5th International Conference on Smart Energy Systems
Copenhagen, 10-11 September 2019
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Application of Hotmaps toolbox in the project DeCarb
Supporting the Clean Energy Transition of Coal-Intensive EU Regions

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Funded by the Horizon 2020 programme of the European Union

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1. PROJECT DECARB – OVERVIEW

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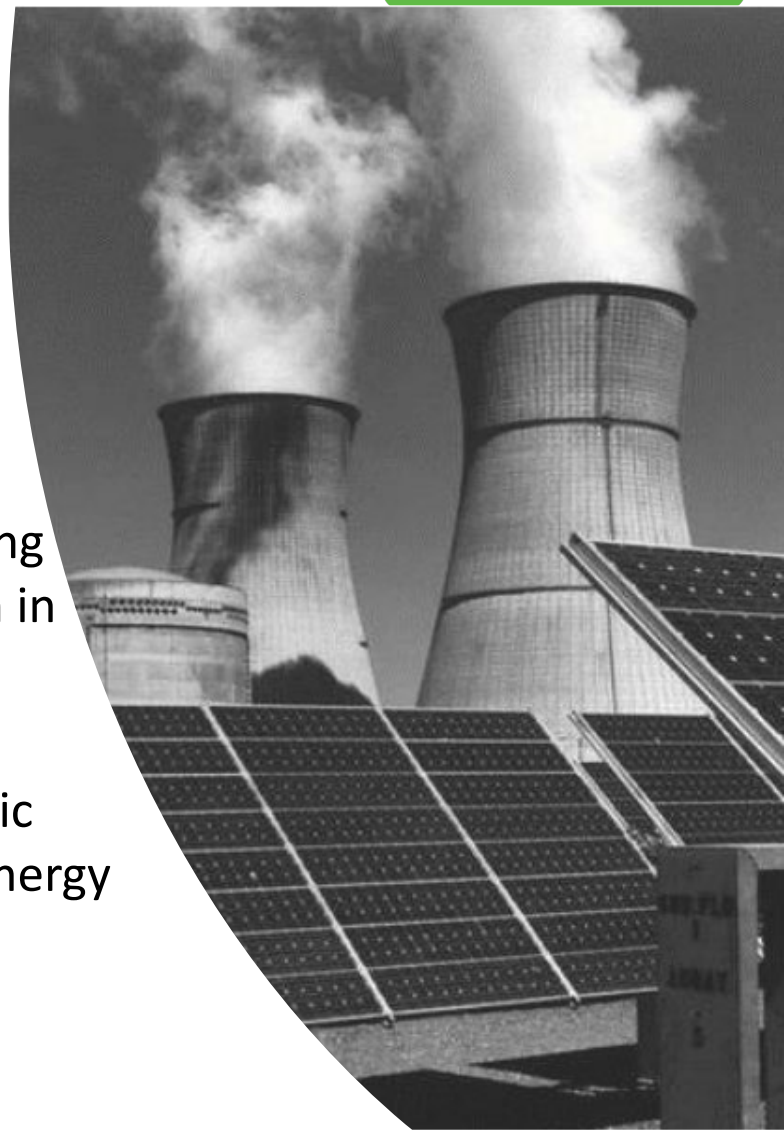
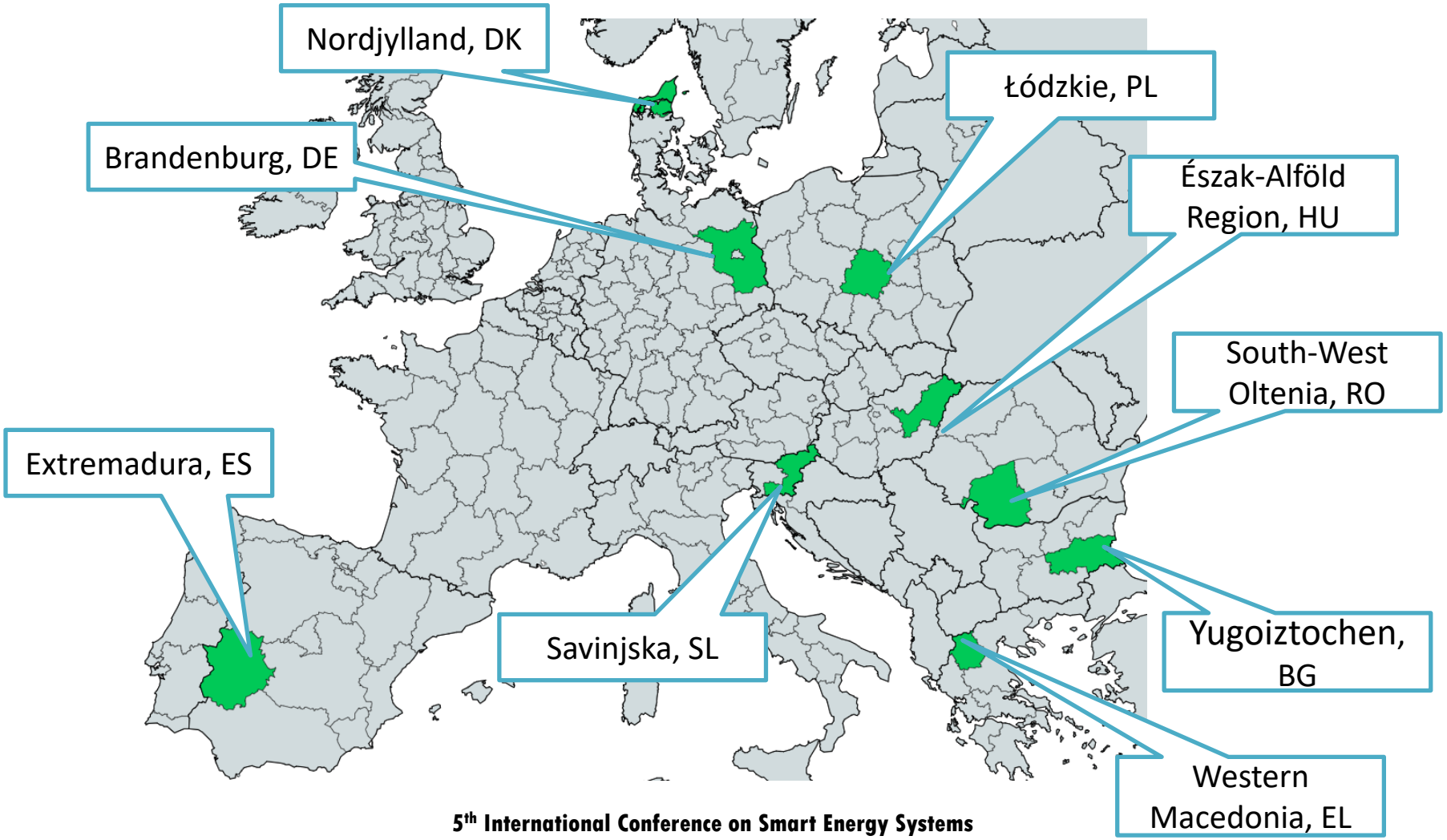
Project DeCarb

