KNOW HOW HP

D6.5

Advanced chatbot deployment package

Public deliverable

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About the project

KnowHowHP develops skills and planning methods for heat-pump refurbishment in existing multi-family buildings. The project focuses on installers, planners and energy consultants. It connects technical knowledge with the practical decisions that arise during refurbishment.

Heat-pump projects need coordinated choices about the building envelope, heating system and use of the building. Training helps professionals understand these connections and assess suitable refurbishment concepts. This work supports the transition to low-carbon heating and the European Union's climate and energy objectives.

The project combines an integrated planning and implementation process with training material and digital tools. Professionals can use these resources to examine options, explain their implications and identify the information needed for a decision.

The consortium brings together three scientific partners and four partners experienced in knowledge transfer and training. WP2 analyses existing needs, training offers and planning processes. WP3 and WP4 develop material and tools for installers and planners. WP5 delivers the training activities.

WP6 supports communication, dissemination and the continued use of the results. The multilingual Wiki and chatbot make project knowledge easier to find and revisit. They provide a route from the published material to questions that arise in everyday professional practice.

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EXECUTIVE SUMMARY

KnowHowHP develops practical knowledge for heat-pump refurbishment in existing multi-family buildings. This deliverable documents two connected results. The Wiki is a curated collection of published, searchable guides. The chatbot offers a conversational way to explore the same subject area in German, Italian and English. It can link to Wiki articles when they support a specific statement.

Together, the Wiki and chatbot form the KnowHowHP knowledge service. It is intended for planners, building-services designers, energy consultants, installers and other relevant craftspeople. They can use it to connect questions about the building envelope, heat load, heating system and operation. A chatbot answer supports understanding; building-specific decisions still require measurements, calculations and professional judgement.

The Wiki contains 132 guides, each available in German, Italian and English. Its topics range from the building envelope and heating systems to acoustics, economics, commissioning and the refurbishment process. The chatbot offers another route into this material: users can ask in their own words without knowing an article title.

The chatbot gives short explanations and supports follow-up questions. Mimo, the animated character in the chat, shows when an answer is being prepared. Its gestures respond to the interaction, and its clothing can reflect the topic of the conversation. Mathematical notation, optional images and simple conceptual diagrams can support an explanation when useful.

This report explains the implementation, intended use and observed results. It presents four complete representative answers without ratings. Annex C contains 84 live answers, 28 per language. Three connected conversations with 15 answers were assessed in an exploratory internal review, documented in Section 2.7; their transcripts are in Annex B. A focused comparison of six sets of German, English and Italian answers examines technical meaning and terminology. Interface examples show Mimo and optional visual answers. The findings identify useful explanations as well as language, technical and citation issues.

The Wiki and chatbot are accessible at https://training.knowhowhp.eu/?mode=knowledge. Annex A gives a concise technical description.

1 INTRODUCTION

KnowHowHP supports professionals planning and implementing heat-pump refurbishments in existing multi-family buildings. These projects connect the building envelope, room heat loads, heating emitters, water temperatures, domestic hot water, acoustics and operation. The project develops training resources and digital tools so that this knowledge can be used beyond a single course or project event. [1]

The Wiki is the project's online knowledge base. It contains structured guides that users can search and read directly. Each published guide has a language version and source information. The chatbot is a second route into this content: users ask a question in their own words, receive an explanation and can continue the conversation. When a Wiki passage supports a claim, the answer can link to the relevant article. The chatbot may also explain general concepts that are not covered by a published guide. [3]

1.1 The Wiki and chatbot

The Wiki and chatbot are accessed through the KnowHowHP training platform at https://training.knowhowhp.eu/. Its Knowledge area brings both services together. The platform builds on the project training materials and connects them with building-based exercises and the integral refurbishment journey. Learners can consult an article or ask the chatbot to explain a concept, then return to their exercise. This places both services within a wider training environment. The broader training workflows are covered by the platform documentation prepared for D5.1 and D5.2. [19]

The two parts serve different needs. The Wiki provides a stable place to read an article and inspect its sources. The chatbot helps users formulate a question and connect related topics. Table 1 summarises what users receive from each part.

Table 1. What users receive from the knowledge service

Result	Value for the user
Searchable multilingual Wiki	Users can find and read the project knowledge in German, Italian and English.
Conversational answers	Users can ask about the issue they face and request further explanation in the same conversation.
Supporting article links	Users can inspect the project material behind cited statements.
Optional visual explanations	Images, simple diagrams and mathematical notation can make relationships easier to understand.
Knowledge for different refurbishment projects	The Wiki explains general principles and practical questions. Its content is not tied to a specific building or project.

1.2 Purpose and scope of D6.5

D6.5 documents the multilingual chatbot, its connection to the published knowledge base and its use. This report describes the result, shows representative answers and records an initial review of connected conversations. The report is in English; the service accepts questions in German, Italian and English. [1]

The Wiki and chatbot support information retrieval and understanding. This report does not claim measured reductions in planning time, improved learning outcomes or additional heat-pump installations. Such outcomes need separate evidence. Building-specific design still depends on engineering calculations and professional judgement.

1.3 Links to the other KnowHowHP results

The Wiki and chatbot make knowledge from across KnowHowHP easier to revisit. WP2 establishes the needs, terminology and refurbishment approach; WP3 and WP4 develop teaching material and planning support; WP5 brings them into training. Table 2 shows how Task 6.5 connects these results. [1, 11–15]

Table 2. Connections between the project results and the Wiki and chatbot

Project output	Connection to the Wiki and chatbot
D2.1 and D2.2 Needs, terminology and existing offers	D2.1 identifies barriers and knowledge gaps and provides the EN/DE/IT glossary. D2.2 maps planning instruments and training offers. Together they guide topic selection, terminology and links to further material. [11, 12]
D2.3 and D2.4 Process and integrated refurbishment	D2.3 sets out stakeholder roles and the process roadmap. D2.4 brings technical, economic and organisational choices into an integrated refurbishment approach. Wiki explanations can connect individual questions to these wider dependencies. [13, 14]
D3.1 and D3.2 Installer training material	WP3 develops teaching material for installers. Relevant, reviewed explanations can be adapted into Wiki guides with source information, giving installers continued access between and after training sessions. [1]
D4.1 Toolbox with GUI	The toolbox supports calculations and comparisons for building-specific options. The Wiki explains concepts and assumptions; the chatbot helps users understand them. A conversational answer does not provide the calculation evidence of a toolbox result. [1]
D4.2 Test Cases Report	The test cases provide building and system examples for the integral planning workflow. They can supply worked examples for guides, with the case assumptions and system boundaries retained. They are distinct from the synthetic chat scenarios assessed in this report. [1, 15]
D4.3 and D4.4 Professional training material	WP4 develops material for planners and energy consultants. Wiki guides can explain the concepts behind the learning exercises and toolbox use. WP5 training provides the context in which participants encounter and revisit these resources. [1]

An installer can revisit radiator guidance and apply the appropriate calculation. Planners can connect the D2.3/D2.4 refurbishment dependencies with D4.2 cases. Editors retain the sources of adapted guides.

FHI requested inclusion of the training platform in D5.1/D5.2; confirmation is pending. WP4 provides professional calculations and the toolbox. The Wiki and chatbot support understanding of the D2.4 refurbishment journey. [14, 19]

D2.3 separates diagnosis, feasibility, concept, detailed design, procurement with subsidies and approvals, implementation, commissioning and operation. The platform groups work into Survey, Concept, Design, Approval and Evaluation views. These navigation stages do not replace the roadmap. The historical chat sequence in Annex C compresses feasibility and separates procurement from approvals; it is not an agreed new project process. [13, 14]

2 METHODOLOGY

The implementation connects a curated, multilingual knowledge base with a conversational interface. The method has three parts: preparing publishable knowledge, turning a question into a traceable answer, and presenting that answer in a usable form. The following sections explain these steps and the method used to document and assess the resulting answers. [8]

2.1 Implementation approach and system architecture

The browser interface is implemented in React and TypeScript. A server-side knowledge service handles article search, answer requests and publication rules. The service stores article records and editorial knowledge gaps in a persistent JSON knowledge store. It exposes published material through a public interface, while editing and publication require an authorised project role. Figure 1 shows how these parts work together. [8]

The interface sends a question, the selected language, recent conversation context and the user's visual preference. The answer service prepares relevant Wiki passages and asks a language-generation component for a structured response. The returned data separates answer text, source identifiers and optional visual content. The browser renders these elements and updates Mimo's visible state. This separation allows the source links and presentation to be controlled independently of the wording of an answer.

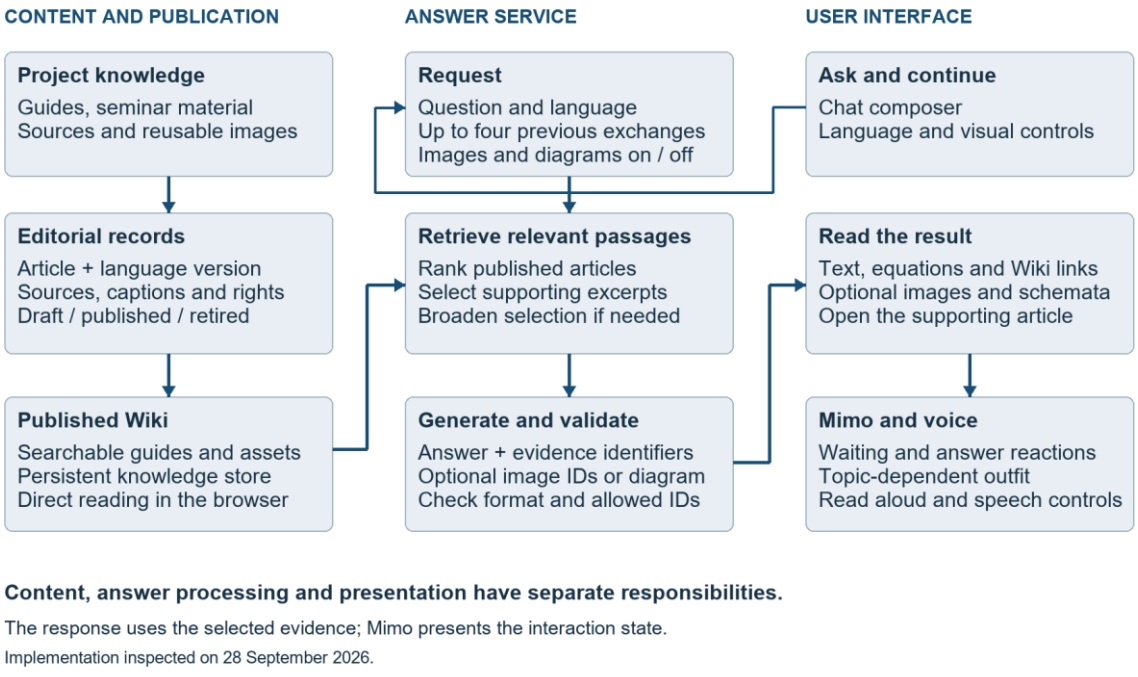

Figure 1. Architecture of the Wiki and chatbot implementation. The arrows show the movement of published content, requests and answer data. [8]

2.2 Preparing and publishing the knowledge base

Each Wiki guide is stored as a structured article containing a title, summary, body text, topics, key points, language, sources and optional images. The German, Italian and English versions are linked to the same article. An article becomes visible in the public Wiki only after an authorised editor publishes it. Drafts remain in the editorial workspace, and withdrawn articles are no longer available to public readers. [8]

The editorial process therefore controls what can become retrievable evidence. Authorised editors prepare or revise a record and then publish it. The publication checks require a cleared source. Images also need alternative text, a caption and cleared reuse rights. These checks make the source and reuse status explicit. They do not replace the editorial assessment of whether the explanation or translation is technically correct.

The same records serve two forms of access. A user can search and read a guide directly in the Wiki, or ask the chatbot a related question. The chatbot does not need a separate copy of the article text for each user. It retrieves material from the published collection at the time of the request. This connection gives the project team a common place to maintain explanations and source information.

2.3 Retrieving evidence and generating an answer

Retrieval starts with the user's question and selected language. The service normalises terms and ranks published articles using matches in titles, topics, summaries, key points and body text. Matches in a title or topic carry more weight than an isolated match in the body. Query coverage also affects the ranking, so an article covering several parts of a question can outrank one that only repeats a common term. [8]

The service normally assembles evidence from a small number of relevant articles. It includes summaries and key points, and can select up to three matching body passages per article. These passages remain verbatim. Their identifiers allow the returned references to be checked against the material actually supplied for the answer. When the initial search does not find sufficient evidence, an additional selection step can choose up to three articles from the published titles and summaries.

The generation request combines the current question, recent context and selected passages. Its instructions define the response language, terminology and form. The intended output uses short, complete sentences, explains unfamiliar terms and applies technical terms consistently. A simple answer should address the question directly without a standard training task appended to it.

Search now maps complete glossary phrases and accepted synonyms to shared concept identifiers. Both article selection and answer generation receive at most eight relevant preferred terms in the response language. This adds no further generation request. The glossary guides terminology; it is not evidence for a technical conclusion and cannot be cited as a Wiki passage. Stored articles and historical answers are not altered by automatic word replacement. [18]

When the Wiki does not cover a concept, the language-generation component can formulate an answer from its general knowledge. It is not restricted to the retrieved passages. Such an explanation must not be presented as if it came from the Wiki. A Wiki citation is included only when the supplied passage supports the associated statement; an answer may therefore contain no Wiki citation.

2.4 Conversation context and response checks

The browser supplies up to four preceding question-and-answer pairs with each new message. On the server, context is bounded to eight user or assistant messages, with each message limited to 1,800 characters. Short follow-up questions can use earlier user questions to identify their subject during retrieval. Both previous questions and answers are available to the generation step. This supports exchanges such as “Tell me more” or a correction to a room heat load. [8]

This context belongs to the current browser conversation. A conversation identifier is not used to retrieve another user’s chat history. The interface offers a new-chat action to clear the current exchange. The reviewed implementation does not establish durable personal memory across later visits. The limit on retained context should also be considered when interpreting long conversations.

The generated response must satisfy a defined data structure. The service checks the required fields and verifies that every citation identifier belongs to the evidence supplied for that request. Unknown references or malformed responses lead to a controlled fallback. Provider errors are also handled through the fallback path. The generation request has a bounded time budget; article selection consumes part of the same overall budget when it is needed. These checks help keep the interface usable when a request fails.

Identifier validation establishes where a reference came from. It cannot prove that the passage supports every claim in the answer. Technical consistency, the interpretation of a passage and the adequacy of a calculation still require content review. Section 5 examines these issues in actual connected conversations rather than treating successful response generation as proof of correctness.

2.5 Producing equations and optional visual material

Text, equations, selected images and conceptual diagrams follow different rendering paths. Equations are written in mathematical notation and displayed through a dedicated mathematics renderer. They remain available regardless of the visual checkbox. The browser does not render arbitrary images embedded in generated answer Markdown; images are supplied as separate, validated response assets. [8]

When “Images and diagrams” is enabled, the server prepares visual candidates from the published articles used for retrieval. Candidates must have cleared reuse rights and an accepted asset URL. The selection is bounded to twelve candidates, from which the answer can select at most two. The generation step receives identifiers, captions and alternative text. The server resolves the chosen identifiers to the stored assets, so the answer cannot invent an image address.

A second path creates a simple conceptual diagram from structured data. The supported layouts are a sequence, a cycle or a comparison, with two to six short labels. The browser renders the diagram using these labels and the selected layout. Instructions distinguish refrigerant circulation from energy transfer and heating-water circulation. For example, a refrigerant cycle contains the evaporator, compressor, condenser and expansion valve; the source and heating-water circuits exchange heat with it but are not additional components in that refrigerant path. A conceptual diagram communicates relationships or an operating principle. It does not specify dimensions, select components or provide an installation-ready hydraulic design.

With the checkbox off, image and diagram fields are not used for the answer. With it on, visual material is included only when it adds explanatory value. Section 4.7 shows a selected Wiki image and a generated conceptual diagram from the live interface.

2.6 Implementing Mimo and interaction feedback

Mimo is the animated three-dimensional character shown in Figure 2. It is rendered locally in the browser using the Three.js graphics library and character files in GLB format. Its behaviour follows interface events. A pending answer request activates the waiting state; input focus or dictation produces an attentive state; answer arrival can trigger an explaining or pointing gesture. Reading an answer aloud uses the speaking state. Figure 3 summarises these interaction states and their triggers. [8, 10]

Mimo has four visual variants, shown in Figure 2. The neutral character is the starting appearance. A scarf represents heating, a neckerchief and sunglasses represent cooling, and a vest represents installation. Local topic rules examine the question and answer to select a variant. A list or comparison can trigger a pointing gesture; other answers use an explaining gesture. These reactions do not require an additional generation request. The enlarged view also provides controls for selecting a variant or playing a gesture.

Figure 2. Mimo's neutral, heating, cooling and installation outfits. These are crops from the live enlarged view; the outfit selector was used to show all four variants. [9]

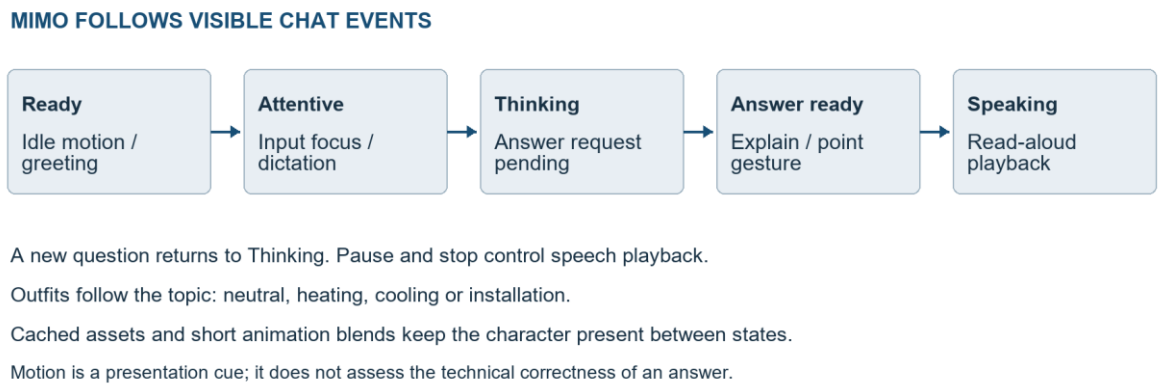

Figure 3. Mimo's interaction states and their triggers. Topic selection and speech playback affect presentation without changing the answer's technical content. [8]

The four character files, one for each clothing variant, are loaded through a shared cache and prepared in advance for the current character view. An outfit change keeps the existing character until the replacement is ready. Animation changes use a short blend of about 0.28 seconds. The waiting animation uses a seven-second cycle with head movement and a more deliberate arm gesture, supplemented by small transitional movements and a thought indicator. These measures are intended to maintain continuity while an answer is being prepared.

Mimo's mouth movement approximately follows speech playback. The implementation uses available speech events and a character-based approximation; it is not a phoneme-accurate performance. Reduced-motion preferences suppress the animated motion, and rendering is paused when the view is not visible. Speech availability still depends on the browser and device. The character indicates activity and helps users follow the conversation.

2.7 Internal review and language comparison method

On 21 September 2026, three synthetic building scenarios were explored through five linked questions each. Each follow-up included recent conversation context. We retained the first answer, sources and response time. An AI-assisted assessment examined continuity, technical consistency, clarity and citation relevance. Selected calculations were recomputed using stated inputs and technical references. Section 5 reports the findings; Annex B retains the records. [5–7]

The author-defined questions largely follow guide subjects. The collection represents 28 topics in three languages, not 84 independent situations. The connected scenarios use invented inputs. These assessments identify particular strengths and errors, not representative performance for professional users.

