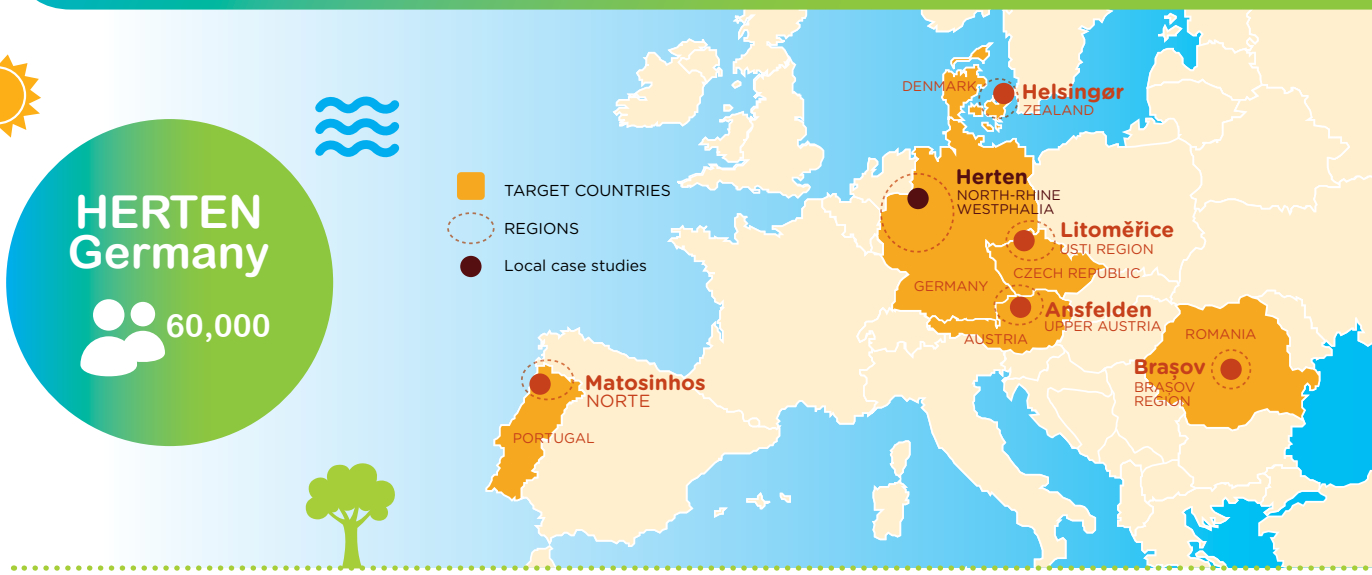
A progRESsHEAT case study

Decarbonising district heating through solar thermal energy and heat pumps



1 Key figures

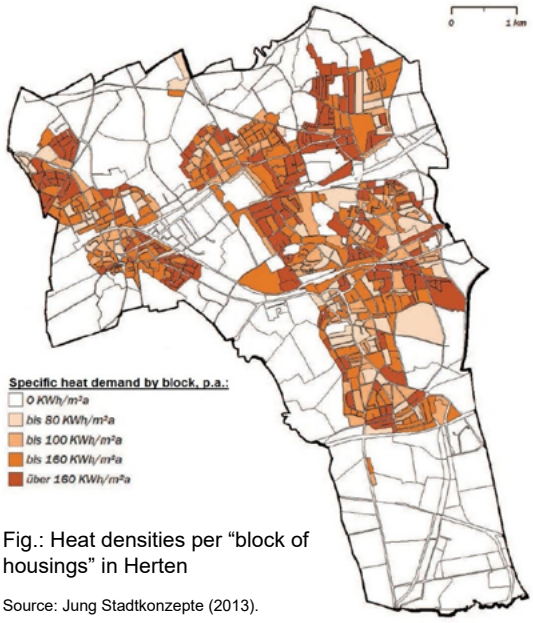


Fig.: Heat densities per “block of housings” in Herten

Source: Jung Stadtkonzepte (2013).

User type / Sector	Electricity	Natural gas	District heating	Fuel oil	Coal
Private Households	126	223	135	85	25
Industry / Commercial	88	84	11	0	0
Public institutions	10	4	5	0	0
Total	**223**	**311**	**151**	**85**	**25**

Table: Final Energy consumption per sector in 2011 by type of energy carrier in Herten (GWh/year).

Source: based on figures from Jung Stadtkonzepte (2013).

2 Main challenges

As the district heating system in Herten is currently supplied with heat from coal-fired Combined Heat & Power (CHP), the approach was to frame a potential alternative mix of centralised heat supply units with a high share of renewable energy sources. It is aimed at designing a system which is technically feasible and to compare it to the current system with regard to the heating costs.

