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D2.3 Inventory of Existing Training Schemes and Materials

ENERHACK

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Executive summary

Deliverable D2.3 provides a comprehensive analysis of the current landscape of training schemes, academic programs, and digital tools relevant to the district heating and cooling (DHC) sector. It builds on inputs collected from project partners, extensive desk research, and structured inventories covering short professional courses, university-level offerings, and practical tools. The final dataset comprises 99 professional training courses, 76 academic courses, and 25 tools, categorized and analysed according to topic, target group, format, accessibility, and geographic scope. This deliverable serves as the knowledge base for subsequent work on designing upgraded training schemes in Task 2.5 and Work Package 3.

The analysis reveals several important trends and gaps. While a significant number of technical courses exist, especially for entry-level professionals, there is a clear lack of advanced, interdisciplinary, and role-specific training, particularly for engineers, municipal staff, and policymakers. Many training programs remain fragmented, poorly coordinated, and inaccessible to professionals working in under-resourced or emerging DHC markets. Tools developed through EU projects offer valuable capabilities, but they are often isolated from training ecosystems and lack onboarding or structured pedagogical support. Likewise, digital learning is still limited, with few fully online or blended formats and little use of interactivity, modularity, or real-world application. These limitations prevent the current landscape from scaling or evolving to meet the workforce needs of a rapidly transforming energy sector.

To address these challenges, the deliverable identifies key success factors for future training schemes. These include the need for role-customized curricula, integration of practical tools, support for peer learning and mentorship, and a stronger emphasis on interdisciplinary content and flexible delivery formats. The outputs of Task 2.3 directly inform the design of new training formats in T2.5 and WP3, offering both a gap analysis and a curated resource base to build upon. Ultimately, this report lays the groundwork for a more coherent, inclusive, and future-ready DHC training ecosystem that supports skills development across technical, strategic, and governance domains.

1. Approach

1.1. Introduction

The aim of Task 2.3 is to compile a comprehensive inventory of existing DHC-related training schemes, materials, guidelines, and digital tools. The output of this task serves as foundational input for the definition of training formats (T2.5) and the development of upgraded and new training schemes (WP3). This deliverable ensures that Skills4DHC's future educational efforts are built on the sector's existing strengths while addressing critical gaps.

1.2. Methodology

The methodology for this deliverable combined quantitative data collection with qualitative content analysis to build a robust inventory of training schemes, academic courses, and tools relevant to the DHC sector. Project partners contributed datasets using standardized templates designed to capture key attributes such as course title, provider, target group, duration, delivery format, and thematic focus. Supplementary desk research was conducted to validate, complete, and expand the initial collection, especially in underrepresented regions. The final dataset was segmented into three categories: professional short courses, university-level academic programs, and digital tools/resources. Each category was analysed to identify frequency, gaps, relevance to professional roles, and patterns in delivery and accessibility. The findings were cross-referenced with insights from Deliverable D2.1 to ensure alignment with workforce needs and skill gaps identified across the sector. Where applicable, the analysis also integrated lessons from EU-funded projects and national training initiatives to contextualize the inventory within broader policy and market developments.

1.2.1 Partner Contributions

All partners received standardized templates to report national or regional training schemes, academic programs, and relevant tools. Inputs were validated and supplemented by the task leader.

1.2.2 Desk Research

In addition to partner inputs, desk research was conducted to identify further training materials, fill data gaps, and ensure geographic and thematic diversity. This involved reviewing university program catalogs, EU project repositories, public training platforms, and industry association websites. The process helped validate existing entries and uncover additional offerings not captured through direct partner submissions.

1.2.3 Tool and Software Inventory

A dedicated template was developed to collect and categorize tools, software, and digital resources relevant to district heating planning, design, and capacity building. Inputs were gathered from project partners and complemented with additional resources identified through desk research, particularly from EU-funded projects and public repositories. Each tool was assessed based on its function, target audience, accessibility (e.g., open access vs. licensed), language availability, and training relevance. The resulting inventory includes planning tools, quality management toolkits, training aids, and simulation platforms, many of which are underutilized in current training schemes but hold significant potential for integration into future programs.

2. Overview of Collected Materials

2.1. Professional Short Courses

The inventory includes a total of 94 professional training courses relevant to district heating and cooling (DHC), collected from a wide range of organizations across Europe. These courses vary significantly in terms of duration, depth, and delivery format. The most frequently offered course lengths are 2 days, 4 hours, and 3 days, suggesting a strong preference for short, intensive learning formats. These are commonly aimed at entry-level learners or professionals who need quick upskilling on specific topics. However, many of the courses (22 out of 94) do not include any information about duration, which creates challenges for learners trying to assess the time commitment or compare options. Similarly, over half of the entries (53 courses) are missing a detailed description, making it difficult to evaluate the scope and learning outcomes based on publicly available information.

The most active training provider identified in the dataset is Enerhack E-Academy, which offers 11 courses, many of which are available online and cater to both beginners and professionals looking to expand their understanding of modern DHC systems. Other frequent providers include AIRU (5 courses), A2A CS (4), AGFW (3), and Heatweb Solutions (3). The diversity of providers spans from private companies and national DHC associations to municipal training centers and technical consultancies. While this variety indicates a healthy ecosystem of actors involved in knowledge transfer, the content and structure of these courses are not harmonized. Topics range from district heating hydraulics, design of substations, and network optimization, to more general overviews such as "Introduction to District Heating." However, there is no clear modular framework or progression path that connects one course level to the next.

Another important trend is the intended target group of these professional courses. The most common audience categories are "beginners", "beginner + advanced", and "blue-collar professionals", suggesting that the training landscape is primarily geared toward foundational knowledge and practical field work. Only a small number of courses are explicitly tailored to engineers, facility managers, or municipal planners, groups that often require more advanced or interdisciplinary content. This imbalance reveals a potential weakness in current training offerings: while there is a fair amount of introductory content, there is a clear lack of role-specific and advanced-level training, particularly for system designers and strategic decision-makers. Overall, while the short-course landscape in Europe offers a solid starting point for DHC education, it remains fragmented and uneven in terms of content quality, delivery consistency, and learner progression.

A closer look at the course content reveals several recurring technical and operational themes. Among the most frequently addressed topics are district heating hydraulics, thermal substation design, operation and maintenance of DHC networks, and integration of renewable energy sources such as solar thermal or large-scale heat pumps. Courses focusing on hydraulic balancing, piping systems, and temperature optimization are particularly common, indicating a strong emphasis on the mechanical and energy efficiency aspects of DHC. In addition, several providers offer modules on business models, regulatory frameworks, and cost-benefit analysis, although these are significantly fewer in number and tend to be offered as part of broader introductory sessions. Notably, digitalization, smart metering, and data-driven network management are largely absent across the dataset, despite being high-priority areas in DHC innovation. This suggests that while the current training landscape addresses many core technical skills, it falls short of covering emerging topics that are essential for future-proofing the workforce and aligning with ongoing policy and technological shifts in the sector.

2.2. Academic Courses (Universities and Colleges)

The following section presents a preliminary review of existing training courses in Europe that address the topic of DHC limiting the analysis to the countries participating in the project. As no comprehensive list or database on such courses currently exists, this represents an initial and non-exhaustive attempt to map the educational academic offer in this field. The aim is to create a base work for the development of an updatable database that could be extended at international level. A total of 76 different courses mentioning DHC systems in their programs were identified. These are summarised in Annex "Inventory of existing academic DHC training programs". These courses are typically embedded within broader study programs in energy systems, environmental engineering, sustainable infrastructure, or urban planning. Rather than offering standalone degrees in district heating, most universities integrate DHC as one or two modules within larger Master's or Bachelor's programs. The inclusion of DHC content ranges from surface-level mentions to more in-depth technical modelling and system design components.

Most of the university-level courses are geared toward graduate students (Master's and post-graduate certificates), with a few also available at Bachelor's level. They tend to focus on core engineering competencies such as thermodynamics, system integration, and grid design, often touching on DHC only as part of a broader unit on heating or energy distribution systems. Some programs also explore urban energy planning, renewable integration, or building-to-grid interaction, which are highly relevant to DHC decarbonisation but not always labelled as such. This creates a visibility problem: students interested in pursuing a DHC-related career may not easily recognize where and how these skills are taught. Additionally, while some academic offerings include project-based work or thesis options on DHC topics, practical, hands-on experience (e.g. lab work or field visits) remains limited. There is also little evidence of collaboration between universities and municipal DHC operators, which could otherwise enrich the curriculum with real-world case studies and applied projects.

Consistency in how DHC is treated across these institutions remains limited, with few examples of dedicated academic tracks or multidisciplinary frameworks specifically designed to support careers in district energy systems. In fact, in only in 21 out of 76 courses, DHC emerges as the major central topic of the course. In the remaining majority of the district heating is addressed only marginally or within a broader energy context, while main focus is dedicated to such as combined heat and power (CHP), renewable energy systems, energy system design and optimisation, power generation and distribution, and heat transfer technologies. A more detailed analysis of the courses whose main topic is DHC reveals a strong focus on Planning and Design, which is the most frequently addressed topic. Other key areas include Generation, Distribution, and Economic & Finance, suggesting a solid interest in the technical, logistical, and financial aspects of energy systems. On the other hand, Operation and Maintenance (O&M) is the least covered aspect, indicating a potential gap in the current training offer related to the practical and technical management of District Heating systems.

A following analysis of the specific topics addressed in each course reveals that the decarbonisation of DHC is covered in a limited and fragmented way, appearing only in a few training offers. Although some courses include elements related to renewable heat sources, waste heat recovery, or low-temperature and 5th generation district heating networks, these aspects are rarely addressed in a complete or integrated manner. The most frequently covered topics are heat supply and heat demand, covered in 11 and 8 courses respectively, while environmental impact is addressed in only 4 courses.

Concluding, most university courses incorporate DHC as a module within broader energy or engineering programs and very few offer specialized DHC degrees or intensive labs, and links to industry, utilities or municipalities are weak.

Another critical observation is the lack of national coordination or strategy around DHC education at the academic level. While countries like Germany and Austria benefit from a strong technical education tradition, their universities still operate independently, and the structure and content of DHC-related modules differ widely. In contrast, countries with less established DHC markets (such as Ireland or Estonia) have only a small number of relevant academic offerings, mostly as part of EU-funded initiatives or sustainability-focused programs. Despite the presence of strong technical expertise in many institutions, there is no harmonized framework, common qualification standard, or shared curriculum that would support academic mobility or standardize professional preparation across countries. Overall, while universities play a key role in building foundational and analytical skills relevant to DHC, the current offerings are scattered, uncoordinated, and not sufficiently visible to either students or the industry.

2.3. Tools and Digital Resources

The inventory includes a collection of approximately 49 tools and digital resources relevant to the district heating and cooling (DHC) sector. These tools serve a variety of functions including energy system modelling, spatial planning, quality management, and capacity building. Many were developed as part of EU-funded projects and are freely accessible online. The most prominent examples include THERMOS, a spatial energy modelling tool for local authorities; the Waste Heat Toolbox, which helps identify and evaluate industrial waste heat sources; and the QM Toolbox, a set of documents and templates to guide quality management in district heating projects. Tools vary significantly in their level of complexity, usability, and documentation, which directly affects their suitability for different professional audiences.

A closer look at the types of tools reveals that the majority fall into three main categories: calculation tools, planning instruments, and training materials. For example, THERMOS and the Heat Planning Toolbox are highly technical applications designed for planners and municipal engineers, enabling detailed analysis of thermal energy demand and infrastructure development. In contrast, the Training Toolbox, developed under the ENTRAIN project, provides guidance materials, checklists, and learning content to support regional training initiatives. There are also toolkits like the Waste Heat Toolbox, which target utilities and consultants by helping them assess the feasibility of integrating waste heat into DHC networks. While this diversity suggests broad coverage, the actual integration of these tools into formal education or professional development programs is very limited.

The target groups for these tools are mainly urban energy planners, public authorities, utilities, and regulatory agencies. A smaller subset of tools are geared toward project developers, investors, or training institutions. Language accessibility varies: although English is the most common language of use, several tools are available in multiple languages, including German, Italian, Polish, and Croatian. This multilingual design increases inclusivity and uptake across different European regions. However, many tools lack structured onboarding, interactive tutorials, or training modules, making them difficult to adopt without prior experience or expert guidance. This is especially true for technical tools that require GIS or simulation knowledge. As a result, the learning curve for new users can be steep, which may limit the practical utility of these otherwise valuable resources.

In terms of access and availability, most tools in the inventory are open access, aligning well with the project's goals of promoting inclusive and scalable training. However, there is no unified platform or

framework where these tools are consolidated or linked with relevant training materials. Many tools were developed within the scope of EU projects and remain siloed within individual project websites, with no long-term sustainability or update plans. Moreover, only a few tools come with pedagogical support, such as exercises, assessment modules, or case studies, that could be used in a classroom or training environment. To increase the impact of these resources, future training schemes should consider incorporating key tools into course curricula, supported by guided walkthroughs, examples of real-world use, and interactive learning components.

3. Key Insights and Gaps Identified

3.1. Disparity in Offerings

One of the clearest findings from the inventory is the significant disparity in the availability and quality of DHC training offerings across countries and institutions. Countries with established district heating markets, such as Germany and Austria, benefit from a broader network of training providers, university programs, and industry-led short courses. These nations often have national associations or technical bodies that play a coordinating role in delivering and updating training content. In contrast, countries with emerging or transitioning DHC markets, such as Ireland, Estonia, and parts of Southern Europe, have very limited structured training opportunities. In these contexts, professionals must rely on international platforms, ad hoc seminars, or project-based learning, which may not be sustained or contextualized for local needs. This imbalance results in uneven workforce preparedness and unequal access to upskilling pathways across the EU.

The disparity also extends to the format, structure, and level of specialization available in different countries. Some regions offer well-developed, progressive learning tracks with short courses, certifications, and advanced modules, while others lack even basic introductory content. In the current dataset, some providers offer entire series of interconnected courses, while others list one-off training events with no clear learning objectives or follow-up. Language is another barrier, most training is delivered in English or national languages, limiting accessibility for cross-border learning unless multilingual options are provided. Without greater coordination and investment in harmonizing DHC education across countries, these disparities risk undermining broader EU goals related to skills mobility, just transition, and workforce development in the energy sector.

3.2. Mismatch Between Roles and Formats

The training materials reviewed in this inventory reveal a clear mismatch between the learning formats provided and the actual needs of different professional groups within the DHC sector. Many of the short courses and online trainings are targeted broadly at "beginners" without specifying whether they are blue-collar workers, technicians, engineers, or municipal planners. This lack of differentiation leads to content that is either too technical for decision-makers or too conceptual for practitioners who need practical skills. For example, installers and maintenance personnel are often offered theory-based lectures or webinars, despite requiring hands-on, site-based training with physical systems, piping layouts, or substation components. Conversely, engineers and system designers are frequently presented with high-level overviews that lack the technical depth needed for tasks like hydraulic modelling or renewable integration.

At the same time, municipal employees and policymakers, who are becoming increasingly central to heat planning and energy transition strategies, are often overlooked entirely. Few courses are designed with their decision-making context in mind. Existing programs tend to ignore essential topics such as regulatory frameworks, stakeholder engagement, public procurement, and heat zoning strategies. Even when these topics are touched upon, they are usually buried in broader technical

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programs that are not accessible or relevant to non-engineering audiences. This results in a training landscape that unintentionally excludes the very actors tasked with long-term DHC development and governance at the local level.

In addition to content misalignment, there is also a format mismatch in terms of time, accessibility, and pedagogical approach. For example, short 2-hour or one-day courses may work for awareness-raising but are insufficient for building job-ready skills. Meanwhile, most academic courses operate on a semester-based model, which is impractical for working professionals who need modular or flexible delivery. Blended learning options, which combine digital modules with on-site demonstrations or mentoring, are rarely offered, despite being well-suited for technicians, facility managers, and engineers who learn best through applied practice. Without a better match between training format and professional profile, the sector risks wasting resources on ineffective training while continuing to experience skills gaps across key roles.

