



Training programme for heating & cooling planning

Advanced Practical Exercise

Please send your answers to: info@actionheat.eu

Attach your exercise named in the following way: **organisation_city/area_advanced**
i.e.: "ICLEI_Freiburg_advanced"



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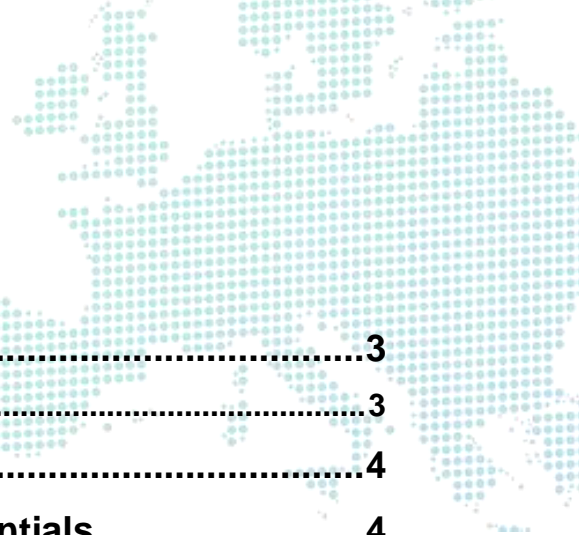


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The Hotmaps Toolbox

The Hotmaps toolbox is an energy mapping tool which allows capturing heating and cooling demand and potential of renewable sources at different territorial level. This provides a geographical representation of default data in the toolbox as well as local data sources uploaded directly to the toolbox. This document aims to demonstrate the functionality of the mapping tool through a range of exercises.

The exercises in this guide have the following structure:

- 📍 **Task.**
- 📍 **Detailed step-by-step guide.**
- 📍 **Feedback with the space for own comments that could be later reported to the toolbox authors.**

Some exercises have also an introduction and research question to answer to.

Tutorial, Wiki and Handbooks

Before addressing the mapping exercises, please watch this video tutorial:

<https://www.hotmaps-project.eu/how-to-use-hotmaps/>

If at any time you feel that you want to understand better the toolbox functionalities, please visit the Hotmaps Wiki, always accessible under the link:

<https://wiki.hotmaps.hevs.ch/en/Welcome>

If you feel that you would like to deepen further your understanding of the reasoning behind the Hotmaps calculation modules and the theory of strategic heating and planning, please refer to the Hotmaps Handbooks:

- 📍 [Summary of the Hotmaps Handbooks for strategic heat planning](#)
- 📍 [Handbook 1 – Definition & experiences of strategic heat planning](#)
- 📍 [Handbook 2 – Guidance for comprehensive assessment of efficient heating and cooling](#)
- 📍 [Appendix report to the Handbook for strategic heat planning: Case descriptions](#)

ADDRESS: You can access the Hotmaps Toolbox here: <https://www.hotmaps.eu/>

BROWSER: The Hotmaps toolbox is fully compatible with Chrome and Firefox, while a number of incompatibilities have been reported when accessed through Microsoft Edge and Internet Explorer. Therefore, we recommend that you complete your training accessing the toolbox through Chrome or Firefox. At the time of writing this training material, June 2020, the recommended compatible versions are: Chrome version 83.0.4103.61 and Firefox version 76.0.1. For the most up to date indications, please see the disclaimer visualized accessing the development server.

1 Identify a significant area

Exercise: Identify an area that you think would be significant exploring with Hotmaps, indicate the name of the area/city, why you think it has a potential for heating and cooling management or for district heating and cooling

Name of your chosen area/city:


Why you think it would be interesting exploring (explain its heat saving/DHC potential):

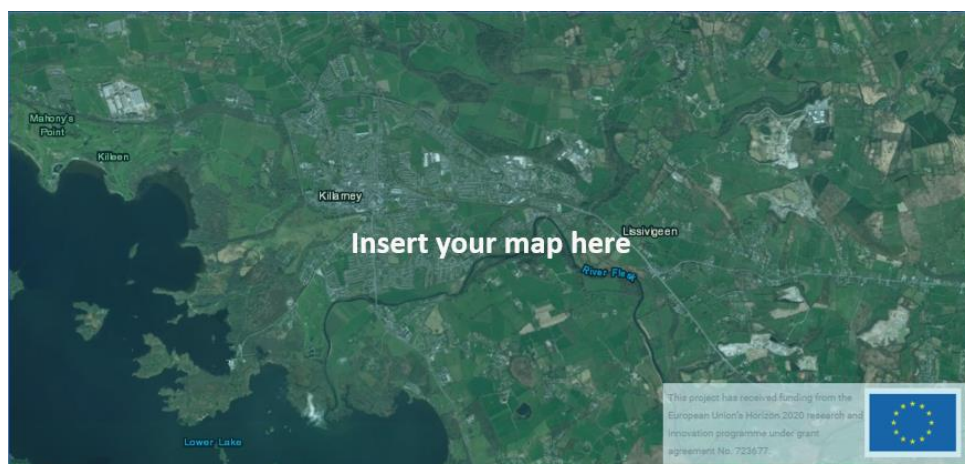
2 Map heat demand and resource potentials

