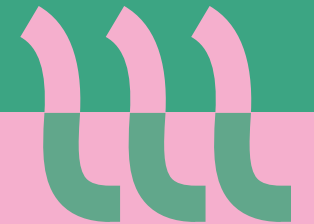


# Unlocking solar heat

28 february 2024

Theo Venema



# WarmteStad



- Groningen
  - 240k inhabitants, 120k houses
  - Biggest European gasfield (1959)
- Local heat distribution company since 2014
  - Provide renewable and affordable (collective) heat
  - Municipality and Watercompany
  - 80 employees serving 8.000 households (2023)
- Ambition
  - 2030: 20.000 houses
  - 2035: 30.000 houses
  - 2050: 50.000 houses



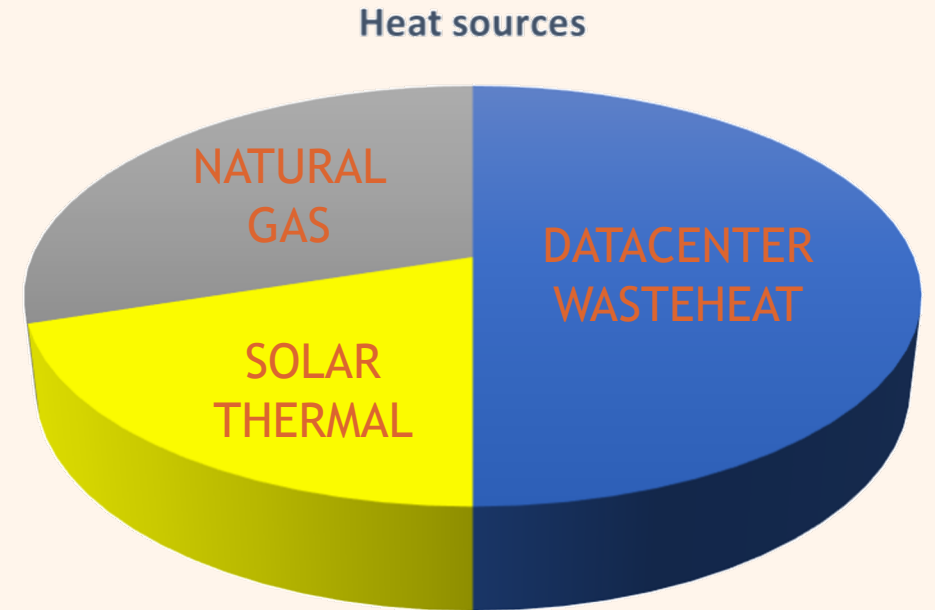
# Our customers

- Housing associations, homeowners, companies, schools, government etc.
- Construction period 65% before 1980
  - design heating temperature 90°C
- Our proposition
  - Collective renewable heat at 65°C
  - Comparable costs as natural gas heating



# Our heat sources

- Delivery temperature  $>65^{\circ}\text{C}$ 
  - Waste heat datacenters (50%)
  - Solar Thermal (20%)
  - Natural gas (30%)
    - 2035: 0%
- Technology
  - Heatpumps
  - Combined heat and power
  - Gasfired boilers
  - Seasonal storage