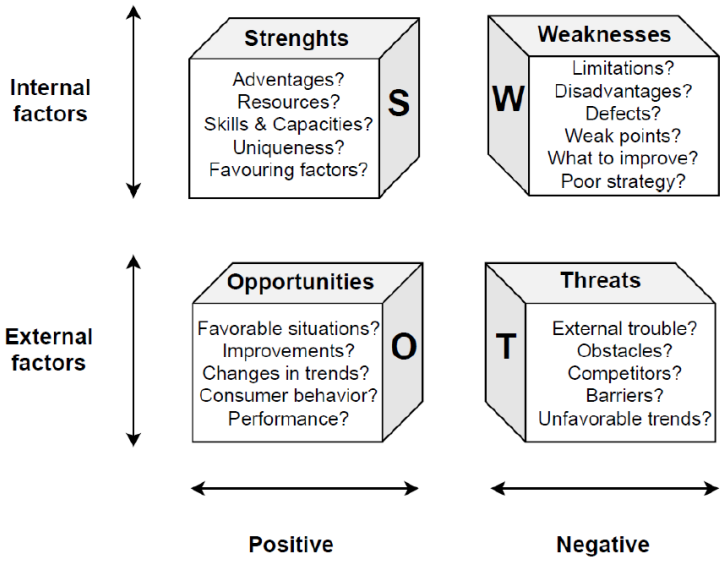


- Interreg Europe funding
- DeCarb addresses the challenge of combining the clean energy transition and job creation in coal-intensive EU regions.
- The project aims to support the regions in securing sustainable development, economic and social stability, and a role in the 2030 energy mix.
- https://www.interregeurope.eu/decarb/

DeCarb's territories



DeCarb - SWOT analysis



What: Key strengths, weaknesses, opportunities and threats of the clean energy transition.

Who: PlanEnergi on behalf of House of Energy.

How: Energy data collection from from DeCarb territories.

Why: to determine decarbonisation growth pathways, and reduce economic and social risk of diversifying sources of energy production.

2. HOTMAPS – FUNCTIONALITIES

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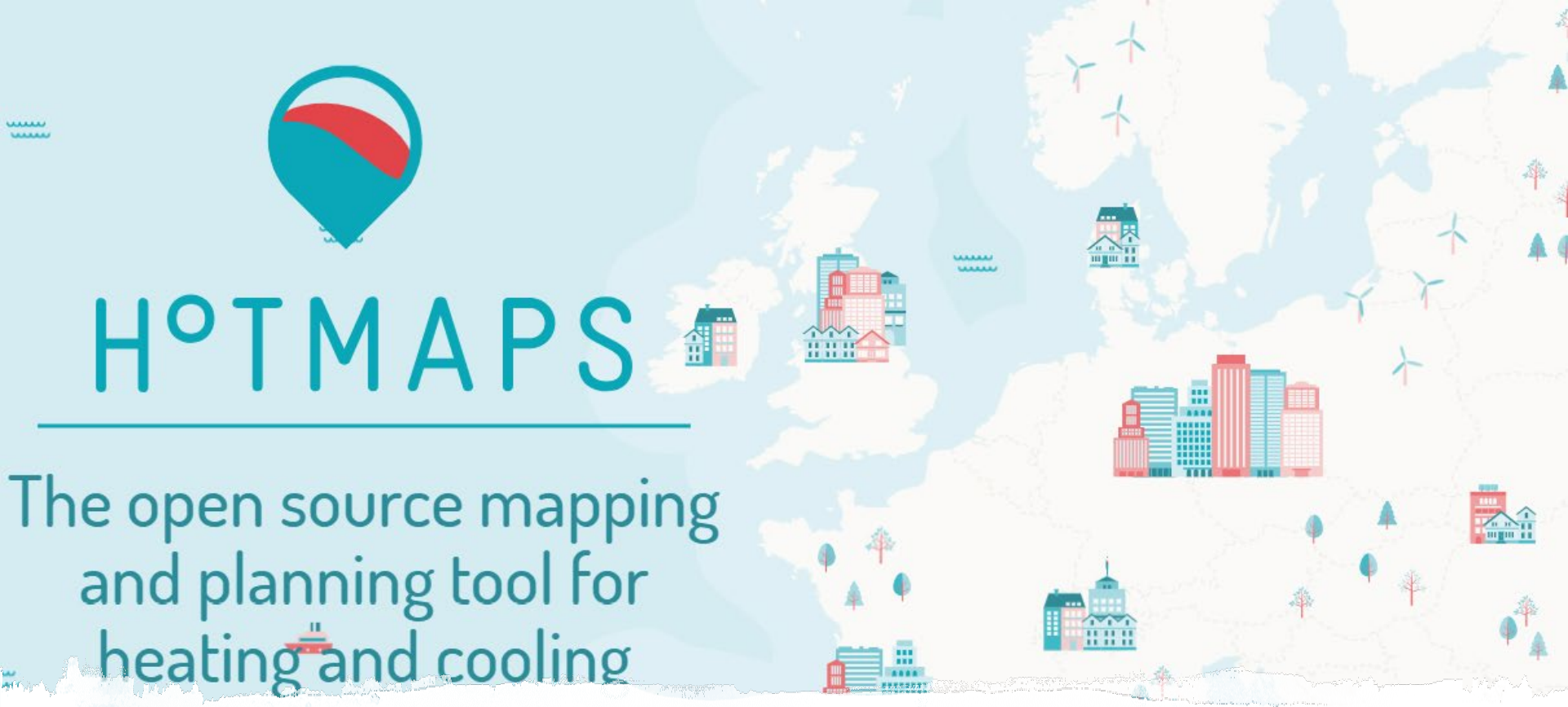

