The overarching goal was to turn interoperability from a research topic into an actively shared and applied concept across the European energy ecosystem.

By linking communication, dissemination, and exploitation in a coherent strategy, int:net has succeeded in transforming research outcomes into a living, self-sustaining ecosystem that promotes interoperability across sectors and supports Europe's energy transition well beyond the project duration.

3.1 A Common Visual Identity

A coherent and widely recognisable visual identity was established early in the project to ensure consistent communication across all media and stakeholders. The hexagonal logo – combining yellow, orange and blue in a dynamic composition – symbolises diversity, collaboration and stability. It visually expresses how multiple actors and domains come together to shape interoperability while maintaining their distinct roles. The design elements were applied across all materials, templates and presentations, establishing a strong, memorable brand presence for int:net at European level.



Fig. 22 int:net logo pack

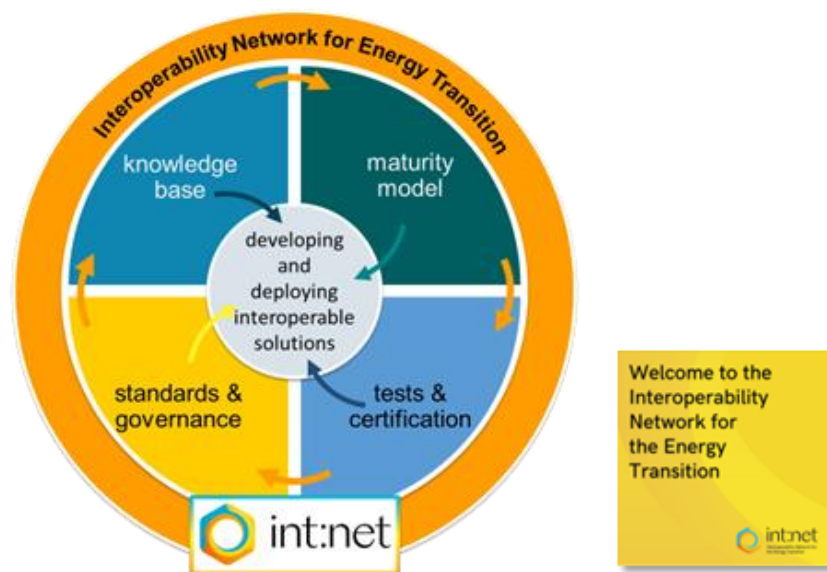


Fig. 23 Implementation of the project design

3.2 Website and Online Presence

The project website (<https://int-net-project.eu>) serves as the int:net ecosystem. It combines traditional project communication - objectives, partners, news and results - with access to the int:net Community platform, where stakeholders can collaborate, share knowledge, and connect to testing facilities and interoperability resources.

The website is fully responsive, SEO-optimized, and designed for integration with social media and the int:net knowledge base.

It provides direct access to events, publications, and repositories, and acts as a gateway to the broader European interoperability network.

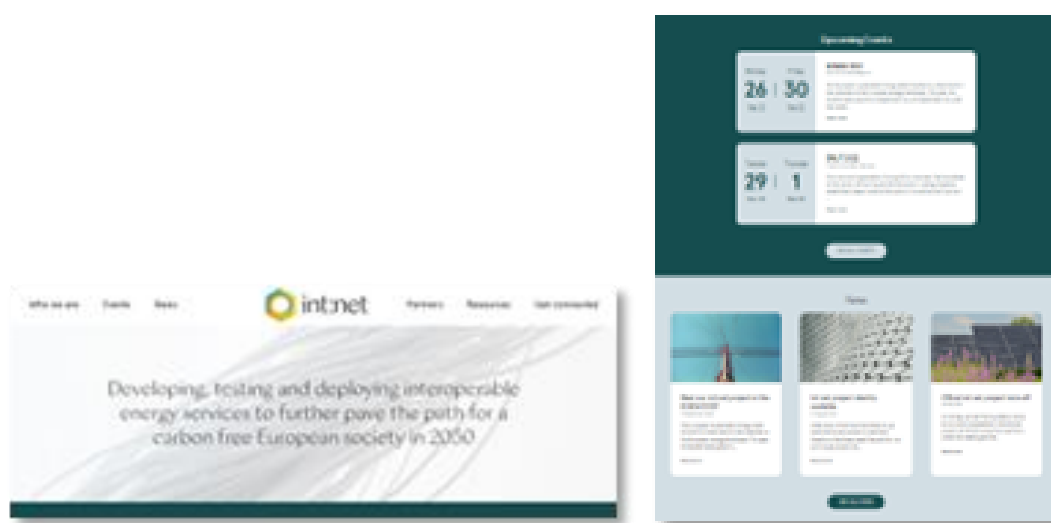


Fig. 24 Website elements

3.3 Social Media and Media Campaign

A media and social network campaign was launched to reach diverse audiences - from industry professionals and standardisation bodies to researchers and policymakers. The project's LinkedIn page (<https://www.linkedin.com/company/int-net-project>) became the main social media hub, growing to over 730 followers by the end of the project. Weekly updates and storytelling posts promoted project results, partner activities, and related European initiatives. To support this, a communication toolkit with templates, hashtags and editorial calendars was provided to all partners. Posts were aligned with project milestones, major events, EU policy activities and publication releases, ensuring timely visibility.

