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Policy Recommendations

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Executive summary

To meet the EU's 2050 climate neutrality targets, Europe must significantly increase its annual energy renovation rate. The BuildUPspeed project aims to accelerate both the volume and depth of deep renovations by promoting the practical implementation of industrialised renovation solutions. By testing solutions in five pilot countries, BUPS has identified practical pathways to increase deep renovation rate and market uptake of industrialised solutions.

To scale industrialised solutions, policymakers must harmonise technical standards across the EU to enable cross-border trade of modular kits, as well as establish "regulatory sandboxes" and modernise building codes. Financially, long-term, stable policies must be in place to create confidence in using these renovation solutions and bridge the higher upfront cost, and public procurement should shift to also support innovation. From a technical perspective, EU should support knowledge-sharing and capacity building among both public authorities and renovation professionals in using industrialised renovation techniques and adopting more modern ways of construction. Lastly, increasing market uptake from a social perspective requires launching awareness-raising campaigns to highlight the benefits of using industrialised solutions, as well as incentivising One-Stop Shops to help co-owners reach a collective consensus.

The project also assesses Pop-up Factories - temporary, rapidly deployable facilities that enable localised production near renovation sites. To support this model, policy must provide flexible PuFs models tailored to local contexts allowing temporary manufacturing in residential areas and targeted EU funding for initial infrastructure. Technically, authorities should institutionalise specialised training to ensure the workforce can manage the requirements of these decentralised assembly hubs.

The Market Activation Platform serves as the digital bridge between supply-side innovation and demand-side requirements. Recommendations urge the harmonisation of data protocols to ensure interoperability across regional platforms. To drive market uptake, the platform should include financial modelling and "matchmaking" tools that demonstrate the economic benefits of renovation, while ensuring platforms reflect regional languages and building laws.

National recommendations address specific ecosystem constraints identified during the pilots. In Austria, fragmented building codes and the unclear status of reused components require harmonisation and clarification, supported by financial incentives targeted specifically at industrialised innovation. France should focus on adapting insurance frameworks and financial incentives for reconditioned products, while investing in capacity-building and regional material hubs. For Italy, the priority lies in establishing long-term financial frameworks, modernising procurement rules, and funding regional innovation hubs. In the Netherlands, policy should focus on streamlining construction protocols, establishing project facilitators, and improving data-sharing between similar projects. Finally, Spain requires the harmonisation of regional construction regulations, the reform of mortgage classifications to support industrialised solutions, and the implementation of aggregated renovation mechanisms to incentivise circular material recovery.

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Introduction

To reach EU's 2050 climate neutrality target as set out in the Climate Law (Regulation (EU) 2021/1119)), increasing the renovation rate of buildings is essential[1]. While the EU's Renovation Wave strategy aimed to at least double annual energy renovation rates by 2030[2], data shows that the current progress to reach this target remains insufficient, with the annual energy renovation rate being stagnant at only 1%[3], and deep renovations, defined as those reducing energy consumption by at least 60%, occurring even less frequently[4].

In December 2025, the European Commission published its Housing Package, including the European Strategy for Housing Construction (ESHC). This strategy seeks to increase both the construction and renovation of buildings by addressing structural barriers, such as high costs and low productivity, that currently hinder the construction ecosystem from reaching its full potential. As a priority for overcoming these hurdles, the Commission highlights the need to modernise the regulatory framework to increase innovation uptake and increase the deployment of innovative construction materials and products. Industrialised solutions, including offsite construction and modularity, are seen as essential drivers for increasing housing supply and renovation depth. However, the strategy acknowledges that the growth of these methods is still constrained by several factors, including fragmented regulations and a lack of harmonised standards[5].

While several EU H2020 projects have already developed a wealth of technical and non-technical solutions to support the Renovation Wave, a critical bottleneck remains: the absence of effective market uptake strategies to capitalise on these results. The BuildUPspeed (BUPS) project specifically addresses this gap. By building upon the outcomes of previous H2020 initiatives, BUPS aims to accelerate both the volume and depth of deep renovations by promoting the practical implementation of industrialised renovation solutions.

To support the uptake of these industrial solutions, the project focuses on two specific actions. First, it assesses the implementation of Pop-up Factories (PuFs) across five pilot ecosystems. These temporary, rapidly deployable facilities enable flexible, localised production, offering a direct solution to the supply-side challenges of industrialised renovation. Second, the project establishes a Market Activation Platform (MAP). This digital ecosystem facilitates the sharing of critical renovation data tailored to the specific needs of tenants, property owners, professionals, and public sector actors.

The recommendations presented in this report are the result of a robust methodology involving tools developed and tested throughout the project's duration and in the five pilot ecosystem countries Austria, France, Italy, the Netherlands, and Spain. They stem from extensive stakeholder engagement, rigorous quantitative and qualitative

[1] European Commission (n.d.a)
[2] European Commission (n.d.b)
[3] European Commission (n.d.a)
[4] BPIE (2022)
[5] European Commission (2025a)

evaluations, and practical insights gained from national pilots. These findings have been further refined through learning networks and workshops with external practitioners to ensure they reflect real-market conditions.

The report is divided in four parts. The first three are divided based on the projects core pillars: (1) industrialised solutions, (2) Pop-up Factory, and (3) Market Activation Platform). These parts identify current shared market challenges among the five pilot ecosystems and propose recommendations to local, national and EU-wide policymakers on how to support a broader market uptake. The fourth part provides nation-specific policy recommendations to the five pilot ecosystem countries.

Section 1: Industrialised solutions

One of the key objectives of BUPS is to improve the performance of deep renovation projects and make it more attractive and reliable for all stakeholders within the construction ecosystem through industrialised solutions. Industrialised solutions refer to a general approach that integrates elements on automation and mechanisation into the construction processes. Generally, it describes a shift from traditional, project-based construction methods to a more standardised production process. More than simply referring to a shift to factory settings, industrialised solutions also entail the increased use of technologies, digitalisation, standardisation and automation into the construction operations[6].