HOTMAPS

The open source mapping and planning tool for heating and cooling

Mapping tools

- Energy consumption
- Gross Internal Area
- Excess heat from processes
- Population
- RES potential
- Climate data
- Electricity emissions

Calculation modules

- Heat and cooling scaling
- DH potential areas
- DH economic assessment
- Decentralised heat supply
- Excess heat supply cost
- Demand projection
- Heat load profiles

3. HOTMAPS – TOOL APPLICATION IN DECARB

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Data collection Manual

Source name	HotMaps - Heating and Cooling Open Source Tool for Mapping and Planning of Energy Systems
Author	Technische Universität Wien (TU Wien),
Issue date	February 2019
Date of data used	2015
Source link	http://www.hotmaps.hevs.ch/map

o extract the required figures for your region, please follow the steps:

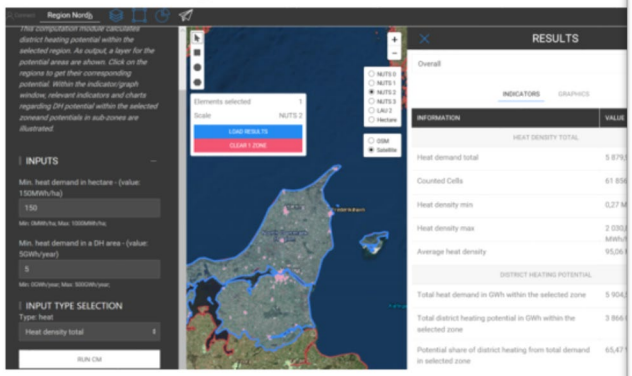
- Go to the website address.
- Select the NUTS2 in the territorial NUTS scale on the right-hand side of the screen.
- Find on the map and select your region (you can use the search tool in the top left corn 'Go to place' or using the mouse move the map to the destined area and click on yo region).
- Open filter panel using the icon and select the tab 'Calculation modules'.
- In the 'Buildings' category click on the button 'District Heating Potential'.
- Insert input variables and run calculations by selecting the button 'Run cm'. There a two variables that should be defined.
  - a minimum capacity of a single heat network that could be built -1 GWh, 5 GV and 10 GWh were selected for Nordjylland.
  - a minimum heat demand required to occur per one hectare in order this area could be connected to the DH – 1 MWh/ha, 150 MWh/ha and 300 MWh/ha were selected for Nordjylland.

  A few different values should be tested to show the range of district heat potential.
- After running the tool, copy the result 'Potential share of district heating from total demand in selected zone'(%).
- Repeat the calculation for each combination of these two variables to get different figures of DH potential and collate them in the table as shown below which enable to make a graph.

The list of figures to be collected with the example values

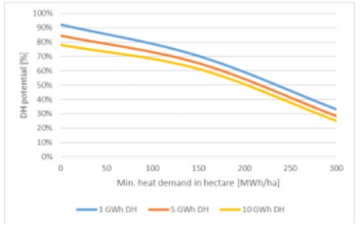
Total potential of district heating supply		Min. heat demand in hectare		
		1 (MWh/ha)	150 (MWh/ha)	300 (MWh/
Min. heat demand in a DH area	1 (GWh/year)	92%	71%	33%
	5 (GWh/year)	84%	65%	29%
	10 (GWh/year)	78%	61%	25%

The example view of the data source with the results for DH potential that need to be extra is illustrated on the following picture.



District heating supply	General data		Specific data	
	GWh	GWh/1000 of population	GWh	GWh/1000 of population
DH heat sale	3,000	3000/587335/1000 = 5.1	3,620	3620/587335/1000 = 6.2
Other heat supply	2,880	2880/587335/1000 = 4.9	2,350	2350/587335/1000 = 4.0
Total heat demand	5,880	5880/587335/1000 = 10.0	5,970	5970/587335/1000 = 10.2
DH %	51%	N/A	61%	N/A

3. Graph showing district heating supply potential (no local data was available for comparison)



This graph was drawn using the outputs from the HotMaps district heat potential tool. Each line was is created using three results of DH potential (%) in a function of min. heat demand in hectare. The blue line represents the findings from the 1st row in table below (for the minimum DH size of 1 GWh/year), the orange line refer to 2nd row (for the minimum DH size of 5 GWh/year), and the yellow line represents the last row (for the minimum DH size of 10 GWh/year).

