Driving renovations through policy

Authors

Dimitris Papantonis (IEECP), Vasilis Stavrakas (IEECP), Marta Maia (IEECP)

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Introduction

Climate change represents one of the most pressing and complex challenges of the 21st century. The continued rise in global temperatures, driven primarily by greenhouse gas (GHG) emissions from human activities, together with increasing climate variability, poses substantial risks to ecosystems, economies, and public health (Zeng et al., 2025). Immediate, coordinated, and sustained action is essential to mitigate these impacts through the transition to renewable energy, the widespread implementation of energy-efficiency measures, and the adoption of sustainable development practices across all sectors of society.

The buildings and construction sectors play a central role in this transition; together, they account for approximately 30% of global final energy consumption and 27% of energy-related carbon dioxide (CO2) emissions (United Nations Environment Programme, 2025). Energy demand associated with these sectors continues to grow as global floor area expands and reliance on energy-intensive appliances increases. Improving the performance of buildings is therefore indispensable for achieving climate neutrality. Decarbonising the buildings sector requires not only greater integration of renewable energy sources (RES) but also a fundamental redesign of energy systems at both the building and district levels. As electricity generation becomes increasingly low-carbon, the electrification of end-uses traditionally reliant on fossil fuels- particularly heating, cooling, and mobility- becomes a crucial strategy for economy-wide emissions reductions (IEA, 2022). This transformation is expected to reshape energy demand patterns, especially with the projected increase in electric vehicles (EVs) and heat pumps, both central to delivering clean and efficient building- and district-level services.

Recognising this, the EC recommends a 90% reduction target in GHG emissions by 2040, with the buildings sector expected to deliver up to 92% of the required savings (Hesse & Braungardt, 2024). Yet national projections indicate that current policies are insufficient: existing measures would reduce building-related emissions by only 42% by 2030 and 53% by 2040, revealing a substantial gap between ambition and implementation. Key performance indicators- carbon dioxide (CO_2) emissions reduction, energy savings, renewable energy uptake, and renovation rates- remain more than 40% below the required trajectories (Amorocho et al., 2024).

To bridge this gap, the EU has adopted a comprehensive policy package: The "Renovation Wave" strategy (2020) (European Commission (EC), 2020a) aims to at least double annual energy renovation rates by 2030. Recent revisions of the Energy Efficiency Directive (EED) in 2023 (European

Commission (EC), 2023c) and the Energy Performance of Buildings Directive (EPBD) in 2024 (European Commission (EC), 2024), introduce more stringent performance requirements, strengthen minimum energy performance standards (MEPS), promote the phaseout of fossil-fuel boilers, and mandate that all new buildings achieve zero-emission status by 2030, with the existing building stock following by 2050.

The following policy recommendations are designed to support the wide deployment and long-term sustainability of the renovation solutions developed and demonstrated within FORTESIE. They respond directly to the project's objectives, which call for the formulation of clear, actionable messages for European, national, and regional/ local policymakers, as well as for industry associations and civil-society organisations engaged in the building-renovation agenda. The purpose is to translate the empirical evidence generated through the project's pilots, together with cross-cutting insights from WP2-WP5 and the broader policy analysis presented in Section 2 into recommendations that can inform legislative processes, guide implementation efforts, and strengthen the enabling conditions for ESIE-oriented renovation services across Europe.

Recommendations are structured according to each governance level of interest, reflecting the differentiated roles and responsibilities of key policy actors. At the EU level, they aim to support the evolution and effective implementation of core legislative frameworks such as EPBD (European Commission (EC), 2024), EED (European Commission (EC), 2023c), and RED (European Commission (EC), 2023b) regulations, as well as related financial and digital initiatives, including the "EU Taxonomy" (European Commission (EC), 2020b), the CEEAG (European Commission (EC), 2022), the "InvestEU" programme, and the emerging Energy Data Space.

At the national level, they address the practical challenges of policy transposition, regulatory coordination, financing design, and administrative capacity, which are critical to accelerating renovation activity at scale. At the regional and local levels, the recommendations highlight the role of municipalities, energy agencies, and public building owners as frontline implementers and multipliers of innovative renovation approaches. In parallel, selected recommendations are directed at industry stakeholders and other relevant market actors, whose engagement, innovation capacity, and service offerings are essential to the deployment of integrated, digital, and performance-based renovation services.

The framework underpinning these recommendations is grounded in the lessons learnt across the seven FORTESIE pilot sites, where real-life operating conditions exposed technical, organisational, financial, and behavioural barriers that remain insufficiently addressed in current policy settings. These empirical findings are complemented by the identification of systemic gaps in existing technological solutions, digital standards, and renovation market structures. By combining pilot-level evidence with a broader assessment of policy and market conditions, the recommendations seek not only to remove existing obstacles but also to actively support

the emergence of new business models, strengthen Europe's renovation value chain, and enable the uptake of innovative ESIE-based services.

Overall, this brief provides the bridge between FORTESIE's empirical insights and the policy actions required to unlock large-scale, performance-driven renovation across Europe. The recommendations that follow are therefore intended as guidance for policymakers shaping the frameworks within which renovation actors operate, ensuring that the knowledge generated in FORTESIE contributes meaningfully to Europe's climate, energy, and social objectives.

Policy strategies

France

France has established a robust and highly structured regulatory framework for building renovations, integrating energy performance requirements, climate objectives, digital tools, and financial instruments within a coherent national transition strategy. Renovation policy is embedded in broader climate and energy governance- most notably the “National Low-Carbon Strategy (SNBC) ”, the “Multiannual Energy Plan (PPE)” , and the forthcoming NBRP under the recast EPBD. The framework spans residential, tertiary, and public buildings and combines minimum performance requirements, certification schemes, digital monitoring platforms, and incentive mechanisms.

The FORTESIE pilot confirmed that France operates in a mature policy environment characterised by high regulatory ambition and substantial public funding capacity. At the same time, it highlights a shift in where the “hard problems” now sit: increasingly, delivery is constrained not by missing policy instruments, but by administrative complexity, behavioural dynamics, and the operational integration of M&V tools into real renovation workflows. These implementation frictions matter because France’s model relies on moving from regulatory intent to verified outcomes.

Make One-Stop Shops operational integrators, including post-renovation verification and monitoring onboarding

France should reinforce the operational mandate of OSS-based structures (notably the network and allied intermediaries) so that support extends beyond advice and funding guidance into monitoring enrolment, device onboarding, troubleshooting, and data-handling interfaces. The pilot shows that data continuity and participation improve markedly when trusted intermediaries reduce the cognitive and administrative burden on households and building owners.

Embed post-renovation verification routines into Minimum Energy Performance Standard enforcement and support schemes

As rental restrictions widen, legitimacy will depend on demonstrating that renovations deliver sustained performance in practice- not only nominal compliance. France should mainstream post-renovation steps (activation of monitoring where relevant, validation of key performance evidence, and updating of building stock records/ logbooks) as routine elements linked to public support and compliance documentation.

