Smart5Grid

Demonstration of **5G** solutions for
SMART energy **GRID**s of the future

Deliverable 7.7

Innovation management report

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5G PPP
The 5G Infrastructure Public Private Partnership

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Executive summary

Managing innovation and intellectual property rights (IPR) is crucial for facilitating the successful post-project utilization and potential commercialization of Smart5Grid outcomes. Hence, the Smart5Grid consortium has prioritized innovation and IPR management within the project framework to effectively lay the groundwork for seamless utilization and sustainability of its results beyond its conclusion in April 2024.

In line with this, the present report unfolds Smart5Grid's Innovation and IPR Management Strategy. It elaborates on the fundamental concepts concerning the administration and safeguarding of intellectual property while outlining the principal elements of the corresponding methodology that has been consistently implemented throughout the project.

This document consolidates the information regarding the project's Background and Foreground Intellectual Property (IP), and also compiles the project's Exploitable Results alongside their primary IP owners. Furthermore, it outlines the intended exploitation types and pathways per partner, utilizing the Smart5Grid IPR matrix for comprehensive analysis.

Furthermore, the final version of the document sets the groundwork for future agreements on who owns the rights to certain important project results. It gives a clear picture of how much each partner has contributed to these results. It also gives basic information about how these results will be used and sustained in the future. For more detailed information about how these results will be used in the market, you can refer to D7.6 – "Market Analysis, Business modelling, and Exploitation Report."

Overall, this report covers several important aspects:

It discusses how Smart5Grid manages innovation and intellectual property rights throughout the project's duration.

1. It presents the final version of the Smart5Grid IPR Matrix, which includes:
    - A comprehensive list of all significant assets.
    - Updates and organization of project results.
    - Determination of the primary owners of each result and the contributions made by each partner.

- Planning for how each partner will use and benefit from the results.
- Assessment of the value of the project's publications and deliverables to each partner.

2. It outlines the most crucial results achieved by Smart5Grid.
3. It establishes the foundation for partners to fairly share rights to these important results.
4. It outlines initial plans for partners to utilize and sustain these important results after the project's completion, following specified guidelines.

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1. Introduction

The Smart5Grid partners are committed to ensuring the long-term sustainability of their project outcomes by making sure that the innovative ideas, methodologies, and results are thoroughly recognized, preserved, and made accessible to all relevant parties. This includes considering the potential for commercialization. To achieve this, the consortium has established fundamental principles early on that will create a robust management framework for both the Background (BG) and Foreground (FG) Intellectual Property Rights (IPR) within Smart5Grid. The Smart5Grid Innovation and IPR Management Strategy lays the foundation for overseeing the protection of intellectual property (IP) and IPR both within the consortium and externally. This approach aims to enhance the value of the project's exploitable results and promote successful innovation.

This final version of the Smart5Grid Innovation Management Report brings forward a complete Smart5Grid IPR matrix. During the period June 2023 – April 2024, 8BELLS (as IPR manager) and ENEL (as co-ordinator), shared general guidelines as well as the IPR matrix tables that are presented in Sections 5.2, 5.2, 5.3, 6.1, 6.2, 6.3, 6.4, 6.6, and 6.7. In more detail, the exploitable results of the Smart5Grid project have been identified by project partners and described thoroughly. The document also confirms the proposals regarding the ownership of Exploitable Results (ER) in Section 6.1, as well as the recommended strategies for Intellectual Property (IP) protection and pathways for their utilization (Sections 6.2 and 6.3), reflecting the perspectives and interests of the partners at the project's conclusion. Furthermore, Section 6.4 outlines the ultimate condition of the Smart5Grid publications and project outputs that have potential for exploitation, as identified by the partners. In Section 6.5, the document prioritizes the Smart5Grid Key Exploitation Results (KERs) to identify those with the greatest added value and impact within the project's objectives. Section 6.6 details the terms for future agreements on joint ownership of these KERs, establishing each participant's contributions in accordance with the Smart5Grid Grant Agreement. Section 6.7 outlines the primary exploitation and sustainability strategies for each KER, designated by the principal IP holders. Section 6.8 identifies the key external stakeholder groups and the potential advantages they could receive from the Smart5Grid KERs.

The final version of the Innovation and IPR Management Strategy includes seven distinct sections:

Chapter 1: introduces the report's context, objectives, and structure.

Chapter 2: explains essential IPR management terms, goals, and the primary tools for intellectual property protection used in the project.

Chapter 3: describes the IPR management strategy, its phases within the Smart5Grid project, and the methodology applied throughout the project.

Chapter 4: discusses the IPR Matrix tables and the process for identifying Smart5Grid's Background and Foreground IP.

Chapter 5: confirms the project's BG IP, FG IP, and Exploitable Results as identified at the project's conclusion.

Chapter 6: delves into the Smart5Grid project's Exploitable Results, presenting the final IP status of each result, including main IP owners, contributing partners, exploitation types and pathways, prioritized KERs, the basis for future Joint Ownership Agreements, exploitation and sustainability plans per KER, and the stakeholder groups that will benefit post-project. This section aligns with the "Market Analysis, Business Modelling and exploitation Report" (D7.6), developed in partnership with 8BELLS, leader of Task 7.2.

Chapter 7: offers concluding observations on the value of Smart5Grid outcomes in the EU's 5G and energy sectors, setting the stage for exploitation after the project ends.

1.1. Notations, abbreviations and acronyms

Item	Description
BG	Background
CA	Consortium Agreement
EC	European Commission
EU	European Union
FG	Foreground
GA	Grant Agreement
IP	Intellectual Property
IPR	Intellectual Property Rights
JOA	Joint Ownership Agreements
KER	Key Exploitable Result
PMO	Project Management Office
TRL	Technology Readiness Level
WIPO	World Intellectual Property Organization
KIM Team	Knowledge and Innovation Management Team

Table 1: Acronyms list

2. IPR Management Overview

2.1. Objectives

The primary objectives of the Smart5Grid Innovation Management Strategy aim to efficiently protect project outcomes, facilitate their wider availability to stakeholders, and potentially commercialize exploitable results post-project. These objectives include:

- Establishing a clear methodology for managing Intellectual Property Rights (IPR) within the project.
- Ensuring common understanding among partners regarding key Intellectual Property (IP)-related terms and issues.
- Identifying project results early on to form a comprehensive portfolio.
- Developing consensus on background and foreground IPs and access rights.
- Defining the framework for IP protection for each exploitable result.
- Resolving conflicts in IPs through joint ownership agreements or other means.
- Establishing cohesive strategies within the consortium to ensure smooth IPR operations.

The Innovation Strategy outlines how elements such as background and foreground IP, (key) exploitable results, access rights, result protection, and dissemination will be managed within the project, with an eye towards post-project exploitation. These concepts align with typical considerations in designing the Innovation Strategy for H2020 projects and have been collectively defined and agreed upon by all Smart5Grid partners.

2.2. KIM Team involvement (Knowledge and innovation management team).

The involvement of the KIM team in the evaluation of the exploitable items individually as well as in the evaluation of the D7.6 and D7.7 was strategic, to ensure cohesiveness of the reports, to minimize conflict levels, to support the selection process of the Key Exploitable results as well as to guide towards the protection and exploitation plans of the project's results. The incorporation of some of the project's results in the innovation radar also stretched the importance of the active participation of the KIM team in the project's innovation management and business modelling strategy. It is important to highlight that the involvement of Dr. Ioannis Giannoulakis, Innovation Architect of the KIM team has significantly impacted the innovation management strategy of the Smart5Grid project in the following manners:

(a) With the provision of relevant guidelines to support the process of identifying the project results and selecting the Key exploitable results based on partners' exploitation interest and the results potential.
(b) By maintaining a constant communication channel with the rest of the KIM team through the WP7 leader in order to effectively address conflicts and to support in the innovation management strategy generation and implementation.
(c) By undertaking an external review of deliverables 7.6 and 7.7 and providing valuable feedback on the project's exploitation and business planning vulnerabilities.

Overall, the KIM team has proved to be a valuable instrument in the development and implementation of Smart5Grid's innovation management and business modelling tasks and the consortium suggests that similar innovation management bodies are also constituted in future project endeavors for the facilitation of similar objectives.

2.3. Background IP

Background IP refers to data, know-how, or information, along with associated rights, that a project partner possesses or has licensed before the project's initiation, essential for executing project activities or leveraging its outcomes[1]. Access to this background IP necessary for project activities or result exploitation must be provided to other partners without any royalty fees. Project partners are obligated to identify and provide access rights to pertinent background IP[2], typically outlined in the consortium agreement or a separate background agreement.

Two primary considerations regarding project background entail[3]:

- Identification of necessary background information contributed by each partner, crucial for the successful implementation and exploitation of project actions.
- Clarification of access rights to this knowledge within the consortium's agreed terms and conditions, in accordance with European Commission (EC) regulations, ensuring seamless project implementation.

[1] See Article 24.1 of the Smart5Grid Grant Agreement
[2] See Attachment 1 in the Consortium Agreement for a detailed description of the Smart5Grid background and the access rights granted in principle for the consortium.
[3] See: https://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/amga/h2020-amga_en.pdf

2.4. Foreground IP

Foreground refers to the outcomes generated during the project's implementation, encompassing various forms of information, materials, and knowledge[4]. These outcomes represent tangible or intangible outputs resulting from project actions, which may or may not be protectable. Foreground IP includes rights such as copyrights, industrial designs, patents, plant variety rights, as well as similar forms of protection like rights for databases, and unprotected know-how such as confidential material. It's important to note that results generated outside the project's activities do not fall under foreground. According to the Smart5Grid Grant Agreement (GA), project partners generating results own them, with joint ownership possible for outcomes developed collaboratively[5]. Joint ownership entails partners agreeing on allocation and terms for exercising ownership. While regulations on joint ownership are included in the Smart5Grid GA[6], partners may opt to establish a separate joint ownership agreement during or after project completion to clarify ownership allocation based on each partner's contribution. Joint owners may grant non-exclusive licenses for exploiting jointly-owned results, unless stated otherwise in the Consortium Agreement or relevant joint ownership agreement.

2.5. Exploitable Results

Exploitation of the project's outcomes involves utilizing them in additional research endeavours beyond the project's scope, or in the development, creation, and marketing of products or processes, provision of services, or engagement in standardization activities[7]. An exploitable result within this context refers to a project outcome, whether anticipated or achieved, that satisfies two criteria: it holds commercial, social, or academic significance, and it can be independently commercialized or exploited as a standalone entity, such as a product, process, or service[8]. Therefore, exploitable results may constitute either whole or partial components of foreground outcomes, with not all foreground items necessarily meeting these criteria[9]. Moreover, exploitable

[4] For the detailed definition of the Foreground see: https://iprhelpdesk.eu/glossary/foreground
[5] See Article 26.1 of the Smart5Grid Grant Agreement
[6] See Article 26.2 of the Smart5Grid Grant Agreement.
[7] For more details: https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/support/glossary
[8] A patent for licensing is also an exploitable result
[9] See European Commission, Dissemination and Exploitation in H2020: http://ec.europa.eu/research/participants/data/ref/h2020/other/events/2017-03-01/8_result-disseminationexploitation.pdf

results may not be immediately market-ready, often necessitating further research, development, engineering, and validation before reaching commercial viability.

2.6. Access Rights

Access rights pertain to a partner's entitlement to request access to another partner's background and foreground within the project, either for implementing activities or utilizing results. These rights remain valid as long as they are necessary for exploiting the project's outcomes. The regulations concerning access rights in collaborative H2020 projects are outlined in the GA [10] and the Consortium Agreement (CA)[11], adhering to predefined rules. The specifics of access rights within Smart5Grid are delineated in Table 2, depending on their intended use.

Purpose of Access	Access to background	Access to Results
Project implementation	• Royalty-free • Unless otherwise agreed by participants	Royalty-free
Exploitation of own results	• Subject to individual agreement • Granted under fair and reasonable conditions	

Table 2: Access Rights

2.7. Protection of Results

When contemplating IP protection, it's important to recognize that IP results can be safeguarded through different types of IPR. Therefore, it's crucial to select the most appropriate protection strategy. The choice of the most suitable form of IP protection hinges on the nature and unique attributes of the results in question, as well as the objectives of the IP owner. Several types of instruments may be evaluated for IP protection within the Smart5Grid project context. These suitable IP protection instruments include:

- Trade and service marks
- Utility models
- Trade secrets
- Patents
- Copyrights
- Confidentiality agreements
- Sui generis protection

[10] See Article 25 and Article 31 of the Smart5Grid Grant Agreement.
[11] See Section 9 of the Smart5Grid Consortium Agreement.

Further details with respect to each of the above-mentioned protection instruments are provided in the subsections below.

2.7.1. Trademarks and Service Marks

Trademarks

A trademark grants an exclusive right to use a symbol in connection with the products or services it's registered for[12]. Trademarks encompass symbols capable of distinguishing a trader's goods or services from those of others. The primary function of a trademark is to identify the commercial source of a product. It doesn't necessarily need to inform the consumer about the manufacturer or trader; rather, it instills trust in the enterprise responsible for the product sold under the trademark.

