D2.2

Analysis of Existing Planning Instruments and Training Offers

Public Report

Co-funded by
the European Union

Principal Authors

Dietmar Siegele (Fraunhofer Italia)

Contributors

Ferdinand Sigg (Rosenheim)

Document details

Deliverable No: 2.2
Dissemination level: Public
Work Package: WP2
Lead beneficiary: Fraunhofer Italia
Date of publication: 18/12/2025
Version: 1.0

Version	Date	Comments	Authors
1.0	18/12/2025	Final version	Dietmar Siegele

Sections were language-polished with generative-AI; all data and analysis are author-derived.

Disclaimer

Co-funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or CINEA. Neither the European Union nor the granting authority can be held responsible for them.

Project information

Title: Upskilling for boosting heat pump installation in refurbishments

Project Number: 101166831

Duration: November 2024 until November 2027 (36 months)

Coordinator

Energieinstitut Vorarlberg

Project partner

Rosenheim Technical University of Applied Sciences

universität innsbruck

eza! Energie- und Umweltzentrum Allgäu

RENOWAVE.AT

Fraunhofer ITALIA

KlimaHaus CasaClima®

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 material 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.

CONTENT

EXECUTIVE SUMMARY

Heat pumps are increasingly recognised as a cornerstone technology for decarbonising heating and cooling in buildings, both at European and global level [8]. Yet, while they are rapidly gaining market share in new buildings and single-family homes, their use in existing multi-apartment buildings remains comparatively limited. The KnowHowHP project addresses this gap by focusing on heat-pump-based refurbishment of multi-family buildings in Southern Germany, Austria and Northern Italy. These regions share similar climatic conditions and regulatory drivers, but differ in institutional structures and market practices. Work Package 2 (WP2) provides the analytical foundation for the project's later development of a digital toolbox and training concepts. Deliverable D2.1 documented obstacles, knowledge gaps and role-specific frustrations among planners and installers. This Deliverable D2.2 adds the corresponding "supply-side" perspective: it maps the planning instruments, software tools and training offers that practitioners currently use, and assesses how well they align with the needs identified in D2.1.

The analysis combines three main sources. First, it draws on the WP2 online survey "Heat Pump Challenges and Knowledge Gaps", which yielded 93 valid responses from planners, energy consultants and installers. The sample is deliberately focused on Southern Germany, Austria and Northern Italy and, within these regions, on actors who work regularly on multi-apartment buildings. Second, it uses regional tool overviews compiled by project partners for Austria and Southern Germany, complemented by targeted desk research for Northern Italy. Third, it systematically collects and codes information on training offers from regional energy agencies, universities, vocational providers, national initiatives and manufacturer academies. All tools and trainings identified through these channels are documented in harmonised factsheets in Annex A and Annex B.

To make a heterogeneous tool landscape analytically manageable, D2.2 introduces a functional taxonomy of planning instruments and tools along the integrated refurbishment process. Eight domains are distinguished: building and system energy performance and refurbishment planning; heating load and distribution design; heat pump sizing, configuration and manufacturer tools; dynamic building and system simulation; economic assessment, incentives and risk evaluation; noise, comfort and acoustic assessment; BIM/MEP modelling, schematics and documentation; and advisory, comparison and auxiliary tools. Each tool is assigned to one or more of these domains and mapped to the phases of a typical refurbishment process, from early diagnosis and feasibility through concept development and detailed design to procurement and, where relevant, commissioning and optimisation.

The regional analyses show that all three project regions have mature ecosystems in the core domains of building energy performance, heating load and heat-pump sizing. In Austria and Southern Germany, national "Energieausweis" software families aligned with ÖNORM and DIN provide the backbone for building-level energy analysis, while HVAC packages such as Hottgenroth energieberater, Solar-Computer, PokornyTec Heizlast Austria, ZUB Helena, Plancal/Trimble Nova and liNear support heating load and distribution design. In Northern Italy, the CasaClima/ProCasaClima environment and Italian EPB suites such as Termolog, Edilclima, MasterClima, TerMus and STIMA10 fulfil comparable roles, combining energy certification, Legge 10 documentation and refurbishment-oriented scenario analysis. Manufacturer-specific sizing platforms and configurators are widely used by installers in all three regions and often form the primary practical "planning instruments" on the implementation side.

Dynamic building and system simulation tools such as IDA ICE, Polysun, GeoTSOL, TRNSYS, EnergyPlus-based environments and research-oriented toolboxes (e.g. Carnot, Modelica-based platforms, TAS) are present in all three regions but used by a relatively small subset of specialised offices and research actors, particularly in Austria and Germany. Economic and incentive-related tools exist in the form of EPB modules, national calculators (for example Heizrechner and Conto Termico simulators) and internal spreadsheets, but are rarely integrated tightly with technical design tools. Noise and acoustic assessment is usually handled via simplified calculators from associations and manufacturers, such as BWP's Schallrechner or brand-specific tools, often consulted late in the process rather than embedded from the outset. BIM and MEP environments (Revit MEP, Nova, mh-BIM, AX3000 and similar) are increasingly important in larger offices, but their interfaces to EPB, load and manufacturer tools remain partial. Across regions, the pervasive use of Excel-based "own tools" highlights both the creativity of practitioners and the fragmentation of the formal software landscape.

The training mapping reveals a similarly rich but fragmented picture. In Southern Germany, a decentralised yet mature network of energy agencies (notably eza!), universities of applied sciences (Hochschule Biberach, TH Rosenheim), CPD providers, the Heat Pump Academy and manufacturer academies offers a broad portfolio of HP-related courses. VDI 4645-based planner and installer certifications have become widely recognised, and HP topics are increasingly embedded in energy-consultant and academic programmes. In Austria, ARGE-EBA's A- and F-Kurs system provides a nationwide standard for energy-consultant training, which is implemented by regional energy agencies and WIFI centres. The national Wärmepumpe Weiterbildung framework coordinated by Wärmepumpe Austria and AIT adds a structured pathway to EU-DVO-compliant personal certification for HP planners and installers, while Western Austria's Sanierungsberaterkurse and the renowave/ÖVI course on sustainable refurbishment and heating-system replacement address multi-family building portfolios explicitly. Universities and universities of applied sciences (FH Burgenland, FH Technikum Wien, FH Campus Wien, Donau-Universität Krems, FH Vorarlberg) supply a strong academic underpinning in building physics, building-services engineering and simulation.

Northern Italy is characterised by a strong nucleus around CasaClima, whose designer and craftsperson courses – including the dedicated "Esperto CasaClima Pompe di Calore" path and the Base and Avanzato programmes – embed heat pumps in a holistic envelope–system perspective. ENEA's e-learning platform, private online providers and manufacturer academies (e.g. Accademia Viessmann) complement this with flexible, nationally accessible HP courses. F-gas certification providers ensure that installers are trained and licensed to work safely on HP refrigeration circuits.

Across all three regions, training offers can be grouped into five functional categories: initial vocational education and training; continuing professional development and short courses; manufacturer trainings and in-house programmes; university and UAS courses; and online modules, webinars and self-learning formats. Each category contributes specific pieces to the competence profile required for HP-based refurbishment of multi-family buildings. However, when the training landscape is viewed through the integrated refurbishment workflow developed in WP2, structural gaps become apparent. Multi-apartment hydraulics, staged refurbishment strategies in condominiums, systematic acoustic design in dense urban contexts, interdisciplinary digital workflows and commissioning and optimisation of HP systems in existing multi-storey buildings are still only sporadically covered. Joint learning formats in which planners, installers, energy consultants and property managers work together on HP retrofit scenarios are rare in all three regions.

The overarching conclusion of D2.2 is therefore not that tools or training offers are missing in general, but that they are not yet configured and combined in a way that systematically addresses the specific challenges of HP-based refurbishment in multi-apartment buildings. Toolchains are rich but fragmented; training provision is extensive but tends to introduce technologies and tools in isolation rather than along an explicit, shared process. This deliverable provides the analytical basis and detailed catalogue needed to change that. A forthcoming deliverable, D2.4 "Integrated refurbishment approach", will build directly on D2.1 and D2.2. It will synthesise obstacles, tools and training offers into a coherent, process-oriented target picture for HP-based refurbishment in multi-family buildings, and derive concrete requirements for the role-specific, software-supported planning process, for the digital toolbox and for the training modules to be developed and piloted in WP3–WP5.

Co-funded by
the European Union

1. INTRODUCTION

1.1. Project Background and WP2 Scope

The decarbonisation of the European building stock is a central pillar of the EU's climate and energy policy [2-5]. In this context, heat pumps are recognised as a key technology for phasing out fossil fuel heating systems and enabling a transition towards highly efficient, renewable-based energy supply. While the technical performance of heat pumps has improved markedly in recent years, their successful deployment in existing multi-story buildings remains challenging. Compared to single-family houses, multi-apartment buildings are characterised by more complex hydraulic systems, diverse occupancy patterns, stricter acoustic and spatial constraints, and a higher degree of coordination between owners, tenants and professional actors.

The project addresses this challenge by focusing explicitly on the refurbishment of existing multi-story buildings in Southern Germany, Austria and Northern Italy. In these regions, climatic conditions, economic frameworks and building standards are broadly comparable, and the market share of heat pumps in renovations of multi-family housing is still low. At the same time, there is already substantial experience with performance-oriented energy standards, regional quality labels and pilot projects. KnowHowHP builds on this starting point and aims to upskill the existing workforce of planners, energy consultants, installers and related professionals so that they can design and implement integrated refurbishment solutions that combine envelope measures, heat pump systems, photovoltaics, storage technologies and digital control in a consistent way.

Rather than trying to solve the general shortage of skilled workers, the project concentrates on raising the quality and effectiveness of those professionals who are already active in the market. The core idea is that better skills through training, clearer processes and appropriate digital support can enable these actors to plan and execute more refurbishment projects with heat pumps, in less time and with fewer errors. To achieve this, we develop a role-specific, software-supported planning process and associated training materials, which are subsequently embedded in a wiki and chatbot environment to ensure long-term accessibility and multilingual dissemination.

Work Package 2 (WP2) provides the analytical foundation for these developments. It is dedicated to an in-depth analysis of obstacles and knowledge gaps that hinder the application of a holistic planning approach, with a particular focus on planners (including energy consultants) and installers. WP2 also investigates when, along the refurbishment process, specific knowledge is needed, and how current planning instruments, software tools and training offers support – or fail to support – practitioners in acquiring and applying this knowledge. Finally, WP2 defines the integral planning process that will later be translated into a digital toolbox and concrete training pathways.

Deliverable D2.1, "Report on Obstacles, Knowledge Gaps, and Glossary" [1], constitutes the first outcome of WP2. It synthesises the empirical evidence from the WP2 survey, interviews and workshops, and systematically maps the practical challenges that building professionals encounter when planning heat pump refurbishments in multi-story buildings. It also introduces a glossary that clarifies key concepts and terminology for the project. On this basis, D2.2 takes the next step by turning the focus from "what is missing" to "what is already there" in terms of planning tools and training offers, and by assessing how well these existing elements align with the needs identified in D2.1.

1.2. Objectives of Deliverable D2.2

The overarching purpose of this deliverable is to provide a structured and critical overview of the current landscape of planning instruments, software tools and training offers that are relevant for heat pump-based refurbishments of multi-story buildings in Southern Germany, Austria and Northern Italy. D2.2 does this with a strong emphasis on actual practice: the analysis concentrates on tools and courses that planners and installers genuinely use in their day-to-day work, rather than on an exhaustive catalogue of all products available on the market.

More specifically, D2.2 pursues four closely linked objectives. First, it develops a functional taxonomy of planning instruments and tools along the integrated refurbishment process. This taxonomy distinguishes, for example, between tools for building and system energy performance and refurbishment planning, heating load and distribution design, heat pump sizing and manufacturer-specific configuration, dynamic building and system simulation, economic assessment and incentives, acoustics, BIM/MEP modelling and advisory or comparison tools. By organising the tool landscape into these domains, the deliverable creates a common reference frame that can be used consistently across regions and professional groups.

Second, the deliverable maps the existing tools in the three project regions onto this taxonomy and documents their actual use by planners and installers. Building on the WP2 survey, regional tool lists and additional desk research, D2.2 identifies which tools are considered "core" in a given region, which play a complementary or niche role, and how they tend to be combined in typical "tool stacks" for heat pump refurbishments. For each tool, the analysis records where it is used (Southern Germany, Austria, Northern Italy), how often it appears in the empirical material, and whether it is primarily used by planners, by installers or by both groups.

Third, D2.2 extends this logic to the training landscape. It identifies and characterises relevant training offers for planners, energy consultants and installers in the three regions, including vocational and continuing training, manufacturer courses, university and university of applied sciences modules, and online formats. For each offer, the deliverable documents its provider, target group, content focus, delivery format, duration, language and regional scope, and – crucially – its relationship to concrete tools and to specific phases of the integrated planning process.

Fourth, the deliverable evaluates both tools and training offers against the integrated refurbishment concept that underpins our project. For every tool and training programme, D2.2 assesses the extent to which it supports joint consideration of building envelope and technical systems, multi-apartment hydraulics, partial-load operation, domestic hot water and Legionella-safe concepts, cost and subsidy considerations, and interdisciplinary collaboration.

To ensure transparency and reusability, the deliverable organises its findings in the form of concise factsheets. Each tool that appears in the survey responses or in the regional overviews is documented in an individual factsheet with harmonised metadata, covering identification and vendor, functional domains, regional use, user groups, role in the integrated workflow, interoperability, licensing, language and an assessment of strengths and limitations. An analogous factsheet structure is applied to training offers. This approach allows both a detailed, tool-by-tool view and an aggregated analysis of patterns and gaps across the three regions and the two main professional groups.

1.3. Structure of the document

The remainder of this report is organised as follows. Chapter 2 describes the methodology and data sources used in D2.2. It outlines the design and sample of the WP2 survey, the compilation of the Austrian and German tool overviews, the additional desk research for Northern Italy, and the identification of relevant training offers. It also explains the coding scheme and the development of the metadata frameworks that underpin the tool and training factsheets.

Chapter 3 introduces the functional taxonomy of planning instruments and tools adopted in this deliverable and relates it to the phases of the integrated refurbishment process. It discusses cross-cutting characteristics such as data models, interfaces, licensing and language availability. Chapter 4 then presents the existing tool landscapes in Southern Germany, Austria and Northern Italy, structured by functional domain and differentiated by user group. It concludes with a cross-regional comparison of the tool landscape and typical tool combinations used in practice.

Chapter 5 explains the concept, structure and reading guide of the tool factsheets and provides indices that allow readers to navigate them by functional domain, region and user group. Chapter 6 mirrors this structure for the training offers, describing the different categories of training and presenting the regional training landscapes. Chapter 7 introduces the training factsheets and their metadata structure.

A separate deliverable, D2.4 “Integrated refurbishment approach”, will build on D2.1 and D2.2 and provide a synthesis of obstacles, tools and training offers, together with implications for the digital toolbox and training modules.

2. METHODOLOGY AND DATA SOURCES

2.1. Overall approach in WP2

WP2 follows a mixed-methods approach that started with a broad exploration of obstacles and knowledge gaps and gradually moves towards a structured description of existing solutions. In a first step, an online survey, semi-structured interviews and stakeholder workshops were used to elicit challenges, needs and expectations of planners, energy consultants and installers in the three regions. These results are documented in D2.1 and provide the "demand side" perspective: they clarify which competences are missing, which project phases are perceived as particularly risky, and where practitioners feel they lack appropriate tools or guidance.

D2.2 now complements this perspective with a "supply side" analysis of the tools and training offers that are already available and in use. The same survey that underpinned D2.1 contained specific questions about planning instruments, software and training courses. These responses are combined with structured tool lists prepared by project partners for Austria and Southern Germany, and with targeted desk research for Northern Italy, to obtain a consistent view of the current landscape. Throughout, the analysis keeps a strict focus on the three priority regions of KnowHowHP and on the two main target groups, namely planners (including energy consultants) and installers.

2.2. Survey on heat pump challenges, tools and training offers

2.2.1. Survey design, target groups and regions

The central quantitative input for this deliverable is the "Survey on Heat Pump Challenges and Knowledge Gaps", which was conducted online as part of WP2. The questionnaire was designed to be answered by both planners and installers, with branch-specific questions where necessary. It consisted of several thematic sections. After an introductory part on professional background and regional focus, respondents were asked to describe their experience with heat pump systems, the building types they typically work on and their role in the refurbishment process. Subsequent sections explored perceived obstacles and knowledge gaps, the planning instruments and software tools they use, and their participation in or awareness of relevant training offers.

The survey targeted professionals who are actively involved in heating system design, refurbishment planning and installation in multi-family buildings, with a specific emphasis on projects where heat pumps are considered or implemented. To reflect the geographical focus of the project, recruitment efforts concentrated on Southern Germany, Austria and Northern Italy. Partners disseminated the survey via their networks, newsletters and professional associations; in addition, specific regional multipliers helped to reach installers, who are often harder to involve in online surveys than planning offices.

The questionnaire was available in German and Italian in order to lower language barriers and to make it accessible to the broadest possible range of practitioners in the three regions. It was hosted on an online platform that allowed responses to be exported in anonymised form for further analysis. The underlying dataset comprises 93 valid responses, which form the empirical basis for the quantitative and descriptive parts of this deliverable.

2.2.2. Sample description: Southern Germany, Austria, Northern Italy

For the purposes of this deliverable, the survey sample was filtered to focus on respondents whose main area of activity lies in Southern Germany, Austria or Northern Italy. A small number of participants active in other regions or internationally were retained only where their answers were clearly relevant for one of the three focus regions. Within the filtered dataset, roughly half of the respondents work primarily in Austria, about a quarter in Southern Germany and a somewhat smaller but still substantial group in Northern Italy; a few reported activities across multiple regions (compare Figure 1).

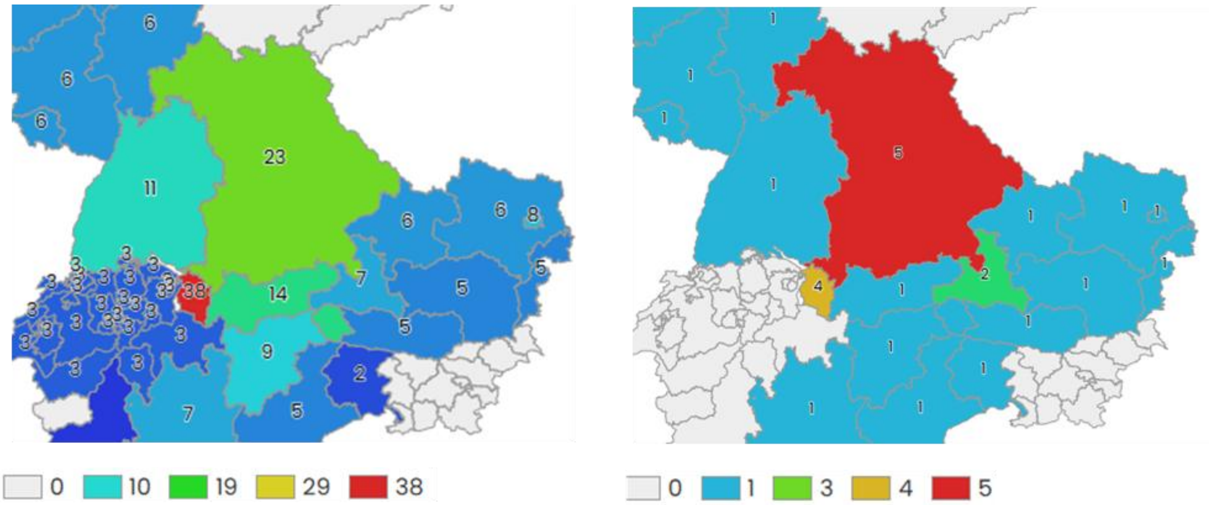

Figure 1: Operation areas of (left) Planners, and (right) Installers.

In terms of professional roles, the sample is deliberately mixed. It includes engineering offices and energy consultants who plan and dimension building services, as well as installation companies and contractors who implement and sometimes also design heating and DHW systems. The questionnaire structure reflects this by branching into planner-specific and installer-specific questions for sections dealing with tools and training offers. This branching is important for D2.2, as it allows the analysis to distinguish which tools and courses are predominantly used by planners, which by installers, and which by both.

The building types and project sizes reported in the survey cover a wide spectrum, but a significant share of respondents indicate that they regularly work on multi-apartment buildings and larger residential complexes. This is crucial, because one of the guiding principles in the analysis of tools and training offers is to focus on those that are actually applied, or at least applicable, in the multi-family refurbishment context, rather than on solutions designed purely for single-family houses.

Co-funded by
the European Union

2.2.3. Limitations of the survey data

The survey data come with several limitations that should be kept in mind when interpreting the results. The sample is not statistically representative of all planners and installers in the three regions; rather, it reflects those professionals who were reached through the project partners' networks and who chose to respond. This can introduce biases, for example towards actors who are already more engaged with energy efficiency or who have a specific interest in heat pumps.

Moreover, the questions on tools and training offers relied partly on free-text responses. While this allows capturing a broad variety of solutions, it also introduces ambiguity: different respondents may use slightly different spellings or abbreviations for the same tool, and some may refer to generic categories ("Energieausweissoftware", "Excel") rather than to specific products. In the analysis, such issues were addressed through careful cleaning and coding, but residual uncertainties remain.

Finally, the survey captures a snapshot in time. The tool and training landscapes are evolving, with new versions, courses and platforms being introduced continuously. D2.2 therefore does not claim to provide a definitive catalogue of all available solutions; instead, it maps those tools and training offers that were visible and relevant at the time of data collection and that appear to play a practical role for planners and installers in the three regions.

2.3. Regional tool mapping

The analysis of planning instruments and tools in D2.2 rests on a regional mapping exercise that combines partner expertise, survey responses and targeted desk research for Southern Germany, Austria and Northern Italy. The aim of this mapping is not to produce an exhaustive market overview, but to identify those tools that play a practical role in heat pump refurbishments of multi-story buildings and to classify them in a way that is comparable across the three regions.

For Austria, project partners compiled a structured overview of software and calculators that are routinely used in energy-efficient refurbishment and heat pump projects. This overview differentiates between tools for assessing seasonal performance and efficiency, software for building and system energy performance calculations and renovation planning, manufacturer-specific sizing and configuration tools, noise and acoustic assessment, economic evaluation, building and system simulation, heating load calculation and combined BIM/MEP solutions. The tools listed include both widely known products and more specialised solutions that are well established in Austrian practice, particularly those aligned with national standards and procedures.

In Southern Germany, a similar mapping was carried out with a focus on tools that support DIN-based energy performance assessment, heating load calculation and system design for residential and small non-residential buildings. The resulting list confirms the importance of several tool families also present in Austria, such as EPB and heating load software, dynamic simulation environments and manufacturer tools, but viewed through the lens of the German regulatory framework and market structures. Taken together, the Austrian and Southern German mappings provide a consolidated picture of the central tool ecosystems in the German-speaking part of the project area, covering the full chain from simple static sizing to detailed simulations and BIM-integrated work-flows.

For Northern Italy, the regional tool mapping builds more strongly on the survey responses and additional desk research. Practitioners from South Tyrol and neighbouring regions named, among others, the KlimaHaus/CasaClima calculation environment, Termolog, Edilclima and other national EPB tools as central instruments for energy performance certification, Legge 10 compliance and refurbishment planning. These references were supplemented by information from software providers and training organisations to identify related modules for heating and cooling load calculations, dynamic building and system simulations and economic assessments. In this way, the Northern Italian mapping captures both the formal tools required for regulatory procedures and the additional software that practitioners use for detailed system design and performance analysis.

Across all three regions, the regional mappings were harmonised by assigning each identified tool to the common functional domains described in Section 2.5.1. This means that, for example, national energy certificate software in Austria, Southern Germany and Northern Italy are all classified under "building and system energy performance and refurbishment planning", while dynamic simulation environments and manufacturer platforms are grouped under their respective domains irrespective of regional specifics. Where possible, the regional mapping was also cross-checked against the survey data to ensure that tools considered important by experts and partners also appear in practitioners' reported toolchains, and vice versa.

This harmonised regional mapping forms the backbone of the subsequent analyses. It defines the long list of tools for which individual factsheets are created and provides the basis for comparing tool use across Southern Germany, Austria and Northern Italy in Chapters 3 and 4.

2.4. Identification of training offers

2.4.1. Partner inputs and stakeholder interviews

The mapping of training offers relevant for heat pump-based refurbishment builds on several complementary inputs. Project partners provided information on courses and programmes they are involved in or aware of, including offers from regional energy agencies, chambers and professional associations. In addition, insights from the stakeholder interviews and workshops conducted for D2.1 [1] were revisited with a specific focus on training: whenever interviewees referred to courses, certificates or manufacturer trainings that they had attended or found useful, these mentions were extracted and included in the initial list of training offers.

This partner- and stakeholder-based approach is particularly valuable for capturing offers that may not be prominently advertised, such as in-house trainings by manufacturers, bespoke workshops organised by local chambers, or practice-oriented seminars at universities of applied sciences. It also helps to understand which offers are perceived as relevant and accessible by practitioners, beyond what is formally available on paper.

2.4.2. Desk research of national and regional training programmes

To complement the partner inputs and interview evidence, a systematic desk research was conducted for each of the three regions. The aim was to identify additional training offers that match the project focus but may not have emerged in the survey or interviews. The research considered, among others, the programmes of energy agencies and competence centres (for example, CasaClima/KlimaHaus in South Tyrol, regional energy institutes in Austria, dedicated centres in Southern Germany, like eza!), vocational training institutions, chambers of engineers and crafts, universities and universities of applied sciences, and manufacturers with established training academies.

For each identified offer, information was collected on the provider, target group, main content and learning outcomes, duration and format, language and geographic scope. Where available, the relationship between the training and concrete planning tools (for instance, courses on Hottgenroth software or on the CasaClima calculation environment) was also documented. All this information was entered into a structured database that mirrors the metadata framework described in Section 2.5.

2.5. Development of tool and training factsheets

2.5.1. Metadata framework for tools

A core feature of this deliverable is the systematic documentation of each relevant tool in the form of a concise factsheet. To enable this, a metadata framework was developed that specifies which information is collected and how it is coded. For each tool, the following elements are recorded.

First, basic identification data capture the tool name, vendor or provider and, where relevant, the specific module or version that is typically used in the context of heat pump refurbishments. This ensures that different products from the same vendor can be distinguished and that factsheets refer unambiguously to a given software.

Second, each tool is assigned to one or more of the functional domains. This assignment is based on both the technical capabilities of the tool and the ways in which it is actually used by practitioners, as evidenced by the survey responses and partner inputs.

Third, the usage profile is coded along three dimensions. The first dimension is the region, distinguishing Southern Germany, Austria and Northern Italy. For each region, a binary flag indicates whether the tool is used, and an intensity level (for example “core”, “relevant”, “niche”) summarises how often it appears in the data and how central it is considered by experts. The second dimension is the user group: the tool is coded as used primarily by planners, primarily by installers, or by both. This coding draws on the branch-specific tool questions in the survey and on qualitative insights from interviews and partner discussions. The third dimension is the phase of the integrated refurbishment workflow in which the tool typically plays a role, such as initial diagnosis and feasibility, concept development, detailed design and dimensioning, subsidy application and economic assessment, or commissioning and optimisation.

Fourth, technical characteristics are documented, including interoperability and data formats (for instance, support for IFC, gbXML, CSV, proprietary formats or direct interfaces to national registries), licensing model (commercial, subscription-based, open-source, free tools from associations or public bodies) and language availability. These characteristics are important for later discussions on how tools could be integrated into a digital toolbox or incorporated into training offers.