While industrialised construction methods have several benefits, including increased productivity, reduced construction waste, less disruption on-site, and tighter quality control, the adoption of industrialised construction remains limited in the EU[7]. In the European Strategy for Housing Construction, innovation and digitalisation of the construction ecosystem is identified as key to increase housing supply and renovation rate[8]. However, key barriers continue to slow down wider implementation, including buildings codes and permitting procedures not adapted to the workflow of industrialised solutions, high up-front investment costs, lack of standardisation and shortage of skilled workers[9]. In an EU-wide survey with property owners on building renovation, only 1% of respondents that have renovated in the past 10 years, or are currently renovating, answered having used modular prefabricated walls, showing the low market uptake[10]. While few property owners might use industrialised solutions currently, there is a potential and a will to implement these solutions further in renovation practices.

BUPS aims to increase the renovation rate by promoting the use of prefabricated and industrialised solutions. BUPS has not developed new technical solutions, but rather focused on capitalising and valorising the outcomes and results of previous EU projects within these contexts. This aims to make these outcomes accessible, adaptable and replicable in different national and/or regional contexts.

The testing of five ecosystems (Austria, France, Italy, the Netherlands and Spain) have focused on different types of industrial solutions. These include prefabrication, development and integration of modular solutions, as well as virtual reality and 3D solutions. Therefore, the EU-wide recommendations will address industrial solutions in general, while the national-specific recommendations are more targeted towards specific types of industrialised solutions.

[6] Dedeu et.al. (2024)
[7] European Commission (2025b)
[8] European Commission (2025a)
[9] Dedeu et.al. (2024)
[10] UIPI (2025)

1.1 Current legal and regulatory EU-level landscape

A recurring barrier to expand the use of industrialised solutions are the outdated building codes and regulatory and permitting frameworks. Currently, these are tailored to conventional construction and fail to accommodate the aspects and requirements needed to implement industrialised methods. Because industrialised solutions lack a common terminology and standards, the processes approving permits for industrialised solutions projects become slower and more complex for the responsible authorities that must make individual assessments for each project. Existing frameworks evaluate construction as a site-specific process rather than a standardised product. This forces manufacturers to prove compliance from scratch for every building, even when using identical components.

This challenge is exacerbated by regulatory fragmentation across Member States, where building codes and permitting are often managed at local or regional levels. This creates significant domestic variations. Such inconsistencies undermine investor confidence and limit the scalability of industrialised solutions, inadvertently favouring conventional, carbon-intensive construction. This fragmentation also extends to cross-border provision of construction services. While the principle of mutual recognition within the Single Market applies to construction products, it does not systematically extend to construction services or to the regulatory conditions governing how products are integrated into buildings. This limits the possibility of companies or skilled professionals dealing with industrialised solutions to offer their services in neighbouring countries.

One specific example mentioned by several project partners are the limitations imposed by public procurement. Public entities are bound by strict procurement rules that often prioritise price over innovation. The process of using other methods than traditional on-site is legally complex for public administrations to handle and requires implementing different workstreams from initial design phase to completion. However, rules currently favour a traditional phased approach which entails designing first and then having a separate call for construction services. EU competition laws also make it difficult to specify a particular industrialised solution early on, even when a specific industrialised system is the most technical and environmental fit, as it may be seen as cutting off competition from other bidders. This stems from procurement rules requiring technology-neutral specifications and equal access for competing suppliers, which prevents contracting authorities from favouring a specific construction system or provider at the design stage.

Regulatory uncertainty continues to undermine confidence in industrialised solutions. In some cases, insurance providers are hesitant to cover modular and prefabricated methods due to unclear safety standards or limited performance benchmarks in local building codes. Fire safety regulations and certification requirements create additional barriers, particularly regarding warranties and liability. As a result, projects may face delays, redesign, or proceed under conventional construction methods or without full insurance.

Policy recommendations

- **Harmonise standards for prefabricated components**: Accelerate the implementation of EU's new Construction Products Regulation (CPR) to create a true single market for modular and innovative renovation kits, eliminating the need for redundant regional certifications.
- **Ensure cross-border provision of construction and installation services**: Within the framework of EU's forthcoming Construction Services Act, policymakers should expand the mutual recognition of certifications and diplomas to the manufacturing and installation of industrialised solutions.
- **Establish regulatory sandboxes**: To foster innovation, Member States should be encouraged to create experimental frameworks (sandboxes) where industrialised solutions can be tested under simplified regulations. This testing would allow real life alternative compliance pathways and performance-based criteria. The results could be used to identify what rules are essential and which ones could be adapted or simplified.
- **Modernise public procurement for industrialised solutions:** Policymakers at EU and national levels should update guidelines to move towards procurement that accounts for lifecycle performance, carbon reduction, and reduced on-site disruption, ensuring that industrialised solutions compete on a level playing field with conventional methods.
- **Update outdated regulations and procedures**: Provide EU-wide guidance on how Member States can update building codes, digitalise and streamline permitting procedures, so they accommodate the unique timelines and technical characteristics of industrial solutions. This guidance should also identify current bottlenecks to help reduce the administrative burden for both public administrations and property owners.
- **De-risk via insurance models:** EU-institutions could develop EU-wide safety and performance benchmarks to standardise insurance risk assessments for industrialised solutions, de-risking the usage and supporting broader market confidence.

1.2. Current financial EU-level landscape

The market for industrialised renovation remains heavily reliant on EU funding, characterised by significant uncertainty regarding the long-term continuity of national investment schemes. This volatility has led to a pervasive lack of institutional and financial confidence in innovative renovation models, preventing them from moving beyond niche applications.