Remove “deep renovation penalties” by creating a single dossier for multi-measure packages

While national regulation is strong, administrative friction still nudges actors towards incremental upgrades. France should implement a single bundled workflow for multi-measure renovations- one submission pathway, one evidence logic, and reduced duplication between audits, grant documentation, and verification.

Establish national technical standards for interoperability and data access

To stabilise digital renovation ecosystems, France should define minimum requirements for device interoperability, data-export formats, API stability expectations, and pre-deployment testing for solutions used in publicly supported schemes. This will reduce late-stage integration failures and protect the long-term usefulness of monitoring data for national systems.

Standardise privacy-by-design and resident value propositions to raise monitoring participation without coercion

Monitoring uptake is often limited by trust and perceived effort, not by technology. France should provide standard national communication and consent materials (plain language, privacy safeguards, “what you get back”), and make monitoring benefits tangible (comfort insights, fault alerts, confirmation of savings).

Use proportionate incentives that reward evidence-sharing, not gadgets

If post-renovation data is needed for benchmarking and policy credibility, France should incentivise participation in evidence creation rather than pushing complex tech. Options include small grant bonuses, faster processing, or enhanced advisory support for households/ building owners who share anonymised post-renovation performance evidence for a defined period.

Treat monitoring logistics as a service obligation, with remote support and fallback routes

To scale, monitoring must be operationally robust: remote onboarding, clear escalation, and fallback modes when connectivity or user capacity fails. France should require service providers to meet minimum support service levels (remote diagnostics, replacement protocols, continuity guarantees) and enable lightweight on-site support through intermediaries.


CHANOINESSE
OUGNAT
4e Arrt
RUE
CHANOINESSE
Café
Le Restaurant Est
à L'Intérieur
DINER ROOM INSIDE
Poussez
PORT LA PORTE
PUSH THE
DOOR

Policy strategies

Greece

Greece is entering a decisive implementation phase for the decarbonisation of its building stock. The recast EPBD (2024) strengthens the EU pathway towards a ZEB stock by 2050 and requires Greece to replace its Long-Term Renovation Strategy (LTRS) with a NBRP, with a draft due by the end of 2025 and a final plan by the end of 2026. The NBRP is expected to operationalise national renovation trajectories in alignment with the updated NECP (published in 2024), specifying renovation targets, investment needs, milestones for non-residential MEPS and residential trajectories, and the policy instruments required to deliver them at scale. In parallel, Greece must adapt its technical and administrative framework (notably the K.En.A.K. regulation- the main legislative instrument and technical framework for the transposition and implementation of the EPBD in Greece, the EPC ecosystem, and inspection/ monitoring practices) to support the emerging EU requirements on ZEBs, BRPs, the SRI, and strengthened databases for building performance (Papantonis, Stavrakas, Tzani, et al., 2025).

The experience of the two Greek FORTESIE pilots shows that the main barriers to achieving verified renovation outcomes are not primarily the availability of technologies, but the operational capacity to deliver complex renovation packages under real-world constraints. The museum pilot in Athens demonstrated how supply-chain failures, permitting uncertainty for PV grid connection, limited in-house capacity, and cost volatility can derail otherwise sound renovation plans, especially in small cultural institutions. The large public-building pilot (Ministry of Digital Governance complex) demonstrated that even when renovation technologies can be deployed at scale- meters, sensors, controls, EMS platforms, and PV systems- the critical path often shifts to procurement sequencing, bureaucratic permitting, and sustained coordination across public authorities. Together, these two realities illustrate Greece's central policy challenge: translating strategic intent into delivery systems that can absorb administrative complexity, reduce transaction costs, and convert upgrades into measurable energy and comfort outcomes.

Build a national “delivery system” for renovations, not parallel programmes

Greece’s immediate priority under the NBRP should be to strengthen the “delivery system” that turns funding and regulation into completed, functioning renovations. The NBRP should therefore explicitly recognise delivery capacity as an investment category, establishing standard procedures, commissioning and handover protocols, and practical implementation support for both large public facilities and small institutions with limited in-house capacity. This shift will reduce the risk that ambitious targets remain declarative and improve the probability that renovated buildings actually achieve verified energy and comfort outcomes.

Position One-Stop Shops as implementation operators with delegated capacity, not only advisory points

Greece should institutionalise and adequately resource OSS-based structures and services as operational intermediaries that actively guide projects through the end-to-end renovation workflows. In practice, this means OSS-based services should be mandated and funded to support procurement preparation (technical specifications, tender templates, supplier engagement), permitting navigation (including PV systems/ grid steps), digital documentation (EPC-related processes, building files), and the onboarding of M&V tools where relevant. Embedding OSS support as a standard component of existing programmes would reduce transaction costs and make implementation less dependent on informal networks and individual initiative.

Create a fast-track pathway for PV and small-scale RES systems permitting and grid connection

Greece should treat PV and small-scale RES integration in buildings as a mainstream decarbonisation lever and design permitting and grid-connection procedures accordingly. A fast-track pathway should therefore standardise documentation requirements, clarify responsibilities across agencies, and set time-bounded administrative steps, with early initiation of permitting in parallel with technical design. This is especially important for public buildings and cultural institutions, where delays undermine project credibility and can leave assets stranded in a “completed but not operational” state.

Embed procurement resilience and market-volatility protections into programme rules

Dependence on a single supplier for innovative components can trigger redesign, dimensional constraints, and major delays, while inflation and logistical costs can force scope reductions. Greece should translate this into procurement rules for publicly supported renovations that encourage multi-supplier strategies, early technical due diligence, and performance-based specifications that allow substitution without restarting design work. For small institutions and heritage-sensitive buildings programmes should allow realistic time buffers and contingency provisions, and they should promote supplier pre-qualification frameworks to reduce exposure to non-delivery and market volatility.

Upgrade the national building performance data backbone from "statistics" to governance-grade interoperability

Greece should implement Article 22 of the EPBD as a practical enabler of MEPS and renovation delivery, not merely as a reporting requirement. The national evidence base currently suffers from fragmentation, conditional access, uneven digitisation, limited timeliness, and the absence of harmonised methodologies. The NBRP should therefore set out a coherent interoperability pathway linking EPCs, HVAC inspection reports, permit and renovation records, cadastre identifiers, and public-building inventories, supported by standardised formats, metadata, quality-control routines, and clear access rules. This is the minimum foundation needed for credible targeting, fair prioritisation, and robust monitoring of national renovation trajectories.

Make performance verification a programme design requirement for public and tertiary renovations

Greece should mainstream digital M&V processes as part of quality assurance in publicly funded renovations, particularly in public and tertiary buildings where operational savings and comfort outcomes are central policy objectives. Commissioning, monitoring, and post-renovation optimisation should be treated as standard deliverables- proportionate to building size and complexity- rather than optional "nice-to-have" features. This will strengthen accountability, improve operational outcomes, and build the evidence base required for MEPS implementation and programme refinement.

