D6.3 - Initial Exploitation Plan and IPR report

WP 6 – Communication, Dissemination and Exploitation

T 6.4 – Exploitation of Project Results

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DISCLAIMER

ABBREVIATIONS AND ACRONYMS

ANSI	American National Standards Institute
CENELEC	Comité Européen de Normalisation Electrotechnique (European Committee for Electrotechnical Standardization)
CIM	Common Information Model
DER	Distributed Energy Resource
DES	Distributed Energy Storage
DKE	Deutsche Kommission Elektrotechnik Elektronik Informationstechnik
DSO	Distribution System Operator
EES	Electrical Energy Storage
EMS	Energy Management System
HESS	Hybrid Energy Storage System
HVDC	High Voltage Direct Current
HVDS	High Voltage Distribution System
ICT	Information and Communications Technologies
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IPR	Intellectual Property Rights
ISA	International Society of Automation
ISO	International Organization for Standardization
NEMA	National Electrical Manufacturers Association
PLC	Power Line Carrier
PR	Public Relations
SAE	Society of Automotive Engineers
SC	Subcommittee
SEP	Smart Energy Profile
SGAM	Smart Grid Architecture Model
SyC	System Committee
TC	Technical Committee
TR	Technical Report
TS	Technical Specification
TSO	Transmission System Operator
UL	Underwriters Laboratories
USNC	U.S. National Committee
VDE	Verband der Elektrotechnik Elektronik Informationstechnik e.V.
WG	Working Group
WP	Work Package

Table of Contents

Executive Summary

This deliverable is structured in 5 main sections:

1. The exploitation strategy and plan
2. The business plan and model
3. The marketing and dissemination plan
4. The knowledge data and IP management
5. The standardization framework

This document outlines the project's exploitable outcomes, strategic goals, and the mechanisms for maximizing the impact and sustainability of these outcomes. It also addresses key considerations for intellectual property management, ensuring that the innovations developed are adequately protected and utilized.

Key Exploitable Results (KERs)

The InterSTORE project has identified four key exploitable results (KERs):

1.Interoperability of Client/Server for Distributed Energy Storage: Development of an interoperable client/server software library enabling IEEE 2030.5 communication between devices and Energy Management Systems (EMS) over NATS.

2.Legacy System Protocol Converter: Tools to integrate legacy systems with new protocols, ensuring seamless communication across different storage solutions.

3.Testing Procedure and Software Tool: Establishment of comprehensive testing procedures to ensure the smooth operation and integration of the entire system.

4.Interoperable Data Space Framework: An open adaptation of data sovereignty connected data space building blocks to enable Distributed Energy Storage (DES) data valorization and data-driven service digitalization.

Strategic Objectives

The exploitation strategy focuses on:

Developing and Deploying Open-Source Tools: Creating interoperable software toolkits that facilitate the integration of distributed storage applications, ensuring compatibility with new generation energy management systems.

Standardization and Interoperability: Promoting the adoption of IEEE 2030.5 and Energy Data Space standards to foster market demand and interoperability among stakeholders, including inverter manufacturers, energy brokers, Distribution System Operators (DSO), and Transmission System Operators (TSO).

Market Engagement: Engaging with market participants to ensure the tools developed are adopted and utilized effectively, enhancing the overall value chain.

Intellectual Property Management

The document provides a detailed approach to managing intellectual property within the project, covering:

Existing and New Intellectual Property: Identification and protection of background and foreground IP, ensuring all partners' contributions are recognized and protected.

Access Rights: Establishing clear guidelines for access rights to ensure smooth collaboration and utilization of project results.

Publications and Open Access: Strategies for disseminating project results while protecting sensitive information and intellectual property.

Marketing and Dissemination

A comprehensive marketing and dissemination plan is outlined, aiming to:

Raise Awareness: Enhance the visibility of the project's outcomes through targeted communication strategies.

Engage Stakeholders: Facilitate knowledge transfer and foster collaborations with relevant stakeholders.

Ensure Impact: Utilize a variety of tools, including a sophisticated visual identity, a comprehensive website, and active participation in key events to maximize the project's scientific and socio-economic impact.

Standardization

Standardization is essential for the InterSTORE project to ensure interoperability, foster economic growth, and improve productivity and quality. The dynamic matrix of technical committees, regular updates through newsletters, and incorporation of project results into standards are strategic tools for achieving these goals.

A "Standardization/Regulation Blog" has been set up to keep InterSTORE project partners informed about relevant standardization and regulation activities.

InterSTORE project is aligned with the main standard regulatory framework and contributes to global standardization efforts, ensuring its innovations are effectively integrated and utilized in the energy storage sector

By focusing on interoperability, standardization, and strategic market engagement, the project aims to create significant socio-economic benefits and drive advancements in the energy storage sector.

This document serves as a preliminary version, with the final exploitation plan (D6.4) that will be released at the project's end (M36), ensuring ongoing alignment with the evolving market and regulatory landscape.

1 Introduction

Deliverable D6.3 contain the initial plan for the exploitation results of InterSTORE project.

It collects and describe the exploitable outcomes that have been identified including

- List of identified SW tools
- Leading partner for each tools
- Background and Foreground IP of each Partner applied to each one of the results;
- Protection form for each result.

The initial and final exploitation plans are labelled as sensitive document and are restricted to the Consortium and IAB members. This document is a preliminary version of the D6.4 final exploitation Plan that will be released at the end of the project.

The marketable results of InterSTORE project described in D6.3 address the main expected impacts described in the proposal: develop and deploy novel open-source software toolkit to integrate different distributed storage applications ensuring interoperability capable to integrate new generation of energy management systems implemented to provide the capability of a hybrid energy storage systems (HESS) to work as a conventional battery energy storage system.

- HESS's HYDEMS Distributed Energy Resource Management Systems
- EAT's Residential/Commercial Power Management and Brightlayer software platform,
- INESC's HEMS home Energy Management System
- ENX's Hybrid E-mobility Management Platform
- CYG's cyberNOC Flexibility Management Platform

InterSTORE aims to integrate distributed storage technology that can work seamlessly with different systems, allowing for efficient use and monetization of storage flexibility in real-world situations. This will involve applying the chosen interoperable protocol or approach to various storage devices and systems. Additionally, to ensure open-source development and integration with existing systems, we plan to:

- Develop open-source interoperable tools, including a protocol converter to integrate legacy systems.
- Establish thorough testing procedures to ensure the smooth operation of the entire system.
- Develop, deploy and validate an open adaptation of data sovereignty connected dataspace building blocks to enable DES data valorization and data-driven service digitalization
- Maximize the impact of InterSTORE through standardization initiatives of the applied interoperable solutions and the promotion through dissemination and communication channels

2 Exploitation Strategy and Plan

InterSTORE start from the assumption that the further adoption of IEEE 2030.5 and Energy Data Space standard will generate a new market demand by several stakeholders: inverter manufacturer, energy brokers, DSO and TSO that should be answered.

- many existing protocols for DERs integration on the market
- simultaneously there is a growing need for data sharing
- bridging difference is a costly and time consuming work

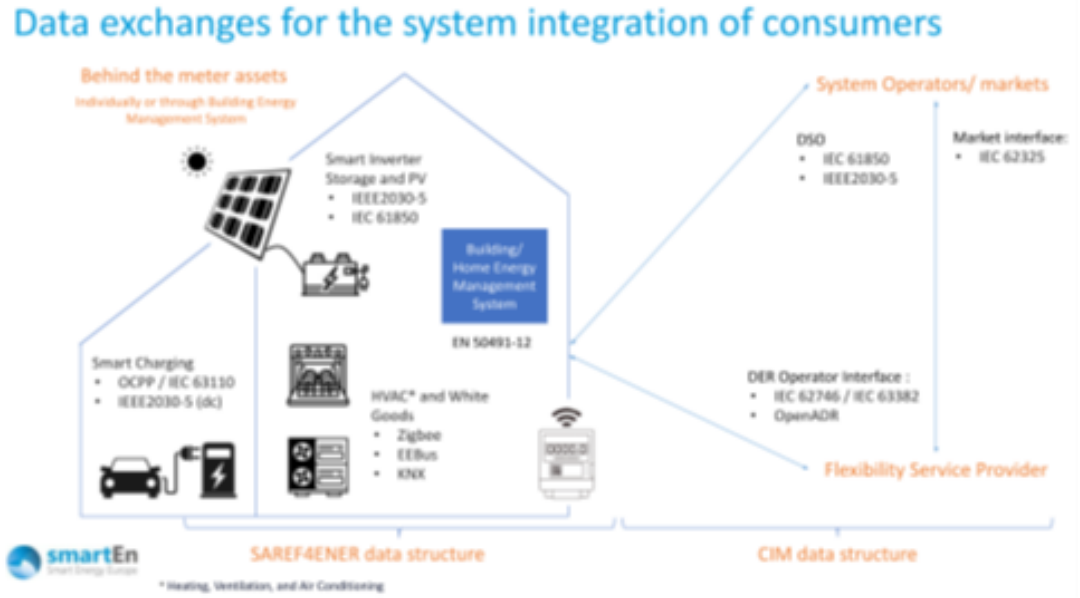

Figure 1: Home energy data exchanges existing multiple protocols

This chapter collets and describes the 4 key exploitable results identified by InterSTORE project:

- Interoperability of the client/server for distributed energy storage
- Legacy system protocol converter
- Testing procedure and software tool
- Interoperable data space framework

To this 4 KER we should ass also the 9 UCs that are dealing with different type of flexibility and monetization enables by the increased interoperability

Table 1: InterSTORE UCs functional specification classification

Use Case name	Place	Demonstrate higher perform Hybrid System	Monetisation	Conn. Data Space	Flexibility/Consumer engagement	IEEE implementation (converter or interoperable client/ server)	2nd Life Batteries	EV charge Batteries support
DES Flexibility Market Monetisation	Austria	x	x	x	x	x		
Energy community DES utilisation	Austria	x	x	x	x	x		
Grid supporting BESS	Germany	x		x		x		
Innovative Frequency services	Spain Lab	x			x	x		
Hybrid storage for arbitrage/flexibility provision	Portugal	x		x	x	x	x	
Management of battery systems for Node capacity increase	Portugal				x			x
Adaptive BESS management for autonomous grid operation	Spain Lab	X			x	x		
Multiphysics flexibility optimization for Home Management Systems and their global integration	Germany	x			x			
Management of EV charging clusters as HESS	Italy			x		x		x

2.1 KER1: Interoperability of the client/server for distributed energy storage: definition and exploitation strategy

The project's first key exploitable result is the development of an interoperable client/server software library that enables IEEE 2030.5 communication between devices and EMS systems over NATS. This library has several objectives and features:

- It offers open-source, out-of-the-box support for IEEE 2030.5 messages in both XML and JSON formats.
- It leverages next-generation NATS messaging as a communication protocol, providing superior performance, scalability, and reliability compared to other protocols.
- It includes a reference implementation as an open-source project, available for anyone to use and modify.

