D4.7 INNOVATION AND EXPLOITATION PLAN

OCTOBER, 2024

DELIVERABLE TITLE

KER1: ENERGY-AWARE ICT METERING SOLUTION

Solution to measure and monitor the energy consumption and carbon footprint of ICT services across various domains

KER2: ENERGY-AWARE ORCHESTRATION PRODUCT

Solution to dynamically allocate application components to the most energy-efficient computing resources, balancing performance needs with carbon emission reductions

ER3: INCENTIVE-COMPATIBLE ENERGY REDUCTION MECHANISMS

Mechanisms that encourage energy-efficient behaviour among stakeholders in the ICT value chain

ER4: USE CASES

Collection of practical, real-world scenarios demonstrating the potential of more sustainable ICT services

ER5: GREEN ICT DIGEST

Compilation of the latest standards, regulations, and best practices in the field of green ICT

ER6: ENERGY CONSUMPTION METRICS

Set of metrics to measure energy consumption in ICT services intra and inter-domain

EXPLOITATION STRATEGY

The overall exploitation plan for the project has four different phases:

- Identify (M1-M9) to pinpoint the project's exploitable results, distinguish their high potential and associate target audiences;
- Characterise (M10-M18) to elaborate the unique value proposition, recognise competitors and develop an initial market analysis;
- Own (M19-M24) to examine the foreground generated, agree on ownership, IPR and needed background; and
- Exploit (M25-M30) to define use and business models, plan actions and milestones, define roles and manage risks.

PROJECT RESULTS

EXIGENCE now finalised phase 1, Identify, recognising several project exploitable results, some of which have considered to have high potential and were classified as key (see left bar).

EXPLOITATION ROUTES

The EXIGENCE project's outcomes offer a broad spectrum of exploitation opportunities, encompassing three main routes:

Scientific Dissemination: To share the project's advancements and insights with the academic and broader research community, fostering further innovation and application in the field of green ICT.

Commercialisation: To translate the project's outcomes into marketable products and services that offer tangible benefits to businesses and consumers, driving the adoption of sustainable ICT solutions.

Standardisation: To contribute to developing international standards that promote energy efficiency and sustainability in ICT, ensuring that the project's innovations become part of the global best practices.

DELIVERABLE INFORMATION	
Author(s)/Organisation(s)	F6S
Document type	Deliverable
Document code	D4.7
Document name	Innovation and Exploitation Plan
Work Package / Task	WP4 / T4.3
Dissemination Level	SEN – Sensitive
Status	Draft
Delivery Date (GA)	30/09/2024 (M9)
Actual Delivery Date	08/10/2024

DELIVERABLE HISTORY			
Date	**Version**	**Author**	**Summary of main changes**
03/04/2024	0.1	F6S	Table of contents and structure
29/04/2024	0.2	F6S	Exploitation strategy and IPR management
24/05/2024	0.3	ALL	Definition of results and exploitation routes
06/09/2024	0.4	F6S	Final definition of exploitable results
18/09/2024	0.5	ALL	Description of exploitable results
27/09/2024	0.6	F6S	Standardisation
01/10/2024	0.7	F6S	Complete draft version
08/10/2024	0.8	ALL	Overall revision
08/10/2024	1.0	F6S	Final version for submission

Co-funded by the European Union

Funded by the European Union.

The project is supported by the Smart Networks and Services Joint Undertaking and its members.

Table of Contents

List of Figures

List of Tables

1 INTRODUCTION

In its work plan, EXIGENCE has a task (T4.3 Innovation & Exploitation activities) focused on innovation and exploitation activities, which started at the beginning of the project. All partners in the consortium are actively involved in this work.

This task covers all the activities related to the exploitation of project outcomes, in line with business planning towards the market, assisted by interacting with a wide range of stakeholder communities. This task will ensure project results flow into feasible and applicable partners' competitiveness and growth plans. To this end, partners will evaluate the market potential of the new technologies, service deployment methods and use cases in their activities.

This task also defines the consortium's IPR strategy, providing EXIGENCE's partners with the tools and rules to protect the innovations and knowledge developed within the project's timeframe, both from competitors and the consortium.

This deliverable, D4.7 Innovation and Exploitation Plan, reports the initial work done on this task, defining the overall approach of the project towards exploitation (see section 2 Approach), identifying the project's exploitable results (see section 4 Project Results), outlining the possible exploitation routes (see section 5 Exploitation routes), highlighting standardisation efforts (see section 6 Standardisation) and delineating the intellectual property management (see section 7 IPR and Ownership Strategy).

The work continues throughout the entire project duration, and its final results will be reported in deliverable D4.8 Innovation and Exploitation Activities Report, due by the project's end (M30). Meanwhile, the partners will continue describing the project's results and the results ownership list, which will be reported in the Funding & Tenders Portal at the end of the two reporting periods (M12, M30).

2 APPROACH

The initial part of the work has been dedicated to developing an approach for this task, to ensure that the consortium builds a robust exploitation plan for the project's results, increasing the take-up potential and maximising its impact.

This plan establishes the phases and activities that will be implemented throughout the project to develop relevant exploitation strategies. The overall exploitation plan for the project has four different phases, as presented in the following Figure 1.

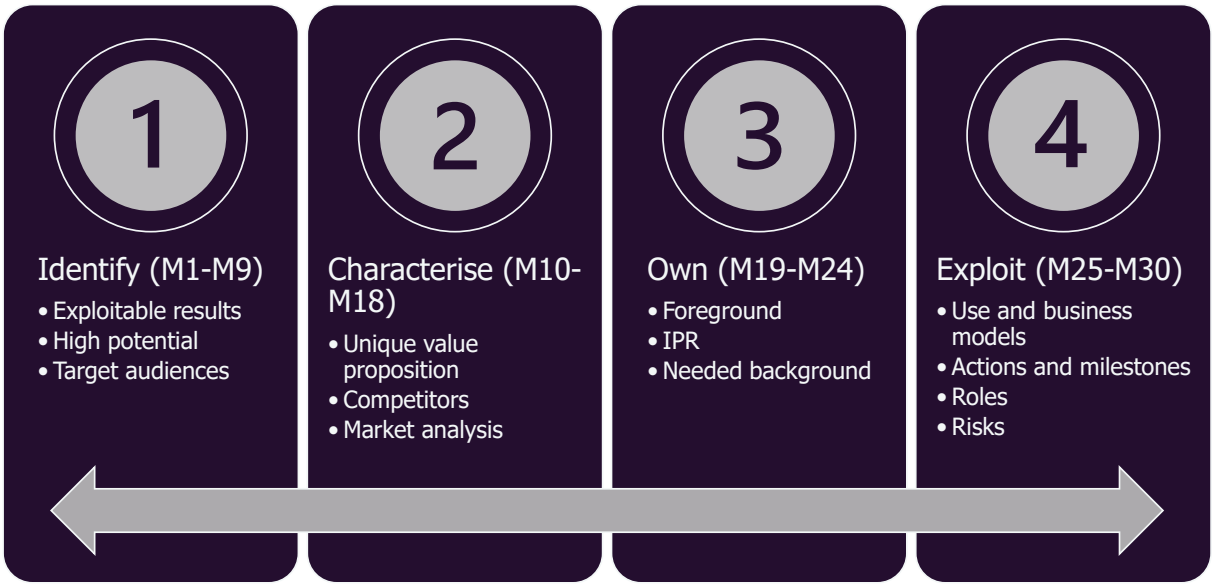

Figure 1: Exploitation approach.

Our approach defines four phases with a specific timeline. However, this is an ongoing process, and it is possible that working on a phase will refine previous phases and outputs. Each phase includes activities that will produce specific outputs, leading to building a strong exploitation plan for the project's results. The outputs also support the project in reporting activities and making the results available in the Funding and Tenders Portal.

As exploitation manager, F6S facilitates this process. F6S has described the activities of each phase and prepared templates for the outputs (see Annex A: Template for Exploitation results). F6S organises workshops in each phase to gather inputs and validate the outputs. The partners involved in developing each result are its owners and those responsible for elaborating its exploitation plan.

The text below describes each phase's activities, process, and output, identifying the partners and their roles. At M12, the exploitation strategy will be re-evaluated to see if it produces the desired outputs and to make any necessary adjustments. Around this time, partners will also decide to use the support of the Horizon Results Booster to work on some key exploitable project results further.

Phase 1: Identify

The Grant Agreement (GA) already identifies the project's results, but it is important to review them and identify their potential and target audiences. The objective of this phase is to have a detailed overview of all results, classified by type and select the ones with the most potential for exploitation, i.e. the key exploitable results.

