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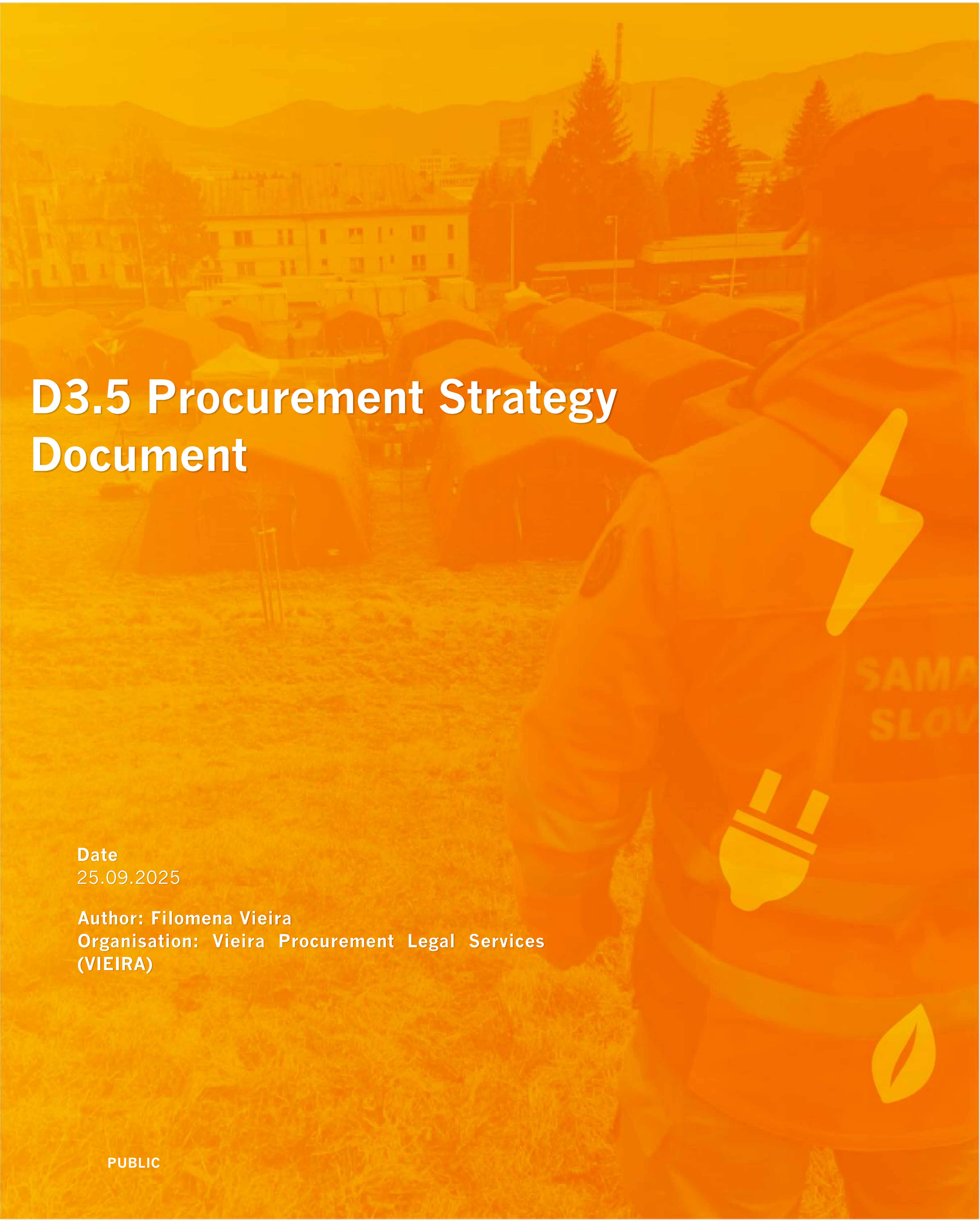
POWERBASE



D3.5 Procurement Strategy Document

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About the document

The Procurement Strategy Document outlines the methodological approach adopted by the Consortium, based on the findings gathered during the preparatory phase. It sets out the rationale for selecting the PCP process and describes the overall procurement strategy, including the procedural steps, governance structure, evaluation methodology and contract management to be applied throughout the PCP lifecycle.

Document revision history

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This document is based on project internal Deliverables, as well as external contributions, mainly from OMC event and Technology showcases.

Nature of the deliverable[1] **R**

Dissemination level

PU	Public, fully open. e.g., website	x
SEN	Sensitive, limited under the conditions of the Grant Agreement	
CL	Classified information under the Commission Decision No2015/444	

[1] Deliverable types:
R: document, report (excluding periodic and final reports).
DEM: demonstrator, pilot, prototype, plan designs.
DEC: websites, patent filings, press and media actions, videos, etc.
OTHER: software, technical diagrams, etc.

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Abbreviations and acronyms

BoO	Base of Operation
CN	Contract Notice
RDI Framework	Communication from the Commission — Framework for State aid for research and development and innovation (2022/C 414/01), published in OJ C 414, 28.10.2022, p. 1.
COTS	Commercial Off-the-Shelf
EAFIP	European Assistance for Innovation Procurement
EEROs	External Emergency Response Organisations
ERO	Emergency Response Organizations
ES	Emergency Shelter
EU	European Union
FAIR	Findable, Accessible, Interoperable, Reusable
HE	Horizon Europe
KPI	Key Performance Indicators
LCC	Life-cycle cost
IPR	Intellectual Property Rights
kWh	Kilowatt hours
OMC	Open Market Consultation
PBG	Public Buyers Group
PCP	Pre-Commercial Procurement
PEC	Procurement Evaluation Committee
PEROs	POWERBASE Emergency Response Organisations
PIN	Prior Information Notice
PPI	Public Procurement of Innovative Solutions
R&D	Research and Development
SME	Small and Medium Enterprises
SOTA	State-of-the-Art Analysis
TEC	Technical Evaluation Committee
TED	Tenders Electronic Daily
TFEU	Treaty on the Functioning of the European Union
TRL	Technology Readiness Level
WCPM	Union Civil Protection Mechanism
WIBGI	“Wouldn’t It Be Great If” methodology
WIPO	World Intellectual Property Organisation
WP	Work Package
WTO	World Trade Organisation

Executive summary

This Procurement Strategy Document presents the strategic, legal, and procedural framework for implementing a PCP under the POWERBASE project, which aims to foster the development of low-emission, modular, and field-adapted energy supply solutions for EROs. The initiative addresses a critical capability gap: existing energy systems used in emergency scenarios, while functional, present significant drawbacks — they are heavy, noisy, dependent on fossil fuels, and impose operational and environmental constraints that impact the working conditions of first responders and the well-being of affected populations.

The PCP preparatory phase included a comprehensive needs assessment, functional and technical requirement definition, a SOTA analysis, an OMC, and extensive engagement with end-users and stakeholders. These activities confirmed the absence of any ready-to-market or near-to-market solution fully aligned with the identified requirements and justified the choice of PCP as the most appropriate procurement instrument to stimulate market innovation and close the identified gaps.

The PCP process will follow a structured, phased approach: solution design (Phase 1), prototyping (Phase 2), and operational validation (Phase 3). Each phase will be subject to rigorous evaluation procedures, jointly conducted by the Procurement Evaluation Committee (PEC) and the Technical Evaluation Committee (TEC). Governance is ensured through clear institutional roles, written agreements among procurers, and compliance with EU PCP principles, including risk-sharing, phased competition, and IPR management. Performance monitoring tools, field validation strategies, and legal safeguards have been defined to ensure transparency, effectiveness, and alignment with both the PCP model and EU funding requirements.

By following this strategy, the POWERBASE project aims not only to enable the development of innovative solutions tailored to operational realities, but also to strengthen European technological autonomy, reduce environmental impact, and promote the uptake of sustainable energy solutions in the security and civil protection sectors.

1. Introduction

The procurement strategy document sets out the framework developed to assess the suitability of PCP for the identified unmet needs, followed by the evaluation of its feasibility and the design of its structure and implementation, aimed at closing critical capability gaps in the field of mobile energy supply for emergency response organisations EROs.

Currently, EROs operating in ES and BoO rely heavily on conventional fossil fuel-based energy systems. These systems present significant challenges: they are logistically burdensome, environmentally damaging, noisy, and often ill-suited to the dynamic, variable and sometimes dispersed nature of modern emergency operations. Moreover, they are increasingly incompatible with broader public policy objectives on climate neutrality and sustainability.

The POWERBASE project responds to this challenge by laying the groundwork for a future joint PCP focused on developing mobile, low-emission, autonomous energy solutions tailored to the specific needs of EROs. These solutions must enhance operational resilience, reduce dependency on fuel logistics, and align with the EU's green transition goals — all while fostering the performance, interoperability, and flexibility required in high-pressure and time-critical emergency scenarios.

To determine whether an actual innovation gap exists and if a PCP is the appropriate instrument to bridge it, the project followed a structured, stepwise methodology:

- Definition of unmet needs: Identification and prioritisation of critical energy-related operational needs gathered from EROs across ten European countries.
- Scenario development: Development of three representative emergency scenarios (wildfire, flooding, earthquake) to frame and stress-test requirements under varied operational conditions, while ensuring the project's scope remains applicable across the broader emergency response landscape.
- Needs clustering and requirement mapping: Aggregation and translation of end-user inputs into a harmonised set of functional and performance requirements.
- SOTA analysis: Benchmarking of existing technological solutions to assess current market capabilities and gaps, along with IPR search.
- Business case analysis: Evaluation of the strategic, economic, and operational justification for a PCP approach.
- OMC: Structured dialogue with suppliers and stakeholders to validate needs, assess feasibility, identify existing solutions and their TRLs, and test market interest in developing or adapting technologies to meet the identified requirements.