Industrialised solutions require a fundamental shift in cash flow compared to conventional construction. While traditional methods allow for incremental payments as work progresses on-site, industrialised construction needs high upfront costs for both construction companies and end-users. Contractors must often pre-finance the entire production phase months before installation occurs, creating a substantial

liquidity risk. As a result, industrialised solutions remain financially uncompetitive, exceeding the price of conventional construction and renovation methods. From the property owner's perspective, financial feasibility is the primary determinant for renovation. Results from UIPI's EU-wide survey show that lack of funds (34%), insufficient financial support (33%) and doubts whether renovations are worth the cost (24%) are the most cited barriers among respondents planning to renovate[11]. Owners prioritise the financial aspects when renovating, which inadvertently can discourage industrialised solutions.

The technical capacity to expand and use industrial solutions exists, but investments in product development are low due to the uncertainty about the future demand. The market remains project-driven rather than demand-driven, lacking a stable project pipeline that would allow manufacturers to achieve the economies of scale necessary to reduce unit costs.

Furthermore, existing financial incentives mainly support renovation in general, rather than specifically encouraging industrialised solutions. As a result, innovative approaches such as prefabrication or offsite manufacturing often do not receive tailored financial support. At the same time, deep renovation projects, whether traditional or industrialised, face structural financial challenges, as high upfront costs are not always matched by energy savings. This is further compounded by the "split-incentive" dilemma: while tenants benefit from improved comfort and lower energy bills, the investment cost and technical risk are borne by the property owner.

Lastly, banks and financial institutions continue to operate under traditional construction financing models, which are not fully adapted to industrialised renovation. Property owners are often required to advance significant capital before visible on-site progress is achieved. In addition, mortgage and financing frameworks are tailored to conventional renovation methods, reducing their eligibility for standard housing loans. This significantly limits the financial attractiveness and uptake of industrialised solutions.

Policy recommendations

- **Ensure long-term and stable financial policies:** Ensure long-term, stable financial incentives at both EU and national level that allow industrialised renovation to become economically competitive. Establishing a supportive policy environment adapted to industrialised construction timelines will provide the industry with the confidence needed to invest in capital-intensive automation.
- **Bridge the upfront cost gap:** Develop specific financial instruments that account for the higher upfront and initial production costs of prefabricated solutions. This could include financial support to conduct feasibility studies to projects using industrialised solutions and grants to production facilities.
- **Address the split incentive:** Establish national financial models where the cost of renovation is balanced by the long-term energy savings, ensuring a viable business case for property owners and landlords.

[11] UIPI (2025)

- **Encourage vertical extension to create a business case for renovation with prefabrication**: The value created from selling or renting these new units can then finance the renovation of the existing apartments below. This leads to solutions that focus on "renovation + new construction" and should be supported by national policymakers
- **Enable financial innovation for industrialised renovation:** Promote adapted loan structures, staged disbursement models and mortgage rules that reflect off-site production cycles. For example, the ESCO model allows property owners to pay back the renovation cost through the energy savings achieved over 20-30 years.

1.3. Current technical EU-level landscape

While the capacity and expertise for industrialised renovation are already available, significant technical barriers remain in achieving broad market. A major challenge is the limited dissemination of specialised knowledge and digital expertise throughout the renovation ecosystem.

The shift from traditional to industrialised methods introduces a new layer of technical complexity that requires a fundamental change in how projects are planned and executed. Unlike conventional construction, which allows incremental decision-making, industrialised renovation demands early-stage integration and precise coordination of all components. Industrialised renovation also requires integrated project coordination. However, traditional delivery models relying on a main contractor and multiple specialised subcontractors often result in fragmented communication and limited cross-disciplinary integration, undermining efficiency gains.

Effective serial renovation relies heavily on high-precision 3D modelling and laser scanning to capture the "as-built" reality of existing buildings. However, limited digital skills across the construction value chain increase planning complexity and upfront costs, reducing competitiveness compared to traditional methods.

Furthermore, the inherent requirements of industrialised systems often lead to increased material complexity. Prefabricated façade modules often require additional structural layers to comply with fire safety and load-bearing requirements, making them thicker and heavier. Transporting large modules in dense urban areas with limited access and space, can further complicate logistics. Finally, the architectural diversity of the European building stock presents a unique challenge to standardisation. Industrialised solutions must be adapted to older buildings characterised by irregular geometries, load-bearing walls, and historical decorations. This limits standardisation and frequently requires costly adaptations, reducing the efficiency gains associated with serial production.

Policy recommendations

- **Establish an EU knowledge and coordination ecosystem for industrialised renovation:** EU policymakers should support the creation of regional

knowledge hubs and promote EU platforms such as the Market Activation Platform to facilitate knowledge exchange across the renovation ecosystem. These initiatives should allow stakeholders to share technical blueprints, project data, and lessons learned from pilot projects, helping companies navigate technical and regulatory requirements and connect supply and demand for industrialised solutions.

- **Accelerate the adoption of digital-first renovation workflows:** Promote the widespread use of high-precision digital tools such as BIM, laser scanning, and advanced 3D modelling across the renovation ecosystem and at all levels of governance. EU and national funding programmes should prioritise support for SMEs to adopt these technologies, ensuring better integration between design, manufacturing, and on-site assembly in industrialised renovation processes.
- **Strengthen workforce skills for industrialised construction methods:** In alignment with the European Strategy for Housing Construction (ESHC), EU should support targeted national training and certification programmes focused on industrialised renovation methods, including modular assembly, prefabrication, and digital construction tools. In the longer term, education and vocational training programmes should integrate industrialised construction and digital skills to prepare the future construction workforce.
- **Build institutional capacity within public administrations:** National policymakers should offer technical assistance and capacity-building programmes for regional and local public authorities, including One-Stop Shops to support the planning, procurement, and permitting of industrialised renovation projects. Strengthening expertise in areas such as specialised procurement procedures, spatial planning, and digital workflows (including BIM) can reduce administrative barriers and help de-risk innovative renovation approaches.