3.3. Missing Policy and Planning Tracks

Despite the growing responsibility of municipalities and regional authorities in leading heat planning efforts, the inventory shows a marked absence of training content focused on policy, governance, and strategic planning. Most of the existing training materials concentrate on technical system components, pipes, hydraulics, substations, energy efficiency, while the broader frameworks needed to support decision-making are largely ignored. For example, there are very few courses that cover how to develop a local heating plan, evaluate district heating zoning, or conduct stakeholder consultations. This is particularly concerning in countries like Germany and the Netherlands, where municipal heat planning is already a legal requirement. The lack of dedicated content leaves public sector staff unprepared to carry out their regulatory duties effectively.

Additionally, most training offerings fail to equip planners and policymakers with the practical tools and frameworks necessary to navigate real-world implementation challenges. Topics such as permitting, public procurement procedures, tariff regulation, risk assessment, and financing models are often absent from course curricula. Similarly, non-technical aspects, such as interdepartmental coordination, communication with local stakeholders, and political negotiation, are rarely addressed, even though these skills are critical for initiating and maintaining DHC projects at the municipal level. As a result, many public authorities remain reliant on external consultants or project developers, which can slow down decision-making and increase project costs.

Moreover, even in the few cases where planning-related tools are available (e.g., THERMOS or the Heat Planning Toolbox), they are not accompanied by structured learning paths or real-world case applications. Public sector users often find these tools too complex to adopt without training, and there is minimal integration between the tools and the training landscape. Bridging this gap would require the development of dedicated training tracks for public sector staff, designed around their workflows, institutional realities, and legal responsibilities. Such tracks would not only build capacity but also create institutional memory and resilience, enabling cities and regions to lead the heat transition more effectively and independently.

3.4. Fragmentation in Tools and Courses

A key finding from the inventory is the lack of integration between tools, learning materials, and formal training pathways in the DHC sector. Many of the tools collected, such as THERMOS, the QM Toolbox, and the Waste Heat Toolbox, offer valuable technical capabilities but exist in isolation from structured training programs. They are often developed as part of EU-funded projects and made publicly available, but without accompanying onboarding resources, learning modules, or alignment

with national curricula. On the other hand, most professional short courses and academic programs fail to incorporate these tools into their delivery, even when doing so could significantly improve applied learning. This disconnection means that learners often acquire theoretical knowledge without gaining experience with the instruments they will use in real projects, limiting their preparedness for real-world application.

The fragmentation also affects the overall structure and progression of learning in the DHC field. There is no shared framework across providers for course levels, skill progression, or certification. For example, some learners may complete a basic course in hydraulics without any clear path to continue toward more specialized training in network design, digital control, or financing. Similarly, many tools come with no guidance on who should use them, planners, engineers, consultants, or how they relate to other parts of the training ecosystem. Without better coordination and integration across tools, courses, and user groups, the sector risks duplicating efforts, missing synergies, and failing to scale up skills development effectively. Developing modular training packages that intentionally link to tools and reflect real project workflows would significantly increase training impact and coherence.

3.5. Digital Learning Still Limited

Although digital learning has become a cornerstone of modern education in many technical and professional fields, the district heating and cooling (DHC) sector has yet to fully embrace digital training formats. The majority of courses in the inventory are still delivered in person or as one-off webinars with limited interactivity. Few providers offer fully developed online courses with structured content, user progression, and certification. Among those that do, content is often static, slides, pre-recorded videos, or PDFs, without integrated exercises, assessments, or feedback loops that are critical for active learning. This restricts the potential reach and scalability of training programs, especially for professionals who cannot travel or attend in-person sessions due to time or geographic constraints.

Blended learning, which combines online modules with hands-on workshops or mentoring, is particularly well-suited for the DHC field but is still underutilized. Such formats can serve a wide range of learner profiles, from installers needing field demonstrations, to municipal staff benefiting from scenario-based planning simulations. However, very few training providers in the inventory offer blended formats, and those that do often lack the instructional design expertise to implement them effectively. This is a missed opportunity, especially given the growing demand for flexible and self-paced learning among adult professionals, technicians, and engineers working in the energy sector.

In addition, many of the digital tools identified in the inventory are not supported by training ecosystems that help users understand and apply them. Tools like THERMOS or the Heat Planning Toolbox are powerful but complex, and without video walkthroughs, sample use cases, or interactive exercises, they remain inaccessible to many potential users. Moreover, the lack of integration between digital tools and training programs creates fragmented learning experiences. To address this, future training initiatives should include interactive digital modules, gamified learning environments, or virtual site simulations that allow learners to explore DHC concepts in a safe, controlled, and scalable way. Investing in digital infrastructure and pedagogy is critical if the sector is to meet the workforce development demands of the energy transition.

4. Lessons Learned and Best Practices

4.1. Effective Training Methods by Professional Group

4.1.1 Technicians and Installers

Technicians and installers are critical to the day-to-day implementation and maintenance of DHC systems, yet the training formats currently available to them are often misaligned with how they best acquire skills. These professionals benefit most from hands-on, practical training environments, such as physical labs, on-site demonstrations, and job-shadowing experiences. However, the majority of short courses in the inventory are classroom-based or online, focusing on theory rather than practice. Key skills such as pipe fitting, welding, substation setup, hydraulic balancing, and leak detection require physical interaction with tools and systems, something that cannot be replicated through slides or passive video lectures. Without access to real-world equipment or field-based learning, technicians may struggle to apply technical knowledge safely and efficiently in operational settings.

In addition, effective training for this group should be modular, repetitive, and visual, using diagrams, videos, and demonstrations to reinforce procedures. Short-duration formats (half-day to 2-day courses) work well if they are focused on a single, well-defined skill, but these must be repeated or stacked in progression. Assessment methods should focus on competency and task execution rather than written tests. In countries like Austria and Germany, where vocational education models are stronger, technicians often receive better-aligned training through dual learning systems. However, in other countries, such as Ireland or Estonia, this role-specific training is rarely available. To ensure safety, reliability, and consistency across installations, training for technicians should not only be expanded but also embedded into formal certification frameworks that require ongoing upskilling and refreshers as technologies evolve.

4.1.2 Engineers and Designers

Engineers and system designers are responsible for the technical integrity, efficiency, and long-term scalability of DHC networks. Unlike technicians, their learning needs are more analytical and require a deeper understanding of system modelling, hydraulic design, control systems, and the integration of renewable heat sources. Yet, as highlighted in the course inventory, many training programs targeting this group remain at a basic or introductory level, offering high-level overviews without diving into the complexities of modern network design. Topics such as simulation-based planning, load profiling, temperature optimization, and hybrid systems are rarely covered in sufficient depth. This leaves many engineers reliant on internal knowledge transfer or learning-by-doing, which can slow innovation and increase the risk of sub-optimal design decisions, especially in projects involving large-scale decarbonization.

Effective training for this group should include advanced workshops, case-based learning, and certified CPD (Continuing Professional Development) modules. Engineers often benefit from scenario simulations that allow them to test design assumptions under different operational conditions. Software tools like THERMOS, Heat Planning Toolbox, or EnergyPRO should be integrated into training environments with hands-on exercises and real-world datasets. Moreover, delivery formats should support flexible learning, such as online technical modules paired with live Q&A sessions or mentoring from experienced practitioners. International best practices, regulatory updates, and evolving technology standards should be embedded into CPD courses to ensure ongoing competence. The current lack of structured, high-level training for engineers is a missed opportunity to strengthen technical leadership within the DHC sector.

4.1.3 Municipal Employees and Policy Professionals

Municipal employees and policy professionals are playing an increasingly central role in the planning and rollout of district heating systems, especially in countries where heat planning has become a legal obligation or is tied to decarbonization targets. Despite this, the training landscape is not adequately serving this audience. The inventory reveals a near-total absence of structured learning opportunities tailored to the responsibilities and decision-making contexts of local authorities, planners, or policymakers. While a few general seminars touch on heat networks or sustainable energy planning, they rarely cover the practical realities of heat zoning, stakeholder consultation, financing models, or regulatory compliance, topics that are critical for municipal actors tasked with initiating and managing DHC projects.

This group requires interdisciplinary training formats that combine technical awareness with policy literacy, public finance, and governance strategy. Effective programs should introduce legal instruments (e.g. zoning laws, procurement frameworks), public engagement methods, economic evaluation tools, and project development workflows in the context of DHC. Training formats that work well for this audience include short policy bootcamps, blended learning modules, site visits, and peer exchanges, especially between municipalities at different stages of implementation. Real-life case studies, practical checklists, and scenario planning tools are especially effective, as they help municipal staff understand their roles and responsibilities in tangible terms.

Moreover, municipal staff often face time and capacity constraints, making it essential that training be concise, accessible, and immediately applicable. Online modules paired with interactive workshops, mentoring from experienced municipalities, or role-based simulations could significantly improve learning uptake and implementation readiness. National governments and EU institutions should also consider embedding DHC-specific training into broader capacity-building programs for local authorities. Without targeted learning pathways for this group, the risk increases that planning obligations will either be outsourced to private consultants or met with minimal strategic input, undermining the long-term sustainability and ownership of district heating initiatives at the local level.

4.2. Success Factors in Training Programs

4.2.1 Customization by Role

One of the most important success factors identified in both the literature and course inventory is the customization of training content based on the professional role of the learner. District heating projects involve a diverse set of actors, installers, engineers, planners, policymakers, consultants, and each of these groups requires different levels of depth, focus, and format. A one-size-fits-all training model is often ineffective, leading to disengagement or knowledge gaps. For example, blue-collar technicians benefit most from visual, hands-on formats that emphasize repetition and demonstration, while engineers require technical modeling tools, scenario-based exercises, and deeper system design content. Similarly, municipal staff and decision-makers benefit from short, strategic modules that integrate regulatory, economic, and social perspectives, rather than overly technical content.

Courses that clearly define their target audience and align their learning objectives, terminology, and case studies with that group's daily responsibilities are more likely to produce tangible outcomes. The inventory shows that only a minority of existing training programs clearly segment their content by professional level or job function. This lack of role clarity often results in courses being too general to be valuable or too specialized for the wrong audience. Customization not only improves comprehension and retention but also increases motivation, as learners can immediately see the relevance of what they're learning. Moving forward, the design of training schemes should begin with

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professional profiling, followed by tailored curricula, role-specific certifications, and flexible delivery formats to serve the full DHC value chain.

4.2.2 Integration of Tools

The integration of digital tools into training programs is a critical yet underutilized success factor in the DHC sector. Tools such as THERMOS, the QM Toolbox, or the Waste Heat Toolbox offer valuable functionalities for planning, quality assurance, and network optimization, but they are rarely embedded in structured learning environments. Most professionals encounter these tools independently, often through EU project websites, without guidance on how to use them effectively or apply them in real-world contexts. By incorporating these tools into training modules, including interactive tutorials, case-based exercises, and walkthroughs with real data, providers can bridge the gap between theory and practice. This not only builds tool proficiency but also strengthens learner confidence and encourages direct application in day-to-day work. Making tools use a standard element of professional upskilling, especially for planners, consultants, and engineers, can significantly enhance the practical impact and long-term retention of training outcomes.

4.2.3 Peer Learning and Mentorship

Peer learning and mentorship have proven to be highly effective approaches for building practical skills and institutional knowledge in the DHC sector. These formats allow professionals, especially those working in municipalities or smaller organizations, to learn from real-world experiences, mistakes, and solutions applied by their peers. Unlike traditional training, peer-based formats offer context-rich knowledge transfer that is directly relevant to the learner's environment. For example, city-to-city mentoring programs in Austria and Germany have allowed smaller municipalities to accelerate DHC planning by learning from more advanced peers, bypassing costly trial-and-error phases. These exchanges often cover not just technical issues, but also procurement strategies, stakeholder management, and regulatory navigation, topics that are rarely addressed in conventional courses.

Mentorship also supports longer-term professional development, especially when linked to specific projects or job roles. Experienced engineers or planners can guide junior professionals through project stages, tool usage, or cross-departmental coordination. This real-time guidance helps solidify theoretical learning and offers insight into tacit knowledge that can't be captured in formal curricula. However, the inventory suggests that peer learning and mentorship are rarely institutionalized or scaled. Future training schemes should consider embedding mentorship components, whether in the form of structured pairings, moderated online communities, or facilitated study visits, to complement formal instruction. These formats are particularly valuable in building confidence, sustaining motivation, and fostering collaborative mindsets that are essential for delivering complex, multi-stakeholder DHC projects.

4.2.4 Interdisciplinary Content

Effective DHC training programs increasingly require an interdisciplinary approach that bridges engineering, urban planning, policy, economics, and environmental science. District heating systems do not exist in isolation, they intersect with building stock, zoning laws, local energy planning, climate policy, and stakeholder dynamics. Yet, many training programs in the current landscape remain siloed, focusing narrowly on technical or regulatory content without linking it to broader urban systems or social contexts. Engineers may graduate with little understanding of municipal decision-making or procurement procedures, while policymakers may lack the basic technical literacy needed to evaluate feasibility studies or infrastructure proposals. Interdisciplinary content is essential not only for

improving communication between professional groups, but also for ensuring that DHC systems are designed and operated as part of integrated energy and urban strategies.

Courses that incorporate multiple perspectives, such as combining legal frameworks with technical case studies, or linking economic modeling with social engagement tools, are more likely to prepare learners for the complex realities of DHC project development. These programs help professionals understand how their decisions impact, and are influenced by, other domains. For example, introducing environmental planners to hydraulic principles, or teaching engineers about participatory planning, fosters mutual understanding and collaboration. While a few advanced university courses and EU-funded workshops attempt this integration, it is far from common practice. Expanding interdisciplinary content, especially in modular formats that allow professionals to acquire cross-cutting knowledge without leaving their core expertise, will be key to equipping the workforce for the multi-sector challenges of the heat transition.

4.2.5 Flexibility and Accessibility

Flexibility and accessibility are critical to ensuring that training opportunities reach a broad and diverse range of professionals within the DHC sector, especially those working in small municipalities, rural areas, or under-resourced organizations. Many professionals cannot afford to travel for multi-day workshops or take extended time away from their jobs, making flexible delivery formats essential. Online learning platforms, modular courses, and blended learning options allow individuals to learn at their own pace and on their own schedule. However, as highlighted in the inventory, very few existing programs make full use of these formats. To increase inclusivity and participation, future training schemes should prioritize low-barrier access, through free or subsidized content, multilingual materials, and mobile-friendly platforms, while also ensuring that course structures accommodate various time constraints and levels of prior knowledge. Doing so will help close regional and institutional gaps and allow more professionals to engage meaningfully in the heat transition.

4.3. Success Factors in Training Programs

A review of the inventory and supporting insights from T2.1 and T2.3 point to several key success factors that determine the effectiveness and long-term impact of DHC training programs. First among these is relevance to the learner's role and responsibilities. Programs that are tailored to specific professional profiles, whether technicians, engineers, planners, or policymakers, tend to have higher engagement and knowledge retention rates. Clear alignment between course content, real-world tasks, and professional challenges ensures that learners can immediately apply what they've learned. This also increases employer buy-in and supports ongoing professional development within organizations. Training that lacks this relevance often results in disinterest, low attendance, or limited impact on job performance.

Another critical factor is the method of delivery and the inclusion of active learning techniques. Programs that incorporate hands-on practice, tool integration, case-based learning, and peer collaboration consistently outperform those that rely on passive formats such as lectures or static video content. This is especially true for complex subjects like hydraulic design, network optimization, or strategic planning, where abstract theory alone is not sufficient. Blended learning, where online materials are paired with on-site demonstrations or interactive workshops, has emerged as one of the most effective approaches, particularly for adult learners balancing work and training. Accessibility also plays a key role: courses that are modular, multilingual, and freely available remove participation barriers and promote wider uptake, especially in smaller municipalities or less-developed DHC markets.

Lastly, the institutional context and follow-up mechanisms matter greatly. Training programs that are linked to recognized certification schemes, professional development requirements, or government mandates tend to generate more consistent participation and greater long-term outcomes. Likewise, programs that are embedded within broader strategies, such as national heat planning efforts or EU climate goals, gain more traction and visibility. Providing learners with post-training support, such as mentoring, user communities, or access to updated materials, also reinforces the impact. In short, successful DHC training programs are those that are role-specific, interactive, context-aware, and connected to both professional incentives and policy objectives. Embedding these success factors into future training formats will be essential for building a resilient and future-ready workforce in the DHC sector.