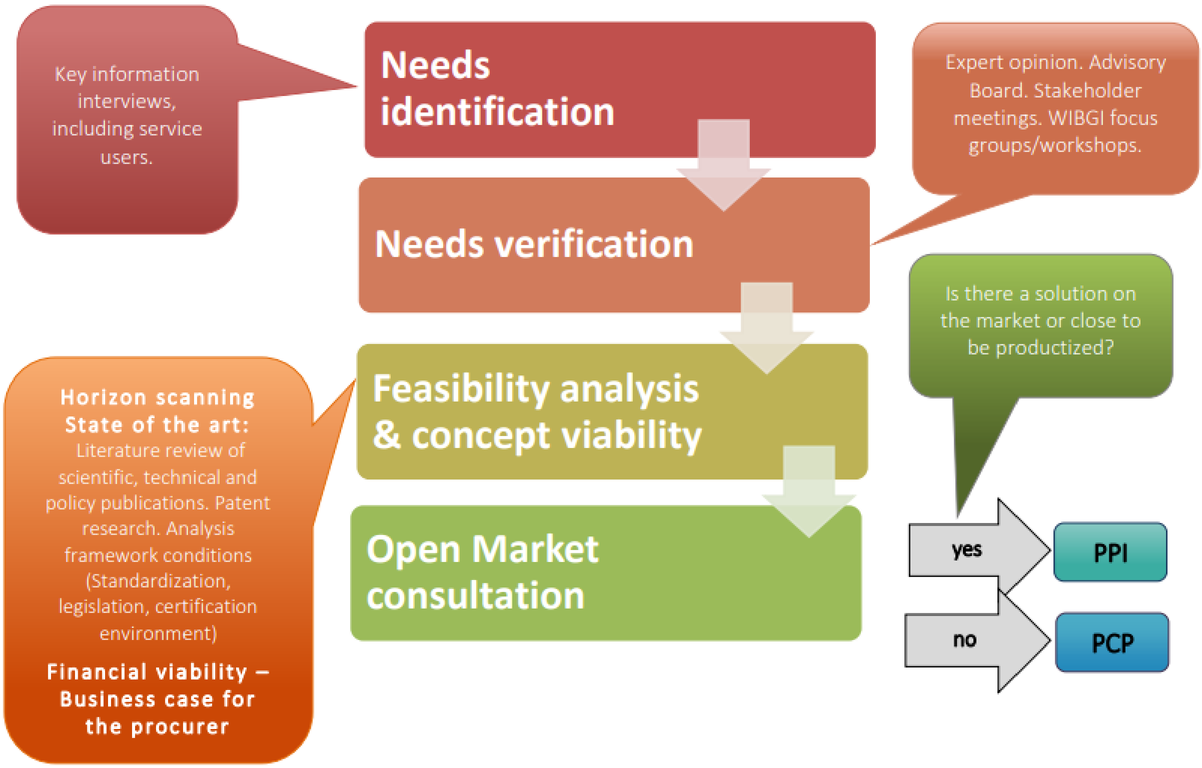

Figure 1 – Steps to prepare an innovation procurement

Source: Stella Consulting and Corvers Procurement Services, *The EAFIP Toolkit – Module 2*, European Commission, 2023, p.8.

This comprehensive analysis revealed that, although certain partial or component technologies exist and are currently in use, none constitutes a fully integrated or market-ready solution capable of meeting the specific operational, mobility, and sustainability requirements of EROs. As a result, it was concluded that no existing commercial or near-to-market solution can address the identified needs in a field-operational context. A PCP is therefore warranted as the most suitable instrument to drive the development of innovative, green, and deployable energy technologies in this field.

In addition to setting out this methodology and the conclusions drawn, the present document also defines the PCP strategy to be followed, including:

- The phased PCP approach (solution design, prototyping, and field testing);
- The procurement and risk-sharing strategy;
- The evaluation methodology for each phase;
- The contracting model and legal framework;
- The IPR regime; and
- The structure and content of the future tender documents.

This Procurement Strategy serves both as a justification for launching a PCP and as a practical guide for its implementation — ensuring that innovation is steered toward viable, sustainable, and mission-ready energy systems for civil protection and emergency response in Europe.

The PCP will be conducted on behalf of a Public Buyers Group, which brings together end-users acting as contracting authorities from several EU Member States with shared operational needs in the field of mobile, low-emission energy for EX and BoO. By aggregating their demand and coordinating their efforts, the Buyers Group strenghtens the business case for innovation and sends a clear sign to the market about solutions sought.

KENTRO MELETON ASFALEIAS (KEMEA) will act as Contracting Authority that will be appointed to coordinate and lead the joint PCP, and to sign and award the Framework Agreement and the specific contracts for all phases of the PCP, in the name of the Buyers Group.

This Procurement Strategy therefore sets out the approach to be followed and includes the governance model and roles of all parties involved.

2. Methodology

2.1. Scenario definition in the POWERBASE context

The POWERBASE project adopted a scenario-based methodology to support a robust and participatory process for identifying operational needs, functional requirements, and procurement strategies related to energy supply systems for ESs and BoOs. While the definition of scenarios played a central role in structuring the project's analytical and co-creation activities, it is important to emphasise that these scenarios are not binding. They do not limit or constrain the identification and assessment of needs or the formulation of functional specifications and requirements. Rather, they serve as methodological tools to enhance the depth and relevance of stakeholder engagement and technical exploration.

The scenario framework was designed to simulate realistic, high-impact emergency contexts in which EROs would need to deploy innovative, low-emission energy solutions. The aim was to provide a common, structured reference to facilitate cross-border dialogue, ensure alignment among diverse end-user perspectives, and anchor subsequent project activities in real-life operational challenges. These scenarios informed the functional requirements gathering, the state-of-the-art analysis, and the development of the innovation procurement strategy itself.

The process of scenario development followed a structured methodology:

- Objective definition to ensure that the scenarios reflected a representative range of operational contexts and logistical challenges.
- Scenario family development to cover different types of natural disasters and geographical settings.
- Validation through consultation with project partners and expert practitioners.
- Standardisation using a common template to allow comparability and clarity.

Each scenario integrates environmental, operational, and logistical dimensions, considering factors such as climate conditions, accessibility, affected population, infrastructure status, and phase of emergency response. The selected scenarios—wildfire, flood, and earthquake—reflect distinct geographic and climatic conditions, as well as varying logistical demands. They were specifically chosen to:

- Stimulate discussion and creativity during co-creation workshops.
- Capture diverse operational needs across different emergency phases.
- Stress-test technical requirements with respect to mobility, autonomy, durability, and scalability.

The scenarios continue to serve as reference points throughout the project and will also inform the validation and testing stages during the PCP process. However, their role remains supportive and illustrative: they enhance, rather than define, the process of identifying unmet needs and specifying functional requirements. This flexible, scenario-informed approach ensures that the resulting procurement strategy remains open, inclusive, and grounded in actual user experience across multiple emergency contexts.

2.1.1. Master scenario 1: wildfire on a Mediterranean island

Scenario 1: Wildfire – Corsica (France)

Context	Climatic Conditions	Accessibility	Deployment	Energy Challenges
Large wildfire in Corsica during summer; thousands of hectares affected; evacuations; infrastructure damage	Hot and dry Mediterranean climate; temperatures around 40°C; high solar exposure	Roads damaged or blocked by fire; some areas only reachable by air	Emergency shelters in public buildings (gyms, schools); supported by mobile BoOs for coordination	Power outages; high energy needs for cooling, communication, medical devices, and lighting

2.1.2. Master scenario 2: floods in winter

Scenario 2: Flood – Ostrava (Czech Republic)

Context	Climatic Conditions	Accessibility	Deployment	Energy Challenges
Winter floods following heavy rainfall and rapid snowmelt in the Moravian-Silesian region	Cold, wet, and unstable weather; temperatures near 0°C; short daylight	Roads and railways flooded; limited access to rural areas	Temporary shelters in sports halls and schools; coordination through mobile units and base camps	High demand for heating, drying equipment, lighting, and IT; risk of short circuits and fuel contamination

2.1.3. Master scenario 3: an earthquake in a rural Himalayan region with complex logistics

Scenario 3: Earthquake – Karnali Province (Nepal)

Context	Climatic Conditions	Accessibility	Deployment	Energy Challenges
High-magnitude earthquake strikes remote, mountainous area in western Nepal, causing landslides, destruction of villages, and infrastructure collapse	Subtropical highland; extreme altitude and temperature variation; frequent precipitation	Remote location; roads destroyed; access only possible by helicopter or long treks	Tented camps and mobile BoOs established under harsh conditions	No access to national grid or fuel supply; energy needed for communications, medical care, shelter heating, and cooking

2.2. Capability gap and functional requirements

A critical step in the preparation of an effective PCP procedure is the identification and articulation of common, user-driven functional and operational requirements. This chapter builds on the analysis carried out during the preparatory phase of the POWERBASE project, which was dedicated to identifying capability gaps and consolidating functional requirements for low-emission energy supply solutions designed for ESs and BoOs.

The primary objective of this work was to provide a structured foundation for guiding innovation procurement in the field of mobile, modular, interoperable, and environmentally sustainable energy systems for EROs. These systems must address both current performance limitations and future operational expectations, while support the broader green transition and enhance field-level resilience.

The methodology employed to reach this objective involved several interrelated steps:

- Identification and assessment of unmet needs based on input from national workshops with EROs across ten European countries.
- Clustering of user needs and expectations to enable the development of harmonised and cross-context requirements.
- Formulation of functional and operational requirements grounded in real-world use cases and validated through stakeholder engagement.

The work presented in this chapter builds directly on the scenario framework developed in the preparatory phase of POWERBASE. The three emergency scenarios served as reference tools to structure discussions, contextualise needs, and test the robustness of the identified requirements. However, as previously noted, the scenarios are not prescriptive; the process remained open to the full range of operational contexts presented by participating EROs.

The consolidated functional requirements presented here are the result of a participatory and iterative co-creation process. They reflect the operational realities of EROs, the performance expectations for future solutions, and the shared needs across countries and emergency types. These requirements were further prioritised and validated through stakeholder engagement and cross-checked with market capabilities through the OMC.

As such, this chapter provides the evidentiary basis for the PCP procedure set out in this Procurement Strategy Document. By ensuring that procurement is directly aligned with clearly defined, end-user-driven functional needs, this approach strengthens the relevance, transparency, and effectiveness of the innovation procurement process.

2.2.1. Needs identification and assessment

The needs assessment was conducted through a participatory and iterative methodology that combined structured workshops with creativity-driven approaches. A total of 107 participants from 58 organisations were involved, including both PEROs and EEROs.

The overall process was aligned with the EAFIP methodology and unfolded in two main phases. The first was a workshop-based process. The first one was held online with PEROs, applying the WIBGI method to encourage open and forward-looking thinking to identify unmet needs and envision ideal future functionalities for energy supply solutions.

Following this, a second workshop was conducted in person at the national level with EEROs. Nine national workshops were organised by project partners, each of whom selected one or more qualitative techniques. These approaches were used to structure brainstorming sessions, stimulate creativity, and cluster ideas effectively.

Data Consolidation and Analysis

Inputs collected from both workshops were systematically clustered and filtered to identify recurring patterns and commonly expressed functional expectations. These were then grouped into the following thematic categories:

Common categories
Functionality
Efficiency
Performance
Modularity
Interoperability
Ruggedness
Maintenance
Usability
Safety
Sustainability
Logistics
Standards
Financial aspects

In addition, quantitative parameters such as power output, operational temperature range, and weight were extracted when such data were provided.

Approach Characteristics

The needs assessment was deliberately structured to move beyond mere incremental enhancements to existing solutions, which do not constitute innovation. Its primary aim was to uncover genuinely unmet needs—rooted in real operational experience but oriented toward ambitious, forward-looking capabilities. All requirements were articulated in terms of functionality and performance, deliberately avoiding prescriptive technical specifications. This approach is intended to foster innovation and leave room for a wide spectrum of potential solutions within the future PCP process.