This interoperable client/server is designed to simplify the integration of IEEE 2030.5 devices and EMS systems and to encourage the adoption of this standard in the smart grid domain.

2.1.1 Exploitation Plan: KER1

SUN, WP2 leader, in agreement with the project consortium decided to release the interoperable client/server software, under open source MIT license.
The selection has been made after consulting with Linux Energy Foundation to assure then the full engagement of the Open Source Community on energy and the collection of feedback and continuous Improvement also after the project end via github: https://github.com/Horizont-Europe-Interstore

Most of the success of this tool will depend by the increase adoption of IEEE 2030.5 standard by new countries and by the main energy and smart grid players to enhance the software's usability and adoption.

Through the engagement of the use case owner (UC1-2-3-4-7-8-9) and the IAB first and after through dedicated workshops in conjunction with the other funded projects under the same

call (FLEXCHESS and PARMINEDES) InterSTORE will establish mechanisms for collecting user feedback and feature requests to guide future development and improvements.

InterSTORE will maintain a regular update cycle to address bugs, introduce new models data models, and ensure the software remains relevant for the use case owner providing some customization and up-to-date with industry standards.

MIT License Benefits of quite some flexibility: Leverage the permissiveness of the MIT license to encourage adoption and contributions. Highlight the benefits of the license, such as the ability to use, modify, and distribute the software with minimal restrictions.

All use case owner that will be demonstrated by ENX, EAT, CYG, HESS will implement an ad hoc exploitation plan for their commercial product, the project can maximize the impact and adoption of the interoperable client/server software, driving the integration of IEEE 2030.5 devices and EMS systems and promoting the standard in the smart grid domain

Finally the exploitation strategy took in consideration the need to integration the 4 InterSTORE Tools together to increase the adoption capability and increase the impact. This will increase the effect of training programs services to assist organizations in implementing and customizing the software for their specific needs and provide technical support to offer support packages for enterprises that require dedicated technical assistance and maintenance.

2.2 KER2: Legacy system protocol converter: definition and exploitation strategy

The Legacy Protocol Converter, is the second KER of InterSTORE project, the SW tool acts as middleware to facilitate data exchange between devices using various communication protocols and EMS systems adhering to the IEEE 2030.5 standard.

Key Features and Capabilities are:

Supports Multiple Protocols: Handles IEEE 2030.5 messages in JSON and XML formats, utilizes next-generation NATS messaging for efficient communication, and translates MQTT and Modbus protocols into IEEE 2030.5 format.

Built-in Transformation Framework: Allows users to define transformations for incoming messages to match the IEEE 2030.5 format, accommodating different device and system message formats.

Flexible Configuration: Uses a configuration file to specify connection details and transformations, supporting multiple message formats and structures for diverse applications.

Versatile Deployment: Deployable via pre-built Docker images, custom Docker images, Java JAR files, or source code compilation, suitable for on-premise or cloud environments including Kubernetes, Docker, virtual machines, and bare-metal setups.

2.2.1 Exploitation Plan: KER2

The Legacy Protocol Converter ensures seamless message transformation between ModBus, MQTT, NATS, and IEEE 2030.5 XML and JSON assuring interoperability between devices and EMS promoting the adoption of the IEEE 2030.5 standard in smart grid environments.

As for the client/server software library the legacy protocol converter has been released with MIT license.

https://github.com/Horizont-Europe-Interstore/Legacy-Protocol-Converter

To assure the exploitation plan 4 IAB members with a potential interest in adopting or certifying this tool have been identified:

Alessandra CUNEO (RINA Consulting); Christian Lelonek (IoT MAXX), Younus Jawad, Windisch Philipp, Muggenhumer Gerold (FRONIUS) and Syam Kalissery (SCHENIDER).

InterSTORE will develop and promote extensions plugins that enable seamless integration with existing tools and platforms used by target users. Docker Hub for direct access of Docker images has also been made publicly available
https://hub.docker.com/r/interstore/legacy-protocol-converter

To promote the engagement and the adoption of the SW tool dedicated tutorials and webinars has been recorded. Is essential to educate users on how to deploy, configure, and integrate LPC into their systems to assure the adoption of the solution also after the project end and continuous development.

Collaboration with Industry Partners that are involved in the project has been assured through a co-design and co-development of the SW tool and ad hoc customization has also been considered.

Partnerships with the twins project FLEXCHESS and PARMINEDES has also allowed to map new companies and organizations in the energy, IoT, and smart grid sectors that potentially might have an interest to integrate LPC into their products and services.

Marketing and promotion will be assured by EASE and all the project partners through ad hoc event such as the participation to E-World 2024, ENLIT 2024,… and through all InterSTORE use cases implementation in the 5 InterSTORE real-world pilot sites and hopefully collect success stories for marketing purposes.

2.3 KER3: Testing procedure and Software tool: definition and exploitation strategy

The InterSTORE Testing Protocol Software Tool is a fully automated testing solution designed to validate the functionality of systems using the IEEE 2030.5 standard. It stands out by employing a message broker, NATS, instead of the traditional HTTP, making it unique in its approach. The software tool is designed to automatically execute tests once initiated. To achieve robust testing, it integrates various open-source libraries and tools.

The development of this software is ongoing and aligned with Sunspec standards. It includes different test categories such as core tests, communication tests, and basic tests. The current version focuses primarily on the core tests, which are considered the most critical, and includes essential test cases for this purpose. A second version will include a larger set of test case and will keep updated to the IEEE 2030.5 technical updates.

Key Features are:

Automation and Reporting: The software automates the testing process, comparing expected and actual outcomes, and reporting pass or fail status.

Open-Source Tools: Utilizes Cucumber for controlling the test flow on the client side, and the pervious described InterSTORE tools within the Java ecosystem for server-side testing.

Innovative Testing Approach: Tests a RESTful architecture-based IEEE 2030.5 using the NATS messaging system, instead of HTTP, which distinguishes it from other testing tools for the same protocol.

Cross-Platform Compatibility: Capable of running on any operating system, ensuring flexibility and user-friendliness.

Adapted Testing Procedures: The testing procedures are specifically adapted to the NATS messaging system, ensuring efficient and lightweight testing.

2.3.1 Exploitation Plan: KER3

The exploitation strategy plan started from a competitor analysis that allow to create a unique value proposition of InterSTORE automatic testing procedure and software protocol compare to the one offered on the market by Quality Logic https://www.qualitylogic.com/knowledge-center/ensuring-a-quality-ieee-2030-5-stack-integration/ . The key distinguish elements that included the NATS messaging system were also discussed with some of the IAB that had already certified their smart inverter such a Schneider. The competitive advantages of adopting InterSTORE facility is that the new architecture will allow the DER controller to receive multiple IEEE 2030.5 messages in real time and to update dynamically the programming of cluster of smart inverters or to send a status report of the DERs back to the server.

Ad hoc activities has been carried out to understand the need of certification requirements to assure that the testing tool can be used both as self assessment both as standardized 2030.5 certification fulfillment protocol.

2.4 KER4: InterSTORE Data space connector and exploitation plan

InterSTORE data space connector relies on previous work of Engineering: true connector and OneNet connector.
True connector, enabled trusted data exchange, as part of IDS ecosystem, a virtual data space leveraging existing standards and technologies, as well as governance models well-accepted in the data economy, to facilitate secure and standardized data exchange and data linkage in a trusted business ecosystem.
True connector has been expanded and specify within the OneNet project for the energy domain adding:

- FIWARE Context Broker fully integrated in the Connector Architecture
- Additional Data Services (Data Quality, Data Harmonisation…)
- Standardised API for any Energy Data

The IDS Connector allows to exchange data and enrich it with metadata. An important aspect of this are usage conditions, which can be defined, administrated, and implemented by the Connector. The metadata is described by the ontology of the IDS Information Model.
The main advantage of the IDS reference architecture and the use of an IDS Connector is the decentralized data storage. This enables data integration from different data sources and allows data access exclusively through other IDS Connectors

The architectural design of Interoperable Data Space Framework is structured to be modular, scalable and easily maintainable.
The Interoperable Data Space Framework mainly consists of two components: the **Data Space Middleware and the Energy Data Space Connector**

The **Data Space Middleware** implements all the central features of the Interoperable Data Space Framework including:
- Identity Management
- Vocabularies and Ontology for Energy Domain
- Data Catalogue discovery
- Services Creation

An IDS Connector is composed of various system services:
- Execution core container with message systems (message router/bus)
- Configuration Manager to configure the Connector (execution core container, application container management, network, firewalls, etc.)
- Data Apps for data processing and handling
- Application container management
- Hardware/Operating system

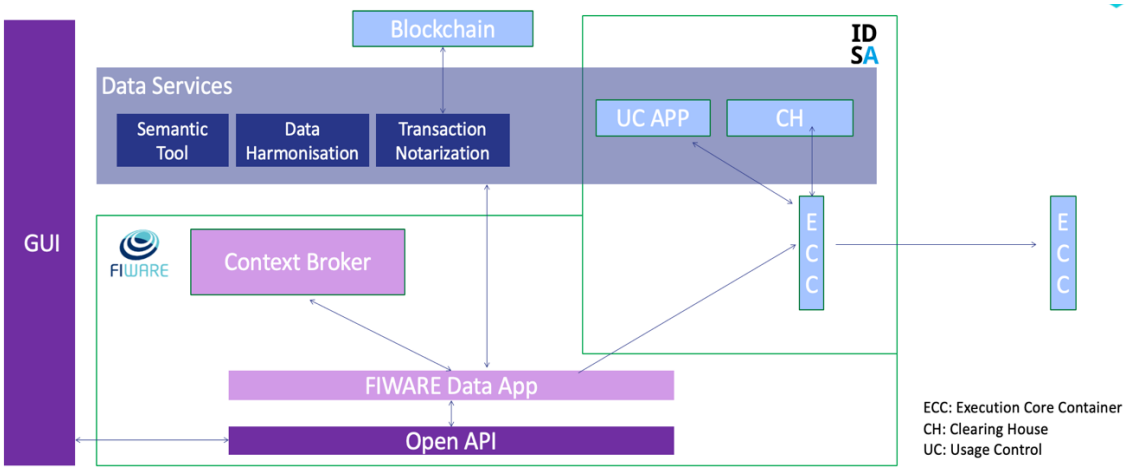

Figure 2: Energy Data Space Connector architecture

Key Features are:

In this first version the InterSTORE Energy Data Space Connector includes the following new features:
- Open Graphical User Interface
- Blockchain integration for data exchange transaction and verification

A new release is foreseen at M27 and will include:
- New data exchange mechanisms for service providers (e.g., Service Subscribe and Push data)
- Integration and support of new standards and protocols (e.g., IEEE 2030.5)

The objective was to create a single page application that used modern technologies and was completely decoupled from the BackEnd API.
Furthermore, the new interface module did not have to have particular constraints on frameworks or proprietary libraries, so that it could be released under an open source license and used/evolved even after the end of the InterSTORE project.