Target capacity building to the actors that determine delivery on the ground

Greece should align training and technical support with municipal technical services, public-building operators, and small organisations such as cultural institutions, because these actors frequently lack the specialised capacity to manage procurement, permitting, commissioning, and digital monitoring. The NBRP should therefore include structured training and practical support packages on permitting workflows (especially RES), digital documentation and data practices, commissioning, and M&V basics, and performance-based procurement. Coupled with OSS-led toolkits and escalation pathways, this would reduce implementation delays, improve renovation quality, and expand the pool of actors capable of delivering deep renovations consistently across regions.

Policy strategies

Latvia

Latvia's pathway for decarbonising the building stock is anchored in its updated NECP and in an ongoing programme of legislative and administrative reform that aligns national practice with the evolving EU requirements. Buildings are positioned as a key demand-side sector where envelope upgrades, improved technical systems, and operational optimisation can deliver measurable energy savings while advancing broader climate and energy-security objectives. In this context, renovation policy increasingly needs to combine energy-performance ambition with implementation capacity, robust data systems, and attention to indoor environmental quality (IEQ), particularly in public buildings.

The Latvian FORTESIE pilot offers a highly policy-relevant signal for this transition. Even after comprehensive envelope renovation, the Riga school case demonstrates that performance gaps can persist when ventilation and operational control are not upgraded in parallel. This matters because it shifts the policy focus from "renovate more" to "renovate in an integrated, verifiable way": ensuring that renovation programmes systematically address the interaction between airtightness, ventilation performance, real occupancy patterns, and the ability of building operators to keep IEQ within acceptable ranges without creating avoidable energy penalties.

Make “healthy school ventilation” a dedicated national renovation outcome, not a side effect

Latvia should treat ventilation performance and IEQ in educational buildings as a core public-service outcome- explicitly alongside energy savings. This means defining a school-specific pathway in the NBRP and in relevant funding rules, where ventilation adequacy, CO_2 control, and moisture risk management are part of the renovation objective, not a residual concern after insulation.

Standardise IEQ performance targets and a minimum monitoring package for publicly funded school renovations

Monitoring should not be “pilot-like” or improvised. Latvia should standardise a minimum IEQ measurement package (temperature, relative humidity) and a clear reporting template for school renovations, with privacy-respecting aggregation and simple governance rules for municipalities and school operators.

Procure outcomes, not devices: Introduce standard technical specifications for school ventilation and control upgrades

Municipal procurement is often the bottleneck for quality and speed. Latvia should publish standard specifications that focus on outcomes- ventilation effectiveness, controllability, stability- rather than brand-like prescriptions, and provide “plug-in” procurement templates that municipalities can reuse.

Make commissioning and operational handover non-negotiable in school projects

School renovations succeed or fail in commissioning: balancing, control tuning, sensor placement, and operator routines determine whether IEQ improves without energy penalties. Latvia should require a lightweight but mandatory commissioning and handover pack for publicly funded school renovations.

Build municipal delivery capacity with school-specific technical assistance and escalation support

Municipalities need practical capacity, not only guidance. Latvia should provide school-targeted technical assistance that includes design review support (ventilation/ condensation risk), commissioning troubleshooting, and rapid escalation when first deployments reveal problems.

Treat district heating interface as part of school renovation quality (balancing, controls, temperature optimisation)

In cases where schools are connected to district heating, envelope and ventilation changes affect hydraulic balance and control stability. Latvia should integrate building-side optimisation measures into renovation rules, so district heating and school comfort outcomes reinforce each other.

Embed IEQ and renovation evidence into the national data backbone, proportionate to

Latvia's EPC registry is a strong base, but schools require additional operational indicators to support prioritisation and credibility. Latvia should ensure school renovation records connect EPC information with renovation measures (what was done), system upgrades, and verified IEQ outcomes in a structured way, without overburdening municipalities.

Manage first-deployment risk through phased roll-out rules and supplier obligations

Innovation adoption in public buildings fails when early operational problems overwhelm staff. Latvia should require supplier support during the stabilisation period and allow phased deployment with buffering, particularly when solutions are new to the school sector.


ANTIKVARIĀTS
VOLMAR

Policy strategies

Poland

Energy transition in Poland's buildings sector is being shaped by an evolving NECP process and by a policy mix that must reconcile three very Polish realities: a large and heterogeneous building stock with deep retrofit needs; the central role of district heating in many towns and cities; and an accelerating push- driven by EU legislation, funding streams, and market pressure- towards deeper renovations, renewables integration, and smarter operation of technical systems. In this context, "buildings policy" cannot be treated as a stand-alone envelope agenda: it is tightly coupled to heat-sector reform, municipal delivery capacity, and the ability to plan, procure, and verify complex renovations under public-sector constraints.

The FORTESIE pilot in Poland is particularly instructive because it sits at the intersection of energy, safety, and asset integrity. In high-humidity facilities, ventilation effectiveness and moisture control are not comfort upgrades; they determine condensation risk, corrosion, material degradation, and ultimately whether the building remains safe and serviceable. The pilot evidence is clear: the key bottlenecks are rarely "missing technology." They are delivery bottlenecks- public approval cycles, procurement design, cost volatility, construction downtime planning, commissioning discipline, and performance verification practices. These are the conditions that decide whether modernisation yields durable outcomes or simply installs new equipment without resolving the underlying operational risk.

Define “system-critical” municipal facilities as a distinct class in national renovation

Poland should explicitly recognise “system-critical” municipal facilities and other high-humidity/ high-ventilation-demand facilities as a separate class under national guidance and funding rules, because their risk profile and performance determinants differ from offices or schools.

Shift public procurement from “lowest-risk paperwork” to “performance-assured service delivery”

Tender design can either attract competent bidders or produce failures/ redesign cycles. Poland should mainstream procurement approaches that match the complexity of integrated HVAC-controls-renewables upgrades.

Make inflation-resilient budgeting and contingency governance mandatory for complex municipal renovations

Cost volatility is structural in long-cycle public renovations with specialised equipment. Public programmes and municipal rules should require explicit contingencies, inflation-adjusted baselines, and flexible reallocation mechanisms that can be activated without restarting approvals. This will protect system integrity and reduce the likelihood of scope cuts that undermine operational safety.

Treat administrative throughput as a design parameter: Time-bounded approvals and parallelised workflows

Public approval cycles will remain slow unless they are managed as part of the renovation delivery system. Programme guidance can require milestone-based administrative pathways, parallel processing of design and approvals, and clear accountability for continuous follow-up across decision layers. Making administrative throughput a design parameter is essential for predictable delivery at scale.

Institutionalise downtime and continuity planning as an eligibility condition for municipal facilities

For facilities that require temporary closure, programme rules should require an operational closure plan that accounts for seasonal use, construction efficiency, weather constraints, and supply-chain lead times. This reduces disruption, preserves public trust, and prevents rushed commissioning driven by reopening pressure.