Service Marks

In today's market, consumers are not only faced with a wide array of goods but also with an increasing range of services, often offered on national or international scales. Consequently, there's a need for symbols that allow consumers to differentiate between various services like insurance companies, car rental agencies, and airlines. These symbols, termed service marks, serve the same purpose of indicating origin and distinguishing services as trademarks do for goods. As service marks are similar in nature to trademarks, they are often subject to the same criteria for protection. In some cases, service mark protection is introduced through minor amendments to existing trademark laws, extending the provisions for trademark protection to service marks as well[13].

2.7.2. Patents

A patent is an exclusive right granted to protect new inventions, whether they are products or processes, that offer innovative technical solutions or enable novel methods of accomplishing tasks. The patent holder has the sole authority to prevent others from commercially using their invention

[12] For the definition of trade mark in Europe, see https://intellectual-property-helpdesk.ec.europa.eu/regional-helpdesks/european-ip-helpdesk/ip-guides_en

[13] See WIPO Intellectual Property Handbook 2008: Policy, Law and Use. Chapter 2: Fields of Intellectual Property Protection, p. 68

for a limited period. However, in exchange for this exclusivity, the patent holder is required to disclose details of the invention in the patent application, making it public[14].

It's important to understand that owning a patent does not automatically grant the right to use the patented invention. The patent holder may need to seek permission from other parties holding relevant rights. Nevertheless, the patent owner retains the power to determine who may or may not utilize the patented invention during the protection period. Additionally, the patent owner has the option to grant permission or license the invention to others under mutually agreed terms. Alternatively, the owner may choose to sell the rights to the patent, transferring ownership to another party.

Patents are typically granted on a country-by-country or regional basis, and although they can be applied in territories without patent protection, they would not receive the same level of protection. Once a patent expires, its protection ends, and the invention enters the public domain. This means that the exclusive rights held by the patent owner are terminated, allowing others to commercially exploit the invention without any charge[15].

2.7.3. Utility Models

A utility model, also known as a "petty patent," is an exclusive right granted to an inventor for an invention that doesn't meet the full patentability requirements, often because it represents a minor improvement to an existing product. Despite not meeting all patentability criteria, these inventions still hold significance within local innovation systems. Once granted, this type of protection enables the holder to prevent others from commercially using the invention without authorization for a limited period[16].

Utility models typically have less stringent requirements and procedures compared to patents. However, since they are tailored to address local needs, the specific requirements and duration of protection may vary across different jurisdictions. The incorporation of utility models into intellectual property systems in certain countries aims to foster the rapid development of indigenous innovation, particularly among small and medium-sized enterprises and individual inventors[17].

[14] Definition of parents in the European context, retrieved from https://intellectual-property-helpdesk.ec.europa.eu/regional-helpdesks/european-ip-helpdesk/ip-guides_en

[15] See WIPO Intellectual Property Handbook 2008: Policy, Law and Use. Chapter 2: Fields of Intellectual Property Protection, p. 17.

[16]Definition of utility models in the European context, retrieved from https://intellectual-property-helpdesk.ec.europa.eu/regional-helpdesks/european-ip-helpdesk/ip-guides_en

[17] See WIPO Intellectual Property Handbook 2008: Policy, Law and Use. Chapter 2: Fields of Intellectual Property Protection, p. 40.

2.7.4. Copyrights

Copyright, also known as author's right, encompasses both economic and moral rights that creators hold over their literary, scientific, and artistic works. It is important to clarify that copyright safeguards the expression of ideas in a tangible form, rather than the ideas themselves, and requires that the expression be original[18].

The scope of works protected by copyright is broad and includes[19]:

- Literary works like novels, poems, and newspaper articles
- Computer programs and databases
- Films, musical compositions, and choreographies
- Artistic works such as paintings, drawings, and photographs
- Advertisements, maps, and technical drawings

Regarding economic rights, copyright laws typically grant the rights owner the authority to authorize or prohibit specific uses of their work, sometimes entitling them to remuneration for its use. These economic rights cover various actions, including reproduction, public performance, recording, broadcasting, translation, and adaptation of the work.

Examples of economic rights include:

- Reproduction in various formats
- Public performance or display
- Recording and broadcasting
- Translation into other languages
- Adaptation, such as transforming a novel into a screenplay[20]

Additionally, copyright protection extends to moral rights, which include the right to claim authorship of a work and the right to object to any changes that may harm the creator's reputation. Depending on the jurisdiction, creators or rights holders can enforce their rights administratively or through legal means, such as securing evidence of infringement or seeking court orders to halt

[18] See WIPO Intellectual Property Handbook 2008: Policy, Law and Use. Chapter 2: Fields of Intellectual Property Protection, p. 40.
[19] Definition of copyrights in the European context, retrieved from https://intellectual-property-helpdesk.ec.europa.eu/regional-helpdesks/european-ip-helpdesk/ip-guides_en
[20] WIPO Copyright definition, retrieved from: https://www.wipo.int/copyright/en/

unauthorized use. Legal remedies may include injunctions to stop infringing activities and claims for damages due to loss of financial rewards or reputational harm.

2.7.5. Trade secrets

Trade secrets encompass any confidential business information that provides a competitive edge to an enterprise. They serve as a form of protection for holders of confidential information, which can be sold or licensed. The range of information eligible for trade secret protection is extensive and can include know-how, technical knowledge (which could potentially be protected by a patent), as well as business and commercial data such as customer lists, business strategies, recipes, or manufacturing processes[21].

Key characteristics of information eligible for trade secret protection:

- Commercial value: The information must hold commercial significance.
- Limited access: It should only be known to a restricted group of individuals and maintained as a secret not generally known or readily accessible to those dealing with similar information.
- Secrecy measures: The right holder must take reasonable steps to maintain the secrecy of the information.

In essence, trade secrets offer protection for valuable proprietary information that, if disclosed or misappropriated, could harm the competitive position of the enterprise.

2.7.6. Confidentiality Agreements

Confidentiality holds paramount importance for participants engaged in innovation projects, spanning from the initial setup to the implementation and exploitation phases. Collaborative initiatives often necessitate the exchange of valuable information among partners. Therefore, it's imperative to address confidentiality concerns and implement appropriate measures to securely exchange information, foster project development, and safeguard sensitive technological, business, or commercially confidential data. Confidentiality agreements serve as contractual safeguards that offer protection and enhance security for organizations sharing or disclosing information with others. These agreements ensure that confidential information is solely used for agreed-upon purposes between the signatories and is not disclosed to third parties without consent. Such

[21] Definition of trade secrets in the European context retrieved from https://intellectual-property-helpdesk.ec.europa.eu/regional-helpdesks/european-ip-helpdesk/ip-guides_en

protection is particularly valuable for safeguarding project results that may not be immediately commercially exploitable but are integral to future exploitation and commercial deployment. Consequently, the execution of a confidentiality agreement is a crucial step in preserving the secrecy of confidential information and maintaining a competitive advantage[22].

For a confidentiality agreement to be legally enforceable, it must meet several criteria:

- The information must be genuinely secret, not readily accessible to those typically dealing with such data.
- The information should possess commercial value.
- The owner of the information must have taken reasonable measures to protect its confidentiality.

By adhering to these criteria, confidentiality agreements provide a robust framework for safeguarding sensitive information and preserving the competitive edge of organizations involved in innovation projects.

2.7.7. Sui Generis Protection

Sui generis protection is utilized to safeguard the content of a database, aiming to prevent the extraction and/or reuse of a significant portion of its content, particularly when the database structure lacks originality. To qualify for this protection, the creator of the database must be either a citizen of the European Union (EU) or a resident in the EU. Additionally, they must demonstrate a substantial investment, involving financial, material, and/or human resources, in acquiring, verifying, or presenting the content of the database.

This protection extends to both electronic and non-electronic databases, including static and dynamic formats. The sui generis right shields the outcomes of the substantial investment made towards the systematic and methodical classification of independent data, constituting an intangible result. It's important to note that this right does not confer control over the information stored in the database and does not serve as an extension of copyright protection that may apply to the database contents[23].

2.8. Dissemination

As stipulated in the Consortium Agreement, the dissemination of project results by any party,

[22] See Chapter Non-Disclosure Agreement of European IPR Helpdesk.
[23] Definition of sui generis database protection in the European context retrieved from: Database protection in the EU - Your Europe (europa.eu)

including publications and presentations, must adhere to the conditions specified in the agreement and any additional confidentiality agreements. These regulations apply during the project's duration and for one year after its completion to maintain confidentiality[24]. The procedures preceding the publication of project results are further elaborated in the "Data Management Plan" (D1.2, Section 3 "FAIR Data"). Partners have the autonomy to choose the appropriate means for disseminating project results, such as scientific publications, website postings, or conference presentations. However, before dissemination, partners must ensure the protection of the project's exploitable results.

[24] See Section 8.5 of the Smart5Grid Consortium Agreement.

3. IPR Management Strategy

Within the Smart5Grid framework, essential aspects IP and innovation management revolve around establishing a shared understanding of key concepts like background, foreground, ownership (including joint ownership), access and usage rights, dissemination, and exploitation throughout and beyond the project's lifespan. The Smart5Grid IPR management strategy employs a structured approach, delineating IP management processes into three distinct stages:

- Grant Agreement preparation stage
- Project implementation stage
- Post-project stage

These stages are illustrated in the following figure, accompanied by the corresponding IP management actions undertaken within each stage. Further elaboration on these stages is provided in the subsequent subsections.

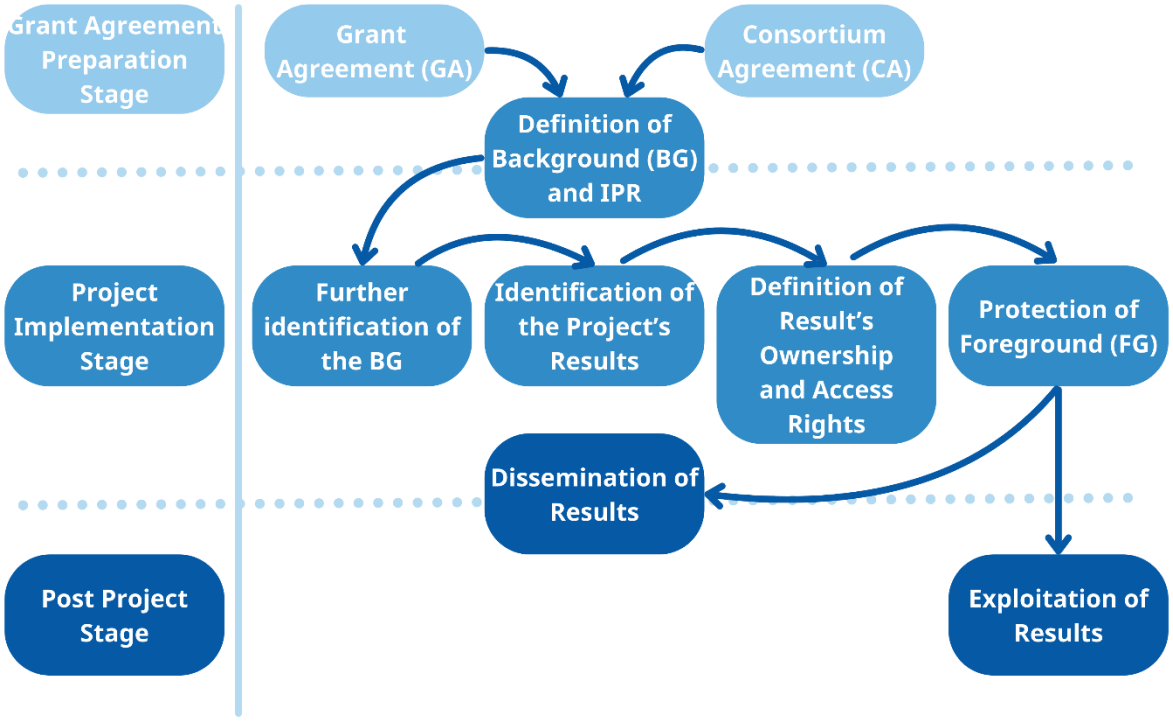

Figure 1: IPR Management Strategy

3.1. Preparation stage

The Grant Agreement and Consortium Agreement serve as comprehensive documents outlining various IPR considerations. Their distinct provisions serve as guidelines for addressing IPR-related matters throughout and following the project's conclusion. Any additional IPR-related actions required by project partners will be guided by the existing provisions laid out in these agreements.

3.1.1. Grant Agreement

The GA serves as a contractual document outlining the fundamental rules and conditions of the project, established between the EC and the Smart5Grid partners. It forms the primary contractual

framework for Smart5Grid, with its key sections regarding IPR detailed in Section 3, titled "Rights and obligations related to Background and Results"[25]. Within this framework, management of Smart5Grid IP is regulated, access rights and obligations related to background are defined, and issues concerning ownership, protection, exploitation, and dissemination of project results are addressed. Additionally, the GA outlines provisions regarding the transferability and access rights to project outcomes.