The new interface includes the following features:
- User management and user authentication
- Dashboards
- Connector Settings
- Viewing the macro services of the Energy domain
- Creation and management of Services
- Subscription of services with acceptance workflow
- Data exchange (upload/download) on a service
- Timeline with visualization of smart contracts created on blockchain

All transactions that take place within the Data APP call a blackchin-based transaction notarization service which takes care of verifying the data entity and writing some identifying transaction information in the blockchain infrastructure exploiting Smart Contracts implementation. In this way any transaction is tracked and verifiable.

2.4.1 Exploitation Plan: KER4

The exploitation started from the need of promoting OneNet connector, specifically developed for energy IDS. To assure the adoption of this connector was crucial to agree on an opensource IP Licence GNLP that was accepted by Linux Energy Data Space.

The Energy Data Space Connector is now available on InterSTORE github

Several activities have been implemented to assure the easy adoption and testing of the tools by project partners and cluster projects partners.
On July 17th, 2023 withing the cluster meeting with FlexChess and Parminides project a dedicated working session was held by Engineering to present the energy data space connector and promote its adoption by the cluster pilot demo owners.
Ad hoc training sessions has been organized to assist project partners to install the connector and familiarize with it.
InterSTORE has been included as part of int:net Energy Data Space Cluster Projects (EDSCP); that included the following initial data spaces projects: ENERSHARE, DATA CELLAR, OMEGA-X, EDDIE, SYNERGIES) and the new ones: InterSTORE, TwinEU, InterStore, Hedge-IoT, Odeon, Begonia.

3 Business Plan and Business Model

3.1 Market and Target Groups

EPRI's assessment indicates that the deployment of IEEE 2030.5 communication technology in the distributed energy resources sector demands an expenditure ranging from $1 million to $2 million per manufacturer and approximately a year of dedicated work. During this period, collaboration with third-party aggregators and investor-owned utilities is essential to ensure proper functionality.

Assuming an average investment of $1.5 million and a one-year commitment per stakeholder, with roughly 20 stakeholders involved, encompassing manufacturers, investor-owned utilities, and third-party aggregators, this initiative has generated substantial cost savings throughout California. The estimated total savings to ratepayers and investor-owned utilities in California amount to around $30 million, resulting from the multiplication of 20 stakeholders by an average investment of $1.5 million. This estimation translates to a remarkable return on in- vestment, exceeding 30:1, for the project.

The innovative InterSTORE software facilitates the seamless integration of decentralized energy storage solutions into the power grid. This integration serves to provide flexibility services by connecting various participants in the energy market and aggregating their supply and demand functions. The incorporation of these solutions offers significant socio-economic advantages, including the reduction of balancing costs. Simultaneously, it brings about transformations in the value chain architectures, affecting both new and established market participants.

This holistic value chain encompasses private and commercial prosumers, Transmission Sys- tem Operators (TSO), Distribution System Operators (DSO), Balance Responsible Parties (BRP), Energy Service Companies (ESCOs), energy traders, as well as business and aca- demic research entities. They collaboratively provide and benefit from the flexibility services, and the sustainability and long-term viability of the InterSTORE value chain hinge on the economic advantages for all involved partners.

Beyond economic viability, the implementation of new business models must consider the societal impacts of the envisioned changes in energy supply. As such, sustainability and Corporate Social Responsibility (CSR) aspects must be carefully assessed and integrated into the design of new value chains to meet the needs and expectations of all stakeholders.

To support the seamless integration of Distributed Energy Storage (DES) and Battery Energy Storage Systems (BESS) and to facilitate economic growth, an interoperable IT infrastructure is essential. Demand response, encompassing Electric Vehicles (EVs), solar PV, and stationary batteries, exhibits substantial global market potential, with Europe and North America as the two largest markets until 2030.

In the European Union, the target group not only includes existing and emerging aggregators and utilities offering demand response but also new market entrants like Energy Communities, empowered to sell flexibilities under the Clean Energy Package. It is anticipated that by 2030, hundreds of energy communities will emerge in Europe, with a focus on countries with favorable regulatory frameworks, such as Spain or Austria.

Specifically in the battery value chain, the deployment of residential BESS is expected to continue its growth. In 2020, annual residential battery storage installations in Europe surpassed 100,000, reaching a cumulative capacity of 3GWh. This growth trajectory is projected

to accelerate, with a 400% increase over five years, reaching 12.8GWh of installed residential capacity across the continent by 2025. Residential BESS offers favorable economics, exemplified by German households with solar and storage systems experiencing a nearly one-third reduction in the levelized cost of electricity, at C0.122 ($0.137)/kWh.

The EAT, ENX, HESS EMS portfolio will be expanded to include the integration of additional storage technologies beyond the current design stage. Furthermore, the project's outcomes will foster closer collaboration with Transmission System Operators (TSOs) and Distribution System Operators (DSOs), considering the market positions of the involved partners. Enel X, a subsidiary of Enel SpA, is dedicated to non-commodity activities, including energy efficiency, demand response, smart cities, smart homes, and electric mobility, and is already present on five continents and in more than 20 countries. Enel SpA operates in 32 countries across five continents, with a net installed energy capacity of nearly 84 GW, and it sells gas and distributes electricity across a network spanning approximately 2.2 million km. With around 73 million end-users worldwide, Enel SpA boasts the largest customer base among European competitors and is one of Europe's leading energy companies in terms of installed capacity and reported EBITDA.

3.2 The Triple Layer Business Model Canvas

The business model canvas of InterSTORE would be developed as the Triple-Layered Business Model Canvas (TLBMC) [1] with economic, social, and environmental layers is a strate- gic framework that would help design and assess the business models while emphasizing sustainability and corporate responsibility. This model has been chosen with the consideration of not only economic viability but also InterSTORE's impact on society and the environment. The following factors are intended to be integrated into the business model canvas.

3.2.1 Economic Layer

The Economic Layer of the TLBMC focuses on the financial aspects of the InterSTORE business model. It aims to ensure economic sustainability and profitability through following key components.

- Revenue Streams: Identifying how the InterSTORE would generate income. This could include subscription fees, licensing, or other sources of revenue.
- Cost Structure: Analyzing the costs associated with running InterSTORE. This encompasses IP costs, operational expenses, marketing expenditures, and any other relevant costs.
- Profitability: Assessing the overall financial health of the business model. Profitability metrics, such as gross margin, net profit margin, and return on investment (ROI), would be assessed in detail.
- Investment and Financing: Considering how InterSTORE secures capital. This includes sources of financing, such as equity investments, loans, or grants.
- Economic Value Creation: Determining how would InterSTORE create economic value not only for itself but also for its stakeholders, including shareholders, employees, and customers, with a motive of fair distribution of value and data resources.

3.2.2 Social Layer

The Social Layer of the TLBMC addresses the impact of InterSTORE on society and its stakeholders. Ethical and social responsibility would be emphasised in InterSTORE operations by integrating the following key components.

- Stakeholder Engagement: Identifying and engage with various stakeholders, including potential users, partners, advisory board, energy producers, communities, and

regula- tory bodies. Understanding their needs, concerns, and expectations would be prioritized as an essential activity.

- Corporate Social Responsibility (CSR): Defining InterSTORE's commitment to re- sponsible business practices. This includes environmental sustainability, fair data prac- tices, community involvement, and ethical governance. A strong CSR strategy would align the project with societal values.
- Social Impact: Assessing the positive or negative social impacts of InterSTORE. Con- sidering how the project contributes to social well-being, diversity and inclusion efforts, and the resolution of societal challenges. Social impact would be a driving force for positive change in the project.
- Diversity and Inclusion: Promoting diversity and inclusion within the project. Diverse partnerships, already integrated in InterSTORE consortium, foster innovation and cre- ativity while contributing to a more equitable society.

3.2.3 Environmental Layer

The Environmental Layer of the TLBMC would focus on the environmental sustainability of the business model. It would address the impact of the business on the environment and strategies to minimize that impact by integrating the following components.

- Environmental Footprint: Evaluating InterSTORE's resource consumption, energy us- age, waste generation, and carbon emissions, with an aim to reduce environmental harm through efficient resource management and responsible energy practices.
- Sustainable Sourcing: Considering sustainable sourcing of materials and resources. This includes using renewable energy, reducing waste, minimizing pollution, and select- ing suppliers committed to environmental responsibility.
- Environmental Compliance: Ensuring compliance with environmental regulations and standards and adopting environmentally friendly practices that benefit the environment and reduce legal and reputational risks.
- Circular Economy Practices: Embracing the principles of a circular economy by de- signing products for longevity, repairability, and recyclability. Minimizing waste and pro- moting the reuse of materials and resources.
- Environmental Innovation: Seeking innovative solutions that reduce the environmental impact of InterSTORE. This could involve adopting clean technologies, implementing green supply chain practices, and exploring sustainable marketing options.

3.2.4 Implementation Plan for Developing the TLBMC

Input from all project partners as well as other stakeholders would be necessary to develop the triple layer business model canvas for the project. Following steps would be undertaken in this context.

1. **Stakeholder Analysis** As the first step towards developing the business model can- vas, a comprehensive stakeholder analysis would be undertaken to strategically iden- tify, evaluate, and understand the interests, expectations, and influence of individuals or groups who can affect or be affected by the project. This would help in categorizing stakeholders into groups for ease of input assimilation and help in making informed de- cisions, managing relationships, and achieving mutual goals. For this purpose, under WP4, the first categorization categories have already been defined for project partners, as illustrated by the following illustration.

Table 2: InterSTORE Partner Categorization

Category	Definition	Partners

Distribution System Operators (DSOs)	Categorized as operators managing the low-voltage distribution networks, delivering electricity from the transmission grid to end-users.	CYG-HES-FZJ
Electric Vehicle (EV) Charging Infrastructure Providers	Categorized as companies involved in building and operating charging stations for electric vehicles, facilitating the adoption of electric mobility	ENX-CAP
Energy Storage Operators/ Brokers	Categorized as companies engaged in the development and operation of energy storage systems to store excess energy and manage supply-demand imbalances.	ENX-CAP-EATON-HES
Energy Aggregators/Brokers	Categorized as companies that combine and coordinate multiple small-scale energy resources to provide grid services and balance energy supply and demand.	CYG-INESC-RWTH ACS

2. Ascertaining Economic Viability Ascertaining the economic viability of InterSTORE would involve a comprehensive evaluation of its financial prospects and sustainability. This assessment would include analyzing revenue potential, cost structures, and profitability projections. Key factors considered would be user acceptance, market demand, pricing strategies, competitive landscape, and growth potential. Financial statements, cash flow forecasts, and return on investment (ROI) calculations provide insights into the business's ability to generate profits and manage expenses. Additionally, assessing economic risks and conducting sensitivity analyses helps in determining the resilience of the business model in various scenarios. A robust economic viability assessment is crucial for informed decision-making and long-term success.
3. Defining Common Goals At the very start common goals and partners activities that already align with all three layers will be identified.
4. Cross-Layer Metrics Key performance indicators (KPIs) and metrics that span all three layers would be developed in consultation with project partners. These metrics should allow the consortium to measure the impact of InterSTORE on economic, social, and environmental aspects simultaneously.
5. Value Synergies Opportunities for value synergies between the layers would be identified from the operations of all partners involved in the core activities related to developing the open-source tools.
6. Trade-off Analysis It is possible that there may be trade-offs between the layers. Some initiatives that benefit one layer might have costs or trade-offs in another. A thorough analysis would be performed to understand these trade-offs and make informed decisions.
7. Life Cycle Analysis: An LCA will be performed to assess InterSTORE's environmental impacts. This would encompass resource use, emissions, and energy consumption. LCA would aids in sustainability efforts by identifying opportunities for improvement and guiding environmentally responsible decision-making and would provide key input for the environmental layer of the TLBMC.
8. Social Life Cycle Analysis: An SLCA will also be performed to assess the social im- pacts of InterSTORE. It would evaluate aspects like user data policies, human rights, and community well-being. SLCA would help identify and address social issues, fostering ethical and responsible practices while enhancing reputation and stakeholder relationships. This would also provide the key input for the social layer of the TLBMC.