Mainstream risk-based digital M&V as a quality-assurance norm in public buildings

Poland should scale monitoring requirements in a risk-based way: start with the most complex public facilities, specifying minimum sensor sets, metering integration, data retention, and oversight roles. The objective is not “data for its own sake”, but operational accountability and durable performance.

Integrate building renovations with district-heating controllability upgrades and tariff-relevant metering

Where district heating is dominant, renovation programmes should explicitly require or incentivise building-side measures that enable network efficiency and decarbonisation: balancing, metering/ sub-metering, control upgrades, temperature optimisation, and interoperability with modernised substations. This will ensure that building upgrades and network transition reinforce each other rather than operating in parallel.

Strengthen operator capacity: Treat facility management competence as part of renovation performance

Complex facilities need operator competence as well as contractor competence. Targeted training for municipal technical teams and facility managers- covering commissioning, setpoint strategies, humidity/ ventilation management, and interpretation of monitoring outputs- can materially improve long-term outcomes and reduce performance drift.


HOLLAND HOUSE
RESIDENCE

Policy strategies

Portugal

Decarbonisation in Portugal's buildings sector is advancing through an increasingly integrated policy architecture that combines long-term renovation objectives, energy-efficiency programmes, and accelerated deployment of renewables. The updated NECP provides the strategic frame for 2021-2030, aligning building renovations with national energy-savings targets, renewable-energy shares, and wider climate goals. At the regulatory level, Portugal has progressively transposed the EPBD through national law and technical regulation, including Decree-Law No. 101-D/2020, which establishes core requirements for energy performance in new buildings and renovations and sets minimum technical criteria for interventions.

A central pillar of implementation is the national building certification system, the "Sistema de Certificação Energética (SCE) ", delivered through a dedicated digital portal and operationally managed by ADENE (Agência para a Energia) on behalf of the competent public authorities. In practical terms, the SCE provides the evidence base for identifying low-performing buildings, targeting incentives, and tracking progress over time. As Portugal transitions to the recast EPBD framework, this institutional and data infrastructure becomes even more central: the forthcoming NBRP will need to convert strategic targets into enforceable trajectories, credible monitoring, and delivery arrangements that work across very different building contexts and social realities.

The FORTESIE pilots in Portugal make this dual reality visible. Portugal has demonstrated strong capacity for socially targeted renovation action, particularly for households facing severe housing deprivation and energy poverty. At the same time, scaling data-enabled renovation governance across dispersed territories- and across very different citizen profiles, from vulnerable elderly residents to highly engaged prosumers- requires policy design that treats delivery capacity, monitoring feasibility, and administrative accessibility as first-order determinants of success, rather than secondary implementation details.

A dedicated “rural, low-density and vulnerable households” pathway within the National Building Renovation Plan

The NBRP should explicitly include a differentiated renovation pathway for low-density territories and vulnerable households, with sequencing logic, realistic timelines, and minimum packages that recognise a recurring reality: habitability and structural remediation often precede energy upgrades. Without this pathway, programme design defaults to “standard renovations” that systematically disadvantage households facing severe deprivation.

One-Stop Shops as empowered delivery agents with delegated administrative capacity

Portugal should institutionalise OSS-based structures as implementation intermediaries, not only as advisory points, but also as actors able to carry documentation, coordinate contractors, interface with SCE/ ADENE procedures, and sustain follow-up across dispersed territories. OSS-based services should be resourced- and where appropriate, authorised with consent safeguards- to act “on behalf of” beneficiaries, including mobile support in remote areas and structured liaison with utilities, certification processes, and local service providers.

Administrative accessibility as a compliance condition, not a social add-on

“Analogue-compatible by default” should become an explicit programme requirement: every digitally delivered scheme should provide a parallel low-barrier route, including paper-compatible documentation, in-person assistance, and delegated handling options for those who need it. Treating accessibility as a design

condition is also a safeguard for MEPS legitimacy: it reduces inequitable outcomes and demonstrates that compliance obligations are matched by practical support.

Procurement, supply-chain, and partner resilience as programme design

Portugal should treat procurement reliability as a policy lever, not a contractor problem. For recurring bottlenecks, framework procurement, pre-approved catalogues, and regional procurement pools can stabilise lead times and reduce repeated tendering-particularly important in dispersed programmes where one delayed component can stall an entire sequence. The same resilience principle should apply to PV, grid-connection processing, and certification-related services. Designing for redundancy reduces systemic fragility and prevents partially completed renovations that never reach their intended performance state.

Fast-track decisions and contingency governance for degraded dwellings

For structurally degraded homes, programmes should formalise two linked mechanisms as standard features: (i). higher contingency envelopes, and (ii). a fast-track decision route for essential additional interventions discovered once renovations begin. Without fast-track governance, projects either pause for approvals (delays) or cut scope (safety and quality risks). A delivery-grade protocol should specify decision authority, evidence requirements, time limits, and eligible cost coverage, so that renovations can proceed without administrative standstill while maintaining accountability.

Minimum delivery standards, commissioning, and post-renovation quality assurance for vulnerable housing

Portugal's next phase should shift from "eligibility compliance" towards outcomes that persist- especially where health, safety, and durability are core goals. Minimum delivery standards for moisture management, ventilation adequacy, thermal comfort, and basic electrical/ structural safety can be operationalised through standard commissioning checklists, minimum documentation of installed measures, and proportionate post-renovation verification. This will ensure that social renovation programmes deliver durable improvements rather than short-lived repairs.

Tiered monitoring and verification that matches connectivity and maintenance realities

Portugal should adopt a tiered M&V architecture that reflects where continuous monitoring is feasible and where it is not. In digitally connected prosumer homes, continuous monitoring can support feedback loops and performance benchmarking, while in remote and vulnerable households, monitoring must be low-maintenance by design, preceded by early connectivity checks, and supported by hybrid options. The policy objective is not "maximum data everywhere", but reliable verification proportional to context, so NBRP monitoring obligations remain workable in low-density territories.

Resilience rules for renewables integration and certification services

Programme rules should explicitly allow substitute certified installers, alternative procurement channels, and practical sequencing options. Designing for redundancy reduces systemic fragility and prevents partially completed renovations that never reach their intended performance state.

Workforce and delivery capacity aligned with the geography of need

Portugal should align workforce measures with where renovations must happen, not only where markets are already mature. Targeted training pipelines, partnerships with vocational centres, and regional contractor mobilisation mechanisms should be explicitly connected to NBRP targets, so renovation trajectories do not become urban-centric by default. Where civic or volunteer-based delivery models exist, policy can strengthen them through regional coordination and quality assurance rather than relying on them informally.

Managed delivery models for energy-poverty renovations as a public-value service

Energy-poverty renovations often behave more like a public service than a standard market transaction. Programmes should therefore enable managed delivery options in which accredited intermediaries (OSSs, NGOs, municipal consortia) can bundle works, coordinate contractors, ensure follow-through, and maintain accountability. This will reduce transaction costs, improve quality, and make the system scalable across dispersed territories while strengthening social legitimacy.

