D2.3

Stakeholder Engagement and Process Roadmap

Public Report

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ABOUT THE PROJECT

The objective of the three-year project KnowHowHP is to upskill installers and professionals with an integral planning process to increase the use of heat pumps (HP) in existing multi-story buildings. HP is increasingly used in single-family homes rather than in existing apartment buildings.

Increased use of HP in this field helps to fulfil the EU's climate and energy goals and the European Green Deal. The training and qualification of planners and installers are crucial to ensure that HP and refurbishment concepts are optimally aligned; otherwise, these refurbishments and the transition to HP are just not realised with the argument that it is not feasible.

The special training and upskilling consist of a knowledge-based software-supported process. That means planners, energy consultants, and installers get upskilled with an integral planning and implementation process for climate-friendly and socially acceptable refurbishments of multi-family houses with HP.

Such planning offers the following advantages: better quality, simpler, faster, more robust planning, better planning documents, more planning reliability (lower risk, error prevention) and better scalability (higher renovation rate). The basis for these planning instruments is the latest research results deducted from various projects and through in-depth investigation. The project consortium consists of three scientific and four knowledge dissemination partners, all with many years of experience in training courses.

In this composition, the existing training offers, and planning processes are first analysed (WP2), and then the new training and digital toolbox are developed (WP3+4). The dissemination partners will then pass this knowledge to the target groups of installers and professionals (WP5). At the same time, strong communication with all stakeholders involved, including the owners of the buildings, will be ensured to disseminate the content beyond the project area and duration.

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EXECUTIVE SUMMARY

This report brings together the stakeholder engagement and process-mapping work carried out in Task 2.3 of KnowHowHP. It builds on the barriers and knowledge gaps described in D2.1 and on the tool and training landscape mapped in D2.2. Its purpose is to turn those findings into a practical roadmap for heat-pump-centred refurbishment of multi-family buildings.

The main message is clear: the bottleneck is not the heat pump as a component. Stakeholders describe successful projects as coordinated processes. Building-envelope decisions, heat distribution, domestic hot water, acoustic and spatial constraints, funding, approvals, owner communication, installation quality, commissioning and early operation all need to be considered together, and early enough to shape real decisions.

The result is a process roadmap for the project. For each phase, the roadmap shows who should be involved, what information is needed, which decision has to be made, where projects commonly break down, and which support material can help in training, guidance and digital knowledge transfer.

The evidence comes from D2.1, D2.2 and three Task 2.3 engagement activities: the Bregenz EUSALP workshop, the St. Pölten (online) workshop and the Bozen stakeholder workshop. The public report uses anonymised findings only. It does not name individual participants and does not reproduce attendance material with personal data.

1. INTRODUCTION

1.1. Why this deliverable is needed

Decarbonising the European building stock is central to the EU climate and energy transition. Heat pumps are one of the key technologies for reducing fossil heat supply. In existing multi-family buildings, however, they cannot simply be treated as a boiler replacement. Projects often have uncertain baseline data, high or unknown flow temperatures, hydraulic systems, domestic-hot-water constraints, limited space, acoustic restrictions, complex owner decisions and funding or approval requirements.

KnowHowHP addresses this challenge by upskilling the professionals who influence refurbishment decisions: planners, energy consultants, installers, training providers and multipliers. The project treats heat-pump integration as an integral refurbishment process, where technical choices, cost efficiency, responsibilities and communication all have to fit together.

Work Package 2 provides the analytical foundation. D2.1 identified obstacles and knowledge gaps through surveys, interviews and workshops. D2.2 mapped the tools and training offers available in the target regions. D2.3 adds the process view: who needs to be involved, when they need to be involved, and which conditions must be in place before the integrated approach is developed in D2.4.

1.2. What D2.3 covers

D2.3 documents what was learned from stakeholder engagement and turns it into a process roadmap for heat-pump integration in multi-family-building refurbishment. The report answers six practical questions: who needs to be involved, when they need to be involved, what information is needed, where current processes break down, what prevents trust, and which support instruments should guide later training and digital-tool development.

D2.3 does not define the final integrated refurbishment approach in full detail. That is the role of D2.4. Instead, this report sets out the stakeholder and process foundation that D2.4 will turn into guidance, training logic, use cases and an interactive web-application concept.

1.3. How this report is organised

The report first explains how the roadmap was developed and which evidence was used. It then summarises the stakeholder engagement activities, maps the relevant stakeholder groups and presents the process roadmap phase by phase. The final chapters draw out the main breakpoints, trust issues and support needs, then translate them into implications for D2.4 and the later work packages.

2. HOW THE ROADMAP WAS DEVELOPED

2.1. From stakeholder input to roadmap

Task 2.3 starts from a simple practical question: what has to happen, and who has to be involved, for a heat-pump refurbishment project in a multi-family building to move forward? The task does not repeat the technical analysis from D2.1 or the tool and training mapping from D2.2. It translates those results into process requirements for the later KnowHowHP work packages.

The work followed three steps. First, the team extracted the barriers, knowledge gaps, tool gaps and training gaps from D2.1 and D2.2. Second, the workshop material was reviewed for roles, process failures, trust barriers and support needs. Third, recurring findings were brought together in a roadmap with phases, decision gates, evidence needs and support instruments.

2.2. What research tells us

The stakeholder evidence was checked against peer-reviewed literature on heat-pump field performance, multi-family-building retrofit, domestic hot water, renovation decision-making, installer competence and integrated renovation services. This literature does not replace the project evidence from D2.1, D2.2 and the Task 2.3 workshops. It strengthens the report where it points in the same direction as the stakeholder findings and helps distinguish general retrofit patterns from single workshop observations.

First, field-study and design-integration research confirms that heat-pump performance in existing buildings depends strongly on the surrounding system: supply temperature, heat emitters, controls, commissioning, monitoring and user operation. Reviews of air-source heat-pump field studies and recent heat-pump design research therefore support the D2.3 choice to treat performance as a process and quality-assurance issue, not only as a product-selection issue (Carroll et al., 2020; Olympios et al., 2024).