Finally, each tool is qualitatively assessed with regard to its strengths and limitations from the perspective of integrated heat pump refurbishment in multi-story buildings. This assessment synthesises the evidence from survey comments, interviews and expert judgement, and highlights aspects such as coverage of multi-apartment hydraulics, treatment of partial-load behaviour and domestic hot water, consideration of envelope measures and architectural constraints, and usability in interdisciplinary collaboration.

2.5.2. Metadata framework for training offers

An analogous metadata framework has been defined for training offers. For each course or programme, identification data include the provider, the official title and, where applicable, the qualification or certificate awarded. The target group is coded in terms of professional roles (planners, energy consultants, installers, apprentices, mixed audiences) and required prior knowledge.

Content-related metadata record the main topics covered, the explicit learning outcomes, and the extent to which planning instruments and tools are part of the curriculum. Format and delivery data capture the duration, structure (single seminar, modular course, longer programme), mode of delivery (in-person, online, blended) and frequency. Region and language are coded to reflect where the offer is available and in which languages it is taught.

Crucially for KnowHowHP, each training offer is also mapped to the phases of the integrated refurbishment process and to the competences identified as critical in D2.1. This mapping allows assessing whether, for example, joint consideration of envelope and system, multi-apartment hydraulics, or digital tool use are addressed, and at what depth. As with tools, a qualitative assessment of strengths and limitations concludes each training factsheet.

3. FUNCTIONAL TAXONOMY OF PLANNING INSTRUMENTS AND TOOLS

3.1. What we mean by "planning instruments"

In this deliverable, the term "planning instruments" is used in a deliberately broad sense. It encompasses all digital and analogue aids that support professionals in analysing, designing, dimensioning, documenting and communicating heat pump-based refurbishment solutions for multi-story buildings. This includes established software products, web-based calculators, manufacturer platforms, spreadsheet-based tools and, in some cases, structured checklists or templates that have a direct influence on the technical and economic configuration of projects.

The emphasis in D2.2 lies on software tools, because the project's long-term objective is to formalise an integral planning process in the form of a digital toolbox and to embed this process into training concepts and everyday practice. However, the taxonomy deliberately does not exclude simple or "low-tech" instruments such as Excel-based heating load calculators or static JAZ estimators if these are widely used and have a tangible impact on design decisions. From the perspective of the end-user and of the integral process, what matters is not whether a tool is sophisticated in a technical sense, but whether it shapes how envelope measures, hydraulic concepts, heat pump configurations, economic trade-offs and occupant-related constraints are understood and combined.

The taxonomy is also explicitly process-oriented. We build on the insight that successful refurbishment projects are organised around a sequence of phases, from early feasibility checks and variant studies through detailed design, subsidy handling and tendering to commissioning and optimisation. Each phase has its own information needs and decision points, and different tools tend to be used at different points along this sequence. The functional domains defined below therefore reflect both technical specialisation and typical points of use in the integrated refurbishment workflow.

3.2. Tool domains along the integrated refurbishment process

In order to make the heterogeneous collection of tools analytically manageable, the tools identified in the survey and in the regional mappings were grouped into a set of functional domains. Each domain corresponds to a primary technical purpose and a typical role in the refurbishment process. Many tools span more than one domain; this is reflected in the metadata and later in the factsheets. Nevertheless, the domains provide a useful backbone for describing the tool landscape in a way that is comparable between Southern Germany, Austria and Northern Italy.

3.2.1. Building and system energy performance and refurbishment planning

The first domain contains tools that are used to assess the energy performance of buildings and technical systems and to plan refurbishment measures at building level. These are typically the environments used to prepare national energy performance certificates, to demonstrate compliance with legal requirements and to explore combinations of envelope and system measures in terms of annual energy balances and key performance indicators.

In Austria and Southern Germany, this domain is dominated by "Energieausweissoftware" aligned with national EPB regulations, by tools such as Archiphysik, AX3000, Ecotech, ETU, GEQ and by calculation environments that implement the relevant ÖNORM and DIN standards. In Northern Italy, comparable roles are played by the KlimaHaus/CasaClima calculation environment and by national tools such as Termolog and Edilclima, which combine energy performance certification, "Legge 10" documentation and renovation-oriented scenario analysis. Across regions, the Passivhaus Projektierungspaket (PHPP) is used in a subset of projects, particularly where ambitious energy standards are pursued in refurbishment.

Tools in this domain typically serve in early diagnosis and feasibility, in concept development and in the preparation of subsidy applications. They translate envelope properties, usage patterns and system assumptions into annual heat demands, primary energy consumption and, in some cases, CO_2 emissions and life-cycle costs. Their outputs often form the formal basis for decisions by authorities and funding bodies, which makes this domain central for the overall feasibility of heat-pump-based refurbishments.

3.2.2. Heating load and distribution design

The second domain consists of tools that calculate design heating loads and support the design of heat emission and distribution systems. These tools implement standards such as DIN EN 12831, ÖNORM H 7500 or UNI EN 12831 and are used to determine peak loads at room, apartment and building level, to size radiators, underfloor heating circuits and other emitters, and to dimension risers, distribution loops and pipe networks.

In the German-speaking regions, this domain includes well-established HVAC packages such as Hottgenroth TGA Heizung, mh-software, plancal nova heizung, Solar-Computer, PokornyTec Heizlast Austria, GEQ Softwareand ZUB Helena, as well as specialised applications and modules integrated into CAD and BIM environments. In Northern Italy, heating load calculation is often embedded as a module within EPB tools such as Termolog, Edilclima, MasterClima or similar products, rather than being handled in separate packages.

For multi-family buildings, this domain is critical because it determines whether existing high-temperature distribution systems can be operated at lower temperatures compatible with heat pumps, or whether significant envelope improvements and emission system adaptations are necessary. The ability to map loads and distribution characteristics at apartment and riser level is particularly important for assessing partial conversions, phased refurbishments and mixed-temperature operation, which are recurring themes in practice.

3.2.3. Heat pump sizing, configuration and manufacturer tools

The third domain brings together tools that are dedicated to the sizing and configuration of heat pump systems, often tied to specific manufacturers or product lines. These include stand-alone sizing programmes, online configurators and integrated manufacturer platforms that guide users through the selection of suitable units, the design of source systems (ground loops, boreholes, air intakes) and, in some cases, the proposal of hydraulic schematics and control concepts.

Such tools are widely used by installers, who rely on manufacturer data and software to translate calculated loads and boundary conditions into concrete product choices. Planners and energy consultants also use them, either directly or indirectly by checking or specifying requirements that installers then implement through manufacturer platforms. In many of the survey responses, these tools appear as the primary “planning instruments” in everyday work, especially where formal heating load calculations are commissioned externally but product selection and layout are handled by the installation company.

From the perspective of the integrated refurbishment process, this domain plays a bridging role between analytical tools and implementation. It transforms generic design targets into concrete technical solutions and often embeds manufacturer-specific assumptions about performance, control strategies and hydraulic layouts. At the same time, these tools tend to be isolated from EPB, BIM and economic assessment environments, which creates manual work and potential inconsistencies in the overall workflow.

3.2.4. Dynamic building and system simulation

The fourth domain contains tools used for dynamic simulation of building and system behaviour over time. Unlike the predominantly steady-state or monthly balance methods implemented in most EPB tools, these environments resolve time-dependent interactions between envelope, internal loads, emission systems, storage and heat pump operation, often with sub-hourly time steps.

Representative examples across the three regions include IDA ICE, TRNSYS, EnergyPlus with graphical front-ends such as DesignBuilder or OpenStudio, Matlab/Simulink environments with dedicated HVAC toolboxes and specialised system simulators like Polysun or GeoT*SOL. In practice, these tools are used by a relatively small subset of planners, researchers and consultants, typically in complex projects, pilot schemes or studies where detailed performance questions arise.

For multi-family heat pump refurbishments, dynamic simulations are particularly valuable when exploring partial-load behaviour, storage strategies, interaction with photovoltaics and demand response, and when assessing comfort and risk of overheating. Although their use is not yet widespread in everyday practice, they provide important reference cases and methodological insights that can inform simplified workflows and training materials in KnowHowHP.

3.2.5. Economic assessment, incentives and risk evaluation

The fifth domain covers tools that support the economic evaluation of refurbishment options, including the treatment of investment costs, operating costs, maintenance, subsidies and, in some cases, risks and uncertainties. These tools range from simple online calculators that estimate energy cost savings and payback periods, through modules integrated in EPB software for comparing refurbishment variants, to specialised applications for life-cycle cost analysis and funding scheme calculations.

Examples include regional heating cost calculators, subsidy "simulators" linked to national programmes and internal tools used by energy agencies and consulting firms to benchmark heat pump solutions against conventional heating systems. In some EPB environments, economic evaluation is provided as an additional module that uses the results of energy balance calculations as inputs.

This domain becomes particularly prominent in early diagnosis and concept development, when clients need to understand the financial implications of different options, and again when preparing subsidy applications and business cases for decision-makers. D2.1 [1] has shown that uncertainty about costs and subsidies is a major barrier to the uptake of heat pumps in multi-family renovations; the availability and usability of tools in this domain therefore has a direct impact on project pipelines.

3.2.6. Noise, comfort and acoustic assessment

The sixth domain comprises tools that help practitioners assess noise, comfort and acoustic impacts of heat pump installations. In dense urban settings and in multi-storey buildings with noise-sensitive occupants, the siting and operation of outdoor units is subject to stringent regulatory and social constraints.

Typical instruments in this domain include sound calculators provided by associations and manufacturers, which allow users to estimate sound pressure levels at specified receiver points and to compare them to regulatory limits, as well as more specialised tools developed in research projects for optimising unit placement and shielding. In some cases, simple spreadsheets or rule-of-thumb calculators are used during initial feasibility assessments, while more detailed tools are applied in the detailed design phase.

Although these tools are often treated as peripheral compared to energy and hydraulic calculations, they can be decisive in determining whether a planned solution is permissible and acceptable. D2.1 [1] documents multiple cases where noise concerns led to the rejection or modification of heat pump concepts. A functional taxonomy that ignores this domain would therefore miss an important practical constraint.

3.2.7. BIM/MEP modelling, schematics and documentation

The seventh domain includes tools used for modelling, coordinating and documenting building services within architectural models. This domain covers both full BIM platforms and specialised MEP solutions that provide functions for three-dimensional modelling of pipelines and ducts, clash detection, automatic generation of views and schedules and integration with calculation engines.

Examples are platforms such as Revit MEP, Plancal/Trimble Nova, liNear-based solutions, mh-BIM and combined design environments that link architectural and technical components. In many offices, these tools form the central environment in which layouts are prepared and coordination with structure and architecture is managed, while detailed calculations are carried out in separate applications and results are transferred manually or via interfaces.

In the integrated refurbishment process envisaged by KnowHowHP, BIM and MEP tools are important not only for documentation but also as potential hubs for data exchange between different analytical tools. Their current capabilities and limitations with respect to heat pump systems, multi-apartment hydraulics and refurbishment-specific constraints therefore receive particular attention in the subsequent analysis.

3.2.8. Advisory, comparison and auxiliary tools

The eighth domain groups together advisory, comparison and auxiliary tools that support early-stage discussions and decision-making but do not themselves provide full planning functionality. These include simple online matrices that compare heating systems on the basis of typical costs and emissions, house-level calculators offered by energy agencies, rough JAZ estimators and internal templates used by consulting firms to structure client interviews and pre-studies.

Such tools are usually applied in the very early phases of projects, when the question is whether heat pumps are considered at all and how they are positioned relative to alternative options. They influence expectations about investment levels, running costs and comfort, and they can either open or close doors for more detailed planning. While they rarely appear in formal documentation, their role in shaping the initial narrative around heat pump refurbishments makes them a relevant part of the overall tool ecosystem.

3.3. Mapping tools to phases in multi-family HP refurbishments

The functional domains described above gain meaning only when they are related to the actual planning and implementation process of multi-family refurbishments. Building on the draft integral refurbishment workflow developed and discussed with practitioners in WP2 workshops, D2.2 maps each tool to the phase or phases in which it is typically used.

In early diagnosis and feasibility, practitioners primarily rely on advisory and comparison tools, on simple economic calculators and, in many cases, on high-level EPB environments. At this stage, the goal is to answer basic questions: whether a heat pump solution is in principle viable given the building's current state, what levels of thermal refurbishment might be required to reach acceptable supply temperatures, and what orders of magnitude in terms of investment costs and subsidies are to be expected. The choice of tools here influences which solution pathways are considered "realistic" and how the conversation with owners and occupants is framed.

During concept development and variant comparison, the focus shifts towards building and system energy performance tools, heating load and distribution design tools and, where competence and project size justify it, dynamic simulation environments. Planners explore combinations of envelope measures, emission systems and heat pump configurations, often constrained by existing hydraulics, building geometry and noise restrictions. In this phase, manufacturer sizing tools also become more prominent, as concrete products and source systems are evaluated against the calculated loads and operating conditions.

In detailed design and dimensioning, BIM and MEP tools, heating load packages, manufacturer platforms and noise calculators dominate. Here, the integral process requires that envelope specifications, hydraulic concepts, control strategies and installation constraints are synchronised, not developed in parallel silos. For planners, this phase is often where fragmented toolchains become most visible, as data must be moved manually between EPB tools, CAD/BIM environments and manufacturer software. For installers, detailed design is frequently experienced through manufacturer tools and paper plans, with limited access to the upstream modelling environments.

During procurement, subsidy application and contracting, tools for economic assessment and incentives, together with EPB software and documentation-oriented BIM outputs, are central. Professionals compile the formal artefacts required by funding bodies and authorities, while also using cost and risk assessment tools to refine the preferred variant in dialogue with clients.

Finally, in commissioning and optimisation, a different set of tools comes to the fore. While not the primary focus of D2.2, it is important to note that many manufacturer platforms now provide commissioning assistants, monitoring dashboards and remote diagnostic tools. In the integral process, these would be complemented by digital checklists, commissioning protocols and possibly by simple feedback loops into the planning tools themselves, allowing future projects to benefit from empirical performance data.

In the tool factsheets and in the underlying metadata, each tool is therefore not only assigned to one or more functional domains but also mapped to the phases in which it is most commonly used. This phase mapping makes it possible to identify, in later chapters, where the current tool landscape leaves gaps in the integral workflow and where redundant or overlapping solutions exist.

Figure 2 illustrates, in a conceptual way, how the eight functional tool domains are intended to support the integrated refurbishment workflow. The horizontal axis shows the main process phases from diagnosis and feasibility through to commissioning and optimisation, while the vertical axis lists the functional domains introduced in Section 3.2. Darker shading indicates a stronger role of a given tool class in the respective phase.

In this integrated target picture, EPB and refurbishment tools span almost the entire workflow: they underpin early feasibility checks and variant studies, provide the formal results for procurement and subsidies and are still used during commissioning to benchmark measured performance against planned values. Heating-load and distribution tools, together with heat pump sizing and manufacturer tools, are concentrated in concept development and detailed design, but they remain relevant for procurement and commissioning, where dimensioning assumptions and operating parameters are verified. Dynamic building and system simulation is deliberately brought forward into the concept phase, where it supports robust comparison of envelope–system variants, and is used again at commissioning to test and refine control strategies. Economic assessment and incentive tools frame the workflow at both ends: they are essential for early go/no-go decisions and for structuring funding packages in procurement, while also providing input for operational optimisation. Noise and acoustic tools are no longer treated as peripheral checks; they appear already in diagnosis and concept development and peak in detailed design, ensuring that siting and façade concepts are robust from the outset. BIM and MEP tools form a digital backbone in concept, detailed design and procurement and are still used in commissioning for as-built documentation and for linking monitoring data to the model. Finally, advisory and auxiliary tools support client dialogue and decision-making in the early phases and are also used again around procurement and commissioning to communicate expected performance and to structure handover and user training.

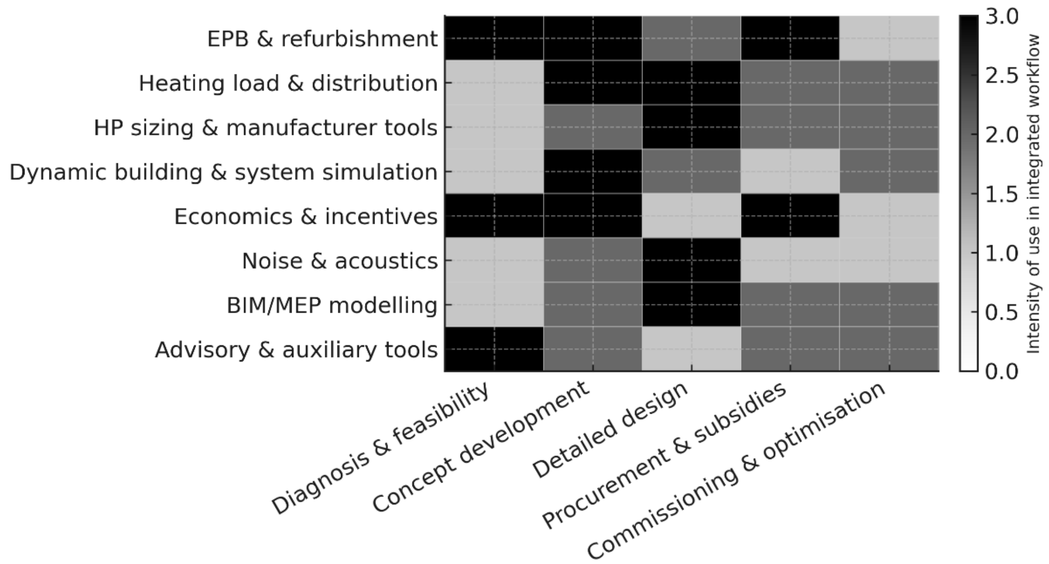

Figure 2: Taxonomy Process.

3.4. Cross-cutting characteristics of tools

3.4.1. Data models, interfaces and interoperability

Data models and interfaces determine how easily information can be exchanged between tools and how much manual work is required to keep models consistent. For EPB and energy balance tools, this includes the possibility to import geometries from CAD or BIM environments and to export results for use in economic evaluation or reporting. For BIM and MEP tools, support for open standards such as IFC or gbXML, and the availability of links to external calculation engines, are central. For manufacturer platforms, the ability to export sizing results and performance data in machine-readable formats, beyond static PDF reports, is critical if they are to be integrated into broader toolchains.

In many of the tool combinations identified for Austria and Southern Germany, data exchange still relies on manual transfer of parameters and on duplicated input between applications. Similar patterns appear in Northern Italy, where EPB tools, manufacturer configurators and custom spreadsheets coexist with limited automation. This fragmentation has direct implications for error risks, for the effort required in planning and for the feasibility of integrated, iterative work across disciplines.

3.4.2. Licensing models and availability

Licensing models and availability shape who can realistically use which tools and under what conditions. Some tools in the identified landscape are commercial products with perpetual or subscription licences; others are free-to-use calculators provided by associations or public bodies; a smaller number are open-source. There are also internal tools developed by individual organisations that are not generally available.

For training design, it is important to distinguish between tools that participants can expect to access in their daily work and tools that, while powerful, are available only to a minority. For the digital toolbox, licensing models influence whether external tools can be directly integrated or whether their functionality needs to be emulated or interfaced in a looser way.

3.4.3. Languages and regional adaptations

Finally, languages and regional adaptations play a key role in a cross-border project that spans different regulatory and linguistic contexts. Tools differ in the languages of their user interfaces and documentation, in the standards they implement and in their formal recognition for national procedures such as energy performance certification or subsidy applications.

Many tools used in Austria and Southern Germany are available primarily in German and are closely aligned with national norms and databases. Tools central to Northern Italy implement Italian norms and procedures and are offered mainly in Italian, sometimes with German-language options in South Tyrol. This means that technical capabilities alone do not determine whether a tool is relevant in a given region; regulatory fit and language support are equally decisive. The taxonomy therefore records, for each tool, not only its functional domain but also its language options and regional suitability, providing an important input for later cross-regional comparisons and for the identification of tools that could underpin joint training materials.

4. EXISTING PLANNING INSTRUMENTS AND TOOLS IN THE THREE REGIONS

This chapter describes how planning instruments and tools are actually used by planners and installers in Southern Germany, Austria and Northern Italy. It combines the survey results with the regional tool mappings and the Italian tool research and presents the findings in a way that aligns with the functional taxonomy introduced in Chapter 3. The focus lies on multi-family refurbishment projects with heat pumps, even though many of the tools are also used in other building types.

4.1. Overview of regional tool landscapes

4.1.1. Positioning of Southern Germany, Austria and Northern Italy

The filtered survey sample comprises 93 respondents. When their self-declared regions of activity are harmonised and grouped, around half of them primarily operate in Austria, roughly a quarter in Southern Germany and a smaller but still significant group in Northern Italy. A few respondents describe cross-border activities across DACH or across the German-speaking regions and Northern Italy, and a handful work “worldwide” or in broader “German-speaking Europe”.

Professionally, the sample is dominated by planners and energy consultants. Eighty-four respondents describe themselves as “Planner or Energy Consultant”, while only nine identify primarily as “Installer”. Among the Austrian respondents, more than forty are planners and four are installers; in Southern Germany, nineteen are planners and three are installers; in Northern Italy all fourteen respondents fall into the planner/consultant category, with no installers responding from that region. This asymmetry must be kept in mind: what follows reflects planners’ toolchains much more clearly than installers’ on the Italian side, and even in the German-speaking regions the installer perspective is based on a small number of cases.

Despite these differences in sample size, the three regional tool landscapes can be described and compared meaningfully. In Austria and Southern Germany, a mature ecosystem of national EPB software, heating load and HVAC design tools, dynamic simulation environments and manufacturer platforms has developed over many years. In Northern Italy, the picture is more heterogeneous: national energy performance packages, the KlimaHaus/CasaClima environment and Italian EPB tools form the backbone, but a patchwork of additional tools and a strong reliance on custom Excel-based calculations is also apparent.

4.1.2. Common tool families across regions

Across the three regions, certain tool families and approaches recur, even if the concrete products differ. In the domain of building and system energy performance and refurbishment planning, all three regions rely on software that implements national EPB regulations and standards. In Austria and Southern Germany, these are the familiar “Energieausweis” tools aligned with ÖNORM and DIN, sometimes mentioned generically ("Energieausweissoftware") rather than by brand. In Northern Italy, analogous roles are played by the KlimaHaus/CasaClima calculation environment and by national EPB tools such as Termolog and Edilclima.

For heating load and distribution design, planners in the German-speaking regions use specialised HVAC packages implementing EN 12831 and national annexes. In the survey, Southern German respondents frequently mention Hottgenroth, Solar-Computer and related modules, while Austrian planners rely more on Plancal/Nova and associated tools, sometimes in combination with national "Energieausweis" environments. In Northern Italy, heating load calculations are typically embedded as modules within EPB tools such as Termolog, Edilclima and Termus; separate stand-alone heating load tools are not prominent in the responses.

Dynamic building and system simulation tools are present in all three regions, but used by a relatively small subset of respondents. Austrian planners report the use of IDA ICE and Polysun, sometimes in combination with geothermal tools such as GeoTSOL and EED. In Southern Germany, TRNSYS and Polysun appear in a few responses. Dynamic simulation is largely absent from the Italian planners' free-text tool lists, although other evidence suggests that EnergyPlus-based tools and similar platforms are used in some offices; this discrepancy likely reflects the fact that only a small group of respondents works with such environments on a regular basis.

Two additional cross-regional patterns stand out. First, Excel-based tools are ubiquitous. Many respondents, especially in Austria and Northern Italy, explicitly mention "own Excel tools" for heating load estimates, economic comparisons or special cases that are not well covered by standard software. Second, manufacturer-specific tools and platforms are used everywhere, especially by installers. Even though the survey question on tools for installers yields only a few explicit product names (for example Hottgenroth modules and a Stiebel Eltron tool), almost all installer responses refer in some form to "manufacturer tools", "tools of the industry partners" or similar wording.

4.1.3. Region-specific solutions and gaps

While these common families create a shared vocabulary across regions, the concrete toolchains remain strongly shaped by national frameworks and local practices. In Southern Germany, DIN-based HVAC tools and the German EPB ecosystem dominate; in Austria, a hybrid of national "Energieausweis" software, Plancal/Nova and simulation tools is characteristic; in Northern Italy, the KlimaHaus/CasaClima environment and Italian EPB packages form the centre of gravity.

These differences have practical consequences. Tools that are formally recognised for energy performance certificates and subsidy procedures in one region are largely irrelevant in another. Likewise, planners trained in one country may be unfamiliar with the software stack used across the border, even if the underlying physics and design questions are similar. From the perspective of KnowHowHP, this means that training and digital support must start from regionally specific realities, while at the same time identifying transferable principles and potential levers for harmonisation.

4.2. Southern Germany

4.2.1. Survey sample and professional roles

The Southern German part of the sample consists of twenty-two respondents whose main region of activity was coded as “Southern Germany” or as specific sub-regions such as Allgäu, Ostallgäu, Westallgäu or the Bodensee area. Nineteen of these respondents describe themselves as planners or energy consultants, while three identify primarily as installers. Most have more than ten years of experience in the industry and report working regularly on multi-storey buildings, including a substantial share of refurbishment projects.

This mix of predominantly planning-oriented respondents with a small number of installer voices shapes the picture of the Southern German tool landscape. The tools listed in the survey reflect the established DIN-based HVAC ecosystem and are consistent with the complementary regional mapping carried out by project partners.

4.2.2. Tools by functional domain

In the domain of building and system energy performance and refurbishment planning, Southern German respondents refer partly to generic “Energieausweis” tools and partly to specific products. While the survey free-text answers do not list individual EPB packages as frequently as heating load tools, the regional mapping confirms that national energy certificate software and tools such as BKI Energieplaner and Dämmwerk are widely used for energy balances, renovation scenarios and funding calculations in the region.

Heating load and distribution design tools are more clearly visible in the survey. Among planners in Southern Germany, Hottgenroth appears three times, Solar-Computer once and Dämmwerk and BKI once each in the answers to the question on planning tools for heat pump installations. These entries align with the regional mapping, which identifies Hottgenroth TGA Heizung, Solar-Computer, DanBasic, PlancalNova, ZUB Helena, BKI Energieplaner and mh-software as core players in the German heating load and HVAC design space. Taken together, these tools implement DIN EN 12831 and associated norms and support emitter sizing, distribution network design and, in some cases, hydraulic and ventilation calculations.

Dynamic building and system simulation appears in the Southern German responses in the form of TRNSYS and Polysun. One respondent reports using TRNSYS, while another mentions Polysun for system simulations. Beyond these explicit mentions, the regional mapping points to further use of IDA ICE, BKI simulation modules and Hottgenroth dynamic calculation features in more complex projects, especially in the context of research and pilot schemes.

For heat pump sizing and configuration, the Southern German responses confirm that manufacturer tools play a dominant role, especially on the installer side. One installer mentions Hottgenroth heating load modules as part of their toolchain, but most installer responses describe their practice in generic terms (“manufacturer tools”, “tools of the industry partners”, “planning documents and design tools of the manufacturers”). For planners, heat pump sizing is often carried out with a mix of national load tools, Polysun or GEOT*SOL for specific source systems, and the configurators provided by manufacturers.

Advisory, comparison and auxiliary tools are present but not extensively detailed in the Southern German answers. Some respondents refer to internal Excel-based calculators and to generic heat cost comparison tools used in early-stage feasibility assessments. These instruments are used to explore economic viability, payback times and approximate JAZ values when discussing options with clients, but they are rarely named explicitly.

4.2.3. Usage patterns by user group (planners vs installers)

Given the small number of installers in the Southern German sub-sample, the distinction between planner and installer toolchains must be interpreted with caution. Nevertheless, a few patterns emerge. Planners rely primarily on established DIN-based HVAC tools for heating load and system design, complemented by EPB software and, in a smaller number of cases, by dynamic simulation tools. They frequently mention Excel-based tools and custom scripts for special cases or for tasks not well covered by standard software.

