D5.1 CoolLIFE tool and knowledge Hub

Cool LIFE

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Deliverable Information Sheet

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List of Figures

Disclaimer

Table of Contents

Executive summary

The CoolLIFE toolbox and Knowledge Hub provide an integrated, open-access platform to support spatially resolved, data-driven planning, analysis, and policy development for sustainable space cooling (SC) across the EU-27. Developed in response to the increasing energy, comfort, and climate demands associated with cooling, the platform enables local, regional, and national stakeholders to assess current and future SC needs, explore mitigation strategies, and make informed decisions grounded in technical, economic, and behavioural evidence.

At the core of the platform is the CoolLIFE toolbox—an interactive, GIS-based interface that supports users in navigating key spatial data, running targeted analysis modules, and visualizing or exporting results across a range of administrative levels (NUTS0–NUTS3, LAU2, and hectare grids). The toolbox is structured around four main themes: Cooling, District Heating and Cooling, Policy, and Finance. Within each theme, a set of calculation modules (CMs) enables users to estimate SC demand, analyze technology performance and diffusion, evaluate economic feasibility, incorporate comfort and behavioural factors, and explore demand-side flexibility through load shifting and PV alignment.

Users can define spatial regions through intuitive selection tools or upload custom boundaries (GeoJSON), apply layers such as theoretical cooling demand or renewable energy potential, and retrieve numerical indicators directly from the platform. The CMs are activated depending on the selected spatial level and are accompanied by extensive documentation, with further details in the CoolLIFE Wiki and Deliverable 5.2. Outputs are provided as indicators and charts, which can be exported in common formats (e.g. Excel), supporting further integration into planning workflows and policy documents.

The toolbox supports modular use of individual CMs as well as structured toolchains, which reflect real-world planning processes. These toolchains connect relevant modules to enable comprehensive analyses tailored to specific user needs—whether for improving building-level efficiency, supporting national reporting under the Energy Efficiency Directive, or designing equitable cooling strategies for vulnerable communities. Seven practical use cases were developed, each illustrating how the tool can inform concrete actions in different governance and decision-making contexts.

Complementing the toolbox, the CoolLIFE Knowledge Hub provides a curated repository of over 50 rigorously selected and FAIR-compliant resources, including scientific literature, project deliverables, technical datasets, and regulatory documents. With advanced filtering, metadata tagging, and thematic indexing, the Knowledge Hub facilitates interdisciplinary learning and evidence-based planning. Users can search by keyword or browse the entire collection to access high-quality information on the technical, socio-economic, and policy dimensions of SC.

Together, the CoolLIFE toolbox and Knowledge Hub form a robust digital ecosystem that empowers stakeholders to plan and implement sustainable cooling solutions. The platform promotes transparency and replicability by offering all calculation modules as open-source code, licensed under Creative Commons CC BY 4.0 and hosted in the public Tuleap repository. This ensures that the tools can be freely accessed, adapted, or extended by public authorities, researchers, and practitioners to meet evolving cooling challenges.

With its combination of interactive spatial analysis, advanced calculation capabilities, open data and code access, and high-quality knowledge resources, CoolLIFE offers a powerful foundation to advance energy-efficient, climate-resilient, and socially inclusive space cooling strategies across Europe.

1. Introduction

The CoolLIFE toolbox and knowledge hub provide an integrated online platform designed to support planning, analysis, and knowledge sharing on space cooling (SC) across the EU-27. The toolbox is accessible at https://tool.coollifeproject.eu/, and is complemented by a dedicated CoolLIFE Wiki that offers detailed guidance, background material, and tutorials.

The platform enables users to map SC demand from high-resolution (100x100m grids) up to NUTS0 level and supports the development of energy-efficient cooling strategies through an extensive set of functionalities. Users can explore opportunities for local renewable energy sources (RES) integration, analyze comfort and lifestyle impacts, perform cost-benefit analyses, and assess regulatory and legal aspects of SC interventions.

The CoolLIFE tool features a GIS-based interface with an intuitive layout. Users can interact with spatial data through the main Map Viewer, while dedicated toolbars provide access to spatial selection tools, layer management, calculation modules, and user account functionalities. The platform supports the analysis of multiple indicators through interactive maps, charts, and exportable data outputs.

Core functions include the ability to select and analyze regions at different scales (NUTS, LAU, hectare grids), manage diverse spatial data layers (buildings, RES potential, climate), and run calculation modules across several themes: Cooling, District Heating, and Cooling, Policy, and Finance. The tool supports a general workflow that guides users through defining a territorial scope, selecting data layers, running calculations, and visualizing/exporting results.

The platform supports data upload of custom regions (GeoJSON), and allows users to export data and results in common formats such as Excel for further analysis. A built-in user feedback survey helps collect user experiences to inform ongoing improvements.

The CoolLIFE Knowledge Hub complements the toolbox by providing a curated collection of high-quality data sources, scientific literature, and project results relevant to SC. The knowledge hub is accessible at https://knowledgehub.coollifeproject.eu/. The Hub integrates a selection of 50 rigorously evaluated sources—including journal papers, project deliverables, datasets, and other materials—covering technical, climatological, and socio-economic aspects of SC in the EU-27. All sources included meet FAIR principles and are accompanied by detailed metadata. The Knowledge Hub is designed to support interdisciplinary research and practical planning, with content continuously updated and quality controlled in collaboration with external experts.

Together, the CoolLIFE toolbox and knowledge hub provide a comprehensive, practical resource for planners, policymakers, technical experts, and stakeholders aiming to advance sustainable and efficient SC solutions across Europe.

2. CoolLIFE Tool User Interface

2.1. Disclaimer and user survey

The graphical user interface (GUI) is the main component of the CoolLIFE toolbox that standard users will interact with. This document describes the key features of the GUI included in the final release of the CoolLIFE toolbox (2025). [https://tool.coollifeproject.eu.] Additional instructions, user manuals, and guides are available through the online CoolLIFE Wiki.[https://coollife-project.github.io/wiki/]

When users open the toolbox, they are first presented with a disclaimer page (see **Error! Reference source not found.**). In addition to the disclaimer text, this page provides an overview of the CoolLIFE toolbox objectives, links to the CoolLIFE project website and relevant data repositories. The page also includes a link to a user survey, where users can provide feedback on their experience with the toolbox and indicate which calculation modules (CM) they have used. The survey page can be seen in Figure 2.