5. Contribution to T2.5 and WP3

The findings of Task 2.3 provide a critical foundation for the design of upgraded and new training schemes in both Task 2.5 and Work Package 3. By analyzing nearly 100 professional courses, 76 academic courses, and 25 tools, the inventory offers a detailed picture of what training resources currently exist across Europe, and where the gaps lie. This information enables the project to avoid duplicating existing efforts and instead focus on creating added value. For example, Task 2.5 will use the dataset to identify where certain formats (e.g. online CPD for engineers or modular workshops for municipal staff) are missing and where demand is unmet. The dataset also informs WP3's development of new training schemes by offering concrete models, language options, and subject matter categories to build on.

Moreover, the inventory supports the creation of role-specific training formats that respond directly to the needs identified across professional groups. For technicians, the data point to a need for more hands-on, certified programs. For engineers, the gap is in advanced, systems-level content with simulation-based learning. For municipal staff and policymakers, the findings clearly show a lack of strategic planning, governance, and regulatory training. These insights will guide the development of targeted training schemes in WP3 that are aligned with user needs, delivery preferences, and national contexts. Task 2.5 will define the appropriate didactic approaches, such as blended learning, peer mentoring, and modular delivery, for each profile based on what is proven to be effective or currently missing from the landscape.

Finally, the tools and templates collected in this task will serve as core inputs for curriculum development and teaching material selection in WP3. The quality-assured, open-access resources gathered during Task 2.3 can be directly integrated into new training schemes, provided they are supplemented with proper onboarding and instructional support. In addition, the gaps identified in digital learning infrastructure, language accessibility, and progression pathways will inform quality assurance criteria and scalability planning in both T2.5 and WP3. In this way, Task 2.3 not only maps the status quo but directly feeds into the project's strategic goal: to co-develop and deliver a coherent, future-ready DHC training framework that supports energy transition efforts across the EU.

6. Annex Overview

- Annex I: Inventory Of Existing Academic DHC Training Programs
- Annex II: Inventory of professional training courses (Attached)
- Annex III: Inventory of collected tools (Attached)

ANNEX I - Inventory of Existing Academic DHC Training Programs

Country	*University*	*Course Title*	*ETC*	*Study Program*	*Bachelor*	*Master*	*PhD*	*Topics*	*Available Course Program (link)*
AT	TU Graz	Heating, Ventilation and Air-Conditioning	4	Mechanical Engineering		X		Basics of thermal engineering which includes steam power plants and gas-fired power plants- electric power and heat production and of combined heat and power production, their energy balance, their thermal and hydraulic design and operating conditions of components as e.g. steam generators and heat recovery steam generators. Heat transfer (free and forced convection) and the design as well as dimensioning of heat exchangers, -fundamentals of using renewable energies, heating, ventilation and air-conditioning systems	https://online.tugraz.at/tug_online/ee/ui/ca2/app/desktop/#/slc.tm.cp/student/courses/530164?$scrollTo=toc_overview
AT	TU Graz	Thermal Engineering	4	Mechanical Engineering	X			Overview about the basics of thermal engineering which includes steam power plants and gas-fired power plants. Subjects of this course are systems of electric power and heat production and of combined heat and power production, their energy balance, their thermal and hydraulic design and operating conditions of components as e.g. steam generators and heat recovery steam generators. Heat transfer (free and forced convection) and the design as well as dimensioning of heat exchangers are also parts of this course. Furthermore, fundamentals of using renewable energies, heating, ventilation and air-conditioning systems	https://online.tugraz.at/tug_online/ee/ui/ca2/app/desktop/#/slc.tm.cp/student/courses/528963?$scrollTo=toc_overview
AT	Montanuniversität Leoben			Energy Engineering	X	X		NA	https://www.unileoben.ac.at/en/studying/undergraduate-studies/advanced-resources/energy-engineering/
AT	FH Joanneum - University of Applied Sciences	Energy Networks and hybrid Technologies		Energy Technologies		X		Concepts and components of energy grids, coupling of different technologies	https://www.fh-joanneum.at/energy-technologies/master/en/my-studies/curriculum/
AT	FH Wels			Applied Energy Engineering	X	X			https://fh-ooe.at/en/degree-programs/environment-energy
AT	FH Burgenland	Renewable Energies	3	Energy and Environmental Management	X			Renewable technologies including DH	https://hochschule-burgenland.at/fileadmin/user_upload/PDFs/ECTS/20242025/L

									E0435_I_0265_ECTS_Guide_BEUM_Final.pdf
AT	TU Vienna	Selected topics in energy economics and environment	3.5	Electrical Power Engineering and Sustainable Energy Systems		X		DH and GIS	https://tiss.tuwien.ac.at/course/courseDetails.xhtml?dswid=4656&dsrid=588&semester=2024W&courseNr=370043&locale=de
BE	KU Leuven	Power Systems	3	Master of Engineering: Energy 120 ECTS		X		Overview of power generation types and special technologies like STEG (solar thermoelectric generation), CHP, and repowering. Fundamentals of electricity demand/supply planning and grid balancing. Design and protection of voltage distribution systems and circuit breakers. Technical aspects of overhead and underground cable infrastructure. Power quality, reliability, and metering in modern electrical networks.	https://onderwijsaanbod.kuleuven.be/syllabi/e/H04A0AE.htm#activetab=doelstellingen_idm2927104
BE	KU Leuven	Renewable Energy	6	Master of Engineering: Energy 120 ECTS		X		Overview of key renewable energy sources: solar (PV, thermal, CSP – concentrated solar power), wind, bioenergy, geothermal, hydro, wave, and tidal. Focus on energy conversion methods for electricity, heat, and transport applications. Exploration of energy storage technologies, including electrical and thermal systems. Introduction to hydrogen and fuel cell technologies for clean energy solutions. Optional enrichment through seminars and site visits to deepen practical understanding.	https://onderwijsaanbod.kuleuven.be/syllabi/e/H04C1BE.htm#activetab=doelstellingen_idp926288

BE	KU Leuven	Heat Transfer	3	Bachelor of Life Sciences, Bridging Programme: Master of Life Sciences: Agriculture and Horticulture Programme: Master of Life Sciences: Food Industry	X	X		Acquisition of foundational scientific and technical knowledge for industrial engineering, with specialization-specific insight. Development of analytical and problem-solving skills applicable to engineering contexts. Training in design, development, and critical reflection for technical systems. Application of heat transport and heat exchanger principles to real-world engineering problems. Strengthening of intuitive understanding supported by scientific reasoning and information processing.	https://onderwijsaanbod.kuleuven.be/2024/syllabi/n/ZA0315N.htm#activetab=doelstellingen_idm672720
BE	KU Leuven	Heat Techniques	4 ECTS	Bachelor of Industrial Sciences (Geel) (Core programme electromechanics) Bridging Programme: Master of Energy Technology (Geel)	X	X		In-depth study of conduction, convection, and radiation, including combined heat transfer and cooling enhancements. Introduction to transient heat transfer and numerical methods for solving thermal problems. Analysis and design of heat exchangers using concepts like logarithmic temperature difference and efficiency calculations. Exploration of combustion fundamentals, including fuel types, combustion equations, and chemical equilibrium. Thermodynamic concepts such as adiabatic flame temperature, enthalpy of formation, and heat of reaction.	https://onderwijsaanbod.kuleuven.be/2024/syllabi/n/ZA0280N.htm#activetab=identieke_opleidingsonderdelen_idp695888
EE	Tallinn University of Technology (TalTech)	Smart District Heating Systems and Integrated Assessment Analysis of Greenhouse Gases Emissions	NA	NA		x	x	Development of Technical Solutions Integrated Assessment Analysis Low-Temperature District Heating Primary Energy Factors and CO_2 Emissions Thermal Energy Storage Combined Heat and Power (CHP) District Cooling Integration of Renewable Energy Utilization of Residual Heat	https://taltech.ee/en/contacts/smart-district-heating-systems-and-integrated-assessment-analysis-greenhouse-gases

DE	Hochschule Nordhausen (supported by AGFW)	Distribution Grid Technology and Grid Operation (Zertifikatsstudiengang Verteilnetztechnik und Netzbetrieb)	13	Certificate Programme	-	-	-	Network planning, maintenance, operations management, technical management	https://www.hs-nordhausen.de/studiengaenge/netztechnik-und-netzbetrieb-fernwaerme/
DE	Hochschule Esslingen	Kommunale Energieversorgung	5	Sustainable building and energy technology	X			Decentralized Energy Systems, District Heating, CHP (Combined Heat and Power), Fuel Cells, Load Duration Curves, Thermal Network Design	https://www.hs-esslingen.de/angewandte-naturwissenschaften-energie-und-gebaeudetechnik/studienangebot/bachelorstudiengaenge/nachhaltige-gebaeude-und-energietechnik
DE	Hochschule Esslingen	Nah- und Fernwärmeversorgung, Netztechnik und Netzbetrieb						NA	https://www.hs-esslingen.de/personen/timm-heinzel
DE	HafenCity Universität Hamburg				X			BIW-B-Mod-604 Leitungsbau	https://www.hcu-hamburg.de/master/reap/academic-staff/ingo-weidlich/
DE	HafenCity Universität Hamburg					X		BIW-M-401-107 Energie-Infrastruktur	
DE	TH Nürnberg	Energiekonzepte für Quartiere							https://www.th-nuernberg.de/person/schaefer-kai/

DE	TU Dresden	District Heating and Cooling (Fernwärmeversorgung)		Building Energy System and Heat Supply Track at Mechanical Engineering or MofSc in Renewable Energy System		X		Planning, construction and operation of district heating and local heating networks. supply of heat at different temperature levels, including the effects on electrical efficiency of combined heat and power systems and technologies for transferring heat to the customer. Aspects of heat storage, control and optimisation of the operation of district heating systems, as well as details of pressure maintenance and safety technologies are covered in depth. Further course content covers future requirements regarding decentralised heat supply, multifunctionality and the integration of renewable energy sources.	https://tu-dresden.de/ing/maschinenwesen/iet/gewv/studium/lehrveranstaltungen/lv_ws
DE	TU Dresden	Thermal Storage (Thermische Energiespeicherung)		Building Energy System and Heat Supply Track at Mechanical Engineering or MofSc in Renewable Energy System		X		The course covers the basic properties and functions of thermal and mechanical energy storage systems. Water heat, steam, cold and ice storage, pumped storage and compressed air storage systems as well as latent, solid-state and thermochemical heat storage systems are covered. Questions of storage evaluation and modelling are also answered for selected storage constructions.	https://tu-dresden.de/ing/maschinenwesen/iet/gewv/studium/lehrveranstaltungen/lv_ws
DE	TU Dresden	Regenerative Energiequellen		Building Energy System and Heat Supply Track at Mechanical Engineering or MofSc in Renewable Energy System		X		The physical and technological principles for the development of renewable energy sources such as solar radiation, geothermal energy, hydropower, wind power and biomass are taught as a prerequisite for their integration into energy systems. The focus is on the utilisation of these energy sources including plant engineering solutions in Central Europe and their evaluation, taking into account the state of the art as well as the technical and economic development potential.	https://tu-dresden.de/ing/maschinenwesen/iet/gewv/studium/lehrveranstaltungen/lv_ws

DE	TU Dresden	Energy Management and Energy Efficiency (Energiemanagement und Energieeffizienz)		Building Energy System and Heat Supply Track at Mechanical Engineering or MofSc in Renewable Energy System		X		The course covers the basics and in-depth elements of organisational and technical energy and load management. This includes the efficient use of energy by analysing demand structures, load forecasts, energy storage and the optimal use of systems as well as the analysis of dependencies between temporal load requirements and various influencing factors. The module therefore also covers methods of mathematical modelling of forecasting and optimisation problems and their solution using MATLAB	https://tu-dresden.de/ing/maschinenwesen/iet/gewv/studium/lehrveranstaltungen/lv_ws
DE	TU Dresden	Wärmepumpensysteme		Building Energy System and Heat Supply Track at Mechanical Engineering or MofSc in Renewable Energy System		X		The content of the course is the integration of heat pumps in building energy systems. Heat sources and heat sinks as well as systemic requirements and hybrid system concepts are covered. The basic functionality of common heat pump technologies (compression and sorption heat pumps) is presented.	https://tu-dresden.de/ing/maschinenwesen/iet/gewv/studium/lehrveranstaltungen/lv_ws
DE	TU Dresden	Solarthermische Anlagen		Building Energy System and Heat Supply Track at Mechanical Engineering or MofSc in Renewable Energy System		X		The courses cover the design, function, dimensioning and operational management of solar thermal systems for heat utilisation with a particular focus on large-scale systems and their integration into district and process heat supply. Included are in-depth theoretical-practical considerations on collector development and testing for liquid and air collectors as well as on the design of systems for decentralised feed-in into district heating systems and considerations on the economic-ecological effects.	https://tu-dresden.de/ing/maschinenwesen/iet/gewv/studium/lehrveranstaltungen/lv_ws

DE	TU Dresden	Thermal Load Management (Lastmanagement: Wärmebedarf und Heizlasten)		Building Energy System and Heat Supply Track at Mechanical Engineering or MofSc in Renewable Energy System		X		Dependencies between the thermal load requirements of buildings and industrial processes and various influencing factors are analysed. Skills for determining energy requirements and energy indicators are taught, taking into account the respective supply structures and utilisation requirements as well as methods and potentials of load management in heating technology.	https://tu-dresden.de/ing/maschinenwesen/iet/gewv/studium/lehrveranstaltungen/lv_ws
DK	DTU	Sustainable District Heating	5			X		Basic concepts on DHC, state of the art on low temperature DHC for new and renovated buildings. Future perspective of DHC, pipeline, hydraulic and thermal simulation of the network	https://kurser.dtu.dk/course/2023-2024/41468
DK	DTU	Integrated energy grids	5	MSc in Electrical Energy, MSc in Sustainable Energy, MSc in Sustainable Energy System		X		Optimal power flow (OPF) problem Optimal gas flow problem Optimal heat flow problem Integration of multi-carrier energy systems	https://kurser.dtu.dk/course/2024-2025/46770?menulanguage=en
DK	DTU	Feasibility studies of energy projects	5	MSC in Sustainable Energy, Technology Entreneruship, Sustainable Energy Systems, Sustainable Energy Technologies		X		We cover principles such as economic valuation, investment analysis, levelized costs of energy, project financing and sensitivity analysis. The course also refers to other aspects of feasibility studies such as environmental impact assessment, societal and regulatory considerations. Through lectures, home studies with readings and videos, exercises and group work, students gradually learn how to build valuation models and conduct feasibility studies. Throughout the course, students work in groups on a relevant case from the energy industry for which a feasibility report is prepared. The course is designed to prepare	https://kurser.dtu.dk/course/2024-2025/46205?menulanguage=en

								students nearing the end of their Master's studies to navigate in a professional environment that requires both engineering and financial skills, such as project management.	
DK	Aalborg University	Energy Project Evaluation	5	Urban, Energy and Environmental Planning		X		Energy-related environmental. Economic and socially related problems, business and socio-economic impact analysis, theories, methods and tool related to energy planning	https://moduler.aau.dk/course/2025-2026/PLSEPMK25102?lang=en-GB
DK	Aalborg University	Sustainable Energy Policies	5	Urban, Energy and Environmental Planning		X		theories and im-pact of sustainable international energy policies, analysis of energy related problems, assessment of energy planning processes and implementation of policies	https://moduler.aau.dk/course/2025-2026/PGLSEPK20202?lang=en-GB
DK	VIA University College	Thermodynamics, Process engineering and District heating	5	Climate and Supply Engineering	X			Optimization of district heating	https://en.via.dk/programmes/bachelor/climate-supply-engineering/course-catalogue
DK	VIA University College	Design and simulation od District Heating System	5	Climate and Supply Engineering	X			Design and simulation of District heating system using also EnergyPro, analysing thermal storage, planning energy system	https://en.via.dk/programmes/bachelor/climate-supply-engineering/course-catalogue
IE	University College Dublin (UCD)	Energy Systems	9	Energy Engineering		x		The scope of the programme includes analysis of global energy systems, use of finite natural resources and the impact on climate. It focuses on use of fossil fuels and on renewable and other energy sources such as wind, wave, nuclear and solar power and on the conversion, storage and transmission by electrical and other means. The programme also addresses the efficient use of energy in buildings, transport and industrial processes, together with the study of other topics such as carbon capture and sequestration.	https://hub.ucd.ie/usis/!W_HU_MENU.P_PUBLISH?p_tag=COURSE&MAJR=T164