The output of this phase is a table of results with the following information:

- Result name:
- Short description
- Result type:
    - SCI — Scientific discovery, model, theory (…)
    - PROD — Product (new or improved)
    - SERV — Service (new or improved)
    - PROC — Industrial process (new or improved)
    - BUS — Business model (new or improved)
    - DSG — Design (new or improved)
    - METH — Method, material, technology, design (new or improved)
    - PO — Policy recommendation, guidance, awareness raising, advocacy
    - EVNT — Event (conference, seminar, workshop)
    - STAFF — (qualified personnel exchanges)
    - LEARN — learning and training (learning modules, curricula)
    - INFRA — new or improved infrastructures or facilities
- Owners
- Key results (KER):
    - High scientific potential
    - High societal potential (other than climate or environmental)
    - High societal potential
    - High technologic, business or economic potential
    - High policy or regulatory potential
    - N/A
- Target audience:
    - Researchers
    - Industry, business partners
    - Investors
    - EU Institutions and/or agencies
    - Policy makers and authorities, international
    - Policy makers and authorities, national
    - Policy makers and authorities, regional or local
    - Citizens
    - Standardization bodies
    - Innovators
    - End users (practitioners, farmers, etc)

- Education/training organisation/ learners
- Research Infrastructures
- Business accelerator providers
- Other
- Applicable to all

This phase aims to be finalised in M9 and this deliverable includes in section 4 Project Results the current output of this phase. The consortium will have two workshops with all partners to work on these activities.

Phase 2: Characterise

In the second phase, the owners of each result will work on characterising it as a first step towards exploitation. This includes describing the problem each result is addressing, alternative solutions and unique selling points. In addition, the result's owners will identify competitors and the potential market, to position the result.

The output of this task is a table characterising each project result, with the following information:

- Problem: Describe the problem you are addressing (the problem your potential users have). Potential users are the people, companies, organisations, etc. that you expect will use the result (and generate an impact). They are your "Customers".
- Alternative solution: Describe how your "customer" has solved the problem so far.
- Unique Selling Point USP - Unique Value Proposition UVP: Describe the competitive advantages, the innovative aspects. What does your solution do better, what are the benefits considering what your user/customer wants, how does your solution solve his/her problem better than alternative solutions, what distinguishes the KER from the competition/current solutions?
- Description: Describe in a few lines your result and/or solution (i.e., product, service, process, standard, course, policy recommendation, publication, etc.). Use simple wording, avoid acronyms, make sure you explain how your UVP is delivered.
- "Market" – Target market: Describe the market in which your product/service will be used/can "compete", answering the following questions:
    - What is the target market?
    - Who are the customer segments?
- Go to Market - Competitors: Who are your "competitors" (note: they are the ones offering "alternative solutions")? What are their strengths and weaknesses comparing to you?

F6S prepared a template to characterise each result (see Annex B: Template for result exploitation roadmap). The first owner identified in the output of phase 1 is responsible for leading the process for their exploitable result and filling in the output table.

F6S will organise an initial 2-h workshop where the owners of each result will lead the group in defining the unique value proposition, market and potential competitors of each result. This will be the basis for the detailed analysis.

F6S will moderate a 2-h workshop, where the owners will validate the characterisation of each exploitable result.

Phase 3: Own

The third phase aims to specify the intellectual property rights and protection of each project result. The partners will identify their contributions for each result, i.e. the foreground, and describe any background used. During this phase, the partners will also define their own interests in exploiting each result.

The output of this phase is a Results Ownership List, including the following information:

- Single or joint ownership of results: number of owners
- Result owners: project partners
- Will the owners exploit the results? (Yes / No)
- In which form will the result be made available to other consortium members and/or third parties?
- Does the exploitation of the results require access to the background of one or several consortium members?
    - Identify the background
    - Insert measures taken /envisaged to give access to the background required for exploitation
- Does the exploitation of the results require access to third party IPR?
    - Identify the background
    - Insert measures taken /envisaged to get access to the required IPR

F6S will gather information from the partners to complete this table (included in Annex A) and organise one or two one-hour workshops to validate the outputs.

Phase 4: Exploit

In this phase, partners will specify steps towards exploiting each result. This includes defining the use and business model and performing a risk assessment and priority map. For each result, partners will work on an exploitation roadmap, to identify and plan activities to be performed after the end of the project.

- Actions: Briefly describe actions planned to be executed 3-6 months after the end of the project.
- Roles: Roles of partners involved in the actions defined above.

- Milestones: List the milestones and KPIs to be used for monitoring the implementation of the actions listed above. Add timeline.
- Financials Costs: Cost estimation to implement planned activities (1 year, 3 years).
- Revenues: Projected revenues and eventual profits once the KER will be used (1 and 3 years after use).
- Other sources of coverage: Resources needed to bridge the investment needed to increase TRL and ensure the result is used.
- Impact in 3-year time: Describe impact in terms of growth/benefits for the society.

In addition, partners will identify risks for exploitation and specify relevant mitigation measures, and provide a priority map for the risks. This is done in two different outputs:

- A Risk Matrix helps partners to identify the type of risks, level of importance related to the use, probability of the risk and success probability of the mitigation measure.
- A priority map provides a snapshot of the main risks identified.

These activities are documented in the template included in Annex B. The outputs of phases 2 and 4 are compiled into an Exploitation Roadmap for each exploitable result in the project (see Annex B).

F6S will facilitate a 2-hour workshop for each exploitable result to validate the exploitation roadmap produced. For some key exploitable results, we will consider having a second workshop to explore the exploitation activities more deeply and also request support from the Horizon Results Booster.

3 ACTIVITIES IMPLEMENTED IN M1-M9

During the initial nine months of the EXIGENCE project, our consortium dedicated significant efforts to implementing Phase 1 of our exploitation methodology, as outlined in our task T4.3—Innovation & Exploitation activities. This phase, crucial for setting the groundwork for subsequent exploitation activities, focused on identifying the project's Key Exploitable Results (KERs) and understanding their potential impact and target audiences. The activities during this period were instrumental in shaping our approach to maximising the project outcomes' market relevance and societal benefits.

We have held two workshops, developing the work described below.

Workshop 1: Refining KER Identification (13 May 2024, 11:00 - 12:15)

The first workshop was convened to critically assess the preliminary list of KERs identified at the project's outset. This session was pivotal in recognising that while all potential outcomes had intrinsic value, not all warranted classification as KERs based on their direct applicability or potential for market exploitation. We discussed the type and potential of each result.

Specifically, it was determined that KER 4, 6G-relevant 3GPP contribution, and KER 5, Dependable inter-domain energy metric exchange, initially considered standalone KERs, were more accurately described as potential exploitation routes rather than distinct exploitable results. This realisation prompted a refined approach to focusing on outcomes with the most immediate and impactful exploitation potential.

Workshop 2: Collaborative KER Identification and Expansion (28 August 2024, 09:30 - 11:00)

In our second workshop, we utilised a collaborative Miro board to facilitate a dynamic and interactive session focused on further identifying and elaborating on the KERs. The workshop had the following ambitious agenda:

1. Agree on the list of exploitable results;
2. Characterise the type, target audience and potential each exploitable result; and
3. Describe the problem and unique value proposition for the key exploitable results.

We aimed to fully cover topics 1 and 2 and see if time allowed to cover topic 3.

We started discussing the previously identified KERs 1-3 within the first agenda topic.

This workshop allowed us to reiterate the significant promise for exploitation of KER 1 (Energy-aware ICT metering solution) and KER 2 (Energy-aware orchestration product).

Although we still see the value in KER3 Incentive-compatible Energy Reduction Mechanisms, we are unsure about its high potential at the moment, partly because this work is just starting (Task3.4 Mechanisms to incentivise greener user behaviours started in M8, August 2024). We will evaluate the potential of this KER in phase 2 of the exploitation strategy.

On the other hand, we also discussed the work the consortium has been developing in the WP1 Requirements and Architecture scope, and the potential contribution our results can offer to other researchers.

The partners worked on a comprehensive compilation of the state-of-the-art standards and regulations concerning green ICT as a foundation for the project and the development of technical work. We decided to make this available on the project website as Green ICT Digest.

In addition, within T1.2 – Requirements and Scenarios, partners identified and developed a first set of use cases covering different scenarios in the use of ICT and service provision, involving different stakeholders and that would serve as practical applications of our project outcomes.

The consortium concluded that both of these results have the potential to be adopted by other researchers and entities working on sustainable ICT, developing methods and solutions to measure and optimise energy consumption in ICT services. So, we expanded the list of exploitable project results to include these two.

Finally, we also discussed the work we're carrying out in WP2 Energy metering, and how a set of energy metrics can be a relevant result for other stakeholders. This could help researchers, developers and service providers understand how to measure energy consumption. Therefore, we also consider this as an exploitable result of the project, independent from the metering solution (KER1).

So, by the end of the discussion on the first agenda topic, we concluded on the following list of results:

- KER1: Energy-aware ICT metering solution
- KER2: Energy-aware orchestration product
- (K)ER3: Incentive-compatible Energy Reduction Mechanisms
- ER4: Use Cases
- ER5: Green ICT Digest
- ER6: Energy consumption metrics

These results are listed and characterised in the next section, 4 Project Results.

