Deliverable 3.1 Report on existing resources

Supporting South Europe municipalities in the definition of Sustainable Local Heating and Cooling Plans

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ABREVIATION AND ACRONYMS

Plan4COLD - Supporting South Europe municipalities in the definition of Sustainable Local Heating and Cooling Plans

RES: Renewable Energy Sources

DHC: District Heating and Cooling

H&C: Heating and Cooling

NPI: Non-Public Investor

BEIS: Department for Business, Energy and Industrial Strategy

EE: Energy Efficiency

RESHC: Renewable Energy Sources for Heating and Cooling

SLHCP: Sustainable Local Heating and Cooling Plan

TECs: Thermal Energy Communities

EHPA: European Heat Pump Association

EPC: Energy Performance Certificate

SCE: Energy Certification System

ABSTRACT

This report presents an assessment of existing tools and methodologies that support municipalities in Southern Europe in defining Sustainable Local Heating and Cooling Plans (SLHCPs). Developed within the Plan4COLD project, this analysis focuses on tools addressing both heating and cooling (H&C) and those integrating Geographic Information Systems (GIS) for spatial energy planning.

The study categorizes the identified resources into five groups–planning software, building energy simulation tools, renewable energy simulation tools, databases, and other relevant methodologies. Each resource is evaluated against 13 predefined criteria, including applicability, robustness, technical complexity, interoperability, cost, environmental impact assessment, and compliance with regulations. The most promising tools undergo a SWOT analysis, identifying strengths, weaknesses, opportunities, and customization needs.

The findings provide a solid foundation for adapting and integrating selected tools into the next stages of the Plan4COLD project, ensuring their suitability for the specific climatic and regulatory contexts of Southern European municipalities. Additionally, they will support the development of capacity-building materials for municipal stakeholders, fostering effective implementation and replication of SLHCPs across various regions.

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1. INTRODUCTION

Deliverable 3.1 – Report on existing resources, presents a summary of the tools and methodologies identified by the partners from previous initiatives and experiences that can support municipalities in the definition of their SLHCPs within the Plan4COLD project. The focus is on resources addressing both heating and cooling (H&C) and those that are GIS-based, ensuring their applicability to spatial energy planning.

The main objective of this work is to assess a selection of existing tools against predefined criteria established by project partners.

By systematically reviewing and assessing these resources, this report aims to provide a solid foundation for selecting the most suitable tools and methodologies to be integrated into the next Plan4COLD tasks, consisting on the adaptation of the relevant existing resources and tools to the specific geographical-climatic context of Southern Europe municipalities and the development of new resources and tools according to the identified gaps and needs (T3.2 - Customize tools and resources for Southern Europe cities) and the development of capacity building materials to be applied in WP4 and used in replication activities in WP7 (T3.3 - Develop capacity building materials).

2. Types of tools/methods analysed and assessment criteria

2.1 Types of tools/methods analysed

The resources analysed in this document have been categorized into four main groups: **planning software**, **energy simulation tools** (focused on buildings or renewable energy sources – RES), **databases**, and **other relevant resources**. Planning software includes tools designed to support decision-making in local energy planning processes. Energy simulation tools encompass methodologies for modelling energy performance in buildings and assessing the integration of renewable energy systems. Databases provide essential datasets related to energy consumption, climate conditions, and spatial information, which are crucial for informed planning. Lastly, the "other" category includes additional tools and methodologies that, while not fitting strictly into the previous groups, were considered by partners as offering valuable support for energy planning.

2.2 Assessment criteria

The existing resources were assessed according to a set of 13 criteria established by the Plan4COLD project partners, which include the following:

- Applicability
- Robustness
- Suitability for H&C planning
- User friendliness
- Technical know-how required from the users
- Compatibility and Interoperability
- Costs
- Language
- Flexibility and customisation
- Technical Support
- Environmental and Climate Impact Assessment

- Compliance
- Data requirements

For each criterion, various parameters were established to assess the suitability of the tools. For better understanding and visual clarity, each criterion is represented by an icon, and its suitability is indicated by the number of icons assigned.

Applicability

✓✓✓	The tool is highly applicable for planning, is specifically designed for it and is suitable for a wide range of planning tasks
✓✓	The tool is useful for some planning tasks but lacks certain advanced features or flexibility needed for comprehensive planning.
✓	The tool has low applicability for planning, is not specifically designed for it, and its features are not well-suited for planning processes.

Robustness

🌀🌀🌀	The tool is highly reliable and produces accurate, consistent and effective outcomes for the planning process.
🌀🌀	The tool is moderately robust, reliable for most planning tasks but may face limitations under certain conditions
🌀	The tool may be prone to issues, producing inconsistent or unreliable outcomes for complex planning tasks.

Suitability for H&C planning

	The tool is highly suitable for the planning process, specifically designed for comprehensive and strategic planning and offering advanced features tailored to planning needs.
	The tool is useful for the planning process but may require some adaptation or lacks certain advanced features specific to planning tasks.
	The tool is not primarily designed for planning, and its features may be too limited or basic for effective planning.

User friendliness

	The tool is easy to navigate and requires minimal learning to use effectively
	The tool uses simple and clear language
	The tool features a clean, well-organized interface that simplifies the user experience.
	The tool allows reports to be exported in multiple formats, catering to diverse user preferences
	The reports generated by the tool are clear and easy to understand
	The tool has a steep learning curve and is not user-friendly for beginners

Technical know-how required from the users

	Suitable for users with minimal technical knowledge
	Suitable for users with moderate knowledge
	Suitable for users with advanced technical expertise

Compatibility and Interoperability
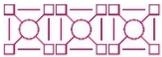
	The tool seamlessly integrates with a wide range of other systems, platforms, and software used in the planning process (e.g. pre-existing GIS models/software) and allows connections with public data repositories
	The tool integrates with some key systems but may have limitations when it comes to broader compatibility or more complex integrations.
	The tool has limited integration capabilities and struggles to work with other systems or platforms, often requiring manual data entry or file exchanges.

Costs

	The tool is entirely free to use
	The tool has a free tier with limited features, often encouraging upgrades to paid plans (affordable)
	The tool has a free tier with limited features, often encouraging upgrades to paid plans (expensive)
	The tool is not free and requires payment to access any of its functionalities

Language

	The tool is available in other languages, including my own
	The tool is available in other languages, but not in my own language
	The tool is only available in English

Flexibility and customisation

	The tool offers extensive adaptability to different contexts/regions/sectors, supports in-depth adjustments for customisation and easily connects with multiple third-party systems and data sources.
	The tool provides a balance between customisation and standardisation
	The tool is rigid and designed for specific purposes with minimal customisation options

Technical Support

	The tool provides complete technical support and resources for capacity building (commercial or not)
	The tool provides limited or restricted technical support
	No technical support is provided by the tool

Environmental and Climate Impact Assessment

	The tool enables a comprehensive and detailed assessment of environmental impacts of various planning options (GHG reduction, renewable energy usage, pollution and overal carbon footprint)
	The tool enables a partial assessment of environmental impacts of various planning options, evaluating some key environmental impacts but has limitations in scope or depth.
	The tool has little to no capability for assessing environmental impacts.

Compliance

	The tool is fully compliant with current regulations and policies
	The tool adheres to some regulations and policies but lacks coverage in certain areas.
	The tool does not effectively address regulatory requirements.

Data requirements

	The tool requires extensive, detailed, and high-quality data inputs to function effectively
	The tool operates effectively with a moderate level of data, balancing detail and simplicity
	The tool functions with minimal data inputs, often relying on defaults or general assumptions.

3. Assessment of existing resources

3.1 KASSANDRA

Type of resource: Planning software **| Promoter:** Kassandra Project®

Target group: Decision makers and city planners

Short summary on the tool objectives and outcomes

Kassandra is a platform for better climate change decision-making powered by generative AI. With Kassandra it will be possible to improve planning and resource management of a city, with the aim of enhancing the natural and built environment and the quality of life of its inhabitants.