Policy strategies

Spain

Spain has put in place a broad and increasingly coherent policy architecture for achieving decarbonisation in the buildings sector, anchored in the updated NECP, the LTRS, and the forthcoming NBRP under the recast EPBD. The strategic direction is clear: accelerate deep renovations, strengthen electrification and the integration of renewables, and build a monitoring and data backbone capable of supporting MEPSs, renovation trajectories, and credible reporting through harmonised indicators. What makes Spain distinctive is not a lack of ambition, but the combination of strong climatic diversity and decentralised implementation. Key operational responsibilities sit with Spain's Autonomous Communities ("Comunidades Autónomas")- the country's regional governments- and with municipalities. This can be an advantage because delivery is close to local realities, building typologies, and climate conditions. It is also a structural challenge: national targets only become real if permitting capacity, delivery workflows, and data interoperability function reliably across territories, in a way that remains comparable, fair, and enforceable.

The FORTESIE pilots illustrate this implementation reality from two complementary angles. Pilot 2a (Building Blocks in Asturias, Spain) showed how deep renovations in multi-residential buildings can be slowed- or forced to change course- by administrative eligibility constraints, municipal permitting capacity, and residents' willingness to participate in monitoring, even when the technical renovation scope is relatively standard (envelope upgrades, window replacements, PV integration). Pilot 2c demonstrated the value of mature digital infrastructures for long-term performance assessment and optimisation after renovation but also confirmed that engagement and trust- particularly in predominantly elderly communities- remain prerequisites for data-enabled governance. Taken together, the pilots pointed to a central policy lesson: Spain's next leap will come less from adding new instruments, and more from strengthening the delivery and data ecosystems that make existing instruments enforceable, fair, and verifiable at scale.

Front-load subsidy and eligibility checks before technical design locks in costs

Spain should standardise an early "compatibility pre-check" (eligibility, subsidy interaction, required permits, documentation pathway) as a default step in NBRP/ PRTR implementation guidance, so projects identify illegibility at early stages, or proceed with a stable administrative route.

Protect permitting continuity with surge-capacity mechanisms at the municipality level

Scale-up will fail if permitting throughput varies sharply by municipality. Spain should treat administrative capacity as NBRP delivery infrastructure: regional shared technical services, temporary reinforcement pools, and fast reallocation of permitting support when staffing gaps emerge, so that renovation pipelines do not stall for reasons unrelated to technical feasibility or finance availability.

Make One-Stop Shops operational intermediaries for multi-family delivery and elderly communities

OSS-based structures should be strengthened as practical operators that can carry documentation, coordinate resident engagement, support monitoring enrolment and troubleshooting, and act as a stable interface with installers, municipal offices, and registries, reducing dropouts and improving data completeness.

Embed renovation traceability into Energy Performance Certificates and permitting ecosystems as a core governance feature

Spain's most policy-critical gap is that EPCs do not reliably encode whether they reflect a renovation, nor do they capture renovation scope and depth in a structured way. Spain should introduce standardised "renovation traceability fields" and link EPC issuance to renovation permits and (where relevant) aid programmes via consistent identifiers. Without this, Spain cannot credibly measure renovation rates, evaluate impact, or underpin MEPS legitimacy beyond counting certificates.

Interconnect regional registries through a national query layer, not disruptive replacement

Given long-standing autonomous community registries and inspection responsibilities, the feasible pathway is interconnection: harmonised metadata rules, standard exchange formats, APIs, and governance clarity on who updates what. The goal is national-level usability and comparability (for MEPS targeting and EU reporting) while preserving regional operational control and avoiding destabilising institutional change.

Adopt proportionate measurement and verification requirements and enforce interoperability in digital procurements

Spain should implement tiered M&V processes that match building context: high-resolution verification where infrastructures exist, and robust low-burden approaches for multi-family renovations, paired with enforceable interoperability specifications, commissioning

requirements, and supplier obligations on data export and continuity, so digital tools actually support verification rather than create friction.


CAVALVERD

Policy strategies

Cross-country

Across the FORTESIE pilots, a consistent pattern emerges: the success of decarbonisation in the buildings sector is now determined less by the availability of technologies or headline policy ambition, and more by whether national systems can deliver, verify, and scale integrated renovations under real-world constraints. The cross-country implication is therefore a shift in policy logic- from “programme design” to “delivery governance”: creating predictable administrative pathways, stabilising market coordination, and building a data backbone that makes MEPS, renovation trajectories, and performance verification feasible, fair, and politically durable.

Implementation readiness is now the binding constraint, not ambition

Delays and ambiguities in transposition and secondary rules (definitions, procedures, eligibility conditions, data obligations) translate directly into stalled projects and redesign cycles. National frameworks must therefore prioritise operational clarity: “what counts as compliance”, “who does what”, “in which sequence”, “with which evidence”- especially for MEPS trajectories, BRPs, and the database requirements that underpin monitoring and reporting.

Permitting and grid-connection must be treated as core renovation infrastructure

Across pilots, renewables integration and electrification are often constrained by permitting throughput and grid-connection processes rather than technical feasibility. If PV, heat pumps, and smart controls are expected to function as mainstream decarbonisation levers, national systems must make authorisations predictable and time-bounded, allow parallel processing with technical design, and clarify responsibilities across agencies to avoid “installed but not operational” outcomes.

Policy must pivot from “installed measures” to “verified outcomes”

The pilots repeatedly show that projects can be technically sound and financially supported yet still underperform because commissioning, tuning, and operational handovers are weak or missing. A cross-country implication is that commissioning and proportionate post-renovation verification should become standard completion conditions for publicly supported renovations- especially in complex

buildings- so that measured energy, comfort, and IEQ outcomes are achieved and sustained.

A new certificate scheme based on the “Price-Comfort” indicator developed in the context of FORTESIE could favour the shift toward “verified outcomes”.

Financing works best when it rewards integrated packages and evidence creation

Renovation uptake and quality improve when public support is structured around coherent packages (envelope + systems + renewables + M&V), rather than fragmented measures that optimise for administrative simplicity. National funding rules should explicitly recognise digital M&V, commissioning, and optimisation as eligible costs, and enable performance-based schemes (including EPC-style/ESCO contracts) that are accessible to SMEs and local actors- not only large providers.

One-Stop Shops and intermediaries are delivery capacity, not “soft support”

Value-chain fragmentation is a structural barrier: households, small institutions, and many public owners struggle with procurement, documentation, sequencing, and monitoring onboarding. Cross-country, OSS-based models are most valuable when mandated and resourced as operational intermediaries, able to carry paperwork, coordinate contractors, support consent and onboarding for monitoring, and keep projects moving through permitting and subsidy interactions.