3.1.2. Consortium Agreement

The CA functions as a contract among the partners of the Smart5Grid consortium, aiming to establish rights and obligations throughout the partnership for the execution of the project's planned actions and activities[26]. By defining rules and responsibilities during the project, the CA helps minimize the likelihood of future disputes and outlines access rights granted to partners for the project's execution. Additionally, it delineates rights and responsibilities among consortium members regarding IP matters.

Key sections pertaining to IP within the Smart5Grid CA include:

- Section 8 "Results": This section outlines provisions regarding the ownership and joint ownership of project results, as well as their transfer and dissemination.
- Section 9 "Access Rights": Here, principles governing access rights are clarified, along with provisions for exploitation and dissemination purposes. Specific provisions for access rights to software are also stated.
- Attachment 1 "Background included": This attachment presents the initial list of usable background, which was subsequently expanded through the application of the IPR methodology.

3.2. Implementation stage

During the implementation phase of Smart5Grid, procedures for managing IP are expected to be implemented among the project partners to effectively organize and oversee all project outcomes. As the project progresses, particular attention is given to identifying foreground results, determining

[25] In particular, see Articles 23a – 31 of the Smart5Grid Grant Agreement.
[26] See IPR helpdesk for the definition of Consortium Agreement, FAQ section: https://intellectual-property-helpdesk.ec.europa.eu/regional-helpdesks/european-ip-helpdesk/europe-frequently-asked-questions_en#Consortium_agreement

ownership, establishing access rights and protection measures, identifying stakeholders to benefit from the outcomes, and planning for their exploitation, broader deployment, and potential commercialization. The Smart5Grid IPR management strategy underscores the importance of establishing robust procedures for handling IPR issues crucial to the project's strategic objectives, facilitating the exploitation of its outcomes. Both the initial and interim versions of the IPR Management Strategy fall within the implementation stage, occurring in the midst of project execution. Consequently, partners are encouraged to prioritize two primary objectives:

1. Granting access rights to their knowledge to enable other partners to carry out project activities.
2. Implementing early procedures for identifying results to safeguard, disseminate, and exploit the project's outcomes.

In this context, key IPR-related considerations during the Smart5Grid implementation phase include:

3.2.1. Background identification

During the first stages of Smart5Grid, it is imperative to identify and further specify the relevant background knowledge, know-how, and data of partners, complementary to those outlined in the consortium agreement, which constitute the background of the project. Under this framework, the underlying background can be attached to the generated results of the project, which, eventually, will help the determination of access rights, ownership issues and IPR.

3.2.2. Foreground identification

A core process of the Smart5Grid IP management is the identification of project results with a view to create a concrete mapping of them, and enhance the Smart5Grid IP portfolio. Therefore, all IP valuable results within the project must be identified, listed, named, described and analysed in a systematic way.

3.2.3. Results' ownership

Partners have been asked (through the Smart5Grid IPR Matrix tables – see Section 4) to elaborate on and validate the provisions of the CA with regard to the result's ownership. Special attention was paid to handling joint ownership issues (see Section 6.6).

3.2.4. Protection of results

The successful exploitation of innovative concepts and outcomes developed within Smart5Grid relies

heavily on adequately protecting the project's results. Specifically, proper protection is deemed necessary if two conditions are met[27]: Firstly, if the project's outcomes are reasonably expected to be commercially exploitable or hold broader exploitation potential; and secondly, if protecting them is both feasible and justified given the circumstances.

In the context of IP protection, Smart5Grid partners have carefully considered not only their individual interests but also those of the entire consortium. It is incumbent upon project partners to ensure that identified exploitable results are safeguarded with appropriate protection mechanisms, offering a sufficient protection duration within a suitable geographical scope. While Europe is typically regarded as the default territory for safeguarding exploitable Smart5Grid results, the parties involved retain the flexibility to collectively determine the appropriate geographical territory based on where the IP will be utilized.

Table 3 provides an overview of various protection instruments applied to a range of Smart5Grid outcomes.

Subject Matter	Patent	Utility	Copyright	Trademark	Confidential Information
Invention					X
Software[28]	X		X		X
Scientific Article			X		
Technology Design			X		

Table 3: Protection Instruments of Results

IP protection serves as a valuable tool for creating value through various means such as licensing, sale, or commercialization of IP in the form of products and services. Its utilization is crucial for potential commercial or industrial exploitation, as it plays a significant role in supporting the branding of products and services, thereby appealing to both customers and investors. While IP protection for a result may not always be obligatory, its value remains substantial, particularly when it can be exploited or widely deployed by relevant stakeholders, as seen in instances of open-source results such as publications of project findings.

[27] See https://ec.europa.eu/easme/sites/easme-site/files/ip_in_h2020_european_ipr_helpdeskmd09112017.pdf

[28] Software patentability is still a debated issue given its exclusion as subject matter as by Article 52(2)(c) and (3) of the European Patent Convention (EPC). Source: IPR Helpdesk

3.2.5. Exploitation of results

The exploitable results identified within Smart5Grid will be effectively leveraged for commercial or other pertinent purposes, as outlined in the Smart5Grid Grant Agreement[29]. Specifically, the consortium aims to explore opportunities for exploiting the project's outcomes in various areas, including further research activities, product or process development, service provision, and participation in standardization activities.

In addition to the sequential phases of IP identification, determination of ownership claims, and establishment of IP protection measures, further actions are undertaken. These include:

- Mapping out potential exploitation pathways, both commercial and non-commercial, envisioned for each of the Smart5Grid results beyond the project's conclusion.
- Developing detailed exploitation and sustainability plans for each Key Exploitable Result (KER), serving as guiding frameworks for the implementation of the project's most promising exploitable outcomes following the Grant period.

3.2.6. Dissemination of results

Smart5Grid partners will choose suitable methods for disseminating project outcomes, such as scientific publications, website publications, conference presentations, and open access, adhering to the conditions specified in the CA[30] and any additional confidentiality agreements. It's imperative for all partners to prioritize safeguarding the project's exploitable results before proceeding with dissemination efforts.

3.3. Post-project stage

Upon the formal conclusion of Smart5Grid, the submission of D7.6 - "Market Analysis, Business modelling and exploitation report" in M40 marked the presentation of the comprehensive strategy for market-oriented exploitation, broader deployment, and commercialization avenues post-project completion. Deliverable 7.6 outlines further activities necessary for disseminating, utilizing, and sustaining Smart5Grid results and foreground with potential for commercial and business exploitation. It includes a techno-economic analysis and showcases market trends for the services and technologies demonstrated by Smart5Grid.

Furthermore, D7.7 - "Innovation Management" (the present document) encompasses the final findings regarding IP issues and provides the ultimate update of the IPR Matrix, detailing the intellectual property rights applied and registered. Together, these deliverables represent the

[29] See Article 28.1 of the Smart5Grid Grant Agreement.
[30] See Section 8.4 of the Smart5Grid Consortium Agreement.

conclusive and most refined strategy for post-project exploitation, IPR management, and sustainability, alongside the concrete wider deployment and, where applicable, commercialization strategies chosen.

3.4. Innovation Management

The leader overseeing the Innovation Management process assumes responsibility for crafting the Smart5Grid Innovation and IPR Management Strategy. Their role involves scrutinizing and evaluating innovative concepts emerging during the project for potential exploitation, while also overseeing the management of all Background (BG) and Foreground (FG) intellectual property. Throughout the project's duration, the Innovation and IPR Management leader maintains close communication with key stakeholders, including the Project Coordinator (ENEL), the technical manager (ENG), and the Steering Committee. This ensures ongoing feedback and oversight of project activities from inception to the conclusion of Smart5Grid.

Finally, the IPR and Innovation Management leader assumes also a mediation role in case of IP conflicts (see Section 3.6), monitors project activities and feeds the development of the subsequent versions of this report in the context of Smart5Grid.

3.5. Knowledge Management of the Project

IP management is a crucial aspect of the overall Smart5Grid project management framework, requiring continuous monitoring throughout the project lifecycle. A robust IPR management methodology is essential to outline procedures for handling newly generated or identified results from the project's outset.

Efficient IP management within Smart5Grid has been realized by implementing a systematic process for identifying IP results and ensuring their appropriate handling and protection. Mechanisms have been established to ensure timely and accurate capture of all IP-related information. Whenever new results are identified within specific work packages or tasks, the IPR and Innovation Management leader is promptly notified to introduce suitable protection measures and incorporate them into the overall IPR management strategy. Typically, such information surfaces during regular plenary meetings or when critical deliverables are being prepared.

The IPR and Innovation Management leader, along with the Project Management Office (PMO) and the partners responsible for generating the newly identified results, collaborate to screen and manage any IP-related issues arising during the project's lifespan. This collaboration involves jointly establishing the most appropriate and efficient IPR strategy tailored to the nature of the newly identified result and the consortium's objectives regarding its exploitation.

To facilitate this process, the Smart5Grid IPR management strategy has foreseen creating and updating a living IPR Matrix that consists of a set of tailored tables (see Section 4) to be revised and extended with new pieces of results and FG assets as the implementation activities of the Smart5Grid advance.

3.6. IP Conflicts

To preemptively mitigate potential conflicts related to IP, Smart5Grid project partners have received comprehensive guidance on IP regulations and exploitation processes. This guidance, facilitated by the IPR and Innovation Management leader, has empowered partners to identify their IPR results, establish ownership and exploitation claims, and transfer relevant results to Smart5Grid's exploitable results in accordance with the rights and obligations outlined in the Consortium Agreement[31].

The IPR and Innovation Management leader has provided support on various issues, including clarifying the definition of exploitable results, refining exploitation claims for compatibility, ensuring alignment between exploitation and ownership claims, addressing confidentiality concerns, and resolving potential IP conflicts among partners. Conflicting parties have been encouraged to engage in constructive dialogue and reach amicable solutions, supported by written agreements when necessary. Additionally, the establishment of future Joint Ownership Agreements (JoAs) has been initiated during the project, with contributions from participating beneficiaries agreed upon to lay the groundwork for potential IP conflicts resolution in the post-project phase.

In cases where conflicts persist beyond the project's duration, mediation processes outlined in the CA, such as those under the World Intellectual Property Organization (WIPO) Mediation Rules, will be employed to facilitate resolution[32]. This proactive approach to managing IP conflicts underscores the commitment of Smart5Grid to fostering collaboration and ensuring the smooth progression of the project.

[31] See Section 8 of the Smart5Grid Consortium Agreement
[32] See Section 11.8 of the Smart5Grid Consortium Agreement.

4. IPR Matrix Methodology

The Smart5Grid project employs an IPR management approach that involves the use of an IPR Matrix to address key IPR issues within the project's Innovation and IPR Management Strategy. This method facilitates the identification and management of background knowledge, foreground knowledge, and exploitable results, providing a comprehensive view of necessary IP protection measures and agreements to enable successful project exploitation.

The IPR Matrix methodology consists of four interconnected steps:

- Identification and consolidation of background IP, defining access rights among project partners.
- Identification and consolidation of foreground IP generated under Smart5Grid activities.
- Identification and consolidation of exploitable results, along with partners contributing to each result.
- Definition of a framework for IPR protection measures and exploitation types and pathways per partner for the identified Smart5Grid results to enhance post-project exploitation and commercialization.

Throughout the project, the Innovation and IPR Management Strategy of Smart5Grid has aimed to validate main results and confirm BG and FG IPs, while integrating evolving results and IPR approaches. This involved establishing an IP ownership regime among partners, defining suitable exploitation types and pathways for exploitable results, and considering rules for accessing these results. Additionally, external stakeholders and their potential benefits from Smart5Grid exploitable results were taken into account.

The structure of the IPR Matrix used during the project is outlined in Table 4, serving as a framework for managing IPR-related activities and decisions.

Background (BG)	Foreground (FG)	Exploitable results (ER)
• BG# • Partner's background • Contributing Partner • Short Description of BG • Type of Protection • How will it be utilized within Smart5Grid? • Conditions to use outside Smart5Grid • Conditions to use within Smart5Grid	• FG# • Project Result • Related WP • Contributing Partner(s) • Short Description of FG, Related BG# (BG owner) • Type of Protection • Conditions to Use within Smart5Grid • Conditions to use after the end of the project	• ER# • Exploitable result • Main contributing partner(s): direct contribution to ER development • Main Partner/owner • Further contributing partner(s): indirect support to ER development • Related FG#

Background (BG)	Foreground (FG)	Exploitable results (ER)
• Interested in further exploitation through Smart5Grid results	• Interest in further commercialization of project results	• Related project task/deliverable (if applicable) • Related BG# (BG owner) • Proposition for the ER-owner • Short description of the ER • Relevance for IP Protection

Table 4: IPR matrix

4.1. Identification of Background IP

The first table of the IPR matrix is that of the background technologies that were used during project implementation (see table 5).