Kassandra creates or builds upon a Digital Twin of the asset to be studied that uses analysis and simulation tools to take a long-term and whole-system view of an environment. With Kassandra, decision makers will be able to 'see' and 'foresee' the effect that individual decisions may have on climate change resilience and on the quality of life in an urban environment.

Summary of criteria assessment

Comments on criteria

Kassandra is a versatile decision-support system designed to tackle complex planning challenges, particularly in climate change adaptation and urban development. By integrating digital twin technology, it enables multi-dimensional analysis and simulation, providing long-term, system-wide perspectives for planning. Its ability to assess resilience across various parameters helps identify vulnerabilities and prioritise actions efficiently.

With a user-friendly, web-based interface, Kassandra ensures accessibility for professionals at all levels while seamlessly integrating with GIS and BIM systems to streamline data management. It has been successfully implemented in diverse global contexts, including England, Northern Ireland, the Caribbean, Slovenia, Bosnia, and Italy, demonstrating its adaptability across sectors. Through scenario modelling, it evaluates environmental impacts, distinguishing between passive scenarios (external changes like climate shifts) and active ones (interventions such as tree planting) to explore plausible futures rather than make fixed predictions.

Kassandra is particularly valuable for optimising heating and cooling strategies in Southern Europe, offering tailored, energy-efficient solutions aligned with EU climate directives. Its Standard service enhances planning accuracy by integrating client-provided data into customised digital twins, with pricing based on area classification. Effective even with moderate data availability, it remains a vital tool for decision-makers in urban resilience, heritage preservation, and sustainable development. Currently, Kassandra is in use in Modica, Sicily, and is conducting a study in Ferla as part of an EU-funded project.

Link: https://www.kassandraproject.org/

3.2 GLOBAL SOLAR ATLAS

Type of resource: Database **| Promoter:** World Bank Group

Target group: Engineering services

Short summary on the tool objectives and outcomes

The World Bank Group, comprising the World Bank and the International Finance Corporation, provides this tool alongside global, regional, and national GIS data layers and poster maps to support solar power expansion in client countries. Funded by the Energy Sector Management Assistance Program (ESMAP), a multi-donor trust fund, this initiative is part of ESMAP's broader Renewable Energy Resource Mapping programme, covering biomass, small hydro, solar, and wind energy. To ensure high-quality data and assessments, the World Bank Group has selected Solargis as its global provider of solar resource information.

The Global Solar Atlas offers quick access to solar resource and photovoltaic power potential data, with GIS layers and poster maps available at different geographic levels. As an open-data initiative, it provides modelled and measured solar radiation and meteorological data, including PV electricity output, various irradiation metrics, and optimal tilt angles for PV modules. It uses three key models— solar radiation, air temperature, and PV power simulation—to deliver accurate location-specific solar energy assessments.

Summary of criteria assessment

Applicability	Robustness	Suitability for H&C plan	User friendliness	Tech know-how required
✓ ✓ ○	(3 full)	(1 of 3)	☺ ☺ ☺ ☺ ○	(2 of 3)

Costs	Language	Flexibility/customization	Compatibility and Interoperability	
€ € € €	(1 of 3)	(2 of 3)	(0 of 3)	

Technical support	Compliance	Data requirements	Env. and cliamte impact assessment	
(3 of 3)	(1 of 3)	(3 of 3)	(1 of 3)	

Comments on criteria

The tool provides global-scale solar resource data and maps, developed by the World Bank and the International Solar Alliance, ensuring reliability. It offers site assessment for solar projects, helping local authorities and stakeholders understand their solar potential while enabling investors to evaluate opportunities in specific regions. The platform is user-friendly and straightforward, though its compatibility with other systems is unclear. Its results are independent of regulatory considerations.

The tool generates annual reports on total photovoltaic energy production and inclined global irradiation for a given location based on input parameters, including PV system azimuth, panel tilt (default: 25°), and installed capacity. It is well-suited for the quick sizing of PV systems in all regions, including municipalities in Southern Europe.

Link: https://globalsolaratlas.info/map

3.3 PVGIS – PHOTOVOLTAIC GEOGRAPHICAL INFORMATION SYSTEM

Type of resource: Energy simulation (RES)   **| Promoter:** EC Joint Research Centre

Target group: Engineering services

Short summary on the tool objectives and outcomes

PVGIS is a tool designed to assess solar energy potential worldwide by providing reliable data on photovoltaic (PV) performance. Developed by the European Commission's Joint Research Centre, it helps users estimate solar energy production based on geographic location, panel orientation, and system specifications.

The tool delivers key outcomes, including annual and monthly PV electricity generation, solar radiation data, and optimal tilt angles for PV panels. It supports decision-making for policymakers, investors, and researchers by enabling efficient solar energy planning, system sizing, and performance analysis across different regions.

Summary of criteria assessment

Link: https://joint-research-centre.ec.europa.eu/photovoltaic-geographical-information-system-pvgis_en

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3.4 EU TRACKER – LOCAL HEATING AND COOLING PLANS

Type of resource: Database　**| Promoter:** EnergyCities

Target group: Decision makers and city planners

Short summary on the tool objectives and outcomes

EU Tracker – Local Heating and Cooling Plans is a tool designed to support municipalities and policymakers in developing sustainable and efficient heating and cooling strategies. It provides data-driven insights to help align local energy plans with EU climate and energy targets while tracking the status of local heating and cooling plans, legal frameworks, and support mechanisms across EU countries.

Provided by Energy Cities, the tool delivers key outcomes, including energy demand assessments, renewable energy potential analysis, and recommendations for optimising heating and cooling infrastructure. It also offers political recommendations for selected EU countries, such as Italy and Spain, alongside an overall analysis of all EU member states. By enabling data-informed decision-making, it helps local authorities enhance energy efficiency, reduce emissions, and implement cost-effective, sustainable solutions.

Summary of criteria assessment

Comments on criteria

The tool serves primarily as a source of inspiration and a first step in gaining a general understanding of the broader context surrounding local heating and cooling plans. To be considered an informative tool.

Link: https://energy-cities.eu/local-heating-and-cooling-plan/

3.5 MUNICIPAL HEAT PLANNING OF BADEN-WURTTEMBERG (GERMANY) - GUIDELINES FOR ACTION

Type of resource: Guideline | **Promoter:** Climate Protection and Energy Agency Baden-Württemberg (KEA-BW)

Target group: Decision makers and city planners

Short summary on the tool objectives and outcomes

In December 2020, the Climate Protection and Energy Agency Baden-Württemberg (KEA-BW) published a guideline for municipal heat planning. The guide serves as orientation and assistance for municipalities in the preparation of a concrete plan for a heat transition strategy. The used approach, which is entirely in line with the integrated urban development, is also likely to be of interest to municipalities in other countries. It turns concepts for a climate-neutral heat supply from a voluntary task into an obligatory municipal planning issue.

Summary of criteria assessment

Comments on criteria

As the resource refers to a guideline, the compatibility and interoperability criteria is not applicable.

The tool is available in German.

Link: https://www.kea-bw.de/waermewende

3.6 OPEN DATA PLATFORM FOR ACCESS TO ENERGY DATA IN FRENCH MUNICIPALITIES

Type of resource: Database **| Promoter:** France Government

Target group: Decision makers

Short summary on the tool objectives and outcomes

French local authorities benefit from an easier access to energy data, covering electricity, gas, heating, cooling, and fuel consumption. Since 2018, data has been accessible at street level, derived from a minimum of 10 supply points in residential areas. This accessibility is mandated by Article 179 of the Energy Transition Law for Green Growth, passed in 2015, which requires grid operators and fuel suppliers to publicly share their data.

Summary of criteria assessment

Comments on criteria

The information on this resource is available in French.