Second, work on existing radiator systems and multi-family buildings supports the roadmap's early focus on heat-distribution temperatures, room-level bottlenecks, domestic-hot-water boundaries and monitoring. Lämmle et al. (2022) show why radiator and flow-temperature checks belong early in the process. Studies on multi-family systems and domestic hot water show the same need for robust configuration, reduced storage and distribution losses, and clear commissioning logic (Dermentzis et al., 2021; Kropp et al., 2025).

Third, the social-science literature supports the roadmap's emphasis on trust, understandable variant comparison and intermediary roles. Renovation decisions are shaped by more than cost: credibility of advice, expected comfort, risk perception, social influence, decision timing and the role of planners, installers and energy consultants all matter (Liu et al., 2022; de Jager et al., 2025; Decuypere et al., 2022). This is why D2.3 treats owner communication and process ownership as technical success conditions, not as soft add-ons.

Finally, research on one-stop-shop and integrated renovation-service models confirms that complex renovations need coordination across critical moments of the customer journey. This supports the D2.3 recommendation to make responsibilities, decision gates, funding logic and support instruments visible across the whole refurbishment process (Pardalis et al., 2021; Bagaini et al., 2022; Pardalis et al., 2022).

2.3. How the findings were interpreted

The synthesis follows the process rather than the chronology of individual comments. Findings were grouped by project phase, responsible actor, decision point and type of support needed. This makes the report more useful as a roadmap and avoids turning D2.3 into a simple workshop summary.

The sources differ in depth and format. D2.1 and D2.2 are formal deliverables. The Bregenz and St. Pölten sources include workshop notes and presentations. The Bozen evidence includes facilitation material, a short report, sanitised board photos and a handwritten-board transcription. For this reason, repeated patterns are treated as stronger evidence than isolated remarks.

The strongest findings are those that appear across several sources. D2.1 shows that the barriers are systemic: regulation, technical constraints, knowledge gaps, owner communication, financing and implementation quality interact. D2.2 shows that tools and training offers exist, but are fragmented across phases, roles, software ecosystems and regional standards. The Task 2.3 workshops show where these fragments become process breakpoints in practice.

The stakeholder findings are therefore used as design input. They are not presented as statistical claims about the whole market. They are used to shape the KnowHowHP roadmap, D2.4, the training material and the digital knowledge-transfer logic.

3. STAKEHOLDER ENGAGEMENT

3.1. How stakeholders were involved

Stakeholder engagement in Task 2.3 combined broad discussion formats with focused process-mapping activities. The formats included technical input sessions, discussion rounds, process-board work, trust-barrier mapping and validation of support needs (see also Annex). Together, these formats allowed the project to connect the technical feasibility discussion with the actor, timing and evidence questions that determine whether refurbishment projects actually move forward.

The engagement activities were designed to bring together the technical and organisational sides of refurbishment. Discussions about heat-pump performance, flow temperature, domestic hot water, acoustics, funding or commissioning quickly became questions about timing, responsibility, communication and trust. This pattern is consistent with the scientific literature: heat-pump retrofits are socio-technical projects in which system design, installation quality, user confidence and decision support influence the final outcome. It confirms the need for a process roadmap rather than a purely technical checklist.

3.2. Main engagement events

Three engagement events are particularly relevant for D2.3. They represent different regions, formats and levels of maturity in the process discussion, and together they show a consistent pattern: stakeholders ask for more credible evidence, earlier coordination, clearer roles and support instruments that can be used in practice.

Event	Main focus	D2.3-relevant findings
Bregenz EUSALP workshop, 2025-05-08	Heat pumps in multi-family buildings, field experience and refurbishment examples.	Room-wise heating-load assessment, targeted radiator replacement, flow-temperature reduction, DHW, monitoring and owner decision structures are decisive. A recurring warning is that replacing boiler capacity one-to-one is a poor basis for HP sizing.
St. Pölten workshop, 2025-10-07	Technical reflection on heat pumps in refurbishment and process requirements.	Planning must connect envelope measures, radiator checks, modular/flexible systems, low-temperature operation, simulation, monitoring and business-model reality. Monitoring data should feed back into planning and training.
Bozen stakeholder workshop, 2026-04-29	Structured validation of process breakpoints and trust/support needs.	Participants identified missing preliminary work, absent process ownership, limited space, bureaucracy, short deadlines, funding uncertainty, missing specialists, high workload, financial-literacy gaps and the need for examples, comparison tools and implementation guidance.

3.3. What we heard across the events

Across the engagement activities, stakeholders repeatedly connected technical feasibility with process quality. Questions about flow temperature, domestic hot water, source selection, acoustic constraints and operating costs were rarely isolated technical topics. They were discussed together with owner trust, funding conditions, documentation effort, responsibility handovers and the ability of planners and installers to work from shared assumptions.

The roadmap implication is clear: heat-pump integration should be structured as a sequence of coordinated decisions. If key information is missing early, later optimisation becomes fragile. If installers are involved only after design assumptions are fixed, practical constraints may lead to redesign or poor execution. If owners or HOAs do not receive understandable variant comparisons, technically sound concepts may still be rejected. If commissioning and monitoring are not built into the process, operational lessons do not feed back into future projects or training.

The Bregenz engagement provides the clearest technical-process bridge. The workshop material shows that MFH heat-pump feasibility depends on lowering heat-distribution temperatures, understanding DHW boundaries, checking electrical and spatial constraints, and using monitoring evidence rather than nominal boiler capacity as the starting point. For D2.3 this translates into early feasibility gates and an explicit warning against late replacement sizing.

The St. Pölten material points in the same direction from a planning-practice angle. It highlights the need for better simulation and measurement support, but also the practical constraint that better planning must be usable, explainable and financially viable. If additional planning effort is not linked to clear owner-facing outputs, installer handover and operational learning, it will remain a specialist exercise rather than mainstream practice.

The Bozen workshop adds a South Tyrolean process and trust layer. The board on process breakpoints shows that projects can fail before detailed design if preliminary work, available space, owner readiness, financial understanding, property-manager competence and process responsibility are unclear. The board also links implementation difficulty to bureaucracy, deadlines, funding procedures, missing specialist staff and high workload.