Procurement resilience and market volatility require programme rules, not improvisation

Supply-chain failures, price volatility, and single-supplier dependence can derail delivery and force damaging scope cuts. National schemes should embed resilience in procurement: multi-supplier strategies, substitution-friendly performance specifications, explicit contingencies, and decision pathways that allow essential adaptations without resetting approvals. This protects outcomes and reduces the risk of stranded, partially completed renovations.

Governance-grade data is a prerequisite for fair Minimum Energy Performance Standards and credible trajectories

A central cross-country implication is that “data exists somewhere” is not enough. MEPS targeting, renovation rate estimation, and policy credibility depend on interoperable registries with harmonised identifiers and renovation traceability (what was done, when, how deep), linked across EPCs, permits, inspections, BRPs, and, where feasible, monitoring outputs. This is not reporting bureaucracy; it is the enabling infrastructure for enforceable and socially legitimate renovation governance.

Monitoring-based governance depends on trust, privacy-by-design, and visible benefits

Where monitoring participation is voluntary, uptake is shaped by perceived intrusiveness, effort, and unclear values, especially in elderly communities and vulnerable contexts. National approaches should therefore standardise privacy-transparent consent pathways, low-burden deployment designs, and clear citizen value propositions

(comfort feedback, fault alerts, proof of improvement), so that performance verification becomes feasible without eroding trust.

A new certificate scheme based on the “Price-Comfort” indicator developed in the context of FORTESIE could make benefits visible for all parties involved, including both beneficiaries and funding authorities.

Differentiated pathways are essential for equity and feasibility

The pilots show that vulnerable households, rural/ low-density territories, and small institutions face higher non-technical barriers and sometimes require habitability-first sequencing before energy upgrades. Cross-country, MEPS, and renovation trajectories will remain politically sustainable only if paired with staged compliance routes, analogue-compatible administration, delegated-management options, and targeted technical assistance that prevents renovation-driven exclusion.

Workforce strategy is renovation strategy

Skills shortages and limited familiarity with integrated solutions and digital tools increasingly determine what can be delivered in practice. National frameworks must align vocational training, reskilling, and professional standards with the needs of integrated renovation markets: building physics, system integration, commissioning, controls, data-handling, and performance-based operation- backed by incentives that support specialised renovation enterprises and municipal technical capacity.

Policy strategies

Regional and local authorities

Regional and local authorities- municipalities, regional energy agencies, public building owners, etc.- are the frontline actors that determine whether national renovation trajectories become real buildings with verified outcomes. Across the FORTESIE pilots, the recurring message is that local success depends on programme-like delivery capacity: the ability to translate targets into a steady pipeline of projects, reduce administrative friction, coordinate multiple suppliers and trades, and sustain citizen trust when monitoring, access, or temporary disruption is required. In this sense, ZEB-aligned renovations are not a single-asset engineering exercise; it is a local public-service endeavour that bundles technical, financial, and social instruments into repeatable workflows.

First,

local strategies should be organised around phased ZEB pathways that reflect territorial realities- climate conditions, dominant building typologies, constraints of local supply chains. Rather than treating each renovation as a bespoke undertaking, authorities can use “portfolio logic”: grouping neighbourhoods or public-building stocks into clusters, applying modular renovation packages (envelope plus HVAC systems plus BIPV systems plus commissioning plus proportionate M&V), and setting clear sequencing rules (what comes first, what must be coordinated, when renewables are integrated, etc.). This portfolio approach improves predictability, lowers transaction costs, and makes prioritisation defensible, especially when combined with transparent criteria to identify the worst-performing assets and those with the highest social vulnerability.

Second,

the pilots confirm that public-sector leadership is a market-shaping lever when it is anchored in procurement practice. Local authorities can accelerate quality and uptake by moving tenders from “equipment lists” to performance-based specifications (comfort/ IEQ targets where relevant, control stability, measured savings, commissioning deliverables). Public buildings are particularly suited to piloting energy-service/ performance-guarantee models, including ESIE-style approaches, because they can bundle buildings, standardise M&V protocols, and create procurement volumes that attract capable suppliers while spreading risk. The crucial point is operational: commissioning, handover, and verification need to be treated as contract deliverables, not optional extras, otherwise installed solutions drift and benefits erode.

Third,

delivery in public facilities must explicitly manage operational continuity. Schools, pools, administrative hubs, and cultural buildings have calendar-driven constraints that often dominate project feasibility. Local planning and procurement should therefore require phased execution plans, service-continuity arrangements, and contingency pathways as standard elements of funded projects. Aligning renovations to low-impact windows (school holidays, low season) and requiring contractors to demonstrate how closures are minimised and recovery is assured, protects public trust and avoids rushed commissioning driven by reopening pressure.

Fourth,

citizen-facing services are not “soft measures”; they are core delivery infrastructure. The pilots show that administrative burden, limited digital literacy, and low trust in monitoring can derail otherwise fundable renovations. Local authorities therefore benefit from strengthening One-Stop Shops as hands-on renovation hubs, not only advisory points- supporting applications, guiding procurement, coordinating installers, and onboarding monitoring where required. For vulnerable households and low-capacity owners, delegated-management options (with clear consent safeguards) can be decisive: someone must be able to carry paperwork, schedule works, and keep the process moving when the beneficiary cannot. In parallel, monitoring uptake improves when local programmes make benefits visible (comfort feedback, fault alerts, proof of improvement) and treat privacy and consent as default design requirements.

Fifth,

local implementation increasingly depends on data-enabled targeting and feedback loops that remain lightweight and workable. Municipal and regional actors do not need “maximum data everywhere”; they need governance-grade minimums that allow prioritisation and learning: linking local asset inventories with EPC information and renovation activity logs, using simple dashboards to track pipeline status, and embedding basic M&V requirements in publicly funded projects so that performance evidence can refine future programme design. Where digital connectivity is weak, local monitoring frameworks should remain tiered and pragmatic, combining low-maintenance options (e.g., gateways/ cellular where feasible) with periodic measurements where continuous monitoring is unrealistic.

Finally,

local delivery is constrained by logistics and supply-chain capacity, particularly in low-density, remote, or island contexts. The pilots point towards a practical response: aggregated procurement for neighbourhood clusters or municipal portfolios, local procurement associations that stabilise lead times, and explicit treatment of logistics costs and delivery risk in programme design. Where geography structurally raises costs, targeted co-financing for logistics and buffering against delays can prevent “stop-start” renovations and improve the feasibility of deep, integrated packages.

Policy strategies

Civil society and citizen/consumer organisations

Across the FORTESIE pilots, one of the most consistent “non-technical” findings is that renovation outcomes depend heavily on trust, comprehension, and perceived fairness. Even when funding exists and technical solutions are available, uptake can stall if households do not understand what is being offered, fear disruption, distrust monitoring, or perceive that obligations (e.g., future MEPS trajectories) will fall unevenly on those least able to act. This places civil society, citizen and consumer organisations/ associations, community groups, and local NGOs in a strategically important role: they are often the actors best positioned to translate policy into lived experience; and to translate lived experience back into policy design improvements.