Link: https://shorturl.at/5Gilj

3.7 APROPRIATE LEGAL FRAMEWORK FOR DANISH LOCAL AUTHORITIES TO DEVELOP H&C POLICY

Type of resource: Regulation | **Promoter:** Danish Government

Target group: Decision makers

Short summary on the tool objectives and outcomes

In Denmark, city councils have the authority to regulate both district heating and natural gas networks, providing a strong legal mandate for municipalities.

This regulatory power allows city councils to make significant decisions regarding the energy infrastructure within their jurisdictions. City councils can mandate compulsory connection to district heating systems for both existing and new buildings within designated collective heat supply areas. They also have the authority to prohibit certain heating systems in these buildings, ensuring alignment with broader energy and environmental goals. By exercising these powers, municipalities can offer a long-term vision for their energy systems. This not only promotes sustainability but also helps ensure the economic viability of local energy projects.

Summary of criteria assessment

Comments on criteria

The information on this normative rule is available in Danish.

Link: https://www.retsinformation.dk/eli/lta/2021/2068

3.8 RESCOOP – SUPPORT FOR EUROPEAN CITIZEN ENERGY COOPERATIVES

Type of resource: Guideline   **| Promoter:** European federation of energy communities

Target group: Decision makers

Short summary on the tool objectives and outcomes

Tool designed to empower citizens to co-own and democratically control renewable energy projects, promoting energy democracy through local energy cooperatives. It supports the development and growth of citizen energy cooperatives across Europe by providing resources, guidance, and a platform for collaboration.

Targeting energy cooperatives, local stakeholders, and citizens, the tool helps communities set up and manage renewable energy projects, promoting energy efficiency and fostering greater citizen involvement in energy decision-making. By enabling local participation, it drives the development of cooperative models that support sustainable energy solutions while contributing to the EU's broader climate and energy objectives.

Summary of criteria assessment

Comments on criteria

REScoop is a comprehensive resource designed to support inclusive planning, involving citizens and citizen associations, thereby promoting decentralized and democratic renewable energy production in municipalities that choose this approach. While it can be applied to support a similar strategy for heating and cooling (H&C), it is not sufficient on its own to develop H&C plans.

The robustness of REScoop relies on how municipalities use it, as it does not offer a "one-size-fits-all" solution. Its practical guide and best practices need to be tailored to each specific context, with the adaptation depending on the expertise of the users. Thus, REScoop is ideal for inclusive and participatory planning in the H&C sector, but its full potential requires external input and customization.

The tool is user-friendly, requiring minimal technical knowledge, but expert support in participatory methodologies is recommended for optimal results. REScoop is a decision-making aid rather than an integrable system but can be complemented by tools like Get2c (Portugal) or REWARDHeat (Europe) for better engagement. The guide is available in multiple languages, though some materials are only in English. While there is no dedicated support, users can contact the creators for inquiries. The tool does not assess environmental impacts but contributes to evaluating energy communities in Europe through policy briefs and reports. The project is ongoing, and adaptation to national regulations may be needed.

Link: https://www.rescoop.eu/toolbox/guidelines-on-community-heating-and-cooling

3.9 SHIFFT – CO-CREATION AND STAKEHOLDER ENGAGEMENT FOR SUSTAINABLE HEATING

Type of resource: Guideline   **| Promoter:** European project consortium (Interreg)

Target group: Decision makers and city planners

Short summary on the tool objectives and outcomes

Guide which provides methodology, good practices and case studies, and facilitates collaboration and co-creation of solutions to decarbonize heat, ultimately driving the heating transition at city level. Target audience: local and regional government stakeholders and decision makers, private investors and citizens.

Developed as part of the EU Interreg 2 Seas funded project SHIFFT, this guide targets barriers and levers to growth of zero carbon heat in households and communities. It specifically addresses the role of municipalities in engaging citizens and stakeholders, emphasizing the importance of maintaining involvement throughout the process. Additionally, the guide is part of a comprehensive four-part series covering financial instruments, city heat strategies, and technologies, providing users with a holistic approach to accelerate the heat transition in cities. Through co-creation and stakeholder engagement, SHIFFT enables users to contribute to sustainable heating solutions, fostering innovation and collaboration across the EU.

Summary of criteria assessment

Applicability	Robustness	Suitability for H&C plan	User friendliness	Tech know-how required
✓ ✓ ✓	(3 of 3)	(3 of 3)	(3 of 5)	(3 of 3)

Costs	Language	Flexibility/customization	Compatibility and Interoperability	
€ € € €	(2 of 3)	(3 of 3)	(2 of 3)	

Technical support	Compliance	Data requirements	Env. and cliamte impact assessment	
(1 of 3)	(3 of 3)	(2 of 3)	(1 of 3)	

Comments on criteria

SHIFFT is a comprehensive resource designed to support participatory and inclusive planning by involving citizens and communities in local decarbonization strategies. Its effectiveness largely depends on how municipalities use it, as it does not provide a pre-packaged solution. Instead, the guide needs to be adapted to each specific context, with the success of this adaptation relying on the skills and expertise of those implementing it. While SHIFFT is well-suited for inclusive and participatory planning in heating and cooling (H&C) strategies, more technical tools (such as GIS, software, or mapping) may be required.

The tool consists of four detailed, comprehensive, and illustrative guides, but it does not have an interface. Its language is straightforward, making it accessible for users with minimal technical knowledge. However, it is recommended that someone with expertise in participatory and inclusive methodologies assist in adapting and applying the tool for optimal results.

SHIFFT is not designed to be integrated directly with other systems, platforms, or software; instead, it serves as a decision-making and planning aid, similar to tools like mPower. The guides are available in English and French. While SHIFFT does not assess the environmental impacts of different planning

options, it offers general guidance on co-creation and stakeholder engagement for sustainable heating solutions. Although the project that developed SHIFFT concluded in 2023, ensuring compliance with European regulations, adaptation to each country's legal and regulatory framework may still be necessary.

Link:https://shifftproject.eu/publications/shifft-guidance-en-how-to-accelerate-the-heat-transition-a-guide-for-local-government-and-actors/

3.10 MPOWER – PEER TO PEER LEARNING PROGRAMME

Type of resource: Learning programme **| Promoter:** European project consortium (Horizon 2020)

Target group: Decision makers and city planners

Short summary on the tool objectives and outcomes

The mPower peer-to-peer learning program provides a comprehensive guide, facilitating knowledge exchange and inspiring municipalities to develop innovative solutions for energy projects. Its target audience includes local authorities, local stakeholders, energy industry, private investors and citizens (This program offers valuable support to government bodies, the energy industry, private investors and communities by providing practical guidance on implementing participatory processes and financing energy initiatives.

By promoting awareness and fostering knowledge transfer, mPower actively contributes to Europe's goals on heating transition, encouraging the adoption of renewable energy solutions at the local level. It also helps enhance the financial viability of renewable energy projects, making financing more accessible and unlocking new economic opportunities in participating regions. Ultimately, mPower serves as a valuable resource for stakeholders seeking to drive sustainable energy transitions and foster community engagement across the EU. The program has produced four guides, namely 1) co-creation with citizens, 2) building energy communities, 3) future-fit home and 4) municipalities tackling energy poverty.

Summary of criteria assessment

Applicability	Robustness	Suitability for H&C plan	User friendliness	Tech know-how required
✓ ✓ ○	▣ ▣ ▢	🧩 🧩 🧩	☺ ☺ ○ ○ ○	⚙ ⚙ ⚙

Costs	Language	Flexibility/customization	Compatibility and Interoperability	
€ € € €	A A A	🔧 🔧 🔧	▨ ▨ ▨	

Technical support	Compliance	Data requirements	Env. and cliamte impact assessment	
🎧 🎧 🎧	✔ ✔ ✔	💾 💾 💾	🌳 🌳 🌳	

Comments on criteria

mPower supports inclusive and participatory planning for decentralized and democratic renewable energy production in municipalities, serving as an inspiration rather than a structured methodology. It provides guides with case studies and best practices but lacks a step-by-step approach, making it a useful complement to tools like REScoop and SHIFFT rather than a standalone solution for Heating & Cooling (H&C) planning.