IE	University of Galway	Energy Systems	9	Energy Engineering		x		This new programme, based at University of Galway's new Engineering Building, is for graduates of Level 8 BE degrees who want to develop their engineering knowledge for a career in industry or research based on energy systems applications. It is designed to meet the education standard for Chartered Engineer (C.Eng.) with Engineers Ireland. It builds on the successful BE in Energy Systems Engineering, providing graduates with an opportunity to specialise further or to broaden their knowledge in engineering disciplines.	https://www.universityofgalway.ie/courses/taught-postgraduate-courses/energy-systems-engineering.html
IE	University College Cork	Sustainable energy	9	Energy Engineering		x		Our Sustainable Energy graduates will be required to source, design, convert, transmit and supply useful energy to meet our present and long-term needs for electricity, mobility and heating and cooling.	https://www.ucc.ie/en/ckr26/
IE	Tecnological University Dublin (TUD)	Sustainable Energy	8	Energy Engineering	x			In this MEngSc programme, we consider firstly how to reduce human impact on the climate through innovative low-carbon energy supply systems and secondly, how to provide a better standard of living for the world's growing population through access to sustainable and secure energy supplies.	https://www.tudublin.ie/study/undergraduate/courses/sustainable-energy-engineering-tu801/?keywords=engineering&courseType=
IT	Università degli Studi di Bergamo	Energy System	9	Mechanical Engineering		x		Recalls of energy conversion principles Electric power generation and cogeneration (CHP) systems: Steam power plants (recap) Simple cycle gas turbines Combined cycle gas turbines Internal combustion reciprocating engines Gas microturbines Organic Rankine Cycle (ORC) systems Cooling power generation systems: Vapor compression refrigeration machines Absorption refrigeration machines Trigeneration systems	https://unibg.coursecatalogue.cineca.it/insegnamenti/2024/8937_45704_1275/2021/8937/90?annoOrdinamento=2021&coorte=2024

								Non-dispatchable renewable energy systems: Photovoltaic solar systems Wind turbines Nuclear power plants (overview)	
IT	Università degli Studi di Bergamo	Technologies for Energy Sustainability	6	Building Construction Engineering		x		CHP and distributed energy generation	https://unibg.coursecatalogue.cineca.it/insegnamenti/2024/8867_43737_17781/2017/8869/229?coorte=2024&schemaid=77081
IT	Università degli Studi di Bergamo	Technologies for Energy Sustainability	6	Mechanical Engineering	x			Covers fundamentals of energy and mass conservation, and energy balances. Explores boilers, heat exchangers, and thermal distribution systems. Introduces plumbing and ventilation components like pumps and fans. Details refrigeration and air conditioning technologies. Examines high-efficiency heat pump systems, including solar-integrated and reversible types. Discusses air handling units, evaporative cooling, and heat recovery. Introduces district heating and cooling, including 5th generation systems. Explains cogeneration and trigeneration, with emphasis on microturbines and solar-assisted systems. Reviews renewable energy sources: solar, geothermal, biomass, and photovoltaics. Evaluates economic incentives and investment strategies for sustainable energy systems.	https://unibg.coursecatalogue.cineca.it/insegnamenti/2022/2199_31820_17781/2014/2199/74?coorte=2020&schemaid=61024
IT	Università degli Studi di Bergamo	Energy and Sustainable Development	6	Management Engineering		x		The course will provide a broad overview of the most widely used technologies for conversion into electrical and thermal power of primary energy sources (exhaustible, almost inexhaustible, and renewable). In particular, the course will include the following topics: - brief thermodynamic analysis to characterize power plants performance - thermal electric power plants: Rankine cycles, Joule Brayton cycles, Combined Cycles; Cogeneration: general features, layout and performance. - photovoltaic systems - Concentrated Solar Power plants	https://unibg.coursecatalogue.cineca.it/insegnamenti/2024/8863_43571_15777/2021/8863/88?annoOrdinamento=2021&coorte=2024&piano=1

								- hydroelectric plants - geothermal power plants - biomass plants and waste-to-energy - (nuclear power plants)	
IT	Università degli Studi di Bergamo	Advanced Systems for Energy and Environment	6	Mechanical Engineering		x		The first part of the course covers the off-design operation of major power generation plants of different size, including: Simple cycle gas turbine, Combined cycle gas turbine, Internal combustion engines, Micro-gas turbines. The effects on performance due to changes in: 1.1) ambient conditions 1.2) electrical load are evaluated according to possible control strategies in order to maximize efficiency. The second part of the course is devoted to decarbonization and fuel flexibility. 2.1) Chemical-physical properties, production and use of hydrogen: fuel cells, Power to Gas. 2.2) Use of alternative solid fuels, such as biomass and municipal solid waste, for electric and thermal power generation: - chemical-physical characterization: char, volatile compounds, ash - combustion - gasification - pyrolysis; - technologies for flue gas/syngas cleanup; - full energy chain comparisons. 2.3) Integrated gasification combined cycle (IGCC) plants with carbon dioxide capture and sequestration (hints).	https://unibg.coursecatalogue.cineca.it/insegnamenti/2023/8237_36581_12125/2021/4612/90?coorte=2022&schemaid=68046
IT	Università degli Studi di Bergamo	Sustainable energy	9	Mechatronics and smart technologies engineering		x		CHP, distributed and centralized energy generation, orc, RES integration	Web page not accessible because under update
IT	Università degli Studi di Trento	District Heating System Desing	6	Energy Engineering		x		Design of DHC systems - Energy analysis of district heating networks (TLR) integrated with adequate energy systems including renewable energy systems.	https://unitn.coursecatalogue.cineca.it/insegnamenti/2024/50310_640856_91603/2023/50310/10437?annoOrdinamento=2023

								- District heating procedures and methodologies actually adopted for the design and testing of a district heating network. - Procedures actually adopted for determining the thermal loads involved in district heating systems. - Analysis of the control systems and systems involved in the management of rRTL. - Economic-energy analyzes aimed at estimating the most important parameters (Pay Back Time, VAN, Proficiency Index) applied to the real case of district heating networks including connected energy systems.	
IT	Libera Università di Bolzano	Power production, CHP and district heating system	12	Energy Engineering		x		NA	https://unitn.coursecatalogue.cineca.it/insegnamenti/2025/50363_646064_91598/2023/50363/10437?coorte=2024&schemaid=8531
IT	Politecnico di Torino	Energy Networks	8	Ingegneria Energetica e Nucleare, Ingegneria Chimica e dei processi sostenibili		x		This course focuses on the major types of energy networks and aims to provide the student with knowledge about energy networks as well as the ability to analyze and model electric, gas, and thermal networks. A technical description of these assets and detailed information on modeling approaches is provided. Current and future trends are described, including consideration on the interaction between the different types of networks. A significant part of the course is devoted to the development of a practical design project.	https://didattica.polito.it/pls/portal30/gap.pkg_guide.viewGap?p_cod_ins=01TVJND&p_a_acc=2025&p_header=S&p_lang=IT&multi=N
IT	Politecnico di Torino	Cogeneration Plants	6	Energy and Nuclear Engineering	x			Design and/or management of energy production plants and district heating system Management of energy supplies and plants in the industrial sector	https://didattica.polito.it/pls/portal30/gap.pkg_guide.viewGap?p_cod_ins=01QMBMK&p_a_acc=2025&p_header=S&p_lang=IT&multi=N

IT	Politecnico di Torino	Machine Learning for energy applications	6	Energy and Nuclear Engineering		x		Experimental measurements on a complex thermo-technical system with thermodynamic analysis and performance evaluation of the different components of the system	https://didattica.polito.it/pls/portal30/gap.pkg_guide.viewGap?p_cod_ins=01SJFND&p_a_acc=2025&p_header=S&p_lang=IT&multi=N
IT	Politecnico di Torino	Geotechnical applications for energy and environment	6	Master of science-level of the Bologna process in Civil Engineering		X		The course focuses on applications of geotechnical engineering to develop solutions to emerging and global challenges, such as climate change, enhancement of urban sustainability and resilience, energy and materials resource management, and management of underground water resources.	https://didattica.polito.it/pls/portal30/gap.pkg_guide.viewGap?p_cod_ins=01OFKVA&p_a_acc=2025&p_header=S&p_lang=IT&multi=N
IT	Politecnico di Torino	Geotechnical Engineering for the Sustainability of Buildings	6	Master of science-level of the Bologna process in Ingegneria Edile - Torino		x		The course Geotechnical Engineering for the Sustainability of Buildings is part of the educational path of Building Engineering, with the aim to give the tools needed for designing sustainable, safe and resilient buildings. The interaction between the ground and the structure is indeed one of the basic problems to be solved in design.	https://didattica.polito.it/pls/portal30/gap.pkg_guide.viewGap?p_cod_ins=01UVKNB&p_a_acc=2025&p_header=S&p_lang=IT&multi=N
IT	Politecnico di Torino	Energy Planning for Urban Systems	6	Spatial, Urban and Landscape-Environmental Planning	x			The course analyses different aspects of sustainable design with particular attention on climate, shape and type of buildings, renewable energy technologies, energy saving solutions and the sustainable design of urban environments.	https://didattica.polito.it/pls/portal30/gap.pkg_guide.viewGap?p_cod_ins=01UUHPW&p_a_acc=2025&p_header=S&p_lang=IT&multi=N

IT	Politecnico di Torino	Computational models for thermofluid network	10 h	Energy Engineering			x	DHC systems as application case study	https://didattica.polito.it/pls/portal30/gap.pkg_guide.viewGap?p_cod_ins=01QTLIV&p_a_acc=2025&p_header=S&p_lang=IT&multi=N
IT	Universita' degli studi di Torino	GIS with Lab and Sustainable Use of Renewable Energy Sources	10	Environmental Monitoring, Protection and Restoration		x		Use of GIS for mapping renewable energy sources and energy demand for power generation plants	https://www.monitoraggioambientale.unito.it/do/corsi.pl/Show?_id=6qu1
IT	Universita' di Parma	Energy Machines and Systems	6	Mechanical Engineering	x			CHP	https://corsi.unipr.it/it/ugov/degreecourse/191043
IT	Universita' di Trieste	Fundamentals of the Energy Sector, Reewables and Energy Systems	15	Engineering for the energy transition	x			CHP, ORC, RES integration	https://units.coursecatalogue.cineca.it/insegnamenti/2024/120590/2024/2/10736?annoOrdinamento=2024&coorte=2024
IT	Universita' di Bologna	Reti Smart per la produzione e il trasporto dell'energia termica e frigorifera	6	Energy Engineering		x		Overview of traditional thermal and cooling energy production and distribution networks. Introduction to the Todini-Pilati algorithm for calculating thermal or cooling networks. Structure and function of thermal and cooling production plants. Traditional thermal exchange substations and their operational principles. Smart substations and their advantages over traditional systems. Design phases of district heating and cooling networks, including optimization strategies. Real-world application cases and practical examples of network design. Centralized plants serving district heating networks. Integration of district heating with cogeneration systems. Definitions, types, regulations, and specific benefits of cogeneration in district heating, with examples.	https://www.unibo.it/it/studiare/insegnamenti-competenze-trasversali-moocs/insegnamenti/insegnamento/2024/491656

IT	Universita' di Padova	Optimization methods for Sustainable Energy Technologies in Buildings	4	NA			x	Optimization, Buildings, Smart Buildings and Districts, HVAC systems	https://www.aimsea.it/index.php/dettaglio-corso.html?sel=197
IT	Universita' di Padova	Energy and Buildings	6	Energy Engineering		x		Climate, Building physics, energy balance in building, energy modelling, energy systems at district level	https://didattica.unipd.it/off/2023/LM/IN/IN1979/000ZZ/INQ2100363/N0
IT	Politecnico di Milano	ZERO EMISSION AND POSITIVE ENERGY DISTRICTS	8	Energy Engineering		x		Positive energy districts and 5th generation DH	https://www4.ceda.polimi.it/manifesti/manifesti/controller/ManifestoPublic.do?EVN_DETTAGLIO_RIGA_MANIFESTO=evento&aa=2023&k_cf=225&k_corso_la=477&k_indir=EEG&codDescr=057902&lang=EN&semestre=1&idGruppo=4687&idRiga=295255
IT	Politecnico di Milano	BUILDING SERVICES AND BUILDING SERVICES ENERGY MODELLING	12	Building engineering		x		Building heating and cooling systems (DH one of them)	https://www4.ceda.polimi.it/manifesti/manifesti/controller/ManifestoPublic.do?EVN_DETTAGLIO_RIGA_MANIFESTO=evento&aa=2023&k_cf=225&k_corso_la=477&k_indir=EEG&codDescr=057902&lang=EN&semestre=1&idGruppo=4687&idRiga=295255
IT	Politecnico di Milano	Energy Systems	8	Energy Engineering		x		CHP (DH as an application)	https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPublic.do?&evn_default=evento&c_classe=836571&lang=IT&__pj0=0&__pj1=bd4ece73d549c16a7f80497da0286034

NL	TU Delft	Track Heating and Cooling	60 per year	Sustainable Energy Technology		x		Heat Sources, Heat in Buildings, Large Scale Heat Systems, Waste and Combined Heat and Power, Solar Energy, Power Engineering, Economics and Society, Digital Energy Technologies	https://www.tudelft.nl/en/education/programmes/masters/set/msc-sustainable-energy-technology/track-heating-and-cooling/programme-in-detail
NL	TU Delft	Heating and Cooling Grids	4	Sustainable Energy Technology		X		DHN, classification of DHN, Cost, planning and construction of DHN, space requirements for DHN, standards and guidelines, hydraulic design, substation design, temperature levels and control operations	https://studiegids.tudelft.nl/a101_displayCourse.do?course_id=67916
NL	TU Delft	Refrigeration and Heat Pumps Fundamentals	4	Mechanical Engineering		X		Thermodynamic cycles, heat pumps systems, HP components, techno-economic analysis, working fluids	https://studiegids.tudelft.nl/a101_displayCourse.do?course_id=67918
NL	TU Delft	Heating and Cooling Demand of Buildings	4	Mechanical Engineering		X		Energy chain from supply to users, thermal comfort, building energy balance, building physics, steady state simulations, transient simulations	https://studiegids.tudelft.nl/a101_displayCourse.do?course_id=67917
NL	TU Delft	Heating and Cooling Technologies from Near - Ambient Temperature Sources	$	Sustainable Energy Technology		x		Technologies that can obtain heat or cold from local environment	https://studiegids.tudelft.nl/a101_displayCourse.do?course_id=67921

NL	TU Delft	Heating and Cooling Sources	4	Sustainable Energy Technology		X		Sources for heating and cooling, characteristics and role in the energy mix (Solar thermal, borehole heat exchanger, geothermal, waste heat, Aquathermal etc)	https://studiegids.tudelft.nl/a101_displayCourse.do?course_id=67920
NL	TU Delft	Heat Storage	4	Sustainable Energy Technology		X		Heat storage, sensible and latent	https://studiegids.tudelft.nl/a101_displayCourse.do?course_id=67923
NL	TU Delft	heat Distribution in Buildings	4	Sustainable Energy Technology		X		Efficient combinations of energy conversion systems accounting for available heat sources, distribute and control air and energy flows minimazing emissions and maximizing thermal comfort	https://studiegids.tudelft.nl/a101_displayCourse.do?course_id=67919
NL	TU Delft	Thermochemistry of Biomass Conversion	4	Sustainable Energy Technology		X		Background, design and implementation of different technologies to convert biomass to valuable energy products	https://studiegids.tudelft.nl/a101_displayCourse.do?course_id=67907
NL	TU Delft	Direct Use of Geothermal Energy	4	Sustainable Energy Technology		X		Geothermal resources, basics and exploitation, modelling, techno-economic assessment	https://studiegids.tudelft.nl/a101_displayCourse.do?course_id=67922
NL	TU Delft	Equipment for heat and Mass transfer		Mechanical Engineering		X		Fundamental of heat and mass transfer Design of heat exchangers	https://studiegids.tudelft.nl/a101_displayCourse.do?course_id=67915
NL	TU Delft	Decarbonization of Heat - An Introduction to Sustainable heating and Cooling Systems	-	Architecture, Urbanism and Building Sciences (MOOC Category)	X			Overview on technologies that can offer sustainable heating and cooling	https://online-learning.tudelft.nl/courses/decarbonization-of-heat-an-introduction-to-sustainable-heating-and-cooling-systems/