Within topic 2, we used the Miro board to identify type, potential, and audience of each exploitable result, as exemplified in Figure 2

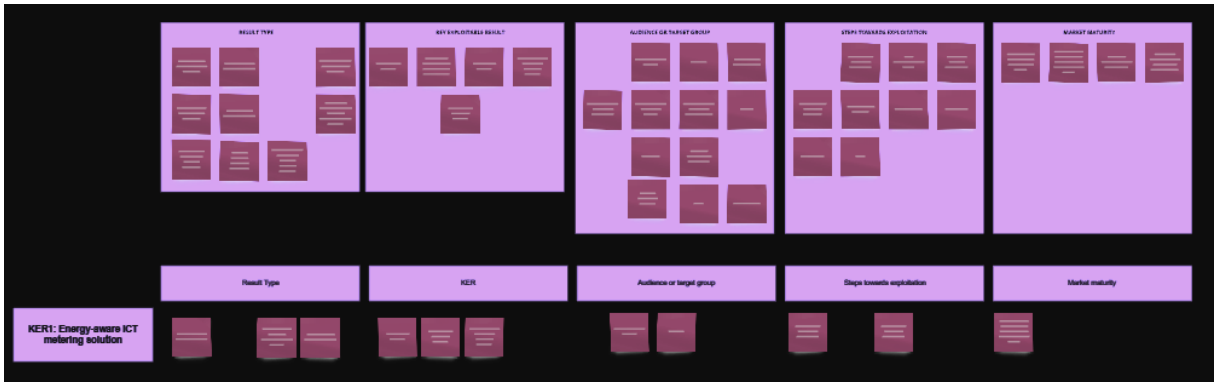

Figure 2: Miro board to characterise type, target audience and impact of the exploitable results.

Regarding topic 3, due to time limitations, we focused on KER1 Energy-aware ICT metering solution, starting to describe the problem we are addressing and the unique value proposition, as presented in Figure 3.

Figure 3: Miro board to elaborate the unique value proposition of key exploitable results.

Throughout these workshops, participants from various consortium partners contributed their expertise and perspectives, enriching the discussions and ensuring a holistic approach to identifying and defining KERs. This collaborative effort was instrumental in refining our understanding of each KER and aligning our consortium's strategic focus towards those outcomes with the highest potential for societal impact and market success.

This was the initial phase of the exploitation strategy, which will continue throughout the project.

The outcomes of these workshops result in the current deliverable.

4 PROJECT RESULTS

As described in the previous section, our iterative discussions led us to the following list of results:

- KER1: Energy-aware ICT metering solution
- KER2: Energy-aware orchestration product
- (K)ER3: Incentive-compatible Energy Reduction Mechanisms
- ER4: Use Cases
- ER5: Green ICT Digest
- ER6: Energy consumption metrics

As the work progresses, we will continue to analyse the project's results and update our list. At this moment, the following Table 1 lists the exploitable results as identified by the end of the project's month 9, September 2024.

Table 1: EXIGENCE exploitable results.

Name	Description	Type[1]	Owners/WP	KER[2]	Target audience[3]
Energy-aware ICT metering solution	Solution to measure and monitor the energy consumption and carbon footprint of ICT services across various domains	PROD, INFRA, SERV	WP2	High societal impact High policy or regulatory potential High technologic, business or economic potential	Industry, business partners Investors

[1] SCI — Scientific discovery, model, theory (…); PROD — Product (new or improved); SERV — Service (new or improved); PROC — Industrial process (new or improved); BUS — Business model (new or improved); DSG — Design (new or improved); METH — Method, material, technology, design (new or improved); PO — Policy recommendation, guidance, awareness raising, advocacy; EVNT — Event (conference, seminar, workshop); STAFF — (qualified personnel exchanges); LEARN — learning and training (learning modules, curricula); INFRA — new or improved infrastructures or facilities

[2] High scientific potential; High societal potential (other than climate or environmental); High societal potential; High technologic, business or economic potential; High policy or regulatory potential; N/A

[3] Researchers; Industry, business partners; Investors; EU Institutions and/or agencies; Policy makers and authorities, international; Policy makers and authorities, national; Policy makers and authorities, regional or local; Citizens; Standardisation bodies; Innovators; End users (practitioners, farmers, etc); Education/training organisation/ learners; Research Infrastructures; Business accelerator providers; Other; Applicable to all

Name	Description	Type[1]	Owners/WP	KER[2]	Target audience[3]
Energy-aware orchestration product	Solution to dynamically allocate application components to the most energy-efficient computing resources, balancing performance needs with carbon emission reductions	PROD, SERV, INFRA	WP3	High technologic, business or economic potential High societal potential	Industry, business partners Research infrastructures
Incentive-compatible Energy Reduction Mechanism	Mechanisms that encourage energy-efficient behaviour among stakeholders in the ICT value chain	SERV, PO, SCI	WP3		Policy makers and authorities, international EU institutions and/or agencies
Use Cases	Collection of practical, real-world scenarios demonstrating the potential of more sustainable ICT services	SCI, BUS	WP1	High technologic, business or economic potential	Researchers Standardisation bodies Industry, business partners
Green ICT Digest	Compilation of the latest standards, regulations, and best practices in the field of green ICT	LEARN	WP1		Researchers Innovators Industry, business partners

Name	Description	Type[1]	Owners/WP	KER[2]	Target audience[3]
Energy consumption metrics	Set of metrics to measure energy consumption in ICT services intra and inter-domain	METH, SCI	WP2	High scientific potential	Researchers End users Standardisation bodies Research infrastructures Citizens

In the following subsections, we describe each result further. We have not yet fully described each result and have not spent the same amount of time on each (reflected in the different levels of detail of each sub-section).

4.1 KER1: ENERGY-AWARE ICT METERING SOLUTION

This solution represents a groundbreaking approach to measuring and monitoring ICT services' energy consumption and carbon footprint across various domains. By integrating with ININ's existing qMON tool, the Energy-aware ICT Metering Solution will provide detailed, real-time insights into the energy efficiency of ICT infrastructures and services. This tool aims to facilitate ICT technology providers and consumers make informed decisions to optimise energy usage and reduce carbon emissions, aligning with global sustainability goals.

Problem Statement

The ICT sector faces a critical challenge in achieving transparency and accountability in energy consumption and its corresponding CO2 footprint. This challenge is multifaceted:

1. **Lack of Visibility and Measurement**: Energy consumption within the ICT sector is not measured with the necessary granularity nor effectively exchanged among different ICT domains. This lack of detailed visibility hinders the ability to accurately assess and manage the environmental impact of ICT services.
2. **Reporting Commitments**: Businesses utilising ICT services are increasingly committed to reporting their energy consumption and CO2 emissions. However, the current absence of mechanisms to do so accurately impedes their ability to fulfil these commitments.
3. **Outsourcing IT and Environmental Impact**: The practice of outsourcing IT services obscures their true environmental impact. The responsibility for the energy consumption and CO2 emissions associated with ICT services should be attributed to the actual users of these services, not just the service providers.
4. **Domain-Level Measurement Limitations**: Until now, energy consumption measurement within the ICT sector has been confined to the domain level without extending to the service level. This limitation is due to the lack of technology, standards, metrics, and an accepted methodology for service-level energy consumption measurement.

Unique Value Proposition

The Energy-aware ICT Metering Solution directly addresses these challenges with a comprehensive approach that offers several competitive advantages and innovative aspects:

1. **Service-Level Energy Consumption Measurement**: This solution introduces a groundbreaking method for measuring energy consumption at the service level, providing unprecedented granularity and accuracy in energy usage data.
2. **Correct Attribution of Eco Costs**: By accurately measuring energy consumption and CO2 emissions, this solution ensures that environmental costs are correctly attributed to the entities responsible for them, whether service providers or users.
3. **Incentives for Eco-Impact Reduction**: The solution empowers ICT service users with actionable insights into their energy consumption and CO2 emissions, providing them the information and the incentive to reduce their environmental impact.
4. **Integration with the Carbon Market**: By bringing the ICT sector, including providers and users, into the carbon market, this solution facilitates a more comprehensive approach to managing and mitigating the environmental impact of ICT services.
5. **Overall Reduction in ICT Sector Energy Consumption**: Implementing this solution is expected to significantly reduce the overall energy consumption within the ICT sector, contributing to broader sustainability goals.
6. **Granular Metering Capabilities**: The solution offers detailed energy/power consumption metering for virtualised components and unique services, enabling a more precise understanding and management of energy usage.

By addressing the specific challenges identified during the brainstorming session, the Energy-aware ICT Metering Solution stands out as a transformative tool for the ICT sector. It enhances transparency and accountability in energy consumption and CO2 emissions and aligns ICT practices with global sustainability efforts and regulatory requirements.

4.2 KER2: ENERGY-AWARE ORCHESTRATION PRODUCT

The Energy-aware Orchestration Product is designed to revolutionize the way ICT services are deployed and managed, with a strong focus on minimizing environmental impact. By leveraging innovative orchestration techniques, this product will enable cloud providers, ICT companies, and IT departments to significantly reduce the carbon footprint of their service offerings. It will dynamically allocate application components to the most energy-efficient computing resources, balancing performance needs with carbon emission reductions. This product is poised to offer a competitive advantage to businesses prioritizing sustainability in their operations.

Problem Statement

The ICT sector is currently grappling with several challenges that hinder the realisation of a truly energy-efficient and environmentally sustainable service delivery ecosystem:

1. **Heterogeneous Resource Management**: The diverse and distributed nature of resources across different authorities, locations, and technological domains complicates the orchestration of services in an energy-efficient manner.
2. **Lack of Carbon-aware Orchestration**: Existing service orchestration mechanisms do not adequately account for the carbon footprint of deploying and executing services, missing opportunities to optimise for environmental impact alongside performance.
3. **Dynamic Resource Availability and Environmental Impact**: The fluctuating availability of resources, coupled with variable carbon intensity of energy sources, demands a more agile and responsive approach to service orchestration that current systems fail to provide.
4. **Inefficient Utilisation of Green Energy Resources**: There is a significant gap in effectively leveraging renewable energy resources and optimising the carbon footprint of ICT services, due to the absence of sophisticated, carbon-aware orchestration tools.