#	Background IP	Contributing Partner	BG Number	Short Description	Type of Protection	How it will be utilised within Smart5Grid	Conditions to use within Smart5Grid	Conditions to use outsie Smart5Grid	Interest in further exploitation through Smart5Grid results

Table 5: Background IP matrix

In the first column of the BG Matrix, a distinct number is assigned to each BG result, as table index. Then in the second column the BG result is listed. In the second column the partner that owns the BG is defined. For each BG result used in the project, a distinct BG number per partner is also assigned (3rd column). In the 4th column, the description of the BG is inputted, while in the fifth column the type of IP protection is inserted (i.e. patent, copyright, utility etc). Thereafter, partners will also need to describe how the BG was utilized within the Smart5Grid project. Then, partners need to specify the conditions that the BG can be used within or outside Smart5Grid.Finally, partners should specify if further exploitation of the BG through project results is anticipated.

4.2. Identification of Foreground IP

As soon as the BG technologies are identified with all the relevant information, the project's foreground (FG) results also need to be registered, along with their IP protection type (where applicable).

WP #	#	Specific Project result	Main Contributing Partner(s)	Further Contributing Partner(s)	Related BG Number	Short description of FG	FG Number	Type of Protection	Conditions to use within Smart5Grid	Interest in further commercialisation	Conditions to use after the end of the project

Table 6: Foreground IP matrix

In the first column of table 6, the number of the WP within which the FG result was developed is noted. Then, in the second column, the table index of the FG result is provided. Moving on, the partners involved in the development of this result are defined. Thereafter, the related BG number that was utilized to develop the FG is to be included, as specified in the BG IPR Matrix. Thereafter, the conditions to use the FG within or outside the project are displayed, along with the interest in further commercialisation (or the absence of such an interest).

4.3. Identification of Exploitable Results

Based, on the identified FG, the Smart5Grid consortium has also defined the exploitable results along with their IP protection type.

ER#	Exploitable Results	Short description of the ER	Main partner(s)	Contributing partner(s)	Related FG number	Related BG number	Proposition for ER – owner	Relevance for IP protection

Table 7: Exploitable results matrix

In table 7, the relevant columns are displayed. In the first column the distinct ER number is requested. Thereafter, the name and description of the ER is requested, along with the Main partner and the contributing partners. In the 6th and 7th column, the FG and BG numbers are requested respectively. Finally, the ER owner needs to be defined, along with the relevance of possible IP protection. Overall, this matrix facilitates the identification of IP ownership and exploitation claims and hence, support partner decision related to IP protection and address occurring issues timely.

4.4. Identification of Exploitation interest per result

Table's 8 purpose is imperative in identifying the exploitation anticipations that each partner has for each one of the ERs that they contributed in the development of. Since different partners of different orientations (i.e. research oriented partners, industrial partners, universities etc.) contributed in the development of the Exploitable Results (ERs), it is reasonable that the expected individual interests in the exploitation of each result vary. To facilitate the smooth collaboration amongst partners along with the clear definition of the post-project exploitation plans, Table 8 will be used to present an overview of each partner's exploitation plans for each ER.

ER / Partners	1	2	3	…	X-2	X-1	X

Table 8: Identification of exploitation interest matrix (stage 1)

In the first column the Partner names are to be inputted. On the first row, the number of each ER is displayed. Thereafter, for each ER, all partners declare their exploitation intent (if any) as following:

- C: Commercial
- I: Internal for improving services/products within the partner organization
- R: Research
- O: Other

4.5. Identification of Exploitation pathway per result

Even though partners might share an interest in jointly utilizing resources, their approaches to determining the most effective exploitation method to enhance the impact of each ER can differ due to varying strategies and priorities. Establishing the exploitation strategy is as critical as deciding on the best way to protect an IP item. In this scenario, it's crucial to outline the preferred methods of exploitation among Smart5Grid partners who have a stake in the same ERs, as depicted in Table 9.

ER / Partners	1	2	3	…	X-2	X-1	X

Table 9: Identification of exploitation interest matrix (stage 2)

Similar to Table 8, the initial column lists the project partners, and the top row assigns a number to each ER, as outlined in Table 7. The table illustrating exploitation strategies is completed in the same way as in Table 8. However, in this instance, partners indicate their preferred methods of exploitation in each cell using one or more of the following abbreviations:

- M: Creating a product for sale.
- U: Leveraging the project's outcomes for internal advancement, such as:
    - creating additional products for sale;
    - utilizing findings in new research initiatives by R&D departments (both public and private).
- L: Granting licenses for the project's outcomes to external entities.
- S: Offering services, including consultancy and more.
- O: Other methods not listed above.

4.6. Allocation and terms of exercise of Joint Ownership

As per Article 26.2 'Joint ownership by several beneficiaries' of the Smart5Grid GA, two or more partners can exploit their own results jointly in the cases that they have generated them jointly. Partners can jointly exploit results via a written agreement (see appendix x for template), to ensure compliance with their obligations under this Agreement.

Table 10 below provides the template for indicating such joint exploitations in the case that partners proceed to such a form of exploitation.

		Main Parties Contribution (%)							
ER#	Key Exploitable Result								

Table 10: Joint exploitation template

4.7. Exploitation and sustainability plan methodology

Finally, Table 11, presents the IPR Matrix template referring to the exploitation and sustainability plan along with the description of actions. The template has been applied for the 11 Smart5Grid KERs, illustrating the links between IPR and exploitation. It contains information regarding the innovation name, TRL at the beginning and end of the project, type of exploitation, conflicting IPs, exploitation potential, SWOT info, as well as target market, Time to market, path to market and Expected ROI.

Innovation	TRL M01	TRL M39	
Type of Exploitation	Exploitation potential	Conflicting IP	
Strengths	Weaknesses	Opportunities	Risks
Targeted market	Time to market estimate	Expected ROI	
Path to market			

Table 11: Exploitation and sustainability matrix

5. Overview of Smart5Grid Results, Background and Foreground IP

5.1. Identified Exploitable Results of Smart5Grid

The main results of Smart5Grid, as identified, updated, and validated by the consortium at the final stage of the project, along with their description and the corresponding ER number, are presented in Table 12.

ER#	Result	Description
ER1	Open Service Repository (OSR)	The OSR service is the component of the Smart5Grid platform that offers the Application Programming Interfaces (APIs) allowing the interaction with the Network Applications either in the form of packaged application or source code. Moreover, the OSR is responsible to preserve logs on the actions performed on the stored Network Applications and VNFs.
ER2	V&V Verification component	It introduces a first phase of Network Application analysis used for checking the software code for errors introduced in the coding phase prior to its deployment. In this initial phase, the V&V is able to perform static checks over the end-to-end Network Application without the need of a target infrastructure or input data. Tests performed: *Syntax verification: Each piece of the Network Application chain is syntactically contrasted with the corresponding information model defined either by an external community or by Smart5Grid. * Integrity verification: This check detects bugs in the overall structure of descriptors through the inspection of references and identifiers both within and outside the individual descriptors. The integrity check ensures that the references are valid by checking the existence of the next component in the chain as well as the connection points (CPs) when applicable. * Topology verification: This check goes a step beyond the integrity verification by executing a set of mechanisms to verify the individual and end-to-end network connectivity graph. Unlinked and unreferenced components are detected per descriptor as well as unintentional functional blocks based on the definition of the objective of each key in the corresponding information model, e.g., invalid internal to external CPs mappings, unexposed internal CPs that are not marked as management CPs, network loops and cycles etc.

ER#	Result	Description
ER3	Network Application Controller module of NearbyOne	Network application controller at the Edge of the network using extensible APIs for open-format service onboarding
ER4	V&V Handler	The V&V Handler is part of a larger system and is responsible for the traceability of the Network Apps, giving visibility to Network App developers of the test results with the goal of improving the quality of the application. To achieve this, the V&V Handler interfaces with several components, namely the OSR, Verification Engine and Network App Controllers, receiving requests and storing the test results.
ER5	Network Application Controller 2 – Local registry component	The local registry is responsible for supporting the onboarding of the Network Application package to the Network Application controller, so that the Network Application can be deployed. The main functionalities are: *API: exposes the different endpoints, which allow the NBI to incorporate a Network Application package with all subcomponents; it can list the Network Application packages according to the chosen type of package it can return the Network Application descriptor if requested by the LCM to perform the Network Application deployment, and also the update and deletion of the packages. *Storage: supports storing and maintaining all types of artefacts involved in a 5G deployment, including Network Function Descriptors and Packages (Network Application, NSD, VNFD), Helm Charts and Container Images. Each of these packages will be stored and exposed using the appropriate service according to the package type. *Provisioning: the system is capable of provisioning a 5G infrastructure by configuring the full NFV MANO stack to be able to access those devices and onboarded directly in the NFVO the NSDs and VNFDs.
ER6	Network Application Controller 2 – Kafka system (Telemetry component)	Telemetry component: Support the LCM in decision for smart placement of Network Applications. The telemetry component, composed of a particular instantiation of the software, supports the LCM in the smart placement of Network Applications, depending on the environmental and contextual information. The software architecture is based mainly on Kafka broker, used as a messaging system or more precisely as event bus to process and distribute streams of data in real time, allowing systems and applications to communicate with each other and process data as it is generated.

ER#	Result	Description
ER7	Edge Node: equipment for local breakout of 4G.5G traffic and edge computing	This equipment is installed within a mobile cellular network, as part of its Core Network and in communication with the Radio Access Network (RAN). The edge node contains all user plane functionalities and is conceived to be placed at the edge of the network to allow local breakout of traffic, from the RAN to edge computing facilities and vice versa. Thus, the user data exchange between User Equipment and applications at the edge is rapid, secure, and does not overload the networks backhaul.
ER8	Network Application UC1 (Automatic Power Distribution Grid Fault Detection)	Network Application in MEC Server able to analyse traffic in the 5G network.
ER9	Network Application UC2 (Remote Inspection of Automatically Delimited Working Areas at Distribution Level)	Network Application that can recognize personnel and the tools they carry upon entering a primary power substation
ER10	Network Application UC3 (msec-level precise distributed generation monitoring)	Network Application with three virtual network functions: 1) real time monitoring of RES performance parameters (energy, technical and environmental), 2) Predictive maintenance enabler for RES/ DER, 3) MQTT broker. The real time monitoring of RES performance parameters' function allows RES/ DER owners and grid operators to have information in real time about the asset performance for improved asset and grid management. The predictive maintenance enabler functionality receives and stores RES performance data that can be used for improved asset management and control and further on, compiled with similar data from other RES units, could be used by predictive maintenance service providers to develop and implement predictive maintenance algorithms. MQTT broker functionality acts as a cost effective, secure communication unit/ broker that allows different data flows, data, signals and other relevant information to be communicated over 5G and used by this application or other similar 5G applications.
ER11	MQTT broker	An additional functionality that can act as a stand-alone service of UC3's Network Application Architecture, which allows different signals or data,

ER#	Result	Description
		from different sources to be received by the application. Currently for the purpose of UC3 use case the MQTT VNF 1) receives data from RES devices and provides them to designated services and 2) receives alarms messages and communicates them to RES owner/TSO.
ER12	Network Application UC4 (real-time wide area monitoring of cross-border power exchange)	Network application implementing PMU-based monitoring of a wide area power grid
ER13	Project Deliverables	Dissemination material and reports demonstrating: 1) State-of-art energy distribution-transition concerns; 2) Network Applications that will be used within the project's demonstration; 3) Requirements and targeted KPIs for the project's use cases; 4) Design, implementation and usability of the developed Network Applications; 5) Overall performance of the Smart5Grid solution and project findings; 6) Smart5Grid Market Analysis, Business Modelling and exploitation report; 7) Smart5Grid Innovation; 8) Smart5Grid Standardisation attempts, audit and certification activities; 9) Additional deliverables or reports with further exploitation potentials.
ER14	Publications	Publications (e.g., academic, scientific, commercial, etc.) stemming from the Smart5Grid findings. These can include scientific publications, articles in various mediums and business-oriented publications

Table 12: Smart5Grid's exploitable results

5.2. Background IP

The main background IP to be used so as to achieve the objectives of Smart5Grid, as identified and validated by the consortium at the final stage of the project, along with their description and the corresponding BG number, are presented in Table 13.

#	Background IP	Contributing Partner	BG No	Short Description	Type of Protection	How it will be utilised within Smart5Grid	Conditions to use within Smart5Grid	Conditions to use outside Smart5Grid	Interest in further exploitation through Smart5Grid results
1	Wide area monitoring and control algorithms for transmission grid.	UCY	BG 1.1	Advanced monitoring and control algorithms which use PMU technology to assess stability of the transmission grid	copyright	It was used and further developed as part of the real-time hardware in the loop (RT-HIL) pre-piloting tests for UC3 and UC4. In the case of UC3, a wide area controller was developed as a complementary application for the pilot, while for UC4 a wide area protection application was	Free to use within the project	Not possible to use outside Smart5Grid	Development of further research and innovations.