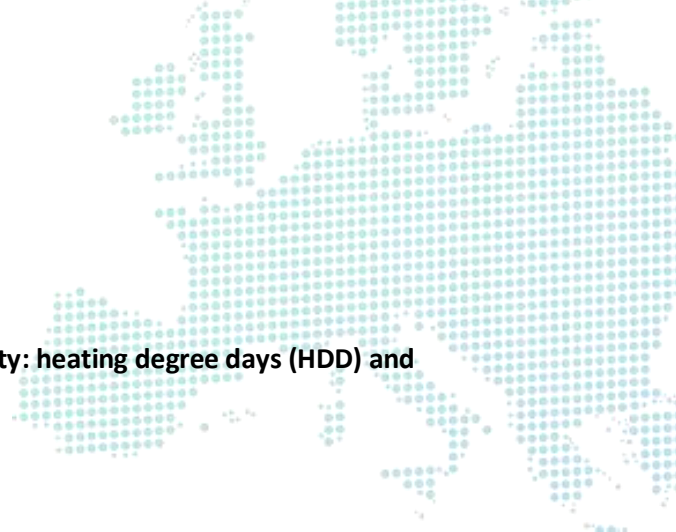
1.1 Overview Map

Exercise: Access the Hotmaps Toolbox and generate an overview map of the chosen area/city (all the following exercises will be done on the same area/city).

Step-by-step procedure:

- Access Hotmaps and select the 'LAU2' in the territorial NUTS scale on the right-hand side of the screen.
- Find your chose area/city on the map and select it. You can use the search tool in the top left corner 'Go to place' and type there the location name or move the map with the mouse to the desired area and click on the bounding box that contains it.
- Use the Windows snipping tool  to take a picture and insert it below:






1.2 Climate Indicators

Exercise: List the climate indicators for your chosen area/city: heating degree days (HDD) and cooling degree days (CDD).

Step-by-step procedure:






- 📍 Open the 'Layers' panel using the icon .
- 📍 Select 'Heating degree days' and 'Cooling degree days' from the left panel.
- 📍 Choose 'Load results'.
- 📍 Copy and paste the required results from the right panel of Hotmpas, to the spreadsheet 'Exercise 1 and 2.xls' tab 1.3 Climate Indicators.

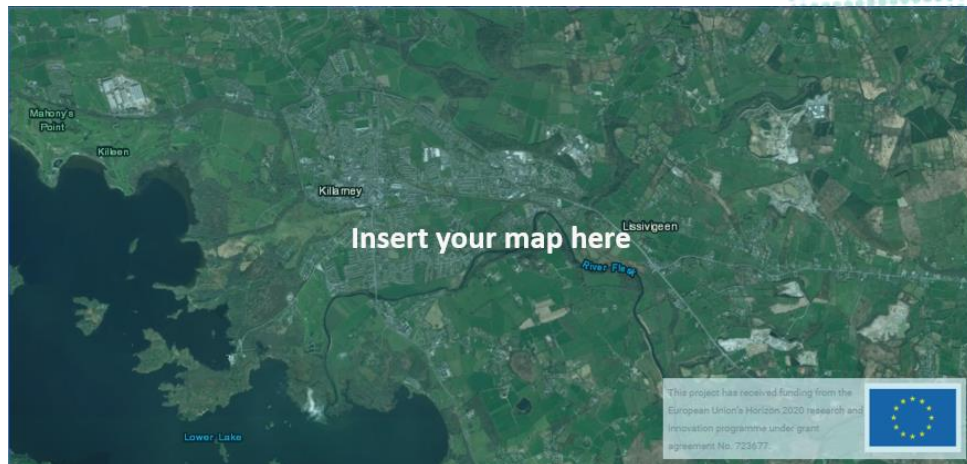
	HDD (heating degree days)	CDD (cooling degree days)
Average		
Maximum		
Minimum		

1.3 Visualisation of a heat demand density map

Exercise: Generate a heat demand density map for your area based on the default data in the toolbox.