Unique Value Proposition

The Energy-aware Orchestration Product addresses these challenges head-on, offering a comprehensive solution with several key advantages:

1. **Advanced Resource Orchestration**: By employing cutting-edge protocols and actuation mechanisms, the product ensures scalable, robust, and energy-efficient resource selection and controllability across the network. It adeptly manages the heterogeneity of resources, aligning them towards the common goal of green service execution.
2. **Carbon-aware Service Deployment**: At its core, the product introduces mechanisms for carbon-aware service orchestration, significantly reducing the carbon footprint of ICT services while maintaining or enhancing their Quality of Service (QoS). It uses detailed energy consumption profiles and advanced optimisation techniques to make informed decisions about resource allocation.
3. **Dynamic Optimisation for Green Execution**: Leveraging AI/ML techniques, the product dynamically adjusts service paths and resource allocations in response to changes within the network. This ensures optimal energy consumption and minimal CO2 emissions for each service delivered, even in the face of resource contention and environmental variability.
4. **Leveraging Renewable Energy Sources**: Through intelligent orchestration and optimization, the product maximizes the use of renewable energy resources, reducing reliance on carbon-intensive energy sources. This not only minimizes the environmental

impact of ICT services but also promotes the transition towards a more sustainable and green energy infrastructure.

The Energy-aware Orchestration Product represents a paradigm shift in how ICT services are orchestrated and executed. By harmonising the objectives of energy efficiency, carbon footprint reduction, and service quality, it paves the way for a sustainable future in ICT service delivery. This product has the potential to significantly impact the industry, driving widespread adoption of green technologies and practices, and contributing to the global effort to combat climate change.

4.3 (K)ER3: INCENTIVE-COMPATIBLE ENERGY REDUCTION MECHANISMS

This result focuses on developing mechanisms that encourage energy-efficient behaviour among stakeholders in the ICT value chain, from end-users to infrastructure operators. These incentive-compatible mechanisms are designed to align the economic interests of all parties to reduce energy consumption and carbon footprints. These mechanisms aim to foster a collaborative effort towards more sustainable ICT service delivery by incorporating economic incentives, such as carbon credits or direct financial benefits.

Problem Statement

Several challenges hinder the transition towards energy-efficient and environmentally sustainable ICT services:

1. **Lack of Visibility and Accountability**: Stakeholders across the ICT service delivery chain, including end users, Mobile Network Operators (MNOs), and cloud providers, lack a clear understanding of their individual and collective contributions to the ecosystem's overall energy consumption. This absence of visibility and accountability makes it difficult to identify and implement effective strategies for energy reduction.
2. **Insufficient Motivation for Energy-Efficient Behaviours**: Simply providing stakeholders with information about their energy consumption is insufficient to motivate a shift towards more energy-efficient behaviours. Without a tangible incentive, there is little motivation for stakeholders to alter their service usage patterns or to invest in greener technologies.
3. **Fragmented Efforts in Energy Reduction**: Current efforts to reduce energy consumption are often isolated and uncoordinated, leading to suboptimal outcomes. There is a need for mechanisms that promote end-to-end coordinated actions across the entire service delivery chain to achieve significant and sustainable energy reductions.

Unique Value Proposition

The Incentive-Compatible Energy Reduction Mechanisms developed as part of the EXIGENCE project address these challenges by introducing a comprehensive framework of economic incentives designed to promote energy-efficient behaviours across all levels of the ICT service delivery chain:

1. **Dual-Level Energy Consumption Metering**: By distinguishing between holistic end-to-end service level and individual tenant-level energy consumption, EXIGENCE provides a unique perspective that enhances stakeholders' understanding of their energy usage and its impact on the ecosystem.
2. **Behavioural and Economic Incentives**: The mechanisms developed offer a mix of monetary and non-monetary rewards to motivate stakeholders towards "carbon-friendly behaviour". This includes in-service discounts, credits, and community-level acknowledgements that incentivise wise service consumption and the adoption of energy-efficient practices.
3. **Promotion of Environmental Awareness**: Through targeted incentives, stakeholders are encouraged to develop environmental awareness, which reduces reckless service consumption and the unnecessary demand for high-quality services when not needed.
4. **Collaboration and Coordination Enhancement**: Economic mechanisms such as energy-aware pricing and monetary compensations are introduced to foster collaboration and coordination within and across different layers of the service delivery chain. This collaborative approach ensures that stakeholders who contribute positively to reducing the ecosystem's energy consumption are rewarded.
5. **Sustainable and Scalable Impact**: By aligning stakeholders' economic interests with environmental goals, these mechanisms ensure a sustainable and scalable impact, driving the ICT sector towards a greener future.

The Incentive-Compatible Energy Reduction Mechanisms represent a groundbreaking approach to fostering energy-efficient behaviours within the ICT sector. By leveraging economic incentives to align stakeholders' actions with environmental sustainability goals, these mechanisms have the potential to significantly reduce the overall energy consumption and carbon footprint of ICT services. This innovative strategy contributes to the global effort to combat climate change and sets a new standard for responsible and sustainable service consumption in the digital age.

4.4 ER4: USE CASES

This result encompasses a collection of practical, real-world scenarios that demonstrate the application and benefits of the EXIGENCE project's outcomes. These use cases cover a range of contexts, including media streaming, green batch scheduling, green real-time scheduling, and energy efficiency services. They showcase the potential energy and carbon footprint reductions achievable with the project's innovations. The use cases serve as a valuable tool for understanding the implications and applications of the project's technologies in various industry sectors.

The use cases are instrumental in bridging the gap between theoretical research and practical application. They provide all stakeholders with concrete examples of how energy-efficient ICT practices can be implemented, evaluated, and optimised, driving the sector towards a more

sustainable and responsible future. These use cases provide valuable insights and guidance for researchers, standardisation bodies, industry, and business partners.

Contribution to Researchers

For researchers, these use cases offer a rich source of data and scenarios that can be further analysed to understand the effectiveness of different energy-saving strategies within the ICT sector. They provide a foundation for academic inquiry into sustainable ICT practices, enabling researchers to explore new theories, validate models, and contribute to the body of knowledge with empirical evidence drawn from real-world applications.

Contribution to Standardisation Bodies

Standardisation bodies can leverage the use cases to identify best practices and develop new standards to measure and reduce energy consumption and carbon emissions in the ICT sector. These practical examples highlight the challenges and solutions in implementing energy-efficient technologies and policies, offering a roadmap for standardisation efforts that support environmental sustainability.

Contribution to Industry and Business Partners

For industry and business partners, the use cases act as a blueprint for adopting and integrating the EXIGENCE project's outcomes into their operations. They illustrate the potential cost savings, efficiency improvements, and environmental benefits of implementing energy-aware ICT solutions. By showcasing successful implementations, the use cases encourage businesses to invest in green technologies and practices, fostering innovation and competitiveness in the market.

4.5 ER5: GREEN ICT DIGEST

The Green ICT Digest is a comprehensive compilation and analysis of the latest developments, standards, regulations, and best practices in the realm of green Information and Communication Technology (ICT). This resource is designed to serve as an authoritative guide for stakeholders across the ICT sector, including researchers, policymakers, industry practitioners, and business partners, to foster a deeper understanding and implementation of sustainable practices within the field.

Key Features

- **Up-to-Date Information**: The digest curates the most recent advancements in green ICT, ensuring readers have access to the latest insights and innovations driving sustainability in the sector.
- **Standards and Regulations Overview**: It provides a detailed overview of current and emerging standards and regulations related to energy efficiency and carbon footprint reduction in ICT, helping stakeholders navigate the complex landscape of compliance and best practices.

- **Best Practices and Case Studies**: The digest includes a collection of best practices and case studies that showcase successful implementations of green ICT initiatives, offering valuable lessons and actionable strategies for organizations looking to enhance their sustainability efforts.
- **Research and Technological Developments**: The digest highlights significant research findings and technological developments that have the potential to impact the future of green ICT, encouraging ongoing innovation and adaptation within the industry.

Contribution to Stakeholders

- **Researchers** gain a curated source of information that can inform their studies, inspire new research directions, and provide a context for their work within the broader efforts to green the ICT sector.
- **Standardisation Bodies** can use the digest as a reference point for understanding current practices, identifying gaps in existing standards, and developing new standards that address emerging challenges and opportunities in green ICT.
- **Industry and Business Partners** benefit from a comprehensive resource that can guide strategic planning, inform technology and process decisions, and help articulate the business case for investing in sustainability initiatives.
- **Policymakers** are provided with a consolidated view of the state of green ICT, supporting informed policy development, regulatory initiatives, and promoting sustainable practices across the sector.

Overall Impact

The Green ICT Digest is crucial in advancing the sustainability agenda within the ICT industry. By providing stakeholders with a thorough and accessible resource, it encourages the widespread adoption of green technologies and practices, contributing to the sector's transition towards a more sustainable and environmentally responsible future.

4.6 ER6: ENERGY CONSUMPTION METRICS

The Energy Consumption Metrics constitute a critical exploitable result of the EXIGENCE project, designed to revolutionise how energy consumption is quantified, analysed, and optimised within the ICT sector. This set of metrics provides a standardised framework for measuring, comparing, and reporting ICT services and systems' energy efficiency and carbon footprint across various domains and service levels.