Installers, by contrast, describe their practice largely through the lens of manufacturer platforms. They use manufacturer-specific configurators, planning guides and online tools for sizing heat pumps, designing source systems, checking JAZ values and, in some cases, assessing noise and siting constraints. Only one installer explicitly mentions Hottgenroth heating load tools, suggesting that installers often rely on planners or on external consultants for formal load calculations regarding legal reasons or regulations imposed by funding agencies, while focusing their own tool use on product selection and practical implementation.

4.2.4. Role of manufacturer tools and in-house solutions

In Southern Germany, manufacturer tools and in-house solutions form an important layer in the tool landscape. Manufacturer platforms are central to installers' practice and are also consulted by planners when selecting products and checking feasibility. At the same time, several respondents report using their own Excel tools or company-specific scripts to aggregate data, explore variants or perform checks beyond what standard tools offer.

From an integrated process perspective, this layering complicates interoperability. Data must often be transferred manually between national EPB software, HVAC design tools, manufacturer platforms and internal spreadsheets. The survey comments and the findings of D2.1 [1] suggest that this leads to duplication of work and to a risk of inconsistencies, especially when assumptions are updated in one environment but not in others.

4.2.5. Summary: strengths and gaps in Southern Germany

The Southern German tool landscape for heat pump refurbishments in multi-family buildings is well-developed and anchored in a mature DIN-based ecosystem. Planners have access to a broad range of EPB, heating load and simulation tools and make active use of them. Manufacturer platforms provide strong support for installers and for the product-specific parts of the design process.

However, the landscape remains fragmented. The tools used for building energy balances, heating load calculations, dynamic simulations and manufacturer-specific sizing are not tightly integrated, and BIM environments are often only loosely connected to the calculation engines. Economic and funding calculators exist but are not systematically linked to the technical design tools. From the perspective of KnowHowHP, this creates both an opportunity and a challenge: the technical foundations are solid, but there is considerable potential for improving process integration, data exchange and the visibility of multi-apartment specific issues such as riser hydraulics and partial-load behaviour.

4.3. Austria

4.3.1. Survey sample and professional roles

The Austrian part of the sample comprises forty-six respondents whose primary region of activity is coded as Austria or specific Austrian regions such as Tirol, Wien, Vorarlberg or Westösterreich. Forty-two of them identify as planners or energy consultants, while four are installers. Many report more than ten years of professional experience and a considerable number of completed heat pump projects in multi-story buildings, including refurbishments.

This relatively large and balanced Austrian group provides a robust basis for describing the national tool landscape, especially on the planner side. The survey responses are also well aligned with the regional mapping prepared by partners, which catalogues the tools typically used in Austrian heat pump and refurbishment projects.

4.3.2. Tools by functional domain

In the domain of building and system energy performance and refurbishment planning, Austrian respondents and partner experts point to a combination of PHPP and national “Energieausweissoftware”. The latter includes tools such as Archiphysik, AX3000, Ecotech, ETU and GEQ, which implement Austrian EPB regulations and support energy certificate production, renovation scenario analysis and subsidy applications. In the survey, several respondents refer generically to “Energieausweis” and “energy performance certificate tools” rather than naming specific products, but the overall pattern confirms that these environments form the backbone for building-level energy analysis in Austria.

For heating load and distribution design, Austrian planners rely on national or German-language HVAC packages that implement EN 12831 and related standards. Plancal/Nova appears explicitly in the survey answers, with two Austrian respondents listing it as a core tool in their heat pump planning practice. The regional mapping further identifies Solar-Computer, PokornyTec modules and similar tools as important solutions for heating load calculations, emitter sizing and distribution network design. As in Southern Germany, these tools are often used in combination with national EPB software, either through direct interfaces or via manual transfer of input data.

Dynamic building and system simulation is more prominent in the Austrian sample than in the Southern German one. Two Austrian respondents explicitly mention IDA ICE, and several refer to Polysun, GeoTSOL and EED when describing their toolchains for heat pump and geothermal projects. In addition, the regional mapping suggests that TRNSYS and other simulation environments are used in larger offices and in research-oriented projects, although they do not appear by name in the survey answers.

Economic assessment and funding tools are integrated to some extent into EPB software and into national advisory platforms. Austrian respondents mention using cost–benefit modules within their energy certificate tools and additional calculators for life-cycle cost and payback analyses, often implemented in Excel. These are used both in early feasibility assessments and in the preparation of funding applications.

Advisory and auxiliary tools, such as online heating system comparison matrices and rough JAZ calculators from associations, appear in partner mappings and in a few survey comments, but are less visible in the structured tool question. As in Southern Germany, it seems that many professionals use such tools informally in early phases without necessarily counting them as “planning software”.

In Austria, noise emission reports are often part of the legal building process for the installation of air-water heat pumps. These reports often must be prepared by acoustic experts and represent a major regulatory constraint. There is no general tool for that topic available.

4.3.3. Usage patterns by user group (planners vs installers)

In Austria, planners clearly dominate the quantified picture of tool use. They combine national EPB tools, heating load software and simulation environments in a way that reflects both regulatory requirements and project complexity. For routine projects, EPB tools and heating load packages suffice; for more demanding refurbishments with complex hydraulics or geothermal systems, dynamic simulations and specialised system tools like Polysun and GeoTSOL are brought in. Many planners supplement these with their own Excel tools and scripts for specific tasks.

Installers, by contrast, are under-represented in the Austrian sample, with only four respondents. Their answers point, as in Southern Germany, to a strong reliance on manufacturer platforms and on the planning documents provided by industry partners. Formal heating load calculations and EPB work are usually handled by planners or external consultants; installers interact mainly with the manufacturer configurations, noise calculators and the practical aspects of implementation.

4.3.4. Role of national EPB tools and dynamic simulation

A distinctive feature of the Austrian landscape is the centrality of national EPB tools and the relatively high visibility of dynamic simulation in the survey. National energy certificate software is not just a compliance tool; it is actively used for refurbishment planning, scenario analysis and economic evaluation. Planners are therefore accustomed to thinking in terms of variants and to quantifying the effects of envelope and system measures at building level.

At the same time, the presence of IDA ICE, Polysun, GeoTSOL and EED in the Austrian responses indicates that a non-negligible group of practitioners is comfortable with detailed system simulations and with the use of more advanced tools for geothermal and complex heat pump systems. This creates a promising basis for the integrated refurbishment process, provided that interfaces and workflows between EPB, heating load and simulation environments can be made more seamless.

4.3.5. Summary: strengths and gaps in Austria

The Austrian tool landscape for heat pump-based refurbishment of multi-family buildings is rich and multi-layered. National EPB software, heating load tools and dynamic simulation environments are used in complementary ways, and planners appear to be familiar with working across several tools and with using Excel to fill gaps. The presence of geothermal simulators and advanced dynamic tools suggests a relatively high methodological maturity in a subset of offices.

At the same time, the fragmentation of tools and the limited involvement of installers in the upstream planning tools pose challenges. As in Southern Germany, data exchange between EPB, heating load, BIM and manufacturer platforms is often manual, and multi-apartment specific aspects such as riser hydraulics, partial-load behaviour and the interface between envelope measures and system design are not addressed consistently in any single toolchain. There is also a risk that the sophistication of tools remains confined to specialist offices, while smaller firms rely mainly on manufacturer platforms and basic calculators.

4.4. Northern Italy

4.4.1. Survey sample and professional roles

The Northern Italian part of the survey sample comprises fourteen respondents whose primary region of activity lies in South Tyrol (Südtirol/Alto Adige, Provincia di Bolzano), neighbouring alpine regions or northern Italian regions such as Lombardia, Veneto and Emilia Romagna. All of them describe themselves as planners or energy consultants; no respondent identifies primarily as an installer. In addition, a few cross-border respondents report activities that include Northern Italy alongside Austria and Germany.

The Italian sub-sample is therefore smaller and more homogeneous in terms of professional roles than the Austrian and Southern German ones. While this limits the statistical robustness of any conclusions, the responses provide valuable insights into the tool chains of offices that are actively engaged in energy-efficient refurbishment and heat pump projects in the region. These insights are complemented by targeted desk research on the Italian EPB and HVAC software landscape.

4.4.2. Tools by functional domain

In the domain of building and system energy performance and refurbishment planning, Northern Italian respondents emphasise tools that are closely aligned with Italian norms and procedures. Termolog and Edilclima appear repeatedly in the free-text answers to the question on planning tools for heat pump installations; four Italian planners mention each of these tools explicitly. They are used for energy performance certification, "Legge 10" reports, energy balance calculations and the exploration of refurbishment scenarios.

The KlimaHaus/CasaClima calculation environment is another central element, especially for respondents based in South Tyrol. Several planners describe the "KlimaHaus calculation programme" as their main tool for building energy assessments and refurbishment planning. This environment is used both for CasaClima certification and for internal analyses and has a strong influence on how regional actors think about envelope measures, energy balances and the integration of heat pumps [9,10].

Heating load and distribution design in Northern Italy is often handled within the same EPB tools. Termolog, Edilclima and Termus include modules for heating and cooling load calculations according to UNI EN 12831 and related standards. In the survey, three Italian planners explicitly mention Termus as part of their toolchain. Stand-alone heating load tools separate from EPB environments do not appear in the responses, and the regional mapping suggests that, in practice, most Italian practitioners rely on the integrated load modules of their EPB software or on internal Excel-based calculations derived from national standards.

Dynamic building and system simulation is less visible in the Northern Italian survey answers than in the Austrian ones. Some respondents mention "basic simulation software" and "standard heat demand tools", and there are indications that EnergyPlus-based platforms and other dynamic environments are used in specific offices, but concrete product names such as IDA ICE or TRNSYS do not appear in the Italian free-text responses. System simulation tools like Polysun and GeoTSOL are also less prominent, although they may be used in geothermal projects by specialised consultants.

Economic assessment and funding tools are typically embedded in EPB environments or handled through spreadsheets. Italian EPB packages include modules for cost–benefit analysis and for calculating compliance with national incentive schemes. In addition, planners report using their own Excel tools to calculate energy cost savings, payback times and funding implications for different refurbishment variants, often in combination with CasaClima-based scenarios.

4.4.3. Usage patterns by user group (planners vs installers)

Because the Northern Italian sub-sample contains only planners and no installers, the survey does not provide a direct picture of installer tool use in the region. Nevertheless, the planner responses and the desk research suggest that, as in the German-speaking regions, installers rely heavily on manufacturer configurators, documentation and planning guides. These manufacturer tools are used for product selection, source system design and practical implementation details, while planners handle the EPB, heating load and building-level analysis in their own software environments.

Planners in Northern Italy tend to work within a combination of CasaClima, national EPB tools and Excel. CasaClima and the Italian EPB packages provide the formal backbone for regulatory compliance and funding applications, while Excel is used to adapt calculations to project-specific conditions or to explore variants beyond the scope of standard modules. In some offices, especially in South Tyrol, this work is carried out jointly by architects and energy consultants, reflecting the strong integration of envelope and system considerations in CasaClima's approach.

4.4.4. Role of CasaClima, national EPB tools and custom solutions

The defining feature of the Northern Italian landscape is the central role of the KlimaHaus/CasaClima environment and of national EPB software, combined with a relatively high reliance on custom calculations. CasaClima's regional influence means that many practitioners are deeply familiar with performance-oriented envelope concepts and with the interplay between building fabric and system design. Termolog, Edilclima and similar tools ground this work in the national regulatory context and provide the formal basis for energy performance certificates and "Legge 10" documentation.

At the same time, the absence of a dominant, integrated toolchain for multi-apartment heat pump refurbishments is apparent. Heating load, hydraulics, economic analysis and noise assessment are split across different modules and spreadsheets, and there is less evidence of consistent use of dynamic simulation or specialised system tools than in Austria. This, combined with the small sample of installers, suggests that there may be a gap between the relatively sophisticated building-level analysis and the detailed design of heat pump systems and distribution networks in multi-family buildings.

4.4.5. Summary: strengths and gaps in Northern Italy

Northern Italy benefits from strong institutional frameworks around CasaClima and from a mature EPB software ecosystem aligned with national standards. Planners are used to thinking in terms of refurbishment variants and to integrating envelope and system considerations at building level. However, the tool landscape for detailed multi-family heat pump design appears more fragmented and less standardised than in the German-speaking regions.

There is limited evidence of widespread use of dynamic simulation tools and of specialised system simulators in everyday practice, and the survey does not provide a clear picture of installer tool use. Internal Excel tools and bespoke methodologies fill many gaps, but this reduces transparency and makes it harder to transfer good practices across offices and regions. For KnowHowHP, this points to the need to strengthen the link between the well-developed EPB and CasaClima layer and the more operational aspects of heat pump system design and hydraulics in multi-apartment contexts.

4.5. Cross-regional comparison of the tool landscape

4.5.1. Coverage of functional domains in AT/DE/IT

Viewed through the functional taxonomy, all three regions have reasonably good coverage of the core domains of building energy performance, heating load and heat pump sizing. National EPB tools and CasaClima in Northern Italy, the "Energieausweis" software families in Austria and Southern Germany and widely used HVAC packages ensure that building-level energy balances and heating loads can be calculated in a standards-compliant way. Manufacturer tools provide robust support for product-specific sizing and configuration in all three regions.

The stacked bars in Figure 3 summarise how many tools were identified in each functional domain and in each of the three project regions. For building and system energy performance and refurbishment planning, all three regions show a comparable number of tools, reflecting the existence of mature EPB ecosystems aligned with national regulations. Heating load and distribution design is particularly dense in Austria, where a large number of national and German-language HVAC packages are used in parallel, while Southern Germany and Northern Italy rely on a smaller but still substantial set of solutions. In the domain of heat pump sizing and manufacturer tools, the coverage is relatively balanced across regions, with a mix of stand-alone sizing software and vendor platforms. Dynamic building and system simulation stands out as a field where Austria clearly has more tools in active use than Southern Germany or Northern Italy, consistent with the survey evidence on IDA ICE, Polysun, GeoTSOL and similar environments. Economic assessment and incentive tools are present in all three regions, but the chart indicates a stronger concentration in Austria and Northern Italy, where EPB packages, advisory platforms and internal calculators are more frequently combined. Noise and acoustic tools, as well as BIM/MEP and advisory tools, appear as smaller but non-negligible clusters, with Austria again showing a somewhat broader set of dedicated solutions. Overall, the figure confirms that the basic technical domains are covered everywhere, but that the depth and diversity of tool support differ significantly between regions, especially for dynamic simulation and for the economic and acoustic aspects of multi-family heat pump refurbishments.

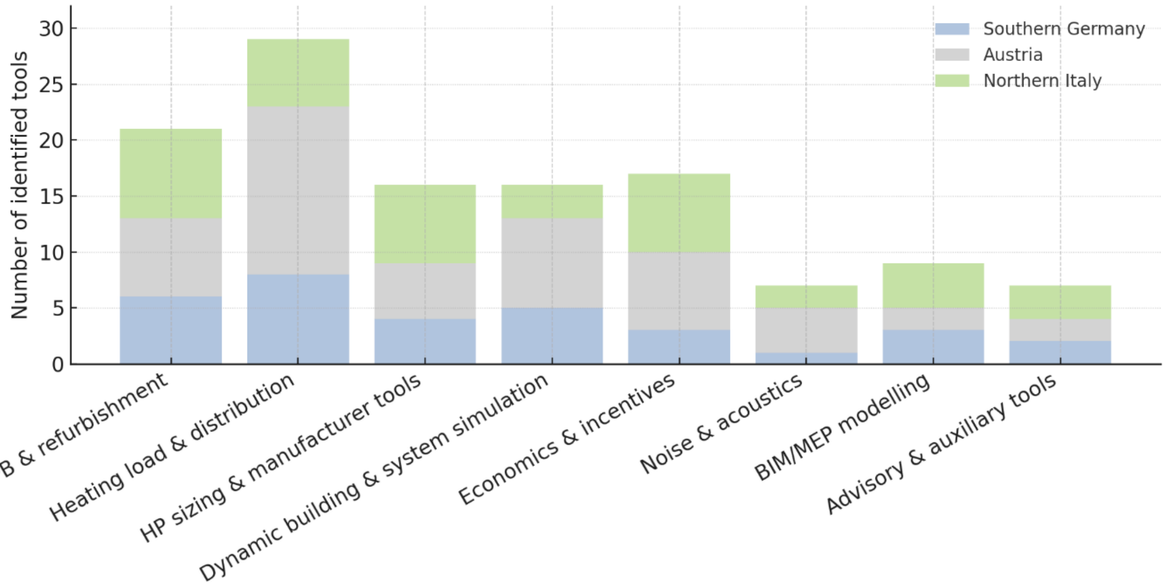

Figure 3: Number of identified tools per functional domain and region (Southern Germany, Austria, Northern Italy).

Differences emerge more clearly in the domains of dynamic simulation, economic assessment and noise/acoustics. Austria exhibits the strongest presence of dynamic simulation tools in everyday planning practice, with IDA ICE, Polysun and GeoTSOL appearing in the survey, while Southern Germany relies more selectively on TRNSYS and Polysun for specific projects. In Northern Italy, dynamic simulation is less visible in the responses, despite the availability of corresponding platforms.

Economic assessment tools are present everywhere but often fragmented, split between EPB modules, external calculators and internal Excel spreadsheets. Noise assessment tools, typically provided by manufacturers or associations, are recognised as important but do not yet form a systematic part of the standard toolchains described by respondents. BIM and MEP environments are important in larger offices in all three regions, but their integration with calculation engines remains partial.

4.5.2. Regional differences in planners' and installers' toolchains

Across regions, planners and installers occupy different positions in the tool landscape. Planners are the primary users of EPB, heating load, BIM and simulation tools; installers focus more on manufacturer platforms and practical implementation aids. This division of labour is most clearly visible in the German-speaking regions, where both groups are represented in the sample.

Regional differences in this pattern reflect the underlying institutional environment. In Austria, planners operate within a dense network of EPB and simulation tools and appear to integrate them relatively fluently. In Southern Germany, planners rely heavily on DIN-based HVAC tools and EPB software, with dynamic simulation used more selectively. In Northern Italy, planners are anchored in CasaClima and national EPB packages, with relatively fewer references to specialised HVAC tools, and rely strongly on internal spreadsheets.

On the installer side, the picture is more limited due to the small sample size, particularly in Northern Italy. Nonetheless, installers in Austria and Southern Germany consistently describe a toolchain dominated by manufacturer configurators and documentation, with only occasional reference to specialist heating load software. This suggests that installers often occupy a position downstream from the main planning tools, relying on planners' outputs and focusing on product selection and installation details.

4.5.3. Typical "tool stacks" for HP refurbishments in multi-family buildings

When the survey responses and regional mappings are interpreted together, typical "tool stacks" for multi-family heat pump refurbishments emerge for each region.

In Southern Germany, a common stack consists of national EPB software and cost calculators for building-level analysis, Hottgenroth or Solar-Computer for heating load and distribution design, optional use of Polysun or TRNSYS for system simulations and manufacturer tools for final sizing and configuration. Excel is used alongside these tools for variant comparisons and economic assessments.

Looking on typical combinations of tool domains and process phases (compare Figure 4), EPB tools are used across all phases from early diagnosis to procurement, with heating-load and distribution tools coming to the fore in concept development and detailed design. Manufacturer sizing tools are mainly active in concept and detailed design, while dynamic simulations are used selectively in those phases for more demanding projects. Economic assessment tools play a visible role in feasibility and procurement, whereas noise, BIM/MEP and advisory tools appear as supporting layers concentrated in concept and design.

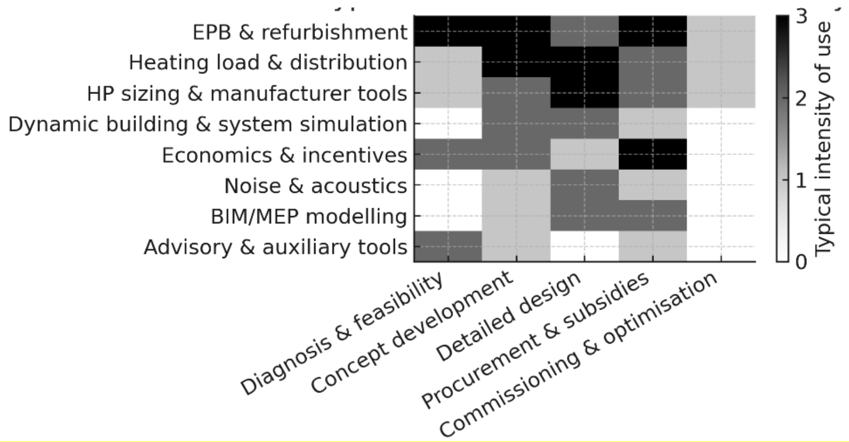

Figure 4: Typical combinations of tool domains and process phases ("tool stacks") for multi-family heat pump refurbishments in Southern Germany. The shading indicates the typical intensity of use of a given domain in each phase of the integrated refurbishment workflow (light = low, dark = high).

In Austria, a typical stack combines national "Energieausweis" software (often linked to funding schemes), Plancal/Nova or similar tools for heating load and HVAC design, optional use of PHPP for detailed building energy balances and IDA ICE, Polysun, GeoTSOL or EED for dynamic system and geothermal simulations. Manufacturer platforms are again used for product-specific sizing, while Excel fills gaps in economic and risk analysis.

The pattern of typical combinations of tool domains and process phases is similar to Germany in structure but with a stronger role for dynamic simulation and national EPB software (compare Figure 5). EPB tools dominate diagnosis, concept and procurement, and dynamic simulation is frequently employed alongside heating-load tools in concept and detailed design. BIM/MEP environments show higher intensity in detailed design than in Southern Germany, reflecting their broader use in coordinated planning. Economic tools, noise calculators and advisory instruments complement this stack, particularly in the early and procurement phases.

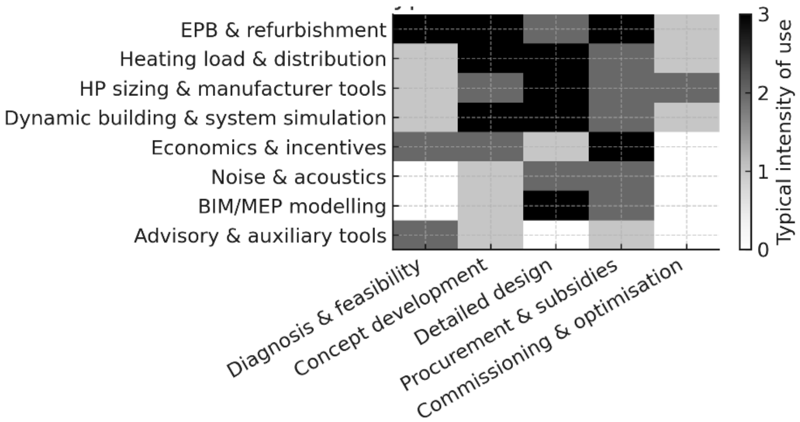

Figure 5: Typical combinations of tool domains and process phases ("tool stacks") for multi-family heat pump refurbishments in Austria. The shading indicates the typical intensity of use of a given domain in each phase of the integrated refurbishment workflow (light = low, dark = high).

In Northern Italy, the stack centres on CasaClima and national EPB tools such as Termolog and Edilclima, with integrated heating load modules and, in some cases, Termus for more detailed heating and cooling load calculations. Excel plays a major role in economic assessments and in bridging between EPB outputs and detailed system design, while manufacturer tools handle product selection and configuration. BIM environments and dynamic simulation platforms appear in specific offices but are not yet part of a broadly standardised workflow.

The typical combinations of tool domains and process phases (compare Figure 6) EPB and refurbishment tools, including CasaClima and national software, are the backbone of all early and procurement phases, while heating-load and distribution functions are mostly handled through integrated modules in these platforms. Manufacturer tools for heat pump sizing are important in concept and detailed design, but the shading for dynamic simulation remains light across all phases, indicating more limited routine use. Economic assessment is again concentrated in feasibility and procurement, often implemented through EPB modules and spreadsheets. BIM/MEP tools and noise calculators are present but less central than in Austria, and advisory tools play a supporting role in early client discussions.

Co-funded by the European Union

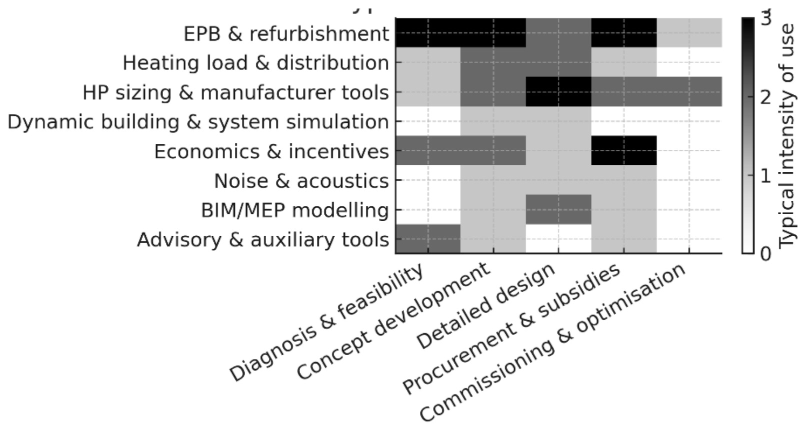

Figure 6: Typical combinations of tool domains and process phases ("tool stacks") for multi-family heat pump refurbishments in Northern Italy. The shading indicates the typical intensity of use of a given domain in each phase of the integrated refurbishment workflow (light = low, dark = high).

Across all three regions, the picture is one of overlapping but fragmented toolchains rather than of fully integrated, end-to-end solutions. This fragmentation contributes directly to the obstacles and knowledge gaps identified in D2.1 [1] and reinforces the need for an integrated, role-specific planning process and digital toolbox that can connect existing tools more effectively, provide missing functionalities and support coherent training across Southern Germany, Austria and Northern Italy.

5. TOOL FACTSHEETS

This chapter explains how the individual planning instruments and tools identified in Chapter 4 are documented in a consistent way. The tool factsheets are the backbone of D2.2: they translate the heterogeneous survey responses, regional mappings and desk research into a harmonised set of short descriptions that can be read independently, but also analysed and aggregated across Southern Germany, Austria and Northern Italy.

5.1. Concept and objectives of the tool factsheets

The primary objective of the tool factsheets is to make the tool landscape transparent and comparable. Each factsheet captures, on one page or less, what a given tool is, what it is used for in practice, who uses it, where it is used and how it contributes – or fails to contribute – to an integrated planning process for heat pump refurbishments in multi-story buildings. By applying the same structure to every tool, the factsheets turn a set of free-text survey answers and partner inputs into a structured "dictionary" of planning instruments.

The factsheets serve several functions within KnowHowHP. For WP2, they provide a detailed reference behind the narrative in Chapters 3 and 4 and allow interested readers to look up the specifics of individual tools. For WP3 and WP4, they form an input to the design of the digital toolbox and the training concepts, because they highlight which functionalities are already available, which are missing and where integration potential exists. For WP5 and beyond, they can be used as a basis for up-to-date online documentation, for example in the planned wiki and chatbot environment.

To achieve these functions, the factsheets follow a concise, text-based format that can be generated from a common metadata structure. This metadata is described in the following sections.

5.2. Metadata fields and coding rules for tools

The metadata framework defines which information is collected for each tool and how this information is coded. It establishes a link between the qualitative descriptions in the factsheets and the quantitative and categorical analysis in the rest of the deliverable. The fields are grouped into several logical blocks: identification and vendor, functional domains and process phases, regional use, user groups, role in the integrated workflow, interoperability, licensing and language, and a qualitative assessment of strengths and limitations with respect to integral heat pump planning.