Data center: 200 meter

# Solarthermal project

novar



24.000  
Panels



12  
hectares



25  
GWh/Y



2600  
Homes

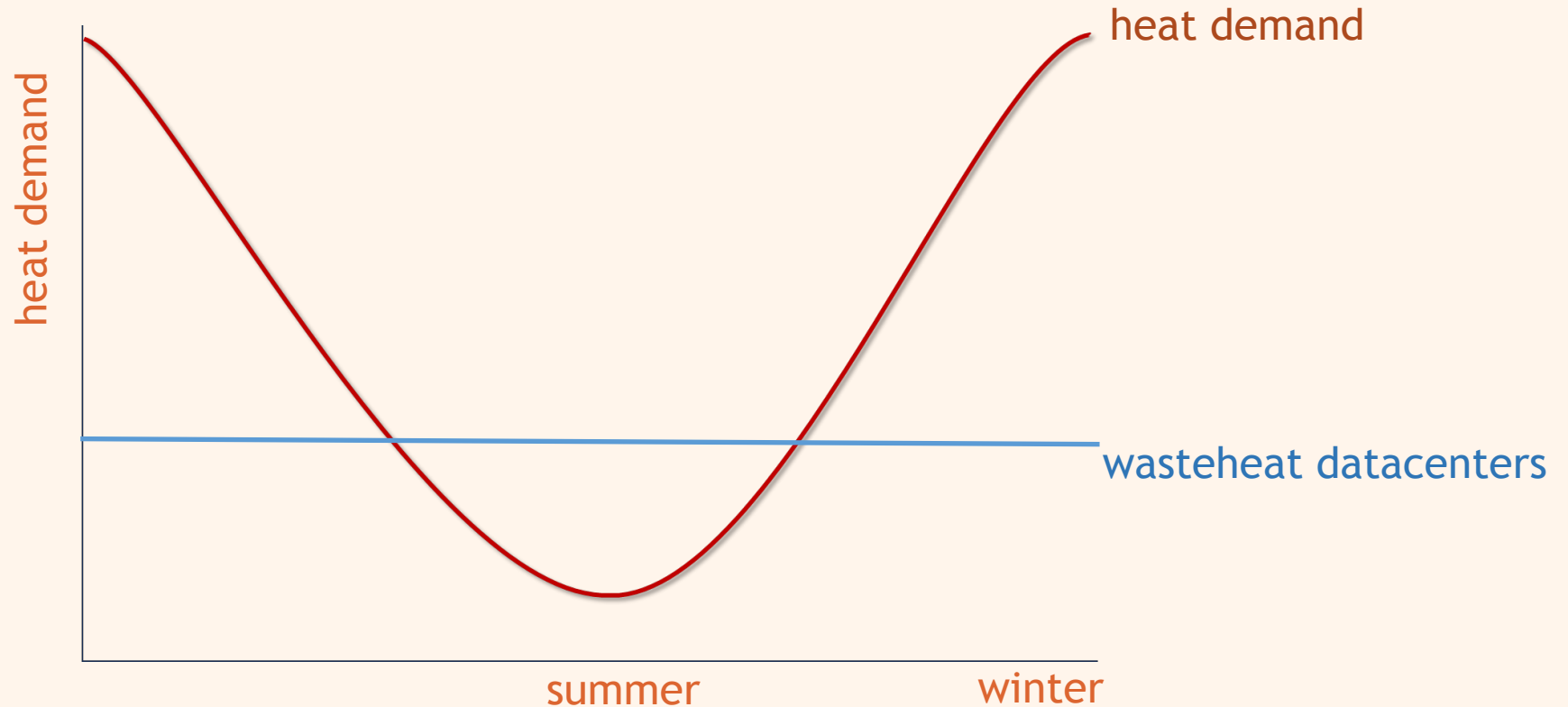


5700 tons  
