

## Mijnwater Heerlen

by Nichol Brummer / © 2019-06-17 16:00:58 / Internazionale / 7474 / EN



**Year of commitment** : 2019

**CO2 Impact** : Currently, we reduce CO2 emissions per unit of energy by about 65%, mostly by reducing the collective energy demand. We plan to improve this to 80%, and finally to 100% by making use of sustainable electricity.



35 000 000 €

**Builder**

Mijnwater BV

**Manager / Dealer**

Mijnwater BV

### GENERAL INFORMATION

Mijnwater Heerlend won a mention at the Dutch level for the Sustainable Infrastructure Grand Prize of the 2019 Green Solutions Awards + the international Sustainable Infrastructure Grand Prize.

The municipality of Heerlen did a pilot study with the purpose of repurposing abandoned coal mines under the town as a geothermal source for heating and cooling. This was built in 2008, and it became the start of a heating grid. In 2013 the company Mijnwater BV was set up with the goal to build it out as a full size heating and cooling grid for the town of Heerlen. It was found that the mine water system has insufficient heat capacity for it to be used merely as source of heat,

and that the usage needs to be optimised more towards storage of heat and cold. This was combined with a District Heating and Cooling grid design that is now being described as '5th Generation District Heating and Cooling' (5GDHC).

In this design, the temperature of water flowing in the grid is like in a (very) low temperature 4th Generation District Heating and Cooling system, but the grid is optimised to exchange energy between the customers, directly on the grid, but also via a storage system, between different points in time, and even between winter and summer. This is enabled by having a distributed system of heat pumps near the points of delivery, that guarantee that customers get the temperatures they demand. Booster heat pumps at the customer produce domestic hot water.

The result is a district heating and cooling grid that in the case of Mijnwater can function with only the underground mine water system that is still also heat source, but is ever more becoming mainly a heat storage. Currently, about half of all the energy for heating and cooling comes from the customers themselves: those that demand cooling power provide heat to the system, and vice versa. In the summer, the demand for cooling large offices produces a large surplus of heat that is stored for use in the winter.

There are many small grids with the 5GDHC design, but the expansive size of the underground mine is at the scale of 10 km, which means that the backbone on the surface that was designed to exchange heat and cold with it also has that scale. It was reasonable to design the Mijnwater 5GDHC grid directly at that same scale, so it could serve a large fraction of the whole town of Heerlen. And because Mijnwater kept close to the low exergy principles the result is now probably the purest and largest example of a 5GDHC grid, and the leader in this field.

Mijnwater is in a process of constant optimisation of the pumps, the injection/extraction wells, and the clusters, which is planned to lower our electricity bill by about 16%. Improvement can be seen when comparing the years 2016/17 with 2017/18, and this will be done by 2021.

The latest new infrastructure was finished in January 2019, when we extended the grid of Cluster D out to a multipurpose community building, and on the other side back to a newly installed "Energy Transfer Station" that connects via heat exchangers to the mine water backbone. This gives us flexibility and options to both serve cooling power to an industrial area, and heat to the neighbourhood and a swimming pool behind the industrial area.

During 2019, the big leap forward will be to deliver Mijnwater services in the town of Brunssum. Initially, this will not be done by building a connection to our mine water backbone in Heerlen. We will start a new island grid, based on new underground thermal storage with boreholes in the aquifer, and employing a new pit-solution, EcoVat.

You can find more information in this video :

<https://www.youtube.com/watch?v=6y6oJc91Cu4>

## Data Reliability

Self-declared

## Funding Type

Public

## Website Enterprise / Infrastructure

<https://mijnwater.com>

## Sustainable Development

**Attractiveness :** Because of the region's past in coal mining, the project has a strong social and historical context: Heerlen used to be known as Energy City of the Netherlands. Now, the abandoned coal mines offer a new perspective, as reservoir of sustainable geothermal energy contained in the mine water. The EU potential for using energy from mine reservoirs is huge, as 25 % of urban area is positioned above abandoned mines.

The starting users are companies owning large office buildings, or a large portfolio of social housing, or government, educational buildings, or supermarkets. Also the government is involved, as owner and initiator. All of these parties are not just passive consumers, but they actively take part in developing this new way where energy use is reduced by sharing it around between users. But this needs to be done in a well balanced combination with measures at the level of the buildings themselves. We want the owners of buildings to invest in measures at the building level, at least to be ready for low temperature heating, but also to reduce their demand for energy by implementing good insulation, and ventilation with heat recovery.

