Comfortably warm
Pleasantly cool with Mine water

MINE WATER, A BASIS FOR SUSTAINABLE ENERGY

WWW.MIJNWATER.COM

November 21, 2016
WELCOME @ MINE WATER

THERMAL ENERGY STORAGE IN URBAN REGIONS

Ir. Herman H.E.W. Eijdems, innovation manager
Mijnwater Heerlen B.V.
BACKGROUNDS Mijnwater Heerlen

17 december 1965

Sluiting 1974

21 augustus 1976
Flooded Shafts and Galleries approx. 1/40 of coal production (voids 1/12)
BACKGROUNDS Mijnwater Heerlen

Mijnwater B.V., November 21, 2016
BACKGROUNDS Mijnwater Heerlen

Mijnwater 2.0, municipality Heerlen

Customers

Heat demand
Heat storage
Cold storage
Cold demand

Depth compared to surface
NAP
0
50
200
300
400
500
600
700
800
900
Tertiary
Coal seam
Mined coal seam
Carboniferous

Mijnwater B.V., November 21, 2016
BACKGROUNDs Mijnwater Heerlen
Artist impression Mijnwater 2.0

MI-Building
MI-Cluster
MI-HLN1
MI-HLN2
MI-HH1
MI-HH2
BACKGROUNDs Mijnwater Heerlen
Customers in the City of Heerlen

Gen Coel HHC
Nieuw CBS kantoor
Rabobank Parkstad
A Gene Bek Bekkerveld
APG Heerlen
Arcus College
Maankwartier
Shared services center
GGD Heerlen
Almost 175,000 m² heating and cooling by mine water energy
Carbon Free Cities
Heating Demand in EU under different scenario’s

Reduction of the heat demand compared with 2006:
- 10% by 2020,
- 20% by 2030
- 30% by 2050
Carbon Free Cities

By 2050

- biomass could contribute 231 Mtoe, while
- geothermal could account for 150 Mtoe and
- solar thermal for 133 Mtoe

(source: European Technology Platform on Renewable Heating and Cooling)

![Figure 1 - Form of final energy consumption in the EU](image1)

![Figure 2 - Distribution of heat by use types in the EU (2006)](image2)
Carbon Free Cities
Potential by renewable energy source in EU
Carbon Free Cities
A lot of energy is spilled

Waste heat is dumped in surface water and in the air on a major scale..
Carbon Free Cities
A lot of energy is spilled

Waste Heat in the EU could cover the total Heat Demand
Carbon Free Cities
Heat map of city of Amsterdam
Need for grids
We need grids!
Need for grids
We have grids!
Need for grids
But they have to evolve

Second Generation District Heating (2g-DH) 1930-1980

Conventional District Heating systems would circulate hot water (> 90 °C) for 24 hrs/day, 365 days/yr often to serve an individual demand of 30 minutes a day…

Elaborated from: www.4dh.dk/about-4dh/4gdh-definition; 4DH Research Centre, Aalborg Denmark
Need for grids
Innovative grids (like the Heerlen Grid)

LOW ↓ Exergy ≈ Water / Energy × Net  LO(WE)^2-Net

MT Heat storage
Seasonal heat storage
(shallow)
Geothermal

MT Cold storage

< 25-28 ° C

> 16-18 ° C

electricity

industry
dwellings
commercial

Including data centres, shops, etc.
Carbon Free Cities

Right place!

Right moment!

Right temperature!

Take-off, Transitie fase, Optimisatiefase.
Storage is one of a number of key technologies that can support decarbonisation. Thermal energy storage systems appear well-positioned to reduce the amount of heat that is currently wasted in the energy system (IEA)"
Need for storage

Mean existing dwelling NL

-electr
dhw
heat
sun

Mijnwater B.V., November 21, 2016
We need storage
Long term - seasonal

Heerlen has reservoirs of 8 million m3 water
That’s the thermal capacity of the batteries of 1,4 million Tesla’s
We need storage
Mid term storage
We need storage
Short term storage

Booster Heat Pump

Boilervessel DHW
Connecting Supply to Storage to Demand
Can we afford it?

### Energy Costs

Total Parkstad = 450 million €/year

<table>
<thead>
<tr>
<th></th>
<th>Euro/GJ</th>
<th>Selling price of heat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gasboiler (traditional)</td>
<td>22,30</td>
<td></td>
</tr>
<tr>
<td>Minewater 1.0 bivalent</td>
<td>4,60</td>
<td>10,30</td>
</tr>
<tr>
<td>Minewater 2.0 electric</td>
<td>6,80</td>
<td>15,80</td>
</tr>
<tr>
<td>Minewater 3.0 electric</td>
<td>2,50</td>
<td>19,00</td>
</tr>
</tbody>
</table>

Profit

- Gas costs
- Electricity costs

Mijnwater B.V., November 21, 2016
Can we afford it?

Area Level

Building Level

Savings - Investment

Progressive Saving measures

Mijnwater B.V., November 21, 2016
Can we afford it?

Optimum for new and for existing buildings
Calculated in different Mijnwater Scenario’s
Can we afford it?

Passive house renovation ~ € 50.000 - € 80.000 / dwelling

Re-inforcement E-grid ~ € 6.000 - € 10.000 /dwelling

Renovation of Gas-grid ~ € 5.000 - € 8.000 /dwelling
Can we afford it?

Connection to Smart Thermal Grid
€ 15,000 - € 20,000
Co-operation NL - NRW

- EU-Investment in Heerlen Coal Mine
  Thermal Reservoir technology = \( \text{M} \)€ 15,-

- Upscaling for learning and cost decrease
  - NL 11 Minereservoirs
  - NRW 140 Minereservoirs
  - Flanders 40 Minereservoirs
  - UK, Italy, France, etc.

- Parkstad Region Ambition: to connect 20,000 dwellings within 5 years
  - Can we share this ambition with NRW and Belgium?

- Horizon2020 STORM project
- Interreg HEATNET project
- ERANET Smartcities
- HT Storage?
- Deep geothermal opportunities
- Share expertise and Business
Share the excellence

European Geothermal Innovation Award
Winner 2015

Mijnwater B.V., November 21, 2016
DHC Smart Grid and Storage
A solution for sustainable Urban Areas

Thanks for your attention
Questions?