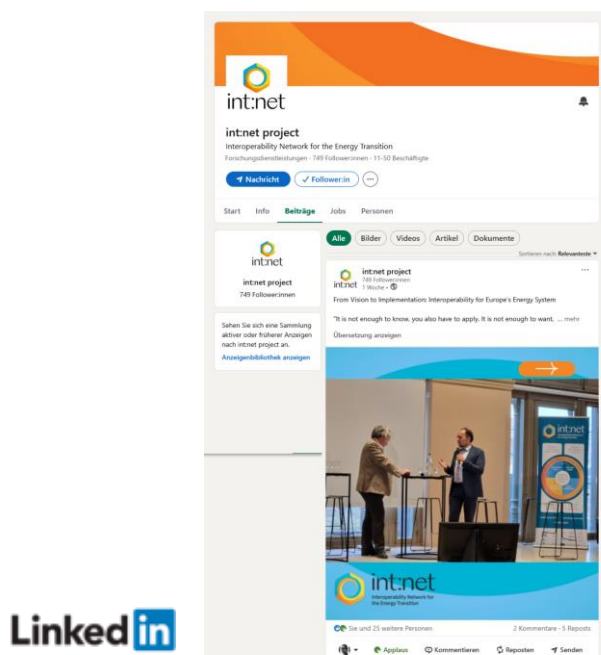


Fig. 25 LinkedIn channel of int:net

3.4 Capacity building and dissemination events

A major pillar of dissemination has been active participation in external events. int:net has been represented at major European conferences including Enlit Europe at the EU project zone (Frankfurt 2022, Paris 2023, Milan 2024) and the European Sustainable Energy Week (EUSEW), where project results were presented through policy sessions and exhibition booths. In addition, int:net contributed to the BRIDGE initiative, fostering exchange and alignment with other Horizon Europe projects and CETPartnership.



Fig. 26 Dissemination events

3.5 Attending external events

Between 2023 and 2025, int:net has actively engaged in numerous high-level European conferences, workshops, and symposia to promote interoperability, collaboration, and digitalisation across the energy sector.

- ComForEn 2023 (Vienna) – int:net organised a stakeholder workshop on establishing a community of practice for interoperability and presented its first Interoperability Roadmap for the Energy Transition.
- InnoGrid 2023 (Brussels) – the project showcased its vision for connecting European energy stakeholders through an interoperability network, with both a booth and participation in the policy session.
- EGI Conference 2023 (Poznań) – int:net contributed to a panel on Making Space for Data, discussing interoperability and governance challenges in emerging energy data spaces.
- Energy Data Space Cluster Workshop (Brussels, Sept 2023) – coordinated by int:net, this workshop brought together European Commission representatives and leading Horizon Europe projects to align on the architecture, governance, and use cases of the Common European Energy Data Space.
- Hannover Messe 2024 – VDE Forum Energy 4.0 – project coordinator Prof. Antonello Monti presented int:net's progress within the "Future Energy Eco Systems" forum, highlighting interoperability as a key enabler of the green and digital transition.
- SET-Plan IWG4 Symposium on Interoperability & Data Spaces (Trieste, June 2024) – co-organised by int:net, this event fostered cross-sector collaboration and alignment of testing procedures across digital domains.
- OSMSES/ComForEn 2024 (Vienna) – int:net introduced the EMINENT framework for assessing interoperability maturity in open-source energy software.
- MedPower 2024 (Athens) – presentation of research on interoperability testing of smart energy systems.
- Data Spaces Symposium 2025 (Warsaw) – int:net represented the Energy Data Spaces Cluster, presenting the Interoperability Framework and contributing to EU-wide strategies for secure data sharing.
- EPRI Workshop Week (Barcelona) – highlighted interoperability as a catalyst for innovation scaling in the energy transition.
- Hannover Messe 2025 & Impulsforum Digitale Energiewende (Berlin) – showcased IntMAS and supported the creation of a new standardisation platform for cross-sector data ecosystems.

Together, these events demonstrate int:net's leading role in shaping Europe's interoperable, data-driven energy future.



Fig. 27 Dissemination event “Impulsforum Digitale Energiewende 2025” (Berlin)

3.6 Collaboration: The capacity and network building week in Vienna

The Capacity and Network Building Week in Vienna in July 2025 was organised as a joint initiative between int:net and the Clean Energy Transition Partnership (CETP). The event combined CETP sessions with int:net activities, bringing together a wide range of partners and stakeholders from across Europe.

Highlights included:

- The int:net Summer School 2025 – the project’s one and only summer school, inspiring young professionals on standardisation, collaboration, and cross-sector alignment for the energy transition.
- The Think Tank 2025 – gathering experts from utilities, research institutions, and policy to discuss governance for a sustainable and interoperable energy system. The event concluded with an engaging exchange with the European Commission’s Digital for Energy experts.
- The 3rd Cross-Sector Symposium on Interoperability – attracting over 80 participants, including policymakers, researchers, and practitioners, to debate key challenges and future directions for interoperability across the energy domain.



