

sEEnergies


Tool Box – Visualisation, Exploitable Tools and Data from sEEnergies


Energy Efficiency First Summit

WP5: Halmstad University (HU), Europa-Universität Flensburg (EUF), Aalborg University (AAU), Universiteit Utrecht (UU), TEP Energy GmbH (TEP Energy), Fraunhofer Gesellschaft zur Förderung der Angewandten Forschung E.V. (Fraunhofer), Norges Miljø-og Biovitenskaplige Universitet (NMBU)

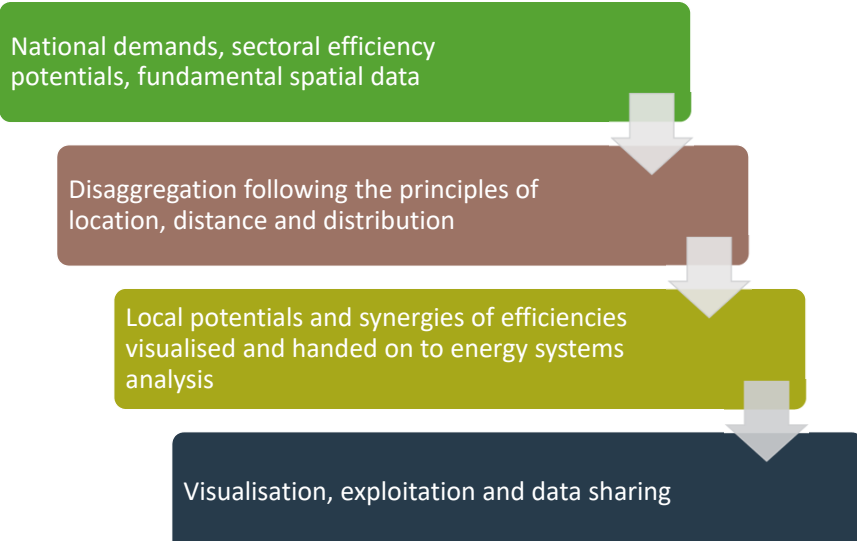
bernd.moeller@uni-flensburg.de, urban.persson@hh.se, eva.wiechers@uni-flensburg.de, luis.sanchez_garcia@hh.se

2022-05-31



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Workflow: from national data to local synergies in energy efficiency



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graph TD; A[National demands, sectoral efficiency potentials, fundamental spatial data] --> B[Disaggregation following the principles of location, distance and distribution]; B --> C[Local potentials and synergies of efficiencies visualised and handed on to energy systems analysis]; C --> D[Visualisation, exploitation and data sharing];
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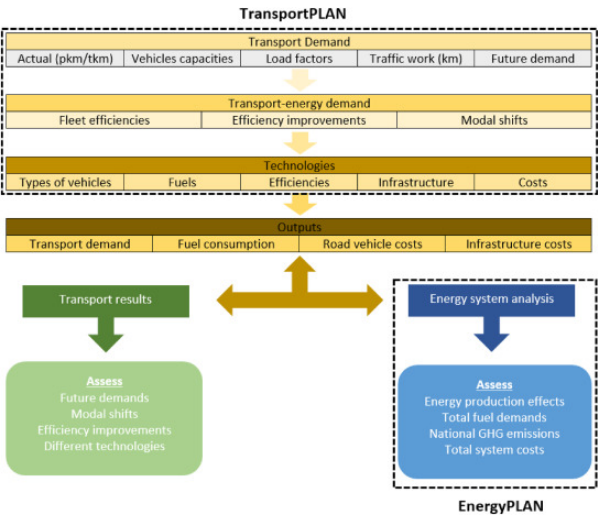
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Energy efficiency potentials - Transport



- ❖Particular focus due to great challenges:
 - ❖>95% reliant on oil
 - ❖High increase historically
 - ❖Large potential for electric cars and direct electricity but..
 - ❖Specific challenges in bringing in electricity in sea, aviation and good transport
- ❖Mapping of all modes of transport
- ❖Connects to Advanced Energy Systems Analyses EnergyPLAN (www.energyplan.eu)