NL	TU Delft	Intelligent and integrated energy systems	-	MOOC	x			Design, plan and operate intelligent and integrated energy systems	https://online-learning.tudelft.nl/programs/intelligent-and-integrated-energy-systems/
NL	Avans+							NA	https://avansplus.nl/opleidingen/techniek-bouw/master-of-pipeline-technology-mpt/master-of-pipeline-technology-mpt
NL	UT Twente	Master Sustainable Energy Technology				X		NA	https://www.utwente.nl/en/education/master/programmes/sustainable-energy-technology/
NL	TU Eindhoven	Master in Energy Conversion and Storage						NA	https://www.tue.nl/studeren/graduate-school/mastertrack-energy-conversion-and-storage/studieopbouw

ANNEX II - Inventory of Professional Training Courses

No.	Training Provider Organization	Course Name	Duration	Target Group	Course Modules	Description	Learning Outcomes	Link
1	ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers)	District Cooling & Heating Systems Central Plants	3 Hours	N/A	N/A	Design principles for an efficient, reliable district cooling/heating plant that serves multi-building facilities are described and demonstrated. The course addresses each component of equipment and the relationship with other equipment within the plant. Types of equipment and the choices available within a type such as chillers will be reviewed and the criteria for selection will be a part of the course. Included is a short discussion of special applications such as thermal storage, combined heat and power, and deep lake water cooling.	N/A	https://www.ashrae.org/professional-development/all-instructor-led-training/catalog-of-instructor-led-training/district-cooling-heating-systems-central-plants
2	Enerhack E-Academy	District Cooling Engineering & Design	4 hours	Professionals in the energy industry, including engineers, designers, and utility owners involved in district cooling systems.	•District Cooling Networks Specificity: Different Pipe Materials, Pressures, and Temperatures •Dynamic District Cooling System Analysis •Current Problems in District Cooling Systems •District Cooling in Practice	This course explores the principles and practices of engineering and designing district cooling networks. It covers the key differences between district heating and cooling networks, examines various pipeline materials, discusses common issues in district cooling systems along with their solutions, and includes hydraulic calculations to ensure efficient system operation. Modeling tools are also introduced.	Participants will gain insights into the unique challenges of district cooling system design, learn to perform hydraulic calculations, understand common problems and solutions in district cooling systems, and explore practical case studies from industry experts.	https://www.enerhack.courses/course/district-cooling-engineering-and-design
3	Enerhack E-Academy	District Heating Hydraulics	4 hours	Professionals in the energy industry, including engineers, designers, and utility owners involved in district heating systems.	•Hydraulic Principles Underpinning DH Systems •Building Level Substations and the Impact on the District Heating System •Common Hydraulic Issues in DH Networks and Enhancing the Resilience of DH Systems •Strategies for Integrating Renewable Energy Sources and Advanced Technologies into DH Hydraulics	This course delves into the fundamental concepts of district heating (DH) hydraulics, covering heat transfer, fluid dynamics, and system components. Participants will analyze and enhance existing DH networks, optimize flow rates, and troubleshoot common hydraulic challenges through real-world case studies and hands-on simulations.	Participants will gain a comprehensive understanding of DH hydraulics, enabling them to contribute to the development of sustainable, efficient, and resilient district heating systems.	https://www.enerhack.courses/course/district-heating-hydraulics?utm_source=chatgpt.com

4	Enerhack E-Academy	Design of District Heating & Cooling Pipelines	8 hours	Engineers, designers, and utility owners dealing with pre-insulated district heating and cooling networks.	•Basics of District Heating Design •Standard EN 13941 Overview •Pipeline Design and Engineering •Stress Calculations and Hydraulic Simulations •Trench Design and Installation •Bends, Branches, and Reductions •TwinPipe Design and Flexible Pipes	This online course provides essential knowledge on designing pre-insulated district heating and cooling pipelines according to EN 13941 standards. It covers pipeline design, pre-stressing, cold installation, and construction quality assessment.	Participants will acquire the skills needed to design and engineer efficient and reliable district heating and cooling pipelines, adhering to industry standards and best practices.	https://www.enerhack.courses/course/design-of-district-heating-district-cooling-pipelines-block-1?utm_source=chatgpt.com
5	Enerhack E-Academy	Introduction to District Heating	4 hours	Early-career professionals in the energy sector	•Overview of District Heating and Global Context •District Heating Fundamentals •Heating and Cooling Sources •Innovations in District Heating •4th and 5th Generation District Heating and Cooling	This video course introduces the roots of district heating and explores current and future technologies. It balances research and engineering theory with practical examples and real-life cases, providing a thorough understanding of district heating principles and innovations.	Participants will be prepared to contribute to district heating projects and engage in industry discussions, equipped with knowledge of both conventional and innovative technologies.	https://www.enerhack.courses/course/introduction-to-district-heating?utm_source=chatgpt.com
6	Enerhack E-Academy	Operation & Maintenance of District Heating Networks	4 hours	Professionals involved in the operation and maintenance of district heating networks.	•Basics of Operation & Maintenance of District Heating Networks •Interconnection of Different District Heating Regions •Practical Examples of Temperature Management •Typical Faults and Mistakes During Operation	This course provides comprehensive knowledge of operating and maintaining district heating networks, combining theory with practical insights. Real-world scenarios and case studies help participants understand the intricacies of these systems.	Participants will acquire skills to ensure efficient operation and maintenance of district heating networks, understanding key components and their roles.	https://www.enerhack.courses/course/operation-and-maintenance-of-district-heating-networks?utm_source=chatgpt.com

7	Enerhack E-Academy	District Heating Networks Design	12 hours	Pre-insulated heat network designers and engineers responsible for the design and construction of heat networks.	•General Presentation •Theoretical Basis - Design Guide and EN 13941-1 •Definition of Pipe Systems •Fundamentals of Bonded Pipe Systems in Soil •Trench Design and Installation •Change in Direction •Bends and Casing Joints •Monitoring Systems •Branches and Reductions •TwinPipe Design and Flexible Pipes •Heat Loss Calculation •Exercises and Practical Examples	This seminar introduces the latest methods of pipeline design, pre-stressing, and cold installation, along with techniques for assessing and controlling construction quality. It includes workshop discussions to address technical challenges faced by heat network designers.	Participants will gain a deep understanding of district heating network design, including practical skills for pre-stressing, trench layout, and calculating heat losses. This course prepares attendees to create efficient and reliable heat networks in compliance with EN 13941 standards	https://www.enerhack.courses/course/course-for-district-heating-networks-designers
8	Enerhack E-Academy	Design and Engineering of Heating Substations	4 hours	Professionals involved in district heating systems, including engineers, designers, and utility managers.	•Design of Heating Substations: Theoretical aspects and practical examples •Heat Exchangers: Types, design principles, and their role in efficient heat transfer. •Pumps for Heating Substations: Selection, configuration, and practical applications. •Operation and Maintenance: Procedures, troubleshooting, and ensuring system longevity.	This course delves into the intricacies of heating substations, essential components in district heating systems. It combines theoretical knowledge with practical insights, covering design principles, key components like heat exchangers and pumps, and best practices for operation and maintenance.	Participants will gain a comprehensive understanding of heating substations, enabling them to design, operate, and maintain these systems effectively. They will learn to optimize performance, ensure reliability, and integrate substations seamlessly into broader district heating networks.	https://www.enerhack.courses/course/heating-substations

9	Enerhack E-Academy	District Cooling in Different Parts of the World	4 hours	Professionals in the energy sector, including engineers, designers, utility managers, and policymakers interested in understanding global district cooling practices.	•Practical Experience in Swedish District Cooling Networks: Lessons learned from Sweden's implementations. •District Cooling Experience in Qatar: Insights into the design and operation of cooling systems in the Middle East. •District Cooling Experience in Asia: Examination of district cooling projects across various Asian countries. •District Cooling Success Factors in Europe, Including the Baltics: Analysis of successful European case studies. •District Cooling Experience in France: Overview of French district cooling systems and their unique approaches.	This course immerses participants in the diverse approaches to district cooling worldwide, exploring design, operations, and environmental impacts. Through engaging case studies, participants will gain valuable insights into successful implementations across different regions, understanding lessons learned and best practices adopted in unique contexts.	Participants will develop a comprehensive understanding of global district cooling models, advanced technologies, regulatory frameworks, and energy-efficient strategies shaping district cooling systems across continents. This knowledge will enable them to apply international best practices to local projects effectively.	https://www.enerhack.courses/course/district-cooling-in-other-parts-of-the-world
10	Enerhack E-Academy	District Heating Business Models	4 hours	Professionals in the energy sector, including engineers, utility managers, policymakers, and business executives involved in district heating systems.	•Introduction to District Heating Business Models: Overview of key components and influencing factors, with a focus on Estonia's experience. •Pricing Models for District Heating: Examination of fixed, variable, and innovative pricing structures, and their impact on revenue and consumer behavior. •Government Regulations and Policies: Discussion on energy efficiency regulations, environmental standards, subsidies, and incentives shaping business models. •District Heating Models in Denmark: Exploration of unique approaches, including regulatory frameworks, pricing strategies, and sustainability initiatives.	This course delves into practical business models for district heating systems, covering pricing strategies, government regulations, and tariff systems. It provides insights into the connection between pricing and customer-side temperatures, and examines specific models from Estonia, Sweden, and Germany, offering an international perspective.	Participants will gain a comprehensive understanding of various business models applicable to district heating systems. They will learn to navigate different pricing strategies, understand the impact of government regulations, and analyze international case studies to apply best practices in their contexts.	https://www.enerhack.courses/course/district-heating-business-models
11	Enerhack E-Academy	District Heating Stress Calculations	3.5 hours	Professionals including thermal engineers, energy engineers, electrical engineers, network designers, utility and construction company employees, owner supervision engineers, specialists, and policymakers involved in developing sustainable heating systems.	•Basics of Stress Calculations: Introduction to core concepts and methodologies for assessing stress factors in district heating systems. •Stress Calculations with sisKMR: Hands-on session focusing on performing stress calculations using the sisKMR software, including data input and result interpretation. •Practical Cases and Experience with Stress Calculations: Real-world case studies highlighting common challenges and solutions in district heating system optimization.	This course delves into the principles of stress analysis, focusing on how thermal expansion, pressure fluctuations, and system components impact district heating pipelines and infrastructure. Participants will engage with real-world case studies and practical exercises to perform stress calculations, evaluate system vulnerabilities, and design mitigation strategies to prevent failures.	Participants will acquire a profound understanding of district heating stress calculations, equipping them to maintain safe, resilient, and efficient district heating systems. They will learn to perform stress analyses, utilize specialized software tools, and apply practical solutions to real-world challenges.	https://www.enerhack.courses/course/district-heating-stress-calculations

12	Enerhack E-Academy	District Heating Stress Calculations	4 hours	Professionals in the energy sector, including engineers, designers, utility managers, and policymakers interested in understanding international district heating practices.	•United Nations Environment Programme Experiences with District Heating Across Continents and Countries: Chile, Argentina, Ukraine, Mongolia. •Innovative Solutions in Swedish District Heating Networks. •Wien Energie Solutions in Austrian District Heating Networks (including thermal planning and solar energy integration). •5th Generation District Heating Networks: A Leading Example in the Netherlands.	This course provides an in-depth overview of various approaches to district heating worldwide, delving into design, operation, and environmental impacts. Through engaging case studies, participants will gain insights into successful implementations in different regions, highlighting lessons learned in unique contexts. The course also explores cutting-edge technologies, regulatory frameworks, and energy-efficiency strategies shaping district heating systems across the globe.	Participants will develop a comprehensive understanding of global district heating models, acquiring knowledge of advanced technologies, regulatory frameworks, and energy-efficiency strategies influencing district heating systems worldwide. This knowledge will enable them to effectively apply international best practices to local projects.	https://www.enerhack.courses/course/kaugkte-mujal-maailmas
13	District Heating Training Program by Ramboll	District Heating – The Role and Significance in Society	1.5 hours	Professionals seeking an introduction to the district heating sector	•District heating in Finland and globally •The role of district heating as a form of heating •The development and history of district heating •The importance of utilizing waste heat •District heating prices	This introductory course provides insights into the significance of district heating in sustainable energy production, its evolution, and its global and local roles.	Participants will understand the foundational aspects of district heating, including its history, current applications, and economic considerations.	https://digitaledu.ramboll.com/learning/district-heating-training-program/
14		Principles of District Heating	1.5 hours	Professionals looking to deepen their understanding of district heating principles	•Basic vocabulary of district heating •Principles of district heating •Heating needs •District heating pipelines •District heating substations •Measuring heat •Storing heat	This course delves into the technical aspects of district heating, covering essential components and their functions within the system.	Participants will gain a comprehensive understanding of the operational principles of district heating systems, including infrastructure and energy distribution.	
15		District Heating Networks – Control and Pumping	1.5 hours	Professionals seeking advanced knowledge in district heating network management	•Introduction and concepts •Network pressure losses and pipe sizing •Control and management •District heating pumping •Booster stations •Factors affecting pumping	This advanced course focuses on the control mechanisms and pumping strategies essential for efficient district heating network operations.	Participants will learn to manage and optimize district heating networks, understanding the dynamics of pressure, flow control, and system efficiency.	

16	HSI	District Energy Basics	1 hours	Professionals seeking foundational knowledge in district energy systems	N/A	This course defines district energy, provides examples of situations where district energy is a viable solution, and identifies some advantages and disadvantages of the technology.	•Define district energy •Identify examples in which district energy is a viable solution •Recall the advantages and disadvantages of district heating/cooling	https://hsi.com/courses/district-energy-basics
17	ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers)	District Cooling for Designers and Owners (MENA)	6 hours	Designers responsible for specifying, designing, or installing district cooling systems, as well as owners and operators managing or transitioning to district cooling systems.	•Planning: Understanding the planning process and key stakeholders for successful district cooling system (DCS) implementation. •Central Plant Design: Exploring different types of central plant systems, their applications, and fundamental processes and equipment. •Distribution System Design: Reviewing construction materials for piping, their advantages and disadvantages, and considerations for chilled-water distribution systems. •Building Interfaces: Discussing methods for buildings to interface with DCS, major components involved, and control strategies. •Thermal Energy Storage (TES): Understanding the basics of TES for DCS and its benefits. •Operation and Maintenance: Learning about common issues such as "low ΔT syndrome," corrective actions, and best practices for operation and maintenance from both designer and owner perspectives.	This course provides practical guidance on district cooling systems, covering planning, design, distribution, building interfaces, thermal energy storage, and operation and maintenance. It draws from ASHRAE's publications: District Cooling Guide, Second Edition and Owner's Guide for Buildings Served by District Cooling.	•Recognize different types of central plant systems and their applications. •Understand the benefits of central plant versus stand-alone systems. •Comprehend the basic components of a district cooling system and their interactions. •Appreciate the complexity of the planning process and the necessary stakeholders for success. •Grasp fundamental processes and equipment of the DCS central plant and basic options. •Identify construction materials used for piping and appurtenances, along with their pros and cons. •Understand key considerations for building owners when connecting to a DCS. •Learn methods for building interfaces with DCS, major components involved, and control mechanisms. •Recognize causes of "low ΔT syndrome" and corrective measures. •Understand the basics and benefits of Thermal Energy Storage in DCS.	https://www.ashrae.org/professional-development/all-instructor-led-training/global-training/district-cooling-for-designers-and-owners-mena#:~:text=District%20cooling%20systems%20can%20provide,plant%20capacity%20or%20load%20growth.