The second Bozen board, structured around funding, information and technology, clarifies what stakeholders mean by trust. Trust requires stable and explainable funding conditions, advisory support, examples of feasibility and costs, positive implementation stories, comparison tables, pilot cases, transparent treatment of domestic hot water and electricity reliance, and tools that make technical options comparable without hiding uncertainty.

4. STAKEHOLDER MAP

4.1. Who needs to be involved

Heat-pump-centred refurbishment of multi-family buildings involves more stakeholders than a conventional heat-generator replacement. The following map summarises the main groups, their role and the risk created if they are involved too late.

Stakeholder group	Main role and information needed	Risk if missing / support needed
Planners / energy consultants	Assess feasibility, develop the envelope-system concept, prepare documentation and compare variants. Need: building baseline, heating demand, envelope status, existing distribution temperatures, funding rules and owner constraints.	Risk: unsuitable concept, late redesign or weak owner communication. Support: workflow guidance, tool links, decision gates and owner-facing variant summaries.
Installers / HVAC contractors	Translate the concept into practical system design, installation, hydraulic implementation, commissioning and handover. Need: design assumptions, hydraulic concept, source and sink constraints, installation space and commissioning requirements.	Risk: oversized systems, poor hydraulic integration, missing handover or operational problems. Support: hydraulic guidance, commissioning checklist and installation-readiness review.
Architects / MEP engineers	Coordinate spatial integration, building measures, routing and technical-room constraints. Need: early system concept, space requirements, acoustic constraints and envelope-measure information.	Risk: impossible layouts, avoidable acoustic conflicts or coordination gaps. Support: coordination checklist and spatial-constraint review.
Owners / HOAs / property managers	Make decisions on financing, governance, occupant communication and acceptance. Need: understandable variants, costs, disruption, comfort impact, funding implications and risk information.	Risk: delays, rejection, mistrust or fragmented decision-making. Support: owner-facing explanation, decision roadmap and comparison of variants.
Authorities / funding bodies	Provide approval, funding and compliance framework. Need: complete technical and administrative documentation.	Risk: funding delays, approval problems, redesign or extra documentation burden. Support: subsidy and approval checklist.
Training providers / multipliers	Transfer knowledge to professional target groups. Need: structured learning content, cases, exercises and process logic.	Risk: fragmented or generic training formats. Support: use-case exercises, teaching material and trainer notes.
Manufacturers / tool providers	Provide technical data, product-specific design tools and component information. Need: project requirements and required data-exchange formats.	Risk: product-specific silo decisions and missing interoperability. Support: standardised input/output templates and transparent assumptions.
Occupants	Support acceptance, operational behaviour and feedback during early operation. Need: clear communication about comfort, disruption, operation and expectations.	Risk: resistance, misuse, complaints and weak operational feedback. Support: handover material and communication support.

4.2. When information is needed

The stakeholder map shows that timing is as important as role definition. Planners need reliable building and owner information before they can prepare meaningful variants. Installers need early access to design assumptions before site decisions become fixed. Property managers and owners need understandable evidence before formal decisions. Authorities and funding bodies need documentation before funding or approval risk becomes a late-stage blocker.

A recurring problem is that required information is often collected only after a preferred solution has already been informally selected. This creates a high risk of late contradiction: a heat-pump option appears promising but later conflicts with flow-temperature requirements, available space, DHW expectations, acoustic limits, subsidy rules or owner decision processes. The roadmap therefore places information checks and decision gates early in the process.

5. ROADMAP FOR HEAT-PUMP INTEGRATION

5.1. How the roadmap works

The process roadmap translates stakeholder engagement into a practical sequence of phases. It is not intended as a rigid project-management template. Rather, it defines the minimum logic that should be visible in each heat-pump-centred refurbishment process: relevant actors, required data, decision gates, typical breakpoints and support instruments.

The roadmap is derived from the recurring pattern that each technical decision has a corresponding process condition. Flow-temperature reduction requires building and heat-distribution data; acoustic feasibility requires early source and placement options; subsidy reliability requires documentation before owner commitment; and commissioning quality requires design assumptions to survive the handover to installation and operation.

Roadmap requirement	Evidence basis	Implication for D2.4 / training
Process ownership and mandate	Bozen process-breakpoint board and D2.1 organisational barriers	Define a visible process-owner role, responsibility map and phase-specific decision gates.
Early baseline and feasibility checks	D2.1 barriers; Bregenz heating-load and flow-temperature discussion; Bozen missing preliminary work	Create a baseline-readiness checklist and use-case entry module before variant selection.
Integrated toolchain instead of isolated calculations	D2.2 tool-fragmentation and interoperability analysis	Show input-output links between building data, heat-load checks, source options, DHW, acoustics, funding and owner communication.
Owner/HOA trust-building	Bozen trust board; Bregenz owner-decision and cost/noise concerns	Use owner-facing variant summaries, examples, pilot cases and transparent uncertainty ranges.
Funding and documentation readiness	D2.1 subsidy complexity; Bozen funding certainty and deadline concerns	Provide subsidy/documentation checklists and make administrative readiness a process gate.
Planning-to-installation handover	D2.1 planner-installer empathy-map findings; St. Pölten planning-practice discussion	Include role-mixed exercises and handover templates that preserve design assumptions.
Commissioning and operational feedback	D2.1 knowledge gaps; Bregenz/St. Pölten monitoring discussion	Define commissioning as a quality gate and monitoring as a feedback loop for training and future projects.

The roadmap visual below condenses the D2.3 result: each refurbishment phase should combine the right actors, minimum evidence, a documented decision gate and a trust-building output. This makes the roadmap transferable into the D2.4 integrated approach, training modules and digital knowledge-transfer workflow.