Step-by-step procedure:

- 📍 Zoom to the location that you want to analyse and click on the bounding box that contains your chosen area/city. Hotmaps allows to selects the desired area at several territorial levels, clicking on the relevant cells or drawing the location boundaries with the drawing tool .
- 📍 Select the layer 'Heat density total' and click on the symbol for Symbolology of the 'Heat density total' layer  to see the color coding of the the heat demand density map.
- 📍 Save your current selection of cells and zoom level with the button 'Save'  located in the top left menu. You will have to name your session and provide an optional description. You can retrieve it anytime through the button 'Folder' .
- 📍 Use the snipping tool  to take a picture including both the city map and the legend and insert it here:



IMPORTANT NOTE: The area you analyse should have at least 30 GWh of heat demand per year.

IMPORTANT NOTE: Please note that the heat demand density layers are expressed in terms of final energy, not in terms of useful energy. In order to calculate these layers in terms of useful energy, you can either scale the single output, multiplying them by the average efficiency factor for heating systems in the selected area, or you can use the calculation module “Scale heat and cool density map”, indicating the average efficiency factor for heating systems in the selected area, and the module will produce the heat demand density map in terms of useful energy. You can then download, save and use that map and data for further analysis.

1.4 Heating and Cooling Demand

Exercise: Retrieve the heat and cold demand of your chosen area/city based on LAU/NUTS borders and based on bespoke borders selected on your own.

Step-by-step procedure:

- 📍 Zoom to the location that you want to analyse, click on the bounding box that contains your chosen area/city. Make sure you remain at the scale 'LAU2'.
- 📍 Select the following categories in the left panel 'Layers':
 - Heat Density Total
 - Heat Density Residential Sector
 - Heat Density Non-Residential Sector
 - Cooling Density Total
 - Population Total
 - Gross Floor Area Total
 - Gross Floor Area Residential
 - Gross Floor Area Non-Residential
- 📍 Click 'Load results' these are shown together with the other layers previously selected. If you want to visualize only new results, unflag previously selected items.

- Manually copy and paste the required results in the NUTS/LAU column in the tab '1.5 Heating and cooling demand' of the spreadsheet 'Exercise 1 and 2.xls'. As some results have the same name for different layers, the layer is indicated in brackets e.g. Heat demand total (TOTAL) refers to the result 'Heat demand total' of the layer 'Heat Density Total'

IMPORTANT NOTE: Please make sure that the layer Population is selected before loading results, as the toolbox can calculate the values "Heat demand per person" and "Theoretical cooling needs per person" only when the Population layer has been selected.

	Unit	Selection 1: NUTS/LAU
Heat demand total (HEAT DENSITY TOTAL)	GWh/yr	
Heat demand total (HEAT DENSITY RESIDENTIAL)	GWh/yr	
Heat demand total (HEAT DENSITY NON- RESIDENTIAL)	GWh/yr	
Theoretical cooling needs total (COOLING DENSITY)	GWh/yr	
Total population (POPULATION)	Pers.	
Heat demand per person (HEAT DENSITY TOTAL)	MWh/pers.*yr	
Theoretical cooling needs per person (COOLING DENSITY)	MWh/pers.*yr	
Gross Floor Area (TOTAL)	m ²	
Gross Floor Area (RESIDENTIAL)	m ²	
Gross Floor Area (NON-RESIDENTIAL)	m ²	
Average heat density (HEAT DENSITY TOTAL)	kWh/m ²	-
Average cooling density (COOLING DENSITY)	kWh/m ²	-

What parameters can be considered in the heating and cooling mapping? What proportion of the total heating needs constitutes the residential and non-residential customers?

1.5 Compare the heat demand with another city

Exercise: Compare the heat demand and other indicators just loaded for your chosen area/city, with the values for another city (e.g. a neighbouring city, a city with similar size, a partner city, your current city...)

	Unit	[Your chosen area/city]	[Second chosen area/city]
Heat demand total (HEAT DENSITY TOTAL)	GWh/yr		
Heat demand total (HEAT DENSITY RESIDENTIAL)	GWh/yr		

Heat demand total (HEAT DENSITY NON- RESIDENTIAL)	GWh/yr		
Gross Floor Area (TOTAL)	m ²		
Gross Floor Area (RESIDENTIAL)	m ²		
Average heat density (HEAT DENSITY TOTAL)	kWh/m ²	-	-

How different is the heat demand for your chosen area/city and the second/neighbouring area/city?

1.6 Identify available RES potentials

Exercise: Identify available RES potentials in and around your chosen area/city.

Step-by-step procedure:

- Click again on your chosen area/city and select the relevant layers for RES sources indicated in the relevant Group table in 'Exercise 1 and 2.xls'. Click 'Load Results' and complete the 'Figure' column of the spreadsheet.
- Check the [WIKI](#) to know more about the different renewable energy potential data (what do they mean, how they have been calculated).
- Look at the collected numbers and try to assess which proportion of the identified RES sources can be realistically exploited for the energy production purpose based on your own knowledge. Indicate % in the corresponding column.