18	Engineers Ireland	Fundamentals of District Heating	6.5 hours	Professionals seeking an introduction to district heating, including engineers, policymakers, and stakeholders involved in the development and implementation of heat networks.	•What is district heating •Types of district heating networks •Why Ireland is adopting district heating—the benefits and supporting policies •Stages of developing a district heating network •Heat planning—purpose, methods, and tools for identifying district heating opportunities •Stakeholder engagement—identifying, prioritizing, and communicating with stakeholders •Assessing the feasibility of potential networks—key elements of techno-economic analysis •Key concepts influencing the design and cost of heat networks •Introduction to methods of optimizing building heating systems for connection to district heating networks •Business model options for district heating projects •Projects currently under development in Ireland •Sector integration potential for heat networks as a means of energy storage and grid balancing	This course provides an introduction to district heating, covering its key concepts and fundamentals across the main stages of heat network development—from initial heat planning and policy to business case development, design, and construction. It addresses the role of district heating in decarbonizing Ireland's heat sector and reducing dependence on imported fossil fuels. The course also discusses the benefits of district heating, supporting policies, stages of developing a district heating network, heat planning methods, stakeholder engagement, feasibility assessment, key design concepts, business model options, and current projects in Ireland.	•Understand what a district heating network is and its evolution. •Learn the benefits of district heating and its significance in Ireland's decarbonization efforts, as reflected in local, national, and EU policies. •Grasp key concepts in the design and optimization of district heating networks and their impact on project feasibility. •Identify areas suitable for district heating. •Learn effective stakeholder engagement strategies for district heating projects. •Become familiar with various business models for developing projects. •Gain insights into innovative networks currently being developed in Ireland. •Understand the potential role of district heating in enabling greater renewable integration into the electricity grid through sector integration.	https://www.engineersireland.ie/Professionals/CPD-Careers/CPD-training-courses-by-theme/The-Engineering-Fundamentals/Fundamentals-of-District-Heating
19	Heatweb Solutions	District Heating Awareness	1-day	N/A	N/A	This course provides an overview of design principles, commissioning options, and network management for district heating systems.	N/A	https://www.heatweb.co.uk/district-heating-training-course/
20	Heatweb Solutions	District Heating Installer	2-day	N/A	N/A	This course delves deeper into design principles, commissioning options, and network management, offering practical hands-on training for district heating systems.	N/A	https://www.heatweb.co.uk/district-heating-training-course/
21	Heatweb Solutions	Thermal Integration, District, and Renewable Systems	2-day	N/A	N/A	This course covers topics such as district heating design, HIU installation, commissioning and maintenance, and advanced control strategies for district heating.	N/A	https://www.heatweb.co.uk/district-heating-training-course/

22	Copenhagen Centre on Energy Efficiency	District Energy Systems Training	4.5 hours	The District Energy Systems Training program is designed for individuals from the public sector and civil societywho are involved in district energy systems (DES) planning. It is suitable for beginners as it does not require prior knowledge, making it accessible to those looking to understand the fundamentals of DES, including its planning, implementation, and best practices.	•Introduction to District Energy: Covers the fundamentals of DES, including context, definitions, benefits, planning steps, and best practices. •District Energy Planning: Focuses on the planning process, stakeholder engagement, and integration of DES into local energy strategies. •Energy Mapping and Data Collection: Emphasizes the importance of data collection and energy mapping in identifying opportunities for DES. •Business Models in District Energy Systems: Explores various business models to ensure the viability of DES projects for both heating and cooling systems. •Integrating Low-Temperature Renewables in DES: Provides guidance on incorporating low-temperature renewable energy sources into DES. •Case Studies: Presents real-world examples of DES implementations across countries like China, Chile, India, Argentina, Denmark, Sweden, and France.	This training program offers valuable insights into key aspects of DES planning, providing tools and skills for successful implementation at city and district levels. It includes real-world case studies to illustrate practical applications.	Participants will gain a comprehensive understanding of DES, including their role in decarbonizing the building sector, benefits across various stakeholders, key planning steps, and best practices from global case studies.	https://c2e2.unepccc.org/collection/district-energy-systems-training/
23	Euroheat & Power in collaboration with the Covenant of Mayors – Europe	Training Programme on District Heating & Cooling	June 3, 2025, from 09:00 to 20:30 CEST	Local authorities, municipality representatives, and government officials	•District heating decarbonisation strategies •Innovative financing approaches •Stakeholder engagement	N/A	N/A	https://eu-mayors.ec.europa.eu/en/2nd-edition-of%20the-crash-course-for-cities-training-programme-on-district-heating-and-cooling
24	Energy and Climate Academy	District Heating: Energy Efficiency for Urban Areas	3-day course with site visits	Planners, advisers, engineers, politicians, economists, technicians, managers, and new employees in the district heating industry from public and private sectors, organizations, cities, and regions seeking a comprehensive introduction to district heating.	•History and development of district heating •Planning and business models •Energy sources and modern piping systems •Operation and optimization •End-user installations and metering •Future developments in district heating •Implementation strategies	This course provides an in-depth introduction to modern district heating systems, focusing on planning, development, and implementation. Participants will gain insights into various aspects of district heating, including energy sources, piping systems, and future trends. The program includes site visits to modern utilities and sessions with experienced lecturers from the industry.	Participants will acquire a thorough understanding of district heating systems, enabling them to engage effectively with external consultants and stakeholders, and make informed decisions in planning and implementing district heating projects.	https://energyandclimateacademy.com/district-heating/

25	Energy and Climate Academy	Renovation & Extension of District Heating Systems	N/A	Professionals involved in the renovation and expansion of existing district heating networks.	N/A	This course focuses on the strategies and best practices for renovating and extending district heating systems to improve efficiency and service delivery.	Participants will learn about the latest techniques and considerations in upgrading and expanding district heating infrastructures.	https://energyandclimateacademy.com/district-heating/
26	Energy and Climate Academy	A Kickstart to the District Heating Business	Online and on-demand training course	Individuals and organizations new to the district heating sector or considering entering the market.	•Introduction to district heating •Planning and development •Production methods •Modern piping systems •End-user considerations •Future trends •Business models and stakeholder engagement •Virtual site visit to a district heating company	This online course offers a comprehensive introduction to the district heating business, covering essential topics from planning and production to modern technologies and business models. It includes video lectures and a virtual site visit to provide practical insights.	Participants will gain foundational knowledge of the district heating industry, enabling them to understand key concepts and engage with stakeholders effectively.	https://energyandclimateacademy.com/district-heating/
27	VNG (Society Dutch of Municipalities)	Kickstart in de energietransitie (Kickstart in the energy transition)	2 days	Professionals working with municipalities in energy transition	local heat transition and sustainable utility buildings; broad introduction on the energy transition; the energy system of the future	Physical attendance in groups at VNG location		https://vng.nl/artikelen/2-daagse-masterclasses-kickstart-in-de-energietransitie
28	TVVL	Warmtenetten in 2 dagen (DHC grids in 2 days)	2 days	Employees working with engineering companies, energy companies, municipalities, DHC organizations, project developers and housing corporaties	what is DHC? policy, legislation, current developments new developments sustainable heat (supply/sources) and process management new developments sustainable DHC supply via demonstration projects projectphases DHC projects DHC transport systems: from design to execution systems, materials and connections development and DHC	2 consecutive days of training, supported with background materials via electronic learning environment	After having completed this course: you can ask critical questions regarding execution and adaptation of DHC grids you make basic calculations you provide advise as to how to use DHC and labels you provide argumented advise on energy savings measures and sustainable DHC grids you participate in and advise on cooperations and contracts you can do feasibility studies including financial calculations	https://tvvl.nl/cursus/warmtenetten-in-2-dagen/
29	TVVL	Collectieve warmtepompen woningbouw (Collective heat pumps housing projects)	3 days	employees in installation/engineering, developers, project managers or advisors	De course consists of 5 phases: 1.Programme phase 2. Design phase 3. Development phase 4. Execution phase 5. Exploitation/management phase Topics are among others: individual vs. collective heat pumps, reversible or irreversible heat pumps, distribution installation, heat loss, circulation grid, hot water and systems integrations	Physical attendance in group at TVVL location		
30	Witteveen en Bos	Cursus Warmtenetten	3 days	beginners				https://www.witteveenbos.com/nl/nieuws/cursus-warmtenetten-een-onmisbare-schakel-in-de-energietransitie/

31	Deltares	Training designing 4th + 5th generation DHC grids	2 days	beginners				https://academy.deltares.nl/nl/-/cursus-ontwerp-van-open-en-duurzame-warmtenetten-theoriedagen-2023
32	NIWT (Warmtetransitiemakers)	Multiple courses	1 to 5 days	beginner + advanced				https://niwt.nl/aanbod/
33	VNG	Masterclass energy transition	2 days	beginners				https://vng.nl/artikelen/tweedaagse-masterclasses-kickstart-in-de-energietransitie
34	Fakton	Basic training heat transition	2 days	beginners				https://www.fakton.com/wp-content/uploads/2023/07/Fakton-Intensives_inclusief-gemeentelijke-rolneming-versie-170723.pdf
35	Vereniging Warmtepompen							
36	Warmteklas	Warmteklas (District heating class)	2 days	beginner + advanced				www.warmteklas.nl
37	PHOE	Multiple levels, courses take 11 half-day modules	11 days	beginner + advanced				https://phoe.nl/
38	Bestuursacademie/ Fontys hogeschool	23 different courses	4 days to 2 years	beginner + advanced				https://www.bestuursacademie.nl/zoekresultaten.html?q=energie
39	KIWA	6 different courses	2 to 23 days	beginner + advanced				https://www.kiwa.com/nl/nl/services/training/opleiding-energietransitie-en-duurzame-energie/?gclid=Cj0KCQjwtJKqBhCaARIsAN_yS_IMfsd5dkGeCU-ibxvxv6wa2K5OWtMmfcPiWtgeibYZiCoUGB4U2gAaAkTCEALw_wcB
40	Universiteit Groningen	Succevolle energietransitie met multidisciplinaire aanpak (successful energy transition with multidisciplinary approach)	5 days	beginners				https://www.nebs.nl/
41	InHolland	Opleiding Energietransitie (training Energy transition)	11 days	beginnes				https://www.inholland.nl/academy/opleidingen/energietransitie/energietransitie/
42	OnzeJoost	Traineeship Duurzaamheid/Energietransitie (Traineeship Sustainability/Energy transition)	8 days	beginners				https://www.onzejoost.nl/leerwerktrajecten/traineeship-beleidsmedewerker-duurzaamheid-energietransitie/
43	Hogeschool Utrecht	Integraal manager energietransitie (Integral manager energy transition)	17 days	beginners				https://www.hu.nl/deeltijd-opleidingen/integraal-manager-energietransitie
44	Euroforum	Adviseur Energietransitie (Consultant Energy transition)	5 days	beginners				https://www.euroforum.nl/energie/opleiding-adviseur-energietransitie/#programma
45	Berenschot Academie	Aimed at cooperation in the energy industry		beginners				https://www.berenschot.nl/opleidingen-en-trainingen/ketenregie-in-de-energietransitie

46	Berghauser	Basiscursus Duurzaamheid en energie, niet alleen energie (Basic course Sustainability and energy, not only energy)	1 to 3 days	beginners				https://www.berghauserpontacademy.nl/aanbod/cl960/basiscursus-duurzaamheid-en-energie-/?gclid=Cj0KCQjwtJKqBhCaARIsAN_yS_laE3NvSr-Z9rBbgt4vgGrW_csj85roHzL68RMkNywNsTrmzDdxhQMaAudMEALw_wcB#inhoud_button
47	Scobe Academy	Projectleider Energietransitie (Project manager Energy transition)	4 days	beginners				https://scobe.nl/opleidingen/projectleider-energietransitie#programma
48	Hanze Hogeschool	Inleiding in de energietransitie (Introduction into the energy transition)	4 days	beginners				https://www.hanzepro.nl/alle-opleidingen/techniek-opleidingen/energie/inleiding-in-de-energietransitie/
49	Techniek Nederland							veel MBO opleidingen, geen overheidsrichting
50	Niemanacademie	lokaal warmtenet (local DHC grid)		beginners				https://niemanacademie.nl/training/lokaal-warmtenet/
51	Hogeschool Zeeland							
52	Hogeschool HAN	Duurzame Energietechniek (Sustainable Energytechnology)	15 days	gevorderden				https://www.han.nl/opleidingen/cursus/duurzame-energietechniek/
53	Hogeschool Avans	Energietransitie in de praktijk (Energy transition in practice)	14 days					https://www.avans.nl/studeren/cursussen/energietransitie-in-de-praktijk
54	Deltares	Cursus: Ontwerp van open en duurzame warmtenetten (Course: Design of open and sustainable heat grids)	3 dagen	minimaal HBO	In deze cursus worden alle aspecten behandeld om een duurzaam warmtenetwerk te ontwerpen en te beheren.			https://www.deltares.nl/nl/academy/ontwerp-van-open-en-duurzame-warmtenetten/#:~:text=Het%20doel%20van%20de%20cursus
55	Lexlumen	De juridische ins en outs van warmtelevering via een duurzaam warmtenet (Legal ins and outs of DH via a sustainable heat grid)	1 day	legal advisors		-		https://lexlumen.nl/cursus/de-warmte-en-woningwet-in-het-kader-van-duurzame-energie-projecten/
56	WR-college	Monteur gas, water en warmtedistributie (mechanic in gas, water and heat distribution)	1 jaar	beginners in blue collar			-	https://wr-college.nl/opleidingen/
57	Avans+	Master of pipeline technology	2,5 jaar	bachelor degree				https://avansplus.nl/opleidingen/techniek-bouw/master-of-pipeline-technology-mpt/master-of-pipeline-technology-mpt
58	SBB	Benutten en toepassen van restwarmte (Using and applying waste heat)	?	beginners in blue collar				https://kwalificatie-mijn.s-bb.nl/keuzedeel/benutten-en-toepassen-van-restwarmte/cmVzdWx0YWF0VHlwZT00O2Rvc3NpZXJJZD0zMjk2O2t3YWxpZmljYXRpZUlkPTA=
59	ROVC/KWR/JouwOpleiding	Vakmanschapsroute afleversets (Craftsmen route heat delivery sets)	depends on own profile and pace	beginners in blue collar				https://vakmanschapafleverset.nl/

60		Keuzedeel basis stadswarmte (module basic DHC; available, but not offered)		beginners in blue collar				https://kwalificatie-mijn.s-bb.nl/keuzedeel/basis-stadswarmte/cmVzdWx0YWF0VHlwZT00O2Rvc3NpZXJJZD01NjE1O2t3YWxpZmljYXRpZUlkPTA=
61		Keuzedeel specialist stadswarmte (module specialist DHC; available, but not offered)		advanced in blue collar				https://kwalificatie-mijn.s-bb.nl/keuzedeel/specialisatie-stadswarmte/cmVzdWx0YWF0VHlwZT00O2Rvc3NpZXJJZD01NjE2O2t3YWxpZmljYXRpZUlkPTA=
62	Soma opleidingen	(Eerste) monteur gas-, water- en warmtedistributie (mechanical gas, water and heat distribution)	1 jaar	courses for both beginners and advanced blue collar				https://somabedrijfsopleidingen.nl/cursussen/?_sf_s=warmte
63	ROCs/KW1/Regio College/Zadkine	Aanleggen van warmtetransportleidingen (installation of DCH transportation grid)						https://kwalificatie-mijn.s-bb.nl/keuzedeel/aanleggen-van-warmtetransportleidingen/cmVzdWx0YWF0VHlwZT00O2Rvc3NpZXJJZD00MzY1O2t3YWxpZmljYXRpZUlkPTA=
64	MBOs/GOA Infraopleidingen	Monteur gas-, water- en warmtedistributie (mechanic gas, water and heat distribution)	1-2 jaar	beginners in blue collar				https://www.kiesmbo.nl/opleidingen/bouwen-wonen-en-interieur/infra/monteur-gas-water-of-warmtedistributie
65	MBOs/GOA Infraopleidingen	Eerste monteur gas-, water- en warmtedistributie	2-3 jaar	advanced in blue collar				https://www.kiesmbo.nl/opleidingen/bouwen-wonen-en-interieur/infra/eerste-monteur-gas-water-of-warmtedistributie
66	NCOI	Energietransitie (Energy transition)	3 days	beginners				https://www.ncoi.nl/opleiding/energietransitie.html?open=brochure-lite&course=0da9ad41-86b1-405d-88d4-20b97fde5539&tab=studieprogramma
67	NPLW/DWTM	Ondersteuningsprogramma warmteprogramma's (support program heat programs)	several modules over the course of 1 year	beginners + advanced				https://www.nplw.nl/warmteprogramma/ondersteuningsaanbod#inhoud-van-de-sessies
68	Omgevingsdienst Nederland	Duurzaamheid en energie (Sustainability and energy)	3 days	beginners + advanced				https://omgevingsdienstnederland.nl/opleiding/duurzaamheid-en-energie/?gclid=Cj0KCQjwtJKqBhCaARIsAN_yS_I64VlekDrzJPUnU-zQZodKoga_h73EwpicrcmOJMUvhQ1piJbBBVAaAg0VEALw_wcB
69								https://tvvl.nl/cursus/warmtenetten-in-2-dagen-i-2023-2024/