2.2.2. Clustering needs and requirements

PEROs participated in an online workshop using the WIBGI method. The brainstorming exercise was structured around the three scenarios. The PERO team identified unmet needs and expectations across several domains. These inputs were later clustered into the following thematic groups:

Thematic groups
Functionality
Efficiency
Performance
Modularity & Scalability
Interoperability
Durability
Ease of Maintenance
Usability
Safety
Transportability
Environmental Impact
Regulatory Compliance
Cost

2.2.3. Consolidated results

The clustering results from both the PEROs and the EEROs workshops were aligned across 13 thematic groups. These groups reflect a shared understanding of the functional and operational requirements for low-emission energy supply solutions in emergency response and recovery contexts.

Key insights from the clustering process include:

Thematic Group	Key Insights / Focus Area
Functionality	Easy-to-deploy, plug-and-play systems that support a wide range of devices and emergency operations.
Efficiency	High-efficiency systems with smart energy management and hybrid energy sources capable of adjusting to fluctuating demands.
Performance	Systems must be reliable with continuous operation in harsh, unpredictable environments and minimal downtime.
Modularity & Scalability	Energy solutions must be modular, scalable, and adaptable to various operational needs.
Interoperability	Energy systems should be compatible with existing infrastructure and various connectors for power and communications.
Resistance & Ruggedness	Systems must be resilient to extreme temperatures, water, dust, and shocks, especially in severe field conditions.
Maintenance & Availability	Low-maintenance systems that are easy to repair, with spare parts and serviceability for long-term use.
Usability	Energy systems should be user-friendly, minimizing setup time and training requirements for non-experts in stressful environments.
Safety & Security	Focus on safety, including protection against electrical hazards, fire, and environmental risks to responders and displaced populations.
Sustainability	Environmental sustainability with recyclable, low-emission solutions that meet environmental goals.
Transport & Deployment	Energy solutions must be lightweight, modular, and compatible with air, land, and sea transport options for remote locations.
Standards & Documentation	Adherence to international standards, ensuring compliance and smooth integration into existing systems.
Costs	Cost-effective solutions that balance upfront investment and long-term maintenance, ensuring affordability without compromising functionality.

2.3. State-of-the-Art Analysis

2.3.1. Methodology and Structure of the Solution catalogue

The methodology used in the SOTA report combines a two-pillar approach:

(1) Technological SOTA Analysis:

Conducted through desk research, literature review, patent analysis, and exploration of publicly available commercial solutions, scientific publications, and R&D projects. It is structured to align with the scenarios and functional requirements defined previously. The analysis classifies technologies based on use cases, maturity levels, and their suitability for deployment in ES and BoO contexts.

(2) Actor Mapping:

In parallel, relevant stakeholders were identified across industry, research, public sector, and standardisation bodies. This mapping is intended to support market engagement and the upcoming PCP process. It is based on information gathered by consortium partners, public sources, and previous project networks.

The entire process is grounded in the needs and challenges defined previously, ensuring that the SOTA is not abstract but directly linked to user-driven requirements. The solution catalogue is a systematic compilation of existing technologies, products, and systems that may be relevant to POWERBASE use cases.

Its structure includes:

- Technology area (e.g. generation, storage, control)
- Solution name or type
- Provider/manufacturer
- Technical characteristics (e.g., capacity, energy source, modularity)
- Use case relevance (e.g., suitable for ES, BoO, or both)
- TRL
- Strengths and limitations
- Alignment with functional requirements

This structure allows for a comparative overview of what is already available on the market or in development, highlighting gaps and opportunities for innovation procurement. It acts as both a reference and a filter to distinguish between mature, emerging, and insufficiently developed solutions.

The relevance of conducting an IPR search before deciding to initiate a PCP procedure must be emphasised. It is a key risk mitigation tool — identifying whether technologies are already protected by third-party patents or other intellectual property rights. Early detection of such issues allows for the redesign of requirements or consideration of alternative approaches. Moreover, it provides a solid knowledge base before the specifications are finalised in the tender documents.

That is why IPR search is critical — not only to verify the innovation status, but also to identify key IPR holders, assess licensing risks, and prevent potential downstream legal or commercial issues.

2.3.2. Technology fact sheets

The technology fact sheets are condensed, structured summaries of specific technologies, presented in the annex of the SOTA report. Each fact sheet provides a focused description of a single technological solution or component, following a common template. These are the reasons they appear in the SOTA report:

- To provide detailed, ready-to-use information on individual technologies that are promising or representative.
- To support workshop and co-creation activities, giving partners and stakeholders a shared basis to discuss feasibility and innovation potential.
- To feed into the OMC and PCP design, helping identify areas where existing technologies fall short of user needs or where R&D is justified.

Technology Fact Sheets do not offer evaluations or recommendations, but present factual, structured information to guide decision-making and stimulate informed discussion within the project.

2.4. OMC process and results

The OMC plays a pivotal role in the definition of an effective procurement strategy. It serves as a structured and transparent dialogue with the market and external stakeholders of the consortium, enabling the consortium to assess the SOTA and maturity of potential solutions. Through this process, the functional and technical requirements identified during the preliminary stages are tested against real-world capabilities and limitations.

Engaging with the market allows the consortium to verify whether the proposed needs are already addressed by existing solutions, or if they pose technological challenges that require further R&D efforts. This understanding is critical not only to validate the innovation gap but also to refine the scope and ambition of the future procurement. As such, the OMC is a key milestone in the CSA, ensuring that the procurement strategy is both aligned with market realities and tailored to drive innovation where it is still needed.

The OMC was carried out as part of Phase 0 to inform the consortium about the technology state-of-the-art relevant to future procurement specifications and strategies. The OMC aimed both to raise awareness among industry and R&D providers about the identified needs, disaster scenarios, and requirements, and to collect insights on industry capabilities to finalise procurement documents. Following the publication of a PIN in the Official Journal of the European Union, OMC activities were organised to optimise the requirements catalogue, complement the SOTA analysis, feed into the business case and procurement strategy, and support the consortium’s decision to engage in a future PCP process.

The OMC was announced on 21.02.2025 through the PIN and an OMC scope document published on the project website and ran until 31.08.2025. Interested parties registered via the website to access information, participate in webinars and hybrid events, and submit written contributions through a RFI questionnaire. The OMC included four hybrid technology showcases, a central hybrid event in Brussels on 12.06.2025, a workshop in Athens on 28.08.2025, and the publication of a Q&A document. In total, 55 participants joined onsite and online, representing 13 technology providers from six EU countries and 15 emergency response organisations, with SMEs and start-ups forming the main participant group.

The events allowed suppliers, innovators, research institutions, and public authorities to explore the project's needs, assess the state of the market, and provide feedback on technical challenges. Participants presented solutions ranging from fully commercialised technologies to low-TRL innovations and engaged in matchmaking and networking sessions to explore potential collaborations and future consortium building. The consultation confirmed that no solution currently available on the market fully addresses the POWERBASE requirements, with some partial solutions identified but further R&D needed. It was commonly agreed that a PCP procedure is justified to meet the challenge of developing renewable, low-emission, mobile energy solutions for ES and BoO.

Industry recommendations gathered through the OMC included allocating sufficient time for Phases 2 and 3 (at least 10 and 8 months respectively), avoiding changes to consortium composition during the process to ensure equal treatment, and including a clear evaluation mechanism in the tender documents to prevent delays. Concerns were raised about market risks that could affect return on investment, and it was recommended to avoid complex procurement procedures and instead opt for a joint, cross-border, innovation-oriented procurement with a clear strategy and conditions that support innovation uptake beyond the PCP.

2.5. Business case development

Developing a robust business case is a foundational step in preparing for a successful PCP. It provides the analytical framework necessary to justify the procurement of innovative solutions, assess the strategic value of addressing the identified unmet needs, and evaluate the potential return on investment—whether economic, social, environmental, or operational.

In the context of the CSA, the business case supports evidence-based decision-making by clearly articulating the problem to be solved, the expected benefits of procuring innovation, and the risks and assumptions involved. It also helps identify the potential for scaling and deployment after the PCP, as well as the alignment with broader policy objectives.

As such, the business case and cost analysis is an essential pre-requisite for the procurement strategy. It ensures that the PCP is not only technically and legally sound, but also strategically justified and viable in terms of long-term impact and value creation.

This business case and cost analysis was carried out to assess the current energy supply systems used by EROs and to evaluate the justification for transitioning to more sustainable alternatives. Data was collected from consortium partners through a questionnaire designed to capture both quantitative and qualitative information about existing energy infrastructure and practices. The analysis shows that most organisations rely on conventional diesel generators, which, despite their reliability, present several operational, financial, and environmental challenges. The consortium expressed a strong interest in exploring innovative and adaptable energy solutions better suited to future needs.

A cost analysis was performed comparing existing solutions with the projected POWERBASE system. The results highlighted the need for a new system that bridges the gap between operational requirements and available technological solutions, offering significant potential cost benefits. The business case confirms both the operational rationale and financial justification for investing in next-generation deployable energy systems. POWERBASE has created a shared understanding of user needs and system limitations, providing a solid basis for future innovation procurement. In civil protection and humanitarian operations, reliable and sustainable energy supply remains a critical enabler, yet current reliance on diesel generators results in inefficiencies, high emissions, and limited scalability.

The business case and cost analysis consolidated input from partners, results from the needs assessment, SOTA analysis, functional requirements, and RFI completed by technology providers and researchers. It evaluated the economic impact and viability of the POWERBASE solution through a cost/benefit analysis, market analysis with buying volumes, and a financial evaluation grid. Findings show that generators, while used only during field missions, generate high annual operational costs — €3,000 to €16,800 per system per year for an average deployment of 30 days, or €30,000 to €168,000 over 10 years, excluding acquisition. The largest cost driver is fuel, aggravated by inefficient use at partial loads, logistics in remote areas, and underappreciated storage and maintenance costs. Environmental externalities further raise the true cost of current solutions.

The future POWERBASE system is expected to address these limitations by reducing fuel consumption, enabling modular scaling of power output to match demand, and incorporating smart features such as AI-supported monitoring, real-time consumption tracking, and predictive maintenance. These improvements should reduce downtime, extend system life, and optimise energy use, leading to a lower total cost of ownership. Maintenance costs, currently €100–700 per system annually despite limited use, are expected to decrease with fewer moving parts and improved diagnostics. Collectively, these innovations should deliver substantial lifecycle savings, particularly for medium and high-consumption scenarios, and align with EU sustainability and innovation objectives.

Quantitatively, a 30% reduction in fuel consumption alone could deliver savings of €900–€4,800 annually per unit, depending on usage intensity. These savings, combined with reductions in maintenance and transport effort, support the economic case for the POWERBASE solution. To enable a comparative assessment, a simplified financial evaluation grid consolidating cost metrics and functional characteristics was prepared. Although the POWERBASE solution is not yet prototyped, its design will be based on functional requirements emphasising modularity, smart monitoring, and reduced fossil fuel dependency.

