Update (Geo-) Thermal Smart Grid Mijnwater Heerlen (T6a-1)

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Update (Geo-) Thermal Smart Grid Mijnwater Heerlen (T6a-1)

Status quo, New developments, Operation, Performance and Lessons learned
Mijnwater 2.0
Clusters of buildings

- Hydraulic cloud grid
- Instant heat/cold exchange
- Minewater as storage
- Fully demand driven
- Bidirectional wells (2017)
- Multiple sources
- All electric (100% HP)

Clusters:

- **CLUSTER A**
  - Arcus-APG

- **CLUSTER B**
  - CBS-Maankwartier

- **CLUSTER C**
  - Weller HHC

- **CLUSTER D**
  - Componenta-Otterveurd

CO₂-reduction 65 %

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Mijnwater 2.0

Current status

- Ltd since November 2013
- Mijnwater owner/operator grid & energy stations
- Part of PALET (Carbon neutral 2040)
- 175,000 m² connected
- 30 M€ invested
- Heat 4.4 MW; Cold 4.2 MW

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New connections

MAB
4,500 m²
All electric
CO₂: - 65%

Maankwartier
50,000 m²
All electric
CO₂: - 65%

Rabobank
3,200 m²
All electric
CO₂: - 65%

Acquisition HHC
Transition to all electric
30,000 m²
CO₂: - 65%

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Cluster D – Heat recovery - Industry

- LT-heat demand
- LT-waste heat
- Detergents Manufacturer
- 10 kGJ
- 6 kGJ
- Swimming pool

- HT-heat demand
- LT-waste heat
- Beverage Manufacturer
- 10 kGJ
- 7 - 13 kGJ
- Foundry

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Smart energy stations: low-exergy & hybrid

Energy exchange between building and cluster grid

Energy station all-electric (HP)

Booster heat pump for domestic hot water

25 °C

40 °C

65 °C

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Local area grids for new and existing renovated dwellings

Cluster grid (2-pipe)

Local area grid (4-pipe)

Energy Transfer Station with booster heat pump for DHW

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Self-learning Thermal Operational Resource Management (STORM – Horizon 2020)

Peak shaving
Valley filling

Self-learning
Adaptive

INTELLIGENT TOP LEVEL CONTROL FRAMEWORK

Heat
Cold

BioCHP

PV
HP

Market Interaction

Cell/cluster balancing

season

week/month

hour/day

CO₂-reduction 80-100 %

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Smart storage: Energy carrousel

Multifunctional:
- Peak shaving
- Passive reuse
- Seasonal/HT storage
- Autonomous operation

HT-Source (Solar, biomass, waste heat or surplus green electricity E grid)

Temperature buffer °C

Ecovat®

Cluster grid connection

Heatpump installation

PV

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Mijnwater Operation
Experiences and lessons learned

- Energy exchange by pumps in series (yes it can);
- Behaviour custer grids as buffers (balancing/back-up);
- Bio-fouling cluster grids (pH control; bio-shots);
- Depletion cold production well;
- Leakage incident cold production well;
- Performance production wells.
## Mijnwater Operation

### Depletion cold production well

<table>
<thead>
<tr>
<th>Production</th>
<th>Infiltration</th>
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<tbody>
<tr>
<td><strong>[°C]</strong></td>
<td>HH 1</td>
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<tr>
<td>January</td>
<td>27.5</td>
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<tr>
<td>February</td>
<td>27.5</td>
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<tr>
<td>March</td>
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<tr>
<td>April</td>
<td>27.5</td>
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<td>May</td>
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<td>June</td>
<td>23.4</td>
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<td>July</td>
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<td>August</td>
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<td>September</td>
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<td>October</td>
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<td>November</td>
<td>27.7</td>
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<tr>
<td>December</td>
<td>27.6</td>
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<tr>
<td><strong>Total</strong></td>
<td>27.5</td>
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**Temperatures Minewater wells in 2014 [°C]**

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**Temperatures Minewater wells in 2015 [°C]**
Mijnwater Operation
Depletion cold production well

Flow path HLN3 – HLN1 Mijnwater EPANET model (Vito)
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Leakage incident cold production well

Pressure peaks

Gasket blown out

Lack of safeguards

Inflow of water

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Performance production wells

Average COP’s production wells and Cluster A

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Performance production wells

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Performance production wells

H [m]

Start/stop Well pump
Continuous Well pump

1th booster pump (speed control)
2th booster pump (no speed control)

Q [m³/h]

- 12.5 Hz
- 15 Hz
- 20 Hz
- 25 Hz
- 30 Hz
- 35 Hz
- 40 Hz
- 45 Hz
- 50 Hz
- Operating curve

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Performance production wells

Mitigations:

- One small booster (jockey) pump for operation during start/stop well pump;
- All booster pumps provided with speed control;
- Advanced process control on maximum pump efficiency;
- More steady operation with less fluctuations of demand by improved tuning cluster installations.

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Innovative concepts like Minewater need Master of Concept assessing consultants, contractors and suppliers during the entire development process (not only design) by sufficient witness points and a solid commissioning protocol to achieve the pre-set targets.
Thank you for your attention!

Questions?
Back-up slides
Mijnwater 2.0
Minewater from source to storage

Minewater as source = limited capacity or depletion

Hot and cold return in same injection well
Thot supply 28°C
Tcold supply 16°C
Thot return 18°C
Tcold return 22°C

Minewater as storage = regeneration = no depletion
= increase capacity

Hot to hot
Cold to cold
Thot supply 28°C
Tcold supply 16°C
Thot return 28°C
Tcold return 16°C

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