On 16 October 2026, the 84 answers were grouped into 28 DE/EN/IT topic triplets. We compared cited article sets, ignoring order and repeated passages. Six topics were read for scope, technical meaning, qualifications and terminology: heat-pump principle, heat load, radiators, hydraulic topologies, weather compensation and seasonal performance. Section 5.5 reports this focused editorial comparison; it is not a new generation run or overall score. [4, 16]

3 THE PUBLISHED WIKI

3.1 Published content and topic coverage

On 21 September 2026, the Wiki contained 132 guides, each published in German, Italian and English, giving 396 language versions. Table 3 outlines the topic coverage. [2]

Table 3. Knowledge areas and example questions

Knowledge area	Questions the material helps users explore
Building and envelope	How does the building condition affect heat demand and refurbishment options?
Heat load and emitters	Can existing radiators provide enough heat at lower water temperatures?
Heat pumps and hydronics	How do system choice, temperature, flow and controls interact?
Domestic hot water and storage	What differs between space-heating and hot-water requirements?
Acoustics and placement	Which factors affect the choice of location and acoustic measures?
Economics and sustainability	Which cost and environmental effects belong in a comparison?
Commissioning and operation	What helps explain operating behaviour and recurring problems?
Integrated planning and process	Which information and professional roles need to be brought together?

3.2 Article structure and sources

Wiki articles combine source information, review status and linked language versions. Titles, summaries and topics help readers find a guide; the article text and key points explain its subject. [3]

Readers can inspect the sources used to prepare a guide and switch between its German, Italian and English versions. The same article structure supports editorial maintenance.

The public collection contains explanations adapted from project material. This does not mean that complete WP3/WP4 slide collections, D2.2 factsheet directories, toolbox executables or all case files have been imported. Sensitive project documents and real-building records require a separate publication decision. Clearance covers the text and data as well as images. [1, 12, 15]

The collection includes guides on subsidy evidence, ownership decisions, existing risers and occupied refurbishment. Such guides explain relevant questions and dependencies. They do not constitute a maintained country-by-country register of standards, hygiene limits or current funding conditions. A general hygiene explanation does not establish a permissible temperature for a particular installation. [17]

3.3 Maintaining the knowledge base

Authorised editors revise articles and publish reviewed material. Wiki content and translations will be maintained throughout the project. The findings in Section 5 can guide corrections to explanations and source links. [3, 5]

3.4 Shared terminology and the D2.1 glossary

D2.1 provides English, German and Italian terms and explanations, including heat pump, building envelope, flow temperature and heat-load calculation. It is a reference for aligning the Wiki language versions. [11]

On 16 October 2026, the deployed chatbot incorporated all 119 entries of the D2.1 glossary in German, English and Italian. The original terms, source rows and document checksum are retained in a versioned resource. Editorial preferences clarify ambiguous terms and add four explicit distinctions: heat load, radiators, heat emitters and SCOP. This terminology resource is separate from the small interface-translation glossary. [11, 18]

4 USING THE WIKI AND CHATBOT

The primary users are planners and building-services designers, energy consultants, installers and relevant craftspeople. Trainers can introduce the Wiki and chatbot in their courses. Building owners and property managers can use accessible explanations for orientation. These groups use the content for different tasks, from early understanding to preparing a professional design.

4.1 Typical professional situations

The following examples illustrate typical uses. A planner can ask which conditions determine whether existing radiators remain suitable. An energy consultant can explore how envelope improvements affect heating requirements. An installer can look up an explanation of frequent heat-pump cycling. The chatbot helps identify and explain the relevant relationships; the professional still applies them to the actual building.

4.2 Using the chat

Figure 4 shows the chat interface. Open https://training.knowhowhp.eu/?mode=knowledge, select the language (DE, EN or IT), and then select Chat. Type a question and press Enter or Send. Shift + Enter inserts a line break. Ask a related question in the same conversation, or use New chat to start again. The stop control cancels an active request; a failed request can be retried.

The current conversation uses up to the last four exchanges for context. It is not permanent user memory. Do not rely on the thread being available after a page reload or a later visit. Open the source section when citations appear to inspect the supporting Wiki material. [3]

4.3 Reading and visual support

Select Wiki to search and read the guides directly. In Chat, enable Images and diagrams before sending a question if a visual explanation would help. This option is off by default and does not force a visual into every response. Conceptual diagrams are explanations, not installation drawings. Mathematical notation supports answers involving formulas.

Dictation and read-aloud controls are available where supported by the browser and device. Microphone permission may be needed. Text entry remains available if speech functions are unsupported. Their availability and quality need to be tested on the intended devices.

4.4 The visible interaction

Figure 4 shows the English chat interface, including Mimo, the example questions and the option to include images and diagrams.

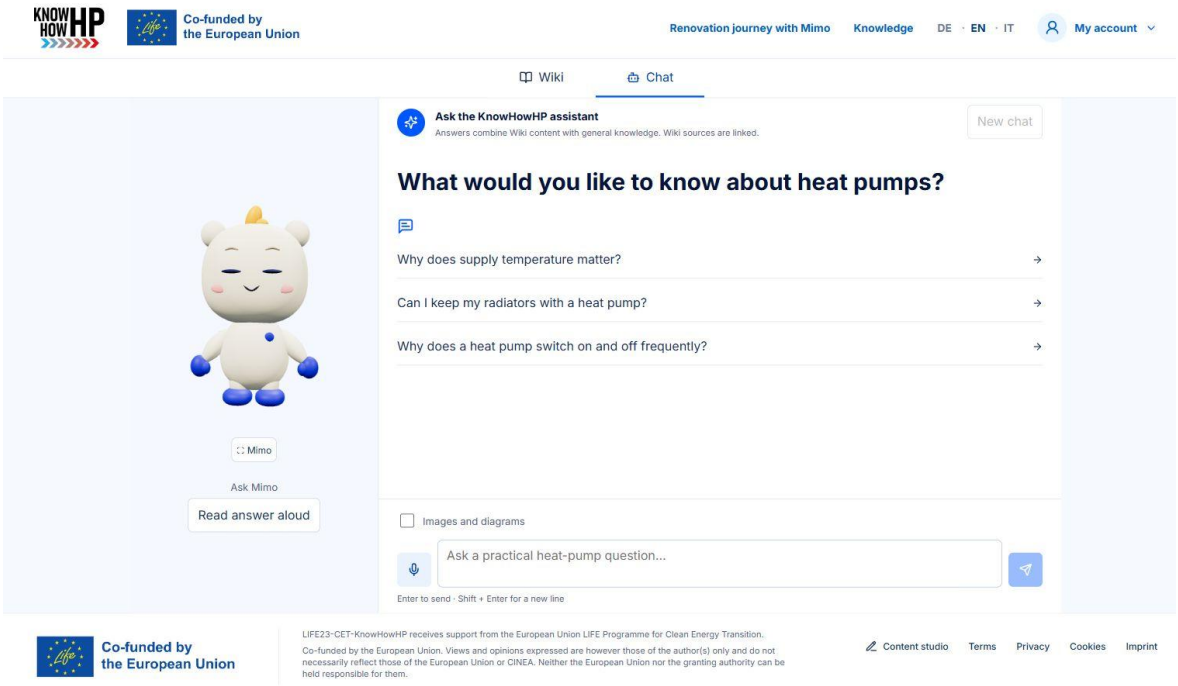

Figure 4. The English chat interface documented on 21 September 2026. Mimo, example questions and the optional visual setting are visible.

Mimo remains visible beside the conversation (Figure 4). Its waiting state shows that the chatbot is preparing an answer. Gestures and topic-related clothing provide additional visual cues.

The three starting questions cover supply temperature, continued use of radiators and frequent switching of a heat pump. Users can also ask their own questions. They are not restricted to a fixed exercise sequence.

4.5 Mimo as a visible companion

Mimo gives the chat a consistent visual presence while the user writes, waits and reads. The enlarged view makes the character and its controls easier to see. The four clothing variants and the rules used to select them are introduced in Section 2.6 and Figure 2. [9]

The character can greet, explain, point and encourage. In the chat, a new conversation triggers a greeting, and answer content can trigger an explaining or pointing reaction. The controls in the enlarged view also let users play the available gestures directly. This gives the project a visual vocabulary that can be reused across the platform while keeping the chat focused on the user's question.

4.6 Animation during the conversation

The animation accompanies different moments of the exchange. While an answer is being prepared, Mimo shows a thought indicator and moves its head and arms. Gestures accompany the arrival or explanation of an answer. During read-aloud playback, mouth movement follows the speech approximately. Figure 5 focuses on two visible cues that can be distinguished in a still image: the thought indicator and the open mouth. The full movement can be viewed in the live chat. [9]

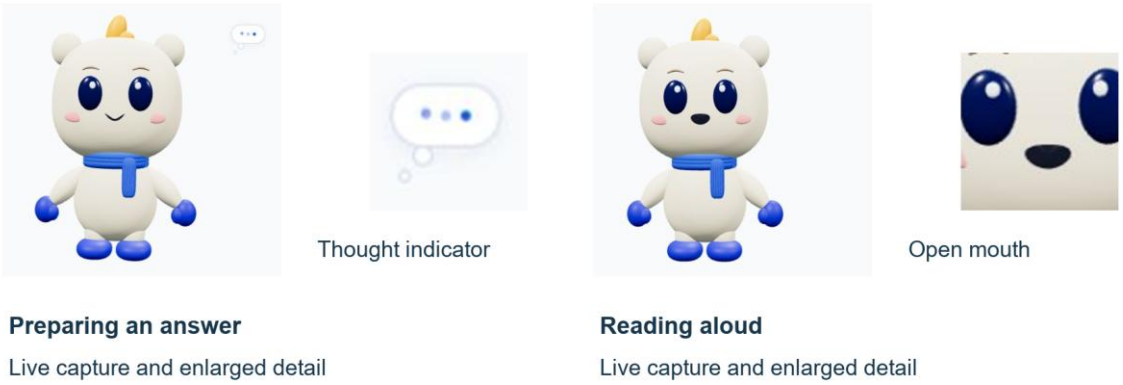

Figure 5. Visible cues during answer preparation (left) and read-aloud playback (right). The enlarged details show the thought indicator and the open mouth. Both are taken from live interface captures; the still images do not show the complete movement. [9]

The interface also displays a written status, such as “Mimo is thinking” or “Mimo is explaining”. Users can therefore follow the state without interpreting movement alone. The enlarged view offers speech pause and stop controls. The local cache and prepared clothing variants described in Section 2.6 support continuity during changes.

4.7 Images and diagrams as additional information

The checkbox “Images and diagrams” lets users choose whether visual material may accompany an answer. It is off by default. When enabled, the answer can include an existing Wiki image or a simple conceptual diagram if that material helps explain the question. The visual appears in the conversation, close to the text, rather than requiring the user to find it in a separate document. [8, 9]

In the live example in Figure 6, the question asked how temperature lift affects heat-pump COP and requested the corresponding Wiki image. The answer explained the relationship and displayed the stored “COP and temperature-lift map” asset. The image is linked and carries a caption. It is qualitative supporting material, not a performance map for a specified heat-pump product. The source article can be opened from the answer’s evidence section.

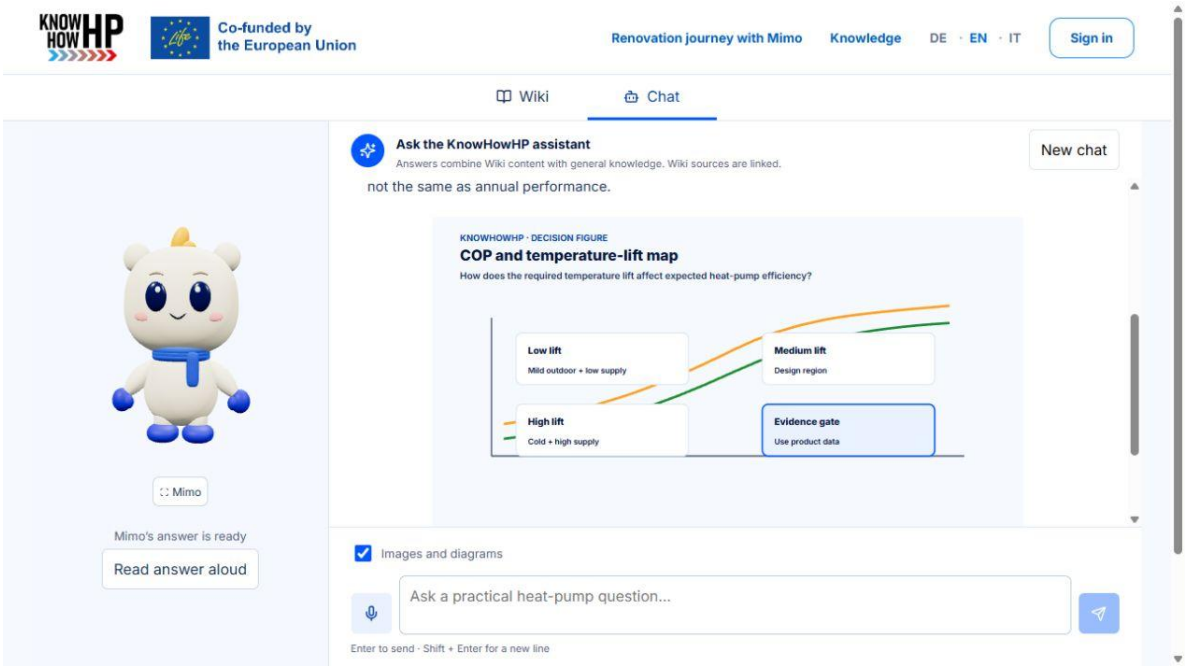

Figure 6. An existing Wiki image displayed as additional information in the chat, with "Images and diagrams" enabled. Live interface, 28 September 2026. The displayed map is qualitative. [9]

Figure 7 shows the second output path. A question about the four stages of a heat-pump refrigerant cycle produced a labelled cycle with evaporator, compressor, condenser and expansion valve. The answer separately explained the heat exchange with the source and heating-water circuits. The diagram was rendered from the answer's structured labels; it was not retrieved as an existing Wiki image.

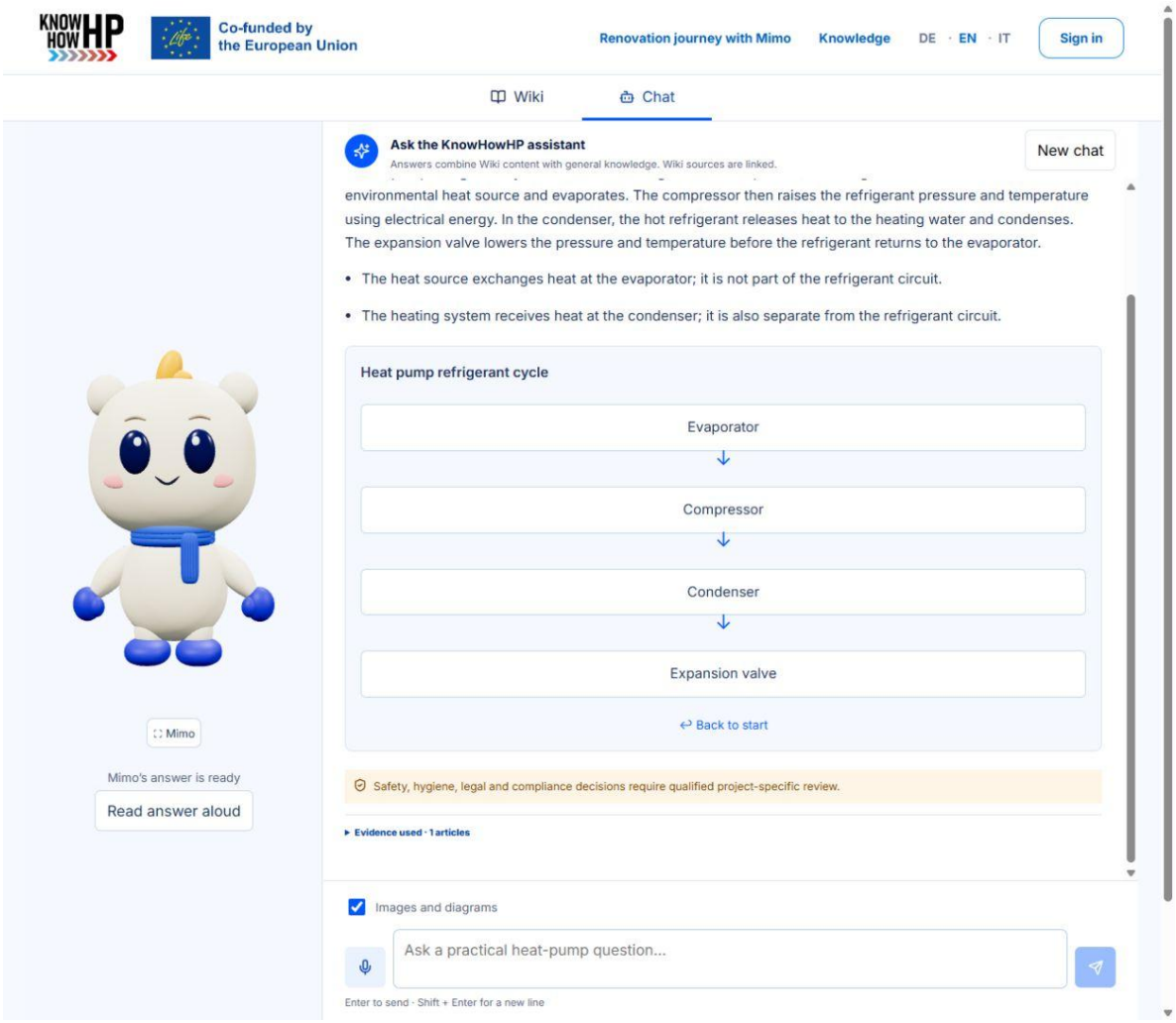

Figure 7. A conceptual refrigerant-cycle diagram displayed within a live chatbot answer on 28 September 2026. This explains the operating principle and is not an installation drawing. [9]

A separate request about temperature lift with the checkbox disabled returned a text answer without an image or diagram. This observed difference confirms the optional behaviour in the demonstrated cases. Mathematics remains available in either mode.

4.8 Representative chatbot answers

The following four questions and complete answers come from the live export of 21 September 2026. They illustrate the range and wording of the result. They are reproduced without assessment. Annex C contains the complete collection of 84 questions and answers in their original languages: 28 each in German, English and Italian. [4]

4.8.1 Heat pump principle and supply temperature

Question: How does a heat pump work and why does supply temperature matter?

A heat pump uses electricity to move heat, not to create all heat directly. The refrigerant absorbs environmental heat in the evaporator, the compressor raises its pressure and temperature, and the condenser releases heat to the heating water. Supply temperature matters because the heat pump must lift the source temperature up to the heating-water flow temperature. A lower required flow

temperature usually improves efficiency, but the radiators or other emitters must still deliver enough heat to each room.

Key points:

• Emitter output falls when heating-water temperature falls, so room heat load and emitter output must be checked together.

• One demanding room can set the required supply temperature for the whole system.

Record: heat-pump-principle-en-evaluation

4.8.2 Room-wise heat load

Question: Why do I need a room-wise heat load before planning a heat pump?

You need a room-wise heat load because a heat pump must be planned around required heating power, not annual energy use. The room results show which rooms lose heat fastest and whether their emitters can cover the load at lower flow temperatures. A building total can look plausible while hiding rooms that need higher water temperatures. Those rooms often determine heat-pump efficiency and the required system design.

Key points:

• Heat load is a power value in kW under defined design conditions; annual demand is energy in kWh over a year.