For procurement planning, an indicative PCP budget was developed based on consortium needs and RFI input. The budget foresees €50,000 per contractor for Phase 1 (solution design), €600,000 per contractor for Phase 2 (prototype development), and €750,000 per contractor for Phase 3 (operational validation and field testing). Phase 1 is expected to engage at least six contractors (€300,000 in total), Phase 2 at least three contractors (€1,800,000 in total), and Phase 3 at least two contractors (€1,500,000 in total), reflecting an increasing intensity of effort and resource allocation. These amounts are consistent with market estimates of €1–1.5 million per complete system. The business case and cost analysis therefore establish a credible foundation for procurement preparation and support the transition toward innovative energy solutions that are modular, efficient, and environmentally sustainable, helping civil protection actors reduce costs, improve resilience, and meet their operational and policy objectives.

2.6. Procurement strategy

In the context of the POWERBASE project, the procurement strategy, together with the tender documents, represents the final output of a comprehensive preparatory process that includes the definition of operational scenarios, needs identification and assessment, functional requirement specification, state-of-the-art analysis, intellectual property mapping, business case development, and an OMC.

It synthesises all evidence gathered throughout these activities and provides a structured framework for determining the most appropriate procurement approach to address the identified capability gaps.

A procurement strategy, in this context, is not merely a planning document. It is a decision-making tool grounded in a robust, user-driven, and market-informed methodology.

Its primary function is to assess whether the identified needs can be met by existing market solutions or through conventional public procurement procedures—or whether the degree of novelty and the risk of technological uncertainty justify the use of a PCP process.

The strategy does not presuppose the use of a PCP. On the contrary, it critically examines whether the unmet needs articulated by EROs correspond to a level of innovation that cannot be satisfied by existing or near-to-market solutions. This includes assessing whether the innovation gap identified requires a structured R&D process, involving risk-sharing with suppliers and phased prototyping, rather than the procurement of finished products or close-to-market adaptations.

Only when the analysis concludes that:

- no suitable solutions currently exist on the market,
- the market is not likely to deliver such solutions without public intervention,
- and the desired outcomes entail technological development that goes beyond standard commercial innovation,

can the procurement strategy validly recommend the use of PCP as the most appropriate and proportionate instrument.

Thus, the PCP in POWERBASE is not a starting assumption but a carefully reasoned conclusion—one that reflects the project's commitment to legality, transparency, and the effective use of public funds to address urgent societal and operational needs through innovation.

3. The innovation gap and the PCP justification

3.1. The innovation gap

The analysis made by POWERBASE SOTA report reveals that no existing solution on the market currently satisfies all the operational, functional, and environmental requirements defined by EROs for energy supply in ESs and BoOs. Specifically:

- **Lack of Fully Integrated, Modular, and Mobile Solutions**

While various technological components in the field of renewable energy generation, conversion and storage (e.g. battery systems, solar panels, fuel cells) as well as smart energy management) are available and some are even mature and integrated in a unique system in various combinations there is a lack of integrated systems that optimally combine mobility (thus sufficiently low size/volume and conditions for meeting air safety regulations), efficient performance, robustness, interoperability with other systems, and autonomous functionality suitable for emergency scenarios. The successful modularity of multiple components is often questioned, as well as the integration of a sub-system of low-emission commercially available fuel. Moreover, existing systems typically lack the adaptability and plug-and-play compatibility required in fast-changing field conditions, often requiring professional knowledge for their set-up and/or maintenance.

- **Inadequate Performance and Configuration for Field Use**

Although low-emission and renewable energy-based and storage systems, mostly individually, exist, most are not rugged, hybrid, interoperable or mobile enough for deployment in real emergency conditions. The report underlines that ERO-specific energy requirements for Base of Operations and Emergency shelters are not adequately addressed by current solutions.

- **Gap Between Civilian Green Tech and ERO Operational Demands**

Much of the existing innovation in green energy technologies is designed for civilian or stationary use cases. These solutions do not fully align with the tactical, logistical, and deployment constraints faced by emergency responders, particularly in disaster-affected, off-grid, or inaccessible areas.

- **Limited Smart Management and Interoperability**

The market lacks deployable energy systems that provide intelligent energy management (e.g., demand adaptation, storage balancing) in a plug-and-play and interoperable format that meets EROs' demand for user-friendliness and integration across equipment and agencies.

- **R&D Needed to Achieve Combined Specifications**

Although elements of the desired system exist, no single solution or supplier currently offers a system that meets the combined operational, environmental, modular, and performance-based specifications required by the consolidated needs assessment. This confirms that further R&D is required to bridge the gap, making PCP the appropriate instrument.

3.2. The maturity of the solutions and the need of R&D efforts

The SOTA analysis reveals that, while numerous energy technologies are under development or commercially available in isolated forms, no integrated system currently meets the full spectrum of functional, operational, and environmental requirements identified by EROs within the POWERBASE project.

The report provides specific insights into the maturity of several promising technologies through references to their TRLs. These TRLs highlight both the technological potential and the current limitations that preclude their immediate deployment in the contexts of ESs and BoOs. For example:

- Saltwater and seawater batteries are only at TRL 2–3, existing as conceptual models with limited power output and no field deployment capacity.
- Solid-state batteries have reached TRL 5–7, reflecting progress but still lacking sufficient maturity for operational use under demanding field conditions.
- Zinc–air batteries, while environmentally promising, remain at TRL 3–6 in their rechargeable variants and are not commercially available in forms suitable for emergency response.
- Hydrogen internal combustion engines are currently at TRL 6–7, facing unresolved challenges related to combustion stability and emissions control.
- Solid-state wind systems and small modular nuclear reactors are still in early development stages, ranging from TRL 3–6 and TRL 4, respectively.

While some conventional technologies—such as lithium-ion batteries, diesel generators, and photovoltaic panels—are commercially available and widely used, the SOTA analysis confirms that these components, when considered individually, do not satisfy the project's requirements for mobility, modularity, low emissions, autonomous operation, and ruggedness in emergency environments.

Most importantly, the report concludes that no off-the-shelf system currently combines these elements into a fully integrated, deployable solution that can be procured through standard procedures.

The absence of a high-TRL, market-ready or near-to-market system capable of fulfilling the consolidated functional requirements evidences a clear innovation gap.

As such, the findings of the SOTA analysis directly support the conclusion that additional R&D efforts are necessary to deliver solutions aligned with ERO needs. This confirms the appropriateness of a PCP procedure, which allows for phased development, prototyping, and testing of innovative systems under real-world conditions. The PCP approach is therefore not only justified, but essential to address the maturity gap identified in the current state of the market.

3.3. Choosing between a PCP and a PPI

The decision to pursue a PCP or a PPI depends fundamentally on the nature of the unmet needs and the availability of solutions in the market. If the functional and technical requirements identified by the procurers cannot yet be met by commercially available products or services — either because no solution exists or existing ones do not achieve the desired performance — a PCP is typically the appropriate path. PCP enables the public sector to engage in the procurement of R&D services in a phased and competitive process, supporting the development and testing of new solutions before they are commercially deployed.

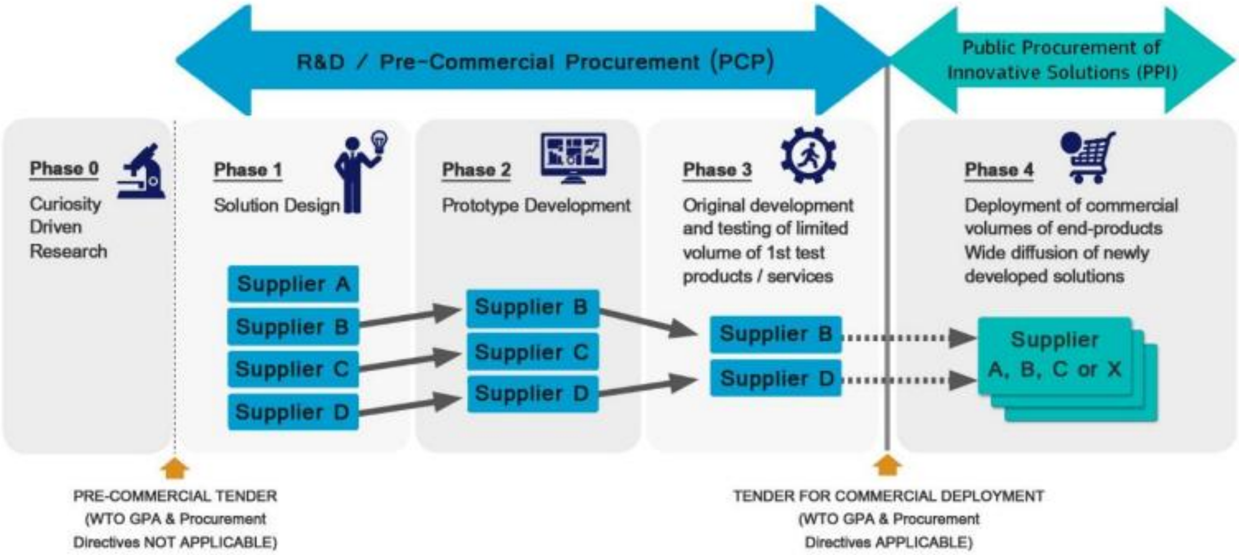

Figure 2 – Overview of a phased pre-commercial procurement
Source: Stella Consulting and Corvers Procurement Services, *The EAFIP Toolkit – Module 2*, European Commission, 2023, p.6.

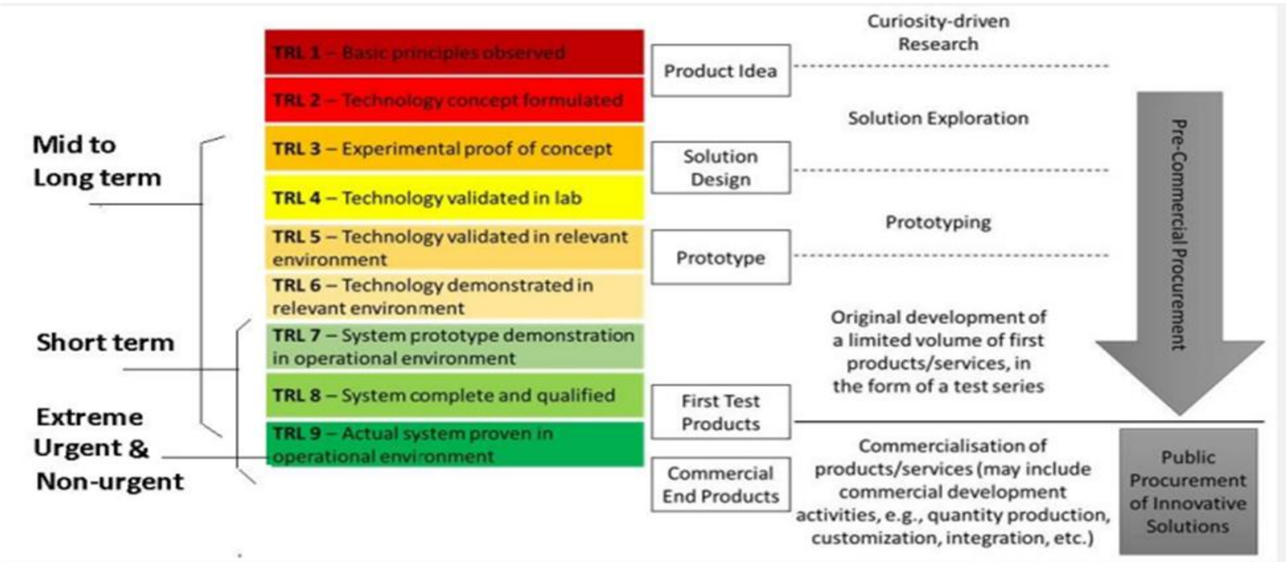

Figure 3 – TRLs correspondence to PCP and PPI
Source: Stella Consulting and Corvers Procurement Services, *The EAFIP Toolkit – Module 2*, European Commission, 2023, p.98.