Total potential of district heating supply		Min. heat demand in hectare		
		1 (MWh/ha)	150 (MWh/ha)	300 (MWh/ha)
Min. heat demand in a DH area	1 (GWh/year)	92%	71%	33%
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SWOT report

PlanEnergi

DeCarb – Supporting the clean energy transition of coal-intensive EU regions

Final Report

Reference case study and SWOT analysis identifying the most advantageous growth areas in relation to the existing workforce and territorial specificities in order to create alternative to coal-driven activities

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DeCarb
Interreg Europe

European Union
European Regional Development Fund

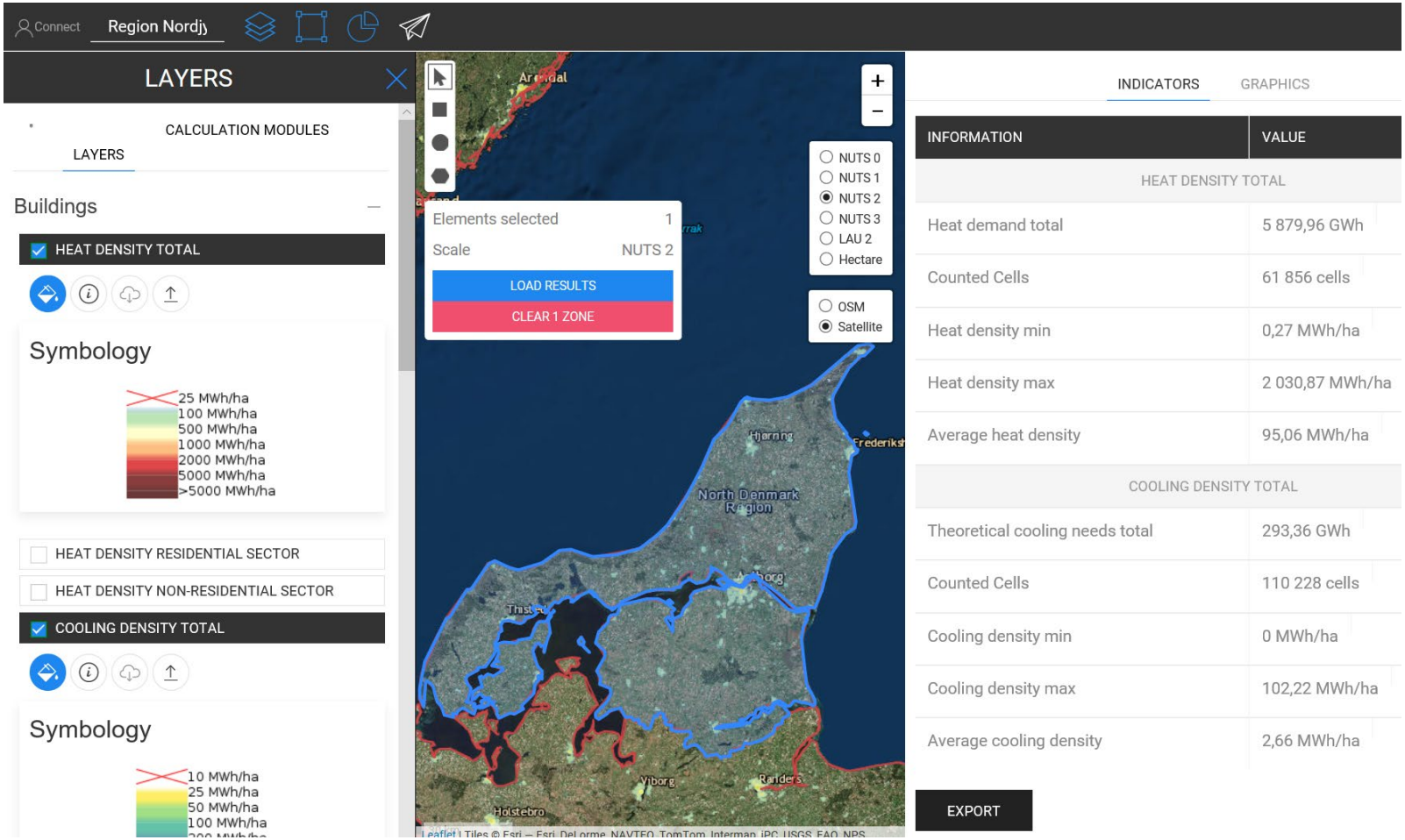
16th August 2019

5.1.2 Denmark – Nordjylland region

STRENGTHS	WEAKNESSES	OPPORTUNITIES	THREATS
- The amount of coal used for electricity and heat production and industrial processes is relatively low (20-30%) compared to the total production making the last steps in the transition easier. - The local energy sources from especially wind and solar can cover the total consumption of electricity and heat. Besides that, there are huge resources of excess heat from industries and geothermal heat. - More than 60% of heat demand is supplied by district heating. Thus, the infrastructure is suitable for high use of RES and transition to other fuels than coal. - Less than 250 directly workplaces and a little more than 1000 indirectly workplaces are connected to the coal value chain compared to a total of 265,000 workplaces in the region. - The unemployment rate is very low (3.3%) and employment in	- Some of the technologies (especially large-scale heat pumps, large scale storages, and geothermal heat) are still in the development phase. - The coal-fired plant Nordjyllandsværket is one of the most efficient in the world and still able to run at least 8 years more. - Change to biomass is not the final solution, so technologies without burning fuels are preferable. - Cement production (the industrial use of coal) is private business and thus coal is low taxed and a cheap solution. Also, other fuels might not be able to provide with the necessary temperatures for the production process. - CCS from cement production is not economically feasible. - Use of excess heat from industries is complicated caused by a complicated tax system. - Nordjylland (and Denmark) does not have a direct coal industry.	- The industrial structure in Region North Denmark is very well for the production of needed technologies for the production of electricity and heat using renewable sources since all near parts of the technologies are already produced in the region or under development. - Researchers at Aalborg University will be able to support the development of the needed technologies in the industry. - The transition of Nordjyllandsværket can be a demonstration case how to replace coal-fired electricity and heat with a new smart, hybrid energy system with electricity from wind and solar and heat from industrial production (excess heat), thermal storages, solar thermal, heat pumps using different heat sources and maybe geothermal heat. - CO_2 from flue gas from cement production can be utilized as a carbon source in methanol production. This technology will	- Cheap CCS technologies might be more economically attractive than transition to RES. - Boundary conditions for district heating can be changed making individual systems more attractive and thus reduce the total flexibility in the energy system. - EU might reduce ambitions for prevention of climate changes. - The CO_2 quota system might not work, resulting in low prices. - The Danish government might give up their policy for zero-emission in 2050. - The only coal-based power plant in Nordjylland is owned by the municipality, so if the local policymakers do not implement the right regulations, the power plant will continue to run on coal. This scenario is very unlikely though, as the city council unanimously voted to convert the power plant to renewable energy. The municipality bought the powerplant from private owners