IMPORTANT NOTE: The parameter "exploitable potential" is not an output of the toolbox. You are asked here to evaluate which share of the gross potential you consider exploitable in percentage. It is hard to give a qualified estimate if you do not know the specific city, but just try as this training is more about understanding how to use the toolbox. Close-to-real scenarios can always be developed once you work with strategies for cities you may know better than Thomaszow Mazowiecki, PL. The absolute exploitable potential is derived by multiplying the percentage times the gross potential. E.g. forest residues: 4MWh/ha/yr or 2,32 GWh/yr for the LAU2 region. If you find this figure too high you may assess that e.g. only 75% is realistically exploitable, i.e. 3 MWh/ha/yr or 1.74 GWh/yr.

IMPORTANT NOTE: For "spatial" RES potential please consider expanding the area of investigation to the hinterland of the city and not just harvest the areas close to the city center. Always check the max resolution of each RES: you may not find enough RES potential in the cell of the city you are analysing at LAU2 level, but there could be available potential in the cells around it (e.g. excess heat or waste water) or at a higher level (e.g. wind and geothermal potential = 0 at LAU2, but populated at NUTS3). At the same time, while considering a wider area, please do not go too far either, as some sources could not be exploitable if too distant (e.g. excess heat from an industrial site not in the same cell, but not further than 20-30km from the area selected for a district heating assessment).

IMPORTANT NOTE: Pay attention to the indicated maximum resolution for each RES potential, as not all sources were spatialised at the maximum resolution of 1 hectare (ha). Some categories are available only down to the NUTS3 scale. Others have been disaggregated to the ha-resolution based on the original data sourced from NUTS3. Wastewater plants, on the other hand, are indicated specifically by the location points, and the results in the right panel will correspond to only the plants situated within the area of selection.

Potential	Unit	Max. Resolution (NUTS, LAU) ^[1]	Figure	Of which realistically exploitable	
				[%]	[abs.]
Wastewater Treatment Plants (POWER)	MW	Points			
Wastewater Treatment Plants (CAPACITY)	PE	Points			
Agricultural Residues	GWh/yr	NUTS3			
Forest residues	Avg. MWh/ha/yr	NUTS3, disagg.			
	GWh/yr	NUTS3, disagg.			
Wind potential at 50 meters	Avg. speed m/s	Raster			
Solar radiation on building footprint (Average)	kWh/(m²*yr)	ha			
Geothermal potential heat conductivity	Avg. W/mK	NUTS3			
Total solar thermal potential - Rooftop	GWh/yr	ha			
Total solar thermal potential - Open Field	GWh/yr	ha			

What are the possibilities for the transition to renewable energy in the city?
What are the available RE resources in the proximity and how much energy they are able to generate?

1.7 Identify excess heat from conventional sources

Exercise: Identify excess heat from conventional sources in and around your chosen area/city.

Step-by-step procedure:

- Go to the Layer-Group 'Industry' and select the following layers:
 - Industrial Sites Emissions
 - Industrial Sites Excess Heat

- Identify excess heat from conventional sources in the region and fill out the following table in the spreadsheet 'Exercise 1 and 2.xls', tab 1.10 Excess heat potentials.

Potential	Unit	Figure
CO ₂ -emissions of energy intensive industries	t/yr	
Excess heat potential [100°C - 200°C]	GWh/yr	
Excess heat potential [200°C - 500°C]	GWh/yr	
Excess heat potential [>500°C]	GWh/yr	
Total Excess Heat Potential of Energy-intensive industries	GWh/yr	

Are there available excess heat sources in the neighbourhood to supply the heating demand of the city? Are they sufficient to cover heating needs? To what extend?

About Act!onHeat

Heating and cooling (H&C) accounts for about half of Europe's total energy needs with 75% still dependent on fossil fuels. Thus, rapid and significant change is needed to reach the EU 2050 goals. Due to the local nature of H&C systems, action has to be taken at local level involving a variety of stakeholders. This has been recognised in recent years and activities have been started like developing best practice policies and open source analysis tools. However, (efficient) H&C planning and project development are still not commonplace in most European municipalities.

Act!onHeat will enable and accelerate local Heating & Cooling transitions by:

- identifying success factors of effective energy plans, turning them into practical workflows;
- developing individual and group support activities to guide municipalities, local planners and stakeholder in applying these workflows;
- facilitating finance and the design of effective heat & cooling projects and policy frameworks

www.actionheat.eu