9. Integrated Strategy Development: Developing an integrated business strategy that accounts for all three layers. Ensure that this strategy is communicated throughout the organization, from the leadership team to employees at all levels. Everyone should understand how their roles contribute to achieving the integrated goals.
10. Supply Chain and Operations: It will be evaluated whether the supply chain and operational processes of InterSTORE align with the triple-layered goals. This includes sourcing materials responsibly, minimizing waste, optimizing energy use and collaborating with suppliers who share the projects commitment to sustainability.
11. Developing Reporting and Transparency Frameworks: Maintaining transparency by regularly reporting progress in each layer would be a crucial aspect of the project. Protocols for reporting in this context would also be defined under the TLBMC.
12. Risk Assessment: Dedicated SWOT and PEST analysis will be conducted and up- dated regularly to conduct risk assessments that consider economic, social, and environmental risks. Vulnerabilities will be addressed in each layer to ensure that the business model remains resilient in the face of external challenges. More information about SWOT and PESTLE has been presented in the following sub chapters.
13. Feedback Loops: Feedback loops would be established between partners that al- low adaptation and refinement of the integrated TLBMC approach as circumstances change. Strategies and metrics would be regularly reviewed to ensure they remain relevant and effective.

3.3 SWOT Analysis

SWOT analysis [2] is a strategic planning tool that would be used by InterSTORE to identify and assess the internal Strengths and Weaknesses, as well as external Opportunities and Threats in the business environment. This analysis would help InterSTORE make informed decisions, develop strategies, and prioritize actions to achieve the defined goals effectively.

Figure 1: SWOT Analysis

1. **Strengths (S)**: Strengths are the internal attributes and resources that would give InterSTORE a competitive advantage. These are characteristics or capabilities that the organization excels in and can leverage to achieve its objectives. Strengths for InterSTORE may include:
   - Unique technological offerings
   - Strong advisory board and partner capabilities
   - Strong industry integration
   - Patented technology or intellectual property
   - Efficient internal processes
   - Market leadership position
   - High-quality services

2. **Weaknesses (W):** Weaknesses are internal factors that could hinder an InterSTORE's ability to achieve its objectives or compete effectively. These areas represent limitations or deficiencies that need to be addressed to improve overall performance. Some weaknesses already identified for InterSTORE include:
   - Lack of technological infrastructure
   - Limited project duration
   - Limited financial resources
   - Inadequate marketing and branding
   - Cybersecurity threats
   - Non-adherence to country-specific data regulations

3. **Opportunities (O):** Opportunities are external factors or situations that InterSTORE can exploit to its advantage. These arise from changes in the business environment, emerging trends, or market dynamics. Opportunities for InterSTORE may include:
   - Expanding into new markets or regions
   - Growing demand for energy storage flexibility
   - Partnerships and collaboration prospects
   - Technological advancements
   - Changing customer preferences or demographics
   - Market gaps or underserved niches

4. **Threats (T):** Threats are external factors or challenges that pose risks to InterSTORE's success or profitability. These can be emerging trends, competitive pressures, regulatory changes, or economic uncertainties. Threats for InterSTORE may encompass:
   - Economic downturns impacting energy industry
   - Regulatory changes affecting energy production and energy storage
   - Rapid technological obsolescence
   - Supply chain disruptions
   - Negative publicity or reputational damage

3.3.1 Implementation Plan for SWOT Analysis

To conduct a SWOT analysis, the following steps are planned in the project:

1. Internal Assessment: Evaluating InterSTORE's strengths and weaknesses by examining its resources, processes, and capabilities. This would involves gathering input from various partners within the project.
2. External Assessment: Identifying external opportunities and threats by monitoring market trends, industry developments, and changes in the competitive landscape. This would be assessed through market research and competitor analysis.
3. SWOT Matrix: Creating a visual representation, in the form of a 2x2 matrix, to to plot strengths, weaknesses, opportunities, and threats. This matrix would help prioritize strategic actions in the project.
4. Strategy Formulation: Developing strategies that leverage strengths to exploit opportunities, address weaknesses to seize opportunities, mitigate weaknesses to counter threats, and utilize strengths to defend against threats.
5. Implementation and Monitoring: Putting the strategies into action, allocating resources, and tracking progress. Regularly revisiting the SWOT analysis to adapt strategies in the project as circumstances evolve.

In conclusion, SWOT analysis would act as a versatile tool towards gaining a holistic view of InterSTORE's internal and external factors. A systematic assessment of these factors would enable informed decisions, optimized strategic planning, and improved ability to respond to

changing market dynamics, ultimately enhancing InterSTORE's competitive position and long-term success.

3.4 PEST Analysis

PEST analysis is a strategic tool used by organizations to assess and understand the external macro-environmental factors that can impact their business operations [3]. It stands for Political, Economic, Social, Technological, Legal, and Environmental factors. The aim of analysing PESTLE variable for InterSTORE is to enable informed decisions, develop strategies, and adapt to changing circumstances effectively. In this respect, the following key factors would be analysed.

1. **Political Factors**

Political factors would encompass the impact of government policies, regulations, and stability on a InterSTORE. These factors can include taxation policies, trade tariffs, government stability, political ideologies, and more. Political changes can significantly affect the energy industry, which would invariably affect InterSTORE. Hence, recognising po- litical risks and opportunities is crucial.

2. **Economic Factors**

Economic factors would focus on the economic conditions in the EU. Elements like in- flation rates, exchange rates, interest rates, and overall economic growth play a crucial role. These factors can impact consumer spending, investment, and overall demand for energy as well as energy storage services. As partners from several EU countries are involved in InterSTORE, analysing economic factors would also enable genralization of the business model in several countries accross EU. Economic indicators also need to be monitored to make informed decisions regarding pricing.

3. **Social Factors**

Social factors pertain to demographic trends, cultural norms, attitudes, and lifestyle changes within society. These factors can significantly affect consumer preferences, buying behaviors, and market demand. For example, changing consumer attitudes to- wards sustainability and greener sources of energy could influence servce design and marketing strategies for InterSTORE.

4. **Technological Factors**

Technological factors relate to advancements in technology and their influence on industries and markets. Rapid technological innovation can disrupt traditional business models and create new opportunities. Interstore must keep pace with technological de- velopments to remain competitive. The need for storage flexibility emphasizes the need for digital strategies and cybersecurity for InterSTORE.

3.4.1 Implementation Plan for PEST Analysis

To conduct a PEST analysis, the following steps will be undertaken:

1. **Data Collection:** Gathering data on each of the six factors. This would involve exten- sive research and monitoring of relevant news, reports, and expert opinions on energy storage and related topics.
2. **Analysis:** Evaluating the collected data to understand the potential impact of each factor on InterSTORE. Identify opportunities and threats associated with each factor.
3. **Integration:** Integrating the findings into the InterSTORE's strategic planning pro- cess. Consider how to leverage opportunities and mitigate threats posed by external factors.

4. **Action Planning:** Developing strategies and action plans based on the analysis, in alignment with the InterSTORE's goals and mission.
5. **Continuous Monitoring:** Regularly reviewing and updating the PESTLE analysis as the business environment evolves. New political, economic, social, technological, legal, and environmental factors may emerge, necessitating adjustments to strategies.

In conclusion, PEST analysis would enable InterSTORE to navigate the complexities of the external business environment by proactively responding to challenges and lever- aging opportunities, ultimately enhancing long-term sustainability and competitiveness in the market.

3.5 Marketing and Dissemination Plan

Within the framework of the InterSTORE project, Communication and Dissemination activities assume a pivotal role, seeking to advance the disclosure of the project's outcomes to a diverse audience. The primary objective is to broaden outreach, facilitate technology transfer, and expedite the integration of the project's results and findings. This strategic focus on Communication and Dissemination is instrumental in providing visibility to the accomplished objectives, thereby generating a more extensive scientific and socio-economic impact.

Initial Communication and Dissemination Plan was designed in the 6th month of the project to ensure the effective setup of project's communication guidelines and performance indicators. These components are essential for implementing and assessing future actions throughout the InterSTORE duration and beyond its conclusion. The Plan delineates the strategic approach aimed at significantly enhancing the project's visibility and impact, primarily by facilitating the transfer of knowledge and technology. In formulating the strategy for InterSTORE, particular emphasis is placed on identifying target groups, as this forms a crucial foundation for selecting the most effective means to engage them.

Wide variety of project-assumed technologic and socio-economic benefits will influence the value chain for both emerging and established market players. In this collaborative effort, the complete value chain, inclusive of private and commercial prosumers, TSO, DSO, BRP, ESCO, energy traders, standardization bodies, and business and academic research entities, participate actively. They contribute to and reap the advantages of the flexibility service, as well as endorse the adoption of a common communication standard.

The chosen tools for disseminating the message of InterSTORE to its eight specified target groups are meticulously outlined. These tools include a sophisticated visual identity, designed to impart distinctiveness and recognizability to the project. Additionally, the establishment of a comprehensive website is highlighted, ensuring accessibility to a broad audience and providing real-time updates on the project's progress, forthcoming events, and publications from anywhere in the world.

In the light of the imminent second year of the project, marked by the anticipation of substantial results, a strategic emphasis will be placed on robust participation in key events. This approach serves the dual purpose of elevating awareness about the project and establishing a robust business network conducive to fostering new collaborative ventures. A cooperation is anticipated with cluster projects, FlexCHESS and PARMENIDERS, aimed at synergizing collective endeavors to effectively reach the identified target groups.