• Useful inputs include boundary areas, U-values, design temperatures, ventilation assumptions and a clear split between measured, calculated and estimated data.

Record: heat-load-en-evaluation

4.8.3 Existing radiator check

Question: How do I check whether existing radiators can work with a heat pump?

Check the radiators room by room, because a heat pump usually works best with lower flow temperatures. First record the real radiator type, height, length, depth, connection and any covers or blocked air paths. Then compare each room's heat load with the radiator output at candidate supply and return temperatures, using a manufacturer table or the correct mean temperature difference method. Finally, verify that valves, pipework and balancing can provide the required water flow without excessive noise or pressure drop.

Key points:

• Do not rely only on labels or visual identification; actual geometry and type affect output.

• Catalogue ratings must be corrected to the intended flow, return and room temperatures.

Record: radiator-check-en-evaluation

4.8.4 Staged renovation

Question: How can a building be renovated in stages without blocking the future heat-pump concept?

Start with the intended final heat-pump system, then plan each interim step so it remains compatible. Avoid upgrades that lock in high flow temperatures, undersized pipework, missing plant-room space, or controls that must be replaced later. Treat each stage as a temporary state with clear triggers for the next step, such as facade renovation, radiator replacement, or the existing boiler reaching end of life.

Key points:

• Record dependencies between insulation, heat emitters, hot-water production, electrical supply and controls before ordering the first measure.

• A cheap interim solution can become expensive if connection sizes, space requirements or control interfaces block the later heat-pump installation.

Record: staged-renovation-en-evaluation

5 REVIEW OF CHATBOT ANSWERS

The 84 answers in Annex C provide a retained collection of German, English and Italian responses. Three separate five-question conversations examine follow-ups and corrections. The internal assessment method is described in Section 2.7. The connected conversations are discussed first, followed by the focused comparison between language versions in Section 5.5. [4, 5, 16]

Each conversation probes a different practical situation. Conversation A starts with an existing radiator, then corrects the room heat load and challenges an earlier assumption. Conversation B follows a staged refurbishment and tests whether the chatbot keeps heat load, emitter output and hot-water demand separate. Conversation C examines frequent cycling and recalculates the water volume after the user changes the room load. Each conversation ends with a short summary request. The full questions and answers are reproduced in Annex B.

5.1 Test design and assessment

We reviewed three connected conversations. The table below summarises what the chatbot did and how we assessed each result.

Table 4. Results of the connected conversation review

Conversation	Observed result	Assessment
A Existing radiators	Retained the topic and the corrected 0.65 kW room load. Calculations were consistent with the stated approximation.	Useful explanation, but two contradictory openings and an inconsistent flow assumption need correction.
B Staged renovation	Rejected an unsupported 30% sizing shortcut and identified a room-level deficit. Kept hot-water sizing separate.	Useful reasoning. One sentence linked heat load misleadingly to a radiator upgrade; it was corrected when challenged.
C Frequent cycling	Recalculated active water volume from about 57 to 86 litres after a load correction. Did not justify the proposed 500 litres.	Coherent worked example. Nominal volume, minimum flow and actual hydraulic operation still require verification.

5.2 Assessment criteria

We examined whether the chatbot retained earlier information, kept calculations and concepts consistent, used clear language, and linked Wiki passages to the statements they support. The judgements are qualitative: demonstrated in this sample, demonstrated with limitations, or not established. Three selected conversations do not provide a service-wide pass rate.

All 15 requests returned an answer. Response times ranged from 5.02 to 14.38 seconds, with a median of 8.04 seconds. These values describe the answer service during this test. They do not measure how long the interaction felt in a browser. Availability during the test does not establish technical correctness. [5]

5.3 Priority findings

The German conversation contains a clear language defect: turn A4 starts with "Ja: Eindeutig nein". A3 also opens with "Ja" before explaining that 45/35/20 °C is insufficient. Both can mislead a reader who only scans the beginning. A1 assumes unchanged flow although heat output changes at the same water temperature difference. A4 subsequently explains why that hydraulic assumption cannot hold exactly.

The English response B4 describes the revised heat load as being after the radiator upgrade. B5 corrects this: changing the radiator changes available emitter output, not normally the room heat load. The same correction still calls the planned upgrade evidence of adequacy before its output has been verified. This wording remains too strong.

Returned Wiki excerpts are not automatically evidence for a whole answer. A1 cites an assumption-register passage, which does not establish the radiator formula. C5 returns heat-load passages about assumptions and limits, which do not establish the 86-litre result or a buffer design. Source selection should be more closely matched to the specific claim. The numerical checks documented in Annex B were performed separately; they are not validations provided by those citations.

5.4 What remains open

The connected-conversation test demonstrates continuity in three selected scenarios and identifies specific issues for correction. It did not assess audio, visual output, accessibility or exchanges beyond the retained context. The focused language comparison in Section 5.5 examines six topics in the separate 84-answer collection. The original records remain in Annex C without individual correctness or usefulness scores.

5.5 Consistency between the language versions

The comparison concerns the retained export of 21 September 2026, not fresh answers from the current service. Across its 28 topic groups, nine use the same set of cited canonical articles in all three languages and 19 use different sets. This measures source selection, not correctness: answers may use different supporting passages and still give compatible explanations. The six selected topic groups provide 18 answers for closer editorial comparison, summarised in Table 5. [4, 16]

Table 5. Focused comparison of six topics across German English and Italian

Topic	Observed alignment and difference across EN, DE and IT
Heat-pump principle	All three explain the refrigerant cycle, the efficiency benefit of lower flow temperature and the need for sufficient emitter output. All cite the same two articles. The wording differs, while the main technical conditions agree.
Room heat load	All distinguish required heating power in kW from annual energy in kWh and explain why individual rooms matter. EN adds radiator evidence, IT adds design-condition evidence, and DE cites the heat-load article alone. These source differences add detail without reversing the main conclusion.

Topic	Observed alignment and difference across EN, DE and IT
Existing radiators	All compare room load with radiator output at the intended temperatures and check actual geometry or flow conditions. All cite the radiator-check article. The DE question uses "Heizkörper"; EN "radiators" and IT "radiatori" have the same scope. The broader term "heat emitters" is used only where the statement covers more than radiators.
Hydraulic topologies	EN additionally cites the article on moving away from gas heating in individual apartments and stresses ownership boundaries. IT adds an efficiency observation. DE describes a semi-central arrangement as frequent, while the supplied evidence gives an example. The example must remain conditional in all languages; source identity alone would not detect that difference.
Weather compensation	All start from design conditions and adjust the curve gradually while checking room comfort. The DE question asks about the heating curve; EN and IT ask about weather-compensated control more broadly. The scope overlaps, but the questions are not literal translations. A matched comparison needs to retain this distinction.
COP and seasonal performance	All distinguish operating-point power ratios from seasonal energy ratios and retain the measurement boundary. DE uses "saisonaler Leistungsfaktor", whereas D2.1 uses "Saisonale Leistungszahl"; the concept agrees, but the preferred term is not harmonised. "SCOP" should not be substituted for a measured SPF without explaining its basis.

The topology example demonstrates why technical qualifications matter as much as shared vocabulary. The evidence describes a possible semi-central configuration; the German answer turns it into a statement about what is frequent. A terminology dictionary alone would not prevent this. The retrieval and generation instructions need to retain the same physical boundaries and qualifiers in each language.

The current Wiki also contains an editorial issue outside the retained answers: the German title "Altlastensteigleitungen und Verteilungsarchtypen erkennen" is awkward and includes a spelling error. A clearer title would be "Bestehende Steigleitungen und Verteilungssysteme erkennen". Its English and Italian titles should be checked against the same article scope when the content is updated. This observation comes from the public article snapshot of 16 October 2026. [16]

The findings support consistent terminology and preservation of technical conditions across languages. Annex C retains the historical answers verbatim.

6 DISCUSSION AND CONTINUED USE

The Wiki and chatbot make project knowledge available beyond a single course or event. Professionals can return to the material when a question arises. Multilingual access also supports use beyond the initial German- and Italian-speaking project area. This is the intended contribution of Task 6.5 to continued knowledge transfer. [1]

6.1 Use through training and professional practice

The project work plan includes trainer workshops and later familiarisation of trainees. In those sessions, trainers can demonstrate how to find a Wiki guide, ask a practical question and inspect an answer's sources. [1]

The service also remains available for direct professional use outside a course. Questions raised during training or direct professional use can reveal unclear explanations or missing topics for the project team to address.

External trainers and education providers can use the public Wiki and chatbot without access to the editorial workspace. Editorial permissions remain restricted. The knowledge service records unsupported questions as editorial knowledge gaps and provides a feedback endpoint for reported questions. This is an editorial contribution mechanism; it is not evidence of a public discussion forum or a completed user-feedback workflow. [18]

6.2 Conditions for continued usefulness

Fraunhofer Italia maintains the current technical service and the authorised editorial workflow described in this report. Continued use requires content responsibility, technical support, hosting resources and clear reuse rights. This deployment does not establish a funded operating commitment after the project ends. No post-project budget or partner support obligation is inferred from the availability of the service. [1, 18]

6.3 Ongoing Wiki content updates

The Wiki content will be updated throughout the KnowHowHP project. The project team will revise existing guides and add relevant material as the project develops. [1]

Authorised editors will maintain the article text, source information and linked language versions. Published updates will be available both to readers of the Wiki and to the chatbot when it retrieves supporting material.

The deployed glossary integration supports ongoing terminology consistency. In Italian, heat-load calculation uses "calcolo del carico termico" to distinguish power from annual energy demand. Radiators remain a specific type of heat emitter. COP, SPF, annual performance and SCOP retain their operating conditions, time periods and system boundaries. Terminology guidance complements editorial review; it cannot by itself guarantee correct calculations or preserve every qualification in an answer. [11, 18]

7 CONCLUSIONS

KnowHowHP offers a multilingual Wiki and chatbot as a common entry point to project knowledge on heat-pump refurbishment. They connect the WP2 evidence and integrated refurbishment approach with the teaching material of WP3 and WP4, the WP4 toolbox and case studies, and use during and after WP5 training. The Wiki provides structured guides; the chatbot makes explanations accessible through practical questions and follow-up dialogue. [1, 11–15]

The implementation also provides a visible interaction layer. Mimo reacts to the conversation state and topic, while optional images and simple diagrams add explanatory material to the text. The documented examples show both a reused Wiki asset and a rendered conceptual cycle. Together, these results provide several routes into the same knowledge: reading a guide, asking a question, following a dialogue, inspecting a visual or listening to an answer. [8, 9]

The connected conversations show useful continuity and identify language, technical and citation issues. The focused comparison of six multilingual topics finds substantial agreement in core concepts, alongside differences in source selection, terminology and qualifications. D2.1 terminology is now incorporated into retrieval and answer formulation. This implementation does not retrospectively correct or revalidate the retained September answers. Ongoing updates to Wiki content are planned throughout the project. [11, 16, 18]

REFERENCES

[1] Grant Agreement 101166831, LIFE23-CET-KnowHowHP, Ref. Ares(2024)5340404, 23 July 2024. Data Sheet; Annex 1 Part A, Task 6.5, Deliverable D6.5 and Milestone 17.

[2] KnowHowHP live service and public knowledge metadata endpoint. https://training.knowhowhp.eu/?mode=knowledge and https://training.knowhowhp.eu/api/knowledge/meta. Content checked on 16 October 2026; the September answer records retain their original source date.

[3] KnowHowHP public Wiki and chatbot user interface. Public entry point https://training.knowhowhp.eu/?mode=knowledge. Earlier interface observations are identified by date; the deployed terminology update is documented in [18].

[4] Live expert-review export dated 21 September 2026. 84 answers, 28 per language, manifest 2026-09-21-live-e5d2da56. Section 4 reproduces four complete examples; Annex C contains all 84 complete questions and answers without assessment. Ratings were empty at document preparation. Chatbot answers vary and should be reviewed in their stated context.

[5] KnowHowHP connected conversation test, 21 September 2026. Three synthetic user scenarios, five turns each, actual live chatbot responses in DE, EN and IT. Raw requests, responses, timestamps and test metadata retained in 2026-09-21_Connected_chat_transcripts.json. Assessment by Codex; not independent expert acceptance.

[6] Purmo. Panel radiators technical catalogue, 01/2018, correction factors section, printed page 100. https://www.purmo.com/docs/Purmo-technical-catalogue-panel-radiators-1-2018-EN.pdf. Consulted 21 September 2026 for the temperature dependence and need for product-specific output data.

[7] Caleffi. Hydronic Fundamentals, Appendix B, 2 August 2022. Buffer sizing by heat-source output minus concurrent load, desired on-time and usable temperature rise. https://www.caleffi.com/en-us/blog/appendix-3. Consulted 21 September 2026. The numerical metric examples in Annex B were independently recomputed from the stated test inputs.

[8] Fraunhofer Italia. Implementation inspection of the KnowHowHP main revision beb2d475ad92fb47087ac5b6bf1808b6ae5d376b, 28 September 2026. Knowledge service, publication rules, answer validation, chat rendering, Mimo assets and motion, and speech components. Internal technical evidence retained by the project.

[9] KnowHowHP public Wiki and chatbot. Focused interface observations and screenshots, 28 September 2026. Mimo outfits and gestures, waiting and speech states, a stored Wiki image, a generated refrigerant-cycle diagram and a text-only temperature-lift request. https://knowhowhp.fraunhofer.app/?mode=knowledge. Supporting screenshots and observation notes retained by Fraunhofer Italia.

[10] Three.js. Official documentation and manual. https://threejs.org/manual/. Consulted 28 September 2026. Browser-based three-dimensional rendering.

[11] KnowHowHP D2.1. Report on Obstacles, Knowledge Gaps and Glossary. Project document v4, Chapter 5 and Annex C, including the English, German and Italian terminology table.

[12] KnowHowHP D2.2. Analysis of Existing Planning Instruments and Training Offers. Project report, v1.0. See also the scope of D2.2 in Grant Agreement Annex 1.

[13] KnowHowHP D2.3. Stakeholder Engagement and Process Roadmap. Project report, v1.0. Stakeholder roles and process dependencies.

[14] KnowHowHP D2.4. Integrated Refurbishment Approach Document. Revised v1.0 reviewed locally on 16 October 2026. Integrated approach, platform demonstrator and links to WP3–WP5.

[15] KnowHowHP D4.2. Test Cases Report. UIBK report snapshot, D4.2 - Test Case report_final_FO.docx, retained in the project source material. The contractual relationship of D3.1–D3.2, D4.1–D4.4 and WP5 is defined in Grant Agreement Annex 1.

[16] Fraunhofer Italia. D6.5 terminology and multilingual consistency inspection, 16 October 2026. Inspection of source revision 6f60bc10573cea1ab8f3f89b95916fe719eca0e9, the D2.1 glossary, the retained 84-answer export and public article records. Article-ID sets compared for 28 topics; focused editorial comparison of six topics and 18 answers. Evidence and method retained with the project review handover.

[17] KnowHowHP access and content snapshot, 16 October 2026. HTTPS access to https://training.knowhowhp.eu/?mode=knowledge and https://knowhowhp.fraunhofer.app/?mode=knowledge; public knowledge metadata and article records. Content version 3.0.9, 132 canonical guides and 396 language versions. These checks concern public access and content, not a new test of generated answers.

[18] Fraunhofer Italia. Chatbot terminology release and deployment verification, 16 October 2026. Software revision d0ae3d114c259ff44993b4d353ca9e1c7210059d; terminology d21-annex-c.2026-10-16.v1; Wiki content 3.0.9. Source checksums, runtime verification, automated checks and new DE/EN/IT service requests are retained with the deployment and review handover. Historical corpus observations remain separate from this release check.

[19] Fraunhofer Italia. WP5 training-platform documentation v1.0 and coordination email to eza!, 22 October 2026. Requested integration into D5.1 and D5.2 after discussion with EIV; recipient incorporation and consortium-wide acceptance are not established by this correspondence.

ANNEX A TECHNICAL DESCRIPTION

The application combines a web interface with an answer service and a persistent knowledge store. The service retrieves published Wiki passages to support its answers. It may also use established general knowledge. The chatbot shows Wiki links only when the linked material supports the answer.

Table 6. Operational information about the reviewed release

Operational item	Essential information
Public service	https://training.knowhowhp.eu/?mode=knowledge
Content state	Version 3.0.9; 132 guides and 396 published language versions. Metadata checked on 16 October 2026.
Verified software release	d0ae3d114c259ff44993b4d353ca9e1c7210059d; deployed and checked on 16 October 2026. Historical source and answer dates remain explicit in the references.
Configuration	Provider credentials remain on the server. Answer-service and knowledge-store settings are configurable.
Deployment	The repository provides Docker and Compose configuration. The API, web service and persistent content store must be configured together.
Recovery	Retain a compatible previous release and a backup of the content store; test restoration before relying on it.
Terminology resource	d21-annex-c.2026-10-16.v1; 119 D2.1 entries plus four editorial extensions; German, English and Italian.

The public training address and the earlier Fraunhofer address both serve the application over HTTPS. The checked entry-page requests did not redirect to a different hostname. The knowledge view is selected with ?mode=knowledge. The training address is the public entry point used in this report. The current release was verified on 16 October 2026. [17, 18]

The answer service sends the question, bounded recent conversation context and selected published passages to the configured language-generation service. Requests disable optional response storage at that service. This setting does not establish zero retention across hosting, security or operational logs. Conversation identifiers do not create a server-side personal chat archive. The knowledge store separately retains editorial gaps. Speech input and output depend on browser/device services and can involve processing outside the application. The public privacy notice describes the service context; processing locations, retention arrangements and provider agreements must be read from the operative privacy and hosting records, not inferred from this software description. [8, 18]

The controlled source repository is https://fhi-git.fraunhofer.it/knowhowhp/training-platform. The release identifier in Table 6 identifies the software checked for this report. Earlier source revisions

in references [4], [8] and [16] identify historical observations, not conflicting identifiers for the current deployment. The accompanying content snapshot retains the public article records, their language links and source metadata. [18]

To reproduce the deployment, check out the documented revision and follow DEPLOYMENT.md. Configure the HTTPS hostname, API route, authentication issuer and client, allowed origin, generation-service credentials and persistent store paths outside version control. Build and start the web, API and worker services with the supplied Dockerfile and docker-compose.yml. The web service routes /api to the API. Credentials are not part of the package.

The knowhowhp-runtime volume retains mutable application and Wiki state. Before an update, retain the previous application image and back up the durable stores consistently. Redeployment must preserve this volume. Recovery uses a compatible application revision and matching state backup; a source-code checkout alone does not restore editorial or account data.

The deployment check compares runtime terminology files with the recorded release, checks the service health and public article metadata, and submits a new question in each supported language plus a related follow-up. Returned citations are checked against supplied Wiki passages. These checks establish the observed release and basic request flow; they are not a service-wide correctness assessment. [18]

The current interface enables necessary browser storage and does not enable analytics or marketing cookies. Editorial gap counts and technical health checks are distinct from usage KPIs such as visits or learning impact. No usage totals or resulting project impacts are claimed here. [18]

AI-assisted drafting and language editing were used in preparing this report. The retained connected-conversation assessments are also identified as AI-assisted. Neither activity constitutes independent technical acceptance.

ANNEX B FULL CONVERSATION TRANSCRIPTS

On 21 September 2026, we sent three five-question conversations to the public chatbot service. Each new question was sent with up to four preceding question-and-answer pairs, matching the context used by the browser chat. After each answer, we chose the next question to test whether the chatbot could follow a correction or challenge. The conversations are labelled A, B and C below. This test called the answer service directly; it did not test the browser interface. [5]

The service returned answers in German, English and Italian. Images and diagrams were disabled. We kept the first answer to every question and did not select from alternative runs. The transcripts below contain the chatbot's complete answer text and key points. Where source titles appear, they describe the Wiki articles returned with the answer. German and Italian wording is preserved for language review. [5]

How to read the transcripts

The building situations and numerical inputs in conversations A, B and C were invented for the test. They let us check whether the chatbot follows stated assumptions; they are not design data for a real building. Codex assessed the answers after the conversations. We also checked the radiator-output and buffer-volume arithmetic separately using the stated inputs and relevant manufacturer or technical references. [6, 7]

Conversation A Existing radiators and a corrected room heat load

Test an indirect follow-up, numerical correction, a challenged assumption and a short owner-facing summary.