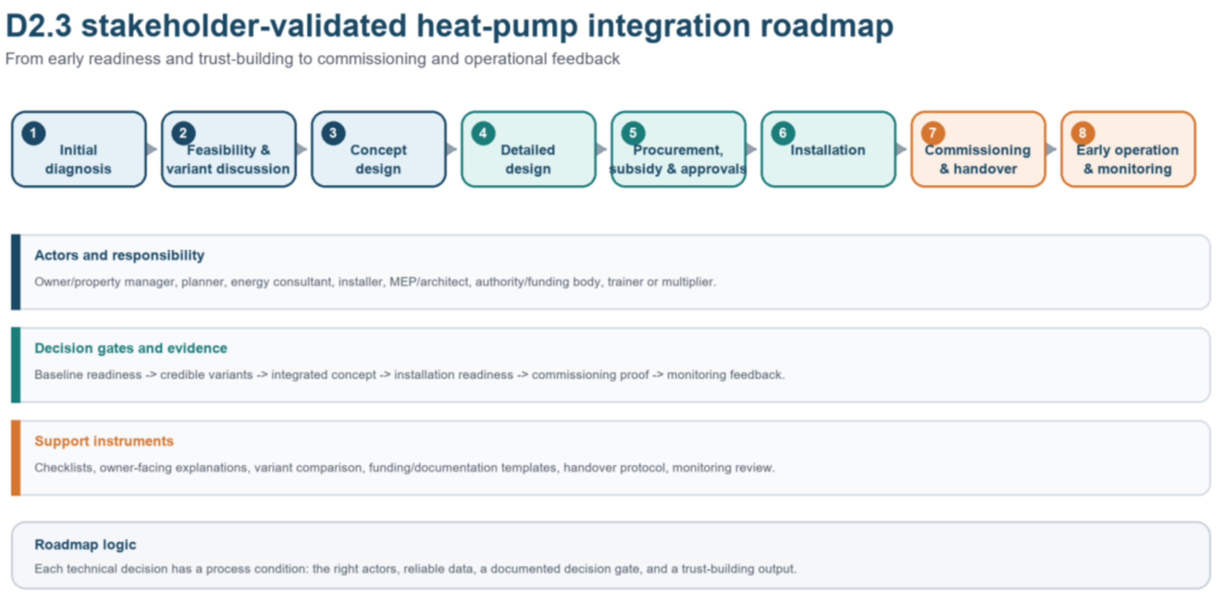

Figure 1. Stakeholder-validated process-roadmap logic for D2.3. The figure links process phases with actors, decision gates and reusable support instruments for D2.4, WP3, WP4 and WP5.

5.2. Roadmap by project phase

Phase	Purpose	Key stakeholders	Required information	Decision gate	Typical breakpoints	Support instruments
1. Initial diagnosis	Understand building baseline and decision context.	Owner/property manager, planner, energy consultant.	Envelope status, existing heating system, energy use, ownership structure, known constraints.	Is the building ready for a structured HP feasibility study?	Missing baseline data, unclear owner mandate, no process owner.	Baseline data checklist; owner briefing; process-owner assignment.
2. Feasibility / variant discussion	Identify technically and organisationally plausible paths.	Planner, energy consultant, early installer input, owner/property manager.	Heat demand, flow temperatures, DHW, source options, space/acoustics, funding context.	Which variants remain credible enough for concept design?	HP considered too late, assumptions undocumented, trust not established.	Feasibility canvas; owner-facing variant sheet; risk/uncertainty log.
3. Concept design	Develop integrated envelope-system concept.	Planner, MEP/architect, installer input, owner/property manager.	Envelope measures, distribution options, source/sink concept, DHW concept, cost direction.	Which integrated concept should be developed in detail?	Envelope, hydraulics, DHW and source decisions handled separately.	Integrated concept checklist; source/space/acoustic screening.
4. Detailed design	Translate concept into coordinated technical design.	Planner, MEP engineer, installer, manufacturer/tool provider where relevant.	Heating-load assumptions, hydraulic concept, controls, acoustic checks, installation constraints.	Is the design ready for procurement and approval?	Late redesign, unclear responsibilities, product-specific silo decisions.	Design-assumption register; installation-readiness review.

Phase	Purpose	Key stakeholders	Required information	Decision gate	Typical breakpoints	Support instruments
5. Procurement, subsidies and approvals	Secure administrative, economic and formal conditions.	Owner/property manager, planner, funding/authority interface, contractors.	Offers, technical documentation, funding conditions, permits, deadlines.	Can the project be committed with acceptable cost/risk transparency?	Short deadlines, changing funding rules, incomplete documentation.	Subsidy/documentation checklist; procurement comparison template.
6. Installation	Implement system according to coordinated assumptions.	Installer, planner/MEP, owner/property manager, occupants.	Design assumptions, site constraints, schedule, handover requirements.	Is the installation aligned with the approved design?	Site improvisation, missing design assumptions, coordination conflicts.	Site handover sheet; assumption-change log.
7. Commissioning / handover	Verify performance-critical settings and hand over responsibilities.	Installer, planner, owner/property manager, occupants.	Commissioning protocol, control settings, hydraulic balancing, user guidance.	Is the system commissioned and understandable for operation?	Commissioning treated as paperwork, weak user handover.	Commissioning checklist; controls/handover guide.
8. Early operation / monitoring	Use first operation as quality and learning feedback.	Owner/property manager, installer, planner, trainer/multiplier where relevant.	Energy use, comfort feedback, faults, operating costs, monitoring data.	What must be optimised or fed back into training?	No monitoring, no feedback loop, lessons not captured.	Monitoring template; optimisation review; training feedback note.

6. WHAT THE ENGAGEMENT SHOWED

6.1. Where the process breaks down

Stakeholder engagement identified several recurring process breakpoints. The Bozen board "Wo bricht der Prozess?" adds a particularly practical view: stakeholders named missing preliminary work, missing space, insufficient financial literacy among owners and the need for property-manager training before a project can even become technically stable. This means the first breakpoint is upstream of engineering calculation.

A second breakpoint is process ownership. The board explicitly points to the problem that nobody is responsible for the overall process. Heat-pump refurbishment in multi-family buildings requires someone to connect owners, property managers, planners, installers, funding requirements and decision gates. Without this connecting function, responsibility falls between actors and owner communication becomes reactive.