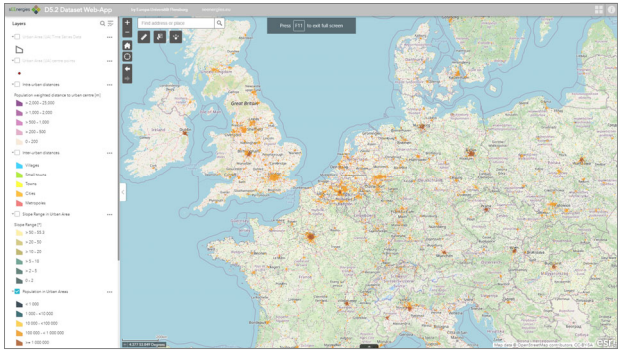


Data: transport sector



- City topographies, settlement patterns, demographics, transport cultures etc.
- The concept of Urban Areas
 - Coherent and contiguous areas of urban land cover delineated, separated from rural areas and populated with descriptive data
 - Urban Area layer consistent with NUTS3 and the INSPIRE directive
 - Basis for mobility and urban development analysis in space and time

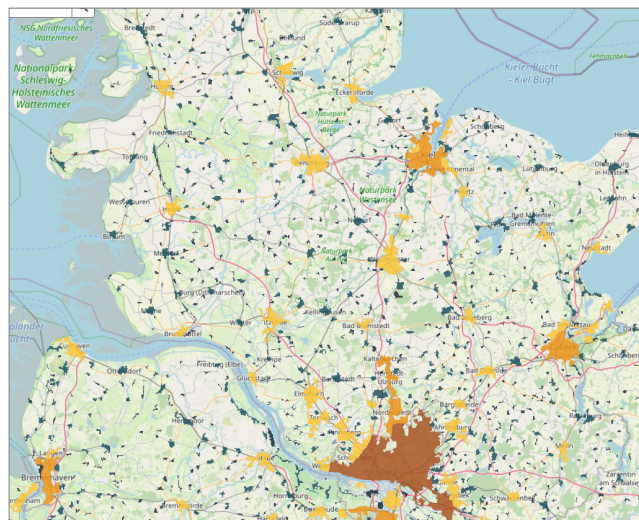
Table 1. Input data for Urban Areas and their centres	
Input data with reference	License
CORINE Land Cover 2018 (EEA under the framework of the Copernicus programme, 2019)	Copernicus data and information policy Regulation (EU) No 1159/2013 of 12 July 2013.
NUTS3 region boundaries (Eurostat, 2019)	© EuroGeographics for the administrative boundaries
OpenStreetMap place points (osmdata.xyz, 2019)	OpenStreetMap® is open data, licensed under the Open Data Commons Open Database License (ODbL) by the OpenStreetMap Foundation (OSMF).



Data: transport sector



- City topographies, settlement patterns, demographics, transport cultures etc.
- Urban Areas concept
 - ~150,000 UAs form a new entity for bottom-up analysis
 - Coherent with authoritative data (Corine landcover, EEA)
 - Unique ID's
 - Place names
 - Geometry



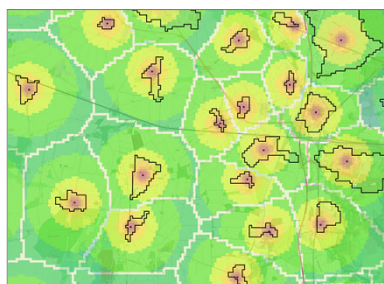
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Data: transport sector



- City topographies, settlement patterns, demographics, transport cultures etc.
- Urban Area data
 - Size classification
 - Demographics (population)
 - Intra-urban transport distances
 - Interurban transport distances
- Bottom-up characterisation
- Used to calculate potentials for modal shift, efficiency etc. for all of the EU27+UK



Intra-urban distances:

- Average distance from locations of residence to the centre of Urban Areas may help explaining inner-city transport
- Distances calculated from each populated 100m grid cell to the centre of UA and weighted by population.

Interurban distances:

- Distances from each Urban Area to the nearest larger one are calculated.
- The data can be used to improve the understanding of local and regional mobility and transport.