The tool is user-friendly, available in multiple languages (English, Portuguese, Spanish, and Croatian), and suited for those with minimal technical knowledge. However, expert support in participatory methodologies is recommended for effective adaptation. Since the project ended in 2022, updates may be needed to align with recent EU regulations. While it does not assess environmental impacts, mPower remains a valuable resource for decision-making, particularly when combined with more structured tools like REScoop and SHIFFT.

Link: https://municipalpower.org/

3.11 WOMBLE BOND DICKINSON: HEAT NETWORKS PROCURING FINANCE

Type of resource: Financial guideline **| Promoter:** Womble Bond Dickison (law firm)

Target group: Decision makers

Short summary on the tool objectives and outcomes

This guidance document provides essential considerations for Local Authorities and Non-Public Investors (NPIs) to collaborate effectively in Heat Network projects. While it refrains from offering legal advice, it emphasizes the importance of seeking appropriate legal, financial, and commercial counsel. Tailored for Local Authorities, it also applies to other public bodies involved in Heat Network development and aligns with additional BEIS (Department for Business, Energy and Industrial Strategy) guidance, such as Detailed Project Delivery (DPD) and Financing Heat Networks in the UK. With a focus on Heat Networks supplying multiple buildings, it offers insights applicable beyond England and Wales, with potential relevance to communal heating in multi occupancy block in other areas.

Summary of criteria assessment

Comments on criteria

This guide is a financial tool that gives specific financial and commercial guidance to local authorities concerning Heat Networks Projects for the United Kingdom context (including illustrative scenarios). Insights may be applicable/adjustable to communal heating in other countries/contexts.

The tool is a robust resource for planning the development, financing, and commercialisation of heat networks, though adaptation is required for contexts outside the UK.

It is particularly suited for H&C planning, focusing on financial and commercial aspects of heat network projects. The guide incorporates a decision tree logic and scenario-based examples to facilitate its use. However, its specialised financial and commercial terminology, along with its UK-specific framework, may present challenges. For optimal results, we recommend involving an expert with experience in financial and commercial aspects to support its adaptation and application.

Originally developed in 2018 for the UK, the guide does not cover environmental or climate impact assessments. Adapting it to EU and other national legal and regulatory frameworks will require expert input.

Link: https://www.womblebonddickinson.com/uk/insights/news/wbd-provides-heat-networks-guidance-department-business-energy-and-industrial

3.12 MANUAL FOR THE ESTIMATION OF REGIONAL WASTE HEAT POTENTIAL

Type of resource: Guideline | **Promoter:** European project consortium (Interreg)

Target group: Decision makers, city planners and engineering services

Short summary on the tool objectives and outcomes

The *Waste Heat Manual* provides a clear and practical approach to estimating regional waste heat potential, offering valuable insights for government stakeholders and the local energy industry across Europe. By using conversion factors from leading studies and standardizing industry sector classifications, it simplifies the estimation process. With access to national and regional energy consumption data, users can assess waste heat potential more accurately, supporting informed decision-making and investment in recovery projects. Additionally, the *Waste Heat Toolbox* helps entrepreneurs and investors identify untapped waste heat opportunities, understand recovery technologies, and navigate administrative, financial, and regulatory challenges. By leveraging waste heat as a renewable energy source, users can contribute to the heating transition while improving financial viability and reducing environmental impact.

Summary of criteria assessment

Comments on criteria

The WasteHeat project (https://www.waste-heat.eu/) provides a comprehensive methodology for estimating regional waste heat potential across European countries, offering insights into business models and funding opportunities.

A key outcome of the project was the development of digital waste heat cadastres, using GIS-based mapping to identify potential sources. Data is gathered through standardized surveys and existing databases. Additionally, the project created a Waste Heat Utilization Toolbox, which includes decision-making tools, energy calculation models, and guidelines on business models and regulatory requirements. Eight pilot projects across partner regions demonstrated the practical application of these tools, validating the approach with real-world insights.

The Waste Heat Manual is particularly useful for H&C planning in municipalities with a strong industrial presence looking to explore waste heat recovery. However, for planning that involves other sectors, such as residential, or stakeholders like citizens and communities, additional tools may be required. The tool is well-structured and user-friendly, though familiarity with the energy and industry sectors and spatial data analysis is necessary. Suitable for users with moderate technical knowledge, the manual includes example surveys for industries. While the project concluded in 2019, making adaptations to updated EU regulations and national frameworks may be necessary. The manual focuses on assessing waste heat potential rather than evaluating environmental and climate impacts.

Link:https://www.waste-heat.eu/waste-heat-potential/manual-for-the-estimation-of-regional-waste-heat-potential

3.13 PLANHEAT: MAPPING TOOL

Type of resource: Planning software | **Promoter:** European project consortium (Horizon 2020)

Target group: Decision makers, city planners and engineering services

Short summary on the tool objectives and outcomes

The Planheat Mapping Tool is a versatile application designed to support cities in decarbonizing their heating and cooling systems, benefiting stakeholders such as government and the energy industry across Europe. By providing economically feasible scenarios, the tool assists in mapping, planning, and identifying low carbon solutions for cities and local areas. Developed as part of the Planheat project, it offers a user-friendly interface and can be used across national borders, enhancing accessibility for diverse users. This tool enables the identification of financially efficient solutions with positive socio-economic impacts, contributing to the transition towards sustainable heating and cooling systems in urban environments. Its ability to simulate different scenarios empowers cities to make informed decisions that align with their decarbonization goals and improve overall energy efficiency.

Summary of criteria assessment
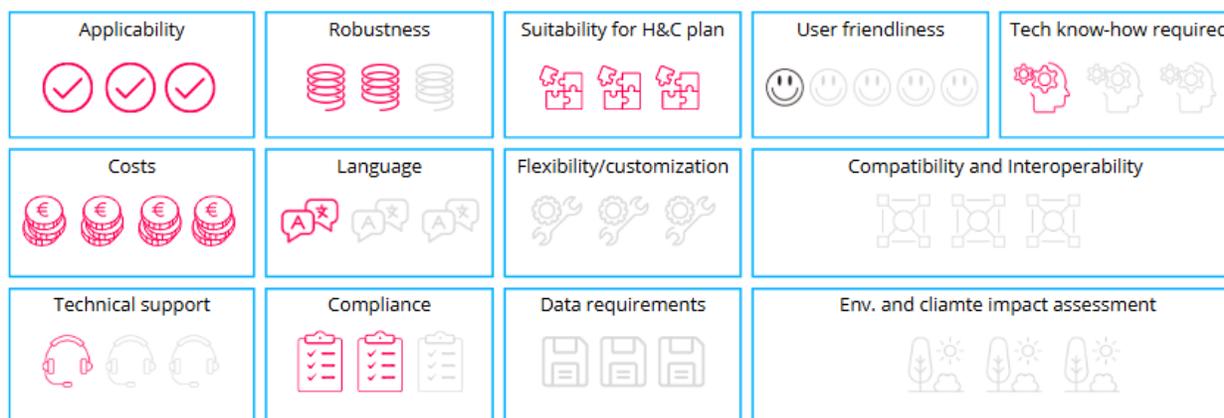
Comments on criteria

The project was completed in 2019, and its website is no longer available. The tool can be downloaded from https://github.com/Planheat/Planheat-Tool, but no installation or usage instructions are provided. Under these circumstances, even installing the tool can be a challenge. Knowledge of IT and GIS tools is required to use it. Although the tool is free, the website and other project deliverables are no longer accessible. Since the project ended in 2019, some adjustments to more recent EU regulations may be necessary, as well as adaptations to the legal and regulatory frameworks of individual countries.