Energy consumption

Heat and cooling demand - total annual and consumption per area



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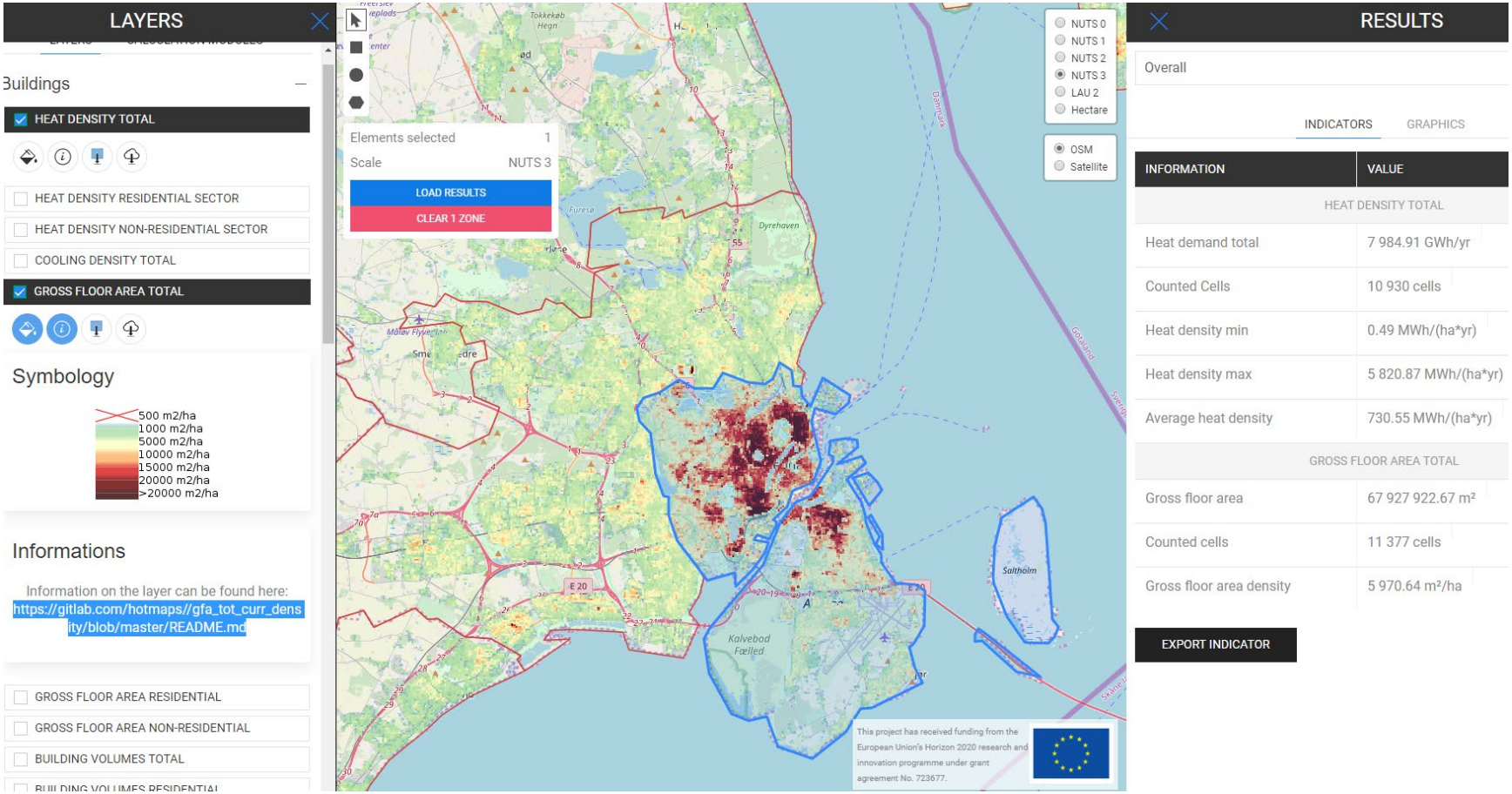
Gross Internal Area