The creative team of Mijnwater is not alone in this challenge: together with the regional cooperation of Parkstad, the Province of Limburg, businesses, social housing and educational institutions, are innovating not just the technology, but the ways to cooperate, the procedures, contracts, the governance, the finance mechanisms, all while figuring out the logic behind this new way to serve heating and cooling to a community. Five EU projects and three national ones recognized the value of having Mijnwater as a member. All these parties are interested for different reasons, but they all are. And all of them have an interest in Mijnwater succeeding to build this new grid, to learn, and develop new ideas.

**Well Being :** The Mijnwater project offers heating and cooling services to building owners and occupants in the city of Heerlen. The building owners get energy at a price approximately 10 % lower than a conventional solution, and independent of increasing fossil fuel prices. In addition, they don't need to invest in gas boilers. The investment needed in the building to be recognized as nearly zero energy (NZEB) is reduced. Mijnwater offers an ESCO construction in which building owners are unburdened for operation and maintenance costs. The Mijnwater project provides a 65% CO<sub>2</sub>-reduction in the Urban Area at a relatively low price per ton CO<sub>2</sub>, and ultimately 100%. Previous expenditures on fossil fuels are converted towards investments in local green infrastructure, which creates local jobs and strengthens regional independence. Our grid ends the dependence on natural gas. The connection of the thermal building mass in the city through heat pumps to large thermal storage facilities (like the mine water reservoir) will enable services of peak shaving and net balancing for fluctuating green sources on the electric grid.

The necessary investment space is found from the reduced fossil fuel expenditure over the coming 30 years. For a medium sized town of 100.000 dwellings plus commercial buildings, the investment for a geothermal smart grid sums to roughly four billion euros. This can create 5,000 to 6,000 good jobs in the region, dependent on the development of a local clean technology industry. If the savings for a single dwelling are summed over 30 years and recalculated to net present value, the investment space is about €45,000 per dwelling. Half of this amount is needed for a 5GDHC grid, which leaves the other half for energy saving

measures in the building. The Mijwater Company is owned by the local government, so any profits are returned to the community.

**Social Cohesion** : Many parties are involved in developing and deploying this grid. Since a new connection to the Mijwater system is mostly synchronised with new building development, or with long term maintenance of existing buildings, it is very important to build long term relationships with potential future customers. Mijwater needs to become part of their long term thinking, and long before they become customers we need to start planning, and if possible make the right combinations. It is important that potential customers for cooling services realise that dumping energy in the environment is waste, not good for the environment, and that it is much preferable to be connected to a grid where your waste heat is made useful for people in the neighbourhood. This is a kind of energy efficiency that can only be done as a community.

**Preservation / Environmental Improvement** : The approach of Mijwater to district heating and cooling is not to see it simply as a technical solution to a problem of having the wrong temperature. Our view is much more holistic, where many parties are responsible for creating an environment where the temperature and the quality of air in buildings is kept comfortable. With the right attitude and attention, also the environment outside and around buildings is kept more comfortable. We look for opportunities to put solar panels on the roofs of buildings connected to Mijwater, as these can start to provide our system with a sustainable source of electricity. If less gas furnaces are burning, and less energy is being wasted in the centre of towns, the quality of air outside will also improve.

**Resilience** : The infrastructure of Mijwater is mostly underground, safe from most natural hazards. The very large storage volume for heat and cooling power make it very robust against fluctuating weather. Though our grid depends on electricity, the infrastructure pipes and the buildings have sufficient thermal mass to survive outages of electricity for quite some time. The plan is that our large long term thermal storage of the mine water system will be complemented by localised storage in the aquifer, or in a pit. In 2019, we are starting a new service in the neighbouring town of Brunssum, without a connection to our mine water system, but with such local thermal storage. This flexible approach is now helpful in deploying a new service, but in the longer term, combining these different techniques in the right way will make our system even more robust.

**Responsible use of resources** : There is currently more heat being wasted in Europe than is required to heat all of the buildings. Heating and cooling consume half of the EU's energy and much of it is wasted. A small fraction of the solar irradiation on urban areas is also enough. District heating can capture this excess heat and move it into, or out of buildings. 5GDHC grids are the solution to exploit these opportunities and transform a large part of our urban environment to sustainable energy. It is a great chance to revitalize local economy and business. It is an opportunity for investment. The Mijwater 5GDHC grid in Heerlen is exploring the way, and leading in this new paradigm.