#	Background IP	Contributing Partner	BG No	Short Description	Type of Protection	How it will be utilised within Smart5Grid	Conditions to use within Smart5Grid	Conditions to use outside Smart5Grid	Interest in further exploitation through Smart5Grid results
						developed to complement the UC4 pilot.			
2	Algorithms for ancillary services provision for reactive support, phase balancing, and peak shaving services for both transmission and distribution power network operators.	UCY	BG 1.2	These algorithms are innovative solutions which allows the assessment of eligibility for a specific generating unit to provide these types of services to the grind operators.	copyright	Two of this suite of algorithms (frequency support and ramping rate compensation) were further elaborated according to the needs of the Bulgarian Pilot as a complementary application for the pilot. They were tested and validated as part of WP3 activities and reported in D3.4.	Free to use within the project	Not possible to use outside Smart5Grid	Contribute to further research and innovation as part of future research projects.
3	Digital twin models in real time simulator for several	UCY	BG 1.3	Specialized, high-fidelity	copyright	Used extensively as part of WP3,	Free to use	Not possible to	Contribute to further research

#	Background IP	Contributing Partner	BG No	Short Description	Type of Protection	How it will be utilised within Smart5Grid	Conditions to use within Smart5Grid	Conditions to use outside Smart5Grid	Interest in further exploitation through Smart5Grid results
	real and testbed systems both for transmission and distribution level.			replicas of actual power grids and plant models (e.g., RES units) which reproduce in hard-real-time the actual operation of the physical system.		Task 3.4 – pre-piloting tests using RT-HIL technology, as well as for validating scenarios which could not be tested in the actual pilots due to the invasive nature of the test (e.g., model grids faults to assess the responsiveness of an innovative controller for the plant)	within the project	use outside Smart5Grid	and innovation as part of future research projects.
4	SCADA-like software (backend and frontend) to automate the operation of a digital twin power system. The software includes API to exchange measurement	UCY	BG 1.4	Platform for real-time measurements and set-points exchange	copyright	Used together with the RT-HIL infrastructure for advanced testing and validation in the pre-piloting	Free to use within the project	Not possible to use outside Smart5Grid	Contribute to further research and innovation as part of future research projects.

#	Background IP	Contributing Partner	BG No	Short Description	Type of Protection	How it will be utilised within Smart5Grid	Conditions to use within Smart5Grid	Conditions to use outside Smart5Grid	Interest in further exploitation through Smart5Grid results
	and setpoints between actual devices (PMUs, PDC, smart meters, smart inverters) and the real time simulator. Software interfaces with following protocols IEEE C37.118, IEC 61850, and Modbus TCP.			between the digital-twin testbed and the actual power or measurement infrastructure from the field.		stage of the UC3 and UC4.			
5	HPE's commercial 4-5G core network solution deployed on premises (full on-site)	HPE (former Athonet)	BG 2.1	Complete software-based mobile packet core solution for centralised or highly distributed edge-cloud 4G and 5G deployments	HPE End User License Agreement	Deployment of user plane functionalities and integration with WI3's commercial mobile network in the scope of UC-1's activities	Free to use within the project	Not possible to use outside Smart5Grid	Yes
6	Nearby One and Nearby Blocks	NBC	BG 3.1	An end-to-end orchestration platform for edge deployments,	Licensed	Network App controller for UC1, UC3 and UC4	Free to use within the project	Subject of licensing agreement	Yes

#	Background IP	Contributing Partner	BG No	Short Description	Type of Protection	How it will be utilised within Smart5Grid	Conditions to use within Smart5Grid	Conditions to use outside Smart5Grid	Interest in further exploitation through Smart5Grid results
				including NFVs, applications and infrastructure.					
7	OTE commercially available 5G mobile network	OTE	BG 4.1	OTE's 5G commercial Network is deployed according to the project time plan in order to cover efficiently the PMUs via its 5G NSA infrastructure	Commercial 5G Network, hardware ownership, software copyrights	Interconnection of the Phasor Measurement Units (PMUs) of IPTO towards the edge/cloud server	Partners may use it after requesting access from the Provider	Not possible to be used post-project	No
8	PMU – PDC toolchain	IPTO	BG5.1	Knowledge regarding synchro-phasor and IoT systems	Trade secret	Provision of specifications for the development of UC4 Network Application	Only used by IPTO	Cannot be used outside Smart5Grid	Yes, through future research and internally

#	Background IP	Contributing Partner	BG No	Short Description	Type of Protection	How it will be utilised within Smart5Grid	Conditions to use within Smart5Grid	Conditions to use outside Smart5Grid	Interest in further exploitation through Smart5Grid results
				deployed on the transmission grid					
9	Wind/hydro power plant performance data	EE	BG6.1	Data from various parameters of EE's wind and hydro power plants coming from different sensors/systems.	Proprietary data	Development and implementation of UC3's Network Application	Partners may use it after requesting access and only for project-related work and activities	Under NDA for third-party experimentation for the development of algorithms and services	As part of UC3's exploitable results
10	Network application software	SC	BG7.1	Knowledge regarding development of network applications	Trade secret	Development and implementation of UC3 and UC4 Network Application	Partners may use it	Free to use	Yes
11	DevOps and GitOps tooling	UW	BG8.1	CI/CD knowledge;	Copyright	Development of the V&V Handler component.	Free to use within	not possible to use	No

#	Background IP	Contributing Partner	BG No	Short Description	Type of Protection	How it will be utilised within Smart5Grid	Conditions to use within Smart5Grid	Conditions to use outside Smart5Grid	Interest in further exploitation through Smart5Grid results
				k8s and docker based workloads; Knowledge of the ETSI architecture ETSI/NFV/OSM and other related components.			the project	outside Smart5Grid'	

Table 13: Smart5Grid's background IP

5.3. Foreground IP

Considering the Smart5Grid's results, the project partners were given the opportunity to update and validate the Foreground IP, based on the final results of the project that occurred in the completion of the implementation phase. The updated content in Table 14.

WP #	#	Project result (PR)	Main Contributing Partner(s)	Further Contributing Partner(s)	Related BG Number	Short description of FG	FG Number	Type of Protection	Conditions to use within Smart5Grid	Interest in further commercialisation	Conditions to use after the end of the project
3	3.1	OSR (Open Smart5Grid Repository)	AXON	ENG, 8BELLS, UW, SID, SC, AXON	-	The OSR service is the component of the Smart5Grid platform that offers the Application Programming Interfaces (APIs) allowing the interaction with the Network Apps either in the form of packaged application or source code. Moreover, the OSR is	FG 3.1	Open-source & Copyright	Free to use	Yes	Free to use

WP #	#	Project result (PR)	Main Contributing Partner(s)	Further Contributing Partner(s)	Related BG Number	Short description of FG	FG Number	Type of Protection	Conditions to use within Smart5Grid	Interest in further commercialisation	Conditions to use after the end of the project
						responsible to preserve logs on the actions performed on the stored Network Apps and VNFs.					
3	3.2	Network Application Controller module of NearbyOne	Nearby Computing	-	BG 3.1	Network application controller at the Edge of the network using extensible APIs for open-format service onboarding	FG 3.2	Copyright	Free to use	Yes	Licence fee based on partners agreement
4	4.1	V&V Handler	Ubiwhere	UW	BG 8.1	The V&V Handler is part of a larger system that and is responsible for the traceability of the Network Applications, giving visibility to Network Application developers of the test	FG 4.1	Open Source & Copyright	Free to use	No	Free to use

WP #	#	Project result (PR)	Main Contributing Partner(s)	Further Contributing Partner(s)	Related BG Number	Short description of FG	FG Number	Type of Protection	Conditions to use within Smart5Grid	Interest in further commercialisation	Conditions to use after the end of the project
						results with the goal of improving the quality of the application. To achieve this, the V&V Handler interfaces with several components, namely the OSR, Verification Engine and Network App Controllers, receiving requests and storing the test results.					
4	4.2	V&V - Verification component	ATOS	-	-	It introduces a first phase of Network Application analysis used for checking the software code for errors introduced in the coding phase prior to its deployment. In this initial phase, the V&V is able to	FG 4.2	Apache 2.0 & Copyright	Free to use. Source Code not available unless otherwise explicitly agreed	Yes	Under Fair and Reasonable Conditions to be agreed. Source Code not available unless

WP #	#	Project result (PR)	Main Contributing Partner(s)	Further Contributing Partner(s)	Related BG Number	Short description of FG	FG Number	Type of Protection	Conditions to use within Smart5Grid	Interest in further commercialisation	Conditions to use after the end of the project
						perform static checks over the end-to-end Network Application without the need of a target infrastructure or input data.					otherwise explicitly agreed
4	4.3	Network application controller 2 - Local Registry	ATOS	-	-	The local registry is responsible for supporting the onboarding of the Network Application package to the Network Application controller, so that the Network Application can be deployed.	FG 4.3	Apache 2.0 & Copyright	Free to use. Source Code not available unless otherwise explicitly agreed	Yes	Under Fair and Reasonable Conditions to be agreed. Source Code not available unless otherwise explicitly agreed.
4	4.4	Network application Controller 2 - Kafka	ENG	I2CAT, SID, SC	-	The telemetry component, composed of a particular instantiation	FG 4.4	Open Source & Copyright	Free to use	Yes	Licence fee based on partners agreement

WP #	#	Project result (PR)	Main Contributing Partner(s)	Further Contributing Partner(s)	Related BG Number	Short description of FG	FG Number	Type of Protection	Conditions to use within Smart5Grid	Interest in further commercialisation	Conditions to use after the end of the project
		System (Telemetry Component)				of the software, supports the LCM in the smart placement of Network Applications, depending on the environmental and contextual information.					
5	5.1	Network Application UC1 (Automatic Power Distribution Grid Fault Detection)	STAM, ENEL	ENEL, ENG, WI3	-	Network Application in MEC Server able to analyze traffic in the 5G network	FG 5.1	Copyright	Free to use	Yes	Licence fee based on partners agreement
5	5.2	Network Application UC2 (Remote Inspection of	SID	ENEL, I2CAT, NOSIA	-	Automated system that can recognise personnel and the tools they carry upon	FG 5.2	Copyright	Free to use	Yes	Licence fee based on partners agreement

WP #	#	Project result (PR)	Main Contributing Partner(s)	Further Contributing Partner(s)	Related BG Number	Short description of FG	FG Number	Type of Protection	Conditions to use within Smart5Grid	Interest in further commercialisation	Conditions to use after the end of the project
		Automatically Delimited Working Areas at Distribution Level)				entering a primary power substation					
6	6.1	Network Application UC3 (msec-level precise distributed generation monitoring)	EE, SC	UBE, NIS, UCY, SETETCHCO	BG 6.1, BG 7.1	Network Application with three virtual network functions: 1) real time monitoring of RES performance parameters (energy, technical and environmental), 2) Predictive maintenance enabler for RES/ DER, 3) MQTT broker.	FG 6.1	Copyright	Free to use	Yes	Licence fee based on partners agreement
6	6.2	MQTT VNF	SC, EE	UBE, NIS, UCY, SETETCHCO	-	A secure, low-latency bidirectional communication protocol bridges	FG 6.2	Copyright	Free to use	Yes	Licence fee based on partners agreement

WP #	#	Project result (PR)	Main Contributing Partner(s)	Further Contributing Partner(s)	Related BG Number	Short description of FG	FG Number	Type of Protection	Conditions to use within Smart5Grid	Interest in further commercialisation	Conditions to use after the end of the project
						energy needs, IoT, and 5G. It enables affordable data reception from various IoT devices in small renewable energy systems for UC3 applications. This protocol facilitates connectivity for IoT devices, extending service potential to backup solutions, monitoring, and third-party services like predictive maintenance and balancing.					
6	6.3	Network Application UC4 (Real-time Wide	SC	OTE, NIS, IPTO, ESO, UoA, UCY, UBE, SETECHCO	BG 4.1, BG5.1, BG7.1	Network application implementing PMU-based monitoring of a wide area power grid	FG 6.3	Copyright	Free to use	Yes	Licence fee based on partners agreement

WP #	#	Project result (PR)	Main Contributing Partner(s)	Further Contributing Partner(s)	Related BG Number	Short description of FG	FG Number	Type of Protection	Conditions to use within Smart5Grid	Interest in further commercialisation	Conditions to use after the end of the project
		Area Monitoring)									
All	PR 1	Publications	ENEL (as co-ordinator)	All Authors	N/A	Publication material stemming from the project's outputs. Produced jointly or individually by partners	FG 1	Copyright	Free to use	Yes	Free to use under open-data status
All	PR 2	Project Deliverables	ENEL (as co-ordinator)	All Authors	N/A	Dissemination material, reports etc. to be published during the project	FG 2	Copyright	Free to use	No	Depends on each project deliverable

Table 14: Smart5Grid's Foreground IP

6. Exploitation and valorisation plan

To facilitate the development of the exploitation and valorization strategy, the project's IPR manager (8Bells) created a specialized IPR matrix table and shared it with all consortium members. This allowed partners to detail their plans for utilizing the project outcomes, specifying the nature of their interest (commercial, internal use within their organization, research, or other) and the intended pathways for exploiting specific results from the Smart5Grid project, both during and after its conclusion. The matrix also served as a tool for gathering critical insights on the rights and responsibilities envisioned by each partner concerning the exploitation of the project's results. This proactive approach enabled the IPR manager to identify and address potential intellectual property conflicts early on by conducting one-on-one consultations with partners to understand and resolve any claims over the results.