By contrast, when innovative solutions already exist or are in the final stages of market readiness, and the procurers' needs can be met without further R&D, a PPI is more suitable. PPI focuses on the procurement of close-to-market or commercially available innovations, helping to bridge the gap between demonstration and full-scale deployment. It allows contracting authorities to act as early adopters of innovative products or services, creating market pull and accelerating the diffusion of innovation within the public sector.

Figure 4 – Choosing between PCP or PPI.
Source: Source: Stella Consulting and Corvers Procurement Services, *EAFIP Toolkit – Module 2*, European Commission, 2023, p.78.

The choice between PCP and PPI also depends on other factors such as risk, time-to-deployment, budget constraints, and the maturity of suppliers. A PCP involves higher technological uncertainty and longer timeframes, but it gives procurers the ability to steer solution development according to their specific needs. A PPI, on the other hand, typically leads to faster implementation but requires a more detailed understanding of the market and greater readiness to handle innovation-related risks within the procurement and operational environments. Therefore, a thorough needs assessment, technology maturity analysis (e.g. TRL levels), and early market engagement (including OMCs) are essential to inform this strategic decision.

3.4. PCP expected benefits

Within the POWERBASE project, PCP is expected to play a pivotal role in addressing specific capability gaps identified by first responders' practitioners. While emergency responders currently rely on power supply systems that are often noisy, heavy, dependent on fossil fuels, and logistically demanding, a number of emerging technologies offer promising features — such as lower noise levels, modularity, interoperability, and reduced emissions from different sources. However, no integrated solution currently exists on the market that meets the operational requirements of first responders. PCP offers a structured, phased R&D procurement approach that enables public buyers to stimulate the development of such solutions, tailored to real operational conditions, practitioner needs and sustainability goals.

A key strength of PCP in POWERBASE lies in its ability to support the co-design of solutions in close collaboration with end users and suppliers. This demand-driven process ensures that the technologies developed are not only technically viable but also operationally relevant, scalable, and adapted to the constraints of practitioners in the field. Field testing of prototypes across varied emergency scenarios — from large emergency shelters in urban environments to base of operations of small, specialized teams in remote areas — reduces the risk of technological mismatch and increases the likelihood of future deployment. Moreover, this approach contributes to fostering a more coherent and innovation-friendly ecosystem.

Beyond the development of specific technologies, the PCP in POWERBASE is also expected to deliver broader systemic benefits. It establishes a framework for cross-border cooperation between public buyers, aligns innovation investment with EU climate and resilience objectives, and supports the emergence of a European market for low-emission energy systems in civil protection. Furthermore, the intellectual property regime embedded in the PCP process ensures that the knowledge generated can be exploited, replicated, and integrated into national and EU-level capability planning, reinforcing Europe's strategic autonomy in critical technologies while maximising the long-term impact of public investment.

4. The PCP process

4.1. The PCP requirements

1. Introduction

PCP is a strategic instrument used by public buyers to drive innovation in areas where no suitable solutions are commercially available. It enables the public sector to procure R&D services in phases — from solution design, through prototyping, to field testing — in order to co-develop and validate breakthrough technologies that address specific unmet needs. PCP is exempt from the full application of the EU procurement directives, the WTO Government Procurement Agreement and the EU's other procurements agreements with third countries. Nevertheless, it must still adhere to fundamental principles of transparency, non-discrimination, and competition. Moreover, PCP procurements may include conditions aimed at ensuring strategic alignment, such as giving preference to European-based participants or requiring that key R&D activities — particularly those involving the principal researchers — are carried out within Europe. For a PCP process to be effective, several procedural, operational, and strategic requirements must be met in advance. This chapter sets out the key requirements for preparing and implementing a PCP, drawing on European Commission guidance and best practices.

2. Strategic and Functional Preconditions

Before launching a PCP, the procurers must assess whether the procedure is the appropriate tool to address their unmet needs. PCP is only justified when there is a clear innovation gap: that is, when the desired functional and technical requirements cannot be met by commercially available solutions. This typically involves:

- Identifying a well-defined unmet need for which no suitable market-ready solution exists;
- Demonstrating that the challenge requires R&D efforts to bridge the gap between current technologies and operational expectations;
- Confirming that the market alone is not addressing the need, due to high technological risk, fragmented demand, or limited commercial incentives.

This assessment should be substantiated by internal capability reviews and informed by external input — especially through OMC processes, where preliminary specifications are tested against market maturity and innovation potential.

3. Procedural Requirements and PCP Structure

The PCP process is based on a phased procurement model, typically structured into three distinct stages:

1. Solution Design
2. Prototyping
3. Original Development and Field Testing

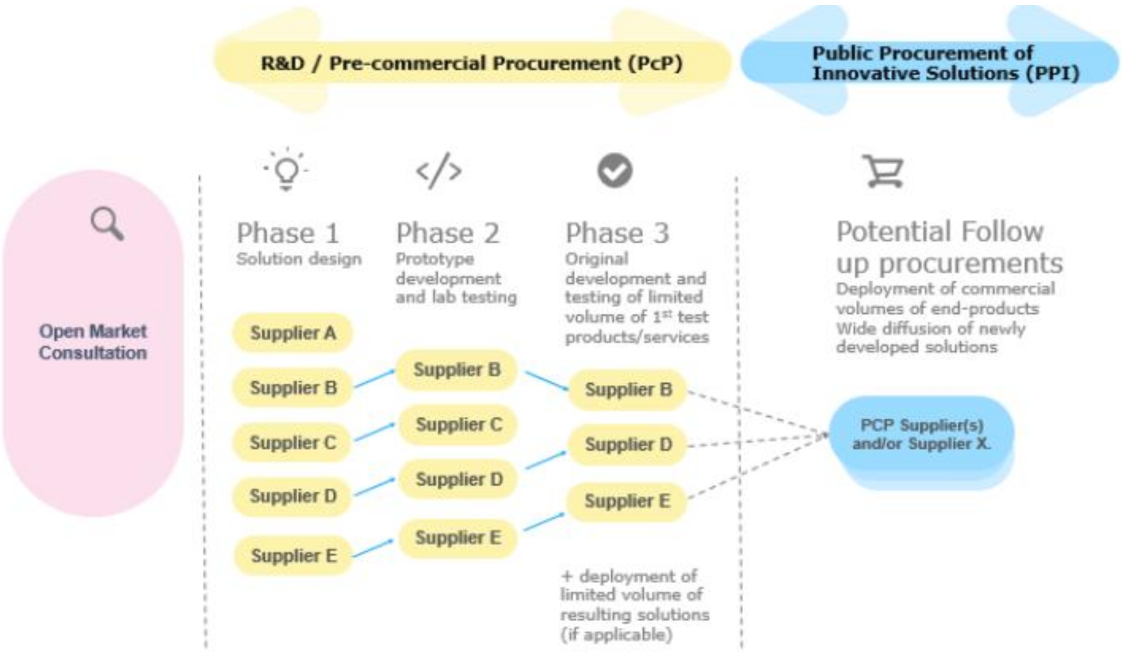

Figure 5 – Standard 3 phase PCP
Source: European Commission, *Horizon Europe (HORIZON) EU Grants: How to set up and manage HE PCP and PPI grants – From designing your proposal to managing your procurements*, version 1.0, 15 October 2023, p.5.

Each phase is competitively awarded to a decreasing number of suppliers based on pre-defined objective evaluation criteria. This phased approach ensures a gradual reduction of technical uncertainty and facilitates early de-risking. To conduct a compliant PCP, the following procedural elements must be in place:

- Clear procurement documents, including challenge definition, functional requirements, evaluation criteria, risk sharing approach and IPR provisions;
- Publication of an open call for tenders, ensuring non-discriminatory access to suppliers across the EU and associated countries;
- Fair and transparent evaluation of bids in each phase, with objective scoring and justification for supplier progression or elimination;
- Contractual arrangements that reflect the phased nature of PCP, often through framework contracts with specific phase contracts.

4. Risk-Benefit Sharing and IPR Regime

One of the defining features of PCP is its risk-benefit sharing model. In contrast to traditional procurement, where the buyer typically assumes most of the risk and owns the results, PCP distributes risk and benefits between the public sector and the suppliers:

- Suppliers retain ownership of the IPR resulting from the R&D activities.
- Procurers receive rights of use for internal purposes and can obtain broader usage rights (e.g., for third-party public bodies) under fair and reasonable conditions.

- The financial contribution of suppliers is expected in part, as a reflection of the commercialisation potential of the solutions being developed.

This model incentivizes supplier investment and innovation, while ensuring that public buyers benefit from the results and maintain freedom to procure follow-on solutions competitively through PPI.

5. Organisational and Technical Capacity

Implementing a PCP requires significant capacity on the part of the contracting authorities. Procurers must demonstrate they possess, or can mobilize, the following capabilities:

- Legal capacity to procure R&D services and manage innovation-oriented procedures;
- Technical expertise to define functional requirements, assess technological feasibility, and evaluate prototypes;
- Project management resources to coordinate multi-phase contracts and interactions with suppliers;
- Commitment to potential deployment, even if the PCP itself does not cover procurement of commercial volumes.

In joint cross-border PCPs, these requirements apply to all members of the buyers' group, with roles and responsibilities clearly defined in a cooperation or consortium agreement.

6. Market Engagement and Demand Aggregation

A successful PCP process is underpinned by early market engagement and, where possible, demand aggregation. This involves:

- Conducting an OMC to inform suppliers about the upcoming PCP, gather feedback on preliminary requirements, and test market readiness;
- Ensuring transparency and equal access to all potential bidders during the OMC and tender phases;
- Aligning needs across multiple buyers, especially in joint procurements, to create a common challenge and increase the attractiveness of the call. Such engagement ensures the PCP is based on a realistic understanding of the market's capabilities and encourages supplier participation — particularly from SMEs and specialised R&D providers.