5.2.1. Identification and vendor

Each tool is first identified by its official name, the name of the vendor or provider and, where relevant, the specific module or version used in practice. This ensures that different products from the same vendor can be distinguished and that the factsheets refer unambiguously to a given software or platform. If a tool is known under various abbreviations or local names, the most common variants are noted in the text of the factsheet, but the metadata uses a single unique identifier.

For tools that are clearly modular, such as EPB platforms with separate heating load or economic modules, the module relevant to heat pump refurbishments is specified. If different modules play different roles in the workflow, separate factsheets can be created, but in many cases one factsheet is sufficient, with the internal modules described under functional domains.

5.2.2. Functional domains and process phases

The second block of metadata assigns each tool to one or more functional domains, as defined in Chapter 3. These domains (for example building and system energy performance and refurbishment planning, heating load and distribution design, heat pump sizing and manufacturer tools, dynamic simulation, economic assessment, noise and acoustics, BIM and MEP, advisory and auxiliary tools) describe the primary technical purpose of the tool. Because many tools span several domains, multiple assignments are possible and are coded explicitly.

In addition, each tool is mapped to the phases of the integrated refurbishment workflow in which it is typically used. The phases correspond to the process steps outlined in WP2: early diagnosis and feasibility, concept development and variant comparison, detailed design and dimensioning, procurement and subsidy handling, commissioning and optimisation. The metadata record one or more phases for each tool. In the factsheet text, this mapping is described in prose, for example by stating that a tool is predominantly used in early feasibility and concept development, with limited use in later phases.

5.2.3. Regional use (Southern Germany, Austria, Northern Italy)

The third block of metadata captures where a tool is used. For each tool, three region flags indicate whether it is used in Southern Germany, Austria and Northern Italy respectively. In addition, a simple intensity scale is applied within each region. In practice, three categories are distinguished: core tool, relevant tool and niche tool.

Core tools are those that appear frequently in the survey responses for a given region, are well known to project partners and are central to typical “tool stacks” in that region. Relevant tools are mentioned less often but still play a role in a significant number of projects or offices. Niche tools are those that appear only once or twice in the data, that are used only in specific subsegments of the market or that are mainly of interest for specialised cases.

The coding of regional use and intensity combines information from the survey, the regional tool mappings and the additional tool research. It does not claim statistical precision, but provides a robust qualitative picture that is sufficient for comparing tools and for drawing conclusions about their relevance in different parts of the project area.

5.2.4. User groups (planners, installers, both)

The fourth block distinguishes between user groups. For each tool, the metadata indicate whether it is used primarily by planners and energy consultants, primarily by installers and contractors, or by both. Where possible, this coding is based on the branch-specific survey questions: tools listed in the planner branch are initially coded as "planner tools", those in the installer branch as "installer tools".

Because only a small number of installers responded to the survey, particularly in Northern Italy, this information is complemented by partner inputs and general knowledge of the market. Manufacturer configurators, for example, are typically coded as "installer" or "both" tools, even if they also appear in some planner responses. EPB software, by contrast, is primarily a planner tool, even though installers may occasionally use its outputs. In ambiguous cases, the factsheet text explicitly notes differences in use between roles.

5.2.5. Role in the integrated refurbishment workflow

The fifth block of metadata describes the role of each tool in the integrated refurbishment workflow. While the assignment to process phases indicates when a tool is used, this field focuses on what it contributes in those phases. It summarises, in a few keywords, the main functions that the tool fulfils in a typical multi-family heat pump project, for example initial feasibility screening, detailed heating load calculation, dimensioning of emitters and distribution systems, configuration of heat pump products and source systems, generation of formal documentation for subsidies or support for commissioning and optimisation.

In the factsheet text, this role is described in one or two sentences that link the tool to specific tasks in example projects. This makes it easier for readers to see how a tool fits into the bigger picture and where potential overlaps or gaps with other tools might exist.

5.2.6. Interoperability, data formats and interfaces

The sixth block of metadata addresses interoperability. For each tool, the main input and output formats are recorded, along with any known interfaces to other tools or platforms. This includes, for example, support for open standards such as IFC, gbXML or CSV, direct links to national EPB registries, the ability to import geometries from CAD or BIM environments, or export of calculation results in machine-readable form.

If a tool is essentially closed, accepting only manual input and producing only static PDF or printed output, this is noted. If it has specific interfaces to other widely used tools in the regions, these are described. The purpose of this field is not to provide an exhaustive technical specification, but to give a clear indication of how easily the tool can be integrated into an overall digital workflow and whether it can realistically feed into the future toolbox.

5.2.7. Licensing, language and availability

The seventh metadata block covers licensing, language and availability. Licensing distinguishes, in broad terms, between commercial licences (perpetual or subscription-based), free but closed-source tools (for example calculators from associations or public bodies), open-source software and internal or proprietary tools developed by individual organisations. Where relevant, the typical cost level and licence model are described in the factsheet text.

Language and regional adaptation record the languages in which the user interface and documentation are available (for example German only, Italian only, German and Italian, English and local language) and the regulatory frameworks implemented by the tool. This is important because many tools are only recognised for specific national procedures and are thus effectively tied to one region. Tools that are available in multiple languages and implement more than one national framework are explicitly highlighted, as they offer potential for cross-regional training and transfer.

5.2.8. Strengths and limitations with respect to integral HP planning

The final metadata field is qualitative. For each tool, the factsheet includes a short assessment of its strengths and limitations in the context of integral heat pump refurbishment of multi-story buildings. This assessment synthesises survey comments, partner experience and expert judgement and focuses on aspects that are particularly relevant for the project.

Strengths may include, for example, the ability to handle multi-apartment hydraulics, robust implementation of relevant standards, good integration with other tools, strong support for refurbishment variants, or widespread use in practice. Limitations might be the lack of explicit support for low-temperature operation, limited treatment of domestic hot water and Legionella-safe concepts, poor consideration of noise and acoustic constraints, weak interoperability or user interfaces that are not well suited to interdisciplinary collaboration.

The aim is not to "score" tools in a quantitative way, but to provide a nuanced picture that can inform later discussions about which tools to build on, which to complement and where the digital toolbox needs to provide additional functionality.

The reading guide explains that the factsheets are intended as concise reference pieces, not as user manuals. They do not replace vendor documentation but provide enough information to understand where each tool sits in the landscape and how it relates to the integrated planning process.

5.3. Individual tool factsheets

The individual tool factsheets themselves are presented in Annex A. For each identified tool, the factsheet follows the structure and coding rules described above. Together, they form a compact but comprehensive catalogue of the planning instruments that currently shape heat pump refurbishments in multi-story buildings in Southern Germany, Austria and Northern Italy.

By keeping the main body of the deliverable focused on patterns, comparisons and implications, while relegating the detailed tool descriptions to the annex, D2.2 maintains readability and at the same time provides a high level of transparency and traceability. Readers can, at any point, move from the aggregated analyses in Chapters 3 and 4 to the tool-specific information in Annex A and vice versa.

6. EXISTING TRAINING OFFERS RELATED TO HP-BASED REFURBISHMENT

In parallel to the analysis of planning instruments and tools, WP2 has mapped a wide range of training offers that are relevant for heat-pump-based refurbishment of multi-family buildings. The survey, interviews and regional desk research show that planners, energy consultants and installers in Southern Germany, Austria and Northern Italy access very different types of courses and programmes, ranging from initial vocational education to highly specialised CPD modules and manufacturer seminars. At the same time, many of the obstacles and knowledge gaps identified in D2.1 [1] relate not only to missing tools, but to missing or fragmented training content: for example, the limited treatment of multi-apartment hydraulics, partial-load behaviour, envelope–system integration or acoustic constraints in existing courses.

To describe this landscape in a way that is comparable across regions and professional roles, D2.2 groups the training offers into five functional categories. These categories do not replace national or institutional classifications, but provide a pragmatic structure for analysing how current training systems contribute to, or fall short of, the competences needed for integrated HP refurbishments in multi-family buildings. The categories cut across regions: similar types of programmes exist in Southern Germany, Western and Eastern Austria and Northern Italy, even though their institutional form, duration and emphasis differ.

6.1. Functional categories of training offers

The functional categories reflect both the typical career stage of participants and the level of specialisation. Initial vocational education and training represents the foundational layer for installers and, to a lesser extent, for planners; continuing professional development and short courses represent the main vehicle for upskilling existing professionals; manufacturer trainings and in-house programmes are central for product-specific skills and practical know-how; university and university of applied sciences courses provide the academic underpinnings for integrated planning; and online modules, webinars and self-learning formats create flexible, scalable channels for updating knowledge and disseminating new methods.

Across these categories, the content and pedagogical approaches vary widely. Some programmes are explicitly framed around heat pumps and refurbishment, such as dedicated HP planner/installer courses or refurbishment and heating-system replacement curricula. Others embed heat pumps as one of several system options within broader topics such as “renewable energy systems”, “building services engineering” or “energy consulting”. For KnowHowHP, the key question is not primarily where each programme sits institutionally, but which phases of the integrated refurbishment process and which functional tool domains they support.

6.1.1. Initial vocational education and training (VET)

Initial vocational education and training forms the entry point into the professions most directly involved in HP-based refurbishment, especially for installers and building-services technicians. In the project regions this includes, for example, the dual apprenticeship system for sanitary, heating and air-conditioning trades in Germany, the Lehrberufe "Installations- und Gebäudetechnik" and "Kälteanlagentechnik" in Austria and the IFP or ITS pathways in Italy for building services and refrigeration. These programmes typically span several years and combine school-based theoretical instruction with on-the-job training.

VET programmes cover many foundational elements that are relevant for heat pump refurbishments: basic thermodynamics, fluid mechanics, electrical safety, pipework design, conventional boiler systems, simple control concepts and, increasingly, the basics of refrigeration and heat pump technology. They also introduce national norms and regulations, occupational safety and often some elements of customer communication. However, their focus is usually on system types and installation practice in general, not on the specific challenges of integrating heat pumps into existing multi-apartment buildings.

For example, apprentices learn how to install and commission a monovalent or bivalent heat pump in a typical single-family setting, but they rarely engage with issues such as riser hydraulics in multi-storey buildings, phased refurbishment scenarios, acoustic constraints in dense urban environments or the coordination of envelope measures and heating system design. Nor do they systematically work with the planning tools described in Chapter 3, such as EPB software, advanced heating load calculation tools or simulation environments. This means that initial VET provides a necessary but not sufficient foundation for the kinds of integrated HP refurbishments targeted by KnowHowHP; further upskilling through CPD and manufacturer trainings is essential.

6.1.2. Continuing professional development (CPD) and short courses

Continuing professional development and short courses constitute the main mechanism through which practising planners, energy consultants and installers acquire new skills and knowledge related to heat pumps and refurbishment. In all three regions, energy agencies, chambers, professional associations and training providers offer a variety of CPD programmes, ranging from short evening seminars to multi-module curricula. Examples include energy-consultant courses that span several weeks or months, refurbishment and heating-system replacement classes for portfolio managers and property managers, and HP-specific seminars on design and operation.

In functional terms, CPD courses related to HP-based refurbishment fall into several clusters. Some focus on broad energy consulting for residential buildings and embed heat pumps as one of several system options, covering envelope renovation, ventilation, funding schemes and typical heating concepts. Others are explicitly centred on heat pumps, addressing topics such as correct load-based dimensioning, source-system design, emission systems in existing buildings, partial-load operation, integration with PV and storage, and typical design errors. A third cluster deals with refurbishment and heating-system replacement in multi-family buildings more generally, combining legal and organisational aspects with technical modules on heat pumps, district heating or hybrid solutions.

CPD courses are the category that comes closest to the “integrated refurbishment workflow” developed in WP2, particularly when they are designed as multi-day or multi-module programmes. Some of the offers identified in Western and Eastern Austria and Southern Germany already incorporate several of the integrated process elements, such as early envelope–system coordination, use of planning tools along the process and consideration of economic and acoustic boundary conditions. In Northern Italy, the CasaClima training pathways and similar offers play a comparable role in combining envelope and system thinking. However, across regions there are still pronounced gaps: multi-apartment hydraulics, interdisciplinary digital workflows and commissioning and optimisation of HP systems in retrofit contexts are not yet consistently covered.

6.1.3. Manufacturer trainings and in-house programmes

Manufacturer trainings and in-house programmes form a distinct and highly influential category, especially for installers and technicians, but also for planners who work closely with specific brands. All major heat pump manufacturers in the project regions operate their own “Akademie”, “training centre” or online training offerings. These programmes range from basic introductions to a manufacturer’s HP product portfolio through to advanced courses on system design, noise and acoustic design, commissioning, troubleshooting and use of manufacturer-specific planning tools and configurators.

Functionally, manufacturer trainings belong to the “heat pump sizing and manufacturer tools” domain and to the practical parts of the integrated workflow, particularly detailed design, installation, commissioning and early optimisation. They are the main channel through which installers learn to navigate manufacturer toolboxes, configurators and service platforms, and they often address practical issues such as refrigerant handling, error codes, the interaction between HP units and existing distribution systems and the specifics of hybrid configurations. Manufacturers also frequently cover acoustic constraints, siting, frost and defrost behaviour and hydraulics in a product-specific way.

From an integrated refurbishment perspective, these trainings have both strengths and weaknesses. On the one hand, they address real-world issues that are often missing from more generic CPD courses and they introduce the digital tools that installers actually use in practice. On the other hand, they are typically brand-specific and focus on optimising a single-product solution, rather than on system-level or building-level design across multiple options. Interdisciplinary collaboration with planners, links to EPB tools, dynamic simulations and broader economic considerations tend to be secondary. For KnowHowHP, manufacturer trainings are therefore seen as an important complement to, but not a substitute for, more holistic CPD programmes.

In-house programmes in energy agencies, housing companies or large planning offices fall into a similar category. They are often tailored to specific portfolios or internal workflows and can be very effective in disseminating project-specific lessons learned, including about heat pump retrofits in multi-family buildings. However, their reach is limited to the organisation in question and their content is rarely visible to the wider training landscape.

6.1.4. University and university of applied sciences courses

University and university of applied sciences (UAS) programmes form the academic backbone for many of the planners and engineers involved in HP-based refurbishment. Bachelor and master programmes in architecture, civil engineering, building services, renewable energy engineering and environmental engineering across the three regions typically include modules on building physics, heating and cooling systems, renewable energy systems and energy-efficient building design. In some cases, specialised postgraduate programmes focus explicitly on sustainable building and refurbishment.

Functionally, university and UAS courses mainly feed into the competence requirements associated with the early phases of the integrated workflow and with the more complex analytical tools introduced in Chapter 3. Students learn the fundamentals of heat and mass transfer, system and control theory, building energy balance equations, regulation and policy frameworks and, in more advanced courses, the use of simulation tools such as IDA ICE, TRNSYS or EnergyPlus. They also become familiar with EPB frameworks, design norms and, increasingly, BIM and digital-twin concepts.

However, there are structural gaps when looking specifically at HP-based refurbishment in multi-family buildings. While heat pumps are widely covered as a technology, refurbishment-specific issues such as integrating HPs into existing multi-apartment hydraulics, staged refurbishment strategies, acoustic constraints in dense urban contexts or the practicalities of funding and stakeholder management in condominium settings are often only touched on briefly or not at all. Likewise, many university courses remain tool-agnostic and focus on theoretical fundamentals, leaving practical EPB tools, manufacturer platforms or digital collaboration workflows to be learned later in the workplace or via CPD.

Despite these gaps, university and UAS programmes play an essential role in forming the "conceptual backbone" that allows graduates to understand and eventually master complex, integrated design processes. For KnowHowHP, they form a natural partner for embedding elements of the integrated refurbishment workflow into revised curricula and for providing advanced modules, for example in dynamic simulation or integrated design studios that include HP-based retrofit scenarios.

6.1.5. Online modules, webinars and self-learning formats

Online modules, webinars and self-learning formats constitute a rapidly growing category that cuts across all roles and regions. National agencies (such as ENEA in Italy or klimaaktiv in Austria), energy institutes, associations and manufacturers increasingly use online platforms to disseminate up-to-date HP and refurbishment knowledge. Examples include free e-learning modules on heat pump fundamentals, webinars on new funding schemes, recorded seminars on successful multi-family HP retrofits and manufacturer-hosted video series on commissioning and troubleshooting.

Functionally, these formats serve several purposes. They are an efficient vehicle for awareness-raising and basic upskilling, especially for busy practitioners who cannot attend multi-day courses. They allow rapid updates when regulations, subsidies or technologies change, bridging the time lag between major curriculum revisions. They also offer the possibility to integrate learning with digital tools directly, for example through tutorial videos on using EPB software, simulation environments or manufacturer configurators.

At the same time, online formats have inherent limitations. They rarely provide the depth, structured feedback and hands-on practice needed for mastering complex tasks such as integrated HP system design in multi-family refurbishments. Their use is highly dependent on self-motivation and digital literacy, and they are often consumed in a fragmented way. Certification and formal recognition vary widely; some online modules lead to credit points or certificates, others are purely informational.

For KnowHowHP, online modules, webinars and self-learning content are an important complement to VET, CPD and manufacturer trainings, particularly for scaling up basic HP literacy and for disseminating elements of the integrated refurbishment workflow across regions and languages. They can also be used to support blended learning concepts, where face-to-face or synchronous sessions focus on discussion and practical work, while theoretical content and tool introductions are provided online. The planned KnowHowHP wiki and chatbot, which will host training content and tool information, fit into this category and will themselves become building blocks in the future training landscape.

6.2. Southern Germany

6.2.1. Overview of relevant training providers

In Southern Germany, the landscape of HP-related training offers for refurbishment is shaped by a mix of regional energy agencies, universities of applied sciences, specialised academies and national associations. On the non-academic side, the Energie- und Umweltzentrum Allgäu (eza!) plays a key role as a long-standing training provider for energy consultants, planners and installers in the Allgäu region, offering energy-consultant courses, specialist seminars and installer trainings, and operating a partner network of more than one hundred building and energy businesses that commit to regular upskilling [15]. The in Southern Germany, universities of applied sciences, in particular the Technische Hochschule Rosenheim (THRo), Hochschule München, Hochschule Esslingen and Hochschule Biberach, represent the academic backbone, with degree programmes in energy engineering, building services and resource-conserving architecture that integrate HP-related topics and, in the case of THRo, specific further-education courses such as the "heat pump certificate of competence" under VDI 4645.

Another important actor is the Heat Pump Academy, which offers a coherent series of HP-focused courses ranging from basic planning modules to specialist seminars on operation and refurbishment. Its programme includes BAW modules on design and planning of heat pumps, modules dedicated to HPs in existing buildings and certification courses according to VDI 4645 [7] for planners and installers. The German Heat Pump Association (Bundesverband Wärmepumpe, BWP) complements these offers with its own seminars, as well as a strong focus on tools and planning aids [17].

The vocational-training layer is covered by chambers, craft guilds and the regional branches of the Handwerkskammern, which run Meisterkurse and specialist courses in heating and refrigeration technology. While these are not always branded specifically as "heat pump" training, they are the institutional framework within which installers in Southern Germany gain the deeper technical competence that is later extended through HP-specific modules. Together, these providers form a dense but heterogeneous training ecosystem in which HP-based refurbishment is increasingly addressed, but often as one topic among many.

6.2.2. Training offers for planners and energy consultants

For planners and energy consultants in Southern Germany, there is a broad portfolio of CPD and academic offers that are relevant to HP-based refurbishment. eza! offers energy-consultant training for professionals in the Schwaben region, with curricula that cover building physics, envelope measures, heating systems, ventilation, funding schemes and the specific challenges of refurbishing multi-family buildings. Within these programmes, heat pumps are treated as a core technology alongside district heating, biomass and other options, and practical examples of HP retrofits in apartment buildings feature prominently in seminars and workshops.

The Heat Pump Academy's "BAW Schulung Modul 1: Auslegung und Planung von Wärmepumpen" and "Modul 5: Wärmepumpen im Bestand" address planners and engineers who need to design heat pump systems in new and existing buildings. Module 1 focuses on fundamentals, dimensioning according to DIN EN 12831 and the selection of appropriate units, while Module 5 explicitly targets planning in existing buildings, including interactions with existing distribution systems and building fabric. The Academy also offers VDI 4645-certified courses for planners ("VDI 4645 P"), which end with a standardised exam and confer a recognised HP competence certificate.

At the academic level, Hochschule Biberach trains the next generation of energy and building engineers through its bachelor programme "Energie-Ingenieurwesen – Gebäude, Energie, Umwelt" and the master programme "Energie- und Gebäudesysteme". These curricula integrate building-energy systems, heat pump technology, simulation and integrated building design, thus anchoring HP-based refurbishment as part of a broader competence in sustainable building and neighbourhood design. TH Rosenheim's courses and lectures in building technology, heating and cooling, and its own HP competence courses complement this academic offer by emphasising practical, project-based learning and close links to the building industry.

In addition, the BWP and regional engineering chambers offer shorter seminars for energy consultants that address specific issues such as HPs in existing buildings, funding schemes (BEG) and interactions between HPs and ventilation systems in multi-family housing. Together, these offers help to close typical knowledge gaps identified in D2.1 [1], particularly around dimensioning HPs in existing multi-apartment buildings and understanding funding and regulatory frameworks.

6.2.3. Training offers for installers and contractors

For installers and contractors, the Southern German training landscape is dominated by the Heat Pump Academy, TH Rosenheim, eza! and manufacturer academies, all of which build on the basic skills acquired in initial vocational education. The Heat Pump Academy's "VDI 4645 PE" and "VDI 4645 P/E" courses explicitly target installers and emphasise the practical aspects of HP integration: correct installation, hydraulic connection, commissioning, error diagnostics and customer handover, all in line with the VDI standard. Seminars such as "WP-Betrieb" focus on operation, optimisation and long-term performance of installed systems, which is crucial for ensuring that refurbished buildings actually deliver the expected savings.

TH Rosenheim has, in recent years, offered HP competence courses for installers and has partnered with VDI to teach the "Wärmepumpen-Sachkundelehrgang" based on VDI 4645. eza! complements this with installer-specific courses and workshops in Schwaben that bring together HP manufacturers, energy agencies and craftspeople to discuss practical obstacles in existing buildings, such as lack of space for outdoor units, noise, and limitations of existing radiators.

Manufacturer academies (for example those of Viessmann, Bosch, Stiebel Eltron and others) provide intensive product-specific training, including on-site training in manufacturer training centres and on-line modules. These programmes address installation details, error diagnostics, refrigerant handling, acoustic optimisation and integration of the manufacturer's HP units into existing distribution systems and control environments. They also introduce manufacturer-specific planning tools and provide guidance on using them in refurbishment projects.

Together, this installer-focused training ecosystem provides solid coverage of HP technology and practical integration topics, but, as D2.1 suggests, content around interdisciplinary coordination with planners, understanding of the broader refurbishment context and the use of planning tools remains patchy and often brand-specific.

6.2.4. Integration of planning tools into trainings

The degree to which digital planning tools are integrated into training offers in Southern Germany varies significantly between providers and target groups. The Heat Pump Academy uses national norms and digital tools as an explicit reference framework: the BAW modules and VDI 4645 courses link directly to standards such as DIN EN 12831, DIN EN 442 and VDI 4645 and introduce the BWP-Planer, a web-based tool that combines these standards to support the dimensioning of HP systems in existing buildings. Within these courses, participants work with simplified calculation tools and see how standard-compliant heating load calculations, emitter capacities and VDI 4645 system schemata are combined in digital workflows. BWP, for its part, explicitly promotes the integration of its planning tools and calculators into everyday design work and refers to them in its seminars and workshops. eza! also gradually incorporates software-supported planning into its energy-consultant and installer courses, as part of teaching the KnowHowHP-integrated process. In the energy-consultant training in Schwaben, participants learn to use national EPB software, heating-load tools and simple economic calculators alongside conceptual content on envelope and system refurbishment.

At the academic level, Hochschule Biberach, Hochschule München, Hochschule Esslingen and TH Rosenheim expose students to more advanced tools such as dynamic simulation environments and BIM platforms in project-oriented courses. However, the explicit combination of these tools in a fully integrated HP refurbishment workflow, is not yet standard and represents an area where the project content can meaningfully add value.

By contrast, many manufacturer trainings still focus on proprietary configurators and internal planning tools, without systematically teaching how these connect to independent EPB, load or simulation tools. From the viewpoint of WP2, this means that while tool-specific competence is built, integrative digital workflows along the entire refurbishment process remain underdeveloped in current training offers.

6.2.5. Summary: strengths and gaps in Southern Germany

In summary, Southern Germany has a rich and relatively mature landscape of training offers related to heat-pump-based refurbishment. For planners and energy consultants, institutions such as eza!, TH Rosenheim, Hochschule München, Hochschule Esslingen, Hochschule Biberach, the Heat Pump Academy and BWP provide a dense mix of academic and practice-oriented programmes that cover HP fundamentals, system design, refurbishment strategies and regulatory and funding contexts. For installers and contractors, VDI 4645-based courses, manufacturer academies and regional seminars offer targeted upskilling in installation, commissioning and troubleshooting of HP systems in existing buildings.

The main strengths of this landscape are the breadth of offerings, the existence of recognised HP competence certificates (for example VDI 4645), the embedding of HP topics in academic curricula and the increasing emphasis on refurbishment-specific issues in CPD programmes. There is also a growing awareness of the need to integrate planning tools into training, as evidenced by the use of BWP-Planer and national EPB and heating-load tools in several courses.

At the same time, important gaps remain. Most training offers still treat HPs primarily at the scale of individual systems or single-family houses; multi-apartment hydraulics, phased refurbishment of large portfolios, and the detailed interplay between envelope measures, HP systems, noise constraints and user behaviour in multi-storey buildings are still the exception rather than the rule. Integration of different tool classes along an end-to-end digital workflow is only partially addressed, with manufacturer tools sitting somewhat apart from EPB, load and simulation environments. Interdisciplinary collaboration between planners and installers is often mentioned as a goal but rarely systematically practised in joint training formats.

From the perspective of KnowHowHP, this means that Southern Germany offers a strong foundation on which to build: the institutional structures, experience with HP training and acceptance of standards such as VDI 4645 are in place. The challenge and opportunity for the project lies in using this foundation to introduce the integral refurbishment workflow and associated toolbox into existing courses, create joint planner–installer formats and strengthen the coverage of multi-family HP retrofit specifics in this otherwise well-developed training ecosystem.

6.3. Austria

6.3.1. Overview of relevant training providers

In Austria, the training landscape that is relevant for HP-based refurbishment builds on a dense network of regional energy agencies, national initiatives, vocational training centres and higher-education institutions. A central structuring role is played by the Arbeitsgemeinschaft Energieberater/innen-Ausbildung (ARGE-EBA), which sets the nationwide professional standard for energy-consultant training. All federal provinces, either directly or via their energy agencies, are represented in ARGE-EBA, and the A- and F-Kurs system for energy consultants is implemented in a harmonised way throughout the country [11].

Regional energy agencies such as Energieinstitut Vorarlberg, Energie Tirol, the Energieagentur Steiermark and the Energie- und Umweltagentur des Landes Niederösterreich (eNu) deliver these ARGE-EBA courses and supplement them with specialised refurbishment and building-services modules. In Western Austria, the Energieinstitut Vorarlberg, often together with the Bauakademie, offers the modular "Sanierungsberaterkurs", which targets architects, master builders, installers and energy consultants and focuses explicitly on energy-efficient refurbishment and heating-system change. In Eastern Austria, eNu and WIFI Niederösterreich cooperate to run the ARGE-EBA A- and F-Kurse for energy consultants.

A second axis in the Austrian training landscape is the national "Wärmepumpe Weiterbildung" initiative, coordinated by Wärmepumpe Austria, the AIT Austrian Institute of Technology and the Österreichische Akademie der Kältetechnik. Its dedicated platform, waermepumpe-weiterbildung.at, bundles HP courses offered in Vienna, Mödling and other locations and leads to personal certification for planners and installers in line with the new EU-DVO 2024/2215 [6].