1.4 Current social and cultural EU-level landscape

The transition to industrialised renovation also requires a cultural and behavioural shift within the construction ecosystem. Many professionals trained in traditional on-site methods perceive industrialised approaches as complex, risky or incompatible with established workflows.

Cultural resistance is further reinforced by the legacy stigma associated with prefabrication, often linked to low-quality social housing projects from the 1970s. This perception leads homeowners and developers to question the aesthetics, durability and architectural value of off-site solutions. As a result, awareness of the modern benefits of industrialisation, including improved comfort, reduced on-site disruption and enhanced lifecycle performance, remains limited.

In multi-apartment buildings, the social barriers are further intensified by the complexities of collective decision-making**.** Serial renovation requires a high degree of synchronisation and agreement among multiple co-owners. The high coordination costs and the "all-or-nothing" nature of industrialised kits make decision-making more difficult.

Policy recommendations

- **Initiate awareness-raising campaigns:** Launch awareness campaigns at EU, national and local levels highlighting the benefits of industrialised solutions that can help overcome a negative conception about these techniques.
- **Support multi-apartment building owners in the decision-making process:** Services such as One-Stop Shops are need, to act as technical mediators for co-owners. These intermediaries provide the objective lifecycle cost-benefit analyses and performance guarantees necessary to bridge the gap between higher upfront costs and long-term value. By offering clear, evidence-based guidance, these services empower homeowners to navigate technical risks and reach a confident consensus on industrialised renovation.

Section 2: Pop-up Factories

A Pop-up Factory (PuF) refers to a temporary manufacturing and/or assembly facility that can be rapidly set up and dismantled to produce components for construction projects[12]. Conceived as a factory embedded within the district for the duration of a retrofitting programme, it develops and assembles industrialised prefabricated building components that are subsequently installed in renovation projects. The model aims to localise part of the production process, bringing industrialised construction closer to the implementation site to increase efficiency and reduce logistical complexity.

Within BUPS, this foundational definition provided the starting point for experimentation across five ecosystems. However, as the concept was applied in diverse regulatory, market and industrial contexts, its operational scope evolved. While the core objective remained the acceleration of industrialised renovation at local level, partners adapted the PuF model to reflect ecosystem-specific capacities and constraints.

As a result, PuFs in BUPS did not materialise exclusively as temporary production units. In some contexts, they took the form of district-based or satellite production setups supporting off-site technologies. In others, they functioned primarily as assembly hubs for prefabricated elements. In several ecosystems, the concept expanded further to encompass circular deconstruction platforms, material reuse systems, and district-level value chain management mechanisms.

In general, there are five types of PuFs:

1. Mobile on-site factory: a movable production cell deployed directly on or near the construction site.
2. Satellite factory: a temporary facility near the site that collaborates with a central production hub.
3. District factory: a semi-permanent facility serving multiple nearby projects, acting as system integrator.
4. Assembly factory: a location focused solely on assembling prefabricated components from other sources.
5. Service factory: a knowledge and facilitation hub that supports sustainable renovation through advice and coordination[13].

Rather than representing a deviation from the original model, this diversification reflects a pragmatic evolution of the concept. Together these types of PuFs illustrate an evolving shift from traditional off-site construction to on-site, hybrid solutions. Across the project, the PuF can therefore be understood not only as a temporary factory in physical terms, but as a locally embedded acceleration framework that integrates production, assembly, circular reuse and coordination functions in support of industrialised and sustainable renovation. This adaptive interpretation underpins the development of five ecosystem implementation scenarios.

[12] BUPS (2025)
[13] BUPS (2025)

Across the five ecosystems, the deployment of PuF models reveals a set of recurring structural constraints that transcend national contexts. While the maturity of industrialised renovation varies between Member States, common patterns emerge that limit scalability and long-term viability.

2.1 Current EU-level landscape

Similar to industrialised solutions, existing regulatory and legal frameworks are not designed for temporary, decentralised production systems integrated within urban environments. Legislation on construction, environmental, waste management, and procurement often lacks cross-sectoral coordination and remains structured around linear construction models. As a result, temporary manufacturing setups, circular material reintegration, and integrated off-site modules face regulatory ambiguity, certification challenges, and complex permitting procedures.

The financial and investment structures remain misaligned with industrialised and decentralised renovation models. Traditional financing mechanisms are structured around on-site execution timelines and lowest-price procurement logic, whereas PuF configurations require upfront capital expenditure, manufacturing before installation cycles, and predictable renovation pipelines. Without stable demand aggregation and adapted financing instruments, private actors face disproportionate investment risk. Furthermore, market fragmentation and insufficient project aggregation undermine economic feasibility. PuFs rely on scale, repetition, and coordinated renovation programmes. However, the absence of district-level planning frameworks or aggregated procurement strategies significantly reduces the business case for temporary production facilities.

Spatial and environmental constraints also present additional operational challenges. Urban density, strict noise and dust regulations, species protection requirements, and limited available land complicate the deployment of temporary production units. In several ecosystems, social perception of “factory like” activities in urban settings further constrains acceptance.

Lastly, institutional and market readiness remains uneven. The deployment of PuF models requires coordination across manufacturers, contractors, public authorities, financial institutions, and material recovery actors. In many contexts, liability frameworks for reused materials, certification standards, and skills capacities are not yet fully aligned with circular and industrialised renovation approaches.

Taken together, these barriers indicate that the scaling of PuF models is not primarily a technological challenge, but rather a systemic governance and market alignment issue. Addressing these constraints requires coordinated action at European level to create enabling conditions that Member States can adapt to their national contexts.