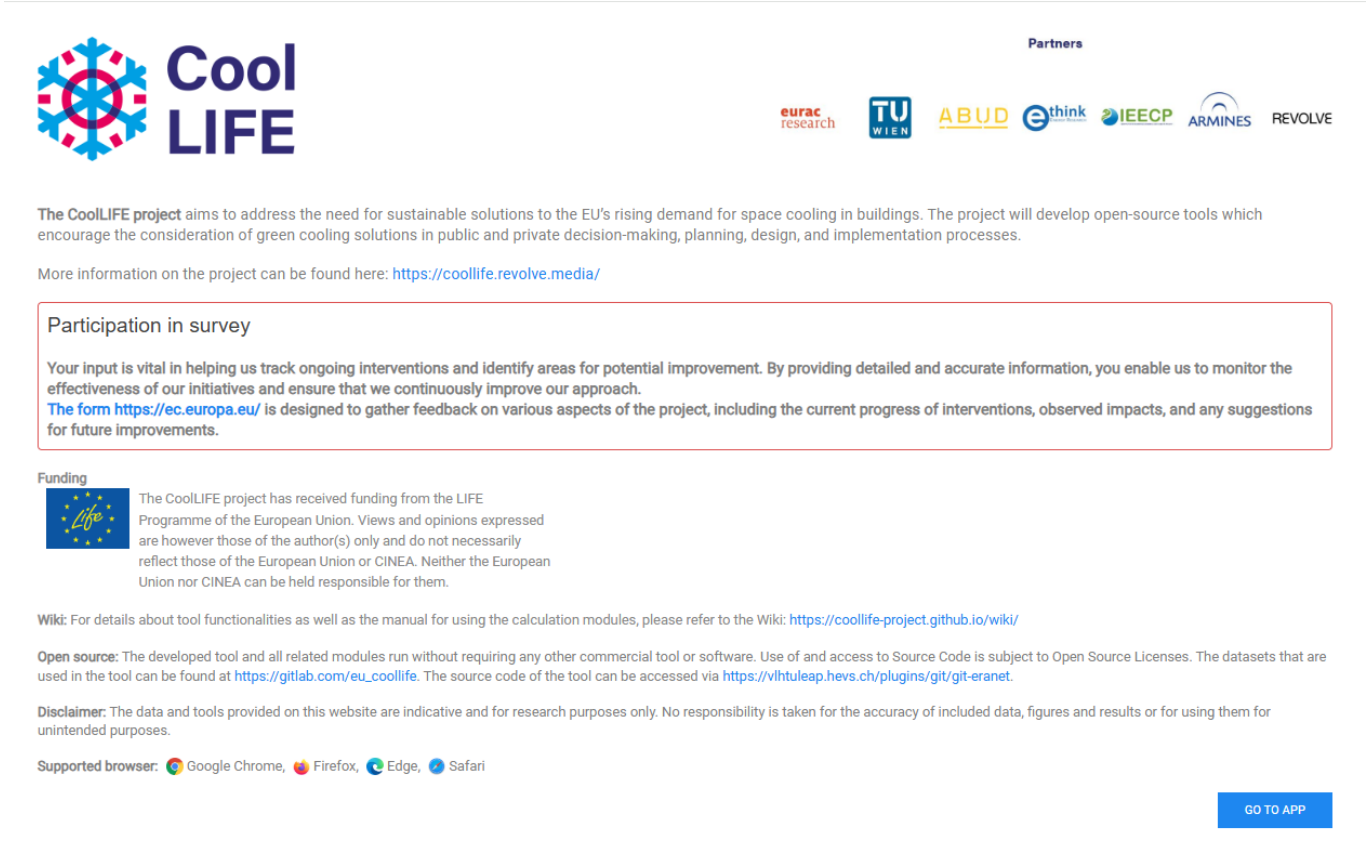

Figure 1. CoolLIFE Toolbox disclaimer page

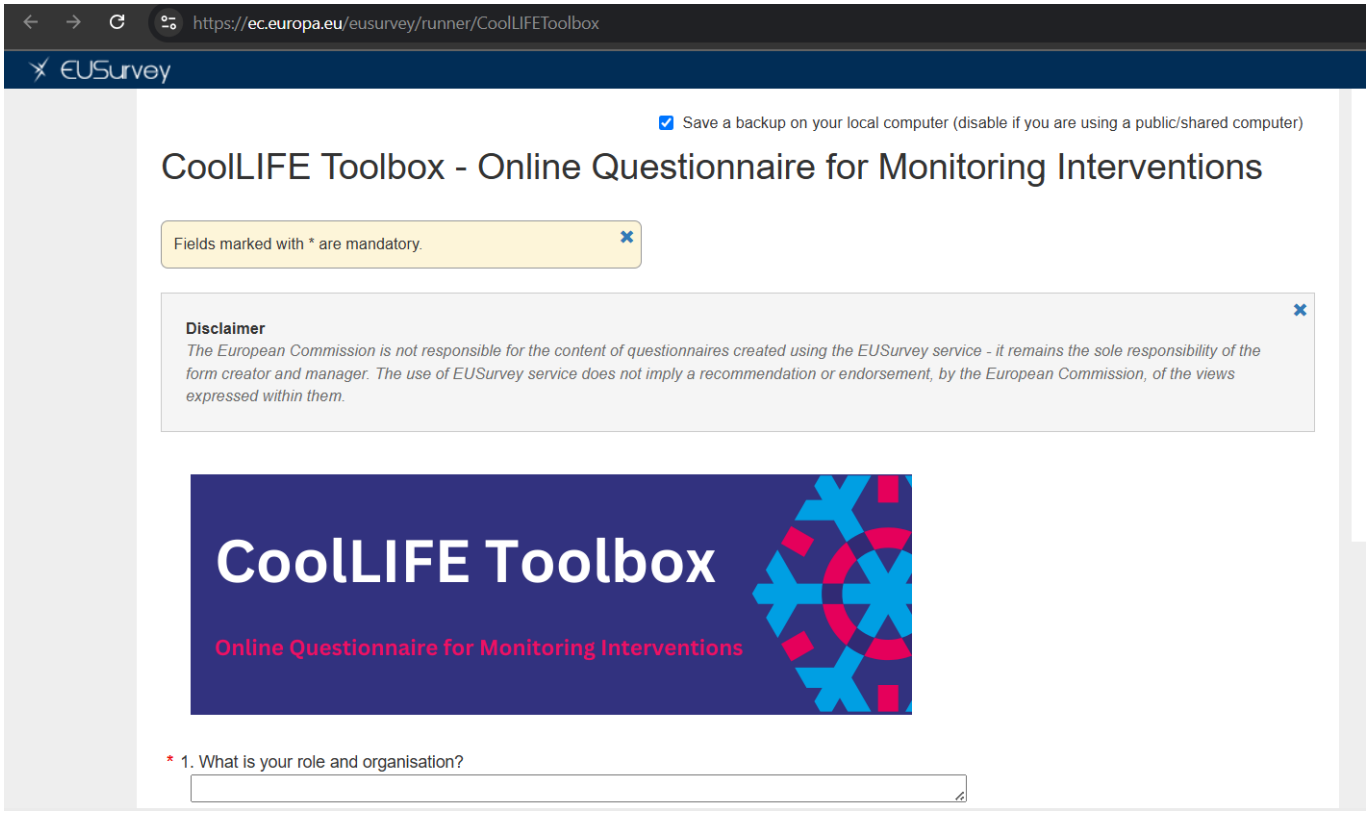

Figure 2. CoolLIFE Toolbox User Survey

2.2. Navigating through CoolLIFE Toolbox

Figure 3. CoolLIFE Toolbox interface layout and navigation

Interface Layout and Navigation

The main interface of the CoolLIFE toolbox consists of:

- **Map Viewer:** A GIS-based viewer for visualizing spatial data, overlaying data layers, and performing interactive analyses.
- **Right Toolbar:** Provides tools for selecting spatial areas (NUTS, LAU, grids), changing basemap styles, and controlling zoom.
- **Left Toolbar:** Contains the main operations of the tool, including layer selection, retrieving indicators, and running calculation modules.