Key Features

1. **Standardisation of Measurement**: These metrics introduce a uniform method for assessing energy consumption, bridging the gap between different ICT domains and facilitating industry-wide comparisons and benchmarks.

2. **Granularity and Precision**: The metrics are designed to capture energy usage with high granularity, enabling precise monitoring of energy consumption at both the component and service levels. This level of detail is crucial for identifying specific areas for improvement and for implementing targeted energy-saving measures.
3. **Integration with Sustainability Goals**: By providing a clear and consistent way to measure energy efficiency, these metrics support the ICT sector's alignment with broader sustainability objectives, including carbon neutrality and reduced environmental impact.
4. **Facilitation of Reporting and Compliance**: The standardised nature of these metrics simplifies the process of reporting energy consumption and CO2 emissions, aiding organisations in complying with regulatory requirements and voluntary sustainability commitments.
5. **Incentivisation of Energy Efficiency**: By accurately measuring and comparing energy efficiency, these metrics incentivise ICT service providers and users to adopt more energy-efficient technologies and practices, contributing to the sector's overall reduction of energy consumption.

The development and adoption of the Energy Consumption Metrics represent a significant advancement in the pursuit of sustainable ICT practices. By establishing a common language for energy efficiency within the sector, these metrics empower stakeholders to make informed decisions, drive innovation in energy-saving technologies, and contribute to the global effort to mitigate climate change.

5 EXPLOITATION ROUTES

The EXIGENCE project's outcomes offer a broad spectrum of opportunities for exploitation, encompassing three main routes: scientific dissemination, standardisation efforts, and commercialisation pathways. Each route presents a unique set of activities and initial steps tailored to maximise the impact and reach of the project's results. Below, we outline the main exploitation routes, describe the associated activities and initial steps, and map which results best suit each route.

Scientific Dissemination

Objective: To share the project's advancements and insights with the academic and broader research community, fostering further innovation and application in the field of green ICT.

Activities and Initial Steps:

- **Publishing Papers**: Drafting and submitting articles detailing the project's findings and methodologies to peer-reviewed journals and conferences in energy efficiency, ICT, and sustainability.
- **Hosting Workshops and Seminars**: Organising events within academic and industry conferences to present the project's results, engage with other researchers, and discuss future research directions.
- **Developing Educational Materials**: Creating case studies, tutorials, and lecture materials based on the project's outcomes for use in university courses and professional development programs.

Results Suited for Scientific Dissemination:

- **KER2 Energy-aware Orchestration Product:** The methodologies and technologies developed can be shared to inspire further research in energy-efficient ICT service orchestration.
- **ER4 Use Cases & ER5 Green ICT Digest:** These resources provide comprehensive insights into the application of green ICT practices and the state-of-the-art, serving as valuable references for researchers and educators.
- **ER6 Energy Consumption Metrics & (K)ER3: Incentive-Compatible Energy Reduction Mechanisms:** The development of new metrics and mechanisms offers a foundation for academic exploration into sustainable ICT practices and economic incentives for energy reduction.

Standardisation

Objective: To contribute to developing international standards that promote energy efficiency and sustainability in ICT, ensuring that the project's innovations become part of the global best practices.

Activities and Initial Steps:

- **Engagement with Standardisation Bodies**: Identify relevant working groups within organisations such as 3GPP, the International Telecommunication Union (ITU), European Telecommunications Standards Institute (ETSI), and Institute of Electrical and Electronics Engineers (IEEE) and participate in their meetings and discussions.
- **Drafting Standard Proposals**: Preparing detailed proposals for new standards or amendments to existing standards based on the project's outcomes, including technical specifications and implementation guidelines.
- **Demonstrating Feasibility:** Collaborating with industry partners to pilot the proposed standards in real-world settings, showcasing their benefits and practicality.

Results Suited for Standardisation:

- **ER4 Use Cases:** The scenarios can provide insights into requirements for green ICT to be considered in different standards.
- **ER6 Energy Consumption Metrics:** The new metrics developed can inform the creation of new standards or the refinement of existing ones, particularly in measuring ICT energy consumption.
- **KER2 Energy-aware Orchestration Product**: The protocols and mechanisms for green service orchestration can inform standards for sustainable network and service management.

Commercialisation

Objective: To translate the project's outcomes into marketable products and services that offer tangible benefits to businesses and consumers, driving the adoption of sustainable ICT solutions.

Activities and Initial Steps:

- **Market Analysis and Business Planning**: Conducting detailed market research to identify potential customers, competitors, and market needs. Developing business plans that outline the value proposition, revenue models, and go-to-market strategies.
- **Product Development and Testing**: Transforming the project's outcomes into fully-fledged products or services, followed by rigorous testing to ensure reliability, scalability, and user-friendliness.
- **Marketing and Sales Initiatives**: Crafting marketing materials and sales pitches that highlight the solutions' environmental and economic benefits. Engaging in direct sales efforts and exploring partnerships with ICT providers and integrators to expand market reach.

Results Suited for Commercial Exploitation:

- **KER1: Energy-aware ICT Metering Solution**: With its advanced capabilities for energy measurement and monitoring, this solution has significant commercial potential

for data centres, cloud providers, and telecommunications operators seeking to enhance their sustainability practices.

- **KER2: Energy-aware Orchestration Product**: This product offers a novel approach to service orchestration that prioritises energy efficiency, appealing to network operators and service providers aiming to reduce their environmental impact.
- **(K)ER3: Incentive-Compatible Energy Reduction Mechanisms**: The mechanisms developed can be applied in various contexts, from consumer-facing applications that encourage sustainable usage patterns to enterprise solutions that optimise energy consumption across operations.

6 STANDARDISATION

The project has been very active and committed to standardisation, which is essential to enabling the measurement of energy consumption across domains.

EXIGENCE has been collaborating with the following standards development organisations (SDOs):

- The 3rd Generation Partnership Project (3GPP) unites seven telecommunications standard development organizations (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC), known as "Organizational Partners" providing their members with a stable environment to produce the Reports and Specifications that define 3GPP technologies. 3GPP specifications cover cellular telecommunications technologies, including radio access, core network and service capabilities, which provide a complete system description for mobile telecommunications. The 3GPP specifications also provide hooks for non-radio access to the core network, and for interworking with non-3GPP networks.
- ETSI (European Telecommunications Standards Institute) provides members with an open, inclusive and collaborative environment. This environment supports the timely development, ratification and testing of globally applicable standards for ICT-enabled systems, applications and services. ETSI is at the forefront of emerging technologies across all sectors of industry and society that make use of ICT. It has 850+ member organisations drawn from over 60 countries and five continents.
- The Internet Engineering Task Force (IETF), founded in 1986, is the premier standards development organization (SDO) for the Internet. The IETF makes voluntary standards that are often adopted by Internet users, network operators, and equipment vendors, and it thus helps shape the trajectory of the development of the Internet. But in no way does the IETF control, or even patrol, the Internet.
- The Internet Research Task Force (IRTF) focuses on longer term research issues related to the Internet. The IRTF is comprised of a number of focused and long-term Research Groups. These groups work on topics related to Internet protocols, applications, architecture and technology. Research Groups have the stable long-term membership needed to promote the development of research collaboration and teamwork in exploring research issues. Participation is by individual contributors, rather than by representatives of organizations.

Table 2 lists all the standardisation activities realised by the EXIGENCE partners during this period, from 1 January 2024 (M1) until 30 September 2024 (M9).

Table 2: Standardisation activities realised in the period M1-M9.

Date	Partner	Standardisation activities	Description (max 200 words)	Types of standardisation bodies involved	Names of standardisation bodies involved	Standard references (if any)
Feb/ 24	8 - HWDU	Elaboration of a new standard	Contribution in order to make the NRF become energy aware to enable energy aware NF selection	International	3GPP SA2	S2-2402290 > S2-2403455
Feb/ 24	8 - HWDU	Elaboration of a new standard	Contribution for enabling Energy consumption exposure and control in the mobile core network	International	3GPP SA2	S2-2402293 > S2-2401927
Feb/ 24	5 - TNO	Others	Contributed to widening description of study item for "Energy Efficiency as a Service Criterion R20" to better enable contributions of use cases & requirements from Exigence	International	3GPP SA1	S1-240310
Feb/ 24	2 - TID	Others	Proposal for OSM long-term view in connection with research projects	International	ETSI SDG OSM	https://docbox.etsi.org/OSG/OSM/05-CONTRIBUTIONS/2023/OSM(23)000057_OSM_Long_Term_View__Telef_nica_.pptx
Mar/ 24	2 - TID	Elaboration of a new standard	Contributions on asset management in network inventories: ALMO	International	IETF IVY WG	https://datatracker.ietf.org/doc/draft-palmero-ivy-ps-almo/ https://datatracker.ietf.org/doc/draft-palmero-ivy-ps-almo/
Mar/ 24	2 - TID	Others	NMOP group creation. Identify existing and anticipated operational issues arising from the near-term deployment of network management technologies, and to consider potential solutions or workarounds for those issues.	International	IETF Ops Area	https://datatracker.ietf.org/group/nmop/about/
Mar/ 24	2 - TID	Elaboration of a new standard	Update on "A Data Manifest for Contextualized Telemetry Data"	International	IETF OPSA WG	https://datatracker.ietf.org/doc/draft-ietf-opsawg-collected-data-manifest/