For every identified project result, partners were required to articulate their exploitation interests, categorizing them into commercial, internal (for enhancing certain processes or products within their own organization), research, or other uses. The gathered information was then structured into an exploitation and valorization plan. This plan outlined the IP strategy for each exploitable outcome, detailed the exploitation interests and routes for each partner within Smart5Grid, and prioritized the results to effectively align them with the needs and value propositions for specific stakeholder groups.

Throughout the project, and extending to month 40, this plan underwent continuous refinement through multiple review cycles with the partners. This iterative process was designed to incorporate new data and feedback from within the consortium, ensuring the strategy remained aligned with the evolving project landscape and partner discussions.

6.1. Exploitable result and ownership proposition

Table 15 showcases a comprehensive inventory of all Smart5Grid outcomes identified as having potential for exploitation, including the primary partners responsible for their development and those who played a supportive role. Additionally, it details the BG and FG intellectual property associated with each project result. The table also includes a finalized ownership proposal for each outcome, as reviewed and agreed upon by both the leading and contributing partners. Furthermore, it outlines the most appropriate strategies for safeguarding each result.

ER#	Exploitable result	Main Partner(s)	Contributing Partners	FG#(related)	BG# (related)	Proposition for ER – Owner	Relevance for IP protection
1	Open Service Repository (OSR)	AXON	-	FG 3.1	-	AXON	Copyright
2	V&V Verification component	ATOS	-	FG 4.2	NA	ATOS	Under Fair and Reasonable Conditions to be agreed. Source Code not available unless otherwise explicitly agreed
3	Network Application Controller module of NearbyOne	NBC	-	FG 3.2	BG 8.1	NBC	Copyright, Patent or Utility Model
4	V&V Handler	UW	-	FG 4.1	NA	UBW	Copyright
5	Network Application Controller 2 – Local registry component	ATOS	-	FG 4.3	NA	ATOS	Under Fair and Reasonable Conditions to be agreed. Source Code not available

ER#	Exploitable result	Main Partner(s)	Contributing Partners	FG#(related)	BG# (related)	Proposition for ER – Owner	Relevance for IP protection
							unless otherwise explicitly agreed
6	Network Application Controller 2 – Kafka system (Telemetry component)	ENG	I2CAT, ATOS, SID, SC	FG 4.4	-	ENG	Copyright
7	Edge Node: equipment for local breakout of 4G.5G traffic and edge computing	HPE/ATH	-	-	BG 2.1	HPE/ATH	HPE End User License Agreement
8	Network Application UC1 (Automatic Power Distribution Grid Fault Detection)	STAM, ENEL, WI3	ENG	FG 5.1	?	STAM, ENEL	Copyright, Patent or Utility Model
9	Network Application UC2 (Remote Inspection of Automatically Delimited Working Areas at Distribution Level)	SID, ENEL, i2CAT	NOSIA	FG 5.2	-	SID, ENEL	Copyright, Patent or Utility Model
10	Network Application UC3 (msec-level precise distributed	EE, SC, NIS	UBE, UCY, SETETCHCO	FG 6.1	BG 9.1, BG 10.1	EE, SC,	Copyright, Patent or Utility Model

ER#	Exploitable result	Main Partner(s)	Contributing Partners	FG#(related)	BG# (related)	Proposition for ER – Owner	Relevance for IP protection
	generation monitoring)						
11	MQTT VNF	EE, SC	UBE, NIS, UCY, SETETCHCO	FG 6.2	BG 9.1	EE, SC	Copyright, Patent or Utility Model
12	Network Application UC4 (real-time wide area monitoring of cross-border power exchange)	SC, IPTO, ESO, NIS, OTE	UoA, UCY, UBE, SETECHCO	FG 6.3	BG 7.1, BG8.1, BG10.1	SC, IPTO, ESO	Copyright, Patent or Utility Model
13	Project Deliverables	All partners	N/A	FG 2	All BG	Per the GA	Copyright
14	Publications	All partners	N/A	FG 1	All BG	To be defined	Copyright

Table 15: Smart5Grid's exploitable results and ownership

6.2. Potential exploitation types

As discussed in Section 4.4, the interest in exploitation varies among consortium members in R&D projects with large consortia for various reasons, such as differences in strategic priorities or the organizational nature. The primary exploitation avenues common in Horizon R&D projects, now applied to the Smart5Grid IPR strategy, are outlined below:

6.2.1. Commercial

The commercial exploitation avenues identified below aim to utilize the project's outcomes with a commercial objective: to increase profits and/or market competitiveness for the partners involved:

- Supply Smart5Grid outcomes to telecommunication operators for network improvements.
- Supply Smart5Grid outcomes to electricity grids operators for efficiency improvements.
- Market Smart5Grid outcomes to IoT companies focusing on device optimization.
- Assist organizations with Smart5Grid outcomes in multi-criteria assessments of evolving ICT components.
- Enhance R&D in SMEs and corporations within 5G networks and smart grids using Smart5Grid outcomes.
- Employ Smart5Grid results to standardizing new concepts under the maxim of balancing efficiency, low latency and interoperability.
- Gradually replace existing services running on Wi-Fi/4G or other networks with Smart5Grid outcomes.
- Create joint ventures with distributors across various sectors (network operators, IoT device manufacturers, etc.) to exploit Smart5Grid results.
- Integrate Smart5Grid outcomes into platforms and networks for stakeholders like researchers, companies, electricity distributors, governmental agencies, aiding in policy-making.
- Promote Smart5Grid outcomes to stakeholders in sectors closely linked to IoT and 5G, such as smart transportation, smart cities, the building industry, AR/VR, e-health, etc.
- A comprehensive analysis of the commercial potential of Smart5Grid results is presented in D7.6 – "Market Analysis, Business Modelling and exploitation Report,".

6.2.2. Internal

The "Internal" exploitation type refers to using project outcomes to enhance an organization's internal processes or products. Smart5Grid partners anticipate utilizing the results as follows:

- Enhance internal processes/products related to electricity generation, distribution and transmission as well as 5G networks programmability for performance improvement.
- Incorporate Smart5Grid outcomes to expand their portfolio and refine existing products.
- Leverage Smart5Grid outcomes to boost knowledge, conduct further research, and explore new opportunities.

6.2.3. Research

The "Research" exploitation type involves using project results for scientific purposes, potentially leading to new research projects, publications, or novel research concepts, without immediate commercialization intent. Smart5Grid partners envisage the following research exploitation paths:

- Utilize Smart5Grid results for ongoing and future research projects, particularly by academic researchers and research centers.
- Advance research collaborations between industry, academia, and government in Energy distribution/transmission automation, IoT, and 5G networks programmability.

6.2.4. Other

The "Other" category encompasses exploitation types not covered under commercial, research, or internal categories, potentially including civic, humanitarian, or policy-related purposes, such as making Smart5Grid results available to open-source communities or enhancing the operational efficiency of energy grids.

As of now, no specific "Other" exploitation types have been identified by Smart5Grid partners. Any future findings in this category will be incorporated into the final version of the Innovation and IPR Management Strategy.

6.3. Exploitation types and pathways per Smart5Grid partner

Table 16 outlines the varied exploitation interests of each partner regarding the Exploitable Results, based on their role as either a lead or contributing entity in the development of the respective outcomes, as detailed in Table x-1. Partners had the option to categorize their interest in each asset into one of four distinct exploitation types: (i) C – Commercial, (ii) I – Internal, (iii) R – Research, (iv) O – Other. Given that the project is nearing completion, the partners' interests in exploitation have been updated to reflect the latest project advancements. To adhere to the intellectual property rights (IPR) (co)ownership of the Network Applications, specifically for the 4 Smart5Grid Network Applications, a partner was eligible to declare a Commercial Exploitation interest only if they were identified as a Main Partner (referenced in Table 7). Thus, Table 8 serves as the definitive declaration of exploitation interest among Smart5Grid partners.

ER / Partners	1 (KER)	2	3	4	5	6	7	8 (KER)	9 (KER)	10 (KER)	11	12 (KER)	13	14
ENEL + E-dis	-	-	-	-	-	-	-	R, I, C	R, I, C	-	-	-	I, R	I, R
ENG	-	-	-	-	-	R, I, C	-	R, I	-	-	-	-	I, R	I, R
WI3	-	-		-	-	-	-	R, I	-	-	-	-	I, R	I, R
OTE	-		-				-	-	-	-	-	R, I	I, R	I, R
NIS	-	-	-	-	-	-	-	-	-	R	R	R, I	R	R
ATOS	-	R, I, C			R, I, C		-	-	-	-	-	-	R	R
IPTO	-	-	-	-	-	-	-	-	-	-	-	R, I	I, R	I, R
ESO	-	-	-	-	-	-	-	-	-	-	-	R, I	R	R
I2CAT	-	-		-	-	R	-	-	R	-	-	-	R	R
UoA	-	-	-	-	-	-	-	-	-	-	-	R	R	R
UCY		-		-	-	-	-	-	-	R	R	R	R	R
8BELLS			-				-	-	-	-	-	-	R	R
HPE/ATH	-	-	-	-	-	-	R, I, C	-	-	-	-	-	R	R
UW	-	-	-	R, I	-	-	-	-	-	-	-	-	R	R
NBC	-	-	R, I	-	-	-	-	-	-	-	-	-	R	R
UBE	-		-				-	-	-	R	R, I	R	R	R
SID	-		-			R	-	-	R, I, C	-	-	-	R	R
INF	-	-	-	-	-	-	-	-	-	-	-	-	R	R

ER / Partners	1 (KER)	2	3	4	5	6	7	8 (KER)	9 (KER)	10 (KER)	11	12 (KER)	13	14
SC	-		-			R	-	-	-	R, I, C	R, I, C	R, I, C	R	R
EE	-	-	-	-	-	-	-	-	-	R, I, C	R, I, C	-	I, R	I, R
AXON	R, I, C					-	-	-	-	-	-	-	R	R
NOSIA	-	-	-	-	-	-	-	-	I	-	-	-	R	R
SETECHCO	-	-	-	-	-	-	-	-	-	R, I	R, I	-	R	R
STAM	-	-	-	-	-	-	-	R, I, C	-	-	-	-	R	R

Table 16: Exploitation types per partner

Table 17 illustrates the exploitation strategies for each partner concerning the Exploitable Results, considering whether a partner has led or contributed to the development of the respective outcome, as outlined in Table 14. Initially, partners were given the choice of five different pathways for exploiting each asset: (i) M: Creating a product for sale, (ii) U: Utilizing the project results internally to aid further development, such as creating additional products for sale or enabling R&D departments (both public and private) to leverage the findings in new research endeavours, (iii) L: Licensing the project outcome to external parties, (iv) S: Offering Services like consultancy, (v) O: Other approaches. With the project nearing its conclusion, partners were prompted to review and, if necessary, revise their chosen exploitation path for one or several exploitable outcomes. Consistent with the IPR (co)ownership rules for the 4 Smart5Grid Network Applications, only partners recognized as Main Partners (as per Table 14) were permitted to choose a commercialization-focused exploitation path for a particular Network Application (e.g., manufacturing and selling a product; licensing the project outcome; or providing a service such as consultancy). For other project results, contributing partners are allowed to offer services such as consulting, training or operational support. Therefore, Table 17 serves as the definitive articulation of the consortium's view on the appropriate exploitation pathways for Smart5Grid results.

ER / Partners	1 (KER)	2	3	4	5	6	7	8 (KER)	9 (KER)	10 (KER)	11	12 (KER)	13	14
ENEL + E-dis	-	-	-	-	-	-	-	U, S	U, S	-	-	-	U	U
ENG						U, S	-	U	-	-	-	-	U	U
WI3	-	-		-	-	-	-	U	-	-	-	-	U	U
OTE	-	-			-	-	-	-	-	-	-	U	U	U

ER / Partners	1 (KER)	2	3	4	5	6	7	8 (KER)	9 (KER)	10 (KER)	11	12 (KER)	13	14
NIS	-	-	-	-	-	-	-	-	-	U	U	U	U	U
ATOS	-	U, S	-		U, S		-	-	-	-	-	-	U	U
IPTO	-	-	-	-	-	-	-	-	-	-	-	U	U	U
ESO	-	-	-	-	-	-	-	-	-	-	-	U	U	U
I2CAT	-	-		-	-	U	-	-	U	-	-	-	U	U
UoA	-	-	-	-	-	-	-	-	-	-	-	U	U	U
UCY		-		-		-	-	-	-	U	U	U	U	U
8BELLS		-	-		-	-	-	-	-	-	-	-	U	U
HPE/ATH	-	-	-	-	-	-	U, L	-	-	-	-	-	U	U
UW				U			-	-	-	-	-	-	U	U
NBC	-	-	U	-	-	-	-	-	-	-	-	-	U	U
UBE	-		-				-	-	-	U	U	U	U	U
SID	-		-			U	-	-	U, S, L	-	-	-	U	U
INF	-	-	-	-	-	-	-	-	-	-		-	U	U
SC	-		-			U	-	-	-	U, S, L	U, S, L	U, S, L	U	U
EE	-	-	-	-	-	-	-	-	-	U, S, L	U, S, L	-	U	U
AXON	U, S	-			-	-	-	-	-	-	-	-	U	U
NOSIA	-	-	-	-	-	-	-	-	U	-	-	-	U	U
SETECHCO	-		-	-		-	-	-	-	U	U	-	U	U
STAM	-	-	-	-	-	-	-	U, S, L	-	-	-	-	U	U

Table 17: Exploitation strategy per partner

6.4. Publications and project deliverables with an exploitation potential

In the span of collaborative research initiatives like Smart5Grid, a substantial volume of publications is anticipated, as these projects are designed to advance research beyond current knowledge and practices. Such publications often feature multiple authors from various organizations, and the research outlined in these scientific papers constitutes IP protected under copyright law held by the authors. Similarly, certain project deliverables may contain innovative information that surpasses existing knowledge and holds potential for exploitation. In these instances, authors from different consortium organizations might seek to safeguard their IP rights. The Smart5Grid consortium has pinpointed project deliverables that contain innovative, exploitable information from the authors' viewpoint (labelled as ER 14) and publications generated during the project's lifecycle (labelled as ER 15). These deliverables and publications are recognized as IP assets of the project. To catalogue the relevant deliverables and publications, Table 18 outlines a comprehensive list of articles published within the Smart5Grid framework or submitted deliverables that have an exploitation interest for each partner. For a more detailed analysis revise D7.5.