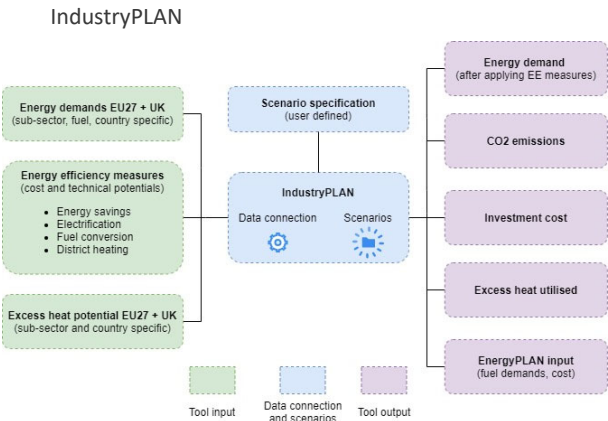
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Energy efficiency potentials - Industry



- Opening the **“black box”** of industry
- Targeting the **lacking middle-ground**
- **Energy efficiency first** principle applied in an **industrial setting**
- **Flexible** and **dynamic** platform
- Mapping of industrial point sources and integration with the heat sector
- Connects to Advanced Energy Systems Analyses EnergyPLAN (www.energyplan.eu)



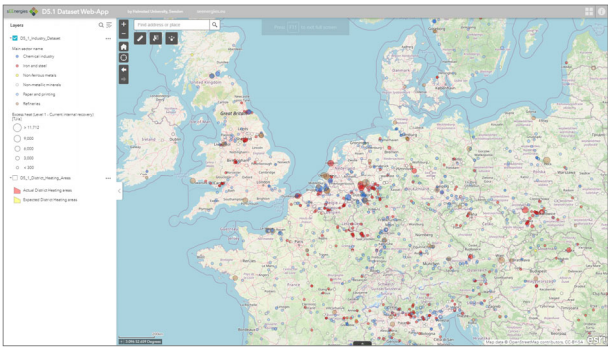
Data: Industry



- Spatial assessment of industrial excess heat recovery potential
- Allocation of excess heat to existing and potential district heating areas
- Contributions:
 - **Fraunhofer ISI (georeferenced industry dataset)**
 - UU (process specific energy use)
 - HU (district heating areas)

Table 25: Selected potential 1: EU28 extract of the georeferenced industrial sites by Main Sectors with spatial match to Expected District Heating areas (DH-E), without and with excess heat data, and estimated potentials for the six level categories

Main Sector	Industrial Sites - With DH-E Match [n]	Industrial Sites - With DH-E Match and Excess Heat Data [n]	Excess Heat Potential					
			Current Internal Heat Recovery			Max Internal Heat Recovery		
			Level 1 (25°C) [PJ/a]	Level 2 (55°C) [PJ/a]	Level 3 (95°C) [PJ/a]	Level 1 (25°C) [PJ/a]	Level 2 (55°C) [PJ/a]	Level 3 (95°C) [PJ/a]
Chemical industry	109	107	112.5	32.1	20.4	105.9	27.0	15.6
Iron and steel	367	191	157.1	124.5	109.0	101.1	68.8	53.7
Non-ferrous metals	16	16	2.5	2.4	2.3	2.5	2.4	2.3
Non-metallic minerals	453	425	252.2	200.6	184.9	101.1	60.8	48.4
Paper and printing	761	740	92.2	32.4	25.3	77.2	21.2	14.5
Refineries	96	96	324.2	100.6	73.6	291.5	78.2	52.4
EU28	1802	1569	941	493	415	679	258	187