7. Alignment with Broader EU Policy Objectives

Finally, PCP must be strategically aligned with wider public policy objectives, such as strategic autonomy in critical technologies, consistency with EU Green Deal, civil protection goals, stimulating SME participation in public markets and integrating PCP outcomes into capability planning at local, national, or EU level.

8. Conclusion

PCP is a powerful instrument for driving targeted innovation in the public sector, but its implementation requires careful preparation and adherence to a specific set of procedural, strategic, and legal requirements. These range from identifying a genuine innovation gap to ensuring transparent supplier selection, phased implementation, appropriate risk sharing, and organisational readiness. When these conditions are met, PCP enables the development of solutions that are not only technologically advanced but also tailored to the real operational needs of public buyers. In projects like POWERBASE, this process contributes directly to shaping a more sustainable, resilient, and innovation-driven public service infrastructure.

4.2. The legal framework

1. Introduction

PCP is a legally recognised procurement model within the European Union, designed to stimulate innovation through the competitive development of R&D services. While it differs from traditional procurement procedures governed by Directive 2014/24/EU, PCP operates within a defined legal framework that ensures transparency, competition, and compliance with the principles of the TFEU. This chapter outlines the EU-level legal foundations for PCP, its relationship with national procurement law, and the legal conditions that must be met to justify the use of PCP as a distinct and lawful procurement tool.

2. EU Legal Basis for PCP

The formal basis for PCP in EU law originates from the European Commission Communication COM (2007) 799 final: *Pre-commercial procurement: Driving innovation to ensure sustainable high quality public services in Europe*. This communication laid out the rationale and model for PCP, distinguishing it from the procurement of commercial products or services. It establishes that contracting authorities can procure R&D services under specific conditions without falling under the full scope of the EU procurement directives, provided certain legal principles are respected.

Directive 2014/24/EU on public procurement does not directly regulate PCP as a specific procedure. However, Recital 47 explicitly acknowledges the possibility for public buyers to procure R&D services through PCP, provided that such services are excluded from the main scope of the Directive under certain conditions. These conditions are set out in Article 14 of Directive 2014/24/EU, which states that the Directive does not apply to public service contracts for R&D services “other than those where the benefits accrue exclusively to the contracting authority for its use in the conduct of its own affairs, on condition that the service provided is wholly remunerated by the contracting authority.”.

Furthermore, when implemented in accordance with the model described in the 2007 Communication and in Commission RDI Framework, PCP is generally not considered State aid. This is because the procurement is carried out under market conditions, with a transparent and competitive process, and without giving undue advantage to selected suppliers. Public buyers do not fully fund the R&D — suppliers are expected to contribute financially, reflecting their potential to commercially exploit the results. The allocation of IPR must also reflect the risk-benefit sharing between the parties. Provided that these safeguards are respected — including open competition, partial public financing, and fair IPR arrangements — PCP falls outside the scope of Article 107(1) TFEU. However, failure to meet these conditions could result in the procedure being qualified as unlawful State aid.

3. Conditions for Legal Compliance

For a PCP process to be considered lawful and compliant with EU procurement law, it must meet the three cumulative conditions set out in the 2007 Communication and reflected in Article 14 of Directive 2014/24/EU:

- Shared risk-benefit model: The benefits of the R&D do not accrue exclusively to the contracting authority. Instead, suppliers retain ownership of the results, enabling them to exploit the innovation commercially beyond the scope of the PCP.
- Partial public funding: The R&D service is not wholly remunerated by the public authority. Suppliers are expected to co-invest, typically through absorbing part of the development costs in exchange for commercialisation rights.
- No procurement of commercial volumes: The PCP procedure must not result in the acquisition of end-products or commercial services. It is strictly limited to the procurement of R&D services. The subsequent procurement of commercial solutions must take place through a separate, open, and competitive procedure — for example, a PPI.

By adhering to these conditions, contracting authorities ensure that the PCP remains outside the scope of the procurement directives, while still respecting EU primary law, including the fundamental principles of transparency, equal treatment, non-discrimination.

4. Relationship with National Procurement Law

Although PCP is exempt from the full application of Directive 2014/24/EU, contracting authorities must still comply with applicable national procurement laws, particularly those implementing general principles of administrative law, financial control, and good governance. In some Member States, the concept of PCP has been explicitly addressed in legislation, while in others it remains governed by general provisions on service contracts or R&D procurement.

In any case, national rules must not contradict the three conditions described above, and public buyers must ensure that the procedure remains competitive, fair, and non-discriminatory. Where PCP is implemented in cross-border joint procurement, as the POWERBASE case, additional legal instruments may be necessary to define cooperation among buyers — such as a joint procurement agreement.

Greek Law n. 4412/2016 and 4782/2021 will govern the POWERBASE PCP procedure, where applicable.

5. PCP Contracts and IPR Arrangements

The contractual model for PCP differs from traditional procurement. Typically, a framework agreement is signed with the selected suppliers, accompanied by phase-specific contracts for each R&D stage. These contracts must clearly define the following topics:

- Scope of R&D services in each phase;
- Evaluation criteria and progression rules between phases;
- Termination clauses if performance criteria are not met;
- IPR regime, allowing suppliers to retain ownership of results while granting the buyer sufficient rights of use for internal purposes;
- Risk and cost-sharing arrangements, ensuring that the PCP is not fully publicly funded.

These legal elements must be defined in line with EU guidance, such as the Horizon Europe "*How to set up and manage HE PCP and PPI grants. From designing your proposal to managing your procurements*" (version 1.0, 15/10/2023), and national contract law. Contracting authorities must also ensure compliance with State aid rules, particularly in relation to the pricing of R&D services and the sharing of IP and results.

6. Legal Safeguards and Review Mechanisms

Although PCP falls outside the direct scope of the procurement directives, it is still subject to judicial review and administrative oversight under national law. This includes:

- Legal remedies for suppliers alleging discrimination or procedural irregularities;
- Audit and financial control by national and EU authorities;
- Compliance with public finance rules, including those linked to EU co-financing under Horizon Europe.

In joint PCP actions, these safeguards must be aligned across all participating entities to ensure consistency and accountability.

7. Conclusion

Pre-Commercial Procurement operates within a clearly defined legal space that balances flexibility with accountability. While it is exempt from the full application of Directive 2014/24/EU, the WTO Government Procurement Agreement and the EU's other procurement agreements with third countries, it must comply with the conditions laid down in EU communications, the TFEU, and relevant national laws. The specific legal model of PCP — including its focus on R&D services, risk-sharing, and IPR arrangements — enables public buyers to foster innovation while maintaining fair and transparent competition. Understanding and applying this legal framework is essential for any contracting authority seeking to implement PCP effectively and lawfully, especially in complex, cross-border or EU-funded contexts.

4.3. Strategic POWERBASE approaches to PCP

The POWERBASE PCP process is strategically positioned to address the so-called "valley of death" — the critical gap between early-stage R&D and market deployment where many promising innovations fail to progress. By acting as an early and informed buyer, the consortium creates a structured demand for solutions that are not yet commercially available but have high potential to meet the specific operational needs of EROs. Through competitive phased funding, real-world testing, and clearly defined functional requirements, the PCP offers suppliers a pathway to validate and mature their technologies under realistic conditions. This de-risks innovation, incentivises investment, and enables the transition from prototypes to deployable solutions, thereby overcoming one of the key barriers to the commercialisation of low-emission, mobile energy systems tailored for the emergency response sector.

4.3.1. PCP phased approach

The PCP procedure will follow the phased model set out by the EC in its Communication (COM(2007)799). This model is designed to fund R&D services up to the stage of creating a limited quantity of initial product prototypes.

The PCP is structured in three sequential phases, with each phase involving a competitive selection process. The number of participating contractors will progressively decrease from one phase to the next, ensuring that only the most technically promising proposals continue through the process. The three phases are:

- PCP Phase 1 – Solution Design
- PCP Phase 2 – Prototype Development
- PCP Phase 3 – Operational Validation and Testing Scenarios

Phase 1 – Solution Design

In Phase 1, contractors are required to deliver a comprehensive end-to-end system design that demonstrates how their proposed solution will meet the functional and technical requirements defined in the PCP tender documents. This includes a detailed description of the system architecture, key components, and the interaction between subsystems, as well as the methodology for progressing from design to prototyping and, ultimately, to operational deployment. The end-to-end design, to be evaluated by the Consortium, must serve as a solid foundation for the development of a working prototype in Phase 2 and must clearly reflect the solution’s capacity to operate effectively in real emergency response scenarios.

Throughout Phase 1, contractors must submit a series of predefined deliverables, which will form the basis for assessing progress. The Public Buyers will monitor contractor performance using these deliverables and the associated milestones.

Responsibility for technical monitoring will lie with the Technical Evaluation Committee (TEC) and the Procurement Evaluation Committee (PEC). Regular monitoring meetings will be held at least monthly — either in person or online — and will be scheduled by mutual agreement between each contractor and the

Technical Board. During these meetings, contractors will present progress updates, outlining their advancement against the expected milestones, deliverables, and outcomes. If technical or procedural issues arise, additional meetings may be organised in accordance with the principles of fairness, transparency, and equal treatment.

Phase 2 – Prototype Development

In Phase 2, contractors selected from the previous phase will proceed with the development of a functional prototype of their proposed low-emission power supply solution. These prototypes must reflect the system architecture and specifications defined during the Solution Design phase and must integrate all essential components necessary for demonstrating core functionality. The aim is to move from conceptual design to a tangible, testable model that represents a credible basis for subsequent operational validation.

During this phase, the focus will be on conducting technical performance assessments in laboratory conditions, where feasible, depending on the maturity and nature of the prototypes. Contractors must demonstrate the solution's ability to meet key technical and functional requirements — including energy efficiency, power output, emissions reduction, modularity, and suitability for field deployment — using controlled testing environments. While real-world conditions are not required at this stage, performance indicators must align with the needs of emergency responders and field logistics, and the testing will be carried out through small-scale pilot exercises

Contractors are expected to actively engage in the testing process and to provide advance training and guidance to the Consortium technical staff to ensure proper use and understanding of their solution.

Contractors will be required to submit supporting technical documentation, performance data, and progress reports, which will serve as the basis for monitoring and for the Consortium evaluation for determining which prototypes are eligible to advance to Phase 3.

Monitoring of progress by TEC and PEC will follow the same model established in Phase 1. Contractors are required to present monthly progress updates, reporting on the status of deliverables, milestones, and overall progress. If issues or uncertainties arise, additional meetings may be convened as needed, in accordance with the principles of fairness and equal treatment. Interim payments for this phase will be based on the timely and satisfactory delivery of those outputs.

At the end of Phase 2, each contractor must submit a Final Report detailing the work carried out, the results obtained, and the approach adopted to address ethical, security, sustainability, and intellectual property considerations. The report must also include an updated business and commercialisation strategy.
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Phase 3 – Operational Validation and Testing Scenarios

During the final phase, a minimum of two selected solutions will undergo validation in real-life conditions. The testing will be carried out based on the operational procedures and scenarios defined within the project's Verification and Validation Strategy.