- **Top Toolbar:** Offers tools for location search, recentering the map, accessing the Wiki, managing user profiles, and accessing user surveys.

The overview of the layout of the CoolLIFE platform is available in Figure 3.

Detailed instructions and examples of the user interface are provided in the CoolLIFE Wiki.

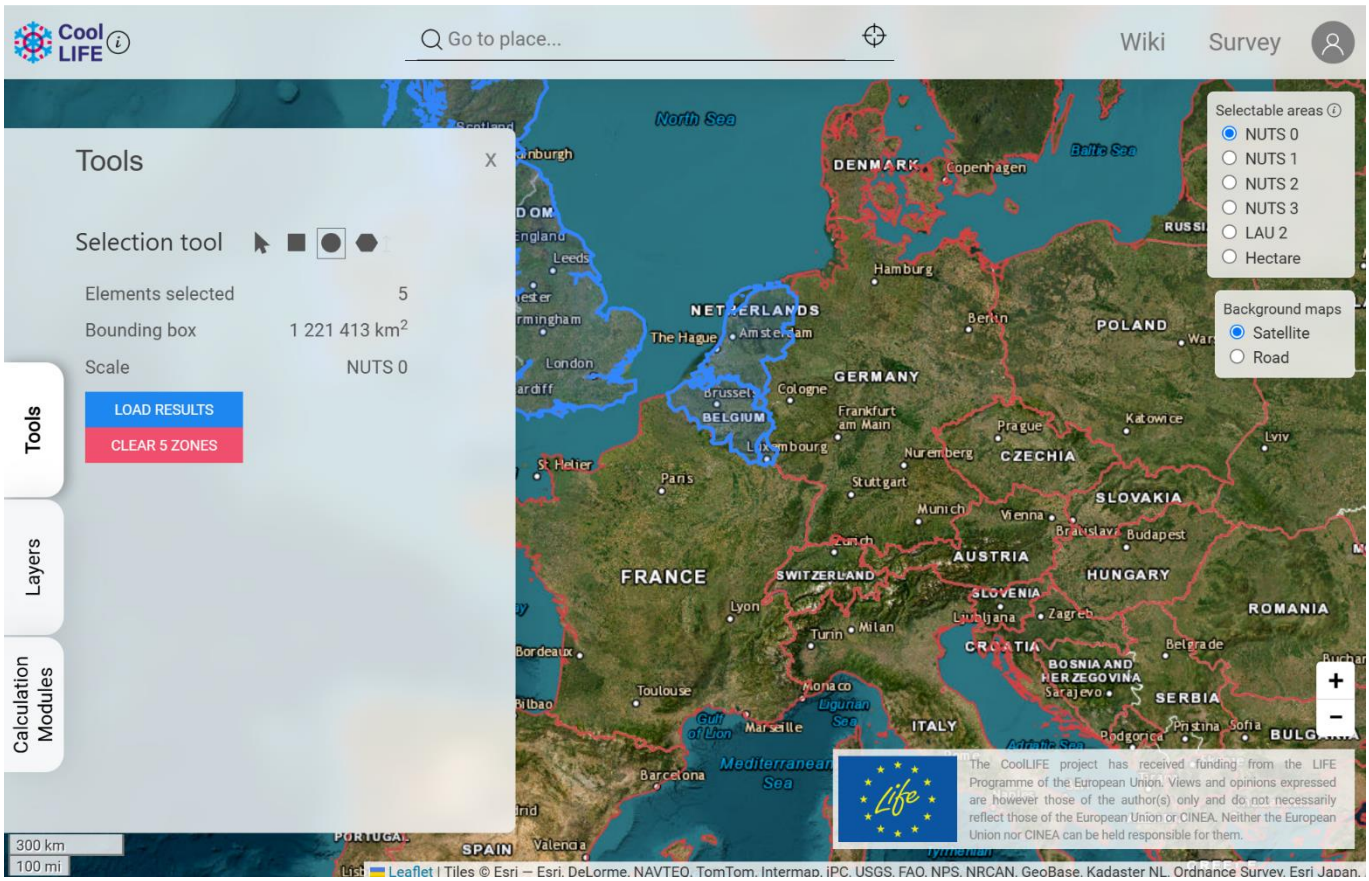

Figure 4. CoolLIFE Selection Tool

The Tools and Layers sections allow users to interact with the data and manage results. Users can load results from selected layers and calculation modules, clear regional selections, and visualise indicators of interest directly on the map. Numerical values can also be retrieved through the Load Results function. The available tools and their layout on the on the platform is seen in Figure 4

Further details are available in the CoolLIFE Wiki.