70	AGFW	Grundlagenmodul Fachkraft Fernwärme nach QRT Stufe C (Basic module for district heating specialists)	3 weeks	The modular training concept supports the desire of companies to develop precisely those skills for their employees that are required by the technical regulations to fulfil the technical safety management for the respective field of work and activity.	Programme content - District heating in the energy industry environment o Possible applications o District heating utilisation planning - District heating generation o Fossil/regenerative o Generating plants o Heat storage - Physical and chemical variables and fundamentals of thermodynamics o Physical quantities o Properties of water and vapours o Corrosion o Water treatment o Hydraulic fundamentals of the dimensioning of networks o Fundamentals of pipe statics - Basis of use o Types of heating networks and systems o Protective measures against hazards - Planning the district heating supply system o Planning principles o Temperature ranges and pressure levels o Transport pipes o Distribution and house connection pipes o House and customer systems	Together with DVGW and VDE|FNN, AGFW has developed modular qualification measures for the tasks of network planning and the monitoring of network construction measures.	not indicated	https://www.agfw.de/veranstaltungen/grundlagenmodul-fachkraft-fernwaerme-nach-qrt-stufe-c
71					- Pipe and socket connections o Pipe connections o Sockets and thermal insulation o Testing and documentation - Operation and maintenance of district heating distribution networks and systems o Commissioning and decommissioning o Shutting off o Draining and venting o Work on pipes in operation o Pipe network and system monitoring o Leak detection and determination of water losses o Principles of maintenance and rehabilitation - Civil engineering o Excavations and trenches - Technical regulations o Standards, AGFW regulations, DGUV regulations o FW 1000, requirements for the organisation of companies and the qualification of employees employees o FW 601, Qualification criteria for pipeline construction companies - Occupational safety, environmental and health protection o Specialised occupational health and safety o Safety at work			

72	AGFW	Basic Knowledge of District Heating (Basiswissen Fernwärme)	3 days	The AGFW basic knowledge seminar is aimed at people who have no prior knowledge of district heating technology and regulations.	DAY1 Introduction to Physical Basics Part 1 Physical Basics Part 2 Connection and customer systems Part 1 Connected and customer installations Part 2 Measurement of thermal energy Fluid mechanics and pressurisation DAY2 Piping systems Pipeline construction Water treatment and monitoring Network operation Basics of district heating generation and storage End of the 2nd day DAY3 Introduction to Technical rules Occupational and organisational safety Laws (GEG, AVBFernwärme, FFVAV, WärmeLV) Laws (WPG 1+2) Laws (WPG 3) Lunch break Funding (BEW, Trafoplan, EEG, KWKG, EFRE) Funding (BEG)	This is what the seminar offers: Participants will learn the basic terms and the physical and technical relationships that are important for understanding district heating systems. Participants will gain an overview of the laws and technical regulations that are relevant to the design, construction and operation of district heating systems and to the relationship between suppliers and customers.	The topics covered are District heating technology (Day 1 & 2): Physical and chemical principles, heat generation technology, heat distribution, customer installations and heat metering. Regulations and laws for district heating (Day 3): Work organisation, health and safety, legislation, funding and technical regulations. The seminar does not provide this: The seminar content does not enable the participants to work independently on district heating systems, to plan or to build them. The individual documents (laws, regulations, etc.) are not dealt with in detail. This seminar does not replace the course "Technical basics of local and district heating" and is aimed at a different target group.	https://www.agfw.de/veranstaltungen/24131-basiswissen-fernwaerme-1
73	AGFW together with training providers	Certified distribution network technician in the field of district heating (Geprüfter Verteilnetztechniker im Handlungsfeld Fernwärme)	50 days, extra-occupational/part-time for the duration of 12 months	This programme is for people with a technical/trade qualification in utilities or related sectors who want to develop their career. You can also complete the programme to become a Certified Distribution Network Technician without an apprenticeship.	not specified; extra-occupational, 50 days in 12 months, Certified distribution network technicians play an important role in the utilities sector. Thanks to their in-company training, professional experience and specialised further training, they are very familiar with the manual and technical work processes involved in grid management. Through their work, they help to ensure a reliable supply.	Certified distribution network technicians (IHK) are vital to the utilities sector. Their on-the-job training, professional experience and specialist training make them familiar with the technical processes involved in network management. They help to ensure a reliable supply.	This course enables participants to take on the following tasks in the field of district heating after completing the training programme: - Work in accordance with legal requirements, recognised technical standards and safety, health and environmental protection regulations - Use information and communication technologies - Act according to the principles of cost and customer orientation - Building, operating, maintaining and participating in the planning of networks and systems - Recognising and assessing faults and initiating suitable measures as part of fault management - Creating documentation	https://www.agfw.de/technik-normung/personalentwicklung/bildungsmassnahmen; https://www.swe-akademie.de/akademie/home/Portfolio/gepruefte_r+verteilnetztechniker_in; https://portal.swe-akademie.de/pub/Gepruefte-r-Verteilnetztechniker-in-im-Handlungsfe/id/TP-0981

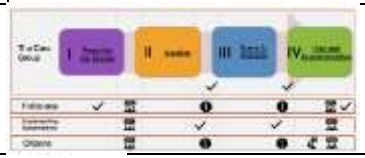
74	AGFW together with training providers	Grid technician (Netzmeister)	6 weeks	DHC staff with professional experience	Programme The examinations consist of two parts: 1. district heating technology (written) 2. management/personnel (oral) The contents of the examination are based on the requirements of the legal regulation 'Certified Network Manager' and thus form the basis of the course. The fields of activity focus on the following: District heating technology - Planning/construction of district heating supply networks - Operation of district heating supply networks - Maintenance of district heating supply networks Field of action Management and personnel - Personnel management - Personnel development - Management systems	Participants are prepared for the IHK examination to become a certified network manager in the field district heating in accordance with the special legal regulations of the responsible examining body.	Participants are prepared for the IHK examination to become a certified network manager in the field of district heating in accordance with the special legal regulations of the responsible examining body. Basic qualifications: legal and business management awareness; application of information, communication and planning methods; co-operation within the company; consideration of scientific and technical principles	https://www.brbv.de/schulungsdetails.html?id=5124
75	Hochschule Nordhausen (supported by AGFW)	Certificate Programme (Study Course) Distribution Grid Technology and Grid Operation (Zertifikatsstudiengang (Studienkurs) Verteilnetztechnik und Netzbetrieb)	2 semester, 13 ECTS points	The certificate programme is aimed at specialists from the energy and water industry as well as engineers who wish to expand their knowledge in the field of district heating and qualify for management positions.	The modules cover topics such as network planning, maintenance, operations management and technical management.	The certificate programme offers practice-oriented content, which is supplemented by laboratory work and practical phases in companies.		https://www.hs-nordhausen.de/studiengaenge/netztechnik-und-netzbetrieb-fernwaerme/
76	AGFW	Technical Basics of Local and District Heating (Technische Grundlagen der Nah- und Fernwärme)	5 days	The AGFW offers a five-day training course for newcomers and career changers.	The course covers the basics of planning, building and operating local and district heating systems in the areas of generation, network and customer systems. Practical examples illustrate the diverse possibilities of district heating. Cases of damage will show the consequences that can result from a lack of expertise.	District heating systems are a major part of the important tools for shaping the heating transition in Germany. The increased expansion and densification of heating networks is therefore leading to a need for the training and further education of expert fitters, master craftsmen and engineers.	The focus is on the technical aspects, accompanied by the relevant legal and safety requirements.	https://www.agfw.de/veranstaltungen/24128-technische-grundlagen-der-nah-und-fernwaerme-1
77	AIRU	District heating networks: planning	2 days	Engineers, Technicians, Planners	1. Introduction to district heating 2. Identifying thermal demand 3. Local heat sources and recovery systems 4. Decision-support tools	The course focuses on the planning phase of district heating systems. It covers the process of identifying thermal demand in the area, evaluating available local heat sources, and assessing relevant recovery and production plants. The course also introduces decision-support tools and multidisciplinary skills needed to successfully plan a district heating system.	Participants will be able to correctly identify the thermal demand in a specific area, evaluate available local heat sources, and design effective district heating systems with the support of decision-making tools.	https://www.airu.it/wp-content/uploads/2024/11/Centro-di-formazione-AIRU-catalogo-2025.pdf

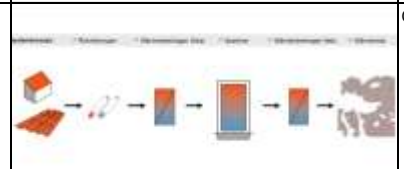
78	AIRU	Distrct Heating Network: Design	2 days	Engineers, Urban Planners, Energy Consultants	1. Design Principles and Standards 2. Network Sizing and Case Studies	Module 1: This module focuses on the key principles of district heating network design. It covers relevant standards and regulations for design. Module 2: Participants will learn how to correctly size district heating networks, utilizing design tools and studying real-life case studies to apply theoretical knowledge in practical scenarios.	Participants will be able to design district heating systems that meet long-term reliability standards, use design tools for accurate sizing, and apply knowledge from case studies to real-world scenarios.	https://www.airu.it/wp-content/uploads/2024/11/Centro-di-formazione-AIRU-catalogo-2025.pdf
79	AIRU	District Heating Networks: Implementation	2 days		1. Pipe Materials and UNI Standards 2. Best Practices for Installation	Module 1: The aim of the course is to provide information on the materials to be used for piping with knowledge of the relevant indications dictated by UNI standards Module 2: The course aims to provide guidelines on site installation and safety aspects	Participants will be able to select appropriate materials, understand regulatory requirements, and apply best practices for safe and efficient district heating network installation.	https://www.airu.it/wp-content/uploads/2024/11/Centro-di-formazione-AIRU-catalogo-2025.pdf
80	AIRU	District Heating Networks: Operation & Maintenance	2 days	Engineers, Technicians, Facility Managers	1. Network Regulation and Leak Detection 2. Maintenance Standards and Water Quality	Module 1: This module provides an analysis of how to regulate key network parameters, including pressurization, temperature control, and pump regulation, to ensure optimal system performance. It also explores advanced techniques for leak detection to identify and address potential failures. Module 2: Focuses on maintenance activities required to keep district heating networks efficient and compliant with industry regulations. It covers the inspection protocols outlined in the Italian technical guidelines (PdR CTI), emergency response strategies, and best practices for maintaining high water quality to prevent corrosion and inefficiencies in the system.	Participants will be able to regulate network parameters, detect leaks using advanced methods, conduct inspections in compliance with PdR CTI guidelines, and ensure optimal water quality in district heating systems.	https://www.airu.it/wp-content/uploads/2024/11/Centro-di-formazione-AIRU-catalogo-2025.pdf
81	AIRU	District Heating Network: Heat Metering	1 day	Engineers, Technicians, Facility Managers	Heat Metering for Energy Sale and Functional Verification	This course will provide a comprehensive understanding of heat metering, focusing on the regulatory framework, types of metering instruments, and their correct application. It will emphasize the Prassi di Riferimento on "functional verifications" produced by the Italian Technical Committee (CTI), guiding participants on how to comply with ARERA requirements for accurate energy measurement and effective system management.	Participants will be able to understand the regulatory requirements for heat metering, select the appropriate instruments, and perform functional verifications to ensure compliance with ARERA standards.	https://www.airu.it/wp-content/uploads/2024/11/Centro-di-formazione-AIRU-catalogo-2025.pdf

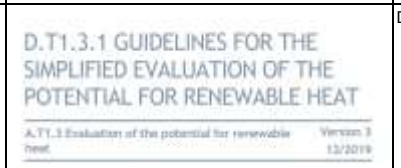
82	A2A CS	T-LAB Maintenance		Maintenance technicians, plant installers, and thermotechnicians	1. Overview of Substations & Maintenance Practices 2. Heat Exchanger Components and Practical Exercise	This course provides a general presentation of substation configurations, operating schemes, and the various models and types of components. It covers technical characteristics, heat exchange theory with sizing calculation examples, as well as assembly/disassembly and regeneration of heat exchanger plates. Finally, a practical exercise on the heat exchanger.	Participants will be able to understand substation configurations and maintenance practices, perform sizing calculations, and execute practical exercises on heat exchanger maintenance to optimize system performance.	https://www.a2acaloreservizi.eu/servizi/corsi-di-formazione https://my.foim.org/event-details/corso-di-specializzazione-sul-sistema-di-teleriscaldamento-giornata-corso-706.xhtml
83	A2A CS	T-LAB Designer		Designers, Constructors, engineers, architects, surveyors, and experts	1. New Technologies in District Heating 2. Regulatory Aspects and Opportunities for Redevelopment	This course provides detailed information and insights on new district heating technologies along with the regulatory framework. It highlights district heating as a strategic opportunity for redeveloping existing buildings and for new urban districts where district heating networks are available.	Participants will be able to assess and integrate new district heating technologies, understand regulatory aspects, and identify opportunities for building redevelopment and urban planning projects in the context of district heating.	https://www.a2acaloreservizi.eu/servizi/corsi-di-formazione
84	A2A CS	T-LAB Manager		Condominium administrators	1. Market Opportunities and Territorial Offers 2. Pricing Strategies and Contractual Aspects	This course focuses on district heating as an opportunity for redeveloping thermal systems in managed buildings. It examines available territorial offers, the specific opportunities present in the market, and discusses advantages, pricing strategies, and contractual aspects. The training provides content situed to the needs of condominium administrators managing building thermal systems.	Participants will be able to evaluate the economic and contractual opportunities of district heating, understand pricing strategies, and manage the redevelopment of thermal systems in their buildings, thereby optimizing energy efficiency and cost-effectiveness.	https://www.a2acaloreservizi.eu/servizi/corsi-di-formazione
85	A2A CS	T-LAB Customer		End customers	Visits to District Heating Plants and Informative Events	This course includes guided visits to district heating plants and organizes events and informational activities on district heating	Participants will be able to appreciate the practical operation of district heating systems, understand their environmental benefits, and evaluate the advantages offered by district heating from a customer's perspective.	https://www.a2acaloreservizi.eu/servizi/corsi-di-formazione
86	Ecoline Energard							
87	Fiper	Webinar: Water Management in District Heating	1 day	Engineers, Technicians, Facility Managers, and Interested Stakeholders	1. UNI/PdR 93.2:2020 Water Quality Standards 2. Water Treatment for Technological Circuits 3. Case History and Best Practicest	This webinar emphasizes the crucial role of water in district heating systems. The session covers the UNI/PdR 93.2:2020 standard on water quality, techniques for water treatment in technological circuits, and practical case studies and best practices.	Participants will be able to understand and apply water quality standards, implement effective water treatment strategies, and evaluate case histories to optimize the performance and maintenance of district heating systems.	https://www.fiper.it/fiper-webinar-formazione-per-il-futuro-la-qualita-dellacqua-del-teleriscaldamento/
88	Brugg Pipes							https://www.bruggpipes.com/it/corsi-di-formazione/?utm_source=chatgpt.com