Policy recommendations

- **Clarify the regulatory positioning of temporary decentralised production models:** EU policymakers should issue guidance clarifying how temporary and decentralised production configurations can be accommodated, including urban

planning, permitting and environmental regulations. Clear guidance would support Member States in adapting national frameworks while ensuring legal certainty for market actors deploying temporary, circular, or hybrid renovation models.

- **Support a flexible PuF concept tailored to local ecosystems:** Adopting a flexible PuF concept that can be adapted to regional capacities and building constraints. As demonstrated by the diverse configurations in the project pilots, local conditions dictate which model is most viable. Future policy and funding schemes should therefore avoid rigid technical definitions, instead encouraging ecosystem-specific implementations that align with local supply chain maturity, available digital infrastructure, and specific building typologies.
- **Deploy targeted EU funding for PuFs:** By offering dedicated financial instruments to support local authorities in deploying, EU policymakers can lower entry barriers for regional and local actors in establishing PuFs.
- **Strengthen institutional capacity and skills for decentralised renovation models:** Scaling PuFs requires institutional capacity, technical expertise, and coordinated governance structures capable of managing decentralised production. EU and national policymakers should therefore support the development of competence centres, knowledge-sharing platforms, and vocational training programmes specifically focused on PuFs, facilitating exchange between projects at different maturity levels and national contexts.

Section 3: Market Activation Platform

The BUPS Market Activation Platform (MAP) is a dedicated digital solution designed to promote and implement industrialised renovation practices, with the primary goal of accelerating both the volume and depth of deep renovation across the EU building stock. Serving as a bridge between supply-side innovation and demand-side requirements, the MAP provides a scalable digital ecosystem to display, compare and share critical renovation data tailored to the specific expertise of property owners, tenants, professionals and public sector actors.

To ensure its relevance to real-world market conditions, the BUPS project conducted extensive consultations with practitioners, including public authorities, construction companies and architects outside of the project consortium. These consultations revealed significant friction points in the current renovation process, which the MAP seeks to address by reducing information asymmetries and supporting more coordinated market activation.

3.1 Functional requirements identified by practitioners

Practitioners identified several essential features that the platform must provide to facilitate market activation:

- **Decision-support tools:** Integration of feasibility modules that allow developers and owners to evaluate the trade-offs between renovation and demolition, utilising Life Cycle Assessment (LCA) and "grey energy" data to highlight the environmental value of preservation.
- **Digital material passports:** Direct access to data on material composition, de-constructability, and circularity to streamline pre-demolition audits and facilitate the high-value reuse of components.
- **Centralised resource hubs:** A consolidated database of products, technical specifications, and regional regulations to enable rapid assessment of renovation techniques during the initial planning phase.
- **Stakeholder-specific configurators:** Tailored interfaces that provide customised advice and technical pathways based on the specific needs of different user groups (e.g. property owners, architects).
- **Financial modelling tools:** Include life-cycle costing tools to demonstrate the long-term economic viability of industrialised solutions, alongside models that quantify savings from material recycling and present innovative financing structures (e.g., guarantee and performance-contracting models).
- **Market visibility and networking:** A geographical directory or expert map to connect users with local suppliers, SMEs, and technical experts specialising in circular and industrialised renovation within their specific region.

- **Knowledge transfer and capacity building:** A central repository for case studies, pilot project results, and technical seminars to foster industry confidence and support the upskilling of the construction workforce.

3.2 Current landscape within BUPS implementation

While practitioners defined the necessary functionalities, BUPS project partners provided insight into the operational challenges encountered during development and implementation across the five pilot ecosystems.

Several structural barriers emerged. Engagement data demonstrated a strong preference for platforms available in users' native languages, and stakeholders showed greater willingness to interact with digital tools embedded within trusted regional brands rather than a centralised European portal. Data fragmentation also posed a significant challenge, as incompatible data formats across ecosystems and reluctance among some data owners to share proprietary or sensitive information limited interoperability.

A further challenge concerns what may be described as a centralisation paradox. While stakeholder needs are broadly similar across Europe, the information provided by the MAP must be localised to remain actionable. Fragmented regional building codes and varying national regulations complicate the direct replication of solutions and challenge the feasibility of a fully centralised platform model. In addition, the high costs associated with technical maintenance, data updates and continuous software improvement raise concerns regarding the long-term financial sustainability of the platform beyond the duration of project funding.

In response to these barriers, the consortium adopted a dual-section platform design, combining a harmonised catalogue providing uniform and comparable data with a connectivity hub linking users to existing local registries and initiatives rather than duplicating their data. To reduce user overload and lower the barrier to entry, a simplified "wizard" assistant was developed to guide non-expert users through complex information. Furthermore, while core technical functionalities were harmonised at EU level, actual market engagement was led by regional actors to ensure regulatory and cultural relevance. The consortium also leveraged EU support schemes, including the Horizon Results Booster, and pursued follow-up funding and business models to enhance long-term viability.

Policy recommendations

Based on the findings from both practitioners and project partners, the following policy actions are recommended to support the scaling of the MAP:

- **Facilitate federated platform structure:** Encourage the development of federated platform structures that allow local agencies to host the MAP functionality under trusted regional branding. While a high-quality platform like

the MAP can be built, gaining actual market share and confidence requires local actors who understand regional "pain points" and can reach the right stakeholders.

- **Harmonise data protocols**: Standardise data formats for Digital Building Logbooks and industrialised component catalogues across Member States. This alignment is essential to ensure data interoperability, allowing solutions developed in one region to be easily compared and deployed in another.
- **Ensure long-term funding**: To ensure the longevity of digital tools like the MAP, one-off development grants must be complemented with long-term evolutionary funding support schemes that cover maintenance and market expansion.
- **Mandate user-centric navigation and segmentation:** Prioritise user-centric design to prevent information overload for non-experts. This includes the implementation of intuitive "wizard" assistants, using simple, diagnostic questioning to guide property owners toward industrialised solutions, while simultaneously maintaining high-granularity technical data for professional stakeholders and contractors.