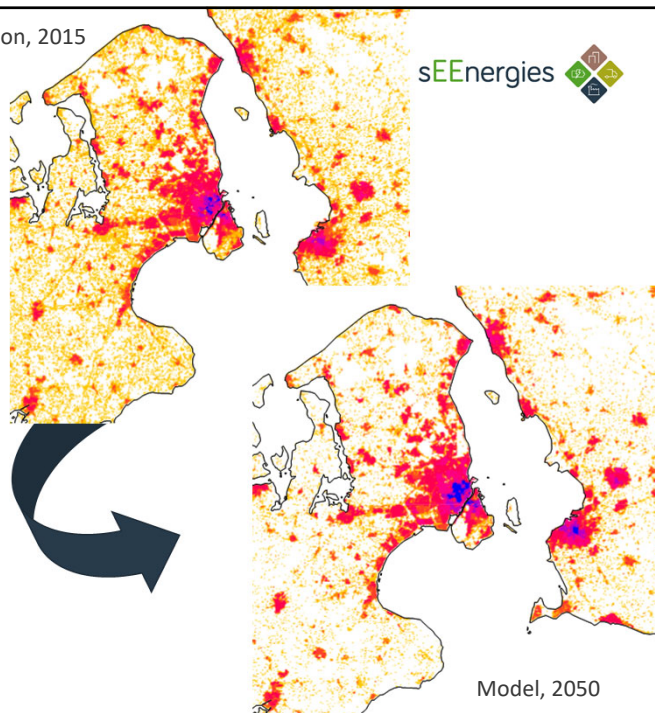


Data: Buildings

- Calculation of future heat demands
 - 2030 and 2050, frozen efficiency and baseline scenarios
- Modelling extent and population of urban areas in 2030 and 2050
 - A novel method to combine national and regional population forecasts with empirical local development
 - A seamless 1-hectare population model for calculating future heat demands, efficiency in buildings, and the potential for district heating.

Population, 2015

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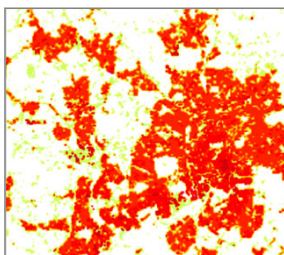


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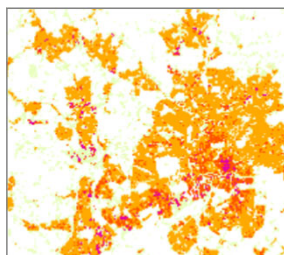
Data: zoning of heat supply

- Modelling of future heat supply options: individual vs. district heat
- Modelling of the distribution network investment costs.

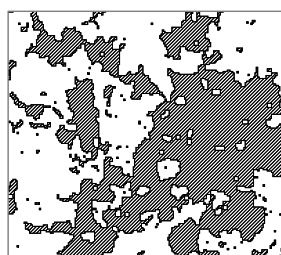
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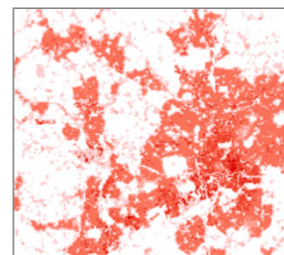
Modelling the extent and density of future urban areas by land use mapping



Modelling heat demand densities (HDD) to determine technical and economic potentials



Zoning of coherent and contiguous prospective supply districts (PSD)



Calculation of DH distribution network investment costs

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Visualisation: Peta 5



- Online web map application
- The Pan-European Thermal Atlas (Peta), version 5.2
 - Facilitation, operation, and maintenance of a project web map application
 - Continuation of the previous Pan-European Thermal Atlas (Peta 4.3)



<https://www.seenergies.eu/peta5/>



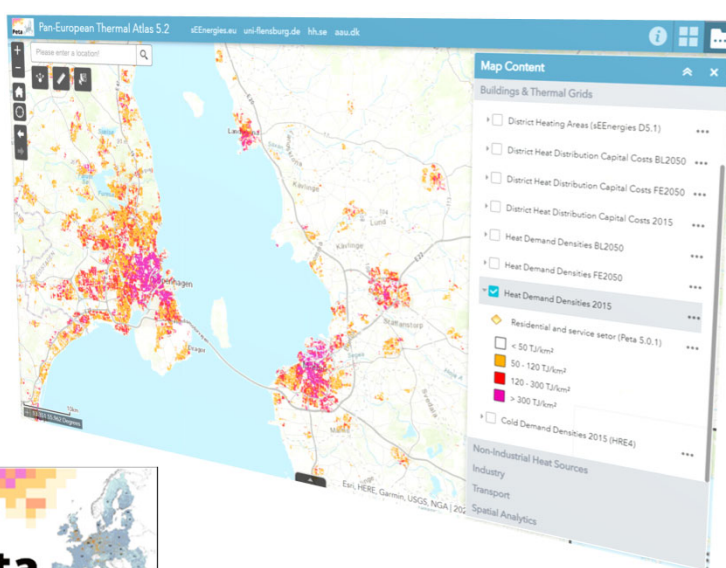
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Visualisation: Peta 5