Type of IP result	Title	Author(s)	Exploitation Interest	Lead Partner(s)	Comments(optional)
Publication	Demonstration of 5G Solutions for Smart Energy Grids of the Future: A Perspective of the Smart5Grid Project, Distribution Grid Management Based on the Use of 5G Communication, MDPI, Energies, Volume 15, Issue 3, 24 January 2022	Daniele Porcu, Sonia Castro, Borja Otura Paula Encinar, Ioannis Chochliouros, Irina Ciornei, Lenos Hadjidemetriou, Georgios Ellinas, Rita Santiago, Elisavet Grigoriou, Angelos Antonopoulos, Nicola Cadenelli, Nicola di Pietro, August Betzler, Inmaculada Prieto, Fabrizio Battista, Dimitrios Brodimas, Ralitsa Rumenova and Athanasios Bachoumis	R	ENEL	Published in 'Energies' Journal https://doi.org/10.3390/en15030839

Type of IP result	Title	Author(s)	Exploitation Interest	Lead Partner(s)	Comments(optional)
Publication	5G Communications as "Enabler" for Smart Power Grids: The Case of the Smart5Grid Project	Daniele Porcu, Ioannis P. Chochliouros, Sonia Castro, Giampaolo Fiorentino, Rui Costa, Dimitrios Nodaros, Vaios Koumaras, Fabrizio Brasca, Nicola di Pietro, George Papaioannou, Irina Ciornei, Antonios Sarigiannidis, Nikolay Palov, Teodor Bobochikov, Charilaos Zarakovitis, Anastasia S. Spiliopoulou	R	OTE	Proceedings of the AIAI-2021 (Artificial Intelligence Applications and Innovations) International Conference, *June 25-27*, *2021*, Hersonissos, Crete, Greece (Virtual Conference). In: I. Maglogiannis, J. Macintyre and L. Iliadis. (Eds.), Artificial Intelligence Applications and Innovations (AIAI) 2021 IFIP WG 12.5 International Workshops: 5G-PINE 2021, AI-BIO 2021, DAAI 2021, DARE 2021, EEAI 2021and MHDW 2021; IFIP Advances in Information and Communication Technology (AICT), vol.628, pp.7-20. Springer Nature Switzerland AG. ISBN: 978-3-030-79156-8; (eBook): 978-3-030-79157-5; ISSN: 1868-4238; ISSN (electronic): 1868-422X. DOI: https://doi.org./10.1007/978-3-030-79157-5_1

Type of IP result	Title	Author(s)	Exploitation Interest	Lead Partner(s)	Comments(optional)
Publication	Fundamental Features of the Smart5Grid Platform Towards Realizing 5G Implementation	I.P. Chochliouros, D. Porcu, S. Castro, B. Otura, P. Encinar, A. Corsi, I. Ciornei, R. Santiago, A. Antonopoulos, N. Cadenelli, N. di Pietro, A. Betzler, I. Prieto, F. Batista, E. Grigoriou, G. Ellinas, L. Hadjidemetriou, D. Brodimas, R. Rumenova, A. Bachoumis, A.S. Spiliopoulou, M. Rantopoulos, C. Lessi, D. Arvanitozisis and P. Lazaridis. In: I. Maglogiannis, L. Iliadis, J. Macintyre and P. Cortez	R	OTE	Proceedings of the Artificial Intelligence Applications and Innovations (AIAI) 2022 IFIP WG 12.5 International Workshops, IFIP Advances in Information and Communication Technology (AICT), vol.652, pp.134-147. Springer Nature Switzerland AG. ISBN: 978-3-031-08340-2; ISBN (eBook): 978-3-031-08341-9; ISSN: 1868-4238; ISSN (electronic): 1868-422X. DOI: https://doi.org/10.1007/978-3-031-08341-9_12
Publication	"5G for the Support of Smart Power Grids: Millisecond Level Precise Distributed Generation Monitoring and Real-Time Wide Area Monitoring"	I.P. Chochliouros, D. Porcu, D. Brodimas, N. Tzanis, N. Palov, R. Rumenova, A. Antonopoulos, N. Cadenelli, M. Asprou, L. Hadjidemetriou, S. Castro, P. Zlatev, B. Bogdanov, T. Bachoumis, A. Corsi, H. Simeão, M. Rantopoulos, C. Lessi, P. Lazaridis, Z. Zaharis and Anastasia S. Spiliopoulou. In: I. Maglogiannis, L. Iliadis, J. Macintyre and P. Cortez	R	OTE	Proceedings of the Artificial Intelligence Applications and Innovations (AIAI) 2022 IFIP WG 12.5 International Workshops, IFIP Advances in Information and Communication Technology (AICT), vol.652, pp.11-22. Springer Nature Switzerland AG. ISBN: 978-3-031-08340-2; ISBN (eBook): 978-3-031-08341-9; ISSN: 1868-4238; ISSN (electronic): 1868-422X. DOI: https://doi.org/10.1007/978-3-031-08341-9_1

Type of IP result	Title	Author(s)	Exploitation Interest	Lead Partner(s)	Comments(optional)
Publication	Optimal Relocation of Virtualized PDC in Edge-Cloud Architectures under Dynamic Latency Conditions	N. Tzanis, D. Brodimas, K. Plakas, M. Birbas and A. Birbas	R	IPTO	2nd International Conference on Electrical, Computer and Energy Technologies (ICECET), 20 – 22 July 2022 DOI: https://doi.org/10.1109/ICECET55527.2022.9872789
Publication	Wide area control of distributed resources through 5G communication to provide frequency support	L. Hadjidemetriou, A. Akrytov, K. Kyriakou, C. Charalambous, M. Asprou, I. Ciornei, G. Ellinas, C. Panayiotou	R	UCY	in Proc. IEEE International Smart Cities Conference (ISC), Paphos, 2022, pp. 1-7. DOI: https://doi.org/10.1109/ISC255366.2022.9921934
Publication	The Impact of Wireless Communication Networks to Wide Area Monitoring and Protection Applications	M. Asprou, A. Akrytov, L. Hadjidemetriou, C. Charalambous, I. Ciornei, G. Ellinas, C. Panayiotou	R	UCY	n Proc. IEEE International Smart Cities Conference (ISC), Paphos, 2022, pp. 1-7. DOI: https://doi.org/10.1109/ISC255366.2022.9922326
Publication	Remote Monitoring at Distribution Network of Dynamically Constrained Working Areas	E. Grigoriou, A. Moukoulis, T. Saoulidis, R. Santiago, H. Simeao, S. Castro, P. Encinar Sanz, I. Prieto Borrero, A. Betzler, S. Cadenas, I. Ciornei	R	UCY, SID	in Proc. IEEE International Smart Cities Conference (ISC), Paphos, 2022, pp. 1-7. DOI: https://doi.org/10.1109/ISC255366.2022.9922368
Publication	Ground Directional Protection Assessment in Inverter Dominated Distribution Networks	L. Hadjidemetriou, C. Frangeskou, M. Asprou, C. Panayiotou	R	UCY	IEEE PES Innovative Smart Grid Technologies, which took place in Novi Sad, Serbia, on October, 10-12, 2022

Type of IP result	Title	Author(s)	Exploitation Interest	Lead Partner(s)	Comments(optional)
Publication	Smart5Grid Testing Strategy & Field Implementations for RT Wide Area Monitoring of Interconnected Systems	I.P. Chochliouros, D. Brodimas, N. Tzanis, M. Rantopoulos, D. Shangov, G. Hristov, A. Velkov, I. Ciornei and D. Porcu	R	OTE	In Proceedings of the AIAI-2023 International Conference, June 14-17, 2023, Léon, Spain (Hybrid Conference). In: I. Maglogiannis, L. Iliadis, A. Papaleonidas and I. Chochliouros (Eds.), Artificial Intelligence Applications and Innovations (AIAI) 2023 IFIP WG 12.5 International Workshops: MHDW 2023, 5G-PINE 2023, AIBMG 2023 and VAA-CP-EB 2023; IFIP Advances in Information and Communication Technology (AICT), vol.677, pp.126-138. Springer Nature Switzerland AG. ISBN: 978-3-031-34170-0; ISBN (eBook): 978-3-031-34171-7; ISSN: 1868-4238; ISSN (electronic): 1868-422X. DOI: https://doi.org/10.1007/978-3-031-34171-7_10.
Publication	Long-term unit commitment with combined-cycle units	L. Tziovani, M. Asprou, I. Ciornei, P. Kolios, L. Hadjidemetriou, A. Lazari, R. Tapakis, S. Timotheou	R	UCY	Proc. IEEE POWERTECH, Belgrade, 25th-29th of June 2023, pp. 1-6. DOI: https://ieeexplore.ieee.org/document/10202920

Type of IP result	Title	Author(s)	Exploitation Interest	Lead Partner(s)	Comments(optional)
Publication	Inertia Estimation Under Normal Operation from Generation Units in the Cyprus Power System	M. Elenkova, M. Asprou, L. Hadjidemetriou, M. Michael, C. Frangeskou, A. Stavrou, C. Panayiotou	R	UCY	Proc. IEEE POWERTECH, Belgrade, 25th29th of June 2023, pp. 1-6. DOI: https://ieeexplore.ieee.org/document/10202788.
Publication	Modelling and analysing security threats targeting protective relay operations in digital substations	M. Elrway, L. Hadjidemetriou, C. Laoudias, M. Michael	R	UCY	in Proc. IEEE CSR, Venice, 2023, pp. 1-7. https://ieeexplore.ieee.org/document/10224964
Publication	Smart5Grid Solutions for enhanced TSO grid observability and manageability in massive RES penetration environment	Daniel Shangov, Krassimir Vlachkov, Ralitsa Rumenova, Georgi Hristov, Atanas Velkov, Angelos Antonopoulos, Nicola Cadenelli. Nikolaos Tzanis, Dimitrios Brodimas, Michalis Rantopoulos ,Ioannis Chochliouros, Vasiliki Vlahodimitropoulou	R	ESO	Sustainable Places 2022. DOI: https://open-research-europe.ec.europa.eu/articles/3-18/v2
Publication	Testing Plan Description & Field Measurements for Real-Time Wide Area Monitoring of Interconnected Power Systems in the Smart5Grid Project	M. Rantopoulos, et al.	R	OTE	in Proc. of the Artificial Intelligence Applications and Innovations (AIAI), Corfu, Greece, June 2024 (Accepted).

Type of IP result	Title	Author(s)	Exploitation Interest	Lead Partner(s)	Comments(optional)
Deliverable	D1.4 – D1.6: Data Management Plan	N/A	I	ENEL	N/A
Deliverable	D2.2: Overall Architecture Design, Technical Specifications and technology Enablers	N/A	I, R	ATOS	N/A
Deliverable	D3.2 Final report for the development of the 5G network facility	N/A	I,R	ENG	N/A
Deliverable	D3.3: Open NetApp repository	N/A	I, R	AXON	N/A
Deliverable	D4.2: Verification and validation framework based on DevOps practices	N/A	I, R	UW	N/A
Deliverable	D5.1: Network Application integration framework and Smart5Grid roll-out plans for uninterruptible Smart Grid Operation	N/A	I, R	WI3	N/A
Deliverable	D6.1: Network Application integration framework and Smart5Grid roll-out plans for integration high-level of variable RES	N/A	I, R	OTE	N/A

Table 18: Publications and project deliverables with an exploitation potential

6.5. Results prioritisation: Key Exploitable Results

Projects with the scale of impact, ambition, and multidisciplinary partnership seen in Smart5Grid naturally generate numerous Exploitable Results. However, certain results may only appeal to specific partners or may require additional development before they are ready for commercial, internal, or scientific exploitation. To ensure effective post-project utilization and to maximize the project's impact, it is critical to concentrate the exploitation strategy on those results with the highest potential for exploitation, impact, and added value – identified as KERs. Given the finite resources in terms of time and budget, efficient management of efforts towards planning for post-project exploitation is essential for: (i) enhancing Smart5Grid's value propositions to key external stakeholder groups; (ii) improving the quality of results most ready for exploitation; and (iii) gaining a deep understanding of the needs of primary target groups that will benefit from the project's outcomes. Additionally, the consortium's strategic priorities, comparative advantages, and the acceptable levels of risk within the Smart5Grid context must be considered when selecting results for prioritization in effective post-project exploitation.