A density of gross floor area for buildings per hectare of land



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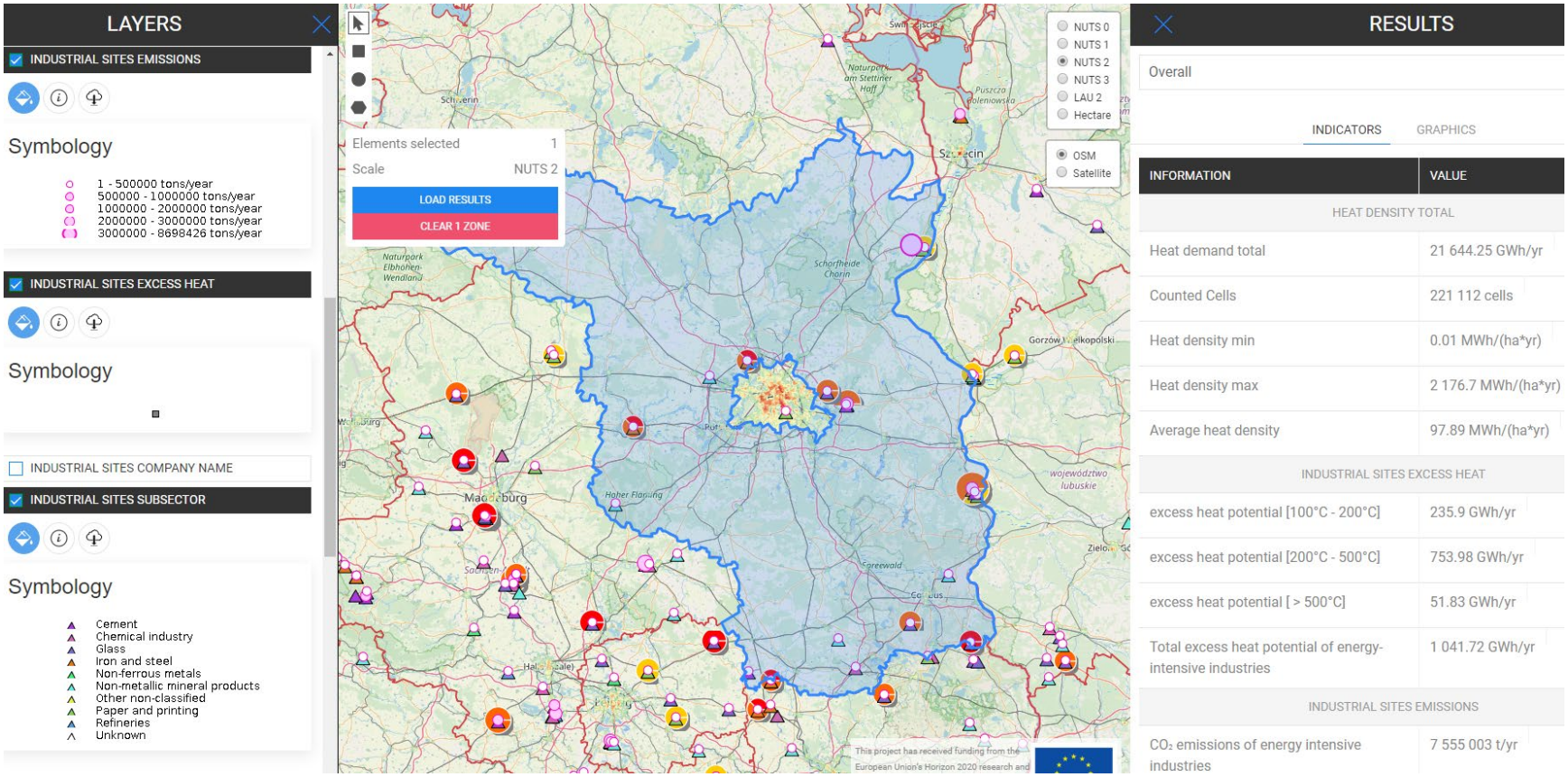
Excess heat - Industrial

Potential for spare heat from industrial processes and plants



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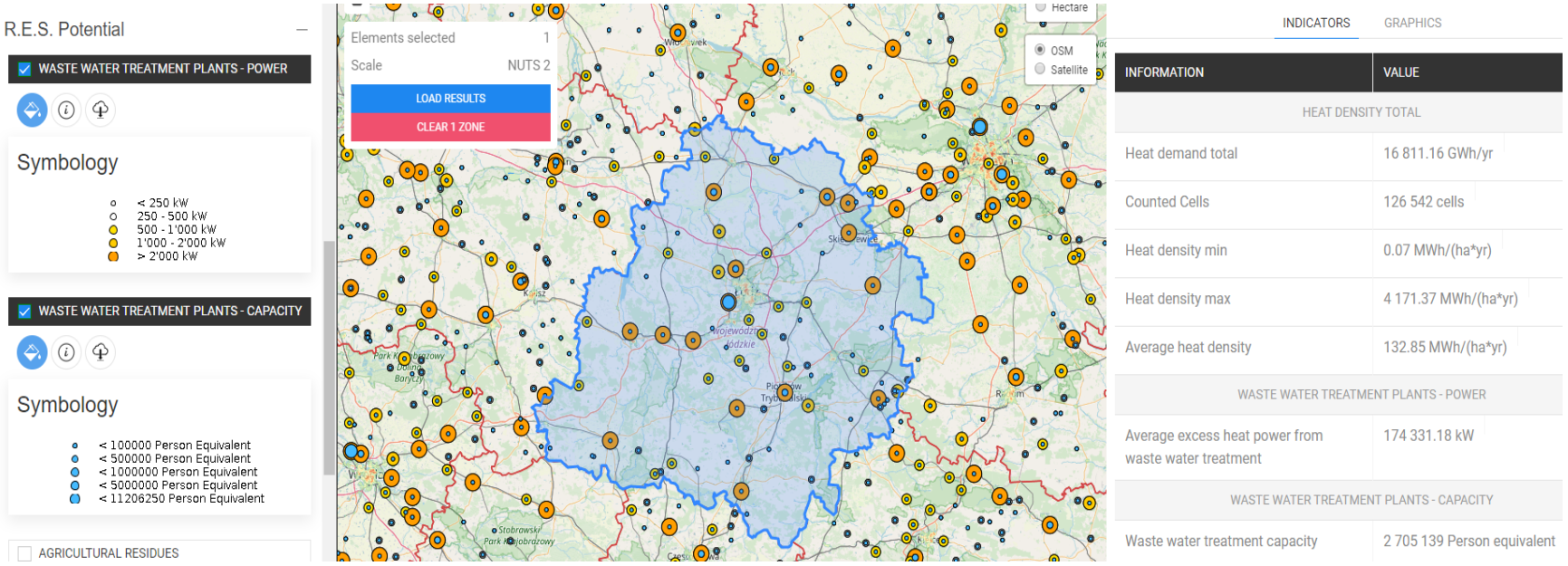
Excess heat – Waste water