- The Pan-European Thermal Atlas (Peta), version 5.2
- Key features:
 - Mapping of localised energy system data for the EU27+UK
 - Highly detailed information down to the 1-hectare level
 - Integration of building, industry and transport sectors
 - Spatial analytics



<https://www.seenergies.eu/peta5/>



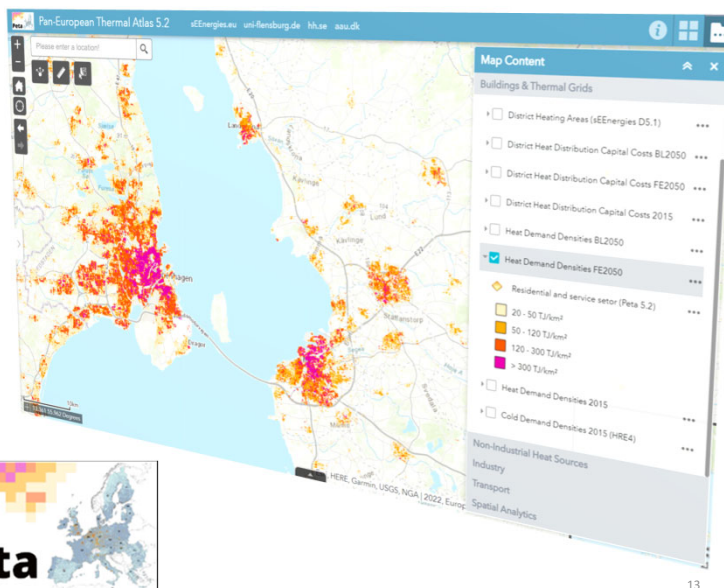
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Visualisation: Peta 5



- Peta, more than heat
- 5 main sections (25 layers)
 - Buildings & thermal grids (9)
 - Non-ind. heat sources (2)
 - Industry (6)
 - Transport (5)
 - Spatial analytics (3)
- Sharing and downloading



<https://www.seenergies.eu/peta5/>

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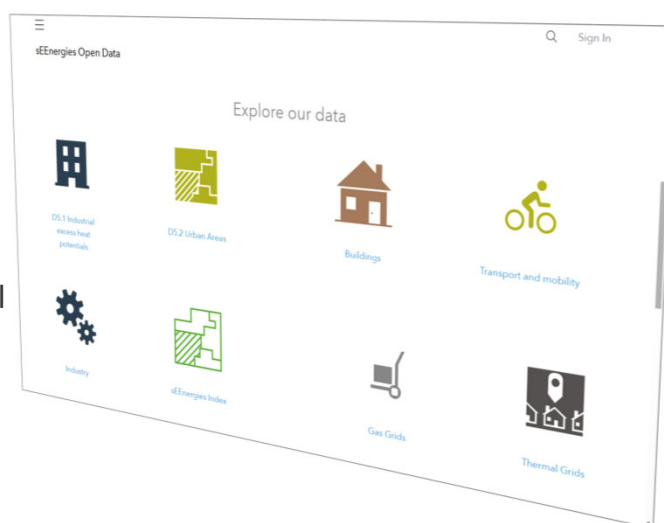
Open Data Hub sharing platform



- sEnergies Open Data Hub based on ArcGIS Online
- Data sharing and management
- Spatial models:
 - Disaggregated energy efficiency potentials down to the 1-ha and Urban Area level
 - Current/future scenarios
 - Data generated in previous projects, public geodata from external sources, etc.
- Open Access to results

<https://s-eenergies-open-data-euf.hub.arcgis.com/>

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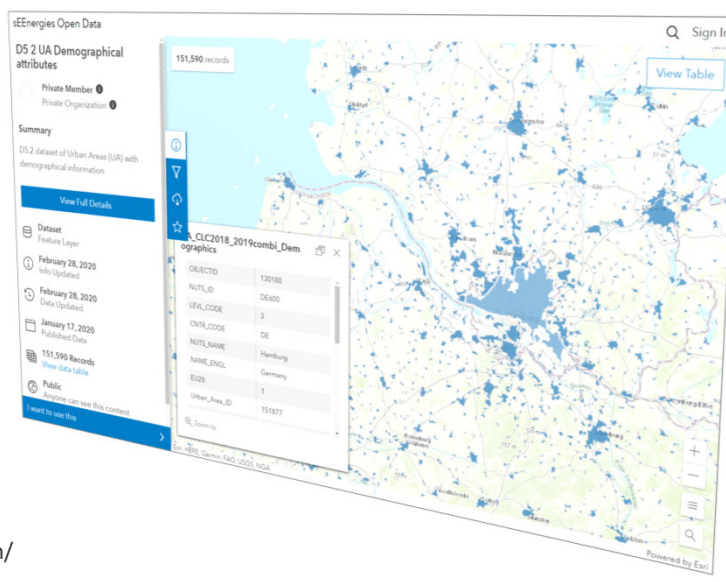