2.3. Core functionalities

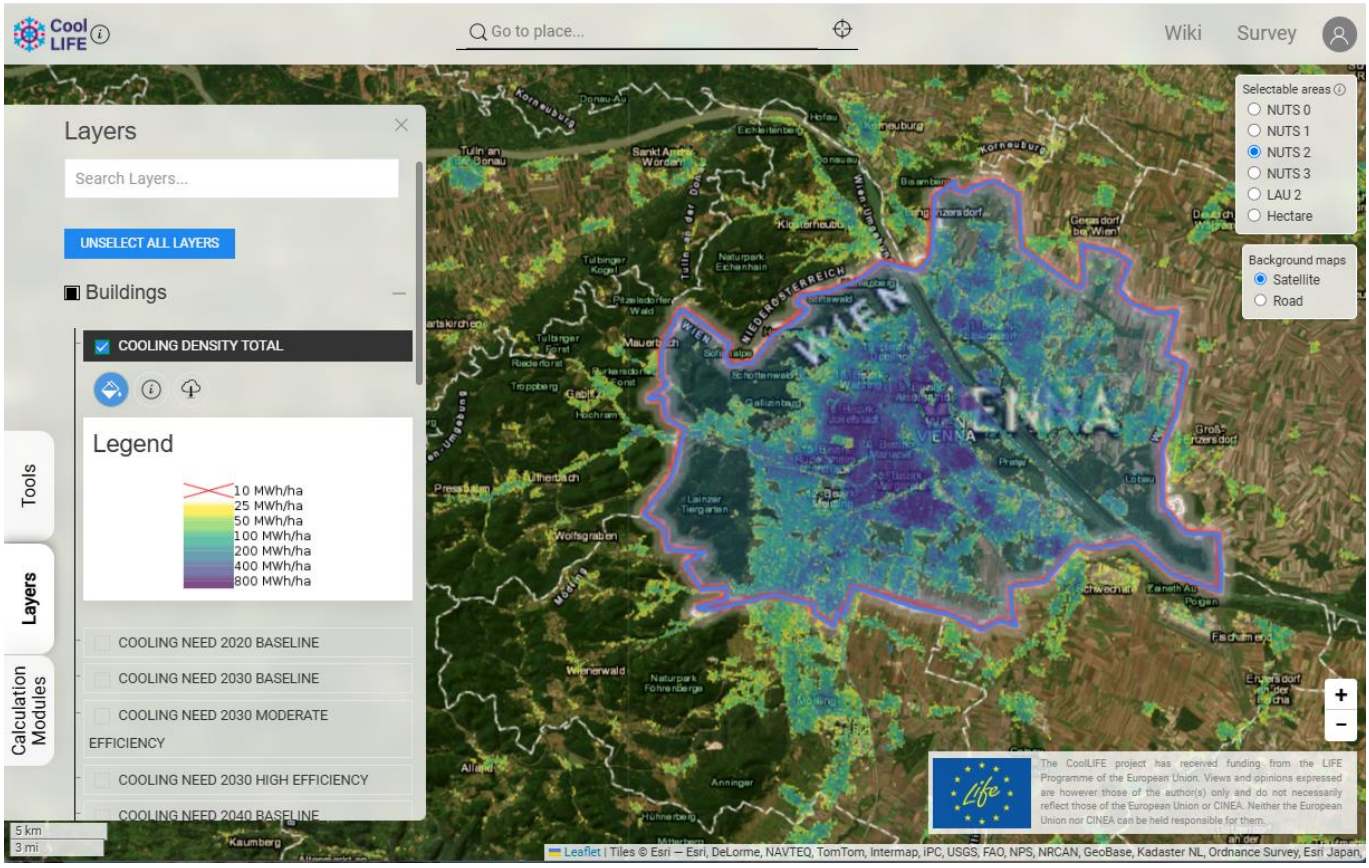

Figure 5. Default Layer Visualization in the toolbox

The Layers section of the CoolLIFE toolbox allows users to explore and visualize different data layers:

Two main categories of layers are available:

- **Raster Layers:** Represent continuous spatial data such as:
  - Theoretical Cooling Needs
  - Building stock characteristics
  - Renewable Energy Systems (RES) potential
  - Climate data
- **Calculation Module Layers:** Generate results after running calculation modules and containing them as continuous spatial data.

The layout of the layer section is seen in Figure 5. Further details on the available layers and their use are provided in the CoolLIFE Wiki.