A1 User question

Ich plane eine Wärmepumpe für ein Mehrfamilienhaus. Im Wohnzimmer beträgt die berechnete Heizlast 1,2 kW. Der vorhandene Heizkörper hat laut Datenblatt 2,0 kW bei 75/65/20 °C, Exponent n = 1,3. Kann ich ihn bei 45/35/20 °C weiter nutzen? Bitte überschlägig rechnen und die Annahmen nennen.

Chatbot answer:

Überschlägig reicht der Heizkörper bei 45/35/20 °C nicht aus. Ich rechne mit mittlerer Heizwassertemperatur $T_m = \frac{45+35}{2} = 40 \quad °C$ und Raumtemperatur $T_{\mathrm{Raum}} = 20 \quad °C$. Damit ist $\Delta T_{\mathrm{neu}} = 20K$; beim Datenblattwert 75/65/20 °C ist $\Delta T_{\mathrm{alt}} = 50K$. Die Leistung ergibt sich näherungsweise zu $Q_{\mathrm{neu}} = 2{,}0\mathrm{kW} \cdot (20/50)^{1{,}3} \approx 0{,}61\mathrm{kW}$. Gegenüber 1,2 kW Heizlast fehlen also etwa 0,59 kW.

• Annahmen: gleicher Heizkörper, gleicher Volumenstrom im sinnvollen Bereich, gleiche Raumtemperatur und normale freie Anströmung ohne Verkleidung.

• Die Annahmen sollten quantitativ festgehalten werden, weil sie die Machbarkeit der niedrigen Vorlauftemperatur direkt beeinflussen.

Wiki sources returned: Risiken und Annahmen verknüpft erfassen

A2 User question

Welche Arten gibt es, und welche davon wäre bei wenig Platz unter dem Fenster sinnvoll?

Chatbot answer:

Gängige Optionen für diesen Raum sind:

- Größerer Plattenheizkörper: bekannt, gut regelbar, aber bei 45/35 °C oft deutlich größer oder dicker.

- Niedertemperaturheizkörper mit Lüfterunterstützung: liefert mehr Leistung aus kleinerer Baugröße, benötigt Strom und kann hörbar sein.

- Gebläsekonvektor oder Fan-Coil: sehr kompakt und leistungsstark, erwärmt vor allem die Raumluft und hat Filter sowie Lüfter.

- Wandheizung: nutzt große Fläche und niedrige Temperaturen, braucht freie Wandflächen und mehr baulichen Eingriff.

- Fußbodenheizung: große Fläche und niedrige Vorlauftemperatur, aber meist hoher Aufwand im Bestand.

Bei wenig Platz unter dem Fenster ist meist ein lüfterunterstützter Niedertemperaturheizkörper oder ein kleiner Fan-Coil am sinnvollsten. Entscheidend sind die Herstellerdaten bei 45/35/20 °C und der akzeptable Schallpegel auf der nötigen Lüfterstufe.

Wiki sources returned: Heizflächen für niedrige Vorlauftemperaturen nachrüsten; Gezielter Einsatz von Fan-Coils und ventilatorunterstützten Konvektoren; Wandheizung und Niedertemperaturheizkörper vergleichen

A3 User question

Korrektur: Die Raumheizlast beträgt nach der geplanten Dämmung nur noch 0,65 kW, nicht 1,2 kW. Reicht derselbe Heizkörper dann bei 45/35/20 °C? Und wie sieht es bei 50/40/20 °C aus? Bitte nicht mit den alten 1,2 kW weiterrechnen.

Chatbot answer:

Ja, mit der korrigierten Raumheizlast von 0,65 kW ist das Ergebnis deutlich günstiger. Bei 45/35/20 °C ergibt sich überschlägig $Q = 2{,}0\text{kW} \cdot (20/50)^{1{,}3} \approx 0{,}61\text{kW}$. Das liegt knapp unter 0,65 kW, es fehlen etwa 0,04 kW. Bei 50/40/20 °C ergibt sich $Q = 2{,}0\text{kW} \cdot (25/50)^{1{,}3} \approx 0{,}81\text{kW}$ und der Heizkörper reicht rechnerisch aus.

• Gerechnet wurde mit mittlerer Heizwassertemperatur: 40 °C bei 45/35 und 45 °C bei 50/40, jeweils gegen 20 °C Raumtemperatur.

• Der knappe Fall bei 45/35 hängt stark von freier Anströmung, Ventilstellung und ausreichendem Volumenstrom ab.

Wiki sources returned: Raumweiser Heizkörper-Check; Auslegungsheizlast als gemeinsamer Startpunkt

A4 User question

Du beginnst mit Ja. Heißt das nun, dass 45/35 sicher reicht? Bitte antworte zuerst eindeutig und erkläre danach kurz, warum gleicher Volumenstrom aus deiner ersten Antwort bei geänderter Leistung und gleicher Spreizung keine genaue Annahme sein kann.

Chatbot answer:

Ja: Eindeutig nein, 45/35/20 °C reicht rechnerisch nicht sicher. Die überschlägige Leistung liegt mit etwa 0,61 kW knapp unter der Heizlast von 0,65 kW. Das ist zu knapp für eine sichere Aussage, weil Herstellerdaten, Einbausituation, Ventilautorität und realer Volumenstrom die tatsächliche Leistung beeinflussen.

Die Annahme „gleicher Volumenstrom" war nur eine Vereinfachung für die Leistungsumrechnung.

Bei gleicher Spreizung gilt näherungsweise $Q = \dot{m} \cdot c_p \cdot \Delta T$: Wenn die Leistung von 2,0 kW auf etwa 0,61 kW sinkt und ΔT bei 10 K bleibt, sinkt auch der erforderliche Massenstrom entsprechend. Daher kann gleicher Volumenstrom bei geänderter Leistung und gleicher Spreizung keine genaue hydraulische Annahme sein.

• Bei 50/40/20 °C liegt die überschlägige Leistung mit etwa 0,81 kW über 0,65 kW.

• Für die Auslegung zählen die Leistung bei den geplanten Temperaturen und die dazu passenden Volumenströme, nicht nur die Nennleistung.

Wiki sources returned: Raumweiser Heizkörper-Check; Hydraulischer Abgleich für Niedertemperaturbetrieb

A5 User question

Fasse für die Eigentümer in drei kurzen Sätzen zusammen: Welche Heizlast gilt jetzt, welche der beiden Temperaturen reicht rechnerisch, und was ist vor einer Bestellung noch offen? Bitte ohne widersprüchliches Ja oder Nein.

Chatbot answer:

Die jetzt anzusetzende Raumheizlast beträgt nach geplanter Dämmung 0,65 kW. Bei 45/35/20 °C liefert der vorhandene Heizkörper überschlägig nur etwa 0,61 kW; rechnerisch ausreichend ist dagegen 50/40/20 °C mit etwa 0,81 kW. Vor einer Bestellung bleiben die Herstellerleistung bei den geplanten Temperaturen, die Einbausituation, der zulässige Volumenstrom und der akzeptable Schallpegel bei Alternativen mit Lüfter zu klären.

Wiki sources returned: None.

Assessment of conversation A

Assessor: Codex, AI-led exploratory review. Context retention: demonstrated. Numerical reasoning: demonstrated for the stated approximation. Language: needs correction. Citation support: limited.

A1 uses an arithmetic mean water temperature. Recomputing 2 × (20/50)^1.3 gives 0.6077 kW; 2 × (25/50)^1.3 gives 0.8123 kW. These agree with the reported 0.61 and 0.81 kW. The exponent 1.3 is supplied by the scenario, not inferred for every radiator. Manufacturer data remain necessary for the actual emitter. [6]

A2 resolves “Welche Arten gibt es” as a question about heat emitters. It retains the 45/35/20 °C condition and discusses compact alternatives. Calling a fan-assisted emitter “usually the most sensible” goes beyond the available dimensions and noise preferences; it should remain an option to compare.

A3 replaces the old 1.2 kW room load with 0.65 kW and identifies the small deficit at 45/35. Its opening “Ja” is nevertheless misleading. A4 then begins “Ja: Eindeutig nein”, despite the explicit request for an unambiguous answer.

A1’s unchanged-flow assumption is inconsistent with changed output and an unchanged 10 K water temperature drop. A4 corrects the relationship using heat output equals mass flow times specific heat times temperature drop. A5 finally gives a clear summary using the corrected load. A correct final answer does not erase the earlier ambiguity.

The sole returned Wiki excerpt in A1 concerns documenting assumptions. It supports that procedural point, not the numerical conversion. Later radiator-check excerpts support the need for a room-wise comparison and appropriate operating temperatures, but do not independently validate every calculated value.

Conversation B Staged renovation and the difference between heat load and emitter output

Test uncertain estimates, a critical room, a related topic change to hot water, and a misleading causal statement.

B1 User question

We are considering a heat pump for a six-flat building. The existing room-by-room design heat load totals 18 kW. Roof insulation is planned next year and window replacement two years later. The boiler still works. How should we compare replacing the boiler now with waiting until after the envelope work? We do not yet have the post-renovation heat load.

Chatbot answer:

Compare three cases: replace now at the current 18 kW design heat load, replace later after the envelope works, and an interim hybrid or staged solution while the boiler remains available. The current 18 kW is heating capacity under design conditions, not annual energy use. For the "later" case, create a provisional post-renovation room-by-room heat load using the planned roof and window U-values, areas, ventilation assumptions and design temperatures. Keep that estimate separate from verified inputs, because it will affect heat-pump capacity, source choice, emitter temperatures and electrical requirements.

• Room-by-room results matter because a reduced building total can still leave individual flats or rooms with high required flow temperatures.

• The working boiler gives you the option to avoid oversizing the heat pump before the envelope work is defined.

Wiki sources returned: Design heat load as the common starting point; Heat-pump feasibility in an existing building

B2 User question

The contractor says we can simply reduce 18 kW by 30% and order a 12.6 kW unit now. Is that enough evidence? Please explain what the 30% assumption does and does not tell us.

Chatbot answer:

No. A 30% reduction is only a placeholder estimate, not enough evidence to order the heat pump. It converts the current 18 kW design heat load into an assumed future total of 12.6 kW, but it does not prove the actual post-renovation heat load. It also says nothing about room-by-room loads, required flow temperatures, ventilation assumptions, or the heat pump's capacity at the real source and sink temperatures. Treat 12.6 kW as a scenario for comparison, not as the sizing basis.

• The assumption should be labelled as estimated, with its method and source kept separate from calculated or verified values.

• A reviewed post-renovation heat-load calculation needs the planned U-values, areas, design temperatures and ventilation assumptions.

Wiki sources returned: Sizing and oversizing; Design heat load as the common starting point; Data quality, provenance and uncertainty

B3 User question

Now the revised calculation is available: 12.6 kW overall, but one corner room still needs 1.4 kW and its radiator delivers only 0.8 kW at 45/35/20 °C. Does the lower building total mean 45 °C is now sufficient everywhere?

Chatbot answer:

No. The lower building total does not prove that 45 °C is sufficient everywhere. The corner room still needs 1.4 kW, but its radiator delivers only 0.8 kW at 45/35/20 °C, so it is short by 0.6 kW at that condition. That room can therefore set a higher required system flow temperature, unless its heat load is reduced or its emitter output is increased. The room load and radiator output must be compared on the same temperature basis, which you have done here.

• A small emitter change in the bottleneck room may allow the whole system to run at a lower heating curve.

• Confirm the radiator type, dimensions, connection, flow and correction factors before deciding whether the 0.8 kW value is final.

Wiki sources returned: Map critical rooms that set supply temperature; Emitters determine required supply temperature; Room-by-room radiator check

B4 User question

We will upgrade that radiator. Can we now use the 12.6 kW space-heating load to size domestic hot-water storage for the six flats as well, or are these separate questions? Do not invent occupancy data.

Chatbot answer:

They are separate sizing questions. The 12.6 kW value is the design space-heating load after the radiator upgrade and envelope assumptions. It does not define domestic hot-water storage for six flats. DHW storage needs an explicit draw-off and recovery basis, including expected use, storage temperature, cold-water temperature, distribution losses and recovery time. Without occupancy or draw-off data, those inputs remain unknown and should not be invented.

• The space-heating load may still affect heat-pump capacity when DHW charging is included, but it is not a DHW storage volume calculation.

• For the six flats, compare the chosen DHW concept and its peak demand, recovery power and circulation losses separately from the room-heating design load.

Wiki sources returned: Domestic hot water concepts; Data quality, provenance and uncertainty

B5 User question

You wrote that the design heat load was after the radiator upgrade. Does changing the radiator itself reduce that heat load? Please correct any misleading wording, then summarise which numbers are established and which decisions still need evidence.

Chatbot answer:

Correction: the 12.6 kW is the revised space-heating design heat load after the envelope assumptions, not after the radiator upgrade. Changing the radiator does not normally reduce the room heat load. It increases the heat output available in that room at a given flow and return temperature. The corner room still has a 1.4 kW design load unless the envelope, ventilation, or design temperatures for that room change. The radiator upgrade is evidence for emitter adequacy at 45/35/20 °C, not evidence for a lower building heat load.

• Established numbers are: 18 kW existing room-by-room total, 12.6 kW revised space-heating total, 1.4 kW corner-room load, and 0.8 kW existing radiator output at 45/35/20 °C.

• Decisions still needing evidence are the upgraded radiator output at the chosen temperatures, whether 45 °C is sufficient in every room, and the separate domestic hot-water storage basis for six flats.

Wiki sources returned: Design heat load as the common starting point

Assessment of conversation B

Assessor: Codex, AI-led exploratory review. Context retention: demonstrated. Conceptual reasoning: useful with a wording defect. Uncertainty handling: demonstrated. Final equipment selection: not established.

B2 correctly treats 18 × 0.70 = 12.6 kW as an assumed scenario until the user supplies a revised calculation in B3. It does not turn an arbitrary reduction into verified design evidence.

B3 computes the corner-room deficit as 1.4 − 0.8 = 0.6 kW and explains why a lower building total does not establish that every room can operate at 45 °C. B4 correctly separates domestic hot-water storage from the space-heating load and does not invent occupancy.

B4 says the 12.6 kW heat load is after the radiator upgrade and envelope assumptions. That can imply the emitter upgrade reduced the load. When challenged, B5 explicitly corrects the distinction between room demand and available emitter output.

B5 still says the radiator upgrade is evidence for emitter adequacy, although the replacement output has not been supplied. Its own final key point correctly says that output still needs evidence. The response should say the upgrade is a proposed route to adequacy, not proof of it.

The returned heat-load, sizing and radiator-check excerpts are relevant to the core distinctions. They do not verify the hypothetical building inputs or prove that a particular unit or replacement radiator is suitable.

Conversation C Frequent cycling and the difference between nominal and active water volume

Test diagnosis without premature equipment selection, a worked energy balance, a changed load and a plain-language summary.

C1 User question

In un condominio con radiatori, la pompa di calore si accende e si spegne circa ogni dieci minuti quando fuori ci sono 10 °C. Alcune valvole termostatiche sono quasi chiuse. Un installatore propone subito un accumulo inerziale da 500 litri. Basta questo dato per dire che sia la soluzione giusta?

Chatbot answer:

No. Il solo fatto che la pompa di calore cicli ogni dieci minuti a 10 °C non basta per giustificare un accumulo inerziale da 500 litri. Gli avvii frequenti possono dipendere da potenza minima troppo alta, poco volume d'acqua attivo, valvole termostatiche chiuse, portata insufficiente o regolazione non adatta. Un puffer può aiutare solo se risolve un problema definito, come separazione idraulica, tempo minimo di funzionamento o gestione dello sbrinamento. Va verificato prima cosa succede a compressore, mandata, ritorno, portata e valvole durante i cicli.

• Le valvole quasi chiuse riducono il volume e la portata disponibili agli emettitori, quindi possono favorire cicli brevi in condizioni miti.

• Un accumulo da 500 litri aggiunge perdite, ingombro, costo e nuove interazioni di regolazione; anche collegamento e posizione dei sensori sono determinanti.

Wiki sources returned: Diagnosticare cicli eccessivi basandosi su evidenze; Comprendere la modulazione minima e il ciclo di accensioni; Accumulo inerziale: prima lo scopo, poi il volume

C2 User question

La potenza termica minima dichiarata è 4 kW e in queste condizioni stimiamo una richiesta di 2 kW. Supponendo un salto utile di temperatura di 5 K, quanti litri servirebbero per assorbire il surplus per dieci minuti? Vorrei vedere il calcolo semplificato.

Chatbot answer:

Il surplus è $4\text{kW} - 2\text{kW} = 2\text{kW}$. In dieci minuti, cioè $\frac{10}{60}h$, l'energia da assorbire è $2 \times \frac{10}{60} = 0{,}333\text{kWh}$, pari a circa 1200kJ.

Con acqua tecnica e salto utile di $5K$:

$$m = \frac{Q}{c \times \Delta T} = \frac{1200}{4{,}18 \times 5} \approx 57\text{kg}$$

Dove m è la massa d'acqua, Q è l'energia, c è il calore specifico dell'acqua e ΔT è il salto termico utile. Poiché 1 kg d'acqua è circa 1 litro, servirebbero circa 57 litri attivi.

• Il calcolo considera solo l'energia in eccesso nel breve periodo, non le perdite e la regolazione reale.

• Il volume utile può essere minore del volume nominale se il serbatoio non lavora davvero su tutto il salto di 5 K.

Wiki sources returned: Comprendere la modulazione minima e il ciclo di accensioni; Accumulo inerziale: prima lo scopo, poi il volume

C3 User question

Quindi posso ordinare un puffer nominale da 60 litri? Nell'impianto ci sono già 40 litri d'acqua, ma non so quanti restino sempre in circolazione quando chiudono le valvole.

Chatbot answer:

Puoi considerare un puffer nominale da 60 litri solo se quei 60 litri sono realmente attraversati durante il funzionamento minimo. Nel tuo calcolo servono circa 57 litri attivi, quindi 60 litri nominali hanno poco margine. I 40 litri già presenti non vanno sommati tutti, se le valvole termostatiche possono escludere parte dei radiatori. La condizione decisiva è il volume che resta sempre in circolazione, insieme alla portata minima richiesta dalla pompa di calore.

• Un collegamento in serie sul ritorno rende più probabile che il volume del puffer sia sempre attivo; un collegamento diverso può ridurne l'effetto utile.

• La chiusura delle zone può ridurre portata e volume disponibili, quindi va identificato il percorso di flusso residuo.

Wiki sources returned: Accumulo inerziale: prima lo scopo, poi il volume; Comprendere la modulazione minima e il ciclo di accensioni; Coordinare zonizzazione, autorità di valvole e flusso della pompa di calore

C4 User question

Correggo un dato: la richiesta reale non è 2 kW ma 1 kW. La potenza minima resta 4 kW. Rifai il calcolo per dieci minuti e 5 K e dimmi se i 60 litri nominali bastano ancora senza contare i 40 litri incerti.

Chatbot answer:

Con richiesta reale di 1 kW, il surplus diventa $4 - 1 = 3\text{kW}$. In dieci minuti l'energia da assorbire è $3 \times \frac{10}{60} = 0{,}5\text{kWh}$, cioè circa 1800kJ. Con acqua e salto utile di $5K$: $m = \frac{1800}{4{,}18 \times 5} \approx 86\text{kg}$, quindi circa 86 litri attivi. I 60 litri nominali non bastano da soli per questo obiettivo, se non conti i 40 litri incerti.