For the case study, it has been decided to generate a possible new mix of supply units for the three largest sub-systems (Innenstadt, Schieferfeld and Kuhstrasse).

For the new mix of generation units, two technologies have been analysed: solar thermal fields with flat plate collectors and possible heat (pit) storage, and ground source heat pumps (brine to water).

3 Current policies and targets

Targets in the heating and cooling sector:
• Reducing heat demand in buildings by 20% by 2020 (compared to 2008)
• Increasing the renovation rate of buildings to 2% per year
• Bring the share of RES-H/C in the heating and cooling demand to 14% by 2020
• Reducing non-renewable primary energy demand by 80% by 2050 (compared to 2008).

The state government enacted a climate protection law in 2011. The targets are the following:
• Reducing CO_2 emissions by 25% by 2020 and by at least 80% by 2050 (compared to 1990).

The targets in Herten's Klimaschutzplan 2020plus with regard to the heating and cooling sector are:
• 3,000,000 sqm of residential and commercial building area should be retrofitted by 2050
• The share of renewables used for heat generation should increase up to 60% by 2050 (compared to 1990)
• The share of CHP in electricity generation should increase up to 60% by 2050 (compared to 1990).

4 Barriers and drivers

Main barriers:
• High investment costs
• Contract agreements
Barriers to the use of heat from waste incineration plants for DH mainly relate to contract arrangements between the plant owner, the municipal energy supplier and the two main energy suppliers in the region.
• Central procurement policy
Barrier to the use of industrial excess heat could be the central procurement policy for large industrial companies. Local production sites with excess heat potential do not have the authority to set up contracts on excess heat delivery even if it would be an interesting option for the local plant manager.
• Dependence on one heating supplier
Notion of being dependent on one locally available DH supplier, while there is the possibility to change the gas supplier easily
• Knowledge and awareness gap regarding renewable heating technologies (amongst installers and craftsmen)
• Missing standard solutions for individual RES systems in existing buildings.

Main drivers:
• Available subsidies
Subsidies for energy-efficient refurbishments are available based on relative CO_2-emission reduction. Furthermore, subsidies for solar thermal installations are provided by the local and supra-regional utilities.
• Continuous investments in district heating network
• Ambitious local climate protection targets
• Development of heating and cooling concepts
An integrated concept for the city centre and a climate protection plan for commercial areas are being developed
• Municipally-owned district heating company
• District-based approaches
The municipality has been developing areas for new buildings and existing buildings with a focus on district heating, low heating demand or individual RES.
• Innovative demonstration and showcase projects
• Campaigns for local installers, households and companies
• Tradition of integrated economy
Industry companies and relevant players are interconnected and can easily communicate.

5 Results from scenarios and policy assessment

Scenario 1: No renovation
• Replacement of the existing heat generators based on the current policies
• No renovation of existing buildings
• District heating network remains supplied by the existing coal-fired CHP units.
Scenario 2: Renovation
• Continuation and intensification of the current policies
• Renovation rate 2015-2030 for single-family homes and multi-family homes is respectively of 2.4% and 1.1%. Renovation rate 2031-2050 is on average of 1%.
• District heating network remains supplied by the existing coal-fired CHP units.
Scenario 3: Renovation + Solar DH
• Energy demand decreases as in Scenario 2
• Integration of 32,000 m^2 of solar thermal collector fields and 6,000 m^3 thermal storage into different parts of the DH network.

__7 scenarios__ have been developed for Herten. Discover all of them in the full-text case study at www.progressheat.eu.

6 Recommendations and possible solutions

In order to enable the transformation of the heating and cooling sector in Herten as assessed in the scenario analysis, a sound policy framework is needed at local and national level. Here, the focus is on policy recommendations at local level.
- Establishment of refurbishment hot spots – integrated planning of retrofits and transformation of the district heating (DH) system to a low temperature system
- Free connection to the DH network and replacement of old heating substations with new 4th generation DH units
- Heat zoning with obligation to connect to DH
- Designated area for solar district heating as part of the city urban planning
- Using existing national financial support schemes for large RES systems.

7 Outlook and open questions

The roadmap for Herten is focused on the prospective development and decarbonisation of the DH network.
• 90% of the energy supply for the DH network should come from renewables or excess heat in 2050.
• The final energy supplied for residential heating (hot water and heating) by the DH system should have nearly the same amount in 2050 as in 2011 (approx.150 GWh/a).

Priorities and timelines to implement roadmap need to be discussed with the municipality.

Interested?
Find more information in the full-text case study on the project website!

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