Universities and universities of applied sciences form the third pillar. FH Burgenland's master's programme "Sustainable Energy Systems" includes, as a core element, a module "Refrigeration and Heat Pumps Technology & Geothermal Energy". FH Technikum Wien's new master "Climate-Responsive Building Technologies" trains graduates in integrated building design, BIM and simulation, with explicit modules on heating and air conditioning as well as BIM & Simulation. Donau-Universität Krems (University for Continuing Education Krems) offers the part-time certificate programme "Building Services Engineering – Heating, Air Conditioning, Ventilation, Automation", which gives practicing engineers a systematic framework for modern building-services engineering. FH Campus Wien (HCW) runs an academic expert programme "Building Services Engineering" that addresses HVAC and electrical systems in the context of low-energy and passive standards.

Finally, renowave.at and the ÖVI Immobilienakademie have emerged as important actors for property managers and project developers. Their jointly developed "Lehrgang Nachhaltige Gebäudesanierung und Heizungstausch" focuses on the technical, legal and organisational aspects of sustainable refurbishment and heating-system replacement in multi-storey housing [16].

6.3.2. Training offers for planners and energy consultants

For planners and energy consultants, Austria offers a dense and structured set of training opportunities that touch on almost all elements of HP-based refurbishment. At the core are the ARGE-EBA energy-consultant courses, organised in two stages: the Grundkurs (A-Kurs), with around 50 teaching units, provides an introduction to energy-efficient building and refurbishment and covers building physics, U-value and heating-load calculations, heating systems, solar energy and cost and economic considerations. The Fortsetzungslehrgang (F-Kurs) deepens these topics with specialty modules on energy-efficient refurbishment, advanced building physics, energy performance certificates and integrated refurbishment concepts. Graduates of the A+F courses are admitted to regional energy-consultant networks and form a key target group for HP-related upskilling.

The Sanierungsberaterkurse of Energieinstitut Vorarlberg, Energie Tirol and their partners build explicitly on this foundation. They concentrate on the particular requirements of energy-efficient refurbishment, including staged refurbishment in existing buildings, the interaction between envelope and building services, and the choice and design of heating systems in multi-family contexts. In Western Austria, these courses already include detailed discussions of HP solutions in residential refurbishment and are targeted at planners, master builders, installers and energy consultants alike.

In Eastern Austria, planners can additionally access the AIT/Wärmepumpe Austria course "Planung, Errichtung und Wartung von Wärmepumpen mit Personenzertifizierung gemäß EU-DVO 2024/2215" delivered in Vienna and Mödling. Although formally geared towards heating and gas/sanitary technicians, electrical installers and mechatronics engineers, it is increasingly used by planners as a structured way to deepen their HP competences. The course covers HP and refrigeration fundamentals, planning and installation practice and cold-circuit maintenance, and leads, subject to prerequisites, to the certificates "Zertifizierter Wärmepumpeninstallateur bzw. -planer" and refrigeration Category II. WIFI Wien and other WIFIs in Lower and Upper Austria offer mirror courses that follow the same modules and explicitly prepare for EU-DVO-compliant Category II certification.

The renowave/ÖVI "Lehrgang Nachhaltige Gebäudesanierung und Heizungstausch" adds a strong process and governance dimension. Conceived as a nine-day continuing-education course for property managers and project developers, it covers the technical fundamentals of building refurbishment and heating-system replacement, including HPs, but places them firmly in a framework of project development, condominium law, stakeholder processes and financing. This is particularly relevant for planners who advise housing companies or work in multi-discplinary project teams.

On the academic side, FH Burgenland's master programme "Sustainable Energy Systems" gives engineers an in-depth understanding of sustainable energy systems, with a dedicated module on "Refrigeration and Heat Pumps Technology & Geothermal Energy" that addresses the design and assessment of HP and geothermal systems. FH Technikum Wien's master "Climate-Responsive Building Technologies" and the postgraduate "Building Services Engineering – Heating, Air Conditioning, Ventilation, Automation" at Donau-Universität Krems train building-services and energy engineers in integrated building technology, HVAC systems and control, with heat pumps naturally integrated as key technologies. The academic expert programme "Building Services Engineering" at FH Campus Wien similarly focuses on integrated HVAC solutions in low-energy and passive buildings, preparing graduates to design and analyse complex building-services systems, including HPs, in refurbishment contexts.

6.3.3. Training offers for installers and contractors

For installers and contractors, Austria's HP-related training is anchored in the same national Wärmepumpe Weiterbildung framework [12] but is complemented by strong vocational and manufacturer offerings. The AIT/Wärmepumpe Austria course "Planung, Errichtung und Wartung von Wärmepumpen mit Personenzertifizierung gemäß EU-DVO 2024/2215" is the flagship: it is advertised as an intensive multi-week training for planning, installation, commissioning and maintenance of heat pumps and air conditioning systems and is explicitly targeted at heating technicians, gas/sanitary installers, refrigeration technicians, electrical installers and mechatronics engineers. Completing this course and passing the associated exam leads to a recognised personal certificate and, for those who fulfil the additional requirements, to refrigeration Category II, authorising interventions in HP refrigeration circuits.

WIFI branches in Vienna, Lower Austria, Upper Austria and Tirol complement this with courses that prepare for or extend Category II and refrigeration competences, including "Planung, Errichtung und Wartung von Wärmepumpen nach EU-DVO 2024/2215 (vormals Kat. II)" and broader "Kältetechnik / Klimatechnik" courses that cover fundamentals of refrigeration and air-conditioning. These programmes form the formal pathway for many installers who then specialise in HP retrofits. In Lower Austria and Vienna, HTL Mödling plays a dual role by hosting the practical workshop components of the AIT courses, which strengthens the link between vocational school-level HVAC training and continuing HP education.

Across all provinces, classical vocational training in "Installations- und Gebäudetechnik" and "Kälteanlagentechnik", Meisterkurse and specialised courses on handling flammable refrigerants underpin the practical skills required for safe HP installation and maintenance. Manufacturer academies—run by companies such as Viessmann, Bosch, Vaillant, Stiebel Eltron, iDM and others—add product-specific depth through courses that address system schematics, installation details, commissioning routines, error diagnostics, acoustic optimisation and use of manufacturer-specific configurators and monitoring platforms.

In Western Austria, courses such as the "Sanierungsberaterkurs" explicitly address installers as part of the target group, recognising that they play a central role in implementing HP-based refurbishment. Overall, the Austrian installer training landscape is well developed, with clear pathways from basic vocational education through to category-II-level HP competence and personal certification.

6.3.4. Integration of planning tools into trainings

In Austria, the integration of planning tools into training offers is strongest in the energy-consultant and refurbishment courses and in the university programmes, with a growing but still partial integration in HP-specific and installer courses. ARGE-EBA-based energy-consultant courses routinely use national EPB software (such as Archiphysik, Ecotech or GEQ) to teach participants how to carry out energy balances, produce certificates and assess consumption and CO_2 savings for refurbishment scenarios. In the A- and F-Kurs formats, participants also work with advisory tools such as the Heizrechner, Heizleistungsrechner and Heizungsmatrix from the regional energy institutes to compare heating systems and to discuss options with clients in an accessible way [14].

The Sanierungsberaterkurse, especially those run by Energieinstitut Vorarlberg and Energie Tirol, build on this by explicitly linking envelope and system measures and by incorporating interactive exercises in which participants use EPB outputs, heating loads and simple economic evaluations to derive refurbishment concepts, including HP solutions for multi-family buildings.

The AIT/Wärmepumpe Austria HP courses integrate planning tools primarily by referencing standards and generic calculation workflows. Standards such as EN 12831 and VDI 4650 are used as the backbone for manual and semi-automated calculations, and participants learn to link basic load calculations with manufacturer tables and configurators. In the Category II context, more emphasis is placed on safe handling of refrigerants and compliance with EU-DVO than on the interoperability of different software tools, but the courses still familiarise installers and planners with the logic behind dimensioning rules and minimum performance requirements.

At university level, FH Burgenland and FH Technikum Wien expose students to advanced simulation and BIM tools as part of modules like “Refrigeration and Heat Pumps Technology & Geothermal Energy” and “BIM & Simulation”, and Donau-Universität Krems and FH Campus Wien emphasise integrated building-services design in their programmes. In all cases, students not only learn the theoretical fundamentals but also receive hands-on experience with simulation and modelling environments that are relevant for HP-based refurbishment.

Manufacturer trainings, in turn, are tightly coupled to proprietary planning tools and configurators, ensuring that installers and planners can effectively use manufacturer-specific software for selecting and configuring HP systems. However, the connections between these tools and national EPB software, dynamic simulations or BIM platforms are rarely presented as a unified workflow. From an integrated-refurbishment standpoint, this is a key area where KnowHowHP can add value by articulating an end-to-end toolchain and helping providers to integrate it into their curricula.

6.3.5. Summary: strengths and gaps in Austria

Austria offers a particularly strong institutional and structural basis for HP-related training. Through ARGE-EBA and the regional energy agencies, the country has a standardised, nationwide system for energy-consultant training that explicitly addresses energy-efficient refurbishment and that provides a natural entry point for HP-related upskilling. Through the AIT/Wärmepumpe Austria framework and the waermepumpe-weiterbildung.at platform, it has also established a nationally coordinated HP training and personal certification scheme that aligns with EU-DVO 2024/2215 and provides clear competence profiles for planners and installers.

Western Austria’s Sanierungsberaterkurse and Eastern Austria’s renowave/ÖVI “Lehrgang Nachhaltige Gebäudesanierung und Heizungstausch” show that refurbishment-specific training is no longer limited to technology or tool topics, but increasingly covers process, stakeholder and portfolio perspectives in multi-family housing. Higher-education programmes at FH Burgenland, FH Technikum Wien, Donau-Universität Krems and FH Campus Wien provide a strong academic underpinning for integrated building and building-services design, with HP technology firmly embedded.

However, as the WP2 survey and stakeholder discussions indicate, significant gaps remain when focusing specifically on HP-based refurbishment of multi-family buildings. Much of the existing training still addresses HPs in generic terms or in single-family contexts. Systematic coverage of multi-apartment hydraulics, phased refurbishment strategies in condominium settings, the integration of HPs into mixed distribution systems, acoustic design in dense urban surroundings and the interplay between HPs, ventilation and user behaviour is still rare. Joint training formats in which planners, energy consultants, installers and property managers actively work through integrated HP refurbishment workflows are the exception.

Moreover, while many programmes introduce individual tools—EPB software, national advisory calculators, HP sizing methods, simulation tools or manufacturer configurators—these are seldom connected into an end-to-end digital workflow that mirrors the integrated refurbishment process outlined in this deliverable. For KnowHowHP, Austria thus offers a highly favourable starting point: the institutions and frameworks for high-quality HP and refurbishment training exist, and there is clear recognition of the need for upskilling. The challenge and opportunity lie in systematically embedding the integrated refurbishment workflow and the associated toolchain into these programmes and in sharpening the focus on multi-family HP retrofit specifics and cross-role collaboration.

6.4. Northern Italy

6.4.1. Overview of relevant training providers

In Northern Italy the training landscape for HP-based refurbishment is dominated by CasaClima (Agenzia CasaClima / KlimaHaus) in Bolzano, complemented by national actors such as ENEA and by manufacturer academies. CasaClima has, over the past two decades, built up a comprehensive, multi-tier training programme for designers, energy consultants, craftsmen and companies, with a clear emphasis on high-quality construction, energy efficiency and renewable-based systems. Its course catalogue explicitly covers heat pump technology, CasaClima design principles, integrated envelope–system design and the use of HPs in low-energy and passive-standard buildings.

At national level, ENEA operates the e-Learn platform, offering free e-learning courses on heat pump technology and on the design of HP systems. These courses address both technical and regulatory aspects, covering thermodynamics, climatic comfort, HP typologies and standards, as well as design and installation guidance. Private providers, such as CorsoFEROnline, Unione Professionisti and MyGreenBuildings, offer online HP courses for designers and installers, often in connection with FER qualification and Superbonus-related competencies [13].

Manufacturer academies add a further layer. Viessmann's Accademia Viessmann, for example, runs an ongoing training programme for both installers and designers that covers heat pumps, hybrid systems, photovoltaics and efficiency solutions through in-person and online seminars. Similar accademie are run by other major brands active in Northern Italy. F-gas certification bodies and training providers (for example E-Train, Coid and STS Certificazioni) complete the picture by offering courses that prepare technicians for the "patentino frigorista" required to work legally on refrigeration and HP systems.

Overall, Northern Italy's HP-related training ecosystem is relatively centralised on CasaClima for integrated building-level competence, with a broad but fragmented periphery of national, private and manufacturer-based offers that deliver specific technical and regulatory skills.

6.4.2. Training offers for planners and energy consultants

For planners and energy consultants, CasaClima offers the most structured and directly HP-oriented training path. The "Esperto CasaClima Pompe di Calore" training programme is a dedicated path that leads to the title of CasaClima Heat Pump Expert. It consists of a series of modules that cover the technological fundamentals of HPs, large-scale systems for residential and non-residential buildings, regulatory aspects, incentives and practical case studies, including multi-family and complex buildings. Participants who complete all modules and pass the examinations obtain a recognised CasaClima HP expert title, which is increasingly valued in the Northern Italian market.

Beyond this HP-specific path, CasaClima's general training programme offers several courses in which heat pumps play a central role. The "Base CasaClima per progettisti" introduces designers to the fundamentals of CasaClima building design (building physics, low-energy concepts, construction details, energy performance) and touches on heat pump and ventilation systems in the context of the standard CasaClima building model. The "Avanzato CasaClima per progettisti" deepens these topics, with intensive work on construction details, thermal bridges, plant systems and measurement techniques and includes a design workshop. While not HP-only, these courses effectively embed heat pumps in a holistic envelope–system view and serve as entry points into CasaClima's consulting and certification ecosystem.

CasaClima also runs thematic short courses such as "Pompe di Calore, Fotovoltaico e Sistemi di Accumulo per Edifici Residenziali", which deal with the integrated design of HPs, PV and storage in residential buildings. These courses are open to designers, artisans and company representatives and focus on practical design and optimisation questions in real-world refurbishment and new-build projects.

Nationally, ENEA's e-Learn platform provides complementary online training for designers. Courses such as "Progettazione di impianti a pompa di calore" offer a legislative and technical framework for HP design, covering European and Italian regulations, basic thermodynamics, comfort and detailed design of compression and absorption HP systems. These courses are self-paced and free, making them accessible to a broad audience of engineers and technicians. Private platforms offer additional HP courses for professionals, for instance "Corso Pompe di Calore" by CorsoFEROnline and online HP courses by Unione Professionisti, which focus on normative aspects, system functioning and practical design considerations.

Finally, manufacturer academies such as Viessmann's Accademia organise seminars and webinars targeted explicitly at designers. Topics include scenario and prospects for HPs in residential and condominium settings, normative frameworks, hybrid system solutions and the economic evaluation of different climatic solutions. For planners who frequently specify specific brands, these seminars provide an important update on product capabilities, application limits and practical design strategies.

6.4.3. Training offers for installers and contractors

Installers and HVAC contractors in Northern Italy access HP-related training primarily through CasaClima's craft-oriented courses, manufacturer academies and F-gas-focused qualification programmes. CasaClima's training catalogue explicitly addresses artisans and companies, not just designers. The general course catalogue and the "Formarsi per crescere" concept highlight that programmes are aimed at "progettisti, artigiani, committenti e imprese" with the goal of raising a common language and level of quality in construction and installation. Short courses on HPs, PV, storage and mechanical ventilation are open to installers and often emphasise correct installation, commissioning and troubleshooting, as well as the interaction between systems and CasaClima standards.

Manufacturer academies provide a second, very tangible channel. Viessmann Climate Solutions Italia's Accademia programme, for example, includes in-person and online courses for installers on residential HP systems (Vitocal), hybrid systems and ancillary technologies. These courses present the HP product range, highlight normative and regulatory aspects, discuss economic convenience and provide practical examples of design and installation. Other manufacturers—Bosch, Vaillant, Mitsubishi Electric, Daikin and others—offer similar accademie with dedicated HP courses, sometimes in collaboration with local professional associations.

In addition, many Italian installers go through F-gas certification pathways, which provide the legal and technical basis for working on HP refrigeration circuits. Providers such as E-Train, Coid, STS Certificazioni and Mitsubishi Electric's ACFGAS offer training courses and exam preparation for the "patentino frigorista", including Cat. 1 or Cat. 2 certification under EU 517/2014 and DPR 146/2018. While these courses are not HP-specific, they cover essential knowledge on refrigerant handling, leak detection, commissioning and safety. Newer offers, such as E-Train's HP-focused courses for installers, address HP installation directly and aim to form installers capable of proposing and installing high-efficiency HP systems for heating and cooling in line with NZEB requirements.

Overall, Northern Italian installers have access to a mix of general refrigeration/AC training, HP-specific manufacturer courses and, increasingly, regionally-focused HP courses under the CasaClima umbrella.

6.4.4. Integration of planning tools into trainings

The integration of planning tools into training programmes in Northern Italy is more implicit than explicit and tends to be concentrated in CasaClima's designer courses and in some ENEA and manufacturer offerings. CasaClima courses for designers are tightly linked to the ProCasaClima calculation environment and, more generally, to the CasaClima methodology for energy performance assessment and refurbishment planning. Participants become familiar with CasaClima's calculation and certification tools as part of the training path, including the use of ProCasaClima and associated checklists when developing refurbishment concepts with HPs.

Courses such as "Pompe di Calore, Fotovoltaico e Sistemi di Accumulo per Edifici Residenziali" explicitly discuss the integration of HPs, PV and storage and, in practice, refer to the CasaClima and national EPB tools used to quantify energy savings and to verify compliance with standards. However, the training descriptions do not typically present an explicit digital toolchain; instead, tool use is embedded in the overall design methodology.

ENEA's e-learning courses, particularly "Progettazione di impianti a pompa di calore", place more explicit emphasis on calculations and normative frameworks. Participants are walked through the regulatory calculation methods and given indicative workflows, which they are expected to implement in their own software of choice. Some private online courses for professionals similarly discuss the use of EPB tools and spreadsheets for HP design, especially in the context of incentives such as Superbonus and Conto Termico [18].

Manufacturer trainings integrate planning tools in a brand-specific way. Viessmann and others use their configurators, simulation modules and acoustic calculators extensively in seminars for installers and designers, teaching participants how to use them for selecting systems, estimating performance and checking acoustic constraints. There is, however, little evidence that these tools are systematically linked in training to upstream EPB packages or to independent dynamic simulation tools.

In summary, Northern Italian training programmes do expose participants to HP-relevant tools, especially CasaClima and national EPB tools on the design side and manufacturer configurators on the implementation side. What is still largely missing is an integrated representation of a digital workflow that connects these tools consistently along the refurbishment process in multi-family buildings.

6.4.5. Summary: strengths and gaps in Northern Italy

Northern Italy has, through CasaClima and national programmes, developed a solid and recognisable training ecosystem for HP-based refurbishment. CasaClima's multi-tier training programmes for designers and craftsmen, and in particular the "Esperto CasaClima Pompe di Calore" path and the Base/Avanzato per progettisti courses, provide a strong foundation for integrated envelope–system design with heat pumps in low-energy and high-quality refurbishment projects. ENEA and private providers add flexible online courses that help professionals across Northern Italy understand normative frameworks, design principles and HP technology. Manufacturer academies and F-gas training providers ensure that installers are kept up to date on products, legislation and safe refrigerant handling.

The main strengths of this training landscape, from a KnowHowHP perspective, are the strong conceptual link between envelope quality and system design embodied by CasaClima, the growing use of online formats that reach designers and installers beyond South Tyrol and the good alignment between HP training and Italian incentive schemes and regulatory frameworks. There is also encouraging evidence that HP-specific training is moving beyond pure product knowledge towards integrated design with PV and storage and towards consideration of larger, multi-apartment and non-residential systems.

At the same time, significant gaps remain when judged against the integrated refurbishment workflow developed in WP2. Much of the training is focused either on CasaClima-standard buildings, which represent a high but specific segment of the market, or on single systems and products taught in manufacturer contexts. Systematic coverage of multi-family refurbishments in existing, often heterogeneous building stock outside CasaClima's core territory is still limited. Multi-apartment hydraulics, staged refurbishment strategies in condominiums, and the practical handling of HP retrofits in large, partially occupied buildings receive less attention than would be necessary to scale up HP conversions in the broader building stock.

Furthermore, while a range of tools are used in training—ProCasaClima and EPB tools on the design side, manufacturer configurators and acoustic calculators on the implementation side—their integration into a coherent, cross-brand digital workflow is rarely discussed. Joint learning formats in which designers, installers and property managers work together on HP retrofit case studies are still rare, with most courses targeting individual professions separately.

For KnowHowHP this means that Northern Italy provides a strong and internationally recognised nucleus for HP and refurbishment training, centred on CasaClima, but that there is room to extend this excellence outward: towards more explicit integration of toolchains, towards broader coverage of non-CasaClima building types and towards cross-role training formats focused specifically on HP-based refurbishment of multi-family buildings in the wider Alpine and Po Valley regions.

6.5. Cross-regional comparison of training landscapes

The analyses of Southern Germany, Austria and Northern Italy show that all three regions have developed substantial training landscapes for heat-pump-related competences, but with different institutional architectures, emphases and degrees of alignment with the integrated refurbishment workflow defined in WP2. In all regions, a mix of classical VET, CPD, manufacturer trainings and academic programmes underpins HP-related knowledge; however, the balance between these pillars, and the extent to which they address multi-family refurbishment and integrated planning, vary significantly.

In Southern Germany, the training system is characterised by a relatively decentralised but mature network of energy agencies, universities of applied sciences, CPD providers and manufacturer academies. Offers such as eza!'s energy-consultant courses, the Heat Pump Academy's BAW and

VDI 4645-certified modules and HP-oriented teaching at TH Rosenheim and Hochschule Biberach ensure that both planners and installers can access HP-focused upskilling that is tightly linked to German standards and funding schemes. The strengths here are breadth and standardisation: VDI 4645 has become a widely recognised reference, and HP topics are well integrated into existing structures. At the same time, the Southern German landscape remains strongly oriented towards single-family houses and brand-specific solutions; explicit coverage of multi-apartment hydraulics, staged refurbishment in condominiums and cross-role, cross-tool workflows is still limited.

Austria stands out through its combination of nationwide standardisation and targeted HP initiatives. The ARGE-EBA system for energy-consultant training, implemented by regional energy agencies and WIFI centres, provides a uniform foundation for refurbishment- and HP-related knowledge, while the national Wärmepumpe Weiterbildung framework coordinated by Wärmepumpe Austria and AIT adds a clear path to EU-DVO-compliant personal certification for planners and installers. Western Austria's Sanierungsberaterkurse and Eastern Austria's renowave/ÖVI "Lehrgang Nachhaltige Gebäudesanierung und Heizungstausch" explicitly address multi-family refurbishment and heating-system replacement, including HPs, and academic programmes at FH Burgenland, FH Technikum Wien, Donau-Universität Krems and FH Campus Wien embed HP topics into broader sustainable-energy and building-services curricula. Institutional structures and regulatory alignment are thus particularly strong. Yet here too, detailed coverage of multi-apartment HP retrofits, integrated digital workflows and joint planner–installer–manager training formats is still the exception rather than the rule.

Northern Italy, by contrast, has a more centralised nucleus in CasaClima, which combines certification, consultancy and training into a coherent concept of high-quality envelope–system integration. CasaClima's designer and craftsperson courses, including the "Esperto CasaClima Pompe di Calore" path and the Base/Avanzato courses, provide a strong conceptual and methodological foundation for HP integration in low-energy and refurbishment projects, supported by national and private online courses and by manufacturer academies and F-gas training. The implicit integration of envelope and system thinking is a key strength in comparison to the other regions. However, much of this training is framed around CasaClima-standard buildings and specific territorial contexts; systematic treatment of HP retrofits in the wider Northern Italian multi-family stock, outside CasaClima's core territory, is less developed, and explicit toolchain integration and cross-role training are still nascent.

Across the three regions, there are also notable commonalities and structural gaps. Everywhere, initial vocational education provides the basic craft and engineering skills, but HP-based refurbishment of multi-family buildings only emerges later, if at all, through CPD and manufacturer trainings. Manufacturer academies are central for practical HP know-how and tool use, yet their content is brand-specific and rarely embedded into a broader integrated planning framework. Universities and UAS programmes provide the theoretical underpinnings for integrated design and advanced simulations, but the link to the day-to-day planning and installation tools used in practice is often weak. Explicit integration of planning tools along the full refurbishment process—from EPB and advisory tools through heating-load, dynamic simulation, economic evaluation and manufacturer configurators to commissioning support—is fragmented in all three regions.

From the perspective of KnowHowHP, this cross-regional comparison suggests a twofold strategy. On the one hand, the project can build on existing strengths: in Southern Germany, the widespread acceptance of VDI 4645 and the strong CPD culture; in Austria, the ARGE-EBA and AIT/Wärmepumpe Weiterbildung frameworks and the explicit refurbishment-focused courses; and in Northern Italy, CasaClima's holistic envelope–system training and growing online reach. On the other hand, the project needs to address common gaps: insufficient focus on multi-family HP retrofits and multi-apartment hydraulics; limited representation of an integrated, tool-supported workflow in training; and a lack of cross-role formats where planners, installers, energy consultants and property managers work together on HP-based refurbishment scenarios.

7. TRAINING OFFER FACTSHEETS

This chapter explains how the individual training offers identified in Southern Germany, Austria and Northern Italy are documented in a structured way. As in the case of planning instruments and tools, the training factsheets turn a heterogeneous set of programmes, courses and initiatives into a coherent knowledge base that supports cross-regional comparison and the design of the KnowHowHP training concept. Each factsheet describes a single training offer or programme in a concise, comparable format, allowing readers to see who it is for, what it teaches, how it is delivered and how it contributes to the competencies needed for integrated HP-based refurbishment of multi-family buildings.

7.1. Concept and objectives of the training factsheets

The primary objective of the training factsheets is to provide a transparent overview of the existing training landscape, organised in such a way that its relevance for HP-based refurbishment can be assessed quickly. Training offers vary enormously in form and content: some are short manufacturer seminars, others multi-week CPD courses, part-time academic programmes or long-term VET pathways. Without a standardised description, it is difficult to see where they overlap, how they complement one another and where gaps remain.

The factsheets therefore serve several functions. For WP2, they document the empirical basis behind the qualitative assessments in Chapter 6 and ensure that references to “existing training offers” can be traced back to concrete programmes. For WP3 and WP4, they provide input into the design of the KnowHowHP training modules and pilot courses: by making explicit what is already available and what is missing, they help avoid duplication and identify where new content or formats are needed. For WP5 and for stakeholders beyond the project, the factsheets can form the basis for a living directory of HP-relevant training offers in Central Europe.

Each factsheet follows a uniform structure, capturing the provider and institutional context, target groups and entry requirements, content focus and learning outcomes, format and delivery mode, region, language and certification, links to planning tools and, finally, the contribution to the integrated HP refurbishment competences defined in WP2.

7.2. Metadata fields and coding rules for training offers

As with the tool factsheets, the training factsheets are underpinned by a metadata framework. This framework defines which fields are recorded for each training offer and how information is coded, ensuring that analyses can be carried out across regions and categories. The fields correspond to the substantive questions outlined above and are grouped into blocks: provider and institutional context, target groups and entry requirements, content focus and learning outcomes, format, duration and delivery mode, region, language and certification, links to planning instruments and tools, and contribution to integral HP refurbishment competences.