• Il risultato dipende dal volume realmente attraversato durante il funzionamento minimo, non solo dal volume nominale del serbatoio.

• La correzione da 2 kW a 1 kW aumenta il surplus da smaltire e riduce il margine contro gli avvii brevi.

Wiki sources returned: Accumulo inerziale: prima lo scopo, poi il volume; Comprendere la modulazione minima e il ciclo di accensioni

C5 User question

Spiegalo ora all'amministratore in tre frasi semplici. Quale conclusione possiamo trarre sui 500 litri proposti all'inizio, sui 60 litri e sui dati da verificare? Non trasformare il calcolo semplificato in un progetto esecutivo.

Chatbot answer:

I 500 litri proposti all’inizio non sono giustificati dal solo dato degli avvii ogni dieci minuti. Con i dati corretti, il calcolo semplificato indica circa 86 litri attivi, quindi 60 litri nominali non bastano da soli se non contiamo i 40 litri incerti. Prima di decidere servono dati verificati su volume sempre in circolazione, portata minima, stato delle valvole e comportamento reale di mandata e ritorno.

Wiki sources returned: Carico termico di progetto come punto di partenza

Assessment of conversation C

Assessor: Codex, AI-led exploratory review. Context retention: demonstrated. Arithmetic: demonstrated for the stated assumptions. Equipment recommendation: conditional and still requires checks. Citation support: partial.

C1 correctly declines to justify 500 litres from a ten-minute cycle alone. C2 uses the surplus of 4 − 2 = 2 kW over 600 seconds. With water specific heat 4.18 kJ/(kg K) and 5 K usable temperature rise, the independent calculation is 1200/(4.18 × 5) = 57.4 kg, approximately 57 litres. This is an ideal active-volume estimate. [7]

C4 replaces the load with 1 kW: the surplus rises to 3 kW. Recalculation gives 1800/(4.18 × 5) = 86.1 kg, approximately 86 litres. It correctly rejects 60 nominal litres alone for the stated ten-minute target and does not count the uncertain 40 litres as guaranteed active volume.

C3 mentions series connection on the return as making active volume more likely. This is not a complete solution: a series tank alone does not guarantee a flow path when valves close. The response does mention minimum flow and the residual path, but the connection suggestion needs that condition stated more directly.

C5 preserves the corrected values and gives the requested three-sentence summary. The returned heat-load excerpts do not directly support the buffer-volume conclusion. A relevant buffer reference or a clear separation of the calculation from its sources would improve traceability.

These figures assume a constant surplus and a genuinely usable 5 K temperature swing. They do not size the final tank or verify defrost requirements, manufacturer minimum water volume, actual modulation at the operating point, control behaviour or hydraulic flow.

ANNEX C UNRATED QUESTION AND ANSWER COLLECTION

This annex reproduces all 84 questions and complete answers from the live review export of 21 September 2026. The three original languages are preserved. There is no assessment, score or correctness label for these answers. Formatting only has been adapted to the report; answer wording and key points are retained. The original export remains the source record. [4]

Entries are grouped by topic and language. The record identifier links each answer to the source collection. Wiki topic identifiers are reproduced as returned metadata. Their presence is not a rating or a claim that every sentence is supported.

C1 Heat pump principle

English question: How does a heat pump work and why does supply temperature matter?

A heat pump uses electricity to move heat, not to create all heat directly. The refrigerant absorbs environmental heat in the evaporator, the compressor raises its pressure and temperature, and the condenser releases heat to the heating water. Supply temperature matters because the heat pump must lift the source temperature up to the heating-water flow temperature. A lower required flow temperature usually improves efficiency, but the radiators or other emitters must still deliver enough heat to each room.

Key points:

• Emitter output falls when heating-water temperature falls, so room heat load and emitter output must be checked together.

• One demanding room can set the required supply temperature for the whole system.

Record: heat-pump-principle-en-evaluation. Wiki topic identifiers: heat-pump-principle, emitter-supply-temperature

German question: Wie funktioniert eine Wärmepumpe und warum ist die Vorlauftemperatur wichtig?

Eine Wärmepumpe nutzt Strom, um Umweltwärme auf ein höheres Temperaturniveau zu bringen. Im Verdampfer nimmt das Kältemittel Wärme aus der Quelle auf. Der Verdichter erhöht Druck und Temperatur. Im Verflüssiger gibt das Kältemittel Wärme an das Heizwasser ab.

Die Vorlauftemperatur ist wichtig, weil sie den nötigen Temperaturhub bestimmt. Je niedriger sie bei gleicher Wärmequelle sein kann, desto effizienter arbeitet die Wärmepumpe meist. Die Heizflächen müssen die Räume dabei trotzdem ausreichend erwärmen.

Wichtige Punkte:

• Mit sinkender Heizwassertemperatur gibt ein Heizkörper weniger Wärme ab.

• Ein einzelner kritischer Raum mit zu kleiner Heizfläche kann die nötige Vorlauftemperatur für den ganzen Heizkreis erhöhen.

Record: heat-pump-principle-de-evaluation. Wiki topic identifiers: heat-pump-principle, emitter-supply-temperature

Italian question: Come funziona una pompa di calore e perché conta la temperatura di mandata?

Una pompa di calore trasferisce calore dall'ambiente all'impianto di riscaldamento mediante un ciclo frigorifero. Il refrigerante assorbe calore nell'evaporatore, viene compresso, poi cede calore all'acqua di riscaldamento nel condensatore. La temperatura di mandata conta perché indica quanto calda deve essere l'acqua inviata ai terminali. A parità di sorgente, una mandata più bassa riduce il salto termico e di solito migliora l'efficienza della pompa di calore. Deve però essere sufficiente per scaldare i locali.

Punti chiave:

• La resa dei terminali diminuisce quando si abbassa la temperatura dell'acqua.

• Il locale più sfavorevole può imporre la temperatura di mandata necessaria per tutto il sistema.

Record: heat-pump-principle-it-evaluation. Wiki topic identifiers: heat-pump-principle, emitter-supply-temperature

C2 Retrofit feasibility

English question: What must I check before deciding whether a heat pump fits an existing apartment building?

Check the whole heating system, not only the heat-pump unit. Start with a transparent design heat load for the building or heated zones. Then identify the critical rooms, existing emitters and the maximum flow temperature needed in cold weather. Also screen the heat source location, plant space, noise constraints, electrical capacity, domestic hot water preparation and any permissions needed for an apartment building.

Key points:

• A high heat load does not automatically rule out a heat pump, but it affects capacity, source choice and renovation scope.

• Critical emitters and required flow temperature often show where radiator upgrades, hydraulic changes or fabric improvements are most useful.

Record: retrofit-feasibility-en-evaluation. Wiki topic identifiers: retrofit-feasibility

German question: Was muss ich prüfen, bevor ich eine Wärmepumpe für ein Mehrfamilienhaus wähle?

Prüfe zuerst die Auslegungsheizlast des Gebäudes. Danach müssen die kritischen Heizflächen und die erforderliche maximale Vorlauftemperatur bekannt sein. Für die Gerätewahl zählen außerdem

Wärmequelle, Aufstellort, Schall, Stromanschluss und Warmwasserbereitung. Im Mehrfamilienhaus solltest du die Aufnahme so planen, dass Eckwohnungen, oberste und unterste Geschosse sowie abweichend umgebaute Wohnungen nicht übersehen werden.

Wichtige Punkte:

• Eine hohe Heizlast schließt eine Wärmepumpe nicht automatisch aus. Sie beeinflusst aber Heizleistung, Wärmequelle und Anlagenkonzept.

• Kritische Räume zeigen oft zuerst, ob Heizflächen vergrößert oder einzelne Bauteile verbessert werden müssen.

Record: retrofit-feasibility-de-evaluation. Wiki topic identifiers: retrofit-feasibility, multifamily-survey-sampling

Italian question: Cosa devo controllare per capire se una pompa di calore è adatta a un condominio esistente?

Controlla prima il carico termico di progetto del condominio e la temperatura di mandata richiesta dai terminali esistenti. Poi verifica i locali critici, perché spesso sono quelli che impongono interventi su radiatori, ventilconvettori o regolazione. Valuta anche sorgente disponibile, spazio per le unità, rumore, potenza elettrica disponibile e produzione di acqua calda sanitaria. Un carico elevato non esclude la pompa di calore, ma può cambiare taglia, schema impiantistico e lavori necessari.

Punti chiave:

• La fattibilità va valutata come sistema edificio-impianto, non solo scegliendo una macchina efficiente.

• Se si considera il riscaldamento a pavimento, servono anche altezza disponibile, potenza per stanza e integrazione di collettori e circuiti.

Record: retrofit-feasibility-it-evaluation. Wiki topic identifiers: retrofit-feasibility, underfloor-heating-retrofit

C3 Heat pump sizing

English question: How should a retrofit heat pump be sized without oversizing it?

Size a retrofit heat pump from the building's design heat load, not from annual energy use alone. Use the local design outdoor temperature and the required heating-water flow temperature, then compare the heat pump's capacity at that exact operating point. Avoid selecting only by catalogue nominal capacity, because it applies only at stated source and sink temperatures. If a backup heater, bivalent system, or cascade is used, define when each heat source runs and how staging is controlled.

Key points:

• Oversizing can cause frequent on-off cycling during low heat demand, which can reduce efficiency.

• Record the design load, climate point, backup strategy, staging logic, and minimum modulation before selecting equipment.

Record: heat-pump-sizing-en-evaluation. Wiki topic identifiers: heat-pump-sizing

German question: Wie dimensioniert man eine Wärmepumpe im Bestand ohne Überdimensionierung?

Man dimensioniert die Wärmepumpe im Bestand zuerst nach der Auslegungsheizlast des Gebäudes und den dafür nötigen Betriebstemperaturen. Die angegebene Nennleistung der Wärmepumpe muss zu genau diesen Temperaturen passen, etwa zur Quelle und zur Vorlauftemperatur. Bedarfsspitzen werden bewusst im Anlagenkonzept geklärt, statt die Wärmepumpe pauschal größer zu wählen. Eine Überdimensionierung ist ungünstig, weil die Anlage bei geringem Wärmebedarf häufiger ein- und ausschalten kann.

Wichtige Punkte:

• Der Jahresverbrauch allein reicht nicht als Dimensionierungsgrundlage.

• Bei Hybridanlagen muss feststehen, welcher Wärmeerzeuger welchen Anteil der Heizlast übernimmt.

Record: heat-pump-sizing-de-evaluation. Wiki topic identifiers: heat-pump-sizing

Italian question: Come si dimensiona una pompa di calore nell'esistente evitando il sovradimensionamento?

Si dimensiona partendo dal carico termico verificato dell'edificio, non dal solo consumo annuo. Il carico va riferito al punto climatico di progetto e alla temperatura di mandata realmente necessaria. Poi si confronta la potenza della pompa di calore proprio a quelle condizioni, perché la potenza nominale vale solo per le temperature dichiarate. Per evitare sovradimensionamento, si controllano anche modulazione minima, cicli di accensione e strategia di eventuale integrazione bivalente o in cascata.

Punti chiave:

• Una macchina troppo grande può lavorare con frequenti accensioni e spegnimenti quando la richiesta è bassa, riducendo l'efficienza.

• Nei sistemi con generatore di supporto servono regole chiare su copertura, stadi e controllo.

Record: heat-pump-sizing-it-evaluation. Wiki topic identifiers: heat-pump-sizing

C4 Heat load

English question: Why do I need a room-wise heat load before planning a heat pump?

You need a room-wise heat load because a heat pump must be planned around required heating power, not annual energy use. The room results show which rooms lose heat fastest and whether their emitters can cover the load at lower flow temperatures. A building total can look plausible while hiding rooms that need higher water temperatures. Those rooms often determine heat-pump efficiency and the required system design.

Key points:

• Heat load is a power value in kW under defined design conditions; annual demand is energy in kWh over a year.

• Useful inputs include boundary areas, U-values, design temperatures, ventilation assumptions and a clear split between measured, calculated and estimated data.

Record: heat-load-en-evaluation. Wiki topic identifiers: heat-load, radiator-check

German question: Warum brauche ich vor der Wärmepumpenplanung eine raumweise Heizlast?

Eine raumweise Heizlast wird vor der Wärmepumpenplanung benötigt, weil sie die nötige Heizleistung jedes einzelnen Raums in kW zeigt. Erst damit lässt sich prüfen, ob die vorhandenen Heizflächen bei niedriger Vorlauftemperatur ausreichen. Die Gebäudesumme reicht dafür nicht aus, weil sich Fehler einzelner Räume ausgleichen können. So bleibt sonst unklar, welcher Raum die maximale Vorlauftemperatur bestimmt.

Wichtige Punkte:

• Der jährliche Heizenergieverbrauch in kWh ersetzt keine Heizlast in kW.

• Die Berechnung berücksichtigt Gebäudehülle, Auslegungstemperaturen und Lüftung.

Record: heat-load-de-evaluation. Wiki topic identifiers: heat-load

Italian question: Perché serve il carico termico per locale prima di progettare una pompa di calore?

Serve perché la pompa di calore va dimensionata sulla potenza richiesta in kW nelle condizioni di progetto, non sui kWh annui. Il calcolo per locale collega involucro, ventilazione, terminali e dimensionamento della macchina. Mostra anche quali stanze hanno terminali insufficienti o dispersioni elevate, che il totale dell'edificio può nascondere. Senza questo dettaglio si rischia di scegliere una temperatura di mandata o una potenza non adatta ai locali critici.

Punti chiave:

• Le ipotesi devono essere esplicite: superfici, valori U, temperature interne ed esterne di progetto, ventilazione e infiltrazioni.

• Un totale plausibile può mascherare errori compensati tra locali diversi.

Record: heat-load-it-evaluation. Wiki topic identifiers: heat-load, design-conditions

C5 Design conditions

English question: Which design temperatures and boundary conditions matter for heat-load results?

Heat-load results depend mainly on the outdoor design temperature, the intended indoor temperature for each room, and the temperature assumptions for adjacent spaces. Each boundary should

be classified as heated, intermittently heated, unheated, or outside, with its area and thermal properties recorded. Ventilation assumptions also matter, including room volume, air change or airflow, airtightness, and any heat recovery. Keep these inputs consistent between variants, otherwise changes in the result may come from changed assumptions rather than from the renovation measure.

Key points:

• Use room-wise inputs where possible, because a building total can hide critical rooms or emitters.

• Separate imported, calculated, and estimated inputs so later checks can identify weak assumptions.

Record: design-conditions-en-evaluation. Wiki topic identifiers: design-conditions, heat-load

German question: Welche Auslegungstemperaturen und Randbedingungen beeinflussen die Heizlast?

Die Heizlast wird vor allem durch die Normaußentemperatur am Standort und die gewünschte Innentemperatur jedes Raums bestimmt. Dazu kommen Temperaturen angrenzender Räume, zum Beispiel unbeheizte Keller, Treppenräume oder Nachbarzonen. Wichtig sind außerdem die Wärmeverluste über Bauteile, Lüftung und undichte Stellen. Für die Berechnung zählen daher Flächen, U-Werte, Raumvolumen, Luftwechsel oder Luftvolumenstrom sowie Luftdichtheit und vorhandene Wärmerückgewinnung.

Wichtige Punkte:

• Standort und Klimadatenquelle sollten eindeutig festgelegt werden.

• Nutzungsabhängige Sollwerte sollten je Raum geprüft werden, weil sie die Heizlast direkt verändern.

Record: design-conditions-de-evaluation. Wiki topic identifiers: design-conditions

Italian question: Quali temperature di progetto e condizioni al contorno influenzano il carico termico?

Il carico termico dipende dalla temperatura esterna di progetto della località e dalla temperatura interna prevista per ogni locale. Dipende anche dai confini termici: pareti, solai e superfici verso spazi riscaldati, intermittenti o non riscaldati. Servono inoltre superfici, valori U e ipotesi di ventilazione. Per la ventilazione contano volume del locale, ricambi o portate d'aria, tenuta all'aria ed eventuale recupero di calore.

Punti chiave:

• Il carico termico è una potenza in kW nelle condizioni di progetto, non un consumo annuo in kWh.

• I setpoint interni vanno verificati in base alla destinazione d'uso dei locali.

Record: design-conditions-it-evaluation. Wiki topic identifiers: design-conditions, heat-load

C6 Envelope first

English question: When should envelope renovation come before heat-pump replacement?

Envelope renovation should come before heat-pump replacement when planned roof, facade, window or basement work can materially reduce heat demand before the new system is sized. It is especially relevant when the current emitters would otherwise need high heating-water flow temperatures, because lower heat load can allow smaller equipment and lower flow temperature. It also makes sense when comfort, moisture risk or building value justify envelope work before the heat generator fails. If the heat generator has already failed, an urgent replacement may be necessary, but it should avoid blocking a later envelope stage.

Key points:

• Do not assume a deep envelope package is automatically best; compare cost, disruption, embodied impacts and operating benefits.

• Intermediate packages can be enough when they target the critical envelope elements or rooms that drive peak load.

Record: envelope-first-en-evaluation. Wiki topic identifiers: envelope-first, renovation-trigger-triage, renovation-depth-portfolio

German question: Wann sollte die Gebäudehülle vor dem Wärmepumpentausch saniert werden?

Die Gebäudehülle sollte vor dem Wärmepumpentausch saniert werden, wenn dadurch die Heizlast deutlich sinkt oder kritische Räume mit niedrigerer Vorlauftemperatur auskommen. Das kann eine kleinere Wärmepumpe ermöglichen und den Betrieb effizienter machen. Besonders sinnvoll ist der Hülle-zuerst-Ansatz, wenn Dach, Fassade, Fenster oder Kellerdecke ohnehin instandgesetzt werden müssen. Er ist weniger zwingend, wenn die Sanierung hohe Zusatzkosten verursacht und die bestehende Heizungsanlage bereits mit moderaten Vorlauftemperaturen auskommt.

Wichtige Punkte:

• Eine tiefe Sanierung ist nicht automatisch die wirtschaftlich beste Lösung. Betriebsenergie, Investition, graue Emissionen und Bauaufwand müssen zusammen bewertet werden.

• Kritische Räume und ihre benötigte Vorlauftemperatur zeigen, ob eher Dämmung, Fenstertausch oder größere Heizflächen den Engpass lösen.

Record: envelope-first-de-evaluation. Wiki topic identifiers: envelope-first, retrofit-feasibility

Italian question: Quando conviene riqualificare l'involucro prima di sostituire il generatore?

Conviene partire dall'involucro quando l'intervento riduce in modo significativo il carico termico, la domanda annua o la temperatura di mandata richiesta dai terminali. È particolarmente sensato se sono già previsti lavori su facciata, tetto o finestre, perché il costo marginale e il disturbo possono essere più bassi. Conviene anche quando un locale critico obbligherebbe il nuovo generatore a lavorare ad alta temperatura. Invece, se il generatore è guasto e serve continuità di servizio, può

essere necessario sostituirlo subito, preservando però la compatibilità con la riqualificazione futura.

Punti chiave:

• Un carico minore può permettere una macchina più piccola e condizioni operative migliori.

• Una riqualificazione profonda dell'involucro non è automaticamente la scelta più conveniente in termini di costo.

Record: envelope-first-it-evaluation. Wiki topic identifiers: envelope-first, renovation-trigger-triage, staged-renovation

C7 Thermal bridges

English question: Why is it important to consider and reduce thermal bridges during renovation?