Section 4: National ecosystem experiences and policy recommendations

This section presents targeted policy recommendations for each of the five national ecosystems participating in the BUPS project. Recognising that each pilot addressed unique regional challenges, technical priorities, and market conditions, these recommendations are tailored to the specific regulatory and socioeconomic landscapes of Austria, France, Italy, the Netherlands, and Spain. To provide the necessary context for these proposals, each subsection begins with a detailed overview of the national ecosystem's characteristics. These descriptions outline the specific approach taken toward industrialised renovation and the unique PuF configuration tested on-site.

4.1 Austria

The Austrian ecosystem within BUPS is characterised by a dual approach to industrialised solutions that combines serial renovation with circular economy principles. This ecosystem involved 15 pilot cases that spanned a diverse range of buildings, including schools, hospitals, and residential units. The ecosystem utilised prefabricated façade modules and advanced digital tools like 3D laser scanning and modelling to ensure high-precision planning and installation. It also focused on a social urban mining concept to provide building owners with transparent assessments of a building's reuse potential and material value.

The Austrian PuF model was operationalised as a circular, service-oriented configuration rather than a static manufacturing facility. It functions as a structured deconstruction and reuse platform embedded directly within renovation projects. This included a social urban mining assessment identifying reusable materials and components before deconstruction, followed by a controlled dismantling and the coordinated reintegration of reusable components such as flooring, doors, and furniture into the new construction cycle. This configuration represents an assembly factory model, focused on material recovery coordination rather than decentralised manufacturing.

The market for industrial renovation in Austria is still project-driven rather than demand-driven. The technical capacity exists, but investments lag due to uncertainty about the future demand and no stable project pipeline. While technical capacity is high, investments are hindered by a fragmented regulatory landscape across nine federal regions (Länder) and stringent tenancy laws (Mietrechtsgesetz – MRG) that strictly limit rent increases, notably rent adjustments after renovation, thereby reducing the financial incentives for high-up-front-investment solutions such as serial renovations.

The Austrian ecosystem experienced a structural mismatch between circular economy ambitions and the existing legal and construction frameworks. Austrian waste legislation and construction product regulations were not designed to allow "output-to-input" reuse pathways at scale. When reused components re-enter formal construction

processes, uncertainty arises regarding certification, liability, fire safety compliance, and warranty allocation. This legal ambiguity increases perceived risk among building owners and contractors, limiting replication beyond demonstration projects.

From a financial perspective, incentives remain misaligned. Mechanical demolition is often faster and evaluated under short-term cost criteria, while social urban mining requires additional planning, selective dismantling, and coordination efforts. Without mechanisms that recognise circular value, it is difficult to compete with conventional demolition workflows.

Country-specific policy recommendations

To foster the national uptake of industrialised solutions and circular deconstruction in Austria, the following recommendations are proposed:

- **Harmonise regional building codes:** Establish federal-level harmonisation of technical requirements to eliminate the fragmentation across the nine Länder, enabling the scaling of industrialised solutions nationally.
- **Develop targeted funding to cover the higher up-front costs:** Introduce public funding schemes specifically designed to cover the cost premium of circular design and serial renovation, notably to bridge the financial gap between those higher up-front investment and limited rent-adjustment possibilities under current tenancy laws.
- **Prioritise innovative legal frameworks to reduce construction complexity:** National authorities should implement regulatory initiatives that simplify construction standards, specifically for industrialised solutions, like the example of Germany's "Building Type E" (*Gebäudetyp E*) initiative. By allowing professionals to legally deviate from overly complex technical norms without increasing liability risks, policymakers can reduce costs and accelerate the deployment of innovative, resource-efficient renovation methods.
- **Clarify the legal status of reused components:** Provide guidance on aspects such as fire safety compliance, liability, and warranties for reused building parts to reduce risk perception among contractors and insurers.
- **Incentivise pre-demolition audits to support circularity:** To increase the uptake of secondary materials and promote resource efficiency, national policymakers should incentive use of pre-demolition audits. As highlighted in the European Strategy for Housing Construction, these audits are essential for gathering high-quality data on available building components before deconstruction and can bridge the gap between supply and demand.
- **Introduce financial incentives for selective dismantling:** Implement financial mechanisms that recognise the value of material recovery, making selective deconstruction through social urban mining economically competitive with conventional mechanical demolition.

4.2. France

The French ecosystem is defined by a strategic emphasis on the circular economy. In contrast to purely technical serial renovation, the project prioritised a reuse-oriented approach, integrating the recovery and refurbishment of materials into the core of the renovation process. In this pilot, the application of the PuF concept transitioned away from the idea of a temporary manufacturing plant toward a service-based, circular configuration. The factory functions as a decentralised platform embedded within social housing projects to coordinate the salvaging, refurbishing, and reintegration of building components.

While France benefits from a strong political commitment to environmental standards and renovation policies, the industrialised renovation market remains hindered by high insurance surcharges, a limited number of specialised producers, and the elevated costs associated with high-quality material recovery. Furthermore, the construction sector's traditional preference for centralised production models creates a cultural barrier, where many stakeholders remain sceptical of the increased upfront investment required for industrialised methods.

Although French law provides flexible pathways for the temporary occupation of land, which is a key enabler for PuF logistics, practical scaling of PUFs is often limited by land scarcity in dense urban environments and the complexity of heterogeneous urban fabrics. The success of this service-oriented model is currently challenged by the absence of mature reuse channels and structured material deposit systems, which frequently results in the cost of refurbishing components exceeding the price of new products.

Bridging this gap requires not only logistical innovation, but also a shift in social and market acceptance, ensuring stakeholder confidence in the long-term performance of circular solutions.