A third breakpoint is capacity and procedural pressure. The handwritten notes refer to bureaucracy, deadlines, funding uncertainty, missing specialist staff, high workload, costs and weak or unclear political pressure. These are not side issues: they influence whether a technically feasible solution can survive the path from first idea to formal decision, procurement and implementation.

Further breakpoints occur during procurement, commissioning and operation. Subsidy and approval requirements can change the preferred variant if they are not considered early. Commissioning is often treated as a final technical step rather than a quality gate. Monitoring and early-operation feedback are rarely used systematically, although stakeholders see them as important for trust-building and learning from implemented projects.

Breakpoint cluster	Typical manifestation	Roadmap response
Unclear starting mandate	Owner/property-manager interest exists, but baseline data, decision mandate and responsible coordinator are missing.	Create an initial readiness gate and assign process ownership before technical variants are compared.
Incomplete baseline and space checks	Heat demand, flow temperatures, DHW, electrical capacity, acoustic limits or space constraints are clarified late.	Use a baseline checklist and early feasibility canvas.
Fragmented technical decisions	Envelope, heat source, distribution, DHW and controls are evaluated separately.	Require integrated concept design before detailed design.
Owner/HOA trust gap	Owners do not understand costs, comfort impact, funding conditions or risk boundaries.	Produce owner-facing variant summaries, examples and transparent uncertainty ranges.
Funding and approval uncertainty	Deadlines, forms, preconditions and documentation requirements are unclear.	Make funding/documentation readiness a decision gate.
Planner-installer handover gap	Installation decisions deviate from design assumptions or practical constraints arrive too late.	Use design-assumption registers and installation-readiness reviews.

Breakpoint cluster	Typical manifestation	Roadmap response
Commissioning treated too narrowly	Commissioning becomes final paperwork rather than performance verification.	Define commissioning protocol, control settings, hydraulic balancing and user handover as a quality gate.
No feedback from operation	Monitoring data and user experience do not feed into optimisation or future training.	Add early-operation review and monitoring template as roadmap phase 8.

6.2. What prevents trust

Trust barriers appear at several levels. Owners and property managers need confidence that the proposed solution is feasible, fundable, affordable, comfortable and manageable in operation. Planners and installers need confidence that assumptions are reliable and responsibilities are clear. Training providers and multipliers need examples and workflows that can be taught without pretending that complex projects are simple.

The Bozen workshop confirmed that trust is created through practical evidence, simple explanations, positive examples, clear preconditions, reliable subsidy information and understandable technology boundaries. Funding, information and technology are therefore not separate communication topics; they are the three trust dimensions that must accompany the roadmap.

Information creates trust when stakeholders can see what a solution means in practice. The board points to examples of feasibility, costs and impacts, comparison tables, positive implementation stories and clear explanations of how a heat-pump solution is implemented. This supports the need for owner-facing material and case-based training.

Technology creates trust when it can be compared, observed and bounded. Stakeholders referred to comparison or simulation tools, pilot examples, implementation and operating costs, suitability boundaries, partial implementation options and transparent discussion of domestic hot water and electricity reliance. D2.4 and the web-application concept should therefore prioritise explainability over false precision.

6.3. Support needs for KnowHowHP

The engagement outcomes point to several support requirements for KnowHowHP. The strongest priorities are: an early-readiness checklist, a process-owner and responsibility map, owner-facing variant comparison material, subsidy and documentation guidance, a planning-to-installation handover template, a commissioning checklist and an early-operation/monitoring feedback format.

Need	Why it matters	Potential project response
Early-readiness checklist	Projects can fail before calculation if mandate, baseline data, owner readiness or space constraints are unclear.	Checklist for initial diagnosis and feasibility entry in D2.4 / web app.
Process-owner and responsibility map	Stakeholders report that nobody often owns the overall process (like a typical general contractor).	Role matrix and decision-gate responsibility sheet.

Need	Why it matters	Potential project response
Owner-facing variant comparison	Technically sound variants can be rejected if costs, comfort, disruption, risks and funding are not understandable.	One-page comparison template with transparent assumptions and uncertainty classes.
Funding and documentation guidance	Subsidy complexity and short deadlines create delays and mistrust.	Funding/document checklist and administrative readiness gate.
Integrated technical feasibility canvas	Flow temperature, DHW, source, acoustics, space and distribution interact.	Feasibility canvas linking technical constraints to stakeholder decisions.
Planning-to-installation handover	Design assumptions are lost when installers are involved too late.	Assumption register and installation-readiness review.
Commissioning protocol	Efficiency and comfort depend on settings, balancing, controls and user guidance.	Commissioning checklist and handover guide.
Monitoring and first-operation feedback	Operational learning is needed to build confidence and improve future training.	Monitoring template and optimisation-review note.
Case and pilot examples	Trust is strengthened by practical evidence and positive stories.	Anonymised examples linked to training exercises and digital use cases.
Explainable digital support	Users need understandable indicators, not black-box precision.	Web-app logic with ranges, suitability classes, warnings and linked learning content.

Support instruments should be designed so that they can be reused in the future web application. Each checklist or guidance element should correspond to a process phase, a stakeholder role and a decision gate. This avoids creating generic training material that is detached from project reality.

The central design requirement is explainability. Users should be able to understand why a measure changes feasibility, efficiency, cost direction, comfort risk, acoustic risk, documentation effort or stakeholder acceptance. This is the bridge from D2.3 to D2.4: the roadmap defines where knowledge is needed, while D2.4 should define how the knowledge is delivered.

7. WHAT THIS MEANS FOR LATER WORK

The D2.3 roadmap has direct implications for later project work. For WP3, training material should be structured around process phases and role interactions, not only around technical topics. Planner-installer-owner coordination should become an explicit learning objective. For WP4, the digital toolbox should guide users through required inputs, decision gates and understandable outputs rather than presenting disconnected calculation functions. For WP5, pilots should test role-mixed learning and validate whether the roadmap helps practitioners handle real constraints. For WP6, communication should translate trust-building needs into owner-facing and multiplier-facing material.