First,

civil society and citizen/ consumer organisations are essential to making “integrated renovations” socially legible. The FORTESIE pilots showed that citizens respond more strongly to outcomes (comfort, health, reliability, lower bills, resilience) than to technical descriptions of measures. Civil society actors can therefore strengthen participation by communicating renovations as practical life improvements- explaining, in plain language, what to expect during renovations, what changes afterwards, and how benefits will be evidenced. This is especially important when renovation programmes increasingly bundle efficiency, renewables, and smart controls: without accessible narratives, integrated packages can appear complex, risky, or intrusive, even when they are objectively beneficial.

Second,

the recast EPBD’s direction of travel makes consumer literacy on digital EPCs and BRPs a governance issue, not an educational luxury. If EPCs, passports, and building logbooks become central to eligibility, targeting, and compliance, then households need to understand what these instruments mean, how to interpret them, and how to use them in decision-making. Civil society and citizen/ consumer organisations can fill a crucial gap here by providing workshops, simple guidance materials, and “translation” services, turning technical ratings and staged recommendations into understandable choices. They can also advocate for citizen-friendly design: short summaries, clear comparators, and transparent explanations of uncertainty and assumptions, so that trust in certification systems is reinforced rather than eroded.

Third,

civil society and citizen/ consumer organisations are a practical safeguard for fairness and inclusion as policy frameworks shift towards trajectories and minimum standards. The pilots repeatedly underline that vulnerability is often driven by non-technical barriers-administrative burden, low capacity to coordinate contractors, low digital literacy, or degraded housing conditions that require basic remediation before energy upgrades. Civil society organisations can contribute by monitoring equity impacts, flagging exclusion risks early, and pushing for pragmatic safeguards, e.g., delegated management options, phased compliance pathways, targeted grants, and simple access routes. In other words, they can help ensure that the renovation transition remains politically durable by keeping fairness visible and operational, not merely declared.

Fourth,

FORTESIE's experience makes clear that monitoring and data collection succeed or fail on social acceptance. In several contexts, participation in sensing and monitoring was limited not by technology but by privacy concerns, unfamiliarity, and low perceived benefits, especially among older residents and in settings where trust must be built patiently. Civil society groups and citizen/ consumer organisations can materially improve monitoring uptake by acting as trusted intermediaries: helping explain consent, clarifying what is (and is not) collected, and demonstrating tangible value to residents (comfort feedback, proof-of-improvement, early fault detection). Where monitoring is a policy-relevant component for verification or learning, these organisations can make the difference between "data assumed" and "data actually obtained".

Finally,

civil society actors are well placed to drive digital inclusion and practical support during implementation. For digitally excluded households (often elderly or low literacy) barriers arise from simple tasks: accessing portals, uploading documents, understanding bills, or interacting with devices. Civil society and citizen/ consumer organisations can complement OSS-based structures and services by providing community helpdesks, phone support, and in-person assistance during critical phases, reducing drop-outs and ensuring that the people who most need renovation benefits are not systematically the least able to access them.

Policy strategies

Industry and market actors

Across the FORTESIE pilots, the clearest message for industry is that Europe's renovation market is shifting from "selling measures" to delivering verified outcomes. As MEPS trajectories, renovation passports, digital EPCs, and national performance databases become operational under the recast EPBD, clients and public procurers will increasingly demand predictable delivery, measurable performance, and interoperable data- not just installed equipment. For ESCOs, renovation firms, installers, prefabrication manufacturers, sensor providers and platform developers, competitive advantage will come from reducing risk across the full chain: procurement → installation → commissioning → operation → verification.

First,

digital M&V must become a product layer, not a pilot add-on. The pilots repeatedly showed that monitoring fails when onboarding is complex, connectivity is assumed, data export is brittle, or troubleshooting requires repeated site visits. Market actors should therefore package M&V as a reliable service: plug-and-play installations, remote diagnostics, clear escalation routes, and stable data interfaces (APIs) aligned with national requirements. “Interoperability-by-design” is now a procurement requirement in practice: devices and platforms that cannot export usable data, or that lock clients into proprietary formats, will increasingly be filtered out, especially in public buildings and performance-based tenders.

Second,

the pilots underline that scaling deep renovation requires industrialised delivery capacity, particularly through prefabrication and off-site methods where they reduce disruption and improve quality control. Multi-dwelling buildings and small institutions are highly sensitive to disruption and delays; shortening time on site can be the difference between feasible and rejected projects. Industry should therefore invest in validated modular façade/ roof systems, standardised interfaces for building services, and repeatable assembly processes. Crucially, industrialised delivery must be paired with “commissioning-ready” design, so that speed does not come at the cost of performance drift after handover.

Third,

the emerging market logic favours performance-based contracting with clear baselines and verification rules. The pilots showed that projects can be technically sound and still underperform if commissioning, tuning and operator handover are weak or treated as optional. ESCOs and implementers should expand contract models that bundle renovations with time-bounded performance guarantees, proportionate M&V protocols, and explicit stabilisation periods. This is not only a financing lever; it is a governance lever that aligns responsibility with outcomes and makes deep renovations more bankable for both public and private clients.

Fourth,

industry needs to treat consumer engagement and behavioural support as part of performance delivery, not a communications afterthought. Monitoring uptake is shaped by trust, perceived intrusiveness, and visible benefits, especially in multi-family settings and in older communities. Providers should embed simple occupant interfaces (plain-language dashboards, comfort/ IEQ feedback, actionable tips), privacy-transparent onboarding, and light-touch post-renovation support where it materially improves outcomes. When citizens understand what is collected, why it matters, and what they get back, participation becomes feasible without coercion.

Finally,

the pilots exposed how often delivery fails due to procurement friction, supply-chain fragility, and single-supplier dependence. Market actors should build resilience into their business models: multi-supplier sourcing for critical components, substitution-friendly specifications, local spare-parts availability, and logistics planning that can support aggregated renovation clusters. In parallel, industry participation in national and EU standardisation efforts is no longer optional: shared data schemas, test protocols, and performance-based contract clauses reduce tender uncertainty, lower transaction costs, and accelerate market uptake, especially for SMEs that cannot afford bespoke compliance work for each procurement.

Policy strategies

EU level

The FORTESIE pilots reinforce a clear EU-level message: Europe does not primarily need more renovation instruments; it needs renovation systems that are interoperable, financeable, and verifiable across Member States, so that national NBRPs can translate EPBD ambition into comparable, trustworthy outcomes. The EU's unique leverage is to (i). set common "rules of the game" where fragmentation currently blocks scale (data, verification, contract standards), (ii). de-risk delivery through targeted financial instruments that reward integrated, performance-assured renovations, and (iii). accelerate market readiness (skills, supply chains, and industrialised solutions) without locking Member States into one-size-fits-all pathways.