Fig. 28 Capacity and Network Building Week, Vienna 2025

3.7 Final Conference in Brussels

The Final Conference, held on 18 September 2025 in Brussels, marked the culmination of three years of intensive work. It showcased int:net's achievements across all work packages and officially introduced the IntPPC platform and IntMAS approved label. Key sessions highlighted the project's impact, the growing European community, and the roadmap for sustaining the Interoperability Network for the Energy Transition.



Fig. 29 int:net final conference, Brussels, 2025

3.8 Video documentation: Interoperability for Europe's Energy System

The int:net video documentary “From Vision to Implementation – Interoperability for Europe's Energy System” constitutes one of the flagship dissemination outputs of the project. Produced in connection with the Final Conference held in Brussels in September 2025, it serves as a comprehensive synthesis of the project's objectives, results, and legacy.

The film follows the structure and thematic flow of the Final Conference programme, using it as a narrative framework to present a comprehensive overview of the entire int:net journey — from its initial vision and collaborative development to the implementation of key frameworks, tools, and platforms such as IntMAS, IntPPC, EMINENT, and the IOP Compass.

It includes excerpts from conference sessions with partner interviews, expert statements from the European Commission and industry stakeholders, illustrating how int:net has advanced interoperability in Europe's energy transition.

The documentary captures the essence of int:net: an open, cross-domain community committed to connecting people, projects, and knowledge for a more interoperable energy future. It highlights lessons learned, showcases practical outcomes, and presents perspectives for the continuation of the interoperability network beyond the project lifetime.

This audiovisual output is publicly available through the project's website. It represents the final communication milestone of int:net, ensuring long-term visibility and accessibility of its results to European and international audiences and supporting their further exploitation through knowledge transfer, stakeholder engagement, and replication in future initiatives.

3.9 Long-Term Exploitation and Sustainability

While the project's immediate objective was not economic exploitation, int:net strategically prepared for long-term sustainability. Through the combination of the IntPPC platform, the active community, the IOP compass and the “int:net approved” label, the project leaves behind a self-sustaining interoperability framework.

Continuous collaboration among partners and integration into ongoing European initiatives (ETIP SNET, BRIDGE, ISGAN, Mission Innovation) ensure lasting impact.

Looking ahead, the int:net ecosystem will remain the European reference point for interoperability in the energy transition—open, connected, and evolving.

For more details check deliverable 5.4, “Exploitation and long-term sustainability of int:net” ⁴.

⁴ available on Zenodo at <https://doi.org/10.5281/zenodo.17487841>

4 Conclusion

The int:net project has been successful in assessing the context under which interoperability and energy transition-related innovations have emerged. Through this assessment, a coherent vision has been developed. Considering the relevance of the topic, its broad scope of application, and the fragmentation of the stakeholder landscape, reaching an agreement on the most adequate approach naturally did not occur without challenges. Nevertheless, through multiple communication efforts, discussions, presentations, webinars, workshops, and other dissemination materials int:net was successful in communicating its vision, and gaining the attention from relevant stakeholders who are willing to apply its lessons and carry the vision forward.

Through an assessment of interoperability use cases, as well as the initiatives which are or have been involved in their governance, clarity in digital energy innovation development dynamics was gained. Understanding, navigating and interacting with the organisational and institutional landscape requires knowledge from multiple domains in a cross-sectoral context, it is challenging (e.g. due to innovation dynamics) and can be time consuming. Hence, the creation of a network and platform (i.e., the IntPPC) which facilitates it, while providing useful tools for collaboration, has been proposed. But, one thing is to navigate the mentioned landscape, and another is to enable stakeholders to form a part of it while facilitating effective working practices. Hence, the platform's approach is to facilitate the creation of use case-related and other thematic networks; without disabling for users to organise for which ever purpose they may see fit. In a sense, this platform then becomes a network of networks (which is consistent with the system-of-systems vision).

The challenge of developing and implementing interoperability-related innovations in an organisation has been tackled through approaches to facilitate capacity building for newcomers and to increase the interoperability maturity of engaged organisations. Of course, final maturity is achieved once an organisation's offering is truly interoperable with solutions from other organisations. For that reason, a central element of the approach is to promote int:net's testing framework. This is done by fostering the continuation of int:net's work on forming the community of interoperability testing facilities, promoting harmonised practices and facilitating the interaction of this community with other expert circles present in the IntPPC. The IntPPC has been conceptualised and created to facilitate these tools to a broad audience, and with the mission to continuously develop our own maturity as a facilitating network when providing such assistance.

While creating stakeholder platforms which are accessible, active and effectively interact with framework setters is a challenge throughout the research and innovation landscape, much has been gained in terms of the development of ideas and lessons learned. Consistent efforts need to be made to promote a way forward and effectively break the silos which hinder European competitiveness and the continuous proliferation of transparent and democratic means of sustainable development, to which int:net contributions are hopefully a grain in the sands of time.