Date	Partner	Standardisation activities	Description (max 200 words)	Types of standardisation bodies involved	Names of standardisation bodies involved	Standard references (if any)
Mar/24	2 - TID	Elaboration of a new standard	Update on "Applying COSE Signatures for YANG Data Provenance"	International	IETF OPSA WG	https://datatracker.ietf.org/doc/draft-lopez-opsawg-yang-provenance/
Mar/24	2 - TID	Others	Side meeting on Power Metrics . With the idea of converging ongoing work in IETF, and defining mechanisms for aggregation	International	IETF Ops Area	https://wiki.ietf.org/en/meeting/119/sidemeetings
Mar/24	2 - TID	Others	Proposal to address capability exposure (NaaS) via ZSM integration fabric at ZSM#26	International	ETSI ISG ZSM	https://docbox.etsi.org/ISG/ZSM/05-CONTRIBUTIONS/2024//ZSM(24)000065_Chairman_Perspective_-_ZSM_26.pptx
Mar/24	2 - TID	Elaboration of a new standard	Rapporteurs for the new WI in ETSI ISG QKD, focused on the definition of a QKD monitoring interface, including energy consumption aspects	International	ETSI ISG QKD	https://portal.etsi.org/webapp/WorkProgram/Report_WorkItem.asp?WKI_ID=69537
Apr/09	8 - HWDU	Elaboration of a new standard	Created a new work item in ETSI ISG permissioned distributed ledger (PDL) for studying Energy Consumption Data Sharing based on PDL Service. This WI is still ongoing and expected to be finalized in 2025 Q1	International	ETSI ISG PDL	https://portal.etsi.org/webapp/WorkProgram/Report_WorkItem.asp?WKI_ID=71695
Apr/16	8 - HWDU	Elaboration of a new standard	Contribution for Update of solution on network optimization for energy saving per S-NSSAI	International	3GPP SA2	S2-2404796
May/24	5 - TNO	Revision of an existing standard	Contribution of a use case on carbon emission charging	International	3GPP SA1	S1-241410
May/24	2 - TID	Elaboration of a new standard	BoF session on the proposal for a new IETF WG on energy efficiency	International	IETF Ops Area	https://github.com/marisolpalmero/GREEN-bof/blob/main/BofRequestProposal.md WG

Date	Partner	Standardisation activities	Description (max 200 words)	Types of standardisation bodies involved	Names of standardisation bodies involved	Standard references (if any)
May /24	2 - TID	Others	Call to action to restructure ZSM work. Either ordered closing or revamp focused on simplifying service interactions	International	ETSI ISG ZSM	https://docbox.etsi.org/ISG/ZSM/05-CONTRIBUTIONS/2024//ZSM(24)000118_Chairman_Perspective_-_ZSM_27.pptx
May /24	2 - TID	Elaboration of a new standard	Discussions and edition of the specification on intent concepts	International	ETSI ISG ZSM	https://docbox.etsi.org/ISG/ZSM/Open/Drafts/016_IntentDrvCL/ZSM-016_IntentDrvCLv010.zip https://pad-public.etsi.org/p/ZSM27
May /24	2 - TID	Elaboration of a new standard	Discussions and edition of use cases and procedures for NDT integration	International	ETSI ISG ZSM	https://docbox.etsi.org/ISG/ZSM/Open/Drafts/0018_NDT_norm/ZSM-018_NDT_normv001.docx https://pad-public.etsi.org/p/ZSM27
May /24	8 - HWDU	Elaboration of a new standard	EnergySys KI#1: Conclusion Update	International	3GPP SA2	S2-2406499
May /24	8 - HWDU	Elaboration of a new standard	EnergySys KI#1: Conclusion Update	International	3GPP SA2	S2-2406500
Jun/ 24	2 - TID	Elaboration of a new standard	Contribution to the charter for the new IETF WG on energy efficiency (GREEN)	International	IETF Ops Area	https://www.ietf.org/mailman/listinfo/green-bof
Jul/ 24	2 - TID	Elaboration of a new standard	Draft on knowledge graph application to network OAM	International	IETF NMOP WG	https://datatracker.ietf.org/doc/pdf/draft-marcas-nmop-knowledge-graph-yang-03
Jul/ 24	2 - TID	Others	Intro on knowledge graph application at NMRG	International	IRTF NMRG	https://datatracker.ietf.org/meeting/120/materials/agenda-120-nmrg-03
Jul/ 24	2 - TID	Others	Organizer and contributor to the AI4NET side meeting on applicability of AI techniques, including data quality and DT considerations, in network management	International	IETF	https://github.com/danielkinguk/ai4network/blob/main/ietf120/agenda.md

Date	Partner	Standardisation activities	Description (max 200 words)	Types of standardisation bodies involved	Names of standardisation bodies involved	Standard references (if any)
Jul/24	2 - TID	Elaboration of a new standard	New version of ALMO lifecycle management model drafts	International	IETF IVY WG	https://datatracker.ietf.org/doc/pdf/draft-palmero-ivy-ps-almo-02 https://datatracker.ietf.org/doc/pdf/draft-palmero-ivy-dmalmo-02
Jul/24	2 - TID	Others	Introduction to operator requirements at the Getting Ready for Energy-Efficient Networking (GREEN) BoF	International	IETF Ops Area	https://datatracker.ietf.org/meeting/120/materials/agenda-120-green-03
Jul/24	2 - TID	Others	Update on the ALMO lifecycle management model	International	IETF IVY WG	https://datatracker.ietf.org/doc/agenda-120-ivy/
Jul/24	2 - TID	Others	WG proposal at the GREEN BoF on energy-efficient networking	International	IETF Ops Area	https://datatracker.ietf.org/meeting/120/materials/slides-120-green-what-the-proponents-think-the-wg-should-work-on https://github.com/marisolpalmero/GREEN-bof/blob/main/GreenCharterProposal.md
Jul/24	2 - TID	Elaboration of a new standard	New draft on intent for energy-aware services	International	IRTF NMRG	https://datatracker.ietf.org/doc/pdf/draft-contreras-nmrg-green-intent-00
Jul/24	2 - TID	Others	Update on interconnection intents at the NMRG meeting:	International	IRTF NMRG	https://datatracker.ietf.org/doc/agenda-120-nmrg/
Jul/24	2 - TID	Others	Update on use cases and best practices for IBN at the NMRG meeting	International	IRTF NMRG	https://datatracker.ietf.org/doc/agenda-120-nmrg/
Jul/24	2 - TID	Elaboration of a new standard	New version of the draft on knowledge graph application in network management	International	IETF NMOP WG	https://datatracker.ietf.org/doc/pdf/draft-marcas-nmop-knowledge-graph-yang-03
Aug/24	5 - TNO	Revision of an existing standard	Contribution of a use case on energy consumption and CO2e transparency in the end-to-end service chain	International	3GPP SA1	S1-242422

Date	Partner	Standardisation activities	Description (max 200 words)	Types of standardisation bodies involved	Names of standardisation bodies involved	Standard references (if any)
Aug/ 24	5 - TNO	Revision of an existing standard	Contribution of a use case on energy efficient, carbon aware, content download	International	3GPP SA1	S1-242543
Aug/ 24	5 - TNO	Revision of an existing standard	Discussion paper on the other SDOs working on end-to-end energy management features as an annex to the Technical Report	International	3GPP SA1	S1-242419
Aug/ 24	2 - TID	Others	Chair reflections on work to support NaaS by the interaction of autonomous multi-domain management, to address anomalies in closed loops, and to consider the migration from automation to autonomy	International	ETSI ISG ZSM	https://pad-public.etsi.org/p/ZSM28 https://docbox.etsi.org/ISG/ZSM/05-CONTRIBUTIONS/2024//ZSM(24)000181_ZSM_28_Meeting_Report.docx
Aug/ 24	2 - TID	Elaboration of a new standard	Discussions on the requirements on issues for intent fulfilment, both for intent owners and handlers in ZSM016	International	ETSI ISG ZSM	https://pad-public.etsi.org/p/ZSM28 https://docbox.etsi.org/ISG/ZSM/05-CONTRIBUTIONS/2024//ZSM(24)000181_ZSM_28_Meeting_Report.docx
Aug/ 24	2 - TID	Others	Joint session between ZSM and F5G on joint activities regarding NaaS and intent-based management of next-generation fixed networks	International	ETSI ISG ZSM	https://portal.etsi.org/Meetings.aspx#/meeting?MtgId=48289 https://portal.etsi.org/Contribution.aspx?MeetingId=48289
Aug/ 24	2 - TID	Others	Nomination as chair of the future IETF WG group on energy efficiency, GREEN	International	IETF Ops Area	https://mailarchive.ietf.org/arch/msg/green-bof/XjbV1EtdVQr3uTh0KmIzgjbTdM4/
Aug/ 24	8 - HWDU	Elaboration of a new standard	Energy Consumption aware slice admission control	International	3GPP SA2	S2-2408359
Aug/ 24	8 - HWDU	Elaboration of a new standard	EnergySys WID agreed in SA2	International	3GPP SA2	S2-2409559

7 IPR AND OWNERSHIP STRATEGY

The strategy for IPR management is built on a detailed framework that breaks down the IP management processes of the Project into the subsequent stages:

1. Grant Agreement preparation stage;
2. Project implementation stage;
3. Post-project stage.

The IPR management stages are illustrated in Figure 4, as considered by the Project. More details about these stages are presented in the sub-sections that follow.