Upon evaluating each exploitable result listed in Table 12 for technical maturity, interest from project partners, impact (on a significant stakeholder group), societal value, and post-project exploitation potential, the primary Key Exploitable Result for Smart5Grid has been identified as the Smart5Grid Network Applications. This framework, which advances beyond the current state of the art by ensuring security, efficiency, low-latency and interoperability in the 5G and smart grids ecosystem through the integration of four distinct Network Applications, is fundamental. These four Network applications are recognized as Key Exploitable Results for Smart5Grid, warranting special attention to their potential for post-project utilization.

6.6. Joint Ownership Agreement (JoA): terms of exercise per Smart5Grid Key Exploitable Result

Under Article 26.2 "Joint ownership by several beneficiaries" of the Smart5Grid Grant Agreement, joint ownership of results is established when:

(a) they are co-created by two or more beneficiaries, and

(b) it is impossible to:

(i) determine the individual contributions of each beneficiary, or

(ii) separate the contributions for the purposes of applying for, obtaining, or maintaining protection (refer to Article 27).

Joint owners must reach a consensus (documented in writing) regarding the division and conditions of their joint ownership (referred to as the 'joint ownership agreement'), to adhere to their commitments under this Agreement.

To guarantee optimal quality for the commercial exploitation of Smart5Grid's Key Exploitable Results post-project, Eight Bells initiated several measures starting February 2023 to prevent any potential exploitation conflicts among contributing partners over a specific KER. Notably, 8bells proposed and deliberated with all partners on a method to quantitatively assign each main contributing partner's involvement in developing a Network Application, correlating these contributions to specific Network Applications sub-components. The goal was to define each beneficiary's contribution in percentage terms, laying a foundational basis for drafting more detailed post-project JoA among partners (where necessary) for comprehensive commercial exploitation of the Network Application.

In winter 2023, 8bells engaged in several bilateral or multilateral discussions with the Network Application owners to calculate and then assign quantitative percentages based on the main partners' contributions per Network Application. Table 19 details the quantitative contributions of each beneficiary towards the Smart5Grid project's Key Exploitable Results.

Main Parties' Contribution (%)													
ER#	Key Exploitable results	SC	EE	ENEL	SID	STAM	WI3	ESO	IPTO	AXON	I2CAT	OTE	NIS
ER1	OSR Repository									100%			
ER8	UC1 Network Application			20%		50%	30%						
ER9	UC2 Network Application			20%	50%						30%		
ER10	UC3 Network Application	50%	50%										
ER12	UC4 Network Application	50%						10%	10%			15%	15%

Table 19: Quantitative contributions per Network Application

The numerical contribution by each partner is related to the development of certain sub-components for each KER. In more detail, Table 20 presents the qualitative contribution by partner:

KER #	Key exploitable result	SC	EE	ENEL	SID	STAM	WI3	ESO	IPTO	AXON	I2CAT	OTE	NIS
KER1	OSR Repository	-	-	-	-	-	-	-	-	Full development of the OSR Repository Development	-	-	-
KER2	UC1 Network Application	-	-	Network Application Integration	-	Full development of the Network Application	-	-	-	-	Network Application Deployment	-	-
KER3	UC2 Network Application	-	-	Network Application Integration	Full development of the Network Application	-	-	-	-	-	Network Application Deployment	-	-

KER4	UC3 Network Application	Development of the Network Application	Network Application Integration and Deployment	-	-	-	-	-	-	-	-	-	-
KER5	UC4 Network Application	Development of the Network Application	-	-	-	-	-	Network Application Integration	Network Application Integration	-	-	Network Application Deployment	Network Application Deployment

Table 20: Qualitative contribution per Network Application

The insights provided in Tables 19 and 20 are foundational for the future establishment of Joint Ownership Agreements (JoA) between primary and contributing partners. These agreements are designed to regulate the post-project utilization of the Network Applications and may be structured as either bilateral or multilateral contracts. All parties involved have concurred that the execution of the JoAs should be deferred until after month 39 (M39) of the project timeline for several key reasons:

- Technology Readiness Level (TRL) of the KERs: The Network Applications in question are currently in the nascent stages of development, exhibiting a TRL that is not yet sufficient for widespread market adoption. Consistent with project expectations, all Smart5Grid Network Applications have achieved, at most, a TRL of seven (7), indicating that while they have been tested in relevant environments (such as labs), they are not yet ready for commercial deployment. The advancement of these technologies to a higher TRL is essential before any JoA is finalized, to ensure they meet all necessary deployment and market entry standards.
- Further Development and Testing Needed: Beyond the TRL considerations, additional development and comprehensive testing are required to verify that the Network Applications fulfill all commercial performance and safety criteria. Premature JoA commitments could lead to unanticipated challenges and responsibilities.
- Compliance with Legal and Regulatory Standards: Drafting and finalizing such agreements necessitate adherence to a complex web of legal and regulatory frameworks at national, European, and international levels, including trade regulations, IP rights, and export controls. This compliance process is intricate, demanding meticulous attention and expert legal counsel for all signatory entities.
- Contractual Complexity: The nature of JoAs demands engagement from senior-level officials from each participating organization, which involves aligning various interests and negotiating the legal terms—a process that is inherently detailed and prolonged. Such coordination and agreement finalization could not feasibly occur within the project's timeframe, especially prior to finalizing the content of this document.
- Market Feasibility Analysis: The decision to sign a JoA is also contingent upon each partner completing detailed market feasibility analyses for the exploitable results they are interested in. These analyses are crucial for evaluating market potential, identifying risks, and formulating a robust commercialization plan post-project. This responsibility typically falls to specialized departments within each organization and represents a complex task that often extends beyond the project's duration. Adequate time must be allocated for these studies to ensure their comprehensiveness and relevance, allowing them to be conducted well after the project concludes.

6.7. Exploitation and sustainability plan per KER

After pinpointing and consolidating the KERs of Smart5Grid, and to facilitate the formulation of the project's exploitation strategy, a detailed analysis identifying the key stakeholder groups expected to benefit from the KERs, along with their current requirements, was carried out. The outcomes of this investigation are summarized in Tables 21-25. This table connects specific stakeholder groups to relevant results, elaborating on the unique value proposition offered by these results to each group.

Innovation	TRL M01	TRL M40	
OSR Repository	5	7	
Type of Exploitation	**Exploitation potential**	**Conflicting IP**	
Network Application Licensing Service provision (training, consulting) Internal use for improving processes Further research	Low	No	
Strengths	**Weaknesses**	**Opportunities**	**Risks**
Novel product	Need to rely on well-functioning market and upfront investment	Be competitive in the liberalised energy market by testing Network Apps	• Transition from 5G to 6G • Not a clear monetization strategy
Targeted market	**Time to market estimate**	**Expected ROI**	
Neutral Hosts, Coordinating Platform Providers, SMEs with VNFs, MNO	1 year	- Enhance market position - Release new product line	
Path to market			
To be defined internally post-project			

Table 21: OSR repository exploitation and sustainability plan

Innovation	TRL M01	TRL M40
UC1 Network Application	5	7
Type of Exploitation	**Exploitation potential**	**Conflicting IP**

Innovation	TRL M01	TRL M40	
Network Application Licensing Service provision (training, consulting) Internal use for improving processes Further research	Medium	No	
Strengths	**Weaknesses**	**Opportunities**	**Risks**
Smart fault selection with shorter restoration times	Rely on outdated switching equipment	End-to-end latency of peer-to-peer, 61850 GOOSE communication < 5msec	• Transition from 5G to 6G • High implementation costs
Targeted market	**Time to market estimate**	**Expected ROI**	
DSOs, TSOs, Energy Service Providers, Regional Distribution Organisations	2 years	- Release of new product / NetApp - Creation of enhanced marketplace for new entries	
Path to market			
To be defined internally post-project			

Table 22: UC1 exploitation and sustainability plan

Innovation	TRL M01	TRL M40	
UC2 Network Application	5	7	
Type of Exploitation	**Exploitation potential**	**Conflicting IP**	
Network Application Licensing Service provision (training, consulting) Internal use for improving processes Further research	Medium	No	
Strengths	**Weaknesses**	**Opportunities**	**Risks**
Remote inspection and automatically delimiting working areas.	Rely on the workers acceptance. Limited market players.	Improve the working conditions of maintenance crews and supervisors.	• Transition from 5G to 6G. • High implementation costs.

Innovation	TRL M01	TRL M40	
Ensure high security standards for employees. Keep record of trespassing.	Multiple single points of failures for the communication.	Instalment of an end-to-end communication system. Decrease accidents in work place.	• No standardisation. • Technological opacity.
Targeted market	Time to market estimate	Expected ROI	
Smart Grid Operators, Independent System Operators	1 year	- Improve the power grid maintenance procedures - Increased safety of the areas during field interventions - Licensing of the Network Application	
Path to market			
To be defined internally post-project			

Table 23: UC2 exploitation and sustainability plan

Innovation	TRL M01	TRL M40	
UC3 Network Application	2	7	
Type of Exploitation	Exploitation potential	Conflicting IP	
Network Application Licensing Service provision (training, consulting) Internal use for improving processes Further research	Medium	No	
Strengths	Weaknesses	Opportunities	Risks
Low cost, highly scalable, not complex and easy to use	Lack of 5G coverage in most rural areas where some of the plants are located	Connect in mass scale multiple in size and nature RES production units and increase their productivity; Increase visibility; Improve grid management, Enable fine-tuning and implementation of predictive maintenance algorithms and services	Lack of availability of CPE and IoT/M2M devices supporting latest 5G specifications
Targeted market	Time to market estimate	Expected ROI	

Innovation	TRL M01	TRL M40
Coordinating Platform Providers, DSOs, Energy Service Providers	2 years	- Improve RES owner's visibility, increase productivity; create opportunities for cost-optimization - Improve the power distribution grid QoS and monitoring procedures
Path to market		
To be defined internally post-project		

Table 24: UC3 exploitation and sustainability plan

Innovation	TRL M01	TRL M40	
UC4 Network Application	4	7	
Type of Exploitation	Exploitation potential	Conflicting IP	
Network Application Licensing Service provision (training, consulting) Internal use for improving processes Further research	Medium	No	
Strengths	Weaknesses	Opportunities	Risks
Precise distribution generation control of (Renewable Energy Sources) RESs	Rely on RES power electronics, energy demand predictions and weather forecasts	Reduce the stand-by conventional power plants, and thus, environmental pollution	• Transition from 5G to 6G • High implementation costs
Targeted market	Time to market estimate	Expected ROI	
RES Producers, Coordinating Platform Providers, Independent System Operators	1 year	- Allow high-RES penetration - Release of new product / Network Application	
Path to market			
To be defined internally post-project			

Table 25: UC4 exploitation and sustainability plan

7. Conclusions and final remarks

The final version of the Innovation and IPR Management Strategy for Smart5Grid outlines the key principles and methodology used throughout the project. It provides an overview of the project's background and foreground IP, as well as its exploitable results.

Additionally, the report documents each exploitable result's exploitation claims and relevant measures for IP protection, with updates from project partners. A dedicated tool, the IPR Matrix, facilitated the revision, update, and finalization of Smart5Grid's results. The final version advances by confirming IP propositions per partner, identifying stakeholder groups benefiting from the results, validating exploitation interests and pathways, and preventing post-project IP conflicts among shared owners through Joint Ownership Agreements. Baseline exploitation and sustainability plans per Key Exploitable Result (KER) are provided in alignment with market analysis.

Furthermore, the final version reflects the status of result identification, protection, ownership, and access rights, supported by all partners, aiming to sustain and continue the project's results. The IPR and Innovation Management leader regularly checked the project's IP landscape and updated the IPR matrix tables in collaboration with partners to capture emerging IP and project progress.

In conclusion, over its 40-month lifespan, the Smart5Grid consortium has generated results with significant commercial, internal, and research exploitation potential. Appropriate IP measures have been applied to enable partners to benefit from the results post-project. The groundwork for future Joint Ownership Agreements ensures smooth exploitation among joint owners, aligning with the collaborative nature of Horizon projects. The wider deployment and exploitation of Smart5Grid results in smart grids and programmable 5G Networks domains are expected to substantially upgrade the next generation of electricity grids in the EU in the coming years.

8. References

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