CO2/Y

# The challenge: matching supply vs demand

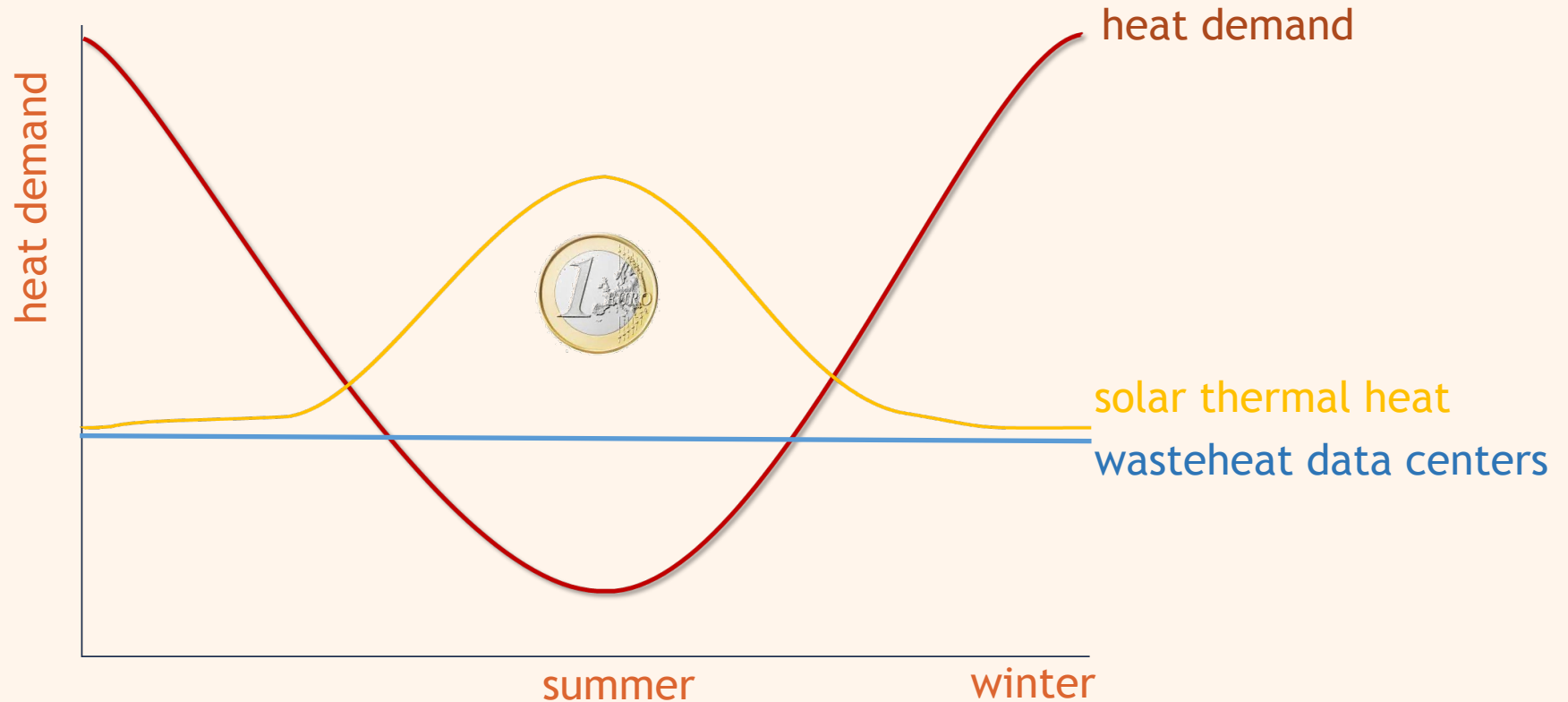


# Demand vs production of wasteheat

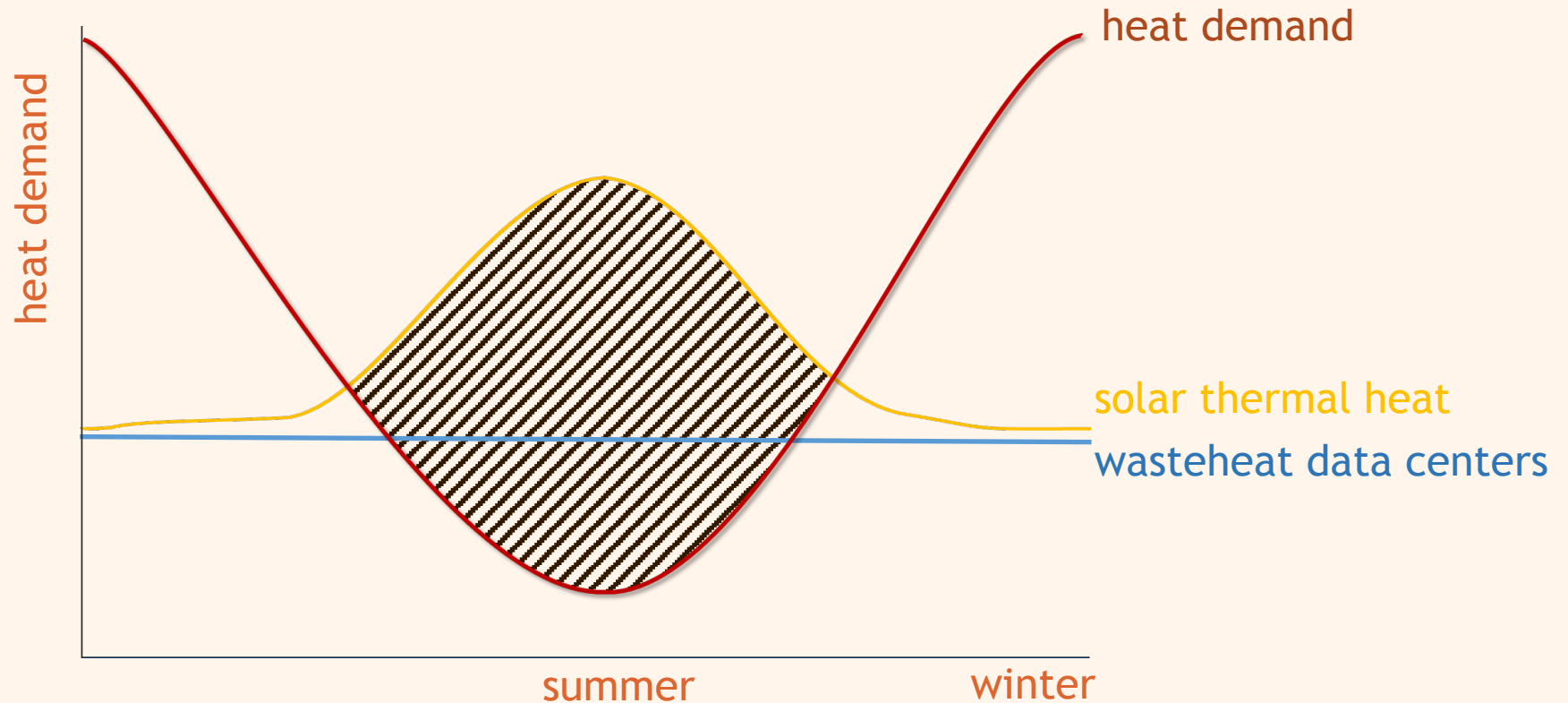