For T2.4 specifically, T2.3 provides the stakeholder and process foundation. T2.4 should transform this foundation into an integrated refurbishment approach and into the conceptual structure for guidance, training and interactive web-based knowledge transfer. It should not repeat the stakeholder analysis; it should operationalise the roadmap into methods, checklists, use cases, measure logic and transparent impact indicators.

The roadmap also suggests a clear division of labour between the future written approach and the digital implementation. T2.4 should define the integrated method, use-case logic, measure categories and quality-assurance loops. The web application can then express this method as an interactive learning workflow where users inspect a baseline, select measures, compare variants, see warnings and understand which actors and evidence are required at each phase.

Evidence behind the conclusions

The conclusions below are based on triangulation rather than on one evidence stream. A conclusion is treated as strong when it appears in the formal project evidence, is repeated across at least one engagement activity, and is consistent with the scientific or regional skills literature. This makes the argument more transparent: the roadmap is not only a workshop interpretation, and it is not only a literature review. It is a process synthesis where project findings and external research point to the same implementation requirements.

The remaining limitation is also explicit. D2.3 is a design and roadmap deliverable, not a market-wide statistical study. Its conclusions should therefore guide D2.4, WP3 training and the web-application concept, while final regional examples, public images and partner-specific wording should still be validated in review.

Conclusion supported	Project evidence	Scientific / regional support	How this limits or strengthens the conclusion
Heat-pump refurbishment in MFH must be treated as an integrated process, not as a heat-generator swap.	D2.1 barrier clusters; D2.2 tool/training fragmentation; Bregenz, St. Pölten and Bozen all connect technical topics with timing, roles and trust.	Field-study and integration reviews link performance to system design, controls, commissioning and user operation (Carroll et al., 2020; Olympios et al., 2024).	Strong support. The conclusion is not based on one workshop remark; it appears across project evidence and external heat-pump literature.
Early feasibility gates are needed before variants are selected.	Bregenz stresses heating-load, radiator and DHW checks; Bozen notes missing preliminary work, space and process ownership; D2.1 identifies technical and organisational barriers.	Radiator-temperature and DHW studies support early checks for emitters, flow temperatures, storage/distribution losses and monitoring logic (Lämmle et al., 2022; Kropp et al., 2025; Dermentzis et al., 2021).	Strong technical support. D2.3 should frame these as decision gates, while D2.4 can define the detailed calculation and tool workflow.
Process ownership and role timing are performance-relevant.	Stakeholder map and Bozen process-breakpoint board show late involvement, unclear ownership and weak handovers as recurring problems.	Installer competence and intermediary studies show that advice quality, professional skills and intermediary roles influence heat-pump adoption and implementation (Gleeson, 2016; Decuypere et al., 2022).	Strong process support. The roadmap can justifiably assign roles and handover points, but partner review should confirm regional role names and responsibilities.
Trust-building material is part of technical implementation quality.	Bozen trust board identifies funding, information and technology as practical trust dimensions; D2.1 shows owner communication and financing as barrier clusters.	Renovation and heat-pump adoption literature links decisions to credibility of advice, risk perception, social influence, comfort expectations and user behaviour (Liu et al., 2022; de Jager et al., 2025).	Strong socio-technical support. The conclusion should be expressed as evidence-based decision support, not as marketing or persuasion.
Training and the web application should follow the process roadmap.	D2.2 shows fragmented tools and offers; D2.3 maps phases, support needs and decision gates; ReBUSk sources stress skills gaps and targeted continuing education for climate-neutral buildings.	One-stop-shop and integrated renovation-service research supports coordinated customer journeys and organisational conditions for complex renovation support (Bagaini et al., 2022; Pardalis et al., 2021; Pardalis et al., 2022).	Strong handover support. The conclusion is appropriate for D2.4/WP3/WP5; final tool content still needs implementation validation in later work packages.

8. CONCLUSIONS AND NEXT STEPS

Task 2.3 supports one central conclusion: successful heat-pump-centred refurbishment of multi-family buildings requires an integrated process. The strongest evidence is the convergence between D2.1, D2.2, the three Task 2.3 engagement activities and the scientific literature. The technical issues named by stakeholders - flow temperature, domestic hot water, acoustics, space, funding, commissioning and monitoring - become manageable only when they are connected to clear responsibilities, early evidence and understandable owner communication.

A second conclusion is that the roadmap should be used as a sequence of decision gates. Before a project moves from interest to concept design, the process should make visible whether the building baseline, owner mandate, heat-distribution constraints, DHW boundary conditions, acoustic and space constraints, subsidy context and documentation needs are sufficiently understood. This is where D2.3 most directly supports D2.4: the later integrated approach should turn these gates into practical checklists, variant logic and web-application workflows.

A third conclusion is that trust is not a separate communication layer at the end of the project. In the evidence reviewed for this deliverable, trust is produced through clear funding information, credible examples, transparent comparison of variants, visible limits of suitability, competent professional roles, commissioning and monitoring. This supports a D2.4 and WP3 design in which owner-facing explanations, professional checklists and quality-assurance loops are built into the method from the beginning.

The roadmap is therefore valuable because it connects technical feasibility with actor coordination and learning. For WP3, training can be organised around real decision moments rather than isolated topics. For D2.4, the roadmap becomes the backbone of the integrated refurbishment approach. For WP5, it provides a navigation logic for a web application where users can start from a building baseline, compare measures, see warnings and understand which actors and evidence are required at each phase.

The remaining work before final submission is bounded. Partner reviewers should confirm the regional framing, the role terminology and the public-use status of the annex images. They should also check whether one or two additional regional examples should be added before the final v1.0 version. The core conclusion, however, is now supported by project evidence, stakeholder validation and scientific literature: KnowHowHP should treat heat-pump integration as a coordinated refurbishment process with explicit decision gates, evidence requirements and trust-building outputs.

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Project sources

KnowHowHP Grant Agreement / project description source for WP2, Task 2.3 and Deliverable D2.3 scope.

KnowHowHP Deliverable D2.1: Report on Obstacles, Knowledge Gaps, and Glossary, current working version v4.