Link: https://cordis.europa.eu/project/id/723757/reporting

3.14 STUDY: THE ROLE OF THERMAL ERNERGY COMMUNITIES IN GERMANY'S HEATING TRANSITION

Type of resource: Study | **Promoter:** European project consortium (Horizon 2020)

Target group: Decision makers, city planners and engineering services

Short summary on the tool objectives and outcomes

Study that emphasizes the significant contribution that Thermal Energy Communities (TECs) can make to Germany's energy transition. It provides valuable insights into the TEC landscape in Germany and offers practical recommendations for local policymakers to integrate TECs into their heat planning and projects, making it a great learning tool not only for German readers but for a broader audience. TECs are key to engaging citizens and encouraging their active participation in local heating projects, thus boosting awareness and involvement in the heating transition. Furthermore, by sharing responsibilities and expertise, TECs can alleviate the burden of citizen workshops, informational campaigns, and financial planning, leading to a more efficient and inclusive transition. In sum, this guide serves as a practical roadmap for stakeholders—including government bodies, the energy industry, private investors, and citizens—fostering effective collaboration to advance the heating transition through TEC involvement.

Summary of criteria assessment

Applicability	Robustness	Suitability for H&C plan	User friendliness	Tech know-how required

Costs	Language	Flexibility/customization	Compatibility and Interoperability	

Technical support	Compliance	Data requirements	Env. and cliamte impact assessment	

Comments on criteria

The article provides valuable insights into Thermal Energy Communities (TECs) in Germany, with potential applicability to other countries, and explores their role in supporting the energy transition. However, it is not a methodology or a structured implementation guide for planning. Rather, it offers an overview of TECs without serving as a direct planning tool.

Written in a scientific yet relatively simple language, the article presents insights that can be adapted to different contexts but does not provide a step-by-step approach to implementation. As it was published in 2018, it aligns with the EU and German regulations in place at that time. Therefore, updates may be required to ensure compliance with more recent EU regulations and the specific legal and regulatory frameworks of individual countries.

Link: https://www.frontiersin.org/journals/sustainable-cities/articles/10.3389/frsc.2022.1027148/full

3.15 ENERGYPLUS

Type of resource: Energy simulation (buildings) **| Promoter:** U.S. Department of Energy's - Building Technologies Office (BTO).

Target group: Engineering services

Short summary on the tool objectives and outcomes

EnergyPlus is a widely used open-source software for building energy simulations. Its main purpose is to model and analyse the thermal, energy, and environmental performance of buildings, helping professionals assess energy efficiency strategies, thermal comfort, and resource consumption. By simulating thermal loads, HVAC systems, ventilation, lighting, and the impact of materials and insulation, EnergyPlus provides a comprehensive evaluation of building performance. It also allows for the integration of renewable energy sources, supporting sustainable design approaches.

The software delivers detailed estimates of energy consumption, enabling the optimisation of thermal performance and overall efficiency. It plays a crucial role in sustainable building design, ensuring compliance with energy regulations and reducing operational costs and environmental impact. With its advanced capabilities, this is an essential tool for engineers, architects, and researchers working towards energy-efficient and environmentally responsible buildings.

Summary of criteria assessment

Comments on criteria

The tool is very complete and supports varying levels of complexity in energy models. Its robustness is evident, as numerous specialized energy simulation software solutions use it as their "energy calculation engine."

While not the most user-friendly tool in its raw form, it can be leveraged as a core energy calculation engine to develop new software tailored for Heating & Cooling (H&C) planning, with customized inputs and outputs. As it stands, the tool is highly complex and feature-rich, but it offers the flexibility to serve as the foundation for a more accessible and user-friendly application.

Being open-source, the tool benefits from extensive documentation provided by its maintainers, including courses and teaching materials. It allows for environmental impact assessments by correlating energy use with different energy vectors. Although it does not inherently enforce regulations or limits, users can define these constraints as needed.

Designed primarily for energy simulations of individual buildings, the tool requires detailed input data, including the thermal characteristics of the building envelope, installed equipment, and energy usage patterns.

Link: https://energyplus.net/

3.16 HEAT PUMP

Type of resource: Energy simulation (RES) **| Promoter:** European Heat Pump Association (EHPA),

Target group: Engineering services

Short summary on the tool objectives and outcomes

The "My Heat Pump" tool, developed by SoftHVAC for the European Heat Pump Association (EHPA), aims to help users to select the ideal heat pump according to the region in which it is to be installed, by calculating the annual operating cost of a heat pump and comparing it with other heating systems, such as electric, gas, solid fuel, or liquid fuel boilers. Additionally, the tool estimates the CO_2e emissions associated with the electricity consumption of the heat pump and compares them with emissions resulting from the combustion of various fossil fuels. The tool provides key outcomes, including the annual operating cost for each type of heating system, the required heat pump capacity, the capacity of an **auxiliary electric heater (if applicable), the bivalence point temperature, and the useful heat supplied annually.** These insights enable users to assess the energy efficiency and environmental impact of different heating solutions, supporting informed decision-making towards more sustainable and cost-effective technologies.

Summary of criteria assessment

Link: https://myheatpump.ehpa.org/en/

3.17 COOLING DOWN

Type of resource: Policy recommendations | **Promoter:** European project consortium (LIFE CET)

Target group: Decision makers and city planners

Short summary on the tool objectives and outcomes

The COOLING DOWN project – *Unlocking the potential of renewable cooling for a decarbonised cooling sector fit for the climate of the 21st century* – aims to establish a vision for a renewable cooling sector in Europe over the coming decades and to provide policy recommendations and proposals to achieve this goal. In addition to assessing technological, economic, and social trends through research, expert consultations, and modelling, the project also addresses the role of renewable cooling technologies in climate change adaptation, with a particular focus on mitigating the urban heat island effect.

As part of its objectives, COOLING DOWN is developing several tools for estimating cooling demand, projecting future demand, and integrating GIS data, which could be valuable for further exploration. The applicability of specific tools such as UrbanColdPro, EURecA, and the GIS-based implementation of Cooling Down technologies into SEAPs should be investigated.

Summary of criteria assessment

Comments on criteria

There is no available information regarding user-friendliness, required technical expertise, compatibility and interoperability, costs, language availability, flexibility, technical support, or environmental and climate impact assessment.

The project is ongoing and aims to develop several policy briefs on the renewable cooling sector in Europe. Adaptation to each country's legal and regulatory framework may be necessary.

A meeting with the project's coordination team would be beneficial to assess the potential for applying these tools.

Link: https://gogeothermal.eu/projects/cooling-down-project/

3.18 HARP – INDICATIVE ENERGY LABELLING OF EXISTING HEATING APPLIANCES

Type of resource: Energy simulation (buildings) **| Promoter:** European project consortium (Horizon 2020)

Target group: Engineering services

Short summary on the tool objectives and outcomes

The *HARP – Heating Appliances Retrofit Planning* is a project funded by the EU Horizon 2020 Programme aiming to raise consumer awareness on the inefficiency of their heating systems and to accompany them in adopting efficient alternatives, such as renewable energy-based solutions.

The HARP online tool aims to provide an indicative energy class for existing heating appliances, following the EU energy labelling methodology for space and water heaters (Reg. 812 and Reg. 813). This classification is indicative and offers two levels of input—basic or detailed, depending on the availability of information.

The primary objective is to inform consumers about the energy performance of their heating appliances and support them in planning their replacement with more energy-efficient or renewable-based solutions.

Summary of criteria assessment

Applicability	Robustness	Suitability for H&C plan	User friendliness	Tech know-how required
✓ ○ ○	▰ ▰ ▰	▰ ▱ ▱	☺ ☺ ○ ○ ○	▰ ▰ ▰

Costs	Language	Flexibility/customization	Compatibility and Interoperability	
€ € € €	🗨 🗨 🗨	⚙ ⚙ ○	▱ ▱ ▱	

Technical support	Compliance	Data requirements	Env. and cliamte impact assessment	
🎧 🎧 🎧	▤ ▤ ▤	💾 💾 💾	🌳 🌳 ○	

Comments on criteria

The tool is available and proves to be effective in reaching out to consumers and raising their awareness. It can also support financing and incentive programs aimed at replacing old and inefficient heating solutions.