7.2.1. Provider and institutional context

The first block identifies the training provider and situates the offer institutionally. It records the organisation responsible for the course (for example regional energy agency, university, vocational training centre, manufacturer academy, professional association or private provider), its main remit and its role in the regional training ecosystem. In many cases, the provider block also notes partnerships (for example ARGE-EBA affiliations, collaborations between energy agencies and WIFI centres or joint programmes between universities).

This metadata is important because training content is shaped by institutional context. Courses offered by universities or universities of applied sciences tend to focus on conceptual frameworks and analysis, while those provided by craft chambers or manufacturers focus on practical installation and commissioning. Knowing who stands behind a training offer helps to interpret its depth, stability and potential reach.

7.2.2. Target groups and entry requirements

The second block describes the intended target groups and the entry requirements. It specifies whether the training is aimed primarily at planners and energy consultants, installers and contractors, property managers and housing sector staff, or mixed audiences. It also records prerequisites, such as completed vocational training in a relevant trade, university degrees, prior attendance of basic energy-consultant courses, or specific certifications (for instance Category II refrigeration certificates).

In some cases, specific combinations of roles are explicitly addressed (for example joint courses for planners and installers, or for property managers and technical staff); this is noted in the metadata. The target-group information allows cross-regional comparisons of how well planners, installers and other key actors are served by existing training offers and where role-specific or cross-role gaps exist.

7.2.3. Content focus and learning outcomes

The third block captures the content focus and learning outcomes. Each factsheet summarises, in a concise form, the main thematic areas covered: for example HP technology fundamentals, building physics and envelope measures, refurbishment strategies in multi-family buildings, hydraulic design, noise and acoustics, digital planning workflows, funding and regulatory frameworks, stakeholder processes, or operation and optimisation.

Where the provider defines explicit learning outcomes (for example the ability to dimension a heat pump system for an existing multi-family building, to prepare a refurbishment plan in line with specific standards, or to carry out Category II-compliant refrigerant work), these are recorded. If outcomes are implicit, they are inferred from the curriculum description and the examination or certification procedures. The content-focus coding allows mapping which components of the integrated HP refurbishment workflow are covered in which trainings and at what depth.

7.2.4. Format, duration and delivery mode

The fourth block details the format, duration and delivery mode of the training. It records whether the offer is a one-day seminar, a multi-day module, a course of several weeks or a semester-long academic or VET programme. It also notes whether it is delivered in-person, online, in hybrid formats, or as a self-paced e-learning module, and whether practical exercises and site visits are included.

This information is crucial to assess accessibility and impact. Short seminars are useful for awareness and updates but may not suffice to instil complex competences; long, modular CPD or academic programmes can address depth but are harder to fit into busy professional schedules. The metadata thus helps to interpret statements like "heat pumps are covered in training" by indicating whether this coverage is a single slide in a webinar or a multi-day practical module.

7.2.5. Region, language and certification

The fifth block documents the geographic and linguistic scope, as well as certification aspects. It records where the training is physically offered (for example specific regions within the three countries, national reach or cross-border availability), in which language(s) it is delivered and whether participation leads to a recognised certificate, title or credit.

Certification can range from informal attendance certificates through regional or national titles (such as CasaClima consultant, ARGE-EBA energy consultant, VDI 4645 HP planner, EU-DVO Category II HP installer) to formal academic degrees. The metadata distinguishes between these levels and notes where a course prepares participants for external examinations (for example F-gas certification). This block is essential for evaluating how training contributes to formal recognition of HP competences, which is often a precondition for regulatory compliance or for building trust among clients and employers.

7.2.6. Links to planning instruments and tools

The sixth block captures explicit and implicit links between training content and planning tools. It notes whether and how particular tools are used in the course (for instance national EPB software, dynamic simulation tools, HP sizing calculators, BIM platforms, advisory tools or manufacturer configurators), whether participants perform exercises with these tools and whether the training encourages the use of integrated toolchains across different phases of the refurbishment process.

In many cases, tools are embedded into the training without being its explicit focus. For example, energy-consultant courses may teach EPB methods through specific software, HP courses may use manufacturer platforms to demonstrate sizing and acoustic checks, and university courses may use simulation tools in design studios. The metadata registers this tool use, which enables a direct cross-reference between training factsheets and the tool factsheets in Annex A and helps to identify trainings that already support an integrated tool-based workflow.

7.2.7. Contribution to integral HP refurbishment competences

Finally, the seventh block synthesises the training's contribution to the integral HP refurbishment competences defined in WP2. It maps the offer against a set of competence dimensions relevant for HP-based refurbishment in multi-family buildings, such as understanding of envelope–system interactions, ability to handle multi-apartment hydraulics, competence in digital planning workflows, familiarity with relevant norms and regulations, proficiency in stakeholder communication and process management, and capacity to support commissioning and optimisation.

This qualitative assessment distils, in one or two sentences, how the course contributes to the overarching KnowHowHP objectives. Some trainings may be strong on HP technology but weaker on refurbishment-specific or process competences; others may shine in envelope–system integration but not address installers' practical needs; still others may emphasise process and stakeholder aspects but treat HPs as one technology among many. By capturing these nuances, the factsheets allow a targeted use of existing offers and form a basis for designing complementary KnowHowHP modules.

7.3. Individual training factsheets

The individual training factsheets themselves are presented in Annex B. For each training offer identified in the mapping, a factsheet provides the structured narrative based on the metadata described above. Together, they form a detailed background to the comparative analyses in Chapter 6 and a practical reference for partners and stakeholders who wish to orient themselves in the HP-related training landscape of Southern Germany, Austria and Northern Italy.

By keeping the main body of Chapter 7 focused on concept, structure and indices, while relegating the detailed descriptions to Annex B, the deliverable remains readable while still offering a high degree of transparency and traceability. Readers can move seamlessly from the high-level discussion of training landscapes in Chapter 6 to the training-specific information in Annex B and back again, just as they can with the tool factsheets in Annex A.

8. SUMMARY AND OUTLOOK

This deliverable has mapped, in a structured way, the planning instruments, software tools and training offers that currently shape heat-pump-based refurbishment of multi-family buildings in Southern Germany, Austria and Northern Italy. It complements the "demand side" perspective of D2.1, which documented obstacles, knowledge gaps and role-specific frustrations, with a "supply side" view of the tools and training systems that practitioners actually use. Taken together, these two deliverables provide a robust evidence base for the process and solution work to follow in the next stages of KnowHowHP.

On the tools side, D2.2 has shown that all three regions possess mature ecosystems for core tasks such as building energy performance assessment, heating-load calculation and manufacturer-specific heat pump sizing. National EPB software, CasaClima and Italian EPB suites, DIN- and ÖNORM-based HVAC packages and manufacturer platforms are firmly embedded in everyday practice. A functional taxonomy with eight domains – from building and system energy performance, through heating-load and distribution design, HP sizing, dynamic simulation and economic assessment, to noise, BIM/MEP and advisory tools – allows these heterogeneous instruments to be compared across regions and user groups. When mapped onto the phases of a typical refurbishment process, a clear pattern emerges: building-level EPB tools and simple calculators dominate early feasibility; heating-load tools, manufacturer configurators and, in some offices, dynamic simulations underpin concept development and detailed design; economic and incentive tools frame feasibility and procurement; BIM and MEP environments support layout and coordination; and advisory and acoustic tools appear at the margins, often late in the process.

The regional analyses confirm that this basic structure is shared but that depth and emphasis differ. In Southern Germany, the tool landscape is technically mature and grounded in DIN-based HVAC and EPB tools, with dynamic simulation used selectively and manufacturer platforms central to installers' practice. In Austria, national EPB software and a relatively strong culture of dynamic simulation create a rich, layered toolchain, particularly in offices that work with geothermal systems and complex projects. In Northern Italy, CasaClima and national EPB packages provide a strong framework for envelope–system integration at building level, but detailed multi-apartment HP design relies more heavily on embedded EPB modules, internal spreadsheets and manufacturer tools, with less systematic use of dynamic simulation or specialised system tools. Across all three regions, Excel-based methods and in-house calculators are ubiquitous and fill perceived gaps in the formal software landscape.

The training mapping mirrors this picture. All three regions have substantial training provision on heat pumps and energy-efficient building, but with different institutional architectures. In Southern Germany, a decentralised but mature network of energy agencies, universities of applied sciences, CPD providers and manufacturer academies offers a broad portfolio of HP-related courses, including VDI 4645-based competence certificates. Austria combines a highly standardised energy-consultant training system under ARGE-EBA with a nationally coordinated Wärmepumpe Weiterbildung framework and refurbishment-oriented courses such as the Sanierungsberaterkurse and the renowave/ÖVI programme. Northern Italy is characterised by a strong nucleus around CasaClima, whose multi-tier training paths for designers and craftspeople embed HP topics in a holistic envelope–system perspective, complemented by ENEA's e-learning, private online courses, manufacturer academies and F-gas training.

Across regions, training offers can be grouped functionally into initial vocational education, CPD and short courses, manufacturer trainings and in-house programmes, university and UAS modules and online/self-learning formats. Each category makes a specific contribution to the competences needed for HP-based refurbishment in multi-family buildings. VET provides the craft and basic engineering skills; CPD and energy-consultant training add refurbishment, funding and advisory knowledge; manufacturer and HP-specific courses supply detailed product and execution expertise; universities and UAS deliver theoretical foundations and exposure to advanced tools; online modules support awareness and rapid updates. However, when seen through the lens of the integrated refurbishment workflow developed in WP2, important gaps become visible: multi-apartment hydraulics, staged refurbishment strategies in condominium settings, systematic treatment of acoustic constraints in dense urban contexts, interdisciplinary digital workflows and commissioning and optimisation of HP systems in existing multi-storey buildings are still only sporadically covered. Joint training formats in which planners, installers, energy consultants and property managers work together on multi-family HP retrofit scenarios remain the exception rather than the rule.

The overarching message of D2.2 is therefore not that tools or trainings are missing in general, but that they are not yet configured and combined in a way that consistently addresses the specific challenges of HP-based refurbishments in multi-apartment buildings. The landscape is rich, but fragmented. Instruments that could, in principle, handle multi-apartment hydraulics or partial-load behaviour are often used only in simplified modes; acoustic calculators and economic tools sit at the edge of the workflow instead of being integrated from the outset; manufacturer platforms and BIM environments are only loosely connected to EPB and load tools; and training typically introduces tools and concepts in isolation rather than along an explicit, shared process.

This analytical deliverable thus sets the stage for the next steps in KnowHowHP. The integrated refurbishment approach document (D2.4) will build directly on D2.1 and D2.2. It will take the taxonomy, regional tool and training landscapes and the role-specific findings from the survey, interviews and workshops and turn them into a coherent, process-oriented target picture for HP-based refurbishment of multi-family buildings. On this basis, it will specify the requirements for the role-specific, software-supported planning process and for the digital toolbox and training concepts to be developed in WP3–WP5. In doing so, D2.4 will translate the analytical insights presented here into a practical roadmap that can be implemented, taught and scaled in Southern Germany, Austria and Northern Italy, and, ultimately, beyond the immediate project regions.

9. REFERENCES

[1] KnowHowHP Consortium, D2.1 Report on Obstacles, Knowledge Gaps, and Glossary, project deliverable, 2025, available via the KnowHowHP website. knowhowhp.eu

[2] European Commission, The European Green Deal, COM(2019) 640 final, Brussels, 2019.

[3] European Parliament and Council, Directive 2010/31/EU on the energy performance of buildings (recast), OJ L 153/13, 18 June 2010.

[4] European Parliament and Council, Directive 2012/27/EU on energy efficiency, OJ L 315/1, 14 November 2012.

[5] European Parliament and Council, Directive (EU) 2018/844 amending Directive 2010/31/EU on the energy performance of buildings and Directive 2012/27/EU on energy efficiency, OJ L 156/75, 19 June 2018.

[6] European Commission, Commission Implementing Regulation (EU) 2024/2215 of 6 September 2024 establishing minimum requirements for the issuance of certificates to natural and legal persons as regards stationary refrigeration, air-conditioning and heat pump equipment, OJ L 2024/2215.

[7] Verein Deutscher Ingenieure (VDI), VDI 4645: Heating systems with heat pumps in single- and multi-family houses – Planning, construction, operation, trainings, examinations, certifications of qualification, Düsseldorf, latest edition.

[8] International Energy Agency, The Future of Heat Pumps, IEA, Paris, 2022.

[9] Agenzia CasaClima / KlimaHaus, "ProCasaClima 2022 – Official software for CasaClima energy certification," software information pages, accessed October 2025.

[10] Agenzia CasaClima / KlimaHaus, "ProCasaClima Hygrothermal – dynamic hygrothermal simulation software," user guide, 2020 and updates, accessed October 2025.

[11] ARGE-EBA – Arbeitsgemeinschaft Energieberater/innen-Ausbildung, "Ausbildung Energieberatung A-Kurs und F-Kurs," organisational and course information, accessed October 2025.

[12] AIT Austrian Institute of Technology / Wärmepumpe Austria / Österreichische Akademie der Kältetechnik, "Weiterbildung im Bereich Wärmepumpen – Planung, Errichtung und Wartung von Wärmepumpen mit Personenzertifizierung gemäß EU-DVO 2024/2215," course description, 2024–2025.

[13] ENEA – Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile, "Progettazione di impianti a pompa di calore," ENEA e-Learn course description and related HP courses, accessed October 2025.

[14] Energieinstitut Vorarlberg, "Heizrechner – Vollkostenvergleich von Heizsystemen" and "Heizleistungsrechner," online tools and documentation, accessed October 2025.

[15] Energie- und Umweltzentrum Allgäu (eza!), “Energieberaterkurse und Fachseminare,” training and seminar information, accessed October 2025.

[16] renowave.at / ÖVI Immobilienakademie, “Lehrgang Nachhaltige Gebäudesanierung und Heizungstausch,” course descriptions and announcements, 2022–2024.

[17] Bundesverband Wärmepumpe (BWP) e.V., “JAZ-Rechner” and associated online planning tools (JAZ-Rechner, Schallrechner, Heizlast etc.), accessed October 2025.

[18] Gestore dei Servizi Energetici (GSE), “Conto Termico” and “Interventi e simulatori” – official information on Italian incentive scheme and related simulators, accessed October 2025.

10. ANNEXES

Annex A: Tool factsheets (alphabetical list)

Archiphysik

Archiphysik is an Austrian building-physics and energy-performance software used for energy certificates and refurbishment variants according to OIB Richtlinie 6 and relevant ÖNORM standards. It belongs primarily to the "building and system energy performance and refurbishment planning" domain. It is a core tool for planners and energy consultants in Austria and has, at most, niche relevance in Southern Germany; it is not in regular use in Northern Italy. In the integrated refurbishment workflow, Archiphysik is mainly used in diagnosis and feasibility, concept development and procurement/subsidy handling. It is commercial software with a German-language interface; interoperability is moderate, with typical imports/exports for project data but limited direct BIM coupling, so data are often re-entered manually when moving to HVAC or BIM tools. Its strengths are strong alignment with Austrian regulations and widespread use in practice; its limitations are weak explicit support for multi-apartment hydraulics and limited integration with dynamic simulation or manufacturer tools. Reference: https://archiphysik.at

AX3000

AX3000 is a CAD/BIM-based building-services and energy-systems suite that combines architectural/MEP modelling with energy and HVAC design. Functionally it spans "heating load and distribution design", "building and system energy performance and refurbishment planning" and "BIM/MEP modelling, schematics and documentation". It is used by planners and MEP engineers primarily in Austria and Southern Germany (relevant to core), and hardly at all in Northern Italy. Along the workflow, AX3000 is employed from concept development and variant comparison through detailed design and documentation, and in some cases for procurement outputs. It is commercial, German-language software with BIM-oriented interoperability (IFC- and CAD-based data exchange, vendor-specific connectors), but interfaces towards national EPB and manufacturer tools remain partial. Its strengths lie in integrated 3D modelling and coordinated MEP design; its limitations include a relatively steep learning curve and the need for separate tools for regulatory energy certificates and detailed economic analysis. Reference: https://www.ax3000-group.de/en/

BKI Energieplaner

BKI Energieplaner is a German tool for energy consulting, GEG-compliant energy assessment and cost-optimised refurbishment planning that combines energetic and cost data. It lies in the domains "building and system energy performance and refurbishment planning" and "economic assessment, incentives and risk evaluation". It is a relevant tool for planners and energy consultants in Southern Germany (relevant to core regionally), with little use in Austria and none in Northern Italy. In process terms it is used mainly in diagnosis and feasibility, concept development and procurement. It is commercial, German-language software with standard report exports; interoperability with other tools is mostly via manual transfer of key parameters and PDF/Excel outputs. Strengths are the explicit link between energetic and economic indicators; limitations are the focus on German regulatory context and the lack of direct integration with hydraulic design, manufacturer tools or BIM. Reference: https://bki.de/bki-energieplaner

Blumatica Diagnosi Energetica

Blumatica Diagnosi Energetica is an Italian tool for detailed energy audits ("tailored rating") according to UNI CEI EN 16247 and related standards. It belongs to "building and system energy performance and refurbishment planning" and "advisory and auxiliary tools". It is a niche to relevant tool for energy consultants in Northern Italy, and not used in Austria or Southern Germany. It supports diagnosis and feasibility and concept development phases, where detailed audit and "as-is" assessments are needed. The software is commercial and Italian-language; interoperability consists mainly of report exports and data exchange with other Blumatica modules. Its strengths are strong support for audit procedures and tailored assessments; limitations are limited direct support for system-level HP design and for multi-apartment hydraulic representations. Reference: https://www.blumatica.it/software-diagnosi-energetica-degli-edifici-tailored-rating/

Blumatica Energy

Blumatica Energy is an Italian EPB suite for APE, AQE, Legge 10 documentation, energy diagnoses and refurbishment planning. It lies in "building and system energy performance and refurbishment planning" and "economic assessment, incentives and risk evaluation". It is a relevant EPB tool for planners and energy consultants in Northern Italy; it has no practical role in Austria or Southern Germany. It is used across diagnosis, concept development and procurement/subsidy handling. Licensing is commercial; the interface and documentation are in Italian. Interoperability is typical for national EPB tools (internal consistency across modules, standard report exports, but limited direct BIM or manufacturer integration). Strengths are regulatory alignment and integrated treatment of EPB and economic indicators; limitations include limited explicit support for complex multi-family hydraulics and a national focus that restricts cross-border use. Reference: https://www.blumatica.it/software-certificazione-energetica-degli-edifici-ape-ed-aqe/

Bosch Heat Pump Advisor

The Bosch Heat Pump Advisor ("Consulente pompe di calore") is a web-based configurator that supports selection and preliminary sizing of Bosch heat pumps, including performance and basic noise information. It belongs to the "heat pump sizing, configuration and manufacturer tools" domain. It is relevant for installers and planners in all three regions wherever Bosch systems are used (niche to relevant, depending on Bosch's local market share). It is used in concept development and detailed design when moving from general loads to concrete products. The tool is free to use, browser-based and available in local languages; data export is usually via PDFs or simple project files, with limited structured data exchange. Its strengths are easy access to product data and the embedding of manufacturer know-how; its limitations include brand specificity, limited integration with independent EPB and load tools, and weak support for portfolio-level or multi-apartment system comparisons. Reference: https://www.bosch-homecomfort.com/it/it/residenziale/per-i-professionisti/installatori/heat-pump-advisor/

BWP JAZ-Rechner (Bundesverband Wärmepumpe)

The BWP JAZ-Rechner from the German Heat Pump Association is an online calculator for annual performance factor / SPF (JAZ) according to VDI 4650 for typical HP configurations. It lies in "economic assessment, incentives and risk evaluation" and "advisory and comparison tools". It is widely used as a relevant tool in Southern Germany and Austria by planners and installers; it is only of niche relevance in Northern Italy (mainly as a reference method). It is used in diagnosis and feasibility, concept development and for funding documentation. It is free, web-based and German-language; interoperability is limited to manual transfer of JAZ values into EPB tools and subsidy applications. Strengths are standardised JAZ estimation aligned with funding rules and an intuitive interface; limitations are the focus on German standard configurations, limited adaptability to complex multi-family hydraulics and the absence of explicit envelope–system coupling. Reference: https://www.waermepumpe.de/werkzeuge/jaz-rechner/

BWP Schallrechner

The BWP Schallrechner is an online calculator for estimating sound pressure levels from air-water heat pumps and checking against German TA Lärm limits at receiver points. It belongs to "noise, comfort and acoustic assessment". It is relevant in Southern Germany and to a lesser extent in Austria, used by both planners and installers; it is largely unknown in Northern Italy. It is typically used in concept development and detailed design when siting outdoor units. The calculator is free, web-based, German-language and produces simple outputs that are manually documented. Its strengths are that it makes acoustic checks accessible without specialist software; its limitations are simplified sound propagation models and a focus on German regulations, as well as the lack of integration with CAD/BIM layouts and EPB tools. Reference: https://www.waermepumpe.de/werkzeuge/schallrechner/

CasaClima / ProCasaClima

ProCasaClima is the official CasaClima calculation environment for energy performance assessments and certification, used for CasaClima/Nature protocols and Italian/EU directives. It belongs to "building and system energy performance and refurbishment planning" and indirectly supports "advisory tools" through its label logic. It is a core tool for planners and energy consultants in South Tyrol and relevant across Northern Italy; it is not used in Austria or Southern Germany. It covers diagnosis, concept development and procurement and feeds directly into certification. Licensing is commercial; languages are Italian and German; interoperability focuses on internal CasaClima workflows with limited direct BIM or manufacturer coupling. Strengths are the strong conceptual link between envelope and system, high quality control and regional acceptance; limitations are the territorial and protocol focus, limited explicit modelling of multi-apartment hydraulics and only indirect support for dynamic system behaviour. Reference: https://www.agenziacasaclima.it/it/software-casaclima-2239.html

Dämmwerk

DÄMMWERK is a German building-physics and energy-consulting suite covering GEG/EnEV proofs, DIN V 18599, KfW/BEG funding and thermal/moisture/sound/fire calculations. It lies in the domains "building and system energy performance and refurbishment planning" and "economic assessment, incentives and risk evaluation". It is relevant for energy consultants and planners in Southern Germany and niche in Austria; it plays no role in Northern Italy. It is used in diagnosis, concept development, procurement and documentation. The software is commercial and German-language; interoperability is mainly via report exports and occasional data exchange with CAD or calculation modules. Strengths are the broad coverage of building physics and funding-relevant indicators; limitations include complexity for occasional users and limited explicit support for multi-apartment HP hydraulics and manufacturer tool integration. Reference: https://bauphysik-software.de/de-de/

DanBasic / Danfoss SET tools

DanBasic and its successors (e.g. Danfoss SET 365) are manufacturer tools used for hydronic design and selection of Danfoss components (valves, balancing, etc.). They belong to "heating load and distribution design" and "heat pump sizing, configuration and manufacturer tools". They are niche but relevant tools for planners and installers in Austria and Southern Germany when Danfoss components are specified; they have little direct relevance in Northern Italy. They are applied in concept development and detailed design to refine hydraulic layouts. Licensing is typically free for registered users; interfaces are tied to manufacturer product data with limited exchange with independent load or BIM tools. Strengths are correct component selection and embedded manufacturer know-how; limitations include brand specificity and the need to combine outputs manually with EPB, simulation and BIM environments. Reference: https://www.danfoss.com/en/service-and-support/downloads/dhs/danfoss-set-365/

Dendrit STUDIO (incl. Studie K)

Dendrit STUDIO is an HVAC planning suite with modules for heating load, radiator and surface heating design and pipe network calculations; Studie K is one of its calculation modules. It belongs squarely to "heating load and distribution design". It is a relevant tool for HVAC planners in German-speaking regions (Southern Germany and Austria), and not used in Northern Italy. It is employed primarily during concept development and detailed design. Licensing is commercial; the interface is German-language; interoperability is focused on CAD add-ins and internal data structures, with limited direct links to EPB software. Strengths are robust EN 12831-based calculations and integrated network design; limitations are limited explicit support for multi-apartment scenarios beyond room-level loads and minimal integration with dynamic simulation or economic tools. Reference: https://www.dendrit.com/de-de/software/studio/

DesignBuilder

DesignBuilder is a graphical interface to EnergyPlus that supports 3D building modelling and dynamic simulation of building and system behaviour. It lies in the “dynamic building and system simulation” domain. It is a niche but important tool for specialised planners and researchers in all three regions (especially Austria and Southern Germany), usually in complex projects. It is typically used in concept development and detailed design when detailed performance or comfort questions arise; occasionally it supports commissioning optimisation. Licensing is commercial; language is primarily English; interoperability with BIM is available via standard file formats but requires expertise. Its strengths are high modelling flexibility and detailed dynamic analysis; its limitations for everyday practice are complexity, required expertise and limited direct recognition in national EPB and subsidy procedures. Reference: https://designbuilder.co.uk/

Ecotech

Ecotech is an Austrian EPB and building-physics solution for energy certificates and refurbishment variants, including detailed ÖNORM-based calculations and variant comparison. It belongs to “building and system energy performance and refurbishment planning”. It is a relevant tool for Austrian planners and energy consultants; it has little relevance in other regions. It is used in diagnosis, concept development and procurement. Licensing is commercial, in German; interoperability is moderate (project data can be exchanged within the Ecotech environment, but links to external BIM or simulation tools are limited). Strengths are alignment with Austrian standards and support for refurbishment variants; limitations are weak explicit multi-apartment hydraulic representation and the need to couple manually with HP manufacturer tools. Reference: https://www.ecotech.cc/

Edificius BIM + usMEP.HVAC (ACCA)

Edificius is ACCA’s BIM authoring tool, and with usMEP.HVAC it supports integrated 3D architectural and HVAC modelling. The combination sits in “BIM/MEP modelling, schematics and documentation” and partially in “heating load and distribution design”. It is a niche but relevant solution for Italian offices using ACCA’s ecosystem; it has no use in Austria or Southern Germany. It is applied in concept development and detailed design, especially when coordinated BIM is required. Licensing is commercial; language is Italian; interoperability focuses on IFC and ACCA’s own formats, with separate EPB tools (TerMus, Termolog) used alongside. Strengths are integrated BIM and plant modelling within one vendor ecosystem; limitations include dependence on ACCA-specific workflows and the absence of direct links to CasaClima or national EPB certification procedures unless coupled manually. Reference: https://www.acca.it/software-impianti-termici

Edilclima EC700 / EC701

Edilclima’s EC700/EC701 are Italian tools for building energy performance and “edificio-impianto” evaluation according to UNI/TS 11300 and UNI EN ISO 52016, with monthly and hourly methods. They span “building and system energy performance and refurbishment planning” and “heating load and distribution design”. They are core EPB tools for planners and energy consultants in Northern Italy; they have no regular role in Austria or Southern Germany. They are used across diagnosis, concept development, detailed design (via load modules) and procurement. Licensing is commercial; language is Italian; interoperability is mainly internal to the Edilclima ecosystem, with exports for Legge 10 and APE documents. Strengths include strong regulatory alignment and integrated building-system treatment; limitations are limited explicit treatment of complex multi-apartment hydraulics and only basic coupling to economic and dynamic system simulators, which are typically handled externally. Reference: https://www.edilclima.it/software-termotecnica/prog-termotecnica-energetica/scheda/700

EED – Earth Energy Designer

EED is a programme for designing borehole heat exchanger fields for ground-source HP systems, focused on long-term ground thermal response. It belongs to "dynamic building and system simulation" (sub-domain: ground-side design). It is a niche but important tool for specialised planners and consultants in Austria and Southern Germany; it is used only sporadically in Northern Italy. It supports concept development and detailed design of geothermal source systems. Licensing is commercial; language is typically English; interoperability is limited to file and report exports used alongside other tools (Polysun, EPB, etc.). Strengths are robust, widely accepted models for borehole sizing; limitations are its narrow scope (no building/system side) and the need to manually couple with load and HP design tools. Reference: https://buildingphysics.com/eed-2/