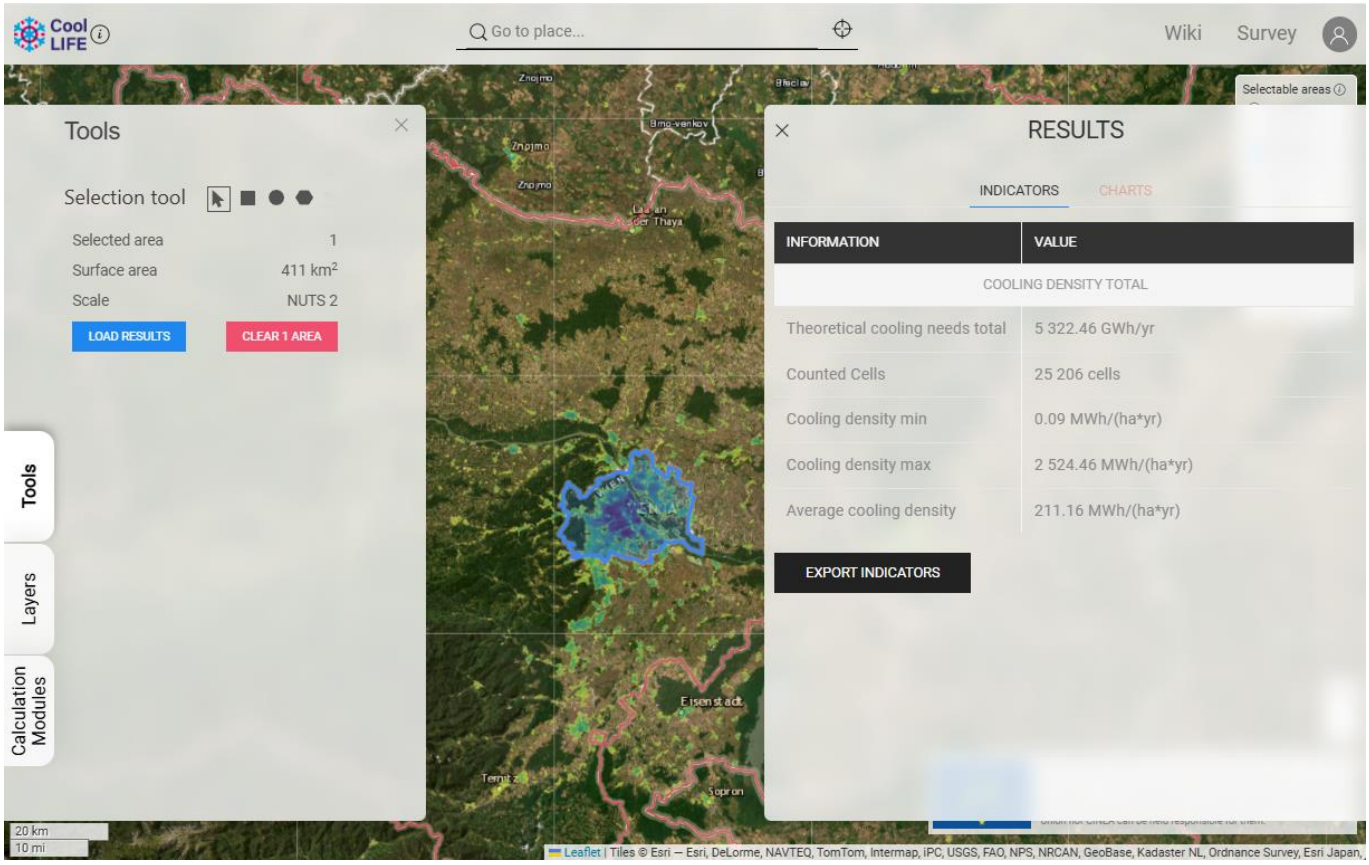

Figure 6. Loading Results

Figure 6 shows the result layout and how it can be observed on the platform.

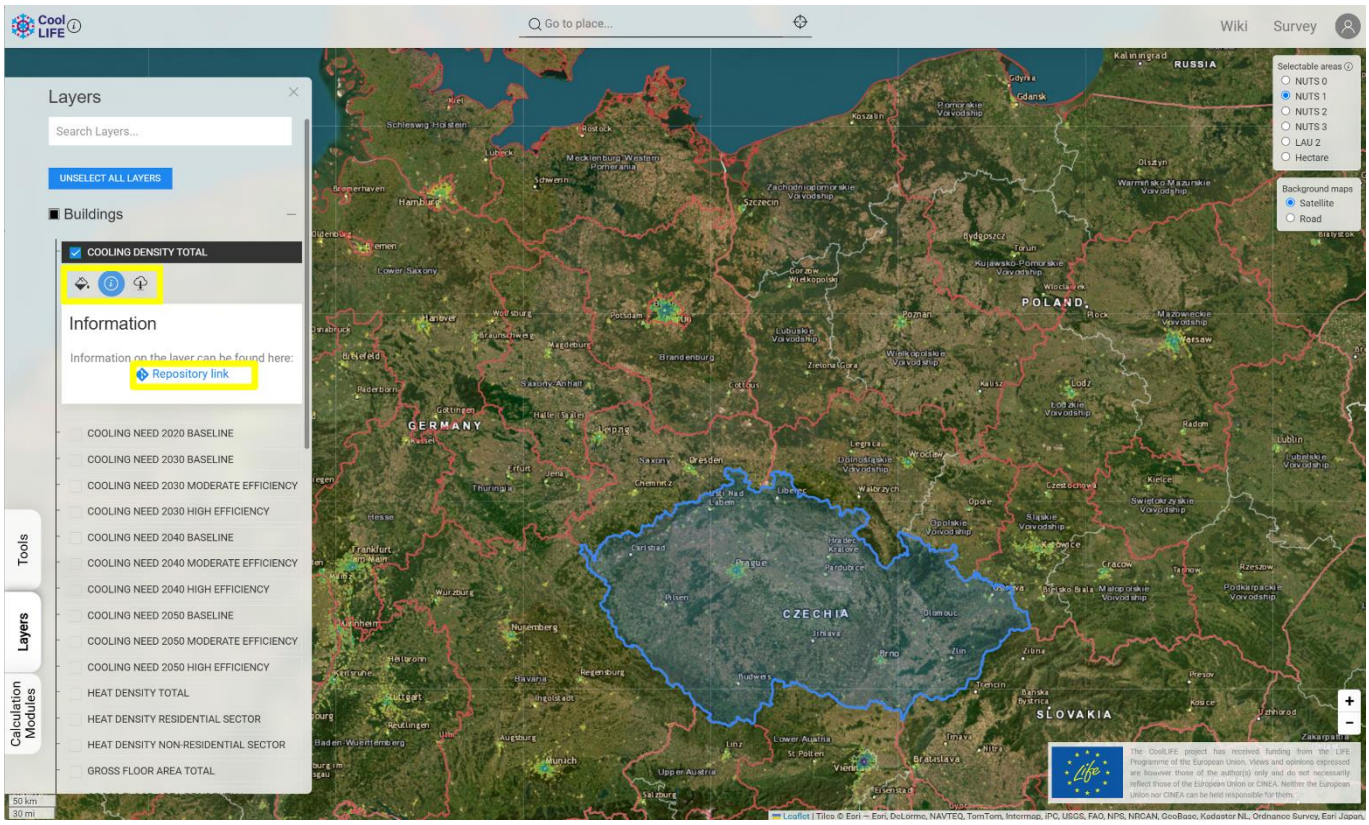

Figure 7. Downloading Information and layers from the Toolbox

Each layer comes with the following features:

- **Layer legend:** Displays the legend of the layer.
- **Information:** Provides a link to the GitLab repository with more detailed information about the data.
- **Download Dataset:** Allows downloading the default dataset for the layer.
- **Download Layer:** Enables downloading the specific data of the selected layer.