Aligned with EU regulations, the tool is robust, though not specifically designed for planning purposes; however, it can support local-level programs. While the full integration potential is uncertain, the tool is managed by ADENE and can be made available for use.

Compliant with current EU labelling regulations for heating products, the tool may require revision in light of a new regulation expected later this year.

The tool is available for use across the entire EU and information is accessible in Spanish, French, Italian, German, and Portuguese.

Link: https://heating-retrofit.eu/

3.19 I-NERGY – FAST EPC AND DEMAND CALCULATION

Type of resource: Study | **Promoter:** European project consortium (Horizon 2020)

Target group: Decision makers, city planners and engineering services

Short summary on the tool objectives and outcomes

The project *I-NERGY – Artificial Intelligence for Next Generation Energy* is an EU funded initiative (H2020), aiming to support and develop new AI-based energy services

This tool can connect to the national (Spanish) public cadastre database to extract data, which is then used to run analytical calculations from compliant EPC (Energy Performance Certificate) tools to estimate energy demand for Heating & Cooling (H&C). The results are stored and displayed through an appropriate web-based GIS visualization, allowing for scoping from the building level to the city level.

Additionally, the tool offers useful functionalities, such as clustering and filtering by demand levels or EPC labels, enhancing its flexibility and analytical capacity.

Summary of criteria assessment

Link: https://i-nergy.eu/

3.20 HAP - HOURLY ANALYSIS PROGRAM

Type of resource: Energy simulation (building) **| Promoter:** Carrier

Target group: Engineering services

Short summary on the tool objectives and outcomes

HAP (Hourly Analysis Program) is a software developed by Carrier designed to assist in the calculation of thermal load, energy analysis, and sizing of HVAC systems. It enables the hourly simulation of energy consumption and system performance, providing detailed insights into the operational efficiency of heating, ventilation, and air conditioning systems.

The tool's key outcomes include accurate thermal load calculations, energy consumption projections, and system sizing recommendations based on building specifications and climate data. HAP allows engineers and designers to optimise HVAC system performance, ensuring energy efficiency and cost-effectiveness in a range of building types.

Summary of criteria assessment

Comments on criteria

The tool allows the input of energy source emission factors, enabling a more accurate assessment of environmental impact. It also requires detailed climate data for application in different regions, ensuring its adaptability to local conditions.

HAP is a robust tool capable of supporting Southern EU municipalities in designing energy-efficient HVAC systems and evaluating energy performance across various building types. However, for urban planning, municipalities will need to complement this tool with others that are specifically designed for broader urban-level analysis and planning.

Link: https://www.carrier.com/commercial/en/us/software/hvac-system-design/hourly-analysis-program/

3.21 PVSYST

Type of resource: Energy simulation (RES) | **Promoter:** PVsyst SA

Target group: Engineering services

Short summary on the tool objectives and outcomes

PVSYST is a technical software used for simulating, sizing, and analysing the performance of photovoltaic (PV) systems. It offers detailed tools for designing solar power systems, considering various factors such as panel configurations, inverter characteristics, and environmental conditions.

The tool's key outcomes include the ability to assess the energy yield of PV systems, optimise system design, and simulate their performance under different scenarios. With an extensive database of modules, inverters, and climate files, PVSYST helps engineers and designers to create efficient, reliable, and cost-effective solar energy solutions, ensuring the best performance and return on investment for solar projects.

Summary of criteria assessment

Comments on criteria

PVsyst is compatible with most common weather data formats and is available in English, French, German, Italian, and Spanish. In the context of solar energy and the design of solar photovoltaic (PV) systems, the tool is flexible and allows for extensive customization to suit various project needs.

While PVsyst does not directly provide a full environmental and climate impact assessment, it plays a crucial role in the simulation, design, and optimization of PV systems. Furthermore, it can indirectly support heating and cooling planning, particularly when solar energy is used in hybrid applications, where solar power is integrated into heating or cooling systems.

Link: https://www.pvsyst.com/

3.22 SCE.CLIMA

Type of resource: Database | **Promoter:** DGEG (Portuguese General Directorate of Energy and Geology)

Target group: Engineering services

Short summary on the tool objectives and outcomes

SCE.CLIMA is a climate database tool for Portugal that provides essential data on solar radiation and temperature. It serves as a support tool for the Energy Certification System (SCE), helping to assess energy performance in buildings.

The tool's primary outcomes include the creation of climate files that can be used in various software applications for energy analysis and simulations. By offering accurate and location-specific climate data, SCE.CLIMA supports the design and evaluation of energy-efficient buildings, contributing to improved energy certification and sustainability.

Summary of criteria assessment

Comments on criteria

The tool generates climate data specifically for Portugal, which can be used in other tools. It produces climate data in EPW format, making it compatible with various software applications. Available in both Portuguese and English, the tool is specifically applicable to Portugal.

SCE.clima's climate files are valuable for predicting heating and cooling demands in Portugal and can be used across multiple software platforms, enhancing their capability to assess energy performance in the region.

Link: https://www.dgeg.gov.pt/pt/areas-setoriais/energia/energias-renovaveis-e-sustentabilidade/sce-er/

3.23 HOTMAPS

Type of resource: Database **| Promoter:** European project consortium (Horizon 2020)

Target group: Decision makers, city planners and engineering services

Short summary on the tool objectives and outcomes

HOTMAPS is a GIS-based online software designed to help authorities and energy planners create strategic heating and cooling plans for their regions. The tool's primary objectives are to map and analyse heating demand, optimise energy systems, and provide decision support for planning and implementation.

Key outcomes of HOTMAPS include identifying the most cost-effective and sustainable heating and cooling solutions, evaluating system performance, and conducting cost-benefit analyses. It helps planners make informed decisions on energy infrastructure, supporting the transition to more efficient and environmentally friendly heating and cooling systems.

Summary of criteria assessment

Comments on criteria

This tool is well-suited for municipalities in Southern EU countries for heating and cooling planning, particularly in simpler scenarios. However, for more advanced cooling-focused scenarios, additional tools or further planning may be required to address the complexities of urban cooling, energy efficiency, and climate adaptation in detail.

Link: https://www.hotmaps-project.eu/

3.24 CITYBES – CITY, BUILDINGS, ENERGY AND SUSTAINABILITY

Type of resource: Planning software **| Promoter:** Lawrence Berkeley National Lab

Target group: Decision makers, city planners and engineering services

Short summary on the tool objectives and outcomes

CITYBES (City, Buildings, Energy and Sustainability) is a web-based data and computing platform designed to analyse the energy performance of a city's building stock. Its main objective is to support district or city-scale energy efficiency programmes by providing detailed insights into building energy consumption.

The tool's outcomes include the ability to identify energy inefficiencies across a city's buildings, assess potential for energy savings, and develop targeted strategies for improving energy performance at a large scale. CITYBES helps city planners and policymakers make informed decisions, enabling more sustainable and energy-efficient urban development.

Summary of criteria assessment

Comments on criteria

The tool allows for customization of building models, supports various data inputs, generates detailed reports, and integrates seamlessly with other tools.

To provide accurate simulations and analysis, the tool requires building details, energy systems, operational data, weather conditions, and policy inputs.

CityBES can be useful for Southern EU municipalities helping them to optimize heating and cooling strategies by accurately modelling use in hot climates and integrating energy sources.

Link: https://citybes.lbl.gov/#citybes_acknowledgment

3.25 SUNNY DESIGN

Type of resource: Energy simulation (RES) | **Promoter:** SMA Solar Technology AG

Target group: Engineering services

Short summary on the tool objectives and outcomes

Sunny Design is an intuitive tool for planning and optimising solar energy systems, allowing users to accurately size systems, analyse energy performance, and assess financial viability. It supports the integration of additional components such as batteries, heat pumps, electric vehicle chargers, and generators, adapting to local climatic conditions for optimal performance.