Table 6. List of events in 2024

Conference	Date	Place
Solar Finance & Investment Europe	31/01- 01/02/2024	London, UK
E-world Essen 2024	20/02/2024	Essen, Germany
9th Energy Storage Summit UK 2024	20-21/02/2024	London, UK
World Sustainable Energy Days	05-08/03/2024	Wels, Austria
Solar Power Summit 2024	13-14/03/2024	Brussels, Belgium
Wind Europe annual event	20-22/03/2024	Bilbao, Spain
Large Scale Solar EU	26-27/03/2024	Lisbon, Portugal
Energy Tech Summit 2024	10-11/04/2024	Bilbao, Spain
26th World Energy Congress	22-25/04/2024	Rotterdam, Netherlands
Advanced Automotive Battery Conference AABC Europe	13-16/05/2024	Strasbourg, France
All-Energy Conference 2024	15-16/05/2024	Glasgow, UK
Lisbon Energy Summit and Exhibition	27-29/05/2024	Lisbon, Portugal
CIRED 2024	19-20/06/2024	Vienna, Austria
Electrical Energy Storage Conference ESS	19-21/06/2024	Munich, Germany
Global Summit on Renewable Energy -GSREN 2024	16-18/09/2024	Venice, Italy
Energy Storage Global Conference (ESGC)	15-17/10/2024	Brussels, Belgium
Enlit Europe	TBD	TBD
Battery Innovation Days	TBD	TBD

To effectively monitor and assess the widespread dissemination efforts, a set of Key Performance Indicators (KPIs) has been instituted, along with a structured monitoring mechanism. The Communication and Dissemination Plan, along with its associated activities, will undergo regular bi-annual updates and evaluations. The website's performance will be scrutinized using Google Analytics, and the various social media channels will be assessed through their respective platform algorithms, facilitating direct tracking of performance on each platform.

4 Knowledge, Data and IPR Management

4.1 Intellectual Property Rights

In the ever-evolving landscape of innovation and creativity, protecting the fruits of intellectual labor is paramount. Intellectual Property Rights (IPR) form the legal framework designed to safeguard the rights of individuals and entities over their intellectual creations. These creations encompass a broad spectrum, ranging from inventions and artistic works to symbols and brand identities used in commerce.

What is Intellectual Property?

Intellectual property refers to intangible creations of the mind, encompassing a diverse array of human intellectual and creative endeavors. This includes inventions, literary and artistic works, designs, symbols, names, and images. Intellectual property is categorized into several types, each with its unique characteristics and legal protections.

Types of Intellectual Property Rights:

- **Patents:** Grant exclusive rights to inventors for their inventions, providing control over the use, manufacture, and sale of the patented product or process.
- **Copyright:** Protects original works of authorship, such as books, music, and artwork, granting creators exclusive rights to reproduce, distribute, and display their creations.
- **Trademarks:** Safeguard symbols, names, and slogans used to identify and distinguish goods or services, preventing confusion among consumers.
- **Trade Secrets:** Guard confidential business information, such as processes, formulas, and customer lists, providing a competitive advantage.
- **Industrial Designs:** Protects the visual design of objects that are not purely utilitarian, such as the shape or ornamentation of a product.
- **Digital Assets:** Digital assets are gaining growing recognition as intellectual property (IP). This encompasses exclusive software code or algorithms, as well as digital content distributed online.

Importance of IPR:

IPR plays a pivotal role in fostering innovation, encouraging creativity, and supporting economic development. By granting exclusive rights to creators and inventors, IPR incentivizes investment in research and development, contributing to advancements in technology, science, and culture.

Challenges and Balancing Acts:

While IPR encourages innovation, there is an ongoing debate about striking the right balance between protection and the free exchange of ideas. Striking this balance is crucial for promoting fair competition, ensuring access to knowledge, and addressing ethical considerations.

In an interconnected global landscape, international agreements like the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) set standards for IPR protection, facilitating cooperation and harmonization on a global scale.

In summary, Intellectual Property Rights are the bedrock of protecting and nurturing human ingenuity. They provide the incentives and protections necessary to foster a vibrant ecosystem of creativity and innovation, contributing to the progress of societies worldwide.

IPR in European projects:

In all research projects, the management of intellectual property rights holds a significant role. The European IP Helpdesk has issued a 'guide to IP in Horizon Europe' with the aim of providing participants with fundamental information on central IP aspects that may arise in these projects. Similarly, the Commission has published a Recommendation emphasizing that IP-related issues should be addressed at the management level and ideally resolved before the start of the research project. These issues include the allocation of ownership of intellectual property generated within the project (referred to as 'Foreground'), identification of pre-existing intellectual property owned by the parties ('background') necessary for project execution or exploitation, access rights to foreground and background for these purposes, and revenue sharing.

It's worth noting that the IP rules of Horizon Europe (and previous Horizon 2020) build upon the established regulations of the previous FP7 rules. However, there are some changes, particularly in terminology, with an impact on the implementation and IP management of projects in Horizon Europe. For instance, while results generated within the project were formerly called 'Foreground,' the term 'Results' is used from Horizon 2020.

To better understand what the management of intellectual property includes, the initial step is to define 'intellectual property' (IP). According to the Guidance for the implementation of the Code of practice incorporated in the Commission's Recommendation, "Intellectual property is to be taken in the broadest sense, as encompassing any kind of new knowledge resulting from R&D activities (including inventions, software, databases, etc.), whether or not it is protected by formal IP rights such as patents".

The glossary of the European IP Helpdesk defines intellectual property rights as any private legal rights protecting creations of the human mind, including inventions, literary and artistic works, and symbols, names, images, and designs used in commerce. These rights are commonly categorized into Industrial Property Rights (e.g., patents, trademarks, industrial designs, geographical indications) and Copyright and Related Rights (e.g., rights of authors/creators, performing artists, producers of phonograms, and broadcasters).

4.1.1 Existing intellectual property

In Horizon Europe, all beneficiaries are required to specify pre-existing intellectual property (IP), know-how, knowledge, or any additional data deemed *"necessary for carrying out the project"* (referred to as "background"). As per Article 16.1 of the Grant Agreement (GA n.101096511 — INTERSTORE), 'Background' means any data, know-how or information — whatever its form or nature (tangible or intangible), including any rights such as intellectual property rights — that is:

(a) held by the beneficiaries before they acceded to the Agreement and

(b) needed to implement the action or exploit the results.

If background is subject to rights of a third party, the beneficiary concerned must ensure that it is able to comply with its obligations under the Agreement.

Specifically, background is defined as *"the information and knowledge held by participants before their accession to the Grant Agreement, as well as any intellectual property rights required for carrying out the project or using the Foreground. For intellectual property rights requiring application filing, only those for which the application was filed before the participant's accession to the Grant Agreement are included."*

Furthermore, it's important to note that a project partner's Background is not confined solely to the information it owns; it also extends to any information or intellectual property rights held, for example, through licensing agreements or material transfer agreements (MTAs).

Ownership

Ownership of intellectual property (IP) rights, as defined in the EU glossary, refers to the status or quality of being the owner of a proprietary right. This ownership empowers the holder to exercise exclusive usage rights concerning the subject matter of the IP and to limit others from utilizing these IP rights.

Participation in a Horizon Europe research project does not impact the ownership of Background. In simpler terms, each project partner retains all intellectual property rights over the background it possesses. The previous guide for European projects correctly highlights the significance of intellectual property rights (IPRs) requiring application filing, such as patents. The guide specifies that the definition of background encompasses only those IPRs for which an application was filed before entering into the Grant Agreement (i.e., before initiating the project). To elaborate, if an invention was conceived before the project's initiation but a patent application was filed after the project began, this application (and any resulting patent) would not be classified as background. To avoid this scenario, particularly when negotiations suggest the possibility, participants may choose to explicitly include such later-filed IPRs in the definition of background.

Access rights

The EU glossary defines access rights for Horizon Europe purposes as rights to utilize the results or background of the project.

As outlined in Article 16 (par. *Access rights for exploiting the results*) of the Grant Agreement, "*The beneficiaries must grant each other access — under fair and reasonable conditions — to background needed for exploiting their results, unless the beneficiary that holds the background has — before acceding to the Agreement — informed the other beneficiaries that access to its background is subject to restrictions.*"

According to Article 16 'fair and reasonable conditions' entail appropriate conditions, including potential financial terms or royalty-free conditions. These conditions consider the specific circumstances of the access request, such as the actual or potential value of the results or background requested and/or the scope, duration, or other characteristics of the envisaged exploitation. Participants may choose a combination of conditions, such as royalty-free for research purposes and fair and reasonable conditions for other uses, as is often the case.

Unless agreed otherwise, access rights do not include the right to sub-license. Access rights may be requested until the end of the project, and requests for access may be made, unless agreed otherwise, up to one year after the period specified in the Grant Agreement, which is 36 months from January 1, 2023.

The INTERSTORE consortium partners have detailed the Background for the Project, along with specific access rights in the Consortium Agreement. This includes potential legal

restrictions or limits. Any project partner may supplement additional Background to during the Project by providing written notice to the other Parties. The Consortium Agreement emphasizes in that access rights are granted on a non-exclusive basis.

4.1.2 Intellectual Property Developed in The Project

As previously noted, the terminology shift in Horizon Europe projects replaces the term *"Foreground" with "Results." Results are now defined as, "...any tangible or intangible effect of the action, such as data, know-how or information, whatever its form or nature, whether or not it can be protected, as well as any rights attached to it, including intellectual property rights."*

The earlier definition characterized foreground rights as, *"The results, encompassing information, materials, and knowledge generated in the project, whether or not they can be protected. It covers intellectual property rights (IPRs), such as those resulting from copyright protection, related rights, design rights, patent rights, plant variety rights, rights of creators of topographies of semiconductor products, similar forms of protections (e.g., sui generis right for databases), and unprotected know-how (e.g., confidential material). Foreground includes tangible (e.g., prototypes, micro-organisms, source code, and processed earth observation images) and intangible (IP) results of a project. Results generated outside a project (i.e., before, after, or in parallel with a project) do not constitute Foreground."*

In the European IP Helpdesk guide, results are succinctly defined as, *"All project outcomes that may be utilized by the project partners or other relevant stakeholders outside the project. They have the potential to be either commercially exploited (e.g., concrete products or services) or lay the foundation for further research, work, or innovations (e.g., novel knowledge, insights, technologies, methods, data)."*

According to Article 16 (par. Ownership of results) of the Grant Agreement, *"Results are owned by the beneficiaries that generate them.". Concerning joint ownership, the GA specifies that "two or more beneficiaries own results jointly if*

a) they have jointly generated them and,

b) it is not possible to:

> *i) establish the respective contribution of each beneficiary, or*
>
> *ii) separate them for the purpose of applying for, obtaining or maintaining their protection."*

To demonstrate ownership (along with the date of generation) of Foreground, it is strongly recommended that all project partners maintain documentation illustrating the development of knowledge or results, adhering to proper standards.

To minimize the likelihood of third parties, especially employees and other personnel, making claims on IP rights to Foreground, participants are advised to reach an agreement with them in advance. Such agreements may involve a formal transfer of ownership or, at the very least, the granting of appropriate access rights (including the right to sublicense).