Potential for spare heat from industrial processes and plants



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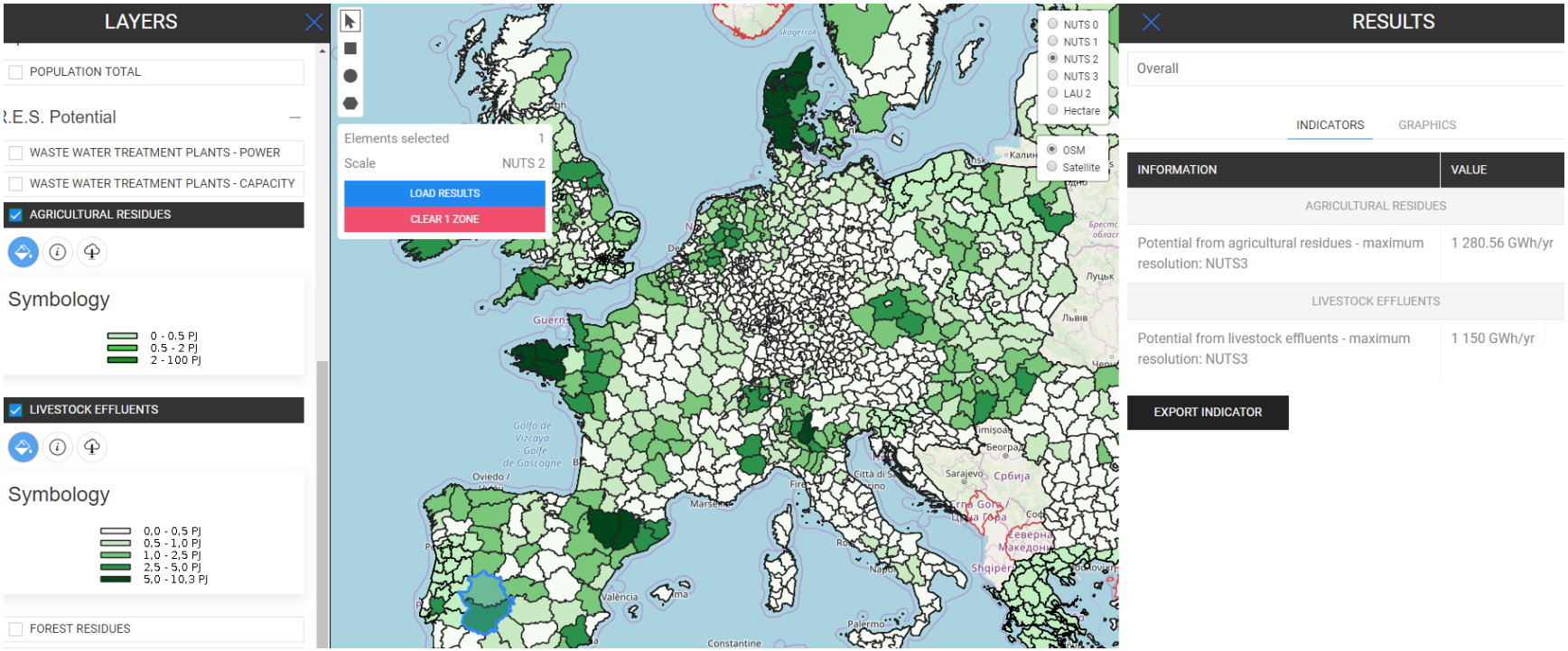
RES potential

Agricultural residues (straws, prunings and residues from agro-industrial processes), Livestock effluents (liquid and solid residues from breeding pig, cattle, poultry)