Figure 7 shows how the different featues of the layers tab can be used to access and download the raster layers.

Further details on the available layers and their use are provided in the CoolLIFE Wiki.

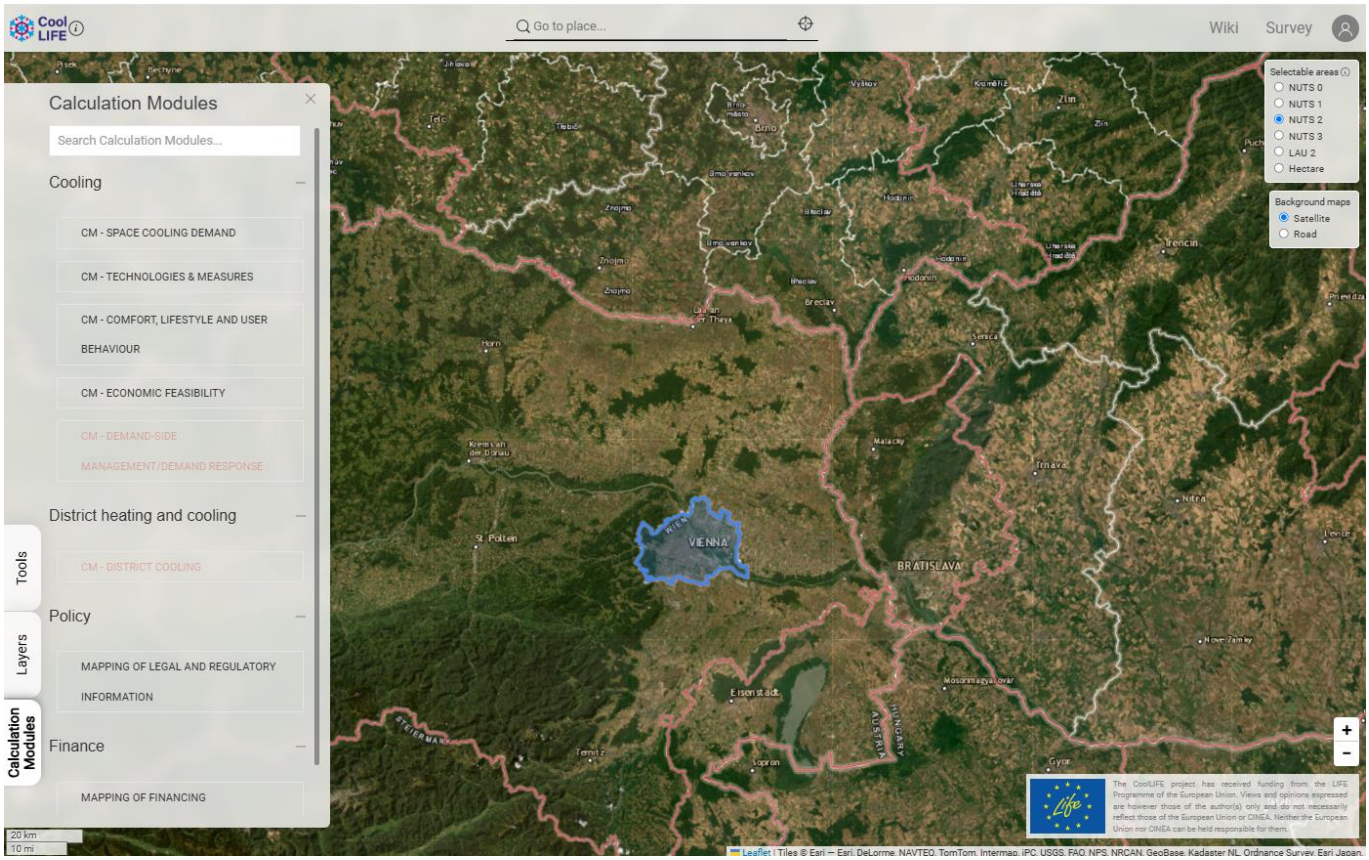

Figure 8. Calculation Modules

The Calculation Modules (CMs) allow users to compute and visualise key indicators relevant for cooling planning:

- CMs are structured into four main thematic categories:
  - Cooling
  - District Heating and Cooling
  - Policy
  - Finance
- Each CM operates at specific territorial scales (e.g. NUTS or LAU levels); the applicable level is indicated in each CM's description.
- Detailed information and guidance on using each CM are provided through direct links to the relevant sections of the CoolLIFE Wiki. Also further details are available in D5.2.

The lis of calculation module on the platform is seen in Figure 8. More details on the Calculation Modules are available in the CoolLIFE Wiki.