This recommendation is particularly pertinent for academic institutions, especially concerning (a) "non-employees" such as students (both undergraduate and postgraduate, e.g., PhD students), and (b) researchers in countries with a specific "professor's privilege"

regime, where researchers may have some personal rights to the results of university research.

4.1.3 Access rights

Access rights to results are governed by the provisions outlined in Articles 16 of the Grant Agreement. The regulations which pertain to access rights to background, are also applicable to Foreground and Results. Consequently, access rights imply the rights to utilize results in accordance with the terms and conditions stipulated in the Grant Agreement.

It is essential to highlight that access to another participant's Foreground and Results will only be granted if the requesting participant requires such access for the execution of the project or the utilization of its own results. The determination of whether access rights are necessary should be made on a case-by-case basis and always in good faith.

Specific terms regarding the partners' access rights to software are detailed in the Consortium Agreement, as specified in Article 16 of the GA.

Protecting Results

In accordance with Article 16 of the Grant Agreement (par. Protection of results), *"Beneficiaries which have received funding under the grant must adequately protect their results — for an appropriate period and with appropriate territorial coverage — if protection is possible and justified, taking into account all relevant considerations, including the prospects for commercial exploitation, the legitimate interests of the other beneficiaries and any other legitimate interests."*

Exploitation of Results

Exploitation, as defined in the EU IP Glossary, involves "The utilization of results in further research activities other than those covered by the action concerned, or in developing, creating and marketing a product or process, or in creating and providing a service, or in standardisation activities."

4.1.4 Publications and Open access

As defined in the EU IP glossary, dissemination is described as *"The public disclosure of the results by appropriate means, other than resulting from protecting or exploiting the results, including by scientific publications in any medium."*

In accordance with Article 17 (par. Dissemination) of the Grant Agreement, *"The beneficiaries must disseminate their results as soon as feasible, in a publicly available format, subject to any restrictions due to the protection of intellectual property, security rules or legitimate interests.*

A beneficiary that intends to disseminate its results must give at least 15 days advance notice to the other beneficiaries (unless agreed otherwise), together with sufficient information on the results it will disseminate.

Any other beneficiary may object within (unless agreed otherwise) 15 days of receiving notification, if it can show that its legitimate interests in relation to the results or background would be significantly harmed. In such cases, the results may not be disseminated unless appropriate steps are taken to safeguard those interests."

Result Transfer

Each partner has the option to utilize its results through either (a) a transfer or (b) a license. The transfer process is governed by Article 16 (par. Transfer of ownership) of the GA, stating: "The beneficiaries may transfer ownership of their results, provided this does not affect compliance with their obligations under the Agreement.

The beneficiaries must ensure that their obligations under the Agreement regarding their results are passed on to the new owner and that this new owner has the obligation to pass them on in any subsequent transfer.

Moreover, they must inform the other beneficiaries with access rights of the transfer at least 45 days in advance (or less if agreed in writing), unless agreed otherwise in writing for specifically identified third parties including affiliated entities or unless impossible under the applicable law. This notification must include sufficient information on the new owner to enable the beneficiaries concerned to assess the effects on their access rights. The beneficiaries may object within 30 days of receiving notification (or less if agreed in writing), if they can show that the transfer would adversely affect their access rights. In this case, the transfer may not take place until agreement has been reached between the beneficiaries concerned."

Licensing

Licensing is governed by Article 16 (par. Granting licences) of the GA: "*The beneficiaries may grant licenses to their results (or otherwise give the right to exploit them), including on an exclusive basis, provided this does not affect compliance with their obligations. Exclusive licenses for results may be granted only if all the other beneficiaries concerned have waived their access rights."*

4.1.5 Confidentiality

Article 13 of the GA outlines the responsibility of beneficiaries to maintain confidentiality throughout the implementation of the action. Specifically, par. 13.1 (Sensitive information) reports: "The parties must keep confidential any data, documents or other material (in any form) that is identified as sensitive in writing ('sensitive information') — during the implementation of the action and for at least until the time-limit set out in the Data Sheet.

The beneficiaries may disclose sensitive information to their personnel or other participants involved in the action only if they:

(a) need to know it in order to implement the Agreement and

(b) are bound by an obligation of confidentiality.

Furthermore, the same article mentions that the confidentiality obligations no longer apply if:

(a) the disclosing party agrees to release the other party

(b) the information becomes publicly available, without breaching any confidentiality obligation

(c) the disclosure of the sensitive information is required by EU, international or national law."

4.2 Open-Source Licensing

Open-source software has become a driving force in the world of technology, fostering collaboration, innovation, and community-driven development. At the heart of the open-source movement are licenses that define the terms under which software can be freely used, modified, and shared. These licenses empower developers to contribute to and benefit from a global pool of shared knowledge, creating a dynamic ecosystem of free and open software.

What is an Open-Source License?

An open-source license is a legal instrument that grants permission for the use, modification, and distribution of a piece of software. It is the foundation upon which the principles of openness, transparency, and collaboration in the software community are built. Open-source licenses come in various forms, each with its own set of rules and conditions that dictate how the software can be utilized and shared.

Key Characteristics of Open-Source Licenses:

- Freedom to Use: Open-source licenses grant users the freedom to use the software for any purpose without any financial or usage restrictions.
- Freedom to Modify: Users can modify the source code of the software, adapting it to their specific needs and contributing improvements back to the community.
- Freedom to Share: Open-source licenses encourage the sharing of software, allowing users to distribute both the original and modified versions.
- Source Code Availability: Most open-source licenses require the distribution of the source code, ensuring transparency and enabling others to understand, learn from, and build upon the software.

In the face of the extensive array of licenses currently accessible [8], the majority of open-source projects continue to opt for distributing their code under the widely adopted GNU or MIT licenses. This decision facilitates users in swiftly discerning the permissible actions and restrictions associated with the software. Specifically, the licenses that enjoy the highest usage are:

- **GNU General Public License (GPL) [9]:**
  This license, issued by the Free Software Foundation, permits individuals to examine, modify, and distribute (including selling) the source code, provided that the recipient upholds the same privileges. Among the licenses outlined in this document, this is considered less favorable in the industry. Specifically, it prohibits proprietary applications from either directly incorporating existing GPL source code or being linked to a GPL library. Violation of this results in the license affecting the proprietary code, compelling the release of its source code—a scenario typically undesired by industrial enterprises.
  According to a recent survey, this license currently holds the second position in terms of usage.
- **GNU Lesser General Public License (LGPL) [10]:**
  In line with the widely adopted GPL, this license permits the connection of proprietary code to an LGPL library, provided the recipient has the option to re-establish this link with a newer or altered version of the library. Unlike GPL, however, the proprietary code linked in this manner does not adopt the open-source license.
  While more lenient than the conventional GPL, this license is deemed unsuitable in certain industrial settings (such as biomedical or automotive), where it is crucial to restrict the recipient from accessing or altering the software executed by the system.

- **GNU General Public License linking exception (GPL-LE) [11]:**
  Referred to as ClassPath, this license, named after the inaugural project employing it, introduces a modification to the standard GPL. This alteration permits the linking of a proprietary object to a GPL-LE library. Importantly, it does not enforce the constraints associated with the LGPL, such as the requirement for the possibility of re-linking. Consequently, this license stands out as the most permissive and industry-friendly among the GPL licenses outlined in this document.
- **MIT License [12]:**
  These licenses, crafted by the Massachusetts Institute of Technology (MIT), form a series designed to place minimal constraints on software redistribution. The license itself is concise and straightforward. In contrast to GPL licenses, this license family permits the incorporation of source code into a proprietary application with the simple requirement of acknowledging the original code author. As per a recent survey, this license currently holds the top spot in terms of usage.
- **BSD Licenses (Berkeley Software Distribution) [13]:**
  BSD comprises a set of licenses originating from Berkeley University. The restrictions closely mirror those found in the MIT license. The initial "4-clause" BSD license featured a contentious "advertising clause," requiring acknowledgment of the original author in all advertising materials. In favor of simplicity, this clause has been omitted in favor of the more straightforward "3-clause" or "2-clause" versions.
- **Apache License [14]:**
  The Apache license, presently in its 2.0 version, is a licensing framework established by the Apache Software Foundation (ASF). It shares similarities with the MIT license but introduces additional constraints regarding the recognition of original authors and the utilization of the project name. Within the open-source community, this license stands out for its explicit handling of software patents.

The choice of license depends on the goals of the project, the community, and the desired balance between openness and control over the code. It's important for developers to understand the terms of each license and choose the one that aligns with their project's goals and values.

Understanding the nuances of each license is crucial when choosing one for a project. Developers should consider the implications of the license on collaboration, distribution, and the overall philosophy of the project.

The most popular software license on GitHub is the MIT License. It is a very permissive license that allows users to do almost anything they want with your code, including using it in commercial products.

Other popular licenses on GitHub include:

- Apache License 2.0
- GNU General Public License (GPL) v3
- Mozilla Public License 2.0
- BSD 3-Clause License

The following figure shows the characteristics of the most used open-source licenses [15]:

	APACHE	BSD	MIT	GPL Free as in Freedom	LGPL Free as in Freedom	AGPL Free as in Freedom
Type	**Permissive**	**Permissive**	**Permissive**	**Copyleft**	**Copyleft**	**Copyleft**
Provides copyright protection	✓ TRUE	✓ TRUE	✓ TRUE	✓ TRUE	✓ TRUE	✓ TRUE
Can be used in commercial applications	✓ TRUE	✓ TRUE	✓ TRUE	✓ TRUE	✓ TRUE	✓ TRUE
Provides an explicit patent license	✓ TRUE	✗ FALSE	✗ FALSE	✗ FALSE	✗ FALSE	✗ FALSE
Can be used in proprietary (closed source) projects	✓ TRUE	✓ TRUE	✓ TRUE	✗ FALSE	✗ FALSE partially	✗ FALSE for web
Popular open-source and free projects	Kubernetes Swift Firebase	Django React Flutter	Angular.js JQuery, .NET Core Laravel	Joomla Notepad++ MySQL	Qt SharpDevelop	SugarCRM Launchpad

Figure 2: Characteristics of the most used open-source licenses

5 Standardization

5.1 Standardization in connection with exploitation

In general, standardization makes new trends visible, knowledge is disseminated worldwide, economic growth is stimulated by higher productivity and improved quality, and bundled knowledge in form of printed and digital documents is accessible to everyone worldwide for application.

The following chapters show the connection of InterSTORE to Technical Committees (TC), Subcommittees (SC) and Working Groups (WG) of IEC/CENELEC and how updates of their standardization work are disseminated. Furthermore, the incorporation of results into existing or future standards is described.