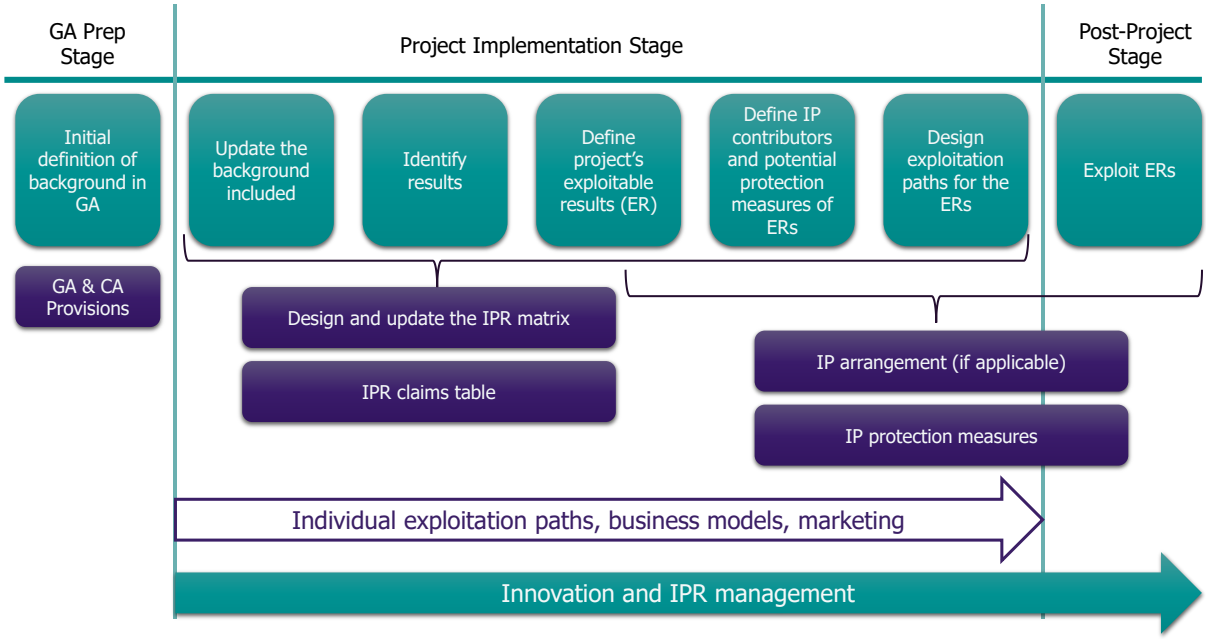

Figure 4: IPR management strategy.

7.1 GRANT AGREEMENT PREPARATION PHASE

Both the GA and the CA are documents that outline various aspects related to IPR. Their specific clauses serve as a guideline for addressing IPR matters among the Project partners. In this context, any additional measures concerning IPR taken by the project partners will align with these foundational provisions.

Grant Agreement

The GA is a contract that outlines the primary rules and terms of the Project, established between the EC and the project partners. It acts as the central contractual foundation for the project, with its significant IPR-related points detailed in Article 16, titled INTELLECTUAL PROPERTY RIGHTS (IPR) – BACKGROUND AND RESULTS – ACCESS RIGHTS AND RIGHTS OF USE. This framework governs the management of the Project's IP, and it also establishes access rights and responsibilities linked to the project's background. Furthermore, the GA specifies matters related to the ownership, protection, exploitation, and dissemination of the

results produced by the Project. The GA also clarifies the transfer and access rights associated with the Project's results.

Consortium Agreement

The CA is a contract in between the Project consortium members, designed to specify rights and duties during their collaboration to execute the Project's planned tasks and initiatives. By setting out clear rules and responsibilities for the Project's duration, the CA reduces the likelihood of future disagreements. It also establishes the access rights that partners have in relation to the Project. Moreover, it delineates the rights and duties of consortium members concerning intellectual property matters.

Key points and sections in the project's CA related to IPR include:

- Section 8 "Results": This section details the provisions on the ownership and joint ownership of results, along with their transfer and dissemination.
- Section 9 "Access Rights": This section clarifies the foundational principles of access rights, as well as the rights for the purpose of exploitation and dissemination. It also includes specific provisions about access rights to software.
- Attachment 1 "Background included": This attachment showcases the preliminary list of background resources that can be utilized.

7.2 PROJECT IMPLEMENTATION PHASE

Throughout the project's execution phase, there are anticipated IP management processes that partners will adopt to effectively oversee the project's outcomes/assets. As the project progresses, the emphasis will shift towards identifying the foreground, recognising partners' input to the results, determining access rights, safeguarding results, and strategising their utilisation and commercialisation. To facilitate this, we utilise an IPR management instrument known as the IPR Matrix.

IPR Matrix methodology

The IPR Matrix supports all project partners in identifying and managing the background, foreground knowledge and commercialisation details (e.g., terms to use) of the exploitable results of the project. In this way, potential co-innovators have a full overview of the Foreground developed, the IP protection and the necessary steps that need to be taken to enable the successful exploitation of the project's offerings via joint collaboration/exploitation agreements. The methodology is comprised by 4 steps, as described below:

- Step 1: Identify the Background IPs and their indicative protection measures, and define access rights among partners for using the BG within the project.
- Step 2: Identify the results that constitute the Foreground IP of the project – matching each Foreground with the respective contributing Background (if relevant).
- Step 3: Identify the partners' contributions and interest in commercialising the project's exploitable results/assets. We use the so-called IPR Claims Table as a tool in this step.

Each partner is called to highlight its contributions to the development of each of the project's exploitable assets/ results by using the following CBF scheme:

- C – Contribution: Partner claiming to have provided (or will provide) substantial assistive Contribution to the Asset development). Of course, the partner must participate in that asset's task with non-zero person-hours.
- B - Background: Partner claiming to have brought Background knowledge on the Asset that existed before the project. It may have also been mentioned in the Consortium Agreement Appendix (CA) as background knowledge.
- F - Foreground: Partner claiming to have developed (or will develop) new Foreground knowledge while working on the asset they can/will exploit).

- Step 4: Definition of a preliminary framework of IPR protection for the defined project assets, the assets' conditions for use after the end of the project, the availability of pertinent documentation for the assets (e.g., via the web portal and/ or shared marketplace), as well as any restrictions in the exploitation and commercialisation of the assets.

Results' ownership

Partners will be asked (through the IPR Matrix) to elaborate further on the CA's provisions regarding the result's ownership. Special attention will be paid to handling joint ownership issues.

Joint ownership is crucial for project assets, as detailed in the Joint Ownership Fact Sheet by the European IPR Helpdesk[4]. According to the European IP Helpdesk, results are jointly owned if they are co-created by multiple participants and cannot be distinctly attributed or separated for protection. Joint ownership typically arises for technological results.

The CA sets joint ownership rules. However, since this agreement precedes the Project's start, partners may draft a joint ownership agreement detailing ownership terms later. If not needed, the IPR Claims and IPR Matrix, agreed upon by all, will serve our needs.

IPR Conflict Resolution

In the unlikely (but still possible) event that conflicts among partners exist regarding IPR rights, the exploitation and IPR experts team takes measures in advance. The exploitation team of experts proposes the action-oriented methodology of the Contribution Benefits Matrix (see also the figure below), which is known to be applicable in such cases for fast and accurate friendly resolutions.

[4] https://op.europa.eu/en/publication-detail/-/publication/3f3f4f1d-87fa-11ec-8c40-01aa75ed71a1/language-en

Table 3: Contributions-benefits matrix for IPR Conflict friendly resolution.

	Partner 1 Benefits	Partner 2 Benefits	...	Partner 10 Benefits
Partner 1 Contributes		Partner 1 (contribute) … This is necessary to let Partner 2 (benefit) to …	X	
Partner 2 Contributes				
...				
Partner 10 Contributes				

On top of that, to proactively avoid IP conflicts, project partners will be well-informed about IP rules and guided through the exploitation process via the IPR Matrix but also through the help of the Innovation Manager. The Innovation Manager will aid with the following indicative (and not exclusive) issues:

- Is there a possible misunderstanding about the definition of the exploitable result and, therefore, of the object of claims?
- Are there exploitation claims that should be further specified so that the partners can check the compatibility of their claims?
- Are the foreseen exploitation claims compatible with the ownership claims of the partners (related issue of access rights)?
- Are there any confidentiality issues e.g., on new knowledge of strategic importance for a partner and the need for a confidential agreement?
- Are there any possible IP conflicts between the partners, both related to ownership and the related need for access rights and to exploitation claims?

Regarding IP conflict, the Exploitation Manager will encourage conflicting parties to contact each other and proactively find solutions, making written agreements whenever necessary. In case no agreement is achieved, an internal mediation process will be kicked off following the provisions of the Consortium Agreement. In case the IP issues remain unresolved after this first mediation procedure, a further mediation process following the WIPO Mediation Rules will be applied (see Article 11.8 of the Consortium Agreement).