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Open Data Hub sharing platform



- Key characteristics:
 - Selective open data policy
 - Thematical structure
 - Meta data and descriptions
 - Download in various formats and via APIs
 - ~40 datasets developed in the project publicly available



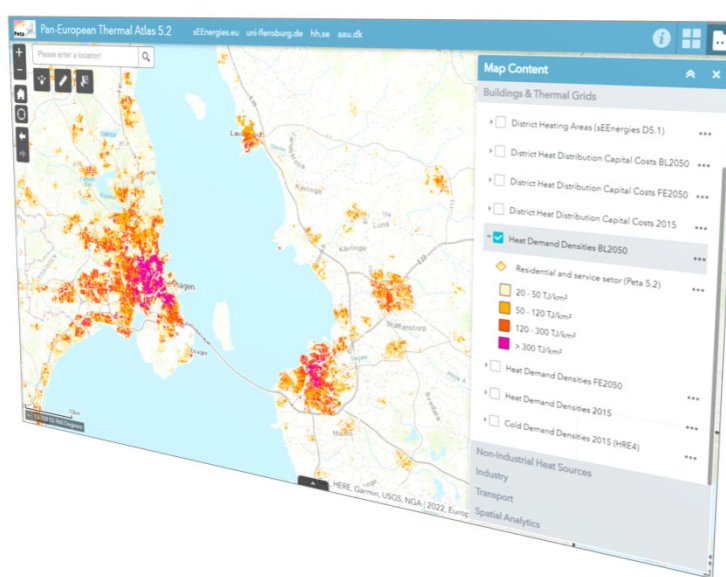
<https://s-eenergies-open-data-euf.hub.arcgis.com/>

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Exploitable results



- Highly disaggregated data for the European heat sector
 - Future population data on the 1-hectare and Urban Area levels
 - Heat Demands, densities, summaries for Urban Areas
 - Frozen efficiency and Baseline scenarios for 2030 and 2050
 - Delineation of potential district heating areas
 - Quantification of heat demands by local shares of individual vs. district heating.

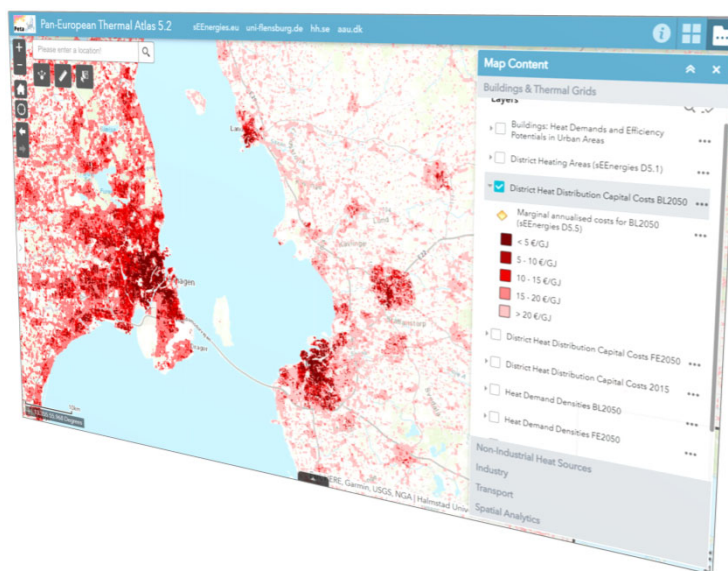


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Exploitable results



- Highly disaggregated data for the European heat sector
 - Physical and economic potentials of district heating
 - Investment costs in heat distribution grids
 - Determination of potentials for each local area
 - Available renewable and excess heat potentials.



