COUNTRY	POPULATION OF THE CITY	NATIONAL MITIGATION TARGET	NATIONAL EMISSIONS IN 2019
THE NETHERLANDS	86,832 (2019)	-49% BY 2030 (BASE YEAR 1990); -95% BY 2050	181 $MTCO_2E$ (-18% SINCE 1990)

In Heerlen, a "5th generation" heating and cooling network

In 2005, with funding from the European Union and the Dutch government, the city of Heerlen drilled five wells to draw benefit from old coal mines and use them as sources of heat and cold. These mines contain underground lakes whose water is naturally heated by geothermal energy – an energy source the city wanted to take advantage of, along with the area's industrial past. Thus, in 2008, 50,000 m² of floor space in buildings was connected to an initial heating and cooling network centred on this source.

Heat exchanges between buildings

As the network grew, the geothermal capacities of the mines could no longer cover the increasing number of buildings. They had to be enhanced, and energy storage solutions developed, in order to extend the network. This is why, in 2013, the city created the company Mijnwater BV, responsible for developing a heating and cooling network covering the entire city. The company has connected buildings to each other, and uses the heat and cold generated by each of them, to in turn cool or heat the others: this is the principle of a 5th Generation District Heating and Cooling network (5GDHC). With the development of the network, the mines have become an inter-seasonal storage solution, making it possible to conserve the heat produced by air conditioners in summer in order to heat buildings in winter.

The network now supplies up to 20 TJ/year of heating and 20 TJ/year of cooling to 250,000 m² of offices, businesses, supermarkets, residential and public buildings. The network can capture heat from wastewater, air conditioning or digital devices. The collected energy is then redistributed according to the needs of each building, thanks to very precise digital monitoring, and to a network of heat pumps and storage solutions. In total, about half of the energy consumed by users for heating and cooling comes from the customers themselves. For example, the school is heated by the heat from a pension fund data centre. This type of network is scalable: at the start, it is possible to connect just a few buildings to each other, gradually expanding the network. The Heerlen network continues to expand, and also incorporates renewable energy sources (such as geothermal energy). The network has reduced the urban energy demand by 50%, and CO_2 emissions by 65%; powered by renewable energy, the balance could fall to zero emissions.

An increase in local energy autonomy

This type of network strengthens local energy autonomy and improves resilience to variations in the national grid. It limits overconsumption and prevents energy loss thanks to its closed-loop operation and energy recovery from the buildings. The development of storage solutions in addition to the network, and the large-scale roll-out of the network have been pinpointed as success factors of the project. While generations of urban heating and cooling networks have succeeded each other at the pace of technological innovation (**see figure**), the Heerlen network heralds the advent of a 5th generation based more on a qualitative rather than a technological leap. Since 2018, Mijnwater BV has become the main partner of the European D2Grids project, which aims to develop 5GDHC similar to that of Heerlen, at 5 pilot sites: Paris-Saclay (France), Bochum (Germany), Brunssum (The Netherlands), Glasgow and Nottingham (United Kingdom).

Sources : Construction21.org ; District Energy Awards

5GDHCs, A CLOSED ENGERY LOOP BETWEEN DIFFERENT HUBS OF URBAN ACTIVITY

Source : 5GDHC, 2021