EnergyPlus

EnergyPlus is a free, open-source building energy simulation engine maintained by US DOE. It lies in the "dynamic building and system simulation" domain and is typically accessed via GUIs like DesignBuilder or OpenStudio. Its use in the project regions is niche and concentrated among advanced modellers in research and specialised offices across all three regions. It supports concept development, detailed design and methodological studies. Being open-source, it is free; interfaces are primarily file-based; language is English. Strengths include high flexibility and transparency; limitations for everyday practice are the lack of direct user-facing interface, limited direct recognition in national EPB procedures and the skill level required. Reference: https://energyplus.net/

ETU-Planer / TGA Heizung (ETU / Hottgenroth)

ETU-Planer and Hottgenroth's TGA-Heizung modules form a suite for TGA and energy planning, including heating-load calculations and, in some configurations, building simulation. They belong to "heating load and distribution design" and "building and system energy performance and refurbishment planning". They are relevant tools for HVAC planners in Austria and Southern Germany; they are not used in Northern Italy. They are applied in concept development and detailed design, and sometimes in procurement documentation. Licensing is commercial; language is German; interoperability is strongest within the Hottgenroth/ETU ecosystem, with limited standardised external interfaces. Strengths are robust DIN/ÖNORM compliance and integrated HVAC modules; limitations include limited explicit multi-apartment features and manual coupling to BIM and manufacturer platforms. Reference: https://www.etu.at/tga-heizung/

GEQ

GEQ is an Austrian EPB software for energy certificates and refurbishment analysis. It lies in "building and system energy performance and refurbishment planning". It is a core EPB tool for Austrian energy consultants and planners; it is not used in Southern Germany or Northern Italy. It is used in diagnosis, concept development and procurement. Licensing is commercial; language is German; interoperability is limited beyond standard report exports, so coupling to heating-load, HP manufacturer and BIM tools is mainly manual. Strengths are user familiarity and regulatory alignment; limitations are limited explicit features for multi-apartment HP hydraulics and the absence of integrated economic and acoustic modules. Reference: https://www.geq.at/

GeoTSOL

GeoT*SOL is a simulation tool by Valentin Software for design and performance assessment of HP systems, especially geothermal ones, including SPF and economic evaluations. It lies in "dynamic building and system simulation" and "heat pump sizing and manufacturer tools". It is relevant for HP specialists in all three regions, with stronger use in Austria and Southern Germany. It is typically used in concept development and detailed design for variant comparison and to support funding applications. Licensing is commercial; language versions include German and English; interoperability is primarily via project and report exports combined with external EPB, load and economic tools. Strengths are focused support for HP and source design with integrated energy/economic output; limitations include limited direct link to building geometry or BIM and the need to import loads from other tools. Reference: https://valentin-software.com/en/products/geotsol/

GSE Conto Termico simulators

The GSE Conto Termico simulators are online calculators that estimate Italian incentives and economic benefits for eligible efficiency and renewable-heat interventions, including HP retrofits. They belong to "economic assessment, incentives and risk evaluation" and partially to "advisory and auxiliary tools". They are relevant tools for planners and installers in Northern Italy; they are not used in Austria or Southern Germany. They are applied in diagnosis, feasibility and procurement/subsidy phases. They are free, web-based, Italian-language tools; interoperability is limited to manual transfer of incentive estimates into business cases. Strengths are direct alignment with Conto Termico procedures; limitations are the narrow focus on incentive calculation and the need to combine them with other tools for technical design and whole-life costs. Reference: https://www.gse.it/servizi-per-te/interventi-e-simulatori

Heizleistungsrechner (Energieinstitut Vorarlberg / klimaaktiv)

The Heizleistungsrechner is an online Austrian tool to estimate room heating capacity and check whether existing radiators can meet loads at lower supply temperatures, enabling quick HP feasibility checks. It sits between "advisory and auxiliary tools" and "heating load and distribution design". It is a relevant tool in Austria (especially Vorarlberg and Tirol), used by planners, energy consultants and sometimes installers; it has only illustrative relevance elsewhere. It is used mainly in diagnosis and feasibility and early concept development. The tool is free, web-based and German-language, with outputs manually transferred into more detailed design tools. Strengths are simplicity and direct relevance to HP retrofit decisions in existing systems; limitations are simplified methods, focus on single rooms and small buildings, and lack of explicit multi-apartment network modelling. Reference: https://www.energieinstitut.at/tools/heizleistungsrechner/

Heizrechner (Energieinstitut Vorarlberg)

The Heizrechner is an online full-cost comparison tool for different heating systems, providing life-cycle cost and CO_2 comparisons tailored to specific buildings. It belongs to “economic assessment, incentives and risk evaluation” and “advisory and auxiliary tools”. It is relevant for Austrian planners, energy consultants and advisors; it is not used in the other regions. It supports diagnosis and feasibility and procurement discussions with clients. It is free and web-based (German), with manual transfer of results into reports and decisions. Strengths are clear cost and emissions comparisons at a level understandable for lay clients; limitations are that it is oriented towards small building typologies and must be complemented by detailed technical design tools. Reference: https://www.energieinstitut.at/tools/heizrechner/

Heizungsmatrix (klimaaktiv / Energieinstitut)

The klimaaktiv Heizungsmatrix is an online matrix that suggests suitable heating systems based on energy demand, heat load and system characteristics, originally for single- and two-family houses. It lies in “advisory, comparison and auxiliary tools”. It is relevant in Austria as an advisory concept, with indirect influence on multi-family discussions; it is not used in Southern Germany or Northern Italy. It is mainly applied in very early diagnosis and feasibility and client discussions. The tool is free, web-based and German-language. Strengths are an easily understandable mapping between building characteristics and heating options; limitations are its focus on small buildings, simplified assumptions and the absence of explicit HP-specific hydraulic constraints; for multi-family refurbishments, it only provides a qualitative orientation. Reference: https://www.energieinstitut.at/tools/matrixweb/

Hottgenroth TGA Heizung / Heizlast 3D Plus

Hottgenroth’s TGA-Heizung and Heizlast 3D Plus modules are DIN/ÖNORM-based programmes for room and building heating-load calculations, radiator and floor-heating sizing and system design. They belong to “heating load and distribution design”, with partial overlap to “building and system energy performance”. They are core tools for planners in Southern Germany and relevant in Austria; installers use them occasionally. They are used in concept development and detailed design and sometimes during procurement to document sizing assumptions. Licensing is commercial; language is German; interoperability is mainly within the Hottgenroth suite and through table/plan exports to other environments. Strengths are wide adoption, standard compliance and flexible handling of building typologies; limitations are limited explicit support for multi-apartment riser hydraulics and only indirect links to manufacturer sizing tools and BIM. Reference: https://www.hottgenroth.de/M/SOFTWARE/Heizung-Klima-Lueftung/Heizung/TGA-Heizung/

HVAC Positioner (AIT)

HVAC Positioner is a research-derived tool from AIT for optimising positions of HVAC outdoor units with respect to noise and efficiency. It belongs to "noise, comfort and acoustic assessment", with some overlap to "advisory tools". It is a niche tool used in a few Austrian pilot projects by planners and researchers; it is not part of mainstream practice in any region. It is applied in concept development and detailed design for complex projects with challenging acoustic constraints. Licensing and distribution are project-based; interoperability is mainly via import/export of point locations from CAD/BIM or GIS. Strengths are advanced acoustic and layout optimisation capabilities; limitations are its limited dissemination, research status and the need for specialist knowledge to apply it. Reference: https://www.ait.ac.at/themen/efficient-buildings-and-hvac-technologies/projekte/hvac-positioner

IDA ICE

IDA ICE (Indoor Climate and Energy) is a detailed multi-zone dynamic building and system simulation tool. It sits in "dynamic building and system simulation". It is a relevant tool for advanced planners and researchers in Austria and Southern Germany and niche in Northern Italy. It is used in concept development, detailed design and in some cases commissioning optimisation and post-occupancy studies. Licensing is commercial; languages include English and other localised versions; interoperability with BIM and data formats is available but used mainly by specialists. Strengths are high fidelity, proven use in Nordic/central European contexts and good handling of HP and multi-zone systems; limitations are complexity, required expertise and the lack of direct coupling to everyday EPB certification workflows. Reference: https://www.equa.se/en/ida-ice

liNear (Building Heating / Revit Solutions)

liNear provides heating-load and HVAC-design solutions integrated into Revit and other CAD environments. They lie in "heating load and distribution design" and "BIM/MEP modelling, schematics and documentation". They are relevant tools for MEP planners in Austria and Southern Germany; they are generally not used in Northern Italy. They are applied in concept and detailed design, especially for BIM-based projects. Licensing is commercial; language is mainly German; interoperability is strong within Autodesk and CAD ecosystems and weaker towards EPB and HP manufacturer tools. Strengths include integration of calculation and BIM modelling; limitations are dependence on Revit and the need to manage interfaces to separate EPB and economic tools. Reference: https://www.linear.eu/en/software/solutions-for-autodesk-revit/revit-heating/

MasterClima

MasterClima (MC 11300) is an Italian EPB and Legge 10 tool for building energy performance according to UNI/TS 11300. It belongs to "building and system energy performance and refurbishment planning". It is a relevant EPB tool for planners in Northern Italy; it is not used in Austria or Southern Germany. It is applied in diagnosis, concept development and procurement/subsidy phases. Licensing is commercial; language is Italian; interoperability is mainly via standard documents and internal links to other MasterClima modules. Strengths are strong regulatory fit and wide recognition; limitations are limited explicit support for HP-specific hydraulic design and the need to couple with external tools for dynamic simulation and multi-apartment hydraulics. Reference: https://www.masterclima.info/

Matlab/Simulink Carnot Toolbox

The Carnot Toolbox is an add-on to Matlab/Simulink for dynamic modelling of thermal systems, including HPs and renewables. It sits in “dynamic building and system simulation”. It is niche and used mainly in research and advanced consulting projects in Austria and Southern Germany. It tends to be used for methodological studies, proof-of-concept models and detailed system research in the concept and optimisation phases, rather than for routine design. Licensing is commercial (Matlab/Simulink plus toolbox), language is English; interoperability depends on user-built interfaces to external tools. Strengths are high flexibility and suitability for complex system modelling; limitations are very high entry barrier for practitioners and absence of direct recognition in everyday practice and funding schemes. Reference: https://www.fh-aachen.de/forschung/institute/sij/carnot

mh-BIM (mh-software)

mh-BIM is a TGA planning tool for heating, cooling, ventilation and plumbing systems with 3D modelling capabilities. It lies in “heating load and distribution design” and “BIM/MEP modelling, schematics and documentation”. It is a relevant niche tool for MEP planners in Austria and Southern Germany; it is not used in Northern Italy. It is used in concept development and detailed design. Licensing is commercial; language is German; interoperability focuses on CAD/BIM environments and internal calculation modules, with limited direct links to EPB or HP manufacturer tools. Strengths are integrated TGA modelling tailored to German-speaking markets; limitations are relatively small user base and weak representation in training and academic curricula, which can limit cross-firm transferability. Reference: https://www.mh-software.de/

Modelica-based environments (e.g. Dymola / OpenModelica)

Modelica-based simulation environments (Dymola, OpenModelica, etc.) are used for equation-based dynamic modelling of building and HVAC systems. They belong to “dynamic building and system simulation”. They are niche tools for research and very specialised consulting across all three regions. They are used in concept, optimisation and research phases, not in everyday office practice. Licensing ranges from commercial (Dymola) to open-source (OpenModelica); language is mainly English; interoperability is driven by user-defined interfaces. Strengths are unparalleled modelling flexibility and ability to capture complex, coupled systems; limitations are very high skill requirements and absence from standard design workflows and training for practitioners. Reference: https://modelica.org

OpenStudio

OpenStudio is an open-source interface and SDK for EnergyPlus, supporting building energy modelling and scripting. It lies in “dynamic building and system simulation”. It is niche and used by a few advanced users in all three regions. It supports concept development and research-focused analysis. Licensing is open-source, language is English; interoperability with BIM and data formats is scriptable but not plug-and-play for ordinary practitioners. Strengths are openness and scriptability; limitations are complexity and limited visibility in mainstream HP refurbishment practice. Reference: https://openstudio.net/

PHPP – Passive House Planning Package

PHPP is the Passive House Planning Package, a spreadsheet-based tool for energy balancing and design of very efficient buildings and refurbishments. It belongs to “building and system energy performance and refurbishment planning”. It is a relevant niche tool for specialised planners targeting high standards in all three regions. It is used in diagnosis, concept development and procurement for ambitious retrofits. Licensing is commercial; languages include German and English and other translations; interoperability consists mainly of data imports/exports via spreadsheets and manual coupling to other tools. Strengths are robust, well-documented methods for low-demand buildings and clear link to certification; limitations are that it is tuned to Passive House-level performance, not directly aligned with national EPB procedures in all regions, and offers limited explicit representation of complex existing multi-apartment systems. Reference: https://passivehouse.com/04_phpp/04_phpp.htm

Plancal / Trimble Nova

Trimble Nova (formerly Plancal) is a BIM-CAD platform for TGA design with integrated 3D modelling and HVAC calculations. It lies in “heating load and distribution design” and “BIM/MEP modelling, schematics and documentation”. It is a core or highly relevant tool for TGA planners in Austria and Southern Germany; it is not used in Northern Italy. It is applied in concept development, detailed design and documentation. Licensing is commercial; language is mainly German; interoperability with other BIM tools exists via IFC, and internal calculation modules support HVAC design. Strengths are strong support for integrated MEP workflows and widespread use in larger offices; limitations are limited coupling with EPB tools and simulation tools, so building-level energy and HP design still require parallel toolchains. Reference: https://cloud.pages.trimble.com/mep-nova-bim-software

Polysun (Vela Solaris)

Polysun is a system simulation and planning tool for combined energy systems (solar, PV, HPs, storage, district systems). It lies in “dynamic building and system simulation” and “heat pump sizing and manufacturer tools”. It is a relevant tool for specialised planners in all three regions, particularly Austria. It is used in concept development and detailed design for system variant comparison, source design and performance analysis. Licensing is commercial; languages include German and English; interoperability is based on standard input/output files, with loads often imported from

EPB/heating-load tools. Strengths are targeted support for multi-technology system layouts and performance metrics; limitations are that its use is limited to specialists and results are not directly integrated into national EPB or BIM environments, requiring manual translation into planning and procurement documents. Reference: https://www.velasolaris.com/en/

PokornyTec Heizlast Austria

PokornyTec Heizlast Austria is a heating-load tool implementing ÖNORM H 7500-3 / EN 12831 for room and building loads. It belongs to "heating load and distribution design". It is a relevant tool for planners in Austria; it is not used in the other regions. It is applied in concept and detailed design. Licensing is commercial; language is German; interoperability is mainly via exports that are re-used in spreadsheets or other tools. Strengths are alignment with Austrian standards and straightforward calculation; limitations are that it offers little explicit support for complex riser hydraulics and must be combined manually with HP sizing and BIM documentation. Reference: https://www.pokorny-tec.at/software_produkte/heizlast-austria/

PokornyTec Wirtschaftlichkeit / Econcalc

PokornyTec's economic modules (Wirtschaftlichkeit, Econcalc) support life-cycle cost and cost-benefit analyses according to relevant ÖNORM methods. They belong to "economic assessment, incentives and risk evaluation". They are niche but relevant tools for Austrian planners and energy consultants; they are not used elsewhere. They are used in diagnosis, feasibility and procurement phases to compare refurbishment and heating options. Licensing is commercial; language is German; interoperability is limited to exchange with PokornyTec's own technical modules and Excel outputs. Strengths are methodologically sound life-cycle costing in line with Austrian standards; limitations are their narrow regional and user base and manual coupling with technical and HP-specific tools. Reference: https://www.pokorny-tec.at/software_produkte/wirtschaftlichkeit-nach-oenorm/

ProCasaClima Hygrothermal

ProCasaClima Hygrothermal is a CasaClima tool for dynamic hygrothermal simulation of building components, assessing heat and moisture transport in assemblies. It lies in "dynamic building and system simulation" (envelope-focused). It is a niche tool used by specialised designers and consultants in Northern Italy (particularly South Tyrol); it has no role in Austria or Southern Germany. It is applied in concept and detailed design of refurbishment details. The tool is free but tied to CasaClima; languages are Italian and German; interoperability is via component data and report export. Strengths are detailed assessment of risk of condensation and moisture in envelopes; limitations are the focus on component-level analysis and the lack of direct coupling to building/system-level HP design and economic considerations. Reference: https://www.agenziacasaclima.it/it/pro-casaclima-hygrothermal--9-1673.html

Revit MEP (Autodesk)

Revit MEP is Autodesk's BIM platform for mechanical, electrical and plumbing modelling. It lies in "BIM/MEP modelling, schematics and documentation". It is a relevant tool for larger multidisciplinary offices in all three regions, particularly for coordination; however, it usually relies on external tools for detailed EPB and load calculations. It is used from concept through detailed design, documentation and sometimes for as-built models that support commissioning. Licensing is commercial; languages are localised; interoperability via IFC and plug-ins is good, though coupling to EPB and HP-specific sizing tools depends on add-ons. Strengths are widespread use, strong BIM coordination and data-rich models; limitations for HP refurbishments are that energy and hydraulic calculations must be done in other tools and manually synchronised. Reference: https://www.autodesk.com/products/revit/overview

Solar-Computer Heizlast

Solar-Computer's heating-load software implements DIN EN 12831 for room and building loads. It belongs to "heating load and distribution design". It is a relevant tool for planners in Southern Germany and partly in Austria; it is not used in Northern Italy. It is used in concept development and detailed design. Licensing is commercial; language is German; interoperability exists via CAD integration and internal calculation modules, with limited connections to EPB and manufacturer tools. Strengths are reliable, standard-compliant calculations and established user base; limitations are limited explicit focus on multi-apartment distribution strategies and manual coupling to HP manufacturer and BIM workflows. Reference: https://www.solar-computer.de/index.php?seite=produkte&software=software-heizung-neue_Heizlastberechnung_DIN_EN_12831&sub=heizung

STIMA10

STIMA10 is an Italian thermotechnical software (IdronicaLine) for peak load and energy needs according to UNI/TS 11300, producing APE/AQE and Legge 10 documents. It sits between "building and system energy performance" and "heating load and distribution design". It is a niche but relevant tool for some planners in Northern Italy; it is not used in Austria or Southern Germany. It supports diagnosis, concept development and procurement phases. Licensing is commercial; language is Italian; interoperability is mainly internal, with reports and exports used elsewhere. Strengths are alignment with Italian norms; limitations are a relatively small user base and manual integration with HP manufacturer platforms, dynamic simulation and economic tools. Reference: https://www.idronicaline.net/index.php?id_sez=soft&id_soft=00002

TAS (EDSL Tas)

EDSL Tas is an hourly dynamic building simulation suite for modelling building thermal performance and HVAC systems. It belongs to "dynamic building and system simulation". It is a niche tool used by specialist modellers in Southern Germany and Austria and rarely in Northern Italy. It is applied in concept development and detailed design for complex or research-type projects. Licensing is commercial; language is primarily English; interoperability with BIM and other tools is available but requires specialist knowledge. Strengths are high resolution and detailed analysis; limitations for mainstream HP refurbishment are complexity, lack of direct EPB certification support and limited penetration among practitioners. Reference: https://www.edsltas.com/

Termolog (Logical Soft)

TERMOLOG is a widely used Italian EPB and thermotechnical suite for APE, Legge 10, dynamic energy calculations and HVAC design, including CasaClima-aligned workflows. It belongs to "building and system energy performance and refurbishment planning", "heating load and distribution design" and "economic assessment, incentives and risk evaluation". It is a core tool for planners in Northern Italy; it is not used in the German-speaking regions. It is used from diagnosis and concept development through detailed design (via load modules) and procurement/subsidy tasks. Licensing is commercial; language is Italian; interoperability focuses on internal modules and outputs for regulators. Strengths are broad functionality, integration of building and system views and good support for refurbishment variants; limitations include limited explicit representation of multi-apartment hydraulics and fragmented coupling with independent dynamic simulation and HP manufacturer tools. Reference: https://www.logical.it/software-termotecnica/

TerMus / TerMus-PLUS (ACCA)

TerMus is ACCA's thermotechnical software for energy certification, Legge 10 reports and heating/cooling load calculation, while TerMus-PLUS integrates EnergyPlus-based dynamic simulation. They sit in "building and system energy performance", "heating load and distribution design" and, for PLUS, "dynamic building and system simulation". They are relevant tools for Italian planners, especially those in ACCA ecosystems; they have no role in Austria or Southern Germany. They support diagnosis, concept development, detailed design and procurement phases. Licensing is commercial; language is Italian; interoperability is best with ACCA BIM tools and less developed toward independent EPB and manufacturer tools. Strengths are an integrated path from EPB to dynamics within one vendor environment; limitations are vendor lock-in, limited multi-apartment hydraulic modelling and the need to manually integrate manufacturer-specific HP configuration. Reference: https://www.acca.it/software-termotecnica

Trimble MEP (including Nova)

Trimble MEP, with Nova as the central TGA platform, offers integrated BIM-based design and documentation for HVAC, plumbing and electrical systems. It belongs to "BIM/MEP modelling, schematics and documentation" and "heating load and distribution design". It is a core or highly relevant tool for MEP planners in Austria and Southern Germany; it is not used in Northern Italy. It is applied in concept, detailed design, documentation and sometimes commissioning/as-built stages. Licensing is commercial; language is mainly German; interoperability via IFC and other BIM standards is good, but integration with EPB, dynamic simulation and HP manufacturer tools depends on custom workflows. Strengths are robust BIM-based TGA workflows; limitations are limited explicit HP- and multi-apartment-specific features and the need for parallel EPB/economic toolchains. Reference: https://mep.trimble.com/de

Uponor HSEdesktop

Uponor HSEdesktop is a planning tool for underfloor heating, drinking-water and buffer tanks with Uponor components. It lies in “heating load and distribution design” and “heat pump sizing and manufacturer tools”. It is a niche but useful tool for planners and installers in all three regions when working with Uponor systems. It is used in concept development and detailed design for hydronic layouts and component selection. Licensing is typically free for partners; languages follow local markets; interoperability is mainly model and drawing exports with limited structured data exchange. Strengths are direct component sizing and clear integration with manufacturer products; limitations are brand specificity, limited explicit multi-apartment modelling capability and lack of integration with broader EPB and HP design workflows. Reference: https://www.uponor.com/en-gb/services/hse-desktop

Viessmann Vitodesk 200 / Haustechnik Pro

Vitodesk 200 and Haustechnik Pro are Viessmann planning tools for designing heating systems, including HP and radiator systems with Viessmann components. They belong to “heating load and distribution design” and “heat pump sizing and manufacturer tools”. They are niche but relevant tools for planners and installers who work heavily with Viessmann products in all three regions. They are applied in concept development and detailed design. Licensing is usually free for partners; language is local; interoperability is focused on Viessmann product data and report exports; integration with external EPB and BIM tools is manual. Strengths are detailed product-level design and alignment with Viessmann service workflows; limitations are brand lock-in and limited explicit support for cross-brand comparisons, multi-apartment hydraulics and integrated economic assessment. Reference: https://www.viessmann.de

Viptool Building / Viptool Master (Viega)

Viptool Building and Viptool Master are Viega planning tools for designing and documenting heating and plumbing systems with Viega components. They lie in “heating load and distribution design” and “BIM/MEP modelling, schematics and documentation”. They are niche but relevant for planners and installers in Austria and Southern Germany using Viega systems; they have no role in Northern Italy. They are used in concept development and detailed design. Licensing is typically free for partners; language is German; interoperability focuses on CAD/BIM outputs and system schematics. Strengths are efficient planning of system layouts with manufacturer fittings and pipes; limitations include brand specificity and separation from EPB, dynamic simulation and cross-brand optimisation tools. Reference: https://www.viega.de/de/service/software-tools/liNear-Solutions-Viega-Edition.html

Weishaupt JAZ- und Schallrechner

Weishaupt's JAZ and sound calculators estimate SPF and noise for Weishaupt HPs, supporting funding eligibility checks and acoustic assessments. They belong to "economic assessment, incentives and risk evaluation" and "noise, comfort and acoustic assessment". They are niche but relevant tools wherever Weishaupt HPs are installed across all three regions. They are used in diagnosis and feasibility, concept development and detailed design. They are free, web-based or downloadable tools with local-language interfaces; interoperability is limited to manual transfer of values into broader toolchains. Strengths are straightforward, brand-aligned calculation of funding-relevant SPF and acoustic constraints; limitations are brand specificity and lack of integration with cross-brand, system-level design and economic tools. Reference: https://www.weishaupt.de/service/wp-rechner

ZUB Helena

ZUB Helena is an energy-consulting software for EnEV/GEG-compliant energy balances, funding calculations and some heating-load analysis. It belongs to "building and system energy performance and refurbishment planning" and "heating load and distribution design". It is a relevant tool for energy consultants and planners in Southern Germany and niche in Austria; it is not used in Northern Italy. It is applied in diagnosis, concept development and procurement for refurbishment projects. Licensing is commercial; language is German; interoperability is limited mainly to report/Excel exports. Strengths include integration of energy and funding calculations in a single environment; limitations are modest support for multi-apartment HP specifics and limited coupling with manufacturer tools and BIM. Reference: https://www.zub-systems.de/en/produkte/helena

Zvplan

Zvplan is a planning tool from ConSoft for hydraulic balancing and optimisation of heating systems in line with current funding guidelines. It lies in "heating load and distribution design" and "advisory and auxiliary tools". It is a niche but relevant tool for smaller planning offices and installers in Germany and Austria; it has no role in Northern Italy. It is used mainly in detailed design and commissioning-related planning. Licensing is commercial; language is German; interoperability is via tabular exports and printed documentation. Strengths are structured support for hydraulic balancing and compliance with funding schemes (e.g. for optimisation measures); limitations are limited integration with upstream EPB and HP sizing tools and weak explicit representation of complex multi-apartment riser systems. Reference: https://www.zvplan.de/

Annex B: Training offer factsheets (alphabetical list)

Accademia Viessmann (Italy – heat pump and hybrid seminars)

Accademia Viessmann is the training arm of Viessmann Climate Solutions Italia. It offers seminars and webinars on HPs, hybrid systems, photovoltaics and efficiency. Target groups are installers and designers who use or plan Viessmann systems; prior technical experience is expected but not always formally required. The content focuses on system schematics, normative and incentive aspects, economic evaluation and practical design and installation in residential and condominium contexts. Courses are typically one-day in-person seminars or shorter webinars, delivered in Italian, with continuing-education credits for some professional orders. They are offered mainly in Northern Italy but accessible nationally online. Tool use is centred on Viessmann's own configurators and planning aids. From a KnowHowHP perspective, these seminars strongly support HP technology and manufacturer-specific design competences in concept and detailed design, but only indirectly address envelope–system integration, multi-apartment hydraulics and cross-brand comparison. Reference: https://www.viessmann.it

Ausbildung Energieberatung – Grundkurs (A-Kurs, ARGE-EBA / eNu / WIFI, Austria)

The A-Kurs is the basic module of the Austrian energy-consultant training governed by ARGE-EBA and offered by regional partners such as eNu and WIFI. It targets technicians, planners and craftspeople with a technical background; usually a relevant apprenticeship or HTL degree is required. The content covers fundamentals of building physics, heating technology (including HPs), renewables, electricity consumption, user behaviour and basic advisory skills. Typical learning outcomes include the ability to understand and explain energy balances, recognise thermal weak points and discuss basic system options with clients. The course comprises around 50 teaching units, often in evening or block formats, delivered in German and limited to Austria. It leads to a recognised A-Kurs certificate and is a prerequisite for the F-Kurs. EPB tools and advisory calculators are usually introduced in simple exercises. In terms of integrated HP refurbishment competences, the A-Kurs lays the conceptual foundation but does not yet go into multi-family specifics, advanced toolchains or multi-apartment hydraulics; it prepares participants for later specialisation. Reference: https://www.noe.wifi.at/kurs/32722x-ausbildung-energieberatung-grundkurs-a-kurs

Ausbildung Energieberatung – Fortgeschrittenenkurs (F-Kurs, ARGE-EBA / regional energy agencies, Austria)

The F-Kurs is the advanced ARGE-EBA module delivered by regional energy agencies (Energieinstitut Vorarlberg, Energie Tirol, etc.). It targets participants who have completed the A-Kurs and deepens knowledge in energy-efficient refurbishment, advanced building physics, energy performance certificates and system assessment. Learning outcomes include being able to plan refurbishment strategies, prepare EPB certificates and advise on heating-system choices (including HPs) in existing buildings. The F-Kurs spans several days to weeks in modular form, delivered in German within Austria, and leads to full ARGE-EBA consultant recognition and membership in regional consultant pools. EPB software specific to each region (GEQ, Archiphysik, Ecotech) and advisory tools such as

Heizrechner and Heizleistungsrechner are actively used. This course significantly strengthens diagnosis, concept development and procurement competences for HP-based refurbishment in small and medium buildings; however, explicit training on multi-apartment hydraulics and integrated digital workflows is still limited and usually addressed only via case examples. Reference: via regional providers (e.g. https://www.energieinstitut.at, https://www.energie-tirol.at).