Country-specific policy recommendations

To accelerate the adoption of industrialised renovation and circular reuse in France, the following policy actions are recommended:

- **Standardise insurance and warranty frameworks**: Develop national protocols in collaboration with insurance providers to establish clear risk assessment and warranty standards for reused components, reducing the legal and financial uncertainty for contractors.
- **Implement fiscal incentives for reconditioned products**: Introduce targeted tax measures, such as reduced VAT rates for certified reused or refurbished construction materials, to improve their cost-competitiveness against new, carbon-intensive products.
- **Invest in technical training and social advocacy:** Launch national capacity-building initiatives to train contractors in circular deconstruction techniques while implementing communication programmes to build trust in the quality and safety of reused materials.

- **Scale up regional material deposit systems:** Support the development of structured material hubs and digital supply-chain platforms to reduce the logistical complexity and costs associated with recovering and sourcing reused building elements.

4.3 Italy

The Italian ecosystem within the BUPS project focuses on a strategic transition from traditional, manual-intensive construction toward advanced off-site manufacturing. This was demonstrated through a deep renovation pilot of a public social housing complex in Milan.

A primary regulatory barrier to scaling industrialised solutions in Italy is the "Prezzario", the regional standardised price lists used in public tenders. These lists currently lack specific codes or pricing for integrated off-site modules, such as panels that combine insulation, windows, and finishes, making it legally and administratively difficult for public officials to justify the costs of industrialised solutions over traditional methods. Furthermore, the market is hindered by the instability of national tax incentives, such as the fluctuating "Superbonus" rates, which creates significant uncertainty for property owners. This is compounded by a misalignment between national and regional building laws and a geographical imbalance, where the concentration of production facilities in Northern Italy creates high logistical and transportation costs for projects in the South.

The Italian pilot explored the feasibility of a "Satellite" PuF model, designed to assemble large building components closer to the construction site to mitigate logistical constraints. While strong policy drivers for energy and seismic renovations exist, the practical implementation of satellite factories is often obstructed by rigid spatial planning constraints and environmental regulations that complicate the permitting of temporary production sites in dense urban or non-industrial areas. From a market perspective, the satellite model currently struggles with economic viability due to a lack of aggregated demand pipelines. Without a predictable volume of projects, manufacturers are hesitant to invest in the necessary temporary or automated infrastructure.

Additionally, a limited institutional capacity within public administrations to manage innovative procurement frameworks and decentralised production models remains a significant bottleneck. Overcoming these hurdles requires a shift toward district-level planning and the creation of supportive administrative pathways that recognise the unique requirements of temporary, near-site manufacturing.

Country-specific policy recommendations

To support the national uptake of industrialised renovation and the satellite factory model in Italy, the following recommendations are proposed:

- **Modernise the "Prezzario" (official price lists):** Integrate specific entries for integrated off-site and prefabricated components into official public procurement price lists.
- **Establish stable, long-term financial frameworks:** Ensure stable and long-term financial incentives that creates market certainty and can support more stakeholders with doing renovations with industrial solutions. The financial incentives could include direct grants or low interest "green loans" provided by public banks.
- **Harmonise multi-level construction governance:** Resolve the regulatory fragmentation between national and regional building laws to create a unified set of administrative requirements, enabling the replication of industrialised solutions across different regions.
- **Create regulatory pathways for satellite factory models**: Develop simplified administrative procedures for the temporary use of land for near-site assembly, reducing the bureaucratic risk for public authorities and lowering entry barriers for industrial actors.
- **Promote aggregated renovation tenders:** Structure renovation programmes at the district or neighbourhood level rather than building-by-building. Bundling projects generates the predictable volume required to justify the deployment of satellite PuF infrastructure and achieve economies of scale.
- **Formalise regional competence centres:** Provide institutional recognition and funding for regional innovation hubs, such as EDERA, to act as intermediaries that bridge the gap between manufacturers, public administrations, and housing providers through technical and procurement support.

4.4 The Netherlands

The Dutch ecosystem within the BUPS project is anchored by two significant pilot projects in the Limburg region, specifically in the cities of Heerlen and Maastricht. These pilots focused on the integration of high-performance prefabricated facade systems and modular interior components, including advanced boiler systems and ventilation units. A defining technical innovation of the Dutch approach is the "vertical column" renovation method, which allows contractors to complete one vertical section of a building at a time. By moving materials directly through the facade, this strategy minimises internal disruption and enables residents to remain in their homes throughout the renovation process.

Despite the Netherlands' high level of technical maturity, the ecosystem faces significant regulatory hurdles. Current building codes remain inflexible regarding the specificities of prefabricated components, and stringent ecological regulations, such as mandatory seasonal checks for protected species like nesting bats, are vital for environmental protection, but frequently impose unforeseen delays and costs of renovation projects. These delays are particularly disruptive for industrialised solutions, which rely on precise timing for the delivery and assembly of off-site components.

Furthermore, the traditional reliance on a main contractor with a fragmented network of specialised subcontractors often results in communication gaps, highlighting the need for a more transversal and coordinated flow of information.

The Dutch ecosystem successfully operationalised two distinct PuF configurations designed to maximise efficiency across residential blocks. In Heerlen, a District PuF model was implemented, involving an assembly facility that moved sequentially across four adjacent housing blocks to ensure a continuous workflow. In Maastricht, the focus shifted to an Assembly PuF specifically optimised for the rapid installation of facade systems.

These configurations benefited from the Netherlands' high digital maturity and the presence of repetitive housing typologies, which are ideally suited for serial production. However, the operational success of these factories is heavily dependent on sophisticated digital management. The Dutch models are strictly "BIM-based," requiring a high degree of technical expertise and a robust digital infrastructure to maintain the data flow between the design and assembly phases. While these digital tools increase the precision of the renovation, they also add a layer of management complexity that requires specialised training and a departure from traditional construction workflows.