89	Bio Wärme Tirol	KEK Training for Heating Plants Operators and Attendends	16 h per module	Heating Attendends and operators	Module 1: Fuel and Combustion, Climate Justice and Environmental Protection Module 2: Boiler Technology, Heat Recovery, Electrical, Measurement and Control Engineering, Occupational Safety Module 3: Hydraulics, District Heating Plant Systems, District Heating Network, Network Water as well as Practical Training in Network Construction and District Heating Plant Operation Module 4: Customer Data Collection, Transfer Station, Secondary Systems as well as Practical Training in Customer Installations			https://www.gse.it/servizi-per-te/pa/formazione-per-la-pa/gse-in-forma-la-pa
90	klimaaktiv Heizwerke und Wärmenetze	Seminar für Expertinnen und Experten für Biomasseheizwerke und Wärmenetze (Training for quality managers for biomass DH networks and plants)	3 days	Experienced planners, operators and funding agencies		conceptual design, planning, operation, and optimization of the heating plant and district heating network, current technological developments. Furthermore, the seminar covers the implementation of quality management and funding procedures. The seminar also serves as a fundamental requirement for obtaining the qualification to act as a Quality Managers for biomass DH heating		https://www.klimaaktiv.at/fachpersonen/siedlungen-quartiere/waermenetze https://www.aee-intec.at/qm-heizwerke-expertenseminar-biomasseheizwerke-und-waermenetze-v330

ANNEX III - Inventory of Collected Tools

No	Tool	Picture	Type of tool	Language	Target group	Geographcial applicability (International, national, local)	Availability (open access, commercial)	Description	Link
1	Waste Heat Toolbox		Calculation tool	English	Planners, utilities	N/A	open access	The Toolbox is aimed at supporting entrepreneurs and investors who would like to discover untapped potential of waste heat, understand technological aspects of its recovery into usable energy and get familiar with formal, administrative and financial issues of starting a new business based on waste heat.	https://www.waste-heat.eu/waste-heat-toolbox
2	THERMOS		Calculation tool	English	Planners, utilities	Europe	open access	The tool enables the modelling of heating and cooling network systems and their optimal design. It includes a wide range of functions such as the modelling of pipe and civil engineering costs as well as demand models.	https://www.thermos-project.eu/thermos-tool/tool-access
3	QM Toolbox		Documents	English, Croatian, German, Italian, Polish, Slovenian	Regulatory bodies, Ministries, regional ad-ministrations, energy agencies, technical managers of the utilities, designers and planners	international	open access	Several documents on the quality management of heating network systems are available. These tools support the more efficient realisation and operation of heating networks with a variety of renewable energies.	https://programme2014-20.interreg-central.eu/Content.Node/ENTRAIN.html
4	Training Toolbox		Training material	English	Planners, Public Authorities, utilities, investors	N/A	open access	N/A	https://programme2014-20.interreg-central.eu/Content.Node/ENTRAIN.html#TRAINING_TOOLBOX
5	Heat Planning Toolbox		Tool	English and German	Planners, Public Authorities, utilities	N/A	N/A	The toolbox offers tools and advices for a full heat planning process, from the initial steps to the mapping, going then to the analysis and comparison of the scenario, to finally close with the planning and implementation of the most relevant measures.	https://planenergi.eu/projects/heatplan-toolbox/

6	AGFW Guidelines for DH transformation planning		Document	German	Planners, Public Authorities	N/A	N/A	The document summarises helpful tips, tried-and-tested ideas and procedures that address the creation of transformation plans (based on German funding guidelines). It essentially addresses the topics of actual state analysis, determination of potential, target state, path to greenhouse gas neutrality and cost framework.	https://www.agfw.de/transformationsplan
7	The European Waste Heat Map		Web map/Data repository	English	Planners, utilities	N/A	N/A	This web map is a publicly available data repository with information on different waste heat sources from various projects.	https://aau.maps.arcgis.com/apps/webappviewer/index.html?id=789b7faef30148bda20d320de9455919
8	The sEEnergies Open Data Hub		Data repository	English	Planners, utilities	N/A	N/A	This is a platform for exploring and downloading GIS data produced in the sEEnergies-Project and presented in the Pan-European Thermal Atlas (Peta 5.2) web map. Data can be accessed via APIs and downloaded to GIS formats.	https://s-eenergies-open-data-euf.hub.arcgis.com/
9	The Pan-European Thermal Atlas (Peta 5.2)		Web map	English	Planners, utilities	N/A	N/A	This web map is a publicly available data viewer with various information on heating and cooling sector parameters developed in the Heat Roadmap Europe project series (including the sEEnergies project).	https://www.seenergies.eu/peta5/
10	Hotmaps		Calculation tool	English	Public administrations, energy agencies, district heating associations	N/A	N/A	Hotmaps is a software for studying the integration of RES in district heating systems by providing datasets as well as tools for estimating demand reduction scenarios and analysing dispatch and related performance indicators for various supply portfolios under different conditions.	https://www.hotmaps.eu/
11	EnergyPRO		Calculation tool	English	Planners, utilities	site specific	commercial	energyPRO is the a comemrcial software for modelling, optimising, and simulating ditrict energy projects with cross sectional optimization including electricity, PtX, hybrid and thermal energy (such as process heat, hot water and cooling).	https://www.emd-international.com/energypro/
12	ScenoCalc District Heating		Calculation tool	German	Planners, utilities	local	open access	This Excel-based calculation tool can be used to calculate the useful solar heat yield of solar thermal systems integrated into heating networks. A preset parameter selection can be used, but also own data can be implemented.	https://www.scfw.de/

13	Simple Heat Pump calculation		Calculation tool	English	Planners, utilities	local	N/A	Excel calculation tool offers the economics calculation of electrical heat pumps in district heating networks. Its purpose is to evaluate the cost-effectiveness of a heat pump in an already existing grid with a solar thermal plant.	https://www.res-dhc.com/en/know-how/toolbox/
14	IEA DHC - TS5 Annex - Integration of Renewable Energy Sources into existing District Heating and Cooling	IEA DHC	Documents	English	Planners, utilities, energy agencies, district heating associations	International	Open access	Deliverables outcoming from IEA DHC TS5 working group with the aim providing know how on RES DHC project development. ST A - Potential assessement methodologies and technological factsheets ST B - transformation guidelines	https://www.iea-dhc.org/2019-2024-annex-ts5
15	Bioraise	Bioraise 	Calculation tool	English	Planners, utilities	Europe	open access	GIS calculation tool for the estimation of biomass potential in a user defined area, according to the typology of forest species.	http://bioraise.ciemat.es/Bioraise/home/main
16	Entrein Interreg EU - GUIDELINES FOR THE SIMPLIFIED EVALUATION OF THE POTENTIAL FOR RENEWABLE HEAT	 D.T1.3.1 GUIDELINES FOR THE SIMPLIFIED EVALUATION OF THE POTENTIAL FOR RENEWABLE HEAT	Document	English	Utilities	N/A	N/A	The guidelines provide an overview of the necessary information that is important for a development of DH projects and their financing. By presenting the most important questions for each key topic, the tool lays the foundation for a potential analysis.	https://programme2014-20.interreg-central.eu/Content.Node/ENTRAIN/Guidelines-for-evaluation-of-renewable-heat-potential-[ENG].pdf
17	CE - Heat Interreg EU - Manual for the estimation of regional waste heat potential	 waste heat Manual for the estimation of regional waste heat potential	Document	English	Planners, utilities	Central Europe	N/A	how waste heat potential in a region can be estimated in an easy manner.The only data required are the official energy statistics for industry sectors of the region of interest and specified conversion factors. The categorisation of industry sectors is standardised across all European countries. All countries should have a national and/or regional statistic report on energy consumption by sector that can be used to estimate the waste heat potential in the region. In order to estimate the potential in a given sector, a specific conversion factor needs to be multiplied with the total energy consumption figure for a specified sector.	https://www.waste-heat.eu/waste-heat-potential/manual-for-the-estimation-of-regional-waste-heat-potential

18	hot-SPOT model		Calculation tool	Italian	Planners, utilities	national, international, local	open access	GIS based model aimed at assessing the national techno-economic potential of district heating (DH) based on renewables and excess heat sources. The model uses an optimization approach to match heat demand and heat sources at large scale level, while keeping a high degree of spatial detail.	https://zenodo.org/records/4284531
19	REWARDHeat project, Results & Deliverables		Calculation tools, Guidelines	English	Planners, utilities	International	open access	The overall objective of REWARDHeat is to demonstrate a new generation of low-temperature district heating and cooling networks that will be able to recover renewable and waste heat, available at low temperature. Among public available material there are a tool box and several guidelines	https://www.rewardheat.eu/en/Results-%26-Publications/Deliverables
20	Danish energy agency catalogue		Document	English	Planners, utilities	International	N/A	Technology Data catalogue includes technology data for technologies for centralized and decentralized production of electricity and district heat	https://ens.dk/en/our-services/projections-and-models/technology-data/technology-data-generation-electricity-and
21	City Energy Analyst		Calculation tool	English	Planners	International	open access	The City Energy Analyst (CEA) is an urban building energy modeling (UBEM) platform and one of the first open-source initiatives of computation tools for the design of low-carbon and highly efficient cities.	https://www.cityenergyanalyst.com
22	GeoDH Map		Web map/Data repository	English	N/A	International	open access	This system presents the geothermal resource assessment and highlights the areas where potential for geothermal district heating exists. Based on currently available information in terms geological data, already operational district heating systems, and heat demand, it shows the potential in the 14 project countries: Italy, France, Germany, Netherlands, Ireland, United Kingdom, Slovakia, Slovenia, Czech Republic, Romania, Bulgaria, Poland, Denmark, and Hungary.	http://geodh.eu/geodh-map/
23	Emb3rs	EMB3Rs	Toolbox	English	N/A	International	open access	The EMB3Rs platform has been designed to evaluate the reuse and trade of waste Heating and Cooling (HC) in a holistic perspective within an industrial process, energy system environment, or in District Heating and Cooling (DHC) systems under-regulated and liberalized market environment	https://www.emb3rs.eu/platform/

24	Sowhat tool		Toolbox+ guidelines	English	N/A	International	open access	The tool offers the user the ability to understand the potential for waste heat/cooling recovery and use at Manufacturing and Community levels.	https://sowhatproject.eu/sowhat-tool/
25	PILEDHC	N/A	Calculation Tool	English	Planners	International	commercial (TRNSYS environment)	PILEDHC is a dynamic simulation program for the evaluation of low-temperature district heating systems (also called 5th generation). It is based on PILESIM2, to which some components have been added, such as hybrid thermal and photovoltaic (PVT) modules, and a piping network whose length is user-defined, that is necessary for the hydraulic connection between the BHE field and the connected buildings. Thanks to an economic database, it is also possible to estimate the necessary investment, and thus carry out energy-economic analyses.	https://www.supsi.ch/en/geothermal-energy
26	POTENTIAL FOR RENEWABLE HEATING AND COOLING (ENTRAIN)	N/A	Guidelines	English	Public administrations, project developers	N/A	N/A	N/A	https://programme2014-20.interreg-central.eu/Content.Node/ENTRAIN/Guidelines-for-evaluation-of-renewable-heat-potential-
27	COUNTRY HEAT MAPS AND ATLASES (HEAT ROADMAP EUROPE)	N/A	Map	English	Ministries, associations of DH operators, networks of cities and regions	N/A	N/A	N/A	https://heatroadmap.eu/maps/
28	ONLINE PACKAGE FOR VIRTUAL STUDY TOURS (ENTRAIN)	N/A	Videos	Various	Mayors and other representatives of Municipalities, Regions and other Public Authorities, district heating utilities and experts, renewable energy professionals, consumer	N/A	N/A	N/A	https://www.interreg-central.eu/Content.Node/ENTRAIN/Study-tours.html
29	ECONOMICS OF HEAT PUMPS IN DISTRICT HEATING	N/A	Calculation tool	English, Danish (full document with instructions in Danish)	Utilities, technical personnel of Local Authorities	N/A	N/A	N/A	https://www.danskfjern-varme.dk/groen-energi/projekter/drejebog-om-store-varmepumper

30	SOLAR DISTRICT HEATING – PLANT DATABASE	N/A	Database	English	Researchers, technical personnel of Municipalities, utilities, ESCOs, engineering companies and single professionals	N/A	N/A	N/A	https://www.solar-district-heating.eu/en/plant-database/
31	PERFORMANCE ASSESSMENT OF DHC SYSTEMS (WEDISTRICT)	N/A	Document	English	Researchers, technical personnel of the utilities, local, regional and national authorities	N/A	N/A	N/A	https://www.wedistrict.eu/new-publication-performance-assessment-of-district-energy-systems-with-common-elements-for-heating-and-cooling/
32	Solar District Heating in cities	N/A	Guidelines	English, Bulga	Managers of utilities, policy makers at the local, regional and national levels, planners	N/A	N/A	N/A	https://www.solar-district-heating.eu/wp-content/uploads/2018/05/20171116-3-SDHp2m_Implementation-of-SDH-in-Cities-with-
33	Guideline for a spatial multicriteria analysis	N/A	Guidelines	English	Planners, utilities, Public Authorities	N/A	N/A	N/A	https://www.interreg-central.eu/Content.Node/ENTRAIN/A.T3.3-Guideline-MultiCriteriAnalyses.pdf
34	Guide for strategy development	N/A	Guidelines	English	Public Authorities (in charge of the planning processes)	N/A	N/A	N/A	https://www.res-dhc.com/wp-content/uploads/2021/09/RES-DHC_WP3_Task3.1_D3.1_Guideline-for-strategy-development-4.pdf
35	Solar district heating guidelines	N/A	Guidelines	English	Professionals, utilities	N/A	N/A	N/A	https://www.solar-district-heating.eu/wp-content/uploads/2018/06/SDH-Guidelines_update_09.2017.pdf

36	Datacenter map		Location, name and sometimes size of the datacenter	english	N/A	international	open access	Map of datacenter (non complete)	https://www.datacentermap.com/
40	PBL Startanalyse	N/A	Tool to determine optimal solutions per region e.g. heat pump, DHC etc. Includes maps, calculation model, guidelines, etc. Basically a set of tools	Dutch	municipalities and their advisors	national and local	open access	N/A	https://startanalyse.pbl.nl
41	Thermogis	N/A	Web-based geographical information system that shows regional potential for geothermal energy and high-temperature storage in the Netherlands	Dutch	municipalities and companies	national and local	open access	N/A	https://www.thermogis.nl
42	WKO-bodemenergietool	N/A	Web-based geographical tool that shows if WKO (ATES) is allowed and provides an overview of costs and subsidies available	Dutch	municipalities and companies	national and local	open access	N/A	https://wkotool.nl/?page=Bodemenergietool
43	Warmteprojectentool	N/A	web-based tool that shows DHC projects in the Netherlands with filter options on source, project phase, regions and more	Dutch	municipalities and companies	national and local	open access	N/A	https://warmtenetwerk.nl/map/
44	Greenvis Warmtetool	N/A	Tool that shows financial impact of technical, geographical, financial and policy choices	Dutch	municipalities	national and local	commercial	N/A	https://greenvis.nl/diensten/ontwerp-en-energieprestatie/greenvis-warmtetool/

45	DWTM warmteprofielen tool	N/A	Tool to provide insight into user profiles and housing types	Dutch	municipalities	national and local	commercial	N/A	https://warmtetransitiemakers.nl/product/tools-en-trainingen/aanschaf-warmteprofielentool/
46	PBL Vesta Mais	N/A	Energy model for the built environment that shows CO2 impact, energy consumption, investment costs and opportunities of different measures taken, a.o. DHC	Dutch	municipalities	national and local	open source	N/A	https://www.pbl.nl/publicaties/vesta-ruimtelijk-energiemodel-voor-de-gebouwde-omgeving-data-en-methoden
47	CEKER	N/A	Model that shows end user costs of different sustainable heat options	Dutch	municipalities	national and local	unclear	N/A	https://ce.nl/method/ceker/
48	Design Toolkit	N/A	Software to help designers with designing future-proof DHC grids	Dutch	municipalities, DHC suppliers and engineers	national	open source	N/A	https://www.warmingup.info/designtoolkit
49	Rekenmodel potentie aquathermie	N/A	Tool that helps to show potential of aquathermal energy	Dutch	municipalities	national and local	commercial	N/A	https://ekwadraat.com/nieuws/rekenmodel-potentie-aquathermie/