KnowHowHP Deliverable D2.2: Report on Tools and Training Offers, current working version v1.

KnowHowHP Task 2.1 survey source: Survey on Heat Pump Challenges and Knowledge Gaps, 2025.

Task 2.3 Bregenz EUSALP workshop evidence package, 2025-05-08: protocol, anonymised synthesis notes and internal photo documentation.

Task 2.3 Bregenz technical presentation evidence, 2025-05-08: heat pumps in multi-family buildings, field experience, monitoring and technical/process challenges.

Task 2.3 St. Pölten workshop evidence package, 2025-10-07: workshop concept, minutes and attendance evidence used only in anonymised form.

Task 2.3 Bozen stakeholder workshop evidence package, 2026-04-29/30: facilitation pack, short report, sanitised board photos and handwritten-board transcription.

Internal D2.3/D2.4 boundary and draft notes, 2026-04-30, used to keep D2.3 focused on stakeholder engagement and process roadmap while reserving the integrated approach for D2.4.

10. ANNEXES

Annex A: Stakeholder roles

This annex expands the role map from Section 4 into an anonymised working matrix. It is intended as a structured input for D2.4, training design and the future knowledge-transfer application.

Stakeholder role	Contribution	Critical input	Decision support needed	Main risk if missing
Building owner / HOA / property manager	Mandate, decision process, financing, occupant communication and operational acceptance.	Ownership structure, decision timeline, budget frame, comfort expectations, constraints.	Owner-facing variant comparison, funding explanation, disruption and risk summary.	Technically feasible solutions are rejected or delayed because the decision path is unclear.
Planner / energy consultant	Feasibility, baseline assessment, variant logic, envelope-system concept and documentation.	Existing energy use, envelope state, heat distribution, DHW demand, space and acoustic constraints.	Baseline checklist, process gates, input-output links between tools and role-specific guidance.	Assumptions remain implicit and late contradictions force redesign.
Installer / HVAC contractor	Practical system configuration, installation, hydraulic integration, commissioning and handover.	Design assumptions, hydraulic concept, source/sink constraints, installation-readiness status.	Design-handover template, installation-readiness review and commissioning checklist.	Unresolved planning issues move to the construction site and reduce quality.
Architect / MEP coordinator	Spatial integration, routing, technical-room coordination, acoustic and envelope coordination.	System dimensions, source placement, acoustic constraints, building measures and site limitations.	Spatial constraint review and coordination checklist linked to concept design.	Avoidable conflicts appear after procurement or during installation.
Funding / approval actors	Compliance framework, subsidy eligibility, documentation requirements and timing.	Technical concept, required documents, deadlines, funding conditions and approval rules.	Funding and deadline navigator with early feasibility and procurement gates.	Administrative procedures undermine trust or force late changes.
Training provider / multiplier	Transfer into professional learning formats, use cases, exercises and outreach.	Roadmap, role interactions, examples, measure logic and impact indicators.	Teaching notes, use-case exercises and reusable example library.	Training remains generic and does not change real project routines.

Annex B: Process roadmap matrix

This matrix condenses the process-roadmap logic into decision gates. It can be transferred into D2.4 as the backbone for the integrated refurbishment approach and as a navigation structure for the web application.

Phase	Decision gate	Minimum evidence	Trust-building output	D2.4 / web-app translation
Initial diagnosis	Is the building ready for a structured heat-pump feasibility check?	Envelope status, existing heating system, ownership context, space constraints and available data.	Baseline-readiness summary and list of missing inputs.	Use-case baseline module and early-readiness checklist.
Feasibility / variant discussion	Which variants are credible enough for concept design?	Heat demand, flow temperatures, DHW demand, source options, acoustic and funding context.	Transparent variant comparison for owners and professional actors.	Interactive measure selection with impact directions and boundary notes.
Concept design	Which integrated envelope-system path should be developed?	Envelope measures, heat-distribution options, source/sink concept and cost direction.	Concept rationale that connects technical, financial and owner-facing arguments.	Measure catalogue grouped by building use case and process phase.
Detailed design	Is the concept ready for procurement and approval?	Heating load, distribution design, HP sizing, acoustics, controls and documentation needs.	Design-assumption sheet and handover-ready input package.	Expert-check flags and input/output logic for tools.
Procurement / funding / approval	Can the project proceed without major redesign risk?	Tender basis, subsidy documents, approval requirements, deadlines and responsibilities.	Funding and documentation readiness summary.	Funding and deadline navigator linked to feasibility and procurement phases.
Installation / commissioning / early operation	Has the system been implemented and handed over according to the intended concept?	Installation checks, commissioning protocol, control settings, hydraulic balancing and user guidance.	Commissioning and early-operation feedback record.	Commissioning checklist and learning loop for training examples.

Annex C: Workshop evidence

This annex summarises the evidence used for the D2.3 synthesis. Public reporting remains anonymised in the text and tables. The selected workshop-impression photos are included to document the engagement setting, but public release should be confirmed during review because participants are visible. Signed attendance sheets and other personal-data evidence remain internal only. Sanitised Bozen board images can be used to illustrate process breakpoints and trust-building findings because they document clustered workshop content without exposing participant names.

Evidence item	Use in D2.3	Public-use treatment
D2.1 deliverable and underlying survey/interview/workshop synthesis	Defines obstacles, knowledge gaps, empathy-map logic and training needs used as upstream barrier source.	Public deliverable reference; no individual survey/interview data reproduced.

Evidence item	Use in D2.3	Public-use treatment
D2.2 deliverable and tool/training overviews	Defines tool/training fragmentation, interoperability gaps and regional support landscape.	Public deliverable reference; detailed factsheets not repeated.
Bregenz protocol and technical presentation evidence	Supports findings on heating-load assessment, flow-temperature reduction, DHW, monitoring, owner decision structures and replacement-sizing risk.	Report as anonymised event synthesis.
Bregenz photo documentation	Confirms event documentation and workshop context.	Internal evidence unless individual photos are explicitly cleared.
St. Pölten concept and minutes	Supports findings on process mapping, planning effort, simulation, monitoring, modularity, radiator/flow-temperature logic and business-model constraints.	Report as anonymised synthesis; do not quote personal discussion details.
Bozen facilitation pack	Shows the workshop was deliberately structured around process breakpoints and trust-building needs.	Can be referenced as workshop method evidence.
Bozen short report and board transcription	Provides the strongest direct evidence for breakpoints, trust dimensions and support needs.	Use clustered themes only; avoid names and attendance details.
Sanitized Bozen board images	Illustrate process-breakpoint and trust-building boards in Annex C.	Suitable for public use after final visual privacy check.