5.2 Matrix: InterSTORE WPs and IEC/CENELEC Technical Committees

Due to the vast amount of technical expert groups at IEC and CENELEC a structured approach was chosen to show InterSTORE work package requirements and existing expert groups in a matrix. [4] [5]

Table 6: Layout of matrix IEC and CENELEC TC/SC/WG with InterSTORE WP (extract)

Matrix IEC and CENELEC TC/SC/WG with InterSTORE WP 1 = awareness 2 = follow 3 = contribution			WP	InterSTORE WP1	InterSTORE WP2	InterSTORE WP3	InterSTORE WP4	InterSTORE WP5	InterSTORE WP6
			Title	Requirements, Use Cases, Specifications	Open-Source Inter-operability Toolkit	Dimensioning, Testing and Integration	Multiservice and Flexibility Monetization	Pilots Demonstration	Communication, Dissemination and Exploitation
			Key-words (WP)	- identify user acceptance - hybrid storage use cases - specify tools + software	- develop tool kit + interoperable client/server for DES + legacy systems protocol converter	- methodology for HESS - integrate software + tools - validation in lab	- new EMS to provide HESS - energy data space technology enabler - user acceptance	- testing procedure - integrate software + products in ICT infrastructure - collect test data	- promotion + transfer to stakeholders - collaboration with similar projects - IPR
Technical Committee (TC) Subcommittee (SC) Working Group (WG)	Title of TC/SC/WG	Keywords (TC/SC/WG)							
IEC/TC 120	Electrical Energy Storage (EES) systems	EES		2	3	2	1	3	1
WG 1	Terminology	terms, definitions		2	3	2	1	3	1
WG 2	Unit parameters and testing methods	testing		2	3	2	1	3	1
WG 3	Planning and installation	set-up, connection requirements, maintenance		2	3	2	1	3	1
WG 4	Environmental issues	environmental protection, recycling		2	3	2	1	3	1
WG 5	Safety considerations	safety, handling, emergency		2	3	2	1	3	1
IEC/TC 21	Secondary cells and batteries	secondary cells		2	3	2	1	3	1
SC 21A	Secondary cells and batteries containing alkaline or other non-acid electrolytes	nickel-cadmium cells		2	3	2	1	3	1
WG 2	Starter and Auxiliary batteries	lithium batteries		2	3	2	1	3	1
WG 3	Traction and stationary batteries	lead-acid batteries		2	3	2	1	3	1
WG 8	Safe operation of batteries	safety, handling, emergency		2	3	2	1	3	1
WG 11	Secondary high temperature cells and batteries	battery recycling		2	3	2	1	3	1
IEC/TC 57	Power systems management and associated information exchange	information exchange		2	3	2	1	2	1
WG 3	Telecontrol protocols	tel econtrol protocols		2	3	2	1	2	1
WG 10	Power system IED communication and associated data models	communication, protocol , application, interface		2	3	2	1	2	1
WG 13	Software interfaces for operation and planning of the electric grid	substation, grid integration		2	3	2	1	2	1
WG 14	Interface bus iness function interfaces for utility operations	CIM, market, data model		2	3	2	1	2	1
WG 15	Data and communication security	cybersecurity, end2end, access control, grid integration		2	3	2	1	2	1
WG 16	Deregulated energy market communications	communication, market, grid integration		2	3	2	1	2	1
WG 17	Power system intelligent electronic device communication and associated data models for microgrids, distributed energy resources and distribution automation	data exchange, renewables		2	3	2	1	2	1
WG 18	Hydroelectric power plants – Communication for monitoring and control	monitoring, control, hydro storage		2	3	2	1	2	1
WG 19	Interoperability within TC 57 in the long term	SGAM, grid integration, CIM, mapping		2	3	2	1	2	1
WG 20	Power Line Carrier Communication Systems	PLC, communication		2	3	2	1	2	1
WG 21	Interfaces and protocol profiles relevant to systems connected to the electrical grid	SGAM, grid integration		2	3	2	1	2	1
IEC/TC 8	System aspects of electrical energy supply	power systems		2	3	2	1	3	1
SC 8A	Grid integration of Renewable Energy Generation	connection requirements, grid integration		2	3	2	1	3	1

The full matrix can be found in the appendix or for better readability in the attached Excel sheet.

The matrix shows IEC and CENELEC

- Technical Committees (TC)
- Subcommittees (SC)
- Working groups (WG)

and their relevance to the InterSTORE work packages (WP)

- WP 1: Requirements, Use Cases, Specifications
- WP 2: Open-Source Interoperability Toolkit
- WP 3: Dimensioning, Testing and Integration
- WP 4: Multiservice and Flexibility Monetization
- WP 5: Pilots Demonstration
- WP 6: Communication, Dissemination and Exploitation

The relevance is ranked in ascending importance:

- Level 1 - awareness: subject should be known, action is currently not necessary
- Level 2 - follow: activity which should be monitored (passive work)
- Level 3 - contribution: activity which requires action and submittance (active work)

Key words for the TC, SC, WG and key words for the InterSTORE WP facilitate the search for InterSTORE partners.

Illustration the matrix can be used as follows:

WP2 is working in the field of information exchange, key words are communication and protocol converter. Similar key words are used in IEC/TC 57 WG 10. Hence WP2 is connected via level 3 to IEC/TC 57 WG 10.

However, the matrix is a living document and might change while the project is progressing.

Reasons for this could be:

- Changes in the InterSTORE project activity or WP scope, e.g. due to:
  - changes in project objectives
  - new technical developments affecting the subsequent deliverables
  - regulatory changes
- Changes in expert groups or the scope of a TC (Technical Committee), e.g. due to
  - new technical developments
  - new regulatory requirements

Basically, the matrix is dependent on feedback of the InterSTORE project partners.

- Required feedback includes:
- Update of key words describing the InterSTORE WP scope
- Update of the relevance level (1 - awareness, 2 - follow, 3 - contribution)
- Active review of the project progress à changes of the WP scope or project activities
- Active review of standardization documents

In summary, the matrix is a strategic tool which links the InterSTORE project to the selected Technical Committees/Subcommittees and associated Working Groups. It is a living document and needs contribution of all InterSTORE project partners.

5.3 Regular standardization/regulation update newsletters

This chapter explains the procedure how regular standardization/regulation update newsletters will inform the InterSTORE project partners about relevant standardization and regulation activities.

- Set-up of a "Standardization/Regulation Blog"
- Every InterSTORE team member is encouraged to use this chat possibility for standardization and regulation discussions or questions.
- VDE DKE will post a bi-monthly newsletter with news or progress of the in D1.1 (“Report on Standardization, activities and regulatory requirements”) identified relevant Technical Committees and Subcommittees IEC/TC 120, IEC/TC 21, IEC/TC 57, IEC/TC 8 (SC 8A, SC 8B, SC 8C), IEC/TC 69, CLC/TC 8x and the System Committee IEC SyC Smart Energy as well as updates of the in D1.1 identified relevant regulatory directives.

- If interested, draft documents of any TC can be provided. Contacts to the TC expert community are possible in case of deeper interest or if suitable input can be contributed.
- An InterSTORE project internal survey will be made to find out which questions about standardization or regulation are existing.

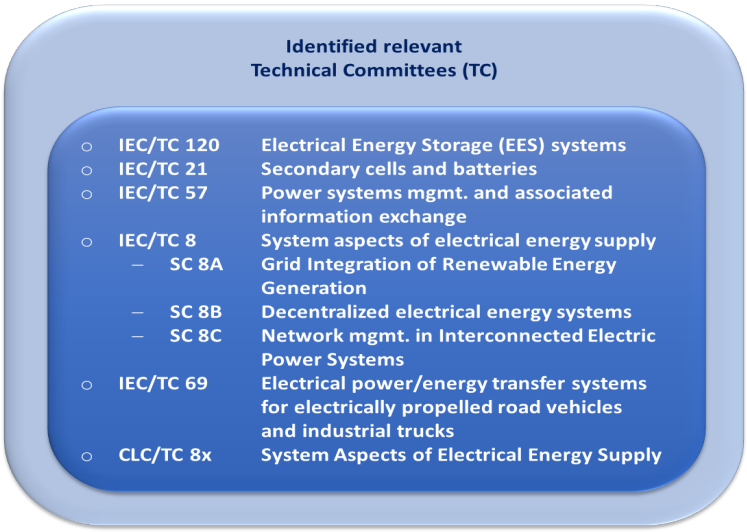

Figure 3: Identified relevant TCs

The above figure gives an overview of IEC and CENELEC expert groups which were evaluated as important for InterSTORE [5]. As the project progresses this might change and will be updated.

In summary, this chapter describes the procedures to keep all project partners up to date regarding standardization and regulation news and updates.

5.4 Incorporation of results into standards

Progress in the InterSTORE project may lead to updates of standards, technical specifications, or technical reports.

Such updates can result from different situations:

- Feedback, e.g. from the pilots, may indicate that information is missing in existing standards. Then the existing standards need to be complemented.
- Progress in the project shows that new developments need to be added in existing standards.
- In the case of a major new technical development, it may be necessary to write a completely new standard.

An example of an extension of an existing Technical Specification could be the subject hybrid storage:

In IEC/TC 120 WG 3 "Planning and installation", the topic "how to plan and build hybrid storage systems" could complement IEC/TS 62933-3-x.

In general, this chapter shows that awareness of the connection to the related Technical Committees (TC), Subcommittees (SC) or Working Groups (WG) and their activities is essential.

An overview of the IEC/CENELEC TC/SC/WG with InterSTORE WG can be found in the matrix in the appendix.

5.5 Excursus: Standardization in the USA and Australia

5.5.1 USA [6]

Unlike European countries, the USA has more than 10 national standardization organizations or associations which develop voluntary consensus standards. Mostly they are also connected globally.

With regards to electrotechnology, the USA is a full member of the IEC (International Electrotechnical Commission) via USNC (U.S. National Committee), which is a committee of ANSI (American National Standards Institute).

Overview of the national standardization organizations related to electrotechnology:

ANSI/USNC

Among its leadership roles in all major global and regional standards and accreditation organizations, the American National Standards Institute (ANSI) is the sole U.S. representative to the International Organization for Standardization (ISO), and, through the U.S. National Committee (USNC), to the International Electrotechnical Commission (IEC). ANSI promotes the use of U.S. standards internationally, advocates U.S. policy and technical positions in international and regional standardization organizations and encourages the adoption of international standards as national standards where they meet the needs of the user community.

IEEE

The Institute of Electrical and Electronics Engineers (IEEE) is the world's largest professional association with more than 395,000 members in around 150 countries. IEEE standards cover a variety of industries including energy, biomedicine and healthcare, information technology (IT), telecommunications, transportation, nanotechnology and data security.

ISA

The International Society of Automation (ISA) (formerly the Instrument Society of America) is a non-profit North American organization that publishes standards and conducts training programs for automation professionals. ISA also participates in the development of international standards and makes adaptations to standards on electrical equipment for use in potentially explosive atmospheres.

NEMA

The National Electrical Manufacturers Association (NEMA), the trade association of the US electrical industry, publishes more than 500 standards, application guides and technical documents. NEMA defines standards for electrical connections and develops manufacturing standards for electrical products. NEMA also participates in the standardization activities of ISO and IEC.