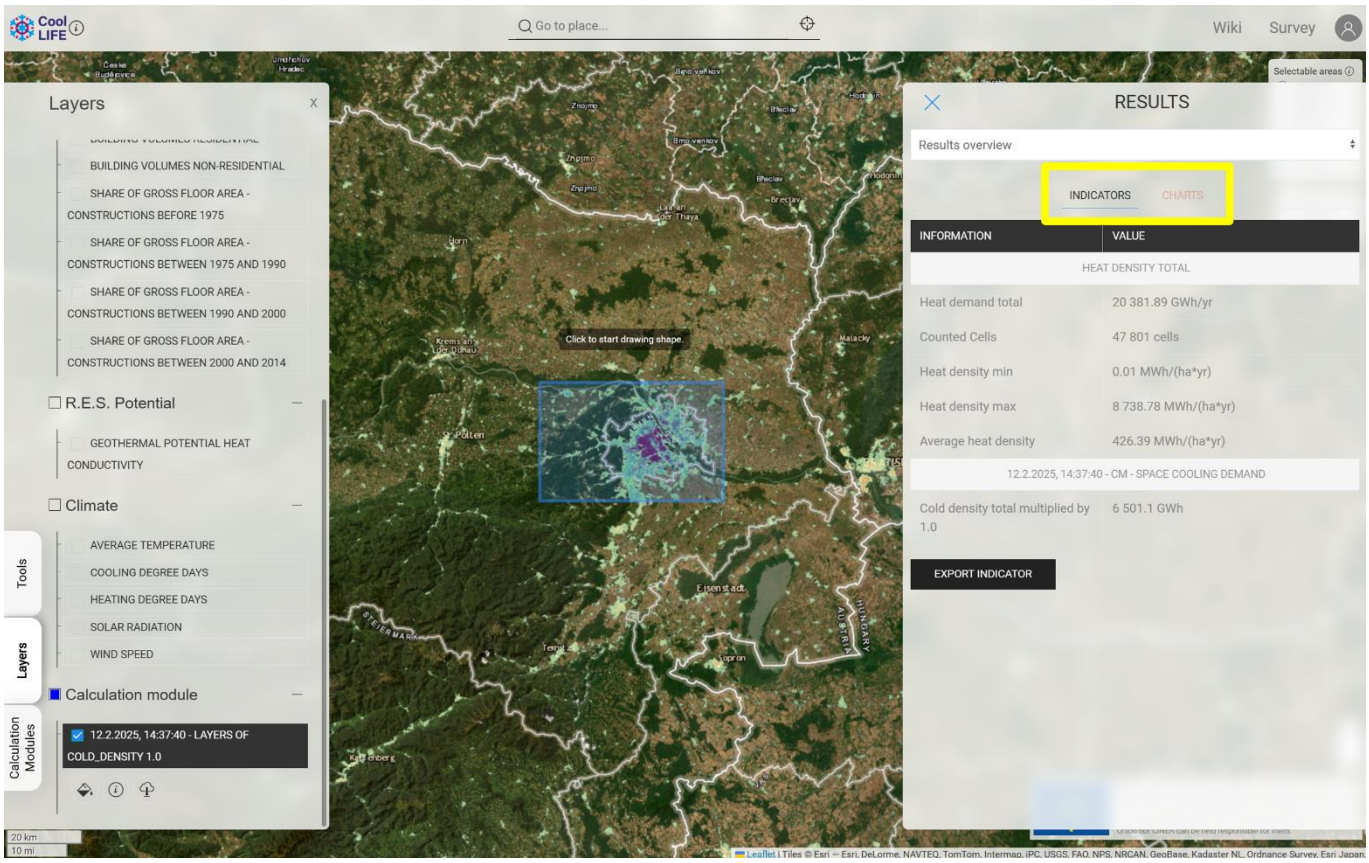

Figure 9. Result Presentation

Results presentation:

- Results from the CMs and selected layers are presented in the results panel on the right side of the interface.
- Outputs are displayed in the form of indicators (numerical values) and charts (visual representations) to support interpretation.
- The type and level of detail of the results depend on the specific calculation module (CM) or data layer selected.
- Users can interact with the results panel to review outputs, compare values, and download results for further analysis.

Figure 9 shows the result indicators.

2.4. General Workflow

The CoolLIFE toolbox guides users through a structured workflow for spatial analysis and cooling planning:

- **Define territorial scale:** Select NUTS regions (NUTS0–NUTS3), LAU2, or hectare-level grids.

- **Select region:** Use selection tools (square, circle, polygon) or upload a GeoJSON file.
- **Enable data layers:** Visualise key indicators (e.g. cooling demand, climate data), view legends, and download data. Retrieve numerical results via the Load Results function.
- **Run calculation modules:** Configure inputs and run modules across thematic areas (Cooling, District Heating and Cooling, Policy, Finance).
- **View results:** Results are shown as indicators and charts in the results panel and can be exported for further analysis.

Detailed guidance is available in the CoolLIFE Wiki.