Protection of results

The successful utilisation of the project's innovative ideas and assets hinges on protecting the project's results if:

- There is a reasonable expectation of commercial exploitation, and
- Protection is feasible, sensible, and warranted under the given circumstances.

In this context, when considering IP protection, partners should balance their individual interests with those of the entire consortium. They must shield the identified exploitable outcomes with appropriate protection measures, ensuring a reasonable duration of protection within a relevant geographical area. Table 4 below showcases various protection tools applicable to different subjects.

Table 4: Indicative protection instruments of results.

Subject Matter	Patent	Utility Model	Copyright	Trademark	Confidential information
Invention	X	X			X
Software	X	X	X		X
Scientific Article			X		
Technology Design			X	X	
Name of Technology				X	
Know How	X	X			X
Website			X	X	X

IP protection serves as a mechanism to add value by licensing, selling, or commercialising IP as products or services. Its use is crucial for potential commercial or industrial ventures, as it can enhance the branding of products and services to both consumers and investors. However, it is worth mentioning that protecting an asset's IP is not always obligatory.

7.3 POST-PROJECT PHASE

At the Project's conclusion, M30, D4.8 Innovation and Exploitation Activities Report and the Periodic Report will be submitted, including the final outline of the consortium's use of its exploitable results and the related plans for exploitation. The documents will include the final version of the IPR Matrix, business models for each of the KERs, and a business plan for the project innovations to facilitate their further usage and sustainability after the project's conclusion.

8 CONCLUSION AND NEXT STEPS

EXIGENCE has elaborated a solid exploitation strategy for the whole project duration, aiming to implement activities to develop a plan ensuring the sustainability of the project's results.

The initial phase of the EXIGENCE exploitation task, as detailed in this deliverable D4.7 Innovation and Exploitation Plan, has laid a solid foundation for the exploitation of the project's outcomes. Through a collaborative effort, the consortium has successfully identified key exploitable results (KERs) and established a comprehensive strategy for their dissemination, standardisation, and commercial exploitation. The activities implemented from M1 to M9 have not only highlighted the project's innovative approach to energy-aware ICT solutions but also underscored all partners' commitment to driving the sustainability agenda within the ICT sector.

During this first period, from 1 January 2024 (M1) to 30 September 2024 (M9), we have implemented the first phase of our exploitation strategy. Here are the main achievements of this Identify Phase:

- **Identification of KERs**: The project has successfully identified several exploitable results, which promise to significantly impact the ICT sector by enhancing energy efficiency and promoting sustainability.
    - KER1: Energy-aware ICT metering solution
    - KER2: Energy-aware orchestration product
    - ER4: Use Cases
    - ER5: Green ICT Digest
    - ER6: Energy consumption metrics
    - (K)ER3: Incentive-compatible Energy Reduction Mechanisms
- **Exploitation Routes Defined**: Clear exploitation routes have been established for each KER, ensuring that the project's outcomes will be effectively communicated to relevant stakeholders, contribute to developing international standards, and find practical application in the market.
- **IPR Strategy Formulation**: A robust IPR strategy has been formulated to protect the innovations developed within the project. This ensures that partners can confidently pursue commercialisation and other exploitation activities without the risk of infringement.

The project will now enter the second phase of the exploitation strategy, Characterise, from 1 October 2024 (M10) until 30 June 2025 (M18). As the project moves into the next exploitation phase, the focus will shift towards characterising each KER in greater detail. This phase will involve:

- **Market Analysis and Validation**: Conducting in-depth market analysis for each KER to identify potential customers, market size, and competitive landscape. This will include engaging with stakeholders to validate the market need and potential adoption barriers.

- **Technical Refinement and Prototyping**: The technical aspects of each KER will be further developed and refined, including prototypes where applicable. This will ensure that the solutions are innovative but also practical and user-friendly.
- **Engagement with Standardisation Bodies**: Initiating discussions with relevant standardisation bodies to explore integrating EXIGENCE outcomes into existing or new standards. This will involve preparing detailed proposals and participating in standardisation meetings and workshops.

The Characterise phase is critical for ensuring that the project's outcomes are technically sound and aligned with market needs and standards. By focusing on these activities, the consortium aims to maximise the impact of the EXIGENCE project, contributing to advancing green ICT practices and fostering innovation and sustainability in the sector.

As we move forward, the consortium remains committed to successfully exploiting the project's results, with the ultimate goal of driving positive change within the ICT industry and beyond. The activities planned for the next phase will build on the achievements of the initial phase, moving us closer to realising the full potential of the EXIGENCE project's innovations.

We will report on the outcomes of exploitation activities in the project periodic report, due on 28 February 2025.

Deliverable D4.8, Innovation and Exploitation Activities Report, is due by the end of the project. It will document the complete work done in this task and the outcomes of the project's achieved take-up capabilities.

9 ANNEX A: TEMPLATE FOR EXPLOITATION RESULTS

Exploitable results

This table will be further elaborated and validated in a workshop.

Name	Description	Type[5]	Owners/WP	KER[6]	Target audience[7]

Results Ownership List

Single or joint ownership of results	Result owners	Will the owners exploit the results?	In which form will the result be made available to other consortium members and/or third parties?	Does the exploitation of the results require access to the background of one or several consortium members?	Does the exploitation of the results require access to third party IPR?
[number of owners]	Partners	(Yes / No)	[Sale of IP] [Licensing] [Open access] [Open source] [Free licence] [Secret/non-disclosure agreement] [Other] [N/A]	Identify the background Insert measures taken /envisaged to give access to the background required for exploitation	Identify the background Insert measures taken /envisaged to get access to the required IPR

[5] SCI — Scientific discovery, model, theory (…); PROD — Product (new or improved); SERV — Service (new or improved); PROC — Industrial process (new or improved); BUS — Business model (new or improved); DSG — Design (new or improved); METH — Method, material, technology, design (new or improved); PO — Policy recommendation, guidance, awareness raising, advocacy; EVNT — Event (conference, seminar, workshop); STAFF — (qualified personnel exchanges); LEARN — learning and training (learning modules, curricula); INFRA — new or improved infrastructures or facilities

[6] High scientific potential; High societal potential (other than climate or environmental); High societal potential; High technologic, business or economic potential; High policy or regulatory potential; N/A

[7] Researchers; Industry, business partners; Investors; EU Institutions and/or agencies; Policy makers and authorities, international; Policy makers and authorities, national; Policy makers and authorities, regional or local; Citizens; Standardisation bodies; Innovators; End users (practitioners, farmers, etc); Education/training organisation/ learners; Research Infrastructures; Business accelerator providers; Other; Applicable to all

10 ANNEX B: TEMPLATE FOR RESULT EXPLOITATION ROADMAP

Characterisation Table

ER NAME	
Problem	Describe the problem you are addressing (the problem your potential users have). Potential users are the people, companies, organisations, etc. that you expect will use the result (and generate an impact). They are your "Customers".
Alternative solution	Describe how your "customer" has solved the problem so far.
Unique Selling Point USP - Unique Value Proposition UVP	Describe the competitive advantages, the innovative aspects. What does your solution do better, what are the benefits considering what your user/customer wants, how does your solution solve his/her problem better than alternative solutions, what distinguishes the KER from the competition/current solutions?
Description	Describe in a few lines your result and/or solution (i.e., product, service, process, standard, course, policy recommendation, publication, etc.). Use simple wording, avoid acronyms, make sure you explain how your UVP is delivered.
"Market" – Target market	Describe the market in which your product/service will be used/can "compete", answering the following questions: - What is the target market? - Who are the customer segments?
Go to Market – Use model	Explain what is your "use model", how the KER will be put in use (made available to "customers" to generate an impact). Examples of use models: manufacturing of a new product, provision of a service, direct industrial use, technology transfer, licence agreement, contract research, publications, standards, etc.
Go to Market - Competitors	Who are your "competitors" (note: they are the ones offering "alternative solutions")? What are their strengths and weaknesses compared to you?
Market maturity	State of the market targeted by this result: Not yet existing and not clear if market can be created; Market creating: not existing but potential for the creation of a new market; Emerging: growing demand, scarce supply; Mature: the market is already supplied with similar products.
Go to Market - Timing	What is the time to market?

Exploitation activities

Actions	Briefly describe actions planned to be executed 3-6 months after the end of the project.
Roles	Roles of partners involved in the actions defined above.

Milestones	List the milestones and KPIs to be used for monitoring the implementation of the actions listed above. Add timeline.
Financial Costs	Cost estimation to implement planned activities (1 year, 3 years).
Revenues	Projected revenues and eventual profits once the KER will be used (1 and 3 years after use).
Other sources of coverage	Resources needed to bridge the investment needed to increase TRL and ensure the result is used.
Impact in 3-year time	Describe impact in terms of growth/benefits for the society.

Risks assessment

Risk No.	Degree of criticality of the risk related to the final achievement of this Key Exploitable Result. Please rate from 1 to 10 (1 low- 10 high)	Probability of risk happening Please rate from 1 to 10 (1 low - 10 high)	Risk Grade	Potential intervention	Estimated Feasibility/Success of Intervention Please rate from 1 to 10 (1 low - 10 high)	Estimated Feasibility/Success of Intervention Please rate from 1 to 10 (1 low - 10 high)	Conclusion

Priority map