Thermal bridges matter because they add heat loss at junctions such as corners, slab edges and window reveals. If these losses are ignored, the design heat load can be too low, so emitters or the heat pump may be undersized. They can also make internal surfaces colder, which reduces comfort and can increase condensation or mould risk when indoor humidity is high. Reducing them improves insulation continuity and gives a more reliable basis for the renovation design.

Key points:

• Check the real junction geometry, materials and insulation continuity before finalising the heat-load calculation.

• After improving details, update the room and building heat-load calculation so equipment sizing reflects the renovated condition.

Record: thermal-bridges-en-evaluation. Wiki topic identifiers: thermal-bridges

German question: Warum ist es bei einer Sanierung wichtig, Wärmebrücken zu berücksichtigen und zu reduzieren?

Wärmebrücken sind bei einer Sanierung wichtig, weil sie zusätzliche Wärmeverluste an Anschlüssen und Kanten verursachen. Dadurch kann die Heizlast höher sein als erwartet. Wenn diese Verluste fehlen, werden Heizflächen oder Wärmepumpe möglicherweise zu knapp ausgelegt. Kalte Innenoberflächen mindern außerdem den Komfort und können bei passender Raumfeuchte Tauwasser oder Schimmel begünstigen.

Wichtige Punkte:

• Nach einer verbesserten Anschlussausbildung sollte die Heizlast aktualisiert werden.

• Entscheidend sind die tatsächliche Geometrie, die Materialien und eine durchgehende Dämmung an den Anschlüssen.

Record: thermal-bridges-de-evaluation. Wiki topic identifiers: thermal-bridges

Italian question: Perché è importante considerare e ridurre i ponti termici durante una riqualificazione?

È importante considerarli perché i ponti termici aumentano le dispersioni nei nodi costruttivi. Se vengono ignorati, il carico termico di progetto può risultare troppo basso. Questo può portare a terminali o pompa di calore sottodimensionati. Inoltre, le superfici interne più fredde peggiorano il comfort e possono aumentare il rischio di condensa o muffa quando l'umidità interna è elevata.

Punti chiave:

• Ridurre i ponti termici rende più continua la coibentazione e migliora la qualità energetica dell'intervento.

• La verifica deve riguardare geometria reale, materiali e continuità dell'isolamento nei punti critici.

Record: thermal-bridges-it-evaluation. Wiki topic identifiers: thermal-bridges

C8 Windows facade

English question: What should be coordinated when windows and facade insulation are renovated together?

Coordinate the window position, insulation build-up, airtightness layer and junction details as one package. A new window alone can improve the glass area but still leave thermal bridges, leakage paths or moisture risks at the reveal. Opening dimensions, facade geometry and service penetrations should be verified before details are frozen. Ventilation must also be reviewed, because more airtight windows reduce uncontrolled air exchange.

Key points:

• If facade-integrated ventilation or other services are included, coordinate intakes, exhausts, power routes, filter access and penetrations with the window layout.

• Prefabricated facade elements can shorten site work, but interfaces need earlier agreement because later changes are harder.

Record: windows-facade-en-evaluation. Wiki topic identifiers: windows-facade, facade-integrated-ventilation-package

German question: Was muss bei gemeinsamer Fenster- und Fassadensanierung koordiniert werden?

Koordiniert werden müssen vor allem Fensteranschlüsse, Fassadenaufbau, Luftdichtheit, Lüftung und Bauablauf. Neue Fenster verändern den Luftaustausch und die Oberflächentemperaturen. Deshalb müssen Anschlüsse und Wärmebrücken zusammen mit der Fassadendämmung geplant werden. Wenn Fenster vor der Fassade erneuert werden, braucht es sichere Übergangsdetails gegen Feuchte und Undichtheiten.

Wichtige Punkte:

• Die Bestandsaufnahme sollte Fassadengeometrie und Fensterflächen nachvollziehbar erfassen.

• Das Lüftungskonzept muss zur höheren Dichtheit der neuen Fenster passen.

Record: windows-facade-de-evaluation. Wiki topic identifiers: windows-facade, facade-moisture-sequencing

Italian question: Cosa va coordinato quando si riqualificano insieme finestre e facciata?

Vanno coordinati come un'unica decisione progettuale, non come prodotti separati. I punti principali sono posizione della finestra nello spessore della facciata, continuità dell'isolamento, nodi di posa, barriera all'aria e gestione della ventilazione. Finestre più ermetiche riducono le infiltrazioni, quindi cambia anche il comportamento dell'umidità interna. Per questo serve un concetto di ricambio d'aria, soprattutto nei locali sensibili all'umidità.

Punti chiave:

• Geometria, aperture e posizione dei serramenti devono basarsi su rilievi verificabili.

• La continuità della barriera all'aria alle giunzioni va definita prima della posa.

Record: windows-facade-it-evaluation. Wiki topic identifiers: windows-facade, airtightness-strategy

C9 Emitter supply temperature

English question: Why can one radiator determine the supply temperature of the whole heat-pump system?

One radiator can determine the supply temperature because the heat pump normally feeds all emitters from one heating curve. If one room has a high heat load or a small radiator, that radiator may only deliver enough heat at a higher flow temperature. Since radiator output falls when water temperature falls, the system temperature must be high enough for the weakest room, not just for the average room. Fixing that bottleneck can allow the whole heating curve to be lowered.

Key points:

• The critical room is found by comparing each room's heat load with its installed emitter output at the same temperature basis.

• Possible fixes include reducing the room load, enlarging the emitter, adding fan assistance, or adding surface heating.

Record: emitter-supply-temperature-en-evaluation. Wiki topic identifiers: emitter-supply-temperature, critical-room-bottleneck-map

German question: Warum kann ein einzelner Heizkörper die Vorlauftemperatur des gesamten Systems bestimmen?

Ein einzelner Heizkörper kann entscheidend sein, wenn er der Engpass im gemeinsamen Heizkreis ist. Jeder Raum braucht bei Auslegungskälte genug Wärme, um seine Heizlast zu decken. Sinkt die Heizwassertemperatur, gibt ein Heizkörper weniger Wärme ab. Ist ein Heizkörper für seinen Raum zu klein, braucht er eine höhere Vorlauftemperatur als die übrigen Heizkörper. Diese höhere Temperatur kann dann für den gesamten Heizkreis nötig werden.

Wichtige Punkte:

• Der kritische Raum ist meist der Raum mit hoher Heizlast, kleiner Heizfläche oder ungünstiger Lage.

• Der Engpass lässt sich oft durch geringere Wärmeverluste, größere Heizflächen, geeignete Heizkörperlüfter oder Flächenheizung entschärfen.

Record: emitter-supply-temperature-de-evaluation. Wiki topic identifiers: emitter-supply-temperature

Italian question: Perché un solo radiatore può determinare la mandata dell'intero impianto?

Un solo radiatore può determinare la temperatura di mandata perché l'impianto deve garantire comfort anche nel locale più sfavorevole. Se quel radiatore è piccolo rispetto al carico termico della stanza, eroga poca potenza quando l'acqua lavora a bassa temperatura. Per coprire quel locale, si alza quindi la mandata di tutto il circuito servito dalla stessa regolazione. In alternativa, si può intervenire proprio sul collo di bottiglia, ad esempio con un radiatore più grande, un emettitore ventilato, una superficie radiante o una riduzione del carico della stanza.

Punti chiave:

• La resa di un radiatore diminuisce quando si riduce la temperatura dell'acqua.

• Il confronto decisivo è tra carico termico del locale e potenza dell'emettitore alla temperatura di mandata prevista.

Record: emitter-supply-temperature-it-evaluation. Wiki topic identifiers: emitter-supply-temperature, low-temperature-emitter-options

C10 Radiator check

English question: How do I check whether existing radiators can work with a heat pump?

Check the radiators room by room, because a heat pump usually works best with lower flow temperatures. First record the real radiator type, height, length, depth, connection and any covers or blocked air paths. Then compare each room's heat load with the radiator output at candidate supply and return temperatures, using a manufacturer table or the correct mean temperature difference method. Finally, verify that valves, pipework and balancing can provide the required water flow without excessive noise or pressure drop.

Key points:

• Do not rely only on labels or visual identification; actual geometry and type affect output.

• Catalogue ratings must be corrected to the intended flow, return and room temperatures.

Record: radiator-check-en-evaluation. Wiki topic identifiers: radiator-check

German question: Wie prüfe ich, ob vorhandene Heizkörper mit einer Wärmepumpe funktionieren?

Prüfe jeden Raum einzeln. Miss zuerst Typ, Abmessungen und Anschluss des vorhandenen Heizkörpers. Ermittle dann die Raum-Heizlast und vergleiche sie mit der Heizkörperleistung bei der geplanten Vorlauf-, Rücklauf- und Raumtemperatur. Nutze dafür Herstellertabellen oder eine passende Umrechnung, nicht nur die alte Nennleistung. Prüfe zusätzlich Ventile, verfügbaren Volumenstrom und Abdeckungen, weil sie die tatsächliche Wärmeabgabe begrenzen können.

Wichtige Punkte:

• Ein Heizkörper passt, wenn seine Leistung bei niedrigen Systemtemperaturen mindestens die Heizlast des Raums deckt.

• Kritisch sind meist Räume mit kleinen Heizkörpern, hohen Wärmeverlusten oder verdeckten Heizflächen.

Record: radiator-check-de-evaluation. Wiki topic identifiers: radiator-check

Italian question: Come verifico se i radiatori esistenti possono funzionare con una pompa di calore?

Verificali locale per locale, confrontando la resa reale del radiatore con il carico termico del locale alla temperatura di mandata prevista per la pompa di calore. Rileva tipo, altezza, lunghezza, profondità e collegamento reale, non solo l'etichetta. Poi calcola la resa alle condizioni candidate usando tabelle del produttore, oppure la differenza media di temperatura con l'esponente corretto. Infine controlla valvole, portata e ostacoli alla convezione, perché possono ridurre la resa anche se il radiatore è abbastanza grande.

Punti chiave:

• I locali più sfavoriti determinano spesso la temperatura di mandata richiesta dall'intero sistema.

• La resa nominale a temperature alte non va usata direttamente per valutare il funzionamento a bassa temperatura.

Record: radiator-check-it-evaluation. Wiki topic identifiers: radiator-check

C11 Hydraulic balancing

English question: Why is hydraulic balancing especially important for a heat pump?

Hydraulic balancing is especially important for a heat pump because heat pumps work best with stable, correctly distributed water flow. If some emitters receive too much flow and others too little, rooms heat unevenly and the heat pump may cycle more often. That reduces comfort and efficiency. Good balancing lets each emitter deliver its intended output without unnecessary pump effort.

Key points:

• Commissioning should include documented valve and pump settings, plus representative flow and temperature checks.

• Balancing helps distribution, but it cannot make an undersized radiator or restricted pipework deliver enough heat.

Record: hydraulic-balancing-en-evaluation. Wiki topic identifiers: hydraulic-balancing

German question: Warum ist der hydraulische Abgleich bei einer Wärmepumpe besonders wichtig?

Der hydraulische Abgleich ist bei einer Wärmepumpe besonders wichtig, weil die Heizflächen bei niedriger Vorlauftemperatur zuverlässig mit den passenden Volumenströmen versorgt werden müssen. Nur dann erreichen sie ihre Leistung ohne unnötig hohe Pumpenarbeit. Eine ungleichmäßige Verteilung führt zu kalten oder überversorgten Räumen. Sie kann außerdem häufiges Takten verursachen, also häufiges Ein- und Ausschalten der Wärmepumpe, und damit Effizienz und Komfort verschlechtern.

Wichtige Punkte:

• Strang- und Heizflächenströme werden aus der vorgesehenen Spreizung berechnet.

• Der Abgleich ersetzt keine zu kleine Heizfläche und keine fehlende Rohrkapazität.

Record: hydraulic-balancing-de-evaluation. Wiki topic identifiers: hydraulic-balancing

Italian question: Perché il bilanciamento idraulico è particolarmente importante con una pompa di calore?

Il bilanciamento idraulico è particolarmente importante perché una pompa di calore lavora meglio con portate stabili e temperature di mandata basse. Se le portate non sono distribuite secondo il fabbisogno dei terminali, alcuni locali ricevono troppo calore e altri troppo poco. Questo può causare comfort disuniforme e più cicli di accensione e spegnimento, con perdita di efficienza.

Punti chiave:

• Le portate si calcolano per rami e terminali in base al salto termico previsto.

• Alla messa in servizio conviene verificare portate e temperature rappresentative, non solo la temperatura ambiente.

Record: hydraulic-balancing-it-evaluation. Wiki topic identifiers: hydraulic-balancing

C12 Hydraulic topologies

English question: How should central, mixed and semi-central heat-pump topologies be compared?

Compare the topologies by using the same system boundary and the same service level. First identify where heat is generated, how space heating is distributed, and how domestic hot water is produced. Then compare flow temperatures, distribution and storage losses, domestic hot water peaks, electrical capacity, space needs, metering, controls and maintenance responsibilities. The labels are not enough on their own, because central, mixed and semi-central are concept families rather than complete hydraulic designs.

Key points:

• Central usually means a shared heat generator serves the building. Mixed often means central space heating with domestic hot water produced in apartments. Semi-central can mean a central low-temperature supply with dwelling boosters.

• Ownership boundaries matter because the concepts move equipment, metering and maintenance between building-level and dwelling-level responsibilities.

Record: hydraulic-topologies-en-evaluation. Wiki topic identifiers: hydraulic-topologies, gas-apartment-heating-exit-architectures

German question: Wie vergleicht man zentrale, gemischte und semizentrale Wärmepumpentopologien?

Man vergleicht diese Anlagenkonzepte zuerst über die physische Aufteilung: Wo sitzt die Wärmeerzeugung, wie wird Wärme verteilt, und wo entsteht Warmwasser? Zentral bedeutet typischerweise ein gemeinsamer Wärmeerzeuger für das Gebäude. Gemischt kombiniert zum Beispiel zentrale Raumheizung mit Warmwasserbereitung in den Wohnungen. Semizentral arbeitet häufig mit zentraler Niedertemperaturversorgung und lokalen Boostern, die die Temperatur in der Wohnung anheben.

Wichtige Punkte:

• Vergleiche nur Konzepte mit gleichem Versorgungsumfang, sonst wirken Verluste, Speicherbedarf und Warmwasserspitzen verzerrt.

• Wichtige Kriterien sind Vorlauftemperatur, Rohr- und Speicherverluste, Platzbedarf, Stromanschluss, Messung, Regelung und Wartungsverantwortung.

Record: hydraulic-topologies-de-evaluation. Wiki topic identifiers: hydraulic-topologies

Italian question: Come si confrontano topologie centrali, miste e semi-centrali con pompe di calore?

Le tre soluzioni si confrontano partendo da dove si produce il calore, dove si distribuisce e dove si prepara l'acqua calda sanitaria. Una soluzione centrale usa un generatore comune per l'edificio.

Una soluzione semi-centrale può usare una rete centrale a bassa temperatura e booster negli alloggi, che alzano localmente la temperatura. Una soluzione mista può avere riscaldamento centralizzato e acqua calda sanitaria prodotta separatamente nei singoli alloggi. L'etichetta da sola non basta, perché servono confini chiari e modi di funzionamento definiti.

Punti chiave:

• Il confronto deve includere temperatura di mandata, perdite di rete e accumulo, picchi di acqua calda sanitaria, potenza elettrica disponibile, spazio, contabilizzazione, regolazione e manutenzione.

• Con pompe di calore, le soluzioni a temperature più basse tendono a favorire il COP, ma possono richiedere integrazioni locali o superfici di scambio adeguate.

Record: hydraulic-topologies-it-evaluation. Wiki topic identifiers: hydraulic-topologies

C13 Buffer storage

English question: When does a heat-pump system actually need buffer storage?

A heat-pump system needs buffer storage only when it solves a defined hydraulic or control problem. Common reasons are hydraulic separation between heat-pump and heating circuits, enough water volume for minimum run time, support during defrost, or limited time shifting of heat production. It should not be added automatically, because it adds standing losses, space demand, cost, and extra control interactions. The connection arrangement and sensor positions are part of the decision, not details to leave until later.

Key points:

• First check whether the heat pump can modulate and whether the heating system already provides the required minimum water volume.

• A simple litres-per-kilowatt rule is not enough to decide the buffer size or whether one is needed.

Record: buffer-storage-en-evaluation. Wiki topic identifiers: buffer-storage

German question: Wann braucht ein Wärmepumpensystem tatsächlich einen Pufferspeicher?

Ein Wärmepumpensystem braucht einen Pufferspeicher nur, wenn er ein konkretes hydraulisches oder regelungstechnisches Problem löst. Typische Gründe sind hydraulische Entkopplung, ausreichende Mindestlaufzeit, Unterstützung beim Abtauen oder zeitliche Lastverschiebung. Ohne solchen Zweck verschlechtert ein Puffer oft die Anlage, weil er Wärmeverluste, Platzbedarf, Kosten und zusätzliche Regelungseffekte verursacht. Entscheidend sind außerdem Anschlussart und Fühlerpositionen, nicht nur das Speichervolumen.

Wichtige Punkte:

• Eine pauschale Liter-pro-kW-Regel ersetzt keine Auslegung des konkreten Anlagenkonzepts.

• Wenn der Heizkreis genügend Volumenstrom und Wasserinhalt sicher bereitstellt, kann ein System oft ohne Pufferspeicher funktionieren.

Record: buffer-storage-de-evaluation. Wiki topic identifiers: buffer-storage

Italian question: Quando un impianto a pompa di calore necessita davvero di un accumulo inerziale?

Un accumulo inerziale serve davvero quando risolve un problema preciso dell'impianto. I casi tipici sono separazione idraulica tra pompa di calore e circuiti, volume minimo per evitare cicli troppo brevi, energia disponibile per lo sbrinamento, oppure spostamento del carico in certe fasce orarie. Non va aggiunto per abitudine, perché introduce perdite termiche, ingombro, costo e possibili interazioni di regolazione. La scelta dipende anche da collegamento, posizione dei sensori e logica di controllo, non solo dai litri installati.

Punti chiave:

• Una semplice regola in litri per kW non basta per dimensionare o giustificare un puffer.

• Prima va verificato se l'impianto può funzionare bene senza accumulo inerziale.

Record: buffer-storage-it-evaluation. Wiki topic identifiers: buffer-storage

C14 Dhw concepts

English question: Why must domestic hot water be planned together with the heat-pump topology?

Domestic hot water must be planned with the heat-pump topology because it often sets the highest temperature level, the peak capacity requirement and the storage concept. Space heating may work efficiently at low flow temperature, while DHW may need higher storage and distribution temperatures for comfort and hygiene. The topology also decides where DHW is produced: centrally, locally in dwellings, or with boosters. That changes circulation losses, pipework, electrical capacity, metering, maintenance access and recovery after peak draw-off periods.

Key points:

• Compare options at the same service level, including DHW peaks, losses, controls, space and maintenance responsibilities.

• Use an explicit draw-off and recovery basis, otherwise storage volume and heat-pump capacity can be under- or overestimated.

Record: dhw-concepts-en-evaluation. Wiki topic identifiers: dhw-concepts, dhw-hygiene, hydraulic-topologies

German question: Warum muss Trinkwarmwasser gemeinsam mit der Wärmepumpentopologie geplant werden?

Trinkwarmwasser muss gemeinsam mit dem Anlagenkonzept der Wärmepumpe geplant werden, weil es oft höhere Temperaturen und andere Lastspitzen verlangt als die Raumheizung. Während

der Speicherladung ändern sich vorübergehend die Temperatur- und Leistungsanforderungen der Wärmepumpe. Die Regelung muss dann Warmwasser bereitstellen, ohne die Raumheizung zu lange zu unterbrechen oder die Anlage dauerhaft auf hohem Temperaturniveau zu betreiben. Besonders im Mehrfamilienhaus können Warmwasser, Speichergröße, Spitzenleistung und Verteilverluste das Gesamtkonzept prägen.