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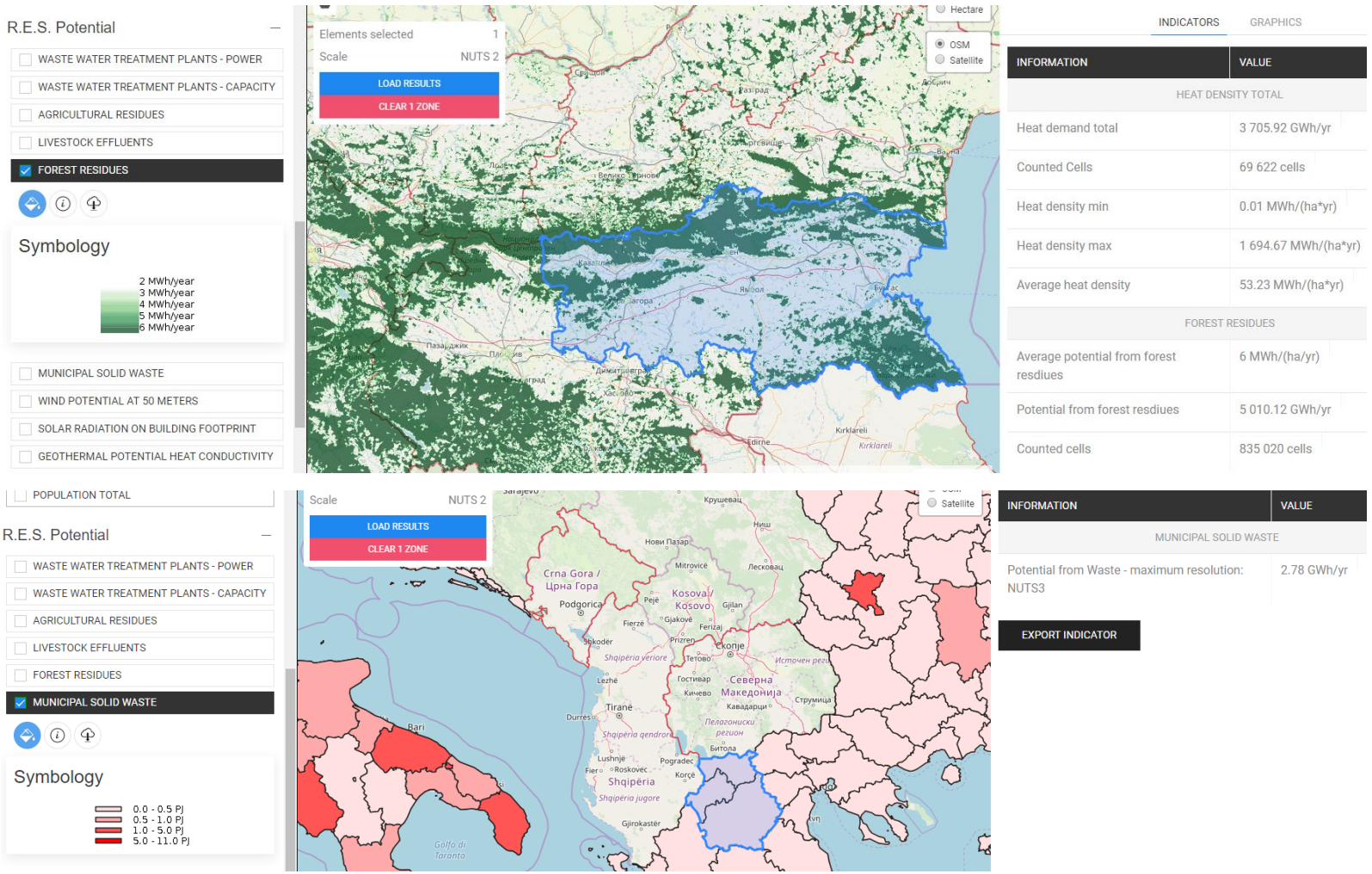
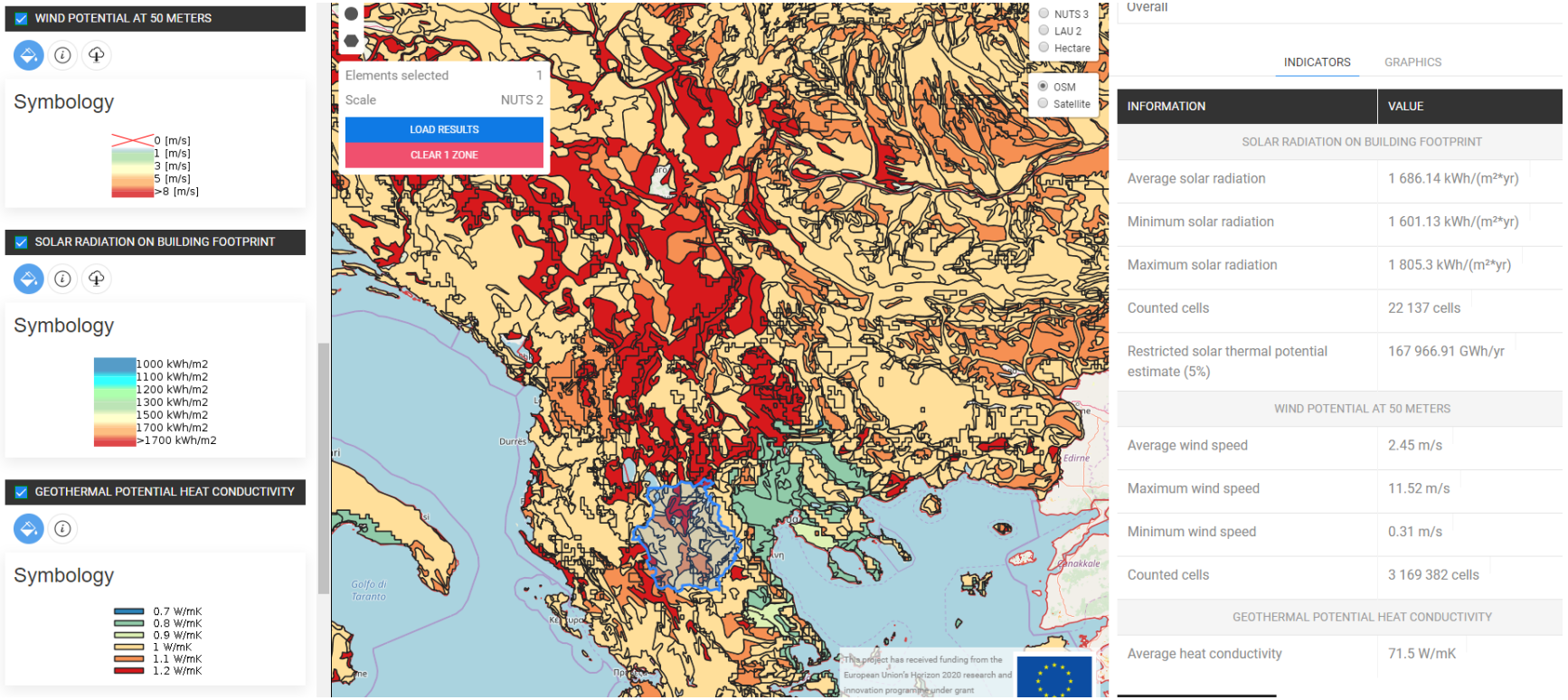
RES potential cont.

Forest residues, Municipal solid waste



RES potential cont.

Wind speed, Solar radiation, Geothermal heat conductivity potential



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4. PROJECT RESULTS

Project DeCarb

results and next steps

- The SWOT provided a thorough overview of the strengths and weaknesses regarding energy resources and also emphasized a diversity in environmental, social and economic conditions across all investigated locations.
- The findings increased the awareness among local authorities helping them to prioritise the adoption of alternative and diversified growth trajectories in the decarbonisation of the economies.
- The SWOT analysis is being used in developing the main deliverable: Energy Action Plans which will address policy instruments on territorial needs and decarbonisation pathways.

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