In the final phase of the PCP, all prototype components and system elements resulting from earlier phases will be formally validated through four complementary field trials, organised and hosted by the public buyers. These trials will simulate real operational conditions for emergency responders, focusing on the deployment of the low-emission power supply equipment solutions in diverse environments.

This validation phase will assess how the proposed solutions integrate into the requirements of the emergency response operations, as stated in the tender documents, taking into account namely the operational constraints under which the systems are expected to function. The trials will also incorporate lessons learned from existing energy supply tools and anticipated future needs identified during the project.

A structured feedback mechanism will be established between the buyers' group and the contractors to ensure that operational users can provide direct input on necessary improvements. This interaction will support the iterative refinement of the solutions and reinforce user-centred design.

For each pilot, technical and functional performance evaluations will be conducted to assess parameters such as energy autonomy, transport conditions, portability, modularity, environmental impact, usability, and interoperability with other field systems. Feedback will be delivered to the contractors, who will then be given the opportunity to optimise their solutions prior to a second testing round. Following final calibration, the solutions will be operated under real-world conditions by emergency responders to assess their readiness for operational deployment.

During this phase, each contractor will be required to submit an Integration Report, documenting the complete setup and deployment of their solution. A Field Acceptance Report must also be delivered, confirming that at least two validated solutions have successfully passed testing under real operational conditions.

As in Phases 1 and 2, interim payments will be conditional on the achievement of specific deliverables and milestones, and project monitoring will continue throughout this phase via monthly progress updates. These updates will serve to evaluate progress against the expected outputs. The PEC and TEC will continue to oversee the technical implementation. Monitoring meetings — held at least monthly, either online or in person — will be scheduled in agreement with each contractor. Additional meetings may be arranged as needed to address specific issues, in full compliance with the principles of equal treatment and transparency. Contractors will also be required to submit End of Phase 3 Reports, summarising their results and conclusions from the Operational Validation phase.

4.3.2. Procurement approach

The Joint Procurement Procedure must comply with EU State aid rules, notably the Commission RDI Framework, and follow the specific provisions for PCP as set out in the European Commission's Communication COM(2007)799. It shall also adhere to applicable national legislation of the Lead Procurer (Greek Laws no 4412/2016 and no 4782/2021) and be conducted in line with the Joint Procurement Agreement, ensuring respect for EU Treaty principles such as transparency, equal treatment, and non-discrimination. All relevant PCP conditions and contract terms must be communicated in advance through standard public procurement channels to guarantee fair access for all potential tenderers.

The PCP procedure will be launched with the publication of the contract notice, accompanied by the Call for tenders, the framework agreement, and the specific phase contract templates. Following the evaluation of bids submitted by economic operators — in line with the criteria set out in the tender documentation — framework agreements and phase 1 contracts will be awarded, and a corresponding contract award notice will be issued. Throughout the process, continuous monitoring will ensure the sound deployment and validation of the PCP.

4.3.3. Evaluation approach

The tender documents will set out specific provisions and the corresponding evaluation criteria, which will be further refined — and adjusted if necessary — as the PCP preparation progresses. This section offers an initial overview of the evaluation committees involved and the procedural steps to be followed.
Once bids are received from eligible technology providers, they will be assessed in line with the rules defined in the tender documents, in a transparent and non-discriminatory manner.

At the conclusion of the evaluation process, a ranking will be established, listing the technology providers in descending order according to their total scores. If two or more providers achieve the same overall score, but differ in their individual scores for price and other evaluation criteria, priority will be given to the provider with the highest score in the technical assessment, who will be placed higher in the ranking.

For the purpose of bids' evaluation, the following Committees will be appointed:

- The Procurement Evaluation Committee: chaired by the Lead Procurer representative and composed at least by one representative of each public buyer.
- The Technical Evaluation Committee: chaired by THW representative and composed by technical and domain-specific experts and a representative from the buyers' group.
- The Administrative Board: composed by three members of the Lead Procurer.

The process for evaluating proposals and awarding initial contracts will be carried out in the following provisional stages, with the approach subject to further refinement if needed:

1. Exclusion criteria checking
2. For those admitted in step 1, selection criteria checking
3. For those admitted in step 2, award criteria checking
4. Bids evaluation following the weighted award criteria
5. Financial offers opening
6. Financial offers evaluation
7. Final ranking
8. Provisional award decision
9. Final award decision.

Before the evaluation bids and the final ranking (steps 4 and 7) a prior approval from Procurement Evaluation Committee will be issued.

4.3.4. Contracting approach

The POWERBASE PCP will be implemented through a Framework Agreement signed between the Lead Procurer and each selected contractor. This agreement will serve as the legal basis for the entire PCP process and will remain in force for the duration of the contractor's participation. Under this framework, specific Contracts for each of the three R&D phases will be awarded through separate call-offs, provided the contractor successfully completes the previous phase. No renegotiation of contractual terms will take place once the agreement is signed.

KEMEA will act as the Lead Procurer throughout all stages of the PCP process and given it is established in Greece, Greek law shall govern the Framework Agreement and all related Contracts throughout the project's duration.

Tenderers whose offers are successful will be awarded both the Framework Agreement and the Specific Contract for Phase 1. The evaluation of tenders will cover both elements simultaneously. Accordingly, tenderers are required not only to submit a detailed proposal for Phase 1 but also to present their objectives and outline their intended approach — including price conditions — for Phases 2 and 3.

The PCP will be carried out in three phases, as follows:

1. Phase 1 – Solution Design: At least six (6) Contractors will be selected through the initial tendering process and awarded both the Framework Agreement and a Specific Contract for Phase 1.
2. Phase 2 – Prototype Development: A first Call-Off procedure will be launched to award Specific Contracts for Phase 2. Only Contractors who have successfully completed Phase 1 will be eligible. The goal is to award at least three (3) Phase 2 contracts.
3. Phase 3 – Operational Validation: A second Call-Off will be launched to award Specific Contracts for Phase 3. Only Contractors who have completed Phase 2 successfully will be eligible. At least two (2) Phase 3 Contracts are expected to be awarded.

Participation in each phase is strictly conditional on the successful completion of the preceding phase. At the end of each phase, evaluations will be conducted to progressively identify the most promising solutions — those that best align with end-user needs and represent the best value for money. This stepwise model gives successful contractors the opportunity to refine and enhance their solutions for the following phase, drawing on feedback and insights received from procurers. The phased structure, with increasing contract value at each stage, also facilitates the participation of smaller firms and enables SMEs to gradually scale their operations and build capacity as they advance through the PCP process.

Any complaint concerning the tendering process must be submitted exclusively to the Lead Procurer within five (5) consecutive days from the date of notification of the final decision by the PEC. Complaints addressed to other members of the Buyers' Group, the POWERBASE Consortium, or the European Commission will not be considered. Any final decision taken by the PEC may be subject to judicial review before the Administrative Court of Appeal of Athens, in accordance with the applicable legal procedures under Greek law.

The data collected and generated during POWERBASE PCP will be managed in line with the FAIR principles (Findable, Accessible, Interoperable, Reusable) according to the needs of the project.

4.3.5. Intellectual Property Rights Management: Foreground, Background and Sideground

IPR have a strategic importance in PCP. Clear IPR rules encourage supplier investment in R&D because they will only invest substantial resources when they have a clarity on which rights they retain and what opportunities exists for future commercialisation.

On the other hand, balanced rights ensure procurers don't overpay. Value comes from obtaining sufficient rights to exploit results without unnecessarily paying for complete ownership when more limited licenses would serve the public interest adequately. This delicate balance between supplier and procurer interests is fundamental to successful PCP implementation and ensures all parties understand their rights and obligations.

Type of contract	Relevant IP	Typical management of IP
Purchase of off-the-shelf products e.g. **software**	Copyright, patents or trademarks over product	IP remains with the supplier. CA acquires licence for use.
Purchase of an adapted product e.g. an **ambulance**	Existing IP in the base vehicle; Design and trademarks of the CA for customisation; New design features	Each party retains its own IP and may have licence over other party's; New IP may be owned by one party or jointly.
Design and build of works e.g. a **bridge**	Design drawings for bridge; copyright over design; patented components or materials; technical know how	Design drawings will normally be owned by CA; Copyright remains with architect; other IPRs will remain with original owner.
Provision of service e.g. **consultancy or training**	Materials developed for delivery of service; pre-existing materials or templates	IP in developed materials will be owned or licenced by CA; Pre-existing IP remains with contractor

Figure 6 – How are IPR usually treated in innovation procurement
Source: Abby Semple, *IP Issues in Public Procurement of Innovation* (presentation at WIPO Expert Meeting on Public Procurement of Innovation, Geneva, 16–17 May 2019).

Defining clear IPR clauses in tender documents is very important for all public procurements, but crucial in PCP. Public buyers must ensure that the allocation of intellectual property rights takes into account the applicable IPR legal framework in Europe and at national level.

IPRs grant temporary exclusive use of creations to their holders, encouraging innovation by allowing creators to share their work while protecting it from unauthorized use. Although IPRs like patents, copyrights, and trademarks are publicly disclosed, their use typically requires a license.

In PCP a balanced approach to IPR is required, mainly characterised by the following topics:

- Contractors (suppliers) retain IPR ownership of results generated from the R&D services, while procurers retain usage, licensing, and call-back rights.
- The PCP process is designed for risk-benefit sharing under market conditions, meaning that both procurers and suppliers share the risks (e.g., of technology development) and benefits (e.g., future exploitation of the IPR) at market price.
- Procurers must have at least royalty-free access rights to use the R&D results for their own purposes, and a right to grant non-exclusive licences to third parties to exploit these results under fair and reasonable market conditions, but without the right to sublicense.
- There must be a call-back provision: If suppliers do not commercially exploit the results within a set period, or if public interest is at risk, procurers can require a transfer of IPR ownership.
- The allocation of IPR and related rights and obligations must be clearly stated in the PCP call for tender documents to ensure transparency and compliance with state aid rules.

These provisions aim to stimulate innovation and facilitate the entry of SMEs and innovative companies into POWERBASE PCP contracts.

The Framework Agreement to be concluded with the contractors will include clear provisions regarding background, foreground, and sideground IPR, as briefly outlined below:

- Foreground IPR: The contractor retains ownership of any results generated during the PCP process. However, the public procurers are granted specific rights, typically including a royalty-free license for their own internal use. Under certain conditions—such as the contractor's failure to exploit the results or actions contrary to the public interest—the public procurers may also be entitled to broader licensing rights or even transfer of ownership (call-back clause).
- Background IPR: These are pre-existing rights, such as knowledge, patents, or data, that exist before the PCP contract. The EC's guidance requires that all parties declare any background IPR before starting the contract, and ownership remains unchanged; the declaring party retains full ownership.
- Sideground IPR: Refers to intellectual property generated during the PCP timeframe but not within the scope of the contracted work. Ownership remains with the party that creates it. Access rights may be granted to the extent they are necessary for carrying out the PCP or for exploitation of the PCP results.