## Governance

Mijwater BV

**Holder Type** : Publicly Owned Development Corporation

Mijwater BV

**Builder Type** : Other

Mijwater BV

**Manager / Dealer Type** : Public

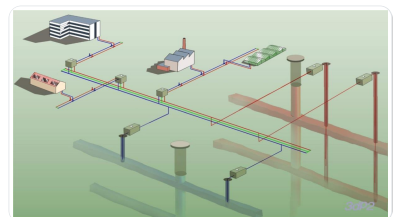
The town of Heerlen started the company 'Mijwater BV' to design, build, deploy, maintain, operate the district heating and cooling grid, based on the geothermal source and storage of the water in the abandoned coal mine. Ownership of the company has been taken over by the 'Limburg Energy Fund' of the province, and regional cooperation of 7 municipalities of 'Parkstad Limburg' has endorsed this grid as its main strategic solution for transforming the built environment.

**Business Model** :

## Sustainable Solutions

5th Generation District Heating and Cooling System

**Description** : The town of Heerlen developed an innovative piece of infrastructure to turn the abandoned coal mines under the town that are filled with water into a large geothermal resource, and a storage volume for heat and cold. Subsequently, this large resource was the basis for building a large town-sized 5th Generation District Heating and Cooling Grid. On such a grid, the customers are connected with each other, so that customers that need cooling power will give away their excess heat, that can be used by others who need heating. Averaged over a year, the demand for cooling and heating power is very balanced: we deliver 20 TJ/year of both. Having the large thermal storage volume allows us to keep the surplus warmth from the summer, to keep our buildings warm in the winter. But also to use the wintercold to help deliver cooling in the summer. This network makes use of a system of heat pumps that are positioned near the end users, to make sure that the right temperature can be delivered. The result is a system that does not need to burn any fuels, but does depend on electricity. Because energy is shared, the electricity demand is small enough that we can already reduce CO2 emissions by about 65%. In the longer run, we will be able to become more efficient, and also use sustainable electricity, allowing us an open path towards total decarbonization.



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- Governance :
- Quality of life :
- Economic development :
- Resources :
- Energy/climate :
- Business development

- Circular economy
- Infrastructure
- Climate adaptation
- Renewable energies
- Low-carbon materials/ infrastructure
- SmartGrids

Company (es) Website :

## Photo credit

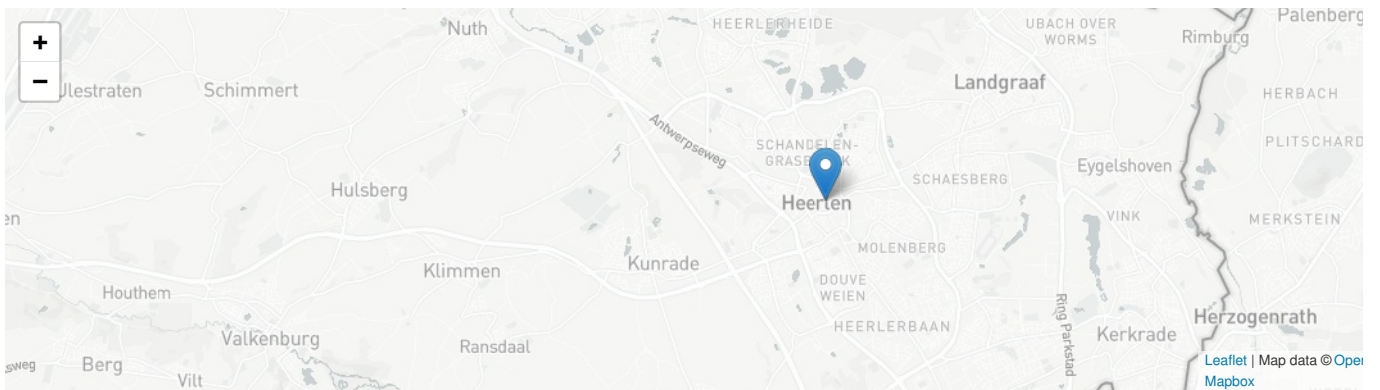
Mijnwater / Bak Hoensbroek, Pascal Moors,

## Contest

### Reasons for participating in the competition(s)

Mijnwater BV has designed and built what is a leading example of a 5th generation heating and cooling grid (5GDHC). The grid has a trench length of about 40 km, and it already serves a floor space of about 250000 m2 with approximately 20 TJ/a of heating and 20 TJ/a of cooling.

Importantly, it has full support and commitment from the municipality of Heerlen, and the regional cooperation of Parkstad Limburg, to build out this grid over the whole area. This means a strong push for further growth of the grid infrastructure, development of technical hardware, the ways to cooperate with the community, standardisation of contracts, the development of a governance system that builds trust, which can be a solid base for long term finance to allocate the necessary investment.



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