First,

The FORTESIE pilots repeatedly showed that the hardest problems arise in the "secondary layer" of implementation: definitions, procedures, evidence requirements, and database interoperability. EU institutions can materially strengthen implementation by issuing high-clarity guidance packages that help Member States translate obligations into workable delivery rules, especially for MEPS trajectories, renovation passports, and Article 22 database requirements. The value is not generic guidance, but toolkit-level operational detail: minimum fields for renovation traceability, examples of proportional verification approaches for different building types, and templates that show how to link EPCs, permits, inspections, and, where feasible, monitoring outputs without imposing excessive burden.

Second,

the EU has a critical role in turning M&V from an "optional pilot feature" into a standardised, proportionate governance layer. A recurring cross-country bottleneck is not the absence of sensors but the absence of reliable evidence routines, commissioning, stabilisation, data export, and usable reporting. EU-level action can accelerate this through a common "minimum interoperability profile" for building M&V: baseline definitions, required metadata, data-format expectations, and privacy-by-design consent patterns that allow aggregation and benchmarking. Done well, this reduces vendor lock-in, improves procurement certainty, and makes performance-based financing more credible.

Third,

EU finance should explicitly reward integrated packages and evidence creation, not fragmented single measures. The FORTESIE pilots showed that deep renovation performance depends on commissioning, optimisation, and verification- elements that are often underfunded because programmes focus on capex-visible measures. The EU can address this by ensuring that digital M&V, commissioning, and post-renovation stabilisation are consistently treated as eligible and encouraged cost categories in EU-backed programmes and blended finance facilities. In parallel, de-risking instruments (e.g., guarantees, aggregation support) can be shaped to support outcome-linked contracts and ESIE-style delivery models that reduce the burden on households and small institutions and make projects bankable at scale.

Fourth,

the EU can substantially lower transaction costs by strengthening standardisation and digitalisation as market infrastructure. Interoperability and data usability should not depend on ad-hoc integration work in each project. Coordinated action with standardisation bodies can accelerate shared specifications for: device data formats and APIs, renovation-traceability fields, commissioning documentation, and performance-based contract clauses. In parallel, the emerging “Energy Data Space” agenda is an opportunity to ensure that building-performance data becomes usable for governance- secure, privacy-respecting, and query-able across systems- rather than merely “available somewhere” in PDFs, static tables, or incompatible registries.

Fifth,

EU-level policy should embed equity safeguards as implementation requirements, not only as aspirations. The pilots show that exclusion risks are created by administrative complexity, low capacity to coordinate renovations, and weak digital access, often more than by technology costs alone. EU guidance and funding conditions can mainstream practical safeguards: delegated-management options via trusted intermediaries, analogue-compatible routes for applications and documentation, staged compliance pathways for vulnerable households, and explicit protection against renovation-driven inequalities as MEPS trajectories tighten.

Finally,

the EU can accelerate scale by treating market readiness- skills, supply chains, and industrialised renovation capacity- as part of the policy system. Cross-border initiatives that build installer competence in integrated renovation, commissioning, controls, and data-handling; support prefabrication and off-site solutions; and improve resilience for critical components reduce the risk that national targets become infeasible in practice. This is especially relevant for public buildings, where predictable delivery and verified outcomes are central to credibility and replication.

Conclusion

The activities undertaken over the past three and a half years in FORTESIE, alongside project findings confirm that Europe's building decarbonisation challenge has entered a new phase. The limiting factor is no longer a lack of available technologies or policy ambition; it is the ability to deliver integrated renovations with verified outcomes under real-world constraints. Across the FORTESIE pilots, the most consistent determinants of success were delivery governance (permitting and administrative throughput, procurement design, commissioning discipline, capacity of intermediaries) and the availability of governance-grade data that can underpin renovation trajectories, MEPS implementation, and credible reporting. The project therefore points to a strategic shift in how renovation policy and markets must operate: from component-driven upgrades and "paper compliance" towards performance-assured delivery, proportionate M&V, and user-centred implementation models that remain workable for vulnerable households, multi-family buildings, and complex public facilities.

This shift is directly aligned with the direction of the EU's "Renovation Wave" and the "Fit-for-55" package, which together raise both the pace and the accountability expectations of the renovation transition. The recast EPBD strengthens the pathway to ZEBs by 2050 and increases the operational relevance of building performance databases, BRPs, and national renovation trajectories. In parallel, the EED's EE1st principle and tightening savings requirements reinforce the need to prioritise demand reduction and verified efficiency gains, while RED accelerates the integration of renewables and electrification in buildings. FORTESIE's core contribution is therefore not only the demonstration of technical solutions, but the validation of a delivery logic that can help Member States and market actors turn these EU frameworks into scalable, socially legitimate renovation pipelines.

Looking forward, the most disruptive potential identified by FORTESIE lies in the combination of digitalisation and performance-based approaches. Digital M&V- when embedded early and implemented with interoperability and privacy-by-design- can transform renovation from an activity measured mainly through inputs (installed measures, subsidy uptake, certificates issued) into an outcome-driven system where energy, comfort, and indoor environmental quality improvements are evidenced in operation. This could enable new types of performance guarantees and ESIE-oriented contracting models that reduce risk for building owners and public authorities, improve accountability for suppliers, and increase the investment potential of deep renovations. In this context, innovations such as the FORTESIE

"Green Euro", the FORTESIE app, and the FORTESIE "Marketplace" are not simply project "tools"; they signal a broader market trajectory towards data-enabled value creation: rewarding verified performance, supporting user engagement, and lowering transaction costs by connecting actors across the renovation value chain. A new certificate scheme based on the "Price-Comfort" indicator developed in the context of FORTESIE could embed these digitalisation, performance-based rewarding, and behaviour-based rewarding approaches.

In sum, FORTESIE contributes to Europe's building transformation pathway in three (3) complementary ways. First, it strengthens the evidence base for moving from ambition to delivery: identifying the operational bottlenecks that most often prevent deep renovations from being completed and verified. Second, it demonstrates how digital M&V and performance-based models can act as enabling infrastructure for MEPS, BRPs, and credible national renovation plans, while remaining feasible in diverse contexts through tiered, proportionate verification approaches. Third, it reinforces the social and behavioural dimensions of renovation-based transitions: showing that trust, accessibility, and citizen-facing support are not peripheral issues, but core determinants of uptake, monitoring feasibility, and long-term performance persistence.

The future outlook is therefore clear. If the next renovation decade is to succeed, Europe will need to industrialise not only technologies, but also delivery systems: interoperable data backbones, standardised commissioning and verification routines, procurement practices that buy outcomes, and strong intermediaries that reduce friction for households and public owners. FORTESIE provides a practical foundation for this evolution, helping ensure that the "Renovation Wave" and "Fit-for-55" ambitions translate into verified energy savings, improved comfort and health, reduced emissions, and a socially credible pathway towards a European zero-emission buildings sector by 2050.

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