By clearly defining the ownership and access rights to background, foreground, and sideground IPR, the PCP contractual framework supports both the effective exploitation of results by contractors and the strategic use of innovations by public procurers. This alignment of incentives is crucial to achieve the dual goals of promoting market uptake and addressing unmet public needs.

4.4. Tender documents

4.4.1. The Governance structure

A well-defined governance structure is essential for the effective implementation of a PCP process, particularly in multi-stakeholder and cross-border settings such as the POWERBASE project. Governance ensures that roles, responsibilities, and decision-making processes are clearly allocated among the lead procurer, participating buyers, technical experts, and project coordinators. This clarity is crucial to guarantee legal compliance, maintain transparency and competition, and ensure coherence between the R&D phases and the strategic objectives of the procurers. Moreover, a robust governance framework enables efficient coordination, facilitates risk management, and supports informed, collective decision-making throughout the PCP lifecycle — from the definition of needs, technical requirements, and functionalities, through supplier selection and evaluation, to the validation of field-tested solutions. Ultimately, good governance safeguards both the procedural integrity and the strategic impact of the PCP.

The PCP process is governed by core principles that ensure its integrity and effectiveness. These include transparency and open competition in supplier selection, a clear division of roles supported by written agreements among procurers, and a phased implementation with evaluation gates between each stage. Additionally, the PCP model ensures balanced risk-sharing and well-defined IPR arrangements, in full compliance with EU legal and policy frameworks.

The PCP governance structure includes the following key functions:

- **Lead Procurer / Contracting Authority**

  The lead procurer holds the legal and operational responsibility for launching and managing the PCP procedure. It signs the contracts with the selected suppliers on behalf of the procurers' group and is in charge of coordinating supplier management and reporting throughout the process.

- **Procurers' Group**

  This group is composed of the lead procurer and other participating procuring entities (the buyers' group). All members contribute to the needs assessment, definition of functional and technical requirements, and evaluation of supplier proposals. They commit to the potential uptake of developed solutions. To ensure clear responsibilities, the group must establish a joint procurement agreement.

- **Procurement Evaluation Committee**

  A Project Evaluation Committee (PEC) will act as the formal decision-making body for evaluating suppliers' offers and prototypes during the PCP. Composed of procurement, technical, and legal/financial experts from the Buyers' Group, the PEC will evaluate and rank submissions in each phase, select suppliers to proceed, and record all results. It will operate in strict compliance with public procurement rules, observing confidentiality, equal treatment, and conflict-of-interest requirements, thereby ensuring a transparent and legally robust competitive process.

- **Technical Evaluation Committee**

  This committee is composed of technical experts from the procurers' group and may include end-user representatives. It is responsible for designing the functional and technical specifications and for evaluating supplier proposals at each PCP phase — from solution design to prototyping and field testing — ensuring that operational relevance is maintained.

- **Administrative Board**

  This board is composed by KEMEA procurement department dealing with administrative aspects of the procurement (e.g., receiving and opening the Tenders, evaluations against exclusion grounds etc.). The scope of this Board is to facilitate and fasten the procurement procedure. It passes this opinion to the Procurement Evaluation Committee for final decision.

- **Legal and Financial Advisory Support**

  This advisory function ensures legal and financial compliance across the entire PCP process. It provides expert guidance on procurement law, IPR, competition rules, and funding conditions, helping to guarantee that the PCP follows both EU and national regulations.

- **External Stakeholders Advisory Board and Users' Observatory Group**

  An Advisory Board may be established to provide strategic guidance and quality assurance throughout the PCP process. Composed of external experts with relevant legal, technical, and policy expertise, it offers independent advice on key aspects such as procurement strategy, risk management, IPR arrangements, and exploitation planning. Its function is to ensure alignment with EU procurement principles, best practices, and project objectives, and to help maintain the innovation ambition of the PCP. The Advisory Board operates in a purely advisory capacity and does not take part in procurement decisions or the evaluation of suppliers, thereby safeguarding the independence and integrity of the competitive process.

  The Users' Observatory Group is a consultative body made up of representatives from end-users' organisations. They provide structured feedback throughout the process. Its role would include contributing to the validation of functional requirements, observing key stages of solution design, prototyping, and testing, and offering input on usability, performance, and operational suitability. By acting as a continuous feedback mechanism, the Users' Observatory Group can help to ensure that the PCP remains demand-driven and results in solutions that are fit for deployment, without interfering with the independence and integrity of the formal procurement and evaluation procedures.

Figure 7 below provides an overview of the governance structure.

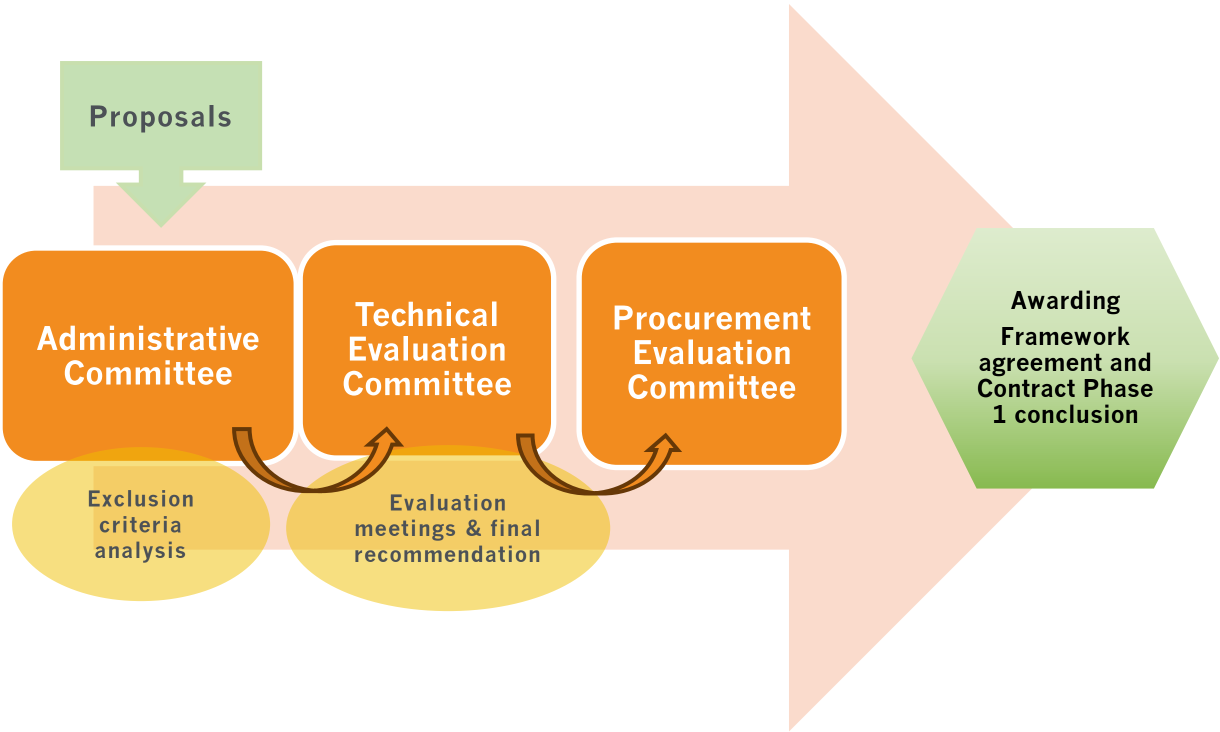

Figure 7 – Governance structure for proposals' selection and evaluation
Source: Adapted by the author from D3.4.

4.4.2. Monitoring tools of performance and validation strategy

Effective performance monitoring and a robust validation strategy are critical components of a successful PCP process. Given the phased and R&D-intensive nature of PCP, continuous assessment of supplier progress and solution maturity is essential to ensure that the innovation trajectory remains aligned with the end-users' needs and the procurement objectives.

The PCP process is typically divided into three sequential phases — solution design, prototyping, and original development with field testing. At the end of each phase, pre-defined evaluation criteria must be applied to assess supplier performance and determine which contractors advance to the next stage. These evaluation gates require both qualitative and quantitative assessment tools, such as technical reviews, milestone reporting, prototype demonstrations, usability testing, and compliance scoring against functional and technical specifications.

To enable effective monitoring, the procurers must define KPIs for each phase. These KPIs should reflect not only technical progress (e.g., energy efficiency, portability, emission levels, interoperability) but also usability, scalability, and operational relevance. The monitoring process should include regular reporting obligations by suppliers, review meetings, and documentation of results.

The validation strategy in the final phase (original development and field testing) is particularly important to determine whether the developed solutions meet the operational expectations of the end-users. This phase should involve real-life testing scenarios, simulation exercises, or deployment in controlled environments. End-user feedback plays a central role in this validation process, ensuring that the solutions are not only functional but fit-for-purpose.

Moreover, the involvement of a technical committee or evaluation board, composed of representatives from the procurers and relevant experts, is essential to ensure that monitoring and validation are conducted consistently, transparently, and according to agreed procedures. This body is responsible for scoring supplier performance, documenting justification for continuation or exclusion, and ensuring traceability in decision-making.

In summary, a clear monitoring and validation framework safeguards the integrity of the PCP process, enables early risk detection, and supports evidence-based decisions regarding supplier progression and future adoption. It also reinforces the credibility of the PCP as a strategic procurement tool, ensuring that public investment in innovation delivers tangible, validated outcomes.

5. Conclusions and recommendations

The POWERBASE PCP procurement strategy represents a coherent and methodically grounded approach to addressing the critical capability gaps identified in the domain of low-emission power supply systems for emergency shelters and operational bases. Through a structured needs assessment process, the involvement of practitioner expertise, the analysis of state-of-the-art solutions, and an open market consultation, the strategy has successfully identified a technological gap that justifies a demand-driven R&D procurement procedure.

The PCP model has been chosen not only for its alignment with the maturity level of existing solutions, but also for its ability to drive innovation in close connection with end-user needs, while ensuring competition, transparency, and risk-sharing. The phased approach, legal compliance, governance model, and IPR strategy set out in this document provide a solid foundation for launching a successful PCP process under the POWERBASE project.

In light of this strategic framework, it is recommended that the Buyers' Group:

- Maintain strong coordination and communication mechanisms within the procurers' group and the governance bodies throughout all phases of the PCP;
- Ensure active and continued engagement of end-users in the evaluation and testing processes, especially during the operational validation phase;
- Prioritise transparency and equal treatment in all interactions with suppliers, particularly in relation to IPR management and the dissemination of PCP results;
- Foster knowledge sharing and replicability of the process, contributing to the wider European innovation procurement ecosystem.

POWERBASE PCP is not only an instrument to stimulate market innovation, but also a strategic effort to enhance European resilience and sustainability in civil protection and emergency response. Its outcomes have the potential to inform future procurement policies, scale up successful solutions, and strengthen the EU's strategic autonomy in the field of low-emission technologies for security and crisis operations.

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