Ausbildung zum/zur Energieeffizienzbeauftragten (WIFI / Quality Austria, Austria)

This course prepares participants to act as company energy-efficiency officers (Energieeffizienzbeauftragte). Target groups are technical staff, facility managers and engineers; practical experience in building or industrial energy use is expected. Content covers energy management, legal frameworks (EEffG, ISO 50001), analysis of building and process energy use, identification and evaluation of measures (including HPs) and reporting. The course is typically two to four days, in modular blocks, delivered in German in Austria, and leads to a person certificate (approximate NQR level 5). It focuses more on management and process than on detailed HP design; tools include energy-benchmarking spreadsheets and, in some cases, metering/monitoring platforms. Its contribution to integrated HP refurbishment lies in strengthening economic assessment, portfolio thinking and process management competencies, but it does not address multi-apartment hydraulics or detailed toolchains. Reference: https://zertifizierung.wifi.at (search "Energieeffizienzbeauftragter")

Aus- und Weiterbildung zum/zur Haustechniker:in (WIFI Vorarlberg / Energieinstitut Vorarlberg, Austria)

This training targets building caretakers and facility technicians responsible for day-to-day operation of building-services systems. Entry requirements are practical experience in building operations. The content covers fundamentals of heating, hot water, ventilation, control strategies, maintenance and basic optimisation, with HPs treated as a core modern heating technology. The course is typically composed of several evenings or days, delivered in German in Vorarlberg, and concludes with a WIFI certificate. Tools used include BMS interfaces, simple monitoring platforms and checklists rather than design software. The training strengthens commissioning and operational optimisation competences, helping to bridge the last phases of the integrated workflow; however, it does not address design-side topics or digital planning toolchains. Reference: https://www.vlbg.wifi.at (search "Haustechniker") and https://www.energieinstitut.at

BWP-Planer – seminars and workshops (Bundesverband Wärmepumpe, Germany)

The BWP-Planer is a web-based planning tool, and BWP runs seminars and workshops to train its use. Target groups are planners and installers in Germany with prior knowledge of HP basics. The seminars cover dimensioning of HP systems in existing buildings according to DIN EN 12831, VDI 4650 and VDI 4645, use of the BWP-Planer interface and interpretation of outputs for funding and design. Events are usually one-day workshops delivered in German and primarily held in Southern Germany but relevant nationally; they are often limited to BWP members. Tools are central: participants work hands-on with the BWP-Planer and related JAZ and sound calculators. These seminars contribute strongly to correct HP sizing and to embedding standard-compliant workflows into practice; they only partially touch on multi-apartment hydraulics and rely on participants to integrate outputs into broader EPB and BIM workflows. Reference: https://www.waermepumpe.de/profis/planungstools/

CasaClima – Base CasaClima per progettisti (Italy)

The Base CasaClima course addresses designers who wish to adopt CasaClima methodology; typical participants are architects and engineers with basic building-physics knowledge. Content includes building-physics fundamentals, low-energy concepts, construction details, introduction to plant systems (including HPs and ventilation) and the CasaClima classification system. Learning outcomes include understanding the CasaClima standard, being able to interpret and design envelope solutions and knowing the role of HPs in that context. The course spans roughly 24 hours, delivered as blended online/on-site sessions, in Italian (and sometimes German), with a final test; it is offered nationally but with focus on South Tyrol. The ProCasaClima software is usually demonstrated. This course builds strong envelope–system integration competences at conceptual level, but does not go deeply into HP system design, multi-apartment hydraulics or detailed digital workflows; it is a foundation for later specialisation. Reference: https://www.agenziacasaclima.it/it/on-demand-base-per-progettisti-casaclima--6-2049.html

CasaClima – Avanzato CasaClima per progettisti (Italy)

The Avanzato course is the advanced designer module for CasaClima. Target groups are designers who have completed the Base course. It deepens building-physics and construction-detail topics, thermal bridges, plant systems (HPs, ventilation, PV, storage) and measurement, and includes an integrated design workshop. Learning outcomes include the ability to design CasaClima-compliant buildings and refurbishments, including system concepts. The course is typically around 24 hours, hybrid delivery, in Italian or German, offered mainly in Northern Italy. ProCasaClima and hygrothermal tools are used more extensively in exercises. The course significantly reinforces envelope–system integration and holistic design competences, including for refurbishment; however, explicit training on multi-apartment HP retrofits and digital cooperation with installers remains limited and is covered primarily via case studies. Reference: https://www.agenziacasaclima.it (course details in the training catalogue)

CasaClima – Esperto CasaClima Pompe di Calore (Italy)

This dedicated path targets HP specialists among designers. Participants are typically engineers and senior designers with CasaClima or equivalent background. The programme consists of four modules covering HP theory, HP systems in residential and non-residential buildings, large-scale applications, regulatory aspects and incentives, with extensive case studies. Learning outcomes include being able to dimension and design HP systems in CasaClima and non-CasaClima buildings and to manage incentives and regulatory constraints. The total workload is around 40 hours; delivery is modular, in Italian, and completion with passing exams leads to the CasaClima "Esperto

Pompe di Calore" title. ProCasaClima and national EPB tools are used to support energy and performance calculations, and real case studies are analysed in depth. This path is highly relevant for concept and detailed design in HP refurbishments and contributes strongly to system-level HP competence; multi-apartment hydraulics and complex refurbishment scenarios are addressed through examples, but not yet as a systematic, process-mapped curriculum. Reference: https://www.agenziacasaclima.it/it/esperto-casaclima-pompe-di-calore-percorso-formativo--6-1219.html

CasaClima – Pompe di Calore, Fotovoltaico e Sistemi di Accumulo per Edifici Residenziali (Italy)

This thematic course targets designers, artisans and company representatives with some experience in HP and PV; it focuses on the integrated design of HPs, PV and storage for residential buildings. Content includes HP types, PV dimensioning, storage strategies, control aspects, economic and regulatory context and real-case discussions. It is typically a one-day seminar, on-site or online, delivered in Italian, mainly in Northern Italy. Tools used include ProCasaClima or national EPB tools as background and manufacturer tools for illustrative examples. It strengthens concept-level understanding of HP–PV–storage interaction; its contribution to multi-family HP refurbishment is indirect: the principles are transferable, but multi-apartment hydraulics and condominium processes are not central. Reference: https://www.agenziacasaclima.it/it/pompe-di-calore-fotovoltaico-e-sistemi-di-accumulo-per-edifici-residenziali--6-4615.html

CasaClima – craftsperson and company trainings ("artigiani e imprese", Italy)

CasaClima's craftsperson and company trainings target installers, site supervisors and companies implementing CasaClima solutions. Entry requirements are practical craft experience. Content covers correct installation and commissioning of HPs, integration with PV and storage, details of envelope and plant interfaces and CasaClima quality requirements. Courses are usually one or two days, delivered in Italian (sometimes German), in Bolzano and regionally. Tool use focuses on checklists, ProCasaClima outputs, commissioning protocols and manufacturer tools. These trainings significantly support execution quality, commissioning and basic troubleshooting in HP refurbishments, but leave system design and multi-apartment planning to designers; digital planning tools are mainly present indirectly. Reference: https://www.agenziacasaclima.it/it/formazione-73.html

Centro Galileo – Corso Pompe di Calore (Italy)

Centro Galileo's HP course is a two-day distance-learning module for technicians and installers, typically those with F-gas background. It covers HP principles, components, installation, commissioning and maintenance, as well as regulatory changes in F-gas rules. Learning outcomes include being able to install and maintain HPs safely and in compliance with current regulations. Delivery is fully online in Italian, in fixed-time sessions with live trainers; the course is accessible nationally and leads to a certificate of attendance. Tools are limited to manufacturer documentation and basic calculators. The course strengthens HP technology and regulatory competences for installers toward the detailed design, installation and commissioning phases; it does not address multi-apartment hydraulics, EPB workflows or integrated economic evaluation. Reference: https://www.centrogalileo.it/sede/formazione-a-distanza/ (see "Corso Pompe di Calore")

CorsoFEROnline – Corso Pompe di Calore (Italy)

This online FER module targets installers and designers seeking to update their FER qualifications. Participants need a technical background and, for FER credits, often prior FER status. Content covers HP types, operation, normative frameworks, FER accreditation, design fundamentals and installation considerations, with emphasis on Italian incentives and standards. It is self-paced, fully online in Italian, and leads to a certificate recognised for FER professional development. Tools are mainly conceptual (slides, examples, simple worksheets). It improves general HP literacy and awareness of regulations and incentives but provides limited depth in integrated multi-family design or complex digital toolchains; it is mainly relevant for diagnosis/feasibility and general concept understanding. Reference: https://www.corsoferonline.it/prodotto/corso-pompe-di-calore/

Donau-Universität Krems – Building Services Engineering – Heating, Air Conditioning, Ventilation, Automation (Austria)

This part-time academic programme targets engineers and professionals in building-services engineering, with entry requirements of a relevant degree and professional experience. Content covers modern heating, air conditioning, ventilation, HP technologies, control and automation, with emphasis on energy efficiency and integrated design. Learning outcomes include being able to design and assess complex building-services systems, including HP-based solutions. The programme is delivered over multiple semesters in German, in blended block formats, and leads to an academic certificate. Tools include EPB software, TGA design tools and sometimes dynamic simulation, depending on elective modules. It strongly contributes to high-level integrated plant design and control competences relevant to all design phases; multi-family and multi-apartment HP retrofits are addressed in case studies but not the exclusive focus. Reference: https://www.donau-uni.ac.at/en/studies/building-services-engineering---heating--air-conditioning--ventilation--automation.html

eNu Akademie / WIFI NÖ – Ausbildung Energieberatung (Austria)

The eNu/WIFI NÖ implementation of ARGE-EBA's A- and F-Kurse targets planners, technicians and craftspeople in Lower Austria. Entry requirements and structure mirror the national A/F system. Content spans building physics, heating systems including HPs, renewables, funding schemes and advisory practice. Delivery is in German, regionally in Lower Austria, in blended evening/block formats; certificates are aligned with ARGE-EBA. EPB software specific to Lower Austria and tools like Heizrechner are used in exercises. The courses collectively build strong diagnosis, concept development and procurement competences for HP-based refurbishments in the local context, but multi-apartment HP specifics and digital multi-tool workflows are still treated only in outline. Reference: https://www.noe.wifi.at (search "Ausbildung Energieberatung") and https://www.enu.at

ENEA e-Learn – Progettazione di impianti a pompa di calore (Italy)

This ENEA e-learning course targets designers, engineers and technicians nationwide with some thermotechnical background. Content provides a legislative and technical framework for HP design: EU and Italian regulations, comfort considerations, HP typologies, design principles and example calculations. It is free, self-paced, online in Italian, with a completion certificate. Tools are conceptual; participants are expected to implement the methods in their own EPB or calculation environments. The course strengthens diagnosis and concept-level design competences for HP systems and aligns methods with national regulations; it does not cover multi-apartment hydraulics in depth nor does it teach specific EPB or BIM tools. Reference: https://formazione.enea.it/scheda_corso-960

eza! – Energieberater- und Fachseminare (Allgäu, Germany)

The Energie- und Umweltzentrum Allgäu (eza!) offers an energy-consultant course and related seminars for planners, energy consultants and installers in the Allgäu region. Participants are typically practitioners with technical backgrounds. Content covers building physics, envelope renovation, heating systems (including HPs), ventilation, funding schemes and frequently the specifics of multi-family refurbishment in the regional context. Courses are delivered in German, regionally in Southern Germany, in evening/block formats; many contribute to formal consultant certification and continuing-education obligations. EPB software, heating-load tools and simple economic calculators are used in practical exercises. These courses build strong competences in diagnosis, concept development and procurement for HP-based refurbishments in small and medium multi-family buildings; multi-apartment hydraulics and integrated digital workflows are addressed to some extent but not systematically across all modules. Reference: https://www.eza-allgaeu.de/bildung

Fachhochschule Burgenland – Master Sustainable Energy Systems (Austria)

This international master's programme targets engineers with bachelor degrees in related fields. It focuses on sustainable energy technologies and systems; HPs and geothermal energy are central in the "Refrigeration and Heat Pumps Technology & Geothermal Energy" module. Learning outcomes include understanding and modelling HP and geothermal systems, integrating them into broader energy systems and evaluating performance and economics. The programme is taught in English over four semesters and leads to an MSc. Tools used include dynamic simulation environments (e.g. TRNSYS, Matlab/Simulink), EPB concepts and project-based toolchains. It contributes strongly to advanced analytical competences for concept development and detailed system design, and equips graduates to design and assess complex HP-based refurbishments; however, explicit training on multi-apartment hydraulics and everyday EPB workflows is limited and depends on elective choices. Reference: https://hochschule-burgenland.at/en/master-sustainable-energy-systems/

Co-funded by
the European Union

Fachhochschule Campus Wien – Academic Expert Programme Building Services Engineering (Austria)

This expert programme targets working professionals in HVAC and building services, requiring relevant prior education and experience. Content covers heating, ventilation, air conditioning and electrical systems in low-energy and passive buildings, with HPs as key technologies in case studies. Learning outcomes include the ability to design and assess integrated building-services concepts. The programme is part-time, delivered in German in Vienna, and leads to an academic expert certificate. Tools include TGA design software, EPB methods and sometimes BIM platforms. It reinforces integrated plant-design competence across the design phases; multi-family HP refurbishments and digital workflows are addressed in examples but are not the exclusive focus of the curriculum. Reference: https://www.hcw.ac.at/en/studies/study-courses/building-services-engineering-al

Fachhochschule Technikum Wien – Master Climate-Responsive Building Technologies (Austria)

This master targets graduates in architecture/engineering with interest in integrated, climate-responsive building technologies. Content includes building physics, HVAC engineering, HP systems, nZEB concepts, BIM and simulation (e.g. IDA ICE, EnergyPlus). Learning outcomes include the ability to design integrated building concepts using digital workflows. The programme is four semesters, partly in English and German, delivered in Vienna. Tools embedded include BIM platforms and dynamic simulation tools. It contributes strongly to early and detailed design competences, particularly digital workflow and integrated envelope–system design; multi-family HP retrofits are one of several application areas, and explicit condominium process topics are limited. Reference: https://www.technikum-wien.at/en/programs/climate-responsive-building-technologies/

Fachhochschule Vorarlberg – Bachelor Umwelt und Technik / Master Nachhaltige Energiesysteme (Austria)

These programmes target prospective engineers in environmental and energy systems. HPs and hybrid systems are treated within modules on building energy systems, renewables and energy management. Delivery is in German in Dornbirn; graduates receive BSc/MSc degrees. Tools include EPB concepts, system-modelling environments and sometimes simulation. Together they build the conceptual backbone for understanding HP-based refurbishment at system level, but do not explicitly focus on multi-family HP retrofits or on teaching specific market tools; such skills are acquired later in practice or CPD. Reference: https://www.fhv.at/studium/technik/umwelt-und-technik-bsc and https://www.fhv.at/studium/technik/nachhaltige-energiesysteme

F-gas certification courses (Italy)

These preparatory courses and exams, offered by providers like E-Train, Coid and STS Certificazioni, target technicians installing and servicing refrigeration and HP systems. Entry requirements vary but typically include technical experience. Content covers refrigerant properties, leak detection, recovery and charging, commissioning, safety and legal obligations under EU 517/2014 and DPR

146/2018. Courses are delivered in Italian, in multi-day blocks, nationwide, and conclude with theoretical and practical exams leading to national F-gas certification. Tools used are mainly instruments and manufacturer documentation. These courses are essential for safe HP installation and legal compliance, contributing to commissioning and maintenance competences; they do not address system design, multi-apartment hydraulics or digital planning. Reference: for example https://www.e-train.it, https://www.coid.it

GETIT – Gebäudetechnik-Ausbildung (HTL Rankweil / ARGE VGE, Austria)

GETIT is a modular building-services training concept at HTL Rankweil and within the ARGE Vorarlberger Gebäudetechnikexperten. It targets HTL students, installers and electricians. Content covers heating, ventilation, hydraulics, control and efficient building-services solutions, including HPs. Delivery is in German, in school programmes and evening CPD modules in Vorarlberg. Tools are basic calculation methods, simple simulations and sometimes TGA software. GETIT builds foundations in building-services and HP concepts and strengthens understanding of hydraulics; explicit focus on multi-apartment HP retrofit workflows and EPB tools is limited, but the hydraulics content is particularly relevant for later multi-family work. Reference: https://getit-ausbildung.at

HBQ Vorbereitungskurs Technische Beratung für Energieeffizienz (WIFI Tirol, Austria)

This preparation course targets experienced practitioners aiming for the HBQ "Technische Beratung für Energieeffizienz". Entry requires substantial practice. Content includes building and process energy analysis, efficiency measures (including HP-based retrofit), funding schemes and client communication. It is delivered in German in Tirol, modularly, and prepares for an external HBQ exam. Tools include spreadsheet-based analyses and sometimes EPB/advisory tools. This course strengthens high-level advisory and economic-assessment competences for refurbishment, including HP-based solutions; it does not, however, cover detailed HP system design or digital multi-tool workflows. Reference: https://www.tirol.wifi.at/kurs/92510x-vorbereitungskurs-hoehere-berufsqualifikation-hbq-technische-beratung-fuer-energieeffizienz

Heat Pump Academy – BAW modules and VDI 4645 courses (Germany)

The Heat Pump Academy's BAW modules and VDI 4645 courses target planners and installers with previous HP or HVAC experience. Content includes HP fundamentals, dimensioning according to DIN EN 12831, VDI 4650 and VDI 4645, system schematics, partial-load operation, common errors and commissioning. Courses are multi-day blocks, in German, in Germany (including Southern Germany), and lead to VDI 4645 personal certificates (for planners or installers). Tools taught include standard calculation methods, BWP-Planer and manufacturer tools. These courses substantially strengthen HP design and execution competences, including for existing buildings; multi-family hydraulics are addressed but not systematically mapped onto an integrated refurbishment workflow, and integration with EPB and BIM toolchains is implicit rather than explicit. Reference: https://waermepumpen-akademie.de

Hochschule Biberach – Energie-Ingenieurwesen / Energie- und Gebäudesysteme (Germany)

The bachelor and master programmes at Hochschule Biberach target future engineers in building and energy systems. Entry follows standard HE routes. Content includes building energy systems, HP technologies, hydraulics, building physics and renewable energy, with project-based modules. Tools include EPB concepts, TGA design software and simulation environments. Delivery is in German; graduates work across Germany. These programmes provide strong conceptual and analytical competences for HP-based refurbishment, including understanding of integrated systems; however, explicit focus on multi-family HP retrofits, multi-apartment governance and specific commercial tools is limited, and graduates typically learn those through practice or CPD. Reference: https://www.hochschule-biberach.de

HTL Jenbach – Energie- und Gebäudetechnik (Austria)

HTL Jenbach's five-year programme targets pupils who will become building-services technicians and planners. Content includes heating, cooling, HP systems, ventilation and basic control, with lab and project work. Tools are introductory EPB and TGA software and spreadsheets. The programme builds foundational competences in building-services and HP technology and contributes to long-term capacity for HP refurbishments; explicit training on multi-apartment refurbishment workflows and digital integration is limited but hydraulics and system basics are covered well. Reference: https://htl-jenbach.at/energie-und-gebaeudetechnik

HTL Rankweil – Höhere Lehranstalt Bautechnik Heizung/Lüftung (Austria)

This HTL programme specialises in heating/ventilation within civil engineering. Students learn building physics, heating and ventilation systems, including HPs, over five years, culminating in a diploma. Tools used are basic design software, EPB concepts and plan-drawing tools. It builds strong technical foundations relevant to HP refurbishments; multi-apartment specific issues and integrated digital workflows are not central but basic hydraulics and coordination with architecture are embedded. Reference: https://www.htl-rankweil.at

Kiwa – Online Corso Pompe di calore e pompe di calore geotermiche (Italy)

Kiwa's online course targets designers and technical managers who want a concise overview of HP and geothermal HP systems. Content covers HP and geothermal HP typologies, principles, advantages, application fields and key design considerations. Delivery is short, online, in Italian, with a certificate of attendance. Tools are conceptual; no specific EPB or design tools are taught. The course improves general HP/GSHP literacy and awareness; its contribution to integrated multi-family HP refurbishment is indirect, by broadening understanding of HP options rather than teaching detailed process or multi-apartment hydraulics. Reference: https://www.kiwa.com/it/it/servizi/formazione/corsi-formazione/ambiente-ed-energia/

MyGreenBuildings – HP specialisation courses (Italy)

MyGreenBuildings' advanced online courses target experienced designers and energy consultants. Entry assumes familiarity with HP basics. Content includes realistic HP sizing, low-GWP refrigerants, system schematics, integration with PV and storage, typical errors and practical rules of thumb; some modules explicitly address central HP systems and more complex projects. Delivery is via live webinars and recordings in Italian, nationally accessible. Participants often receive spreadsheets and checklists as tools. These courses significantly strengthen HP system design competences and bridge theory and practice; multi-family HP retrofits and multi-apartment hydraulics are addressed in some workshops, though not as a structured multi-phase process. Integration with EPB software and manufacturer tools is discussed pragmatically but not formalised into a full workflow. Reference: https://www.mygreenbuildings.org

NaturalNZEB – Workshop Impianti a Pompa di Calore (Italy)

This eight-hour workshop targets practitioners who already know HP basics. Content is a step-by-step design of a complete HP system with PV and storage for a real building, including key decisions and common mistakes. Delivery is usually online, in Italian, with interactive exercises and a certificate and professional credits. Tools include simple design spreadsheets and possibly EPB outputs; manufacturer tools may be used as examples. It strongly supports hands-on design competences for HP systems and fosters integrated thinking between HP, PV and storage; however, it primarily addresses single buildings or small multi-family cases and does not systematically cover multi-apartment hydraulics, condominium governance or full digital toolchains. Reference: https://www.naturalnzeb.it/product/workshop-impianti-pompa-calore/

renowave.at / ÖVI – Lehrgang Nachhaltige Gebäudesanierung und Heizungstausch (Austria)

This joint course targets property managers, project developers and planners involved in multi-family housing. Entry requirements are professional roles in real estate or planning. Content spans building refurbishment fundamentals, heating-system options (HPs, district heating, hybrids), condominium law, stakeholder processes, funding and project development. Delivery is modular, over nine days, in German, in Austria, with a recognised certificate. Tools include EPB outputs, economic spreadsheets and decision matrices; specific HP design tools are not central. This course strongly contributes to process, governance and portfolio competences for multi-family HP refurbishment and complements technical training; it does not teach detailed hydraulics or digital design workflows, but frames the context in which they must operate. Reference: https://www.renowave.at

Sanierungsberaterkurs – Energieinstitut Vorarlberg / Energie Tirol (Austria)

The Sanierungsberaterkurse target architects, master builders, installers and energy consultants focusing on refurbishment. Entry assumes prior technical training. Content concentrates on energy-efficient refurbishment, staged strategies, interaction between envelope and building services and choice/design of heating systems (including HPs) in existing buildings; multi-family examples are prominent in Western Austria. Delivery is modular, in German, at regional energy institutes; courses conclude with certificates and often klimaaktiv recognition. Tools include EPB software, advisory calculators and simple economic/spreadsheet tools; in some cases, HP-specific tools and Heizleistungsrechner are used. These courses contribute strongly to holistic refurbishment planning competences and explicitly address envelope–system integration and practical constraints; multi-apartment hydraulics and digital toolchain integration are touched upon via case work but not taught as an explicit, repeatable digital workflow. Reference: https://www.energieinstitut.at and https://www.energie-tirol.at

Unione Professionisti – Corso online "Pompe di Calore: normativa, funzionamento e dimensionamento" (Italy)

This online course targets designers and technicians needing a concise and accredited introduction to HPs. Content covers HP typologies, operation, performance indicators, energy labels, normative frameworks and basic dimensioning. Delivery is self-paced online, in Italian, and awards CFP credits for engineers and architects. Tools are conceptual; participants are expected to apply the methods in their chosen EPB and design software. It strengthens general HP design literacy and awareness of regulations and labels, particularly for diagnosis and conceptual sizing; it does not address multi-apartment hydraulics or integrated multi-tool workflows explicitly. Reference: https://www.unioneprofessionisti.com/corsi-di-formazione-in-e-learning/corso-online-pompe-calore/

Wärmepumpe Weiterbildung – Planung, Errichtung und Wartung von Wärmepumpen mit Personenzertifizierung gemäß EU-DVO 2024/2215 (Austria)

This nationally coordinated course targets heating technicians, gas/sanitary and refrigeration installers, electrical installers, mechatronics engineers and planners. Entry requires relevant vocational training and experience. Content includes HP and refrigeration fundamentals, planning and installation practice, commissioning, maintenance, regulatory requirements and preparation for Category II certification. Delivery is multi-week blended learning, in German, based at AIT Vienna and HTL Mödling, and leads to personal certificates as "Zertifizierter Wärmepumpeninstallateur/-planer" and, depending on prerequisites, refrigeration Category II. Tools taught include standards-based calculation workflows, manufacturer configurators and some generic HP planning tools; EPB tools are referenced but not central. The course substantially strengthens HP design and execution competences across planning, installation and maintenance; multi-apartment hydraulics and multi-family refurbishment are addressed only in selected examples, and integrated digital workflows remain largely implicit. Reference: https://waermepumpe-weiterbildung.at

WIFI Austria – Kältetechnik/Klimatechnik & HP courses (Austria)

WIFI branches offer refrigeration and air-conditioning courses and HP-specific modules. Target groups are apprentices, master candidates and experienced technicians. Content ranges from refrigeration fundamentals and F-gas aspects to HP planning, installation and maintenance under EU-DVO 2024/2215. Delivery is in German, in regional centres, as block courses; outcomes include WIFI certificates and preparation for Category II exams. Tools used are mainly manufacturer tools and basic calculation methods. These courses underpin safe and competent HP installation and maintenance; they do not emphasise multi-family hydraulic design, EPB workflows or cross-role coordination but are essential for the execution and commissioning phases of HP refurbishments. Reference: https://www.wifi.at/kategorie/k-technik-technische-gewerbe/kg-energie-gebaeudetechnik/kga-kaeltetechnik-klimatechnik