Workshop impressions

The following photographs document the engagement setting in two Task 2.3 workshops.

Figure C1. Bregenz EUSALP workshop impression, 2025-05-08. Participants are visible.

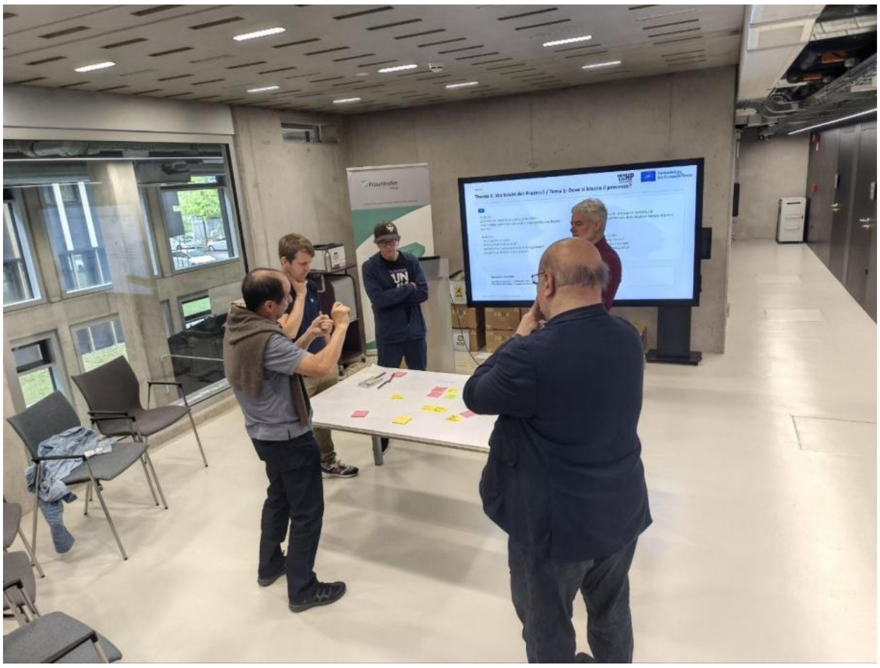

Figure C2. Bozen stakeholder workshop group-work impression, 2026-04-29.

Figure C3. Bozen workshop board on process breakpoints. The public synthesis uses clustered themes only.

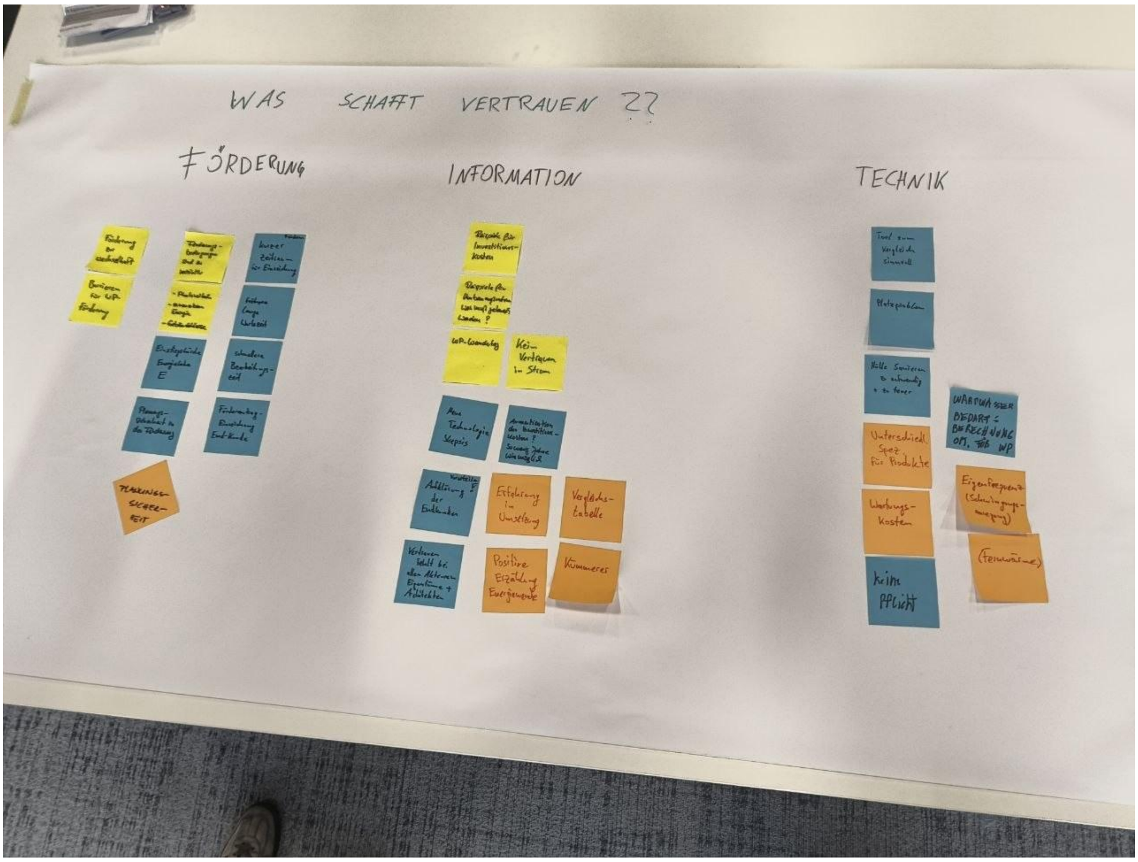

Figure C4. Bozen workshop board on trust-building needs, structured around funding, information and technology.