The tool's outcomes include providing detailed system design recommendations, energy production forecasts, and financial analyses, helping users ensure the economic feasibility and efficiency of solar installations. Sunny Design enables both individuals and businesses to develop tailored, sustainable solar solutions that meet their energy needs while maximising return on investment.

Summary of criteria assessment

Comments on criteria

The tool is well-suited for heating and cooling (H&C) planning, as it allows integration with heat pumps and thermal storage.

With a simple interface, guided workflows, visual diagrams, and quick system simulations, the tool is user-friendly and efficient. It is particularly beneficial for optimizing energy usage, integrating heat pumps, and considering climate conditions. However, for more comprehensive heating and cooling planning, additional tools will be necessary to cover more advanced aspects.

Link: https://www.sunnydesignweb.com/sdweb#/

3.26 RETSCREEN

Type of resource: Energy simulation (building) **| Promoter:** Government of Canada

Target group: Decision makers, city planners and engineering services

Short summary on the tool objectives and outcomes

RETScreen is a software tool developed by Natural Resources Canada to evaluate the energy performance of various systems, including heating, cooling, and renewable energy options. It allows professionals and decision-makers to analyse different energy efficiency measures and assess the technical and financial viability of clean energy projects.

The tool's outcomes include providing detailed simulations of energy consumption, cost savings, and environmental impacts. *RETScreen* supports the optimisation of energy systems by helping users make informed decisions on clean energy investments, ensuring both technical efficiency and financial feasibility in diverse energy projects.

Summary of criteria assessment

Comments on criteria

For users without a technical background, it may take some time to fully grasp the tool's capabilities, particularly when performing more advanced analyses.

RETScreen is a valuable tool for Southern EU municipalities in heating and cooling planning, as it allows for the evaluation of energy efficiency and renewable energy options. The software includes climate data for various regions, though the accuracy of this data for specific cities or areas may require verification.

Link: https://natural-resources.canada.ca/maps-tools-publications/tools-applications/retscreen

3.27 EUCITYCALCULATOR – SUPPORTING PUBLIC AUTHORITIES TOWARDS CLIMATE NEUTRALITY

Type of resource: Planning software **| Promoter:** European project consortium (Horizon 2020)

Target group: Decision makers, city planners and engineering services

Short summary on the tool objectives and outcomes

EUCityCalculator is a web-based tool designed to assist cities in decision-making and implementing their climate strategies. It allows cities to visualize and simulate low-carbon scenarios, helping them assess the impact of different actions on their carbon emissions and overall sustainability goals.

The project adopts the prospective modelling approach of the **EU City Calculator webtool**, an open-source tool providing cities with a sectoral outlook on the type and ambition of measures they can take to achieve a transition towards climate neutrality. The model supports cities in designing tailored transition pathways and policy scenarios. The tool's outcomes include providing cities with a clearer understanding of how various policies and strategies will influence their climate targets. It enables informed decision-making by evaluating the effectiveness of low-carbon solutions and supporting the development of tailored, actionable climate plans for urban areas.

Summary of criteria assessment

Applicability	Robustness	Suitability for H&C plan	User friendliness	Tech know-how required
✓ ✓ ○	⬗ ⬗ ○	🧩 🧩 🧩	☺ ☺ ☺ ☺ ☺	⚙ ⚙ ⚙

Costs	Language	Flexibility/customization	Compatibility and Interoperability	
€ € € €	A A A	🔧 🔧 🔧	⬡ ⬡ ⬡	

Technical support	Compliance	Data requirements	Env. and cliamte impact assessment	
🎧 🎧 🎧	☑ ☑ ☑	💾 💾 💾	🌳 🌳 🌳	

Comments on criteria

The EU City Calculator enables municipalities to create and explore transition pathways reflecting different futures through real-time simulations, assessing the impact of different measures on greenhouse gas emissions and energy consumption.

The tool supports the development of transition strategies by analysing cross-sectoral dynamics and comparing scenarios in terms of emissions, energy use, and costs. A step-by-step guidance to build scenarios by selecting concrete measures is provided.

The webtool is designed to facilitate the transfer of data from the SECAP template provided by the Covenant of Mayors to the EU City Calculator, and also the transfer of outputs from the webtool (measures and their implications) back to the SECAP template.

The EU City Calculator is a linear model and does not provide optimised scenarios or forecasts.

This resource enables the analysis of how heating and cooling measures affect greenhouse gas emissions and calculates the energy consumption of various heating and cooling options, allowing municipalities to choose the most efficient solutions in terms of both cost and environmental impact.

Link: https://europeancitycalculator.eu/the-eu-city-calculator/

3.28 LEAP – LOW EMISSIONS ANALYSIS PLATFORM

Type of resource: Planning software **| Promoter:** Stockholm Environment Institute

Target group: Decision makers, city planners and engineering services

Short summary on the tool objectives and outcomes

LEAP (*Low Emissions Analysis Platform*) is a widely used software tool for energy policy analysis and climate change mitigation. It enables users to model energy consumption, production, and environmental impacts using scenario-based approaches, integrating economic and emissions data for comprehensive planning.

The tool's outcomes include the ability to evaluate the effects of different energy policies and strategies on energy systems, emissions reductions, and economic performance. LEAP supports decision-makers in developing effective climate change mitigation plans and energy transition strategies, providing valuable insights for sustainable development and emissions reduction goals.

Summary of criteria assessment

Comments on criteria

LEAP is highly suitable for Southern EU municipalities in heating DECARB CITY PIP and cooling planning, as it effectively models the seasonal energy demands specific to warmer climates, allowing for the optimization of both cooling and heating systems. The tool also facilitates the assessment of energy efficiency measures and enables municipalities to test various policy scenarios to help meet EU climate goals. Users of the paid version have access to a dedicated help desk, providing additional support when needed.

Link: https://leap.sei.org/default.asp?action=introduction

3.29 DECARB CITY PIPES 2050

Type of resource: Database | **Promoter:** European project consortium (Horizon 2020)

Target group: Decision makers and city planners

Short summary on the tool objectives and outcomes

Decarb City Pipes 2050 is the first project to unite cities across Europe to work out actionable, spatially differentiated transition roadmaps to decarbonise heating and cooling for buildings in 2050. It showcases how local authorities can build capacity to succeed in this challenge. Seven cities (Bilbao, Bratislava, Dublin, Munich, Rotterdam, Vienna and Winterthur) from frontrunners to beginners join forces to learn from each other and elaborate innovative responses together.

Summary of criteria assessment

Comments on criteria

The cities involved in the project represent a wide variety of profiles, with differences in size, population, heat density, and climatic zone. They also have distinct existing infrastructures and varying renewable energy sources (RES) at their disposal. Additionally, their planning competences differ, and they are at different stages of progress in spatial energy planning. As a result, all European cities will find valuable recommendations from the cities involved in the project.

The participating cities assessed their current **heating and cooling (H&C)** energy demand, estimated future demand, and evaluated the potential of RES to meet these needs. **Techno-economic megatrends** were compared with local circumstances to determine the most suitable solutions. Spatially differentiated plans were then developed to identify where different solutions would be the most cost-effective for each district, taking into account factors such as available energy infrastructure, building types and density, and local energy resources. Transition roadmaps were subsequently created to outline how to implement these solutions, at what pace, and who should be involved. These roadmaps also focus on adapting and creating the necessary legal and financial instruments as crucial components for success.

Several **guidebooks** have been published to share the knowledge gained by the partners with other cities wishing to replicate the **Decarb City Pipes 2050** approach. Furthermore, an online tool has been developed and made available on the project website, helping municipalities assess their decarbonisation roadmaps and access the learnings from the cities involved in **Decarb City Pipes 2050**. Results will be fine-tuned according to the specific context of each municipality.