Country-specific policy recommendations

To facilitate the broader adoption of industrialised renovation and the PuF concept in the Netherlands, the following policy actions are recommended:

- **Balance ecological protection with decarbonisation goals:** Develop streamlined protocols to reconcile flora and fauna regulations with deep renovation timelines. This could be done through creating "pre-approved" ecological mitigation strategies for standard building typologies to prevent seasonal checks from halting industrialised renovation schedules.
- **Encourage data sharing between similar projects**: Encourage the transfer of data and experience between identical or similar neighbouring projects. This would allow subsequent projects of the same building class to bypass redundant planning phases, significantly accelerating the deployment of serial industrialised solutions.
- **Institutionalise renovation facilitators:** Establish independent project facilitators tasked with bridging the communication gap between housing associations, municipalities, and the various layers of the supply chain to ensure a cohesive execution of complex industrialised projects.
- **Provide technical assistance for digital PuF operations**: Launch regional support programmes and targeted funding for Building Information Modelling (BIM) training and digital infrastructure. This will ensure that small and medium-sized enterprises (SMEs) can participate in the high-tech data environments required for District and Assembly PuF models.

4.5 Spain

The Spanish ecosystem focused on two primary pilot cases: a student housing residence in Zaragoza and a building rehabilitation in Pamplona. These pilots served as critical benchmarks to compare the performance of industrialised prefabricated systems against traditional construction methods in terms of cost-efficiency and delivery timelines.

While the Spanish construction sector is currently experiencing a notable increased interest in industrialised solutions, several regulatory and financial barriers continue to limit broader market uptake. A significant hurdle lies in public concurrency laws, which often prevent the early specification of a particular industrialised solution to avoid perceived restrictions on competition. Furthermore, industrialised components are frequently classified legally as "products" rather than "buildings" during the construction phase. This classification prevents contractors from accessing traditional incremental construction loans, forcing them to secure full upfront funding and significantly increasing their financial risk. This situation is further complicated by fragmented regional regulations and a lack of economic competitiveness for circular practices, where the cost of recovering and reusing materials often exceeds that of disposal and replacement.

In the Spanish context, the PuF concept was explored primarily at a feasibility and reflection level rather than through full-scale operational deployment. The findings indicate that while there is technical experience with mobile production in civil works, the residential renovation sector lacks a dedicated regulatory framework to support temporary, decentralised production. Service-oriented PuF models currently appear to be the most realistic entry point for the Spanish market. However, the feasibility of these models is heavily constrained by strict urban regulations regarding noise, traffic, and dust, as well as limited land availability in dense city centres.

Furthermore, the Spanish construction market remains highly fragmented with limited vertical integration. Because most rehabilitation projects are isolated and small-scale, it is currently difficult to generate the necessary volume to justify the investment in Satellite or District PuF configurations. Establishing a viable PuF model in Spain will require overcoming these structural limitations and creating more mature material recovery ecosystems to support circular service-based configurations.

Country-specific policy recommendations

To foster the industrialisation of the renovation sector and the implementation of PuF models in Spain, the following policy actions are recommended:

- **Reform financing and mortgage classifications**: Update national financing laws to recognise off-site manufactured components as integral parts of the real estate asset from the fabrication stage, allowing contractors to access traditional incremental construction loans.
- **Harmonise regional construction regulations**: Establish a consistent national regulatory framework for industrialised solutions to reduce

administrative complexity and provide a stable environment for long-term investment and cross-regional scaling.

- **Implement neighbourhood-level renovation aggregation mechanisms:** Promote coordinated renovation programmes at the district or neighbourhood scale rather than building-by-building. Aggregating demand creates the repetition and volume necessary to make PuF configurations economically viable.
- **Clarify permitting frameworks for temporary production:** Provide harmonised national guidance on permitting for temporary assembly facilities in urban environments, establishing predictable pathways for managing noise, traffic, and environmental compliance.
- **Incentivise circular material recovery:** Introduce fiscal support or subsidies to bridge the cost gap between conventional demolition and circular material reuse, encouraging the development of structured material recovery channels and mature reuse markets.

References

Buildings Performance Institute Europe (BPIE). (2022). *Report on the evolution of the European regulatory framework for building renovation*. https://www.bpie.eu/wp-content/uploads/2022/02/rev6_SPIPA_EU.pdf

BuildUPspeed (BUPS). (2025). *Deliverable 4.1 (M33). Report on the activities for the design and implementation of the Local PuF Concept.*

Dedeu Dunton, A.L., Martin, I., Delera, M. and Flickenschild, M. (2024) *Research note on offsite construction*. Available at: https://build-up.ec.europa.eu/system/files/2025-01/RB385Rpj2z_29_01_2025_083227.pdf

European Commission. (2025a). *The European Strategy for Housing Construction: a more competitive and productive construction industry.* Available at: https://webgate.ec.europa.eu/circabc-ewpp/d/d/workspace/SpacesStore/a85e53d8-a82b-47f9-a247-f0819f20466d/download

European Commission. (2025b). *Market potential of offsite construction for housing supply: report*. Available at: https://data.europa.eu/doi/10.2873/3569150

European Commission. (n.d.a). *Energy performance of buildings directive*. https://energy.ec.europa.eu/topics/energy-efficiency/energy-performance-buildings/energy-performance-buildings-directive_en [Retrieved 2026-03-03].

European Commission. (n.d.b). *Renovation wave*. https://energy.ec.europa.eu/topics/energy-efficiency/energy-performance-buildings/renovation-wave_en [Retrieved 2026-03-03].

UIPI. (2025). *EUROPEAN PROPERTY OWNERS' PERSPETIVES & EXPERIENCES ON BUILDING RENOVATION.* Available at: https://www.uipi.com/wp-content/uploads/2025/10/WEB-UIPI-European-property-owners-perspectives-and-experiences-on-building-renovation.pdf