Wichtige Punkte:

• Heizung und Trinkwarmwasser sollten temperaturseitig getrennt bewertet werden, damit die Wärmepumpe nicht unnötig ineffizient betrieben wird.

• Zentralspeicher, Frischwasserstationen und Booster unterscheiden sich bei Verlusten, Serviceaufwand und Auswirkungen auf die Regelung.

Record: dhw-concepts-de-evaluation. Wiki topic identifiers: dhw-concepts, dhw-priority-control

Italian question: Perché l'ACS va progettata insieme alla topologia della pompa di calore?

L'ACS va progettata insieme alla topologia della pompa di calore perché può imporre temperature più alte del riscaldamento ambiente. Questo incide su COP, potenza di picco, accumulo, ricircolo e schema di distribuzione. In un edificio plurifamiliare, la scelta tra accumulo centrale, stazioni istantanee o booster cambia le perdite, la manutenzione e la temperatura richiesta alla pompa di calore. Se l'ACS viene trattata dopo, si rischia di scegliere una soluzione efficiente per il riscaldamento ma penalizzata dal servizio sanitario.

Punti chiave:

• Volume di accumulo e potenza di carica devono essere coerenti con profilo di prelievo e tempo di recupero richiesto.

• Le topologie esistenti, come quattro tubi, due tubi o 2+2, impongono vincoli diversi su ricircolo, temperatura e conversione.

Record: dhw-concepts-it-evaluation. Wiki topic identifiers: dhw-concepts, existing-dhw-topology-identification, dhw-storage-sizing

C15 Dhw hygiene

English question: What hygiene issues must be checked for heat-pump domestic hot water?

Check the hygiene concept before optimizing heat-pump domestic hot water for low temperatures. Verify the required temperatures in the storage vessel, distribution pipework and circulation return where present. Review storage volume, circulation quality, dead legs and infrequently used outlets, because stagnation can create hygiene risk. Also assign who checks temperatures, maintains the system and carries out corrective action when values or operating conditions are not met.

Key points:

• Confirm the applicable local hygiene requirements before selecting equipment or changing temperature settings.

• Map circulation and distribution losses if the DHW system is large or serves multiple dwellings.

Safety, hygiene, legal and compliance decisions require qualified project-specific review.

Record: dhw-hygiene-en-evaluation. Wiki topic identifiers: dhw-hygiene, dhw-concepts

German question: Welche Hygieneaspekte sind beim Warmwasser mit Wärmepumpe zu prüfen?

Zu prüfen sind die geforderten Temperaturen im Speicher, in der Verteilung und im Zirkulationsrücklauf. Ebenso wichtig sind Stagnationsrisiken durch Totleitungen, selten genutzte Zapfstellen und eine unzureichende Zirkulation. Das Hygienekonzept muss zur Wärmepumpe passen, weil höhere Warmwassertemperaturen die Effizienz senken können. Außerdem sollten Temperaturkontrollen, Wartung und Korrekturmaßnahmen eindeutig zugeordnet sein.

Wichtige Punkte:

• Lokale Hygieneanforderungen sollten vor Gerätewahl oder Temperaturänderungen bestätigt werden.

• Bei zentralen und dezentralen Konzepten unterscheiden sich Speicher, Verteilerlängen, Zirkulationsbedarf und Verantwortlichkeiten.

Sicherheits-, Hygiene-, Rechts- und Konformitätsentscheidungen brauchen eine qualifizierte projektspezifische Prüfung.

Record: dhw-hygiene-de-evaluation. Wiki topic identifiers: dhw-hygiene, central-vs-decentral-dhw

Italian question: Quali aspetti igienici vanno verificati per l'ACS con pompa di calore?

Per l'ACS con pompa di calore vanno verificati soprattutto temperatura, ristagno e responsabilità di esercizio. Conferma le temperature richieste in accumulo, nella distribuzione e nel ritorno del ricircolo, se presente. Controlla rami morti, utenze poco usate e tratti con ricircolo insufficiente, perché favoriscono ristagno. Definisci anche chi controlla le temperature, chi esegue la manutenzione e quali azioni correttive si applicano. Se è previsto un ciclo igienico, registrane il comportamento nella sequenza di controllo.

Punti chiave:

• L'efficienza della pompa di calore non deve prevalere sul piano igienico applicabile all'impianto ACS.

• I requisiti locali vanno confermati prima di scegliere componenti o modificare le temperature di esercizio.

Record: dhw-hygiene-it-evaluation. Wiki topic identifiers: dhw-hygiene, dhw-priority-control

C16 Controls weather compensation

English question: How should weather compensation be set up for efficient heat-pump operation?

Set weather compensation so the heat pump uses the lowest flow temperature that still heats every room adequately. Start from the design outdoor temperature and the emitter flow temperature required at the room design loads. Select the matching manufacturer curve or set the outdoor and flow-temperature endpoints. Then tune the slope and offset gradually during operation, using the controller instructions. Check comfort and temperatures in both mild and cold weather before accepting the setting.

Key points:

• Verify that the outdoor sensor is correctly located and that room controls do not fight the weather-compensated control.

• Record the initial design point, curve settings, outdoor temperature, flow temperature and actual room temperatures during tuning.

Record: controls-weather-compensation-en-evaluation. Wiki topic identifiers: controls-weather-compensation

German question: Wie wird eine Heizkurve für effizienten Wärmepumpenbetrieb eingestellt?

Eine Heizkurve wird vom Auslegungspunkt aus eingestellt. Maßgeblich sind die Außenauslegungstemperatur und die Vorlauftemperatur, die die Heizflächen bei Raumheizlast benötigen. Danach wird die passende Herstellerkennlinie gewählt oder es werden Stützpunkte für Außen- und Vorlauftemperatur gesetzt.

Für effizienten Wärmepumpenbetrieb wird die Kurve schrittweise so weit abgesenkt, bis alle Räume noch sicher warm werden. Die Neigung korrigiert vor allem das Verhalten bei Kälte. Das Niveau verschiebt die gesamte Kurve nach oben oder unten. Während der Optimierung werden Außen-, Vorlauf- und Raumtemperaturen verglichen. Nach jeder Änderung muss die Gebäudereaktion abgewartet werden.

Wichtige Punkte:

• Außenfühlerposition und Zusammenspiel mit Raumreglern prüfen, sonst reagiert die Regelung auf falsche Signale.

• Eine niedrigere Vorlauftemperatur verbessert meist die Effizienz, solange die Heizflächen die Räume ausreichend erwärmen.

Record: controls-weather-compensation-de-evaluation. Wiki topic identifiers: controls-weather-compensation, heat-pump-principle

Italian question: Come va impostata la regolazione climatica per un funzionamento efficiente?

Imposta la regolazione climatica sulla temperatura di mandata più bassa che mantiene confortevoli tutti i locali. Parti dalla temperatura esterna di progetto e dalla mandata richiesta dai terminali al

carico dei locali. Scegli la curva del produttore, oppure i punti temperatura esterna e mandata equivalenti. Durante la taratura registra temperatura esterna, mandata e temperatura ambiente. Correggi pendenza e spostamento a piccoli passi, attendendo la risposta dell'edificio.

Punti chiave:

• La pendenza cambia quanto aumenta la mandata quando fuori fa più freddo.

• Lo spostamento alza o abbassa tutta la curva senza cambiarne la forma principale.

Record: controls-weather-compensation-it-evaluation. Wiki topic identifiers: controls-weather-compensation

C17 Acoustic placement

English question: How should I screen the acoustic risk of an outdoor heat-pump unit?

Screen the risk by following the path from the unit to the receiver: emission, transmission and immission. First list candidate outdoor-unit positions and sensitive receiver points, including own-building and neighbouring windows, facades and outdoor areas. Then attach traceable product sound-power data for the documented operating condition, not just a generic dB value. For each position, screen distance, height, directivity, reflections, barriers, receiver windows, night operation and any multiple-unit effect.

Key points:

• Distance alone is not enough, because reflections, directivity, height and barriers can change the most exposed receiver point.

• Carry uncertain geometry, operating periods or legal limits as explicit review items rather than hiding them in the screening result.

Record: acoustic-placement-en-evaluation. Wiki topic identifiers: acoustic-placement, receiver-point-screening

German question: Wie prüfe ich das Schallrisiko eines Wärmepumpen-Außengeräts?

Prüfen Sie das Schallrisiko entlang der Kette vom Gerät bis zu den schutzbedürftigen Orten. Legen Sie zuerst mögliche Aufstellorte und Empfänger fest, etwa Schlafzimmerfenster, Nachbarfassaden und ruhige Höfe. Verwenden Sie die Schallleistung des konkreten Geräts für dokumentierte Betriebsbedingungen, nicht nur einen einzelnen dB-Wert. Prüfen Sie dann Abstand, Richtwirkung, Reflexionen an Fassaden, Abschirmungen, Hindernisse und die geplanten Betriebszeiten. Bewerten Sie den Nachtbetrieb besonders, weil reduzierte Schallpegel mit Heiz-, Abtau- oder Warmwasserbedarf kollidieren können.

Wichtige Punkte:

• Mehrere Außengeräte und ungünstige Hof- oder Fassadenreflexionen können das maßgebende Risiko erhöhen.

• Ein Leisemodus sollte mit der verfügbaren Heizleistung im kalten Nachtbetrieb abgeglichen werden.

Record: acoustic-placement-de-evaluation. Wiki topic identifiers: acoustic-placement, night-operation

Italian question: Come si valuta preliminarmente il rischio acustico di un'unità esterna?

Si valuta seguendo tre passaggi: emissione, propagazione e immissione. Prima si raccolgono dati tracciabili di potenza sonora dell'unità, riferiti a condizioni dichiarate. Poi si confrontano le possibili posizioni con finestre, facciate e aree esterne sensibili, anche dei vicini. Infine si verifica il percorso del rumore, considerando distanza, altezza, direttività, riflessioni, barriere e funzionamento notturno.

Punti chiave:

• La sola distanza non basta, perché cortili, pareti riflettenti e finestre esposte possono rendere critico un punto apparentemente lontano.

• Unità multiple o funzionamento notturno possono determinare il caso più severo per la scelta della posizione.

Record: acoustic-placement-it-evaluation. Wiki topic identifiers: acoustic-placement, receiver-point-screening

C18 Acoustic evidence

English question: Which manufacturer acoustic data is needed for a defensible comparison?

For a defensible comparison, request manufacturer acoustic data that states the acoustic quantity, unit, weighting, test standard and operating point for each product. Prefer sound power for source comparison and propagation modelling; treat sound pressure as valid only for its stated position and conditions. Also record the tested configuration, product revision, fan mode, quiet or night mode, heating capacity available in that mode, relevant frequency spectra and uncertainty where the assessment needs them.

Key points:

• Do not compare a sound power value with a catalogue sound pressure value as if they were equivalent.

• Link each acoustic value to the exact product version used in the placement assessment.

Record: acoustic-evidence-en-evaluation. Wiki topic identifiers: acoustic-evidence, sound-power-vs-pressure

German question: Welche Herstellerdaten braucht ein belastbarer Schallvergleich?

Für einen belastbaren Schallvergleich brauchst du je Gerät die gleiche Schallkenngröße, zum Beispiel Schallleistung statt Schalldruck. Zusätzlich müssen Einheit, Bewertung, Prüfnorm und Betriebspunkt angegeben sein. Wichtig sind auch die genaue Geräteausführung, Produktrevision und der Stand des Datenblatts. Wenn Nacht- oder Leisemodi verglichen werden, müssen deren Schallwerte und die dabei verfügbare Heizleistung separat vorliegen.

Wichtige Punkte:

• Frequenzspektren und Messunsicherheit sind sinnvoll, wenn Tonhaltigkeit oder knappe Grenzabstände relevant sind.

• Schalldruckwerte sind nur vergleichbar, wenn Messort und Prüfbedingungen gleich beschrieben sind.

Record: acoustic-evidence-de-evaluation. Wiki topic identifiers: acoustic-evidence

Italian question: Quali dati acustici del produttore servono per un confronto difendibile?

Per un confronto acustico difendibile servono dati riferiti alla stessa grandezza e a condizioni equivalenti. Chiedi per ogni unità: potenza sonora o pressione sonora, unità, ponderazione, norma di prova, punto operativo e configurazione provata. Se il dato è pressione sonora, deve essere indicato anche il punto di misura, perché dipende dalla distanza e dall'ambiente. Per le modalità notte o silenziosa servono livello acustico, potenza termica disponibile e condizioni operative dichiarate. Registra anche revisione del prodotto, accessori acustici, incertezza e, quando utile, spettro per bande di frequenza.

Punti chiave:

• Non confrontare una potenza sonora con una pressione sonora senza una modellazione di propagazione coerente.

• Le offerte sono confrontabili solo se ricevono gli stessi punti prestazionali e gli stessi requisiti di evidenza.

Record: acoustic-evidence-it-evaluation. Wiki topic identifiers: acoustic-evidence, procurement-comparison

C19 Comfort moisture

English question: How are heat-pump supply temperature, insulation and thermal comfort connected?

Insulation lowers heat loss, so each room needs less heating capacity on cold days. That often allows the heat pump to run with a lower heating-water supply temperature, provided the radiators or other emitters can still deliver the reduced room load. Insulation also raises internal surface temperatures, so occupants feel less radiant cooling from cold walls. Thermal bridges can weaken this benefit because they add local heat loss and create cold internal surfaces.

Key points:

• After insulation, recalculate room heat loads and check emitter output at the lower flow temperature.

• Cold junctions can reduce comfort and may increase condensation or mould risk when indoor humidity is high.

Record: comfort-moisture-en-evaluation. Wiki topic identifiers: comfort-moisture, thermal-bridges

German question: Wie hängen Wärmepumpen-Vorlauftemperatur, Dämmung und thermischer Komfort zusammen?

Dämmung reduziert Wärmeverluste und hebt im Winter die Innenoberflächentemperaturen. Dadurch fühlen sich Räume behaglicher an, auch wenn die Raumlufttemperatur gleich bleibt. Gleichzeitig sinkt die Heizlast. Das kann eine niedrigere Vorlauftemperatur der Wärmepumpe ermöglichen, sofern Heizflächen und Volumenstrom genug Wärme übertragen. Niedrige Vorlauftemperaturen verbessern in der Regel die Effizienz der Wärmepumpe, weil der Temperaturhub kleiner wird.

Wichtige Punkte:

• Kalte Wände verursachen Unbehaglichkeit, auch wenn die Luft warm genug erscheint.

• Bei Tauwasser- oder Schimmelrisiko müssen Oberflächentemperaturen, Raumfeuchte und Lüftung gemeinsam betrachtet werden.

Record: comfort-moisture-de-evaluation. Wiki topic identifiers: comfort-moisture

Italian question: Come sono collegati mandata, isolamento e comfort termico?

Isolamento, temperatura di mandata e comfort termico sono collegati tramite le dispersioni dell'edificio. Migliorando l'isolamento, diminuisce il carico termico e le superfici interne diventano più calde. Questo riduce il disagio da pareti o pavimenti freddi. Se i radiatori o altri terminali hanno superficie e portata sufficienti, lo stesso comfort può essere ottenuto con una temperatura di mandata più bassa.

Punti chiave:

• Dopo l'isolamento è utile ricalcolare i carichi termici, perché i terminali potrebbero coprirli con acqua meno calda.

• Superfici interne più calde riducono anche il rischio locale di condensa, ma umidità e ventilazione vanno comunque valutate.

Record: comfort-moisture-it-evaluation. Wiki topic identifiers: comfort-moisture

C20 Seasonal performance

English question: What is the difference between COP and seasonal performance factor?

COP is an instantaneous efficiency value at a defined operating point. It compares heating output in kW with electrical input in kW at stated source and flow temperatures.

The seasonal performance factor, or SPF, compares delivered heat energy in kWh with electrical energy in kWh over a stated season or year. It includes real operation effects such as weather, water temperatures, cycling and defrost, depending on the chosen measurement boundary.

Key points:

• A catalogue COP cannot be used as the measured annual performance of a heat-pump system.

• SPF values are only comparable when the period and system boundary are the same, including any pumps, backup heat or losses that are counted.

Record: seasonal-performance-en-evaluation. Wiki topic identifiers: seasonal-performance

German question: Was ist der Unterschied zwischen COP und saisonalem Leistungsfaktor?

Der COP beschreibt die Effizienz einer Wärmepumpe an einem bestimmten Betriebspunkt. Er ist das Verhältnis aus Heizleistung in kW und elektrischer Leistungsaufnahme in kW, meist bei festgelegter Quellen- und Vorlauftemperatur.

Der saisonale Leistungsfaktor betrachtet einen Zeitraum, meist eine Heizsaison oder ein Jahr. Er vergleicht die abgegebene Wärmemenge in kWh mit dem Stromverbrauch in kWh im selben Zeitraum. Deshalb enthält er reale Einflüsse wie Wetter, Betriebstemperaturen, Abtauvorgänge und häufiges Ein- und Ausschalten.

Wichtige Punkte:

• Die Bilanzgrenze ist entscheidend. Sie legt fest, ob zum Beispiel Pumpen, Zusatzheizungen und Verluste mitgezählt werden.

• Ein Katalog-COP ist kein Ersatz für einen gemessenen saisonalen Leistungsfaktor, weil er keinen Jahresbetrieb abbildet.

Record: seasonal-performance-de-evaluation. Wiki topic identifiers: seasonal-performance

Italian question: Qual è la differenza tra COP e fattore di prestazione stagionale?

Il COP descrive un punto di funzionamento istantaneo o dichiarato. È il rapporto tra potenza termica prodotta in kW e potenza elettrica assorbita in kW, a temperature definite di sorgente e mandata.

Il fattore di prestazione stagionale, spesso indicato come SPF, descrive invece un periodo. È il rapporto tra energia termica erogata in kWh ed energia elettrica consumata in kWh durante una stagione o un anno, con un confine di misura dichiarato.

Punti chiave:

• Il valore stagionale risente di clima, temperature operative, cicli di avviamento e sbrinamenti.

• Gli SPF sono confrontabili solo se periodo e confine di misura includono le stesse utenze, come circolatori, pompe di sorgente o integrazioni.

Record: seasonal-performance-it-evaluation. Wiki topic identifiers: seasonal-performance

C21 Cost lcc

English question: What should a life-cycle cost comparison of heat-pump renovation variants include?

A life-cycle cost comparison should include the full discounted cost consequence of each renovation variant. It should separate investment, planned maintenance, energy use, component replacements, financing assumptions and residual value. All variants should use the same study period, energy-price assumptions and boundary for taxes, region, price date and included work. Weak quantities or uncertain market prices should be shown as ranges, not as false precision.

Key points:

• Major components should have service-life ranges, because heat pumps, emitters, controls and building works may not share one lifetime.

• Residual value should be treated consistently when a component still has usable life beyond the study period.

Record: cost-lcc-en-evaluation. Wiki topic identifiers: cost-lcc, replacement-maintenance-cost

German question: Was gehört in einen Lebenszykluskostenvergleich von Wärmepumpen-Sanierungsvarianten?

In einen Lebenszykluskostenvergleich gehören alle zahlungswirksamen Kosten über denselben Betrachtungszeitraum. Dazu zählen Investition, mögliche Ersatzinvestitionen, Energie, Wartung, Finanzierung und Restwert. Für jede Variante müssen Preisstand, Region, Steuern und Leistungsumfang gleich klar beschrieben sein. Wichtig ist auch, nicht die Investitionskosten einer Variante mit den Lebenszykluskosten einer anderen zu vergleichen.

Wichtige Punkte:

• Alle Varianten brauchen dieselben Annahmen zu Zeitraum, Energiepreisen und Randbedingungen.