3. CoolLIFE Knowledge Hub

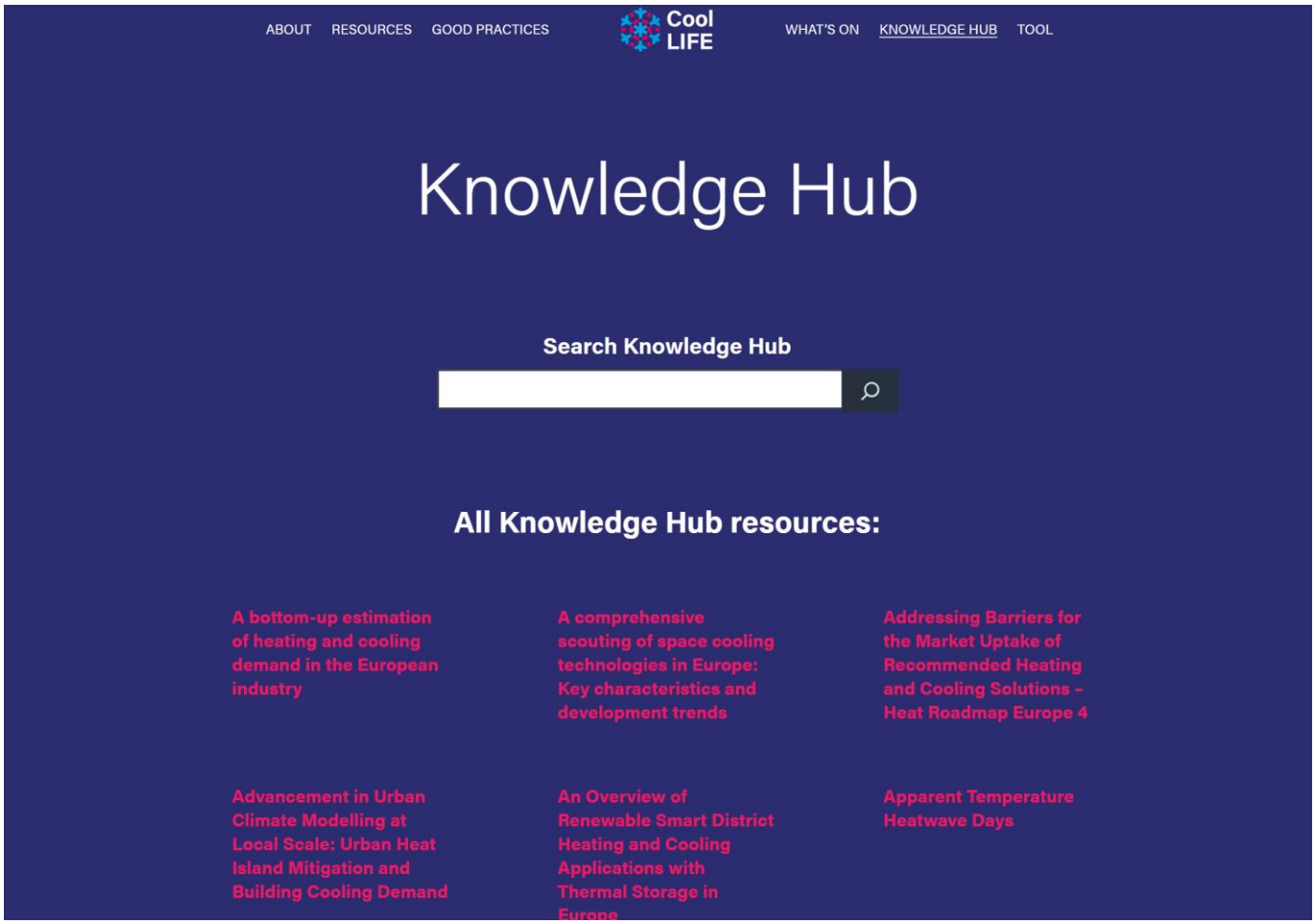

Figure 10. User Interface of the Knowledge Hub

The CoolLIFE Knowledge Hub complements the toolbox by providing a curated collection of high-quality data sources and literature related to SC in the EU-27. It includes selected scientific papers, project deliverables, datasets, and other relevant materials, with a focus on technical, climatological, and socio-economic aspects. All sources are quality-checked and comply with FAIR principles. The Knowledge Hub supports interdisciplinary research and planning by offering easy access to well-documented and reusable information.

The user can access the **Knowledge Hub** via https://knowledgehub.coollifeproject.eu or through the CoolLIFE project website. The Knowledge Hub features a search bar to help users quickly locate relevant resources, as well

as a full list of available materials for users who prefer to browse through the content.

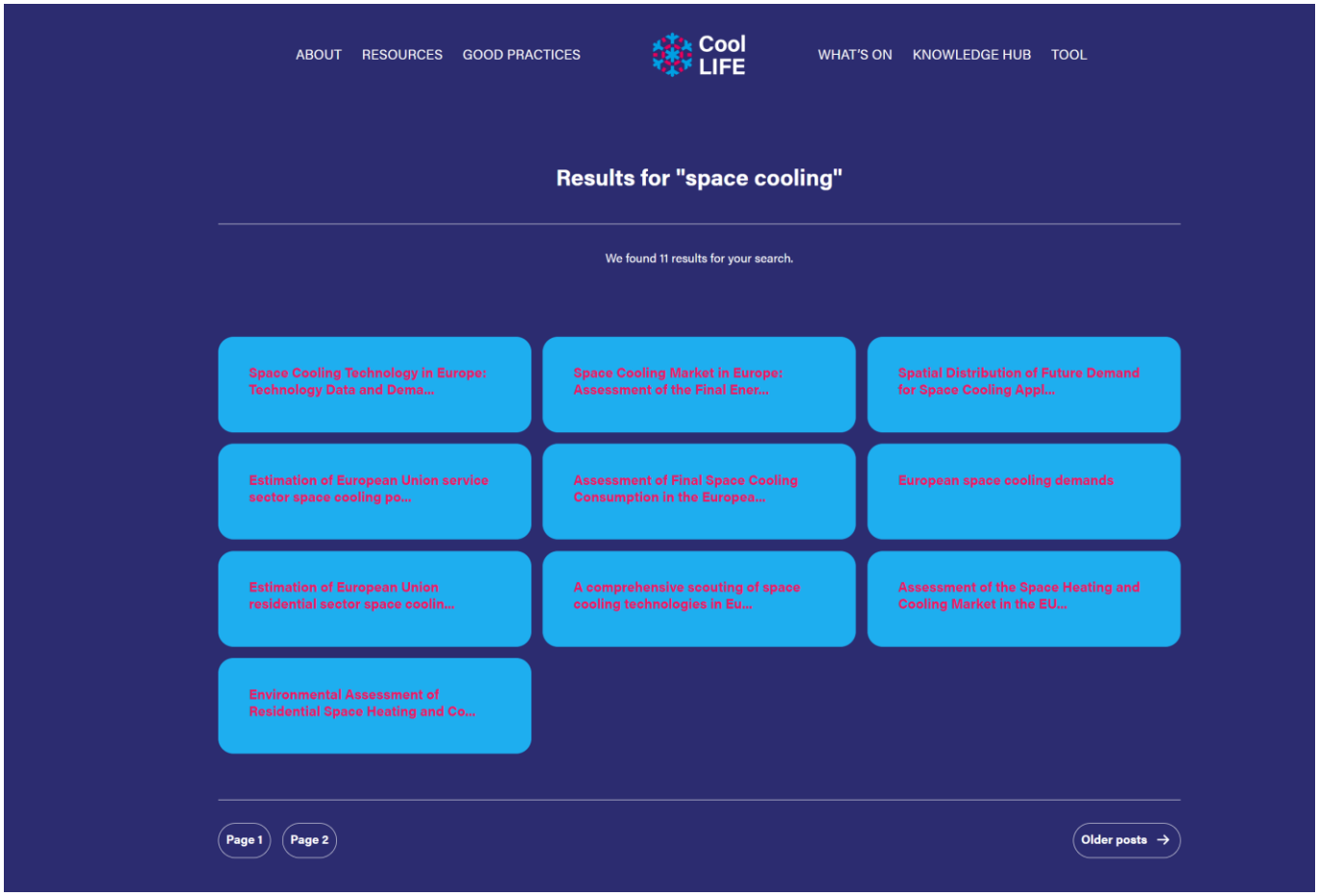

Figure 11. Search feature in the knowledge hub

Users can search for specific keywords using the search bar, which filters and displays only the resources that match the selected terms. This functionality allows users to efficiently explore the Knowledge Hub and identify relevant materials based on their interests. In addition, users have the option to browse the full list of resources to discover content across different thematic areas. The layout and user interaction of the knowledge hub is seen Figure 10, Figure 11, Figure 12.

Figure 12. Information in the Knowledge Hub

Each resource in the Knowledge Hub includes key details such as the title, author(s), year of publication, a direct URL or specific identifier link, and a list of associated keywords to support efficient search and filtering.