Link: https://decarbcitypipes2050.eu/ https://decarbcitypipes2050.eu/game/

4. Comparative analysis by tool type

A total of 29 tools were identified to support the development of Sustainable Local Heating and Cooling Plans (SLHCP), categorized into five groups:

- Planning software – 5 tools;
- Energy simulation (buildings) – 4 tools;
- Energy simulation (RES) – 3 tools;
- Databases – 5 tools;
- Other – 12 tools.

Each tool was evaluated based on the 13 different criteria defined by Plan4COLD project partners and presented in section 2.2 of this document and grouped into two categories:

- **Exclusive criteria**, where only one evaluation option is considered (12 criteria).
- **Non-exclusive criteria**, where multiple evaluation options can apply (1 criterion).

The **exclusive** evaluation criteria are scored incrementally according to their adequacy/convenience, for example:

Applicability

- The tool has low applicability for planning, is not specifically designed for it, and its features are not well-suited for planning processes **(1 point)**.
- The tool is useful for some planning tasks but lacks certain advanced features or flexibility needed for comprehensive planning **(2 points)**.
- The tool is highly applicable for planning, is specifically designed for it, and is suitable for a wide range of planning tasks **(3 points)**.

The **non-exclusive** criterion is scored with one point for each identified attribute, except for the attribute *"The tool has a steep learning curve and is not user-friendly for beginners"*, where one point is deducted.

For some of the evaluated tools, certain criteria could not be assessed. In these cases, a score of zero points was assigned. The total score was calculated by summing the scores of each criterion, with the maximum possible score determined by the highest potential score for all criteria. The final score is expressed as a percentage of the total score relative to the maximum score.

The *COOLING DOWN* tool was excluded from this analysis, as it was not possible to assess 8 out of the 13 criteria.

In the results table, the tools with the highest potential are highlighted in dark blue. These tools achieved the highest score in their respective categories and should be further analysed in Task 3.2 for customization to specific local conditions of the participating municipalities.

While these are the most suitable tools for adaptation, the other tools may also be partially or fully adapted, potentially adding value to the SLHCPs.

Tabel 1. Excel table with comparative analysis by type of tool.

Name of the tool to be assessed	Planning software	Energy simulation (buildings)	Energy simulation (RES)	Data Basis	Other	Applicability	Robustness	Suitability for H&C planning	User friendliness	Technical know-how required from the users	Compatibility and Interoperability	Costs	Language	Flexibility and customisation	Technical Support	Environmental and Climate Impact Assessment	Compliance	Data requirements	Total score	Maximum score	Final score
Kassandra	x					3	3	3	5	3	3	1	1	3	2	3	2	2	34	43	79%
CityBES	x					3	2	3	1	2	2	4	1	3	3	3	3	2	32	43	74%
EU City Calculator	x					2	2	2	1	3	2	3	3	2	2	3	3	2	30	43	70%
LEAP	x					2	2	3	1	2	3	3	2	2	3	2	3	2	30	43	70%
Planheat: Mapping Tool	x					3	2	3	-1	1	0	4	1	0	1	0	2	0	16	31	52%
HARP - indicative energy labelling of existing heating appliances		x				1	3	1	1	3	1	4	3	2	3	2	3	3	30	43	70%
RETScreen		x				3	3	3	1	1	2	3	3	2	3	3	2	1	30	43	70%
Energyplus		x				2	3	2	1	1	2	4	1	3	3	3	1	1	27	43	63%
Hourly Analysis Program		x				3	3	3	-1	1	2	1	1	2	2	2	3	1	23	43	53%
PVGIS			x			2	2	2	4	3	1	4	3	2	1	1	2	3	30	43	70%
Sunny Design			x			2	2	2	1	2	2	3	3	2	3	3	1	2	28	43	65%
PVSyst			x			2	3	1	-1	1	3	2	2	3	3	1	1	1	22	43	51%
Hotmaps				x		3	2	3	1	3	3	4	3	3	3	3	3	2	36	43	84%
EU Tracker - Local heating and cooling plans				x		1	2	1	4	3	1	4	3	2	1	1	3	3	29	43	67%
Global Solar Atlas				x		2	2,5	1	3	3	0	4	1	2	2,5	1	1	3	26	40	65%
SCE.CLIMA				x		1	2	1	1	3	3	4	3	1	2	1	1	3	26	43	60%
Access to energy data - open data platform				x		1	1	2	1	2	2	4	2	2	1	1	3	1	23	43	53%
DECARB CITY PIPES 2050					x	3	3	3	4	2	0	4	2	2	3	3	3	3	35	40	88%
REScoop – Support for European citizen energy cooperatives					x	2	3	3	2	3	2	4	3	3	3	2	3	3	36	43	84%
SHIFFT - Co-creation and stakeholder engagement for sustainable heating					x	3	3	3	3	3	2	4	2	3	1	1	3	2	33	43	77%
Ministry for the Environment, Climate Protection and the Energy Sector of Baden-Württemberg: Municipal heat planning - guidelines for action (Germany)					x	3	3	2	2	2	1	4	2	2	3	2	3	2	31	43	72%
Manual for the Estimation of Regional Waste Heat Potential					x	3	3	3	3	2	0	4	1	2	1	1	2	2	27	40	68%
INERGY - h2020 project - Fast EPC & demand calculation					x	2	1	2	1	3	3	3	1	2	2	2	3	3	28	43	65%
mPower - peer to peer learning programme					x	2	2	2	2	3	2	4	3	2	1	1	2	2	28	43	65%
European Heat Pump Association (Tool Heat Pump)					x	1	1	1	5	2	1	4	1	1	2	2	3	2	26	43	60%
Womble Bond Dickinson: Heat Networks Procuring Finance					x	2	2	3	-1	2	0	4	1	2	1	1	2	2	21	40	53%
Appropriate legal framework for local authorities to develop heating and cooling policy					x	2	2	2	-1	1	2	4	2	2	1	1	2	0	20	40	50%
The role of thermal energy communities in Germany's heating transition					x	1	1	1	1	3	1	4	1	1	0	1	2	3	20	40	50%

5. Conclusions

This report provides a comprehensive assessment of existing tools and methodologies that can support municipalities in Southern Europe in the development of Sustainable Local Heating and Cooling Plans (SLHCPs). By categorizing and evaluating these resources against predefined criteria, the analysis identifies the most suitable tools for integration into the next phases of the Plan4COLD project.

Key findings highlight the strengths and limitations of different planning software, energy simulation tools, databases and other kind of resources, emphasizing the importance of interoperability, user-friendliness, and environmental impact assessment. The comparative analysis further enables project partners to select and adapt the most relevant tools to the specific climatic and regulatory contexts of Southern European municipalities.

The tools analysed were primarily promoted by European-funded projects, governmental agencies, research institutions, and international organisations, reflecting a strong focus on supporting sustainable energy planning at the municipal level. Their main target groups include policymakers, urban planners from municipal energy departments, and engineering professionals involved in heating and cooling (H&C) planning.

These tools are mainly used for strategic planning, energy system simulations, data analysis, and decision support, having potential for assisting municipalities in developing Sustainable Local Heating and Cooling Plans (SLHCPs). They facilitate scenario modelling, environmental impact assessments, and the integration of renewable energy sources into urban energy systems. However, their utilization faces certain constraints, including technical complexity, interoperability challenges, the need for high-quality and comprehensive data, and the necessity for users to have a certain level of expertise. Additionally, adapting these tools to specific local contexts may require significant customization.

To address these challenges and maximise the effectiveness of these tools, the insights gained from this report will inform the customization of selected tools (Task 3.2) and the development of capacity-building materials (Task 3.3). These efforts will ensure that municipalities have access to practical and effective resources, ultimately facilitating the widespread adoption and replication of SLHCPs across various regions.