• Bei unsicheren Mengen oder Preisen sind Kostenbereiche sinnvoller als ein scheinbar exakter Einzelwert.

Record: cost-lcc-de-evaluation. Wiki topic identifiers: cost-lcc

Italian question: Cosa deve includere il confronto dei costi del ciclo di vita tra varianti?

Il confronto dei costi del ciclo di vita deve includere investimento iniziale, energia, manutenzione, sostituzioni e valore residuo. Deve usare lo stesso periodo di analisi e le stesse ipotesi sui prezzi energetici per tutte le varianti. Deve anche dichiarare data dei prezzi, regione, imposte, opere incluse e ipotesi finanziarie. Se quantità o prezzi di mercato sono incerti, è meglio mostrare intervalli invece di un unico valore preciso.

Punti chiave:

• Le vite utili dei componenti principali vanno considerate, perché sostituzioni e manutenzioni diverse possono cambiare il risultato nel lungo periodo.

• Confrontare il costo iniziale di una variante con il costo di ciclo vita di un'altra porta a una decisione non coerente.

Record: cost-lcc-it-evaluation. Wiki topic identifiers: cost-lcc, replacement-maintenance-cost

C22 Lca gwp

English question: How should embodied and operational carbon be compared in a heat-pump renovation?

Compare them within one declared life-cycle boundary and study period. Keep embodied carbon separate from operational carbon first, then compare the combined result and sensitivities for each renovation option. Embodied carbon should include products, construction, replacements and end-of-life where these are in scope. Operational carbon should use the same energy result used to compare the heat-pump variants, with clear electricity scenarios. If data quality is limited, show ranges and uncertainty rather than a precise total.

Key points:

• Operational and embodied carbon can move in different directions, so show the raw indicators before any weighting.

• Crossover or carbon payback ranges are useful when the input data is strong enough.

Record: lca-gwp-en-evaluation. Wiki topic identifiers: lca-gwp, embodied-operational-carbon, package-multicriteria-scorecard

German question: Wie werden graue und betriebliche Emissionen bei einer Sanierung mit Wärmepumpe verglichen?

Graue und betriebliche Emissionen werden gemeinsam über denselben Betrachtungszeitraum verglichen. Graue Emissionen entstehen durch Herstellung, Bau, Ersatz und Entsorgung von Bauteilen und Anlagentechnik. Betriebliche Emissionen entstehen aus dem berechneten Energieverbrauch der jeweiligen Variante, bei einer Wärmepumpe vor allem aus dem Strombedarf. Beide Anteile werden getrennt ausgewiesen und dann als Lebenszyklus-GWP zusammengeführt.

Wichtige Punkte:

• Für jede Variante müssen Bilanzgrenzen, Module, Nutzungsdauern, Ersatzzyklen und Annahmen zum Strommix gleich und nachvollziehbar sein.

• Graue und betriebliche Emissionen können gegenläufig sein. Eine Variante mit niedrigerem Strombedarf kann höhere Materialemissionen verursachen.

Record: lca-gwp-de-evaluation. Wiki topic identifiers: embodied-operational-carbon, lca-gwp, package-multicriteria-scorecard

Italian question: Come confrontare emissioni incorporate e operative in una riqualificazione?

Confronta le emissioni incorporate e operative usando lo stesso confine di studio e lo stesso periodo di analisi. Le emissioni incorporate includono prodotti, cantiere, sostituzioni e fine vita, se questi moduli sono nel confine scelto. Le emissioni operative derivano invece dall'energia futura usata dall'edificio, con gli stessi risultati energetici usati per confrontare le varianti. Presenta il risultato come confronto tra scenari, non come numero assoluto troppo preciso, soprattutto se i fattori ambientali sono incompleti.

Punti chiave:

• Traccia quantità, vite utili, sostituzioni e scenario elettrico usato per ogni variante.

• Quando i dati lo consentono, mostra il tempo di pareggio climatico tra maggiore impatto incorporato e minori emissioni operative.

Record: lca-gwp-it-evaluation. Wiki topic identifiers: lca-gwp, embodied-operational-carbon

C23 Commissioning

English question: Which evidence should be captured when commissioning a heat-pump system?

Capture evidence that proves the installed heat-pump system matches the design intent and provides a clear operating baseline. Use a component and control checklist, and record measured values for flows, temperatures, pressures, sensors, controls and safety functions. Document all unresolved deviations from the design, including their calculation consequences where relevant. Hand over the final settings, manuals, monitoring responsibilities and operator instructions, including any agreed seasonal optimisation review.

Key points:

• Keep measured, imported, calculated and estimated values visibly distinct in the commissioning record.

• Adapt the checklist to the product instructions and applicable local safety requirements.

Record: commissioning-en-evaluation. Wiki topic identifiers: commissioning

German question: Welche Nachweise gehören zur Inbetriebnahme eines Wärmepumpensystems?

Zur Inbetriebnahme gehören Nachweise, die Funktion, Einstellungen und Übergabe nachvollziehbar machen. Wichtig sind dokumentierte Funktionsprüfungen der Komponenten, Regelung, Fühler und Sicherheitseinrichtungen. Dazu kommen Messwerte wie Volumenströme, Temperaturen und Drücke sowie dokumentierte Abweichungen von der Planung. Ebenfalls dazugehören die übergebenen Einstellungen, Betriebsunterlagen, offene Mängel, die Betreibereinweisung und die geklärte Verantwortung für die Betriebsüberwachung.

Wichtige Punkte:

• Offene Abweichungen sollten mit ihren Folgen für Berechnung, Betrieb oder Optimierung festgehalten werden.

• Die konkrete Checkliste muss zu Herstellerangaben und lokalen Sicherheitsvorgaben passen.

Record: commissioning-de-evaluation. Wiki topic identifiers: commissioning, decision-process

Italian question: Quali evidenze vanno raccolte durante la messa in servizio?

Durante la messa in servizio vanno raccolte evidenze che dimostrano la conformità al progetto e la prontezza all'esercizio. Servono checklist compilate dei componenti, misure registrate, deviazioni aperte e impostazioni consegnate al gestore. Le misure principali riguardano portate, temperature, pressioni, sensori, regolazione e sicurezze. Vanno documentate anche le deviazioni dal progetto, le relative conseguenze di calcolo, i manuali consegnati e le responsabilità per il monitoraggio.

Punti chiave:

• Il fascicolo dovrebbe conservare anche alternative scartate, incertezze residue e verifiche ancora necessarie.

• Per prove non eseguibili alla consegna, è utile registrare test stagionali o differiti con criterio di accettazione.

Record: commissioning-it-evaluation. Wiki topic identifiers: commissioning, commissioning-plan

C24 Monitoring

English question: What should be monitored to diagnose heat-pump performance?

Monitor the heat pump with clearly defined measurement boundaries and time intervals. Record electrical input power, electricity use, delivered heat, supplementary electric heating and circulation pump consumption if they are inside the chosen boundary. Also record flow, return, room and outdoor temperatures, because these explain why performance changes. Check data gaps, sensor plausibility and clock alignment before interpreting results.

Key points:

• Compare the data with weather, setpoints and the expected design behaviour.

• Create alerts for missing or implausible readings so faults are not hidden by bad data.

Record: monitoring-en-evaluation. Wiki topic identifiers: monitoring

German question: Was sollte überwacht werden, um die Wärmepumpenleistung zu diagnostizieren?

Für eine belastbare Diagnose sollten Stromverbrauch, elektrische Leistungsaufnahme und abgegebene Wärme erfasst werden. Dazu gehören Vorlauftemperatur, Rücklauftemperatur, Raumtempe-

ratur und Außentemperatur. Bei Taktproblemen sollten auch Kompressorstatus, Starts, Volumenstrom sowie Zonen- und Ventilzustände zeitgleich aufgezeichnet werden. Wichtig sind klare Messgrenzen, passende Einheiten und ein gemeinsamer Zeitstempel für alle Daten.

Wichtige Punkte:

• Elektrische Zusatzheizung und Umwälzpumpen sollten innerhalb der gewählten Messgrenze bewusst ein- oder ausgeschlossen werden.

• Datenlücken, unplausible Werte und fehlende Zeitsynchronität können die Diagnose stark verfälschen.

Record: monitoring-de-evaluation. Wiki topic identifiers: monitoring, cycling-diagnostics

Italian question: Cosa va monitorato per diagnosticare le prestazioni di una pompa di calore?

Per diagnosticare le prestazioni, monitora insieme elettricità assorbita, calore erogato e temperature operative. Il confine di misura deve essere dichiarato, includendo o escludendo in modo esplicito resistenza elettrica integrativa e circolatori. Registra temperatura di mandata, ritorno, ambiente ed esterna, perché spiegano variazioni di COP e comportamento della macchina. Controlla anche completezza, plausibilità e allineamento temporale dei dati, con allarmi per dati mancanti o incoerenti.

Punti chiave:

• Definisci prima domande diagnostiche, KPI, posizioni dei sensori, unità di misura e intervalli di registrazione.

• Interpreta i dati insieme a clima, setpoint e modello di progetto, non come numeri isolati.

Record: monitoring-it-evaluation. Wiki topic identifiers: monitoring

C25 Staged renovation

English question: How can a building be renovated in stages without blocking the future heat-pump concept?

Start with the intended final heat-pump system, then plan each interim step so it remains compatible. Avoid upgrades that lock in high flow temperatures, undersized pipework, missing plant-room space, or controls that must be replaced later. Treat each stage as a temporary state with clear triggers for the next step, such as facade renovation, radiator replacement, or the existing boiler reaching end of life.

Key points:

• Record dependencies between insulation, heat emitters, hot-water production, electrical supply and controls before ordering the first measure.

• A cheap interim solution can become expensive if connection sizes, space requirements or control interfaces block the later heat-pump installation.

Record: staged-renovation-en-evaluation. Wiki topic identifiers: staged-renovation

German question: Wie saniert man stufenweise, ohne das spätere Wärmepumpenkonzept zu blockieren?

Man saniert stufenweise mit einem festgelegten Zielbild für das fertige Gebäude. Jede Zwischenlösung muss heute sicher funktionieren und zugleich niedrige spätere Vorlauftemperaturen, passende Anschlüsse, Platzbedarf und Regelung für die Wärmepumpe offenhalten. Kritisch sind Maßnahmen, die dauerhaft hohe Vorlauftemperaturen erzwingen oder später wieder aufgerissen werden müssen. Gute Auslöser für weitere Schritte sind ohnehin anstehende Fassadenarbeiten oder das Lebensende der bestehenden Heizung.

Wichtige Punkte:

• Erst das spätere Anlagenkonzept festlegen, dann Dämmung, Heizflächen, Speicher, Hydraulik und Aufstellort schrittweise darauf ausrichten.

• Zwischenmaßnahmen vermeiden, die Leitungswege, Elektroanschluss, Außengerät, Schallschutz oder Regelung der späteren Wärmepumpe blockieren.

Record: staged-renovation-de-evaluation. Wiki topic identifiers: staged-renovation

Italian question: Come riqualificare per fasi senza bloccare il futuro concetto a pompa di calore?

Per riqualificare per fasi senza creare vicoli ciechi, definisci prima il sistema finale a pompa di calore. Poi scegli ogni intervento intermedio in modo che resti utile anche dopo. Sono critici la temperatura di mandata, gli spazi tecnici, gli attacchi idraulici, la regolazione e l'eventuale distribuzione del calore. Evita soluzioni provvisorie che richiedono alte temperature o che costringono a rifare tubazioni, accumuli o comandi.

Punti chiave:

• Descrivi lo stato finale e gli stati intermedi prima di avviare la prima fase.

• Usa occasioni già previste, come facciata o fine vita del generatore, come punti di decisione tecnici e finanziari.

Record: staged-renovation-it-evaluation. Wiki topic identifiers: staged-renovation

C26 Data quality

English question: How should the platform show uncertainty and provenance for technical information?

The platform should show uncertainty and provenance next to each important technical value, not only in a separate report. It should label whether the value is measured, imported, calculated, estimated, a placeholder or unknown. It should also show the source, locator, version, method, assumptions and reviewer where relevant. Missing or weak evidence should appear as a decision gate, with the evidence needed to raise confidence stated clearly.

Key points:

• Start from the decision the information supports, including the system boundary, responsible role and evidence version.

• Keep remaining uncertainty, rejected alternatives and the selected response in the project record.

Record: data-quality-en-evaluation. Wiki topic identifiers: data-quality

German question: Wie sollte die Plattform Unsicherheit und Herkunft technischer Informationen zeigen?

Die Plattform sollte jede technische Angabe mit Herkunft, Qualitätsstatus und Unsicherheit anzeigen. Messwerte, übernommene Daten, Berechnungen, Schätzungen und Platzhalter müssen klar getrennt sein. Für wichtige Werte sollten Fundstelle, Version, Methode, Annahmen und Prüfstatus sichtbar sein. Fehlende Werte bleiben als unbekannt markiert und werden nicht durch erfundene Annahmen ersetzt. Zusätzlich sollte die Plattform zeigen, welche Nachweise die Unsicherheit weiter verringern würden.

Wichtige Punkte:

• Entscheidungsrelevante Unsicherheiten sollten zuerst gekennzeichnet werden, etwa Heizlast, erforderliche Vorlauftemperatur, Aufstellort oder Warmwassergrenzen.

• Überholte Annahmen sollten nachvollziehbar erhalten bleiben, damit spätere Änderungen am Anlagenkonzept prüfbar bleiben.

Sicherheits-, Hygiene-, Rechts- und Konformitätsentscheidungen brauchen eine qualifizierte projektspezifische Prüfung.

Record: data-quality-de-evaluation. Wiki topic identifiers: data-quality, uncertainty-reduction-workflow

Italian question: Come deve la piattaforma mostrare incertezza e provenienza delle informazioni tecniche?

La piattaforma deve mostrare per ogni dato tecnico origine, metodo e livello di fiducia. Deve distinguere chiaramente dati misurati, importati, calcolati, stimati, segnaposto e ignoti. Per i valori importanti deve registrare fonte, posizione, versione, metodo e revisore. Quando manca un dato necessario, deve renderlo visibile come punto di decisione, invece di riempirlo con un valore inventato.

Punti chiave:

• Ogni valore dovrebbe avere uno stato di qualità leggibile, non solo un numero finale.

• Per aumentare la fiducia, la piattaforma deve indicare quale evidenza aggiuntiva serve.

Record: data-quality-it-evaluation. Wiki topic identifiers: data-quality

C27 Decision process

English question: Which phases and decision gates are needed for an integrated heat-pump refurbishment?

A practical phase sequence is: survey, concept, design, approvals, procurement, installation, commissioning and operation. Adapt it to the project size and risks; it is a planning framework, not a fixed mandatory procedure. Use decision gates before major commitments, especially before procurement and before operational handover. Each gate should record the decision, owner, evidence, unresolved risks and the selected option.

Key points:

• Before procurement, confirm heat load, emitter temperatures, source and placement feasibility, domestic hot water, acoustics, costs and required approvals.

• Before handover, record functional tests, flows and settings, open defects, operating documents, user instruction and monitoring responsibility.

Record: decision-process-en-evaluation. Wiki topic identifiers: decision-process

German question: Welche Phasen und Entscheidungspunkte braucht eine integrierte Sanierung mit Wärmepumpe?

Eine sinnvolle Phasenfolge ist: Bestandsaufnahme, Konzept, Planung, Freigaben, Beschaffung, Bau, Inbetriebnahme und Betrieb. An jedem Entscheidungspunkt wird geprüft, ob die nächste Phase belastbar starten kann. Dafür müssen Zuständigkeiten, Daten, offene Risiken und notwendige Freigaben geklärt sein. Vor der Beschaffung sind besonders Heizlast, Vorlauftemperatur, Wärmequelle, Aufstellort, Warmwasser, Schall und Kosten zu prüfen. Bei der Übergabe gehören Funktionsprüfungen, Einstellungen, Betriebsunterlagen, Einweisung und die Verantwortung für die Betriebsüberwachung dazu.

Wichtige Punkte:

• Gebäudehülle, Wärmeverteilung, Warmwasser, Wärmequelle, Akustik und Regelung sollten als ein technisches System betrachtet werden.

• Eigentümer, Bewohner, Planer, Installateure und Betreiber sollten früh einbezogen werden, damit Entscheidungen umsetzbar bleiben.

Record: decision-process-de-evaluation. Wiki topic identifiers: decision-process, integrated-vs-integral

Italian question: Quali fasi e punti di decisione servono per una riqualificazione integrata con pompa di calore?

Una sequenza utile è: rilievo, scelta della soluzione, progetto, approvazioni, acquisto, posa, messa in servizio ed esercizio. Non è una procedura universale rigida, ma una traccia da adattare al progetto. Un punto di decisione serve prima di ogni impegno rilevante. Deve indicare decisione da prendere, responsabile, evidenze disponibili e rischi ancora aperti. Nelle riqualificazioni per fasi,

conviene definire prima il sistema obiettivo e verificare che ogni intervento resti compatibile con le fasi successive.

Punti chiave:

• Prima dell'acquisto vanno confermati carichi termici, temperature dei terminali, sorgente, posa, ACS, acustica, costi e approvazioni necessarie.

• Prima della consegna all'esercizio vanno registrate prove funzionali, portate, tarature, anomalie, documenti d'uso e monitoraggio.

Record: decision-process-it-evaluation. Wiki topic identifiers: decision-process, staged-renovation

C28 Wiki assistant use

English question: How can I use the KnowHowHP assistant effectively and verify its answers?

Use the assistant best by asking a specific technical question and giving relevant context, such as building type, heat emitter type, or the decision you need to make. Then open the citations and compare the answer with the cited Wiki article and its sources. If an answer has no supporting Wiki evidence, treat it as a general technical explanation rather than a verified Wiki-backed statement.

Key points:

• Focused questions usually produce clearer explanations, comparisons, or checklists.

• The assistant gives technical information, but it does not replace project-specific engineering design.

Record: wiki-assistant-use-en-evaluation. Wiki topic identifiers: wiki-assistant-use

German question: Wie nutze und überprüfe ich die KnowHowHP-Assistenz sinnvoll?

Nutze die KnowHowHP-Assistenz am besten mit konkreten Fachfragen. Frage zum Beispiel nach einer Erklärung, einem Vergleich oder einer Checkliste. Prüfe danach die angezeigten Quellen. Sie zeigen, auf welche Wiki-Inhalte sich die Antwort stützt. Wenn keine passende Wiki-Grundlage vorhanden ist, sollte die Assistenz diese Lücke benennen und nichts erfinden.

Wichtige Punkte:

• Gute Fragen enthalten den konkreten Bauteil, die Anlage oder die Entscheidungssituation.

• Die Assistenz liefert fachliche Informationen, ersetzt aber keine projektspezifische Fachplanung.

Record: wiki-assistant-use-de-evaluation. Wiki topic identifiers: wiki-assistant-use

Italian question: Come posso usare bene l'assistente KnowHowHP e verificare le risposte?

Usa l'assistente con domande tecniche precise, indicando il contesto utile. Per esempio, specifica edificio, impianto, obiettivo e dubbio pratico. Verifica le risposte aprendo le citazioni mostrate e confrontando testo, articolo e fonte. Se una risposta non è coperta dalla Wiki, l'assistente dovrebbe

indicare la lacuna invece di inventare dati. Per decisioni di progetto, usa la risposta come supporto tecnico, non come sostituto della progettazione specifica.

Punti chiave:

• Le domande precise aiutano a ottenere spiegazioni mirate, confronti o checklist quando servono.

• Le citazioni servono per controllare su quali contenuti pubblicati si basa la risposta.

Record: wiki-assistant-use-it-evaluation. Wiki topic identifiers: wiki-assistant-use