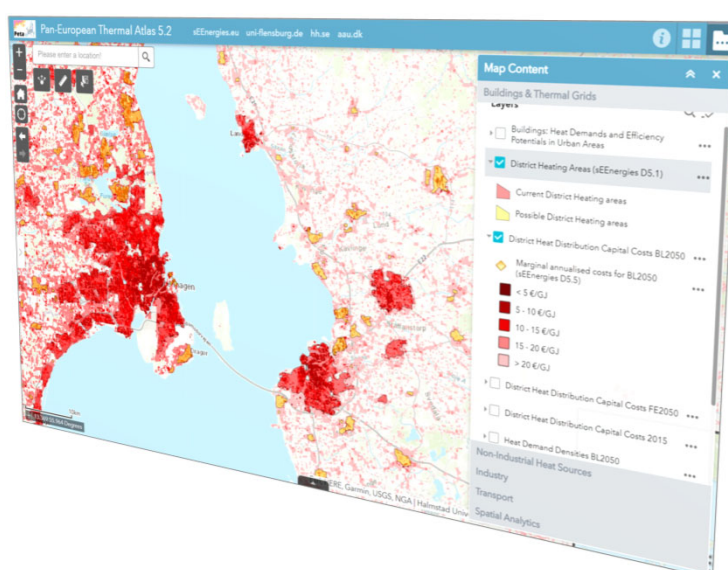
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Exploitable results



- Highly disaggregated data for the European heat sector
 - Data on current district heating networks
 - Summarised information for potential district heating
 - Simple potential studies for 150,000 Urban Areas



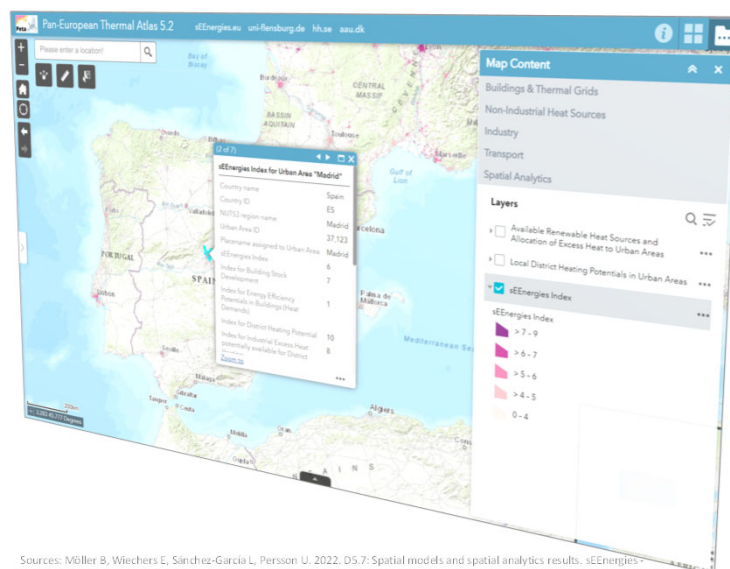
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Exploitable results



- The sEnergies Index
 - Cross-sectoral mapping of local energy efficiency potentials
 - Scoring system based on energy efficiency potentials to be harvested
 - Combines spatially distributed information on energy efficiency to identify local synergies



Sources: Möller B, Wiechers E, Sánchez-García L, Persson U. 2022. D5.7: Spatial models and spatial analytics results. sEnergies - Quantification of Synergies between Energy Efficiency First Principle and Renewable Energy Systems. Horizon 2020 Project No. 846463, and Persson U, Wiechers E, Möller B, Werner S. Heat Roadmap Europe: Heat distribution costs. Energy. 2019;176:604-22.

Exploitable results



- Story maps for dissemination
 - Easy to understand, contextual and appealing maps that tell the story of energy efficiency
 - Story maps for the sectors buildings, transport and industry.



<https://s-eenergies-open-data-euf.hub.arcgis.com/>
Or through the sEnergies Website

Key findings



- ~150,000 Urban Areas with key characteristics of energy efficiency
- Geographical representations of sector-related energy efficiency potentials
- Spatially evaluated energy efficiency potentials determined on local level
- Online web-map interface established and populated with two sets of map layers for current and future years
- Open Data Hub created for public sharing of geospatial datasets
- Story Maps created for increased dissemination of results

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Thank You!