SAE

SAE International (established as the Society of Automotive Engineers) is a professional association and standards development organization for the engineering industry, with a special focus on transport sectors such as automotive, aerospace and commercial vehicles.

UL

The UL (Underwriters Laboratories) enterprise is a global safety science company. Its subsidiary organization UL Standards & Engagement develops, amongst others, standards for electrical and electronical products. It is accredited in the USA and Canada.

5.5.2 Australia [7]

The national Australian standardization organization is called "Standards Australia".

Its purpose includes:

- Standards development: Offering stakeholders from a variety of sectors a range of pathways to develop or update new or existing standards.
- International participation: Participating in the development and adoption of a wide range of International Standards.
- Accreditation of standards development organizations: Assessing and approving other organizations to develop Australian Standards.

For every new standard, Standards Australia brings together key parties and stakeholders to form a technical committee. These committees collaborate to develop standards, which are of value to Australia, its businesses, and its people. With stronger standards in place, Australia can enjoy greater economic efficiency and increased prominence on the international stage. Robust standards also help support local communities by building a safer, more sustainable environment.

Although Standards Australia develops standards, they are not responsible for enforcing, regulating or certifying compliance with those standards.

Standards Australia is a full member of the IEC (International Electrotechnical Commission).

5.5.3 IEEE and InterSTORE

Of special interest to InterSTORE is IEEE 2030.5 which is described in D1.1. "Report on Standardization, activities and regulatory requirements".

Smart Energy Profile Application Protocol (IEEE 2030.5)

As InterSTORE assumed using IEEE 2030.5 as a fundamental starting point of the project it is essential to understand it's role in comparison within the international standards from CENELEC and IEC.

In the US, Australia, Canada, Japan and many other countries (figure 3), distributed energy resource (DER) integration applications employ the IEEE 2030.5 standard, formerly known as Smart Energy Profile 2 (SEP 2) as the communications protocol. As far as the IEEE 2030.5 structure and content is concerned the IEC 61968 data model is used for the majority of the semantics in the IP-based IEEE 2030.5 standard, which is independent of the underlying

physical transport (Wi-Fi, ZigBee, etc.). The IEC 61850-7-420 logical node classes for DER components are adopted by the IEEE 2030.5 standard. The IEEE authorized an update to IEEE 2030.5 in 2018 that adopted changes to bring it into compliance with IEC 61850 extensions for DER.

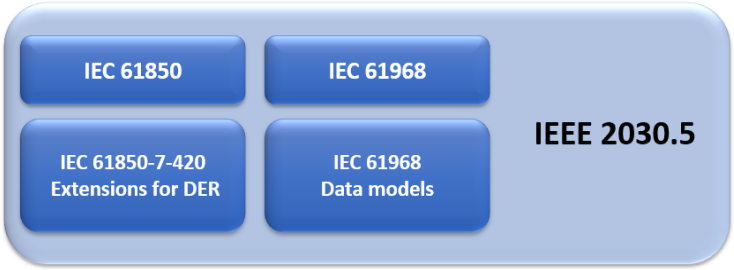

Figure 4: IEEE 2030.5

Australia = 56
Austria = 1
Bangladesh = 1
Belgium = 1
Brazil = 1
Canada = 24
Chile = 1
China = 2
Costa Rica = 1
France = 2
Germany = 3
India = 8
Ireland = 1
Italy = 3
Japan = 11
Lebanon = 1
Malaysia = 2
Mexico = 1
Netherlands = 3
New Zealand = 4
Paraguay = 1
Poland = 2
Puerto Rico = 3
Serbia = 1
Singapore = 5
South Africa = 1
South Korea = 1
Spain = 5
Sweden = 1
Taiwan = 3
Tunisia = 1
Turkey = 1
United Kingdom = 2
Untied States = 249

Figure 5: Global interest in IEEE 2030.5 as of May 2021

So, IEEE 2030.5, also known as the Smart Energy Profile (SEP) standard, focuses on the interoperability of energy management systems (EMS) and devices within a smart grid environment. It defines the communication protocols and data models for exchanging information between various components, such as smart meters, renewable energy systems, electric vehicles, and energy management systems. IEEE 2030.5 provides a framework for secure, reliable, and efficient communication and control within smart grid infrastructures.

In D1.1. "Report on Standardization, activities and regulatory requirements" IEEE 2030.5 is also compared to IEC 61850 and 61968 in detail, and advantages using it are shown.

In summary, the USA has several national standard developing groups which makes the overview more difficult than in Europe. Australia, on the other hand, is structured similarly to Europe, having one national standardization organization. Both countries are full members of the IEC. IEEE 2030.5 is of special interest in both countries, USA and Australia.

It is described in D1.1. "Report on Standardization, activities and regulatory requirements" in detail: A comparison to the IEC standards 61850 and 61968 shows overlaps, and advantages for InterSTORE using IEEE 2030.5 are listed.

6 Conclusion

The InterSTORE project, through Deliverable D6.3, has laid the groundwork for a comprehensive exploitation strategy and robust intellectual property rights (IPR) management plan. This document underscores the project's commitment to release the main 4 interoperable, open-source tools that enhance the integration and management of distributed energy storage systems and that will be integrated in the 5 project demo site, validating 9 high impact innovative new energy market services.

The deliverable recognizes that the dynamic field of energy storage technology requires an ongoing commitment to innovation and adaptability. This involves not only the initial development of cutting-edge tools and solutions but also their continuous improvement over time.

The project plans to establish a robust feedback loop where insights from pilot implementations and real-world applications are systematically collected and analyzed. This feedback will be instrumental in identifying areas for enhancement and in ensuring that the tools remain relevant and effective. By regularly updating the developed solutions with the latest technological advancements, the project aims to maintain a high standard of performance and to address emerging challenges promptly. This proactive approach ensures that the project's outputs do not become obsolete but evolve to meet the changing needs of the industry.

The InterSTORE project aims to transition its innovative solutions from development to market, ensuring they are not only technically sound but also commercially viable. This transition is guided by a Final Exploitation Roadmap including Business Plan and IPR report that will be describe in D6.4 and will include the following sections:

Business Model: The business model will be meticulously crafted to ensure the solutions developed by InterSTORE can be effectively commercialized. This involves identifying how the project's tools can generate revenue, whether through licensing, subscription services, or direct sales. The goal is to create sustainable business models that can support long-term growth and provide value to stakeholders.

Market Analysis: A thorough market analysis will be conducted to understand the current landscape and future trends in the energy storage sector. This includes assessing the needs of potential customers, the size of the market, and the growth prospects. By aligning the project's offerings with industry demands, the team can ensure that their solutions are well-positioned to meet market needs and achieve wide adoption.

Competition and PEST Analysis: Evaluating the competitive environment is crucial for positioning the project's outcomes strategically. The project will perform a detailed analysis of existing competitors, identifying their strengths and weaknesses. Additionally, a PEST analysis (Political, Economic, Social, and Technological) will help understand external factors that could impact the market, such as regulatory changes, economic conditions, societal trends, and technological developments.

Financial Model and Funding Requirements: Developing a comprehensive financial model is essential for planning the commercialization process. This model will outline the costs involved in bringing the project's solutions to market, projected revenue streams, and overall financial strategy. It will also detail the funding requirements needed to support these activities, whether through internal resources, external investment, or grants.

IPR Report: Protecting intellectual property is fundamental to the project's success. The IPR report will ensure that all innovations developed during the project are properly documented and protected. This includes securing patents, trademarks, and copyrights as necessary. Effective management of intellectual property rights will help safeguard the project's competitive advantage and provide a clear framework for exploiting these assets commercially.

Through these detailed strategies and analyses, the InterSTORE project is poised to effectively manage innovation and transition its solutions from the development phase to successful market adoption, ensuring both technological and commercial success.

The exploitation mechanisms for InterSTORE will focus on three main areas:

Knowledge Transfer: Facilitating the transfer of knowledge within the consortium and to external stakeholders. This will involve regular updates, workshops, and training sessions to ensure that all partners and potential users are well-informed about the project developments and how to utilize the tools effectively.

Commercialization: Developing strategies for commercializing the project outcomes, including licensing agreements, partnerships with industry players, and participation in key industry events. This will help in driving the adoption of the developed solutions and maximizing their market impact.

Sustainability: Ensuring the long-term sustainability of the project outcomes by developing robust business models, engaging with regulatory bodies for standardization, and continuously innovating to stay ahead of market trends. Sustainability efforts will also focus on the environmental and social impacts of the project, aligning with the principles of corporate social responsibility (CSR).

Standardization plays a pivotal role in the InterSTORE project. The alignment with existing IEC and CENELEC technical committees ensures that the project's outcomes are integrated into global standards, fostering interoperability and broad market acceptance. Regular updates through newsletters and a dedicated blog will keep all stakeholders informed about relevant standardization activities and regulatory changes.

The final Exploitation Plan and IPR report (D6.4) due at M36 will provide a comprehensive roadmap for bringing the innovative solutions to market. This plan will ensure that the project not only achieves its immediate goals but also creates lasting value by driving advancements in energy storage technology and contributing to a more sustainable and interoperable energy landscape. InterSTORE project has demonstrated a comprehensive approach to integrating distributed energy storage solutions through its initial exploitation plan and IPR management strategy. This document provides a robust framework for leveraging the innovative outcomes of the project, ensuring they are adequately protected, disseminated, and utilized. Through strategic planning, effective innovation management, and targeted market engagement, the project is well-positioned to capitalize on its results and drive significant advancements in the energy storage domain

7 References

[1] Alexandre Joyce and Raymond L Paquin. "The triple layered business model can- vas - A tool to design more sustainable business models". In: Journal of cleaner production 135 (2016), pp. 1474–1486.
[2] Richard Puyt et al. "Origins of SWOT analysis". In: 2020.1 (2020), p. 17416.
[3] V Basil Hans. "Business environment–conceptual framework and polices". In: International Educational Scientific Research Journal 4.3 (2018), pp. 67–74.
[4] www.IEC.ch, www.cenelec.eu
[5] D1.1 - Report on Standardization, activities and regulatory requirements (30.06.2023)
[6] www.ansi.org, www.ieee.org, www.isa.org, www.nema.org, www.sae.org, www.ul.com, www.ulstandards.ul.com
[7] www.standardsorg.au
[8] Open Source Initiative, https://opensource.org/
[9] GPL, https://www.gnu.org/licenses/old-licenses/gpl-2.0.html
[10] LGPL, https://www.gnu.org/licenses/old-licenses/lgpl-2.1.html
[11] GPL Linking exception, https://en.wikipedia.org/wiki/GPL_linking_exception
[12] MIT License, https://en.wikipedia.org/wiki/MIT_License
[13] BSD licenses, https://en.wikipedia.org/wiki/BSD_licenses
[14] Apache license 2.0, https://www.apache.org/licenses/LICENSE-2.0
[15] https://muratkaragozgil.medium.com/software-licenses-on-github-which-one-should-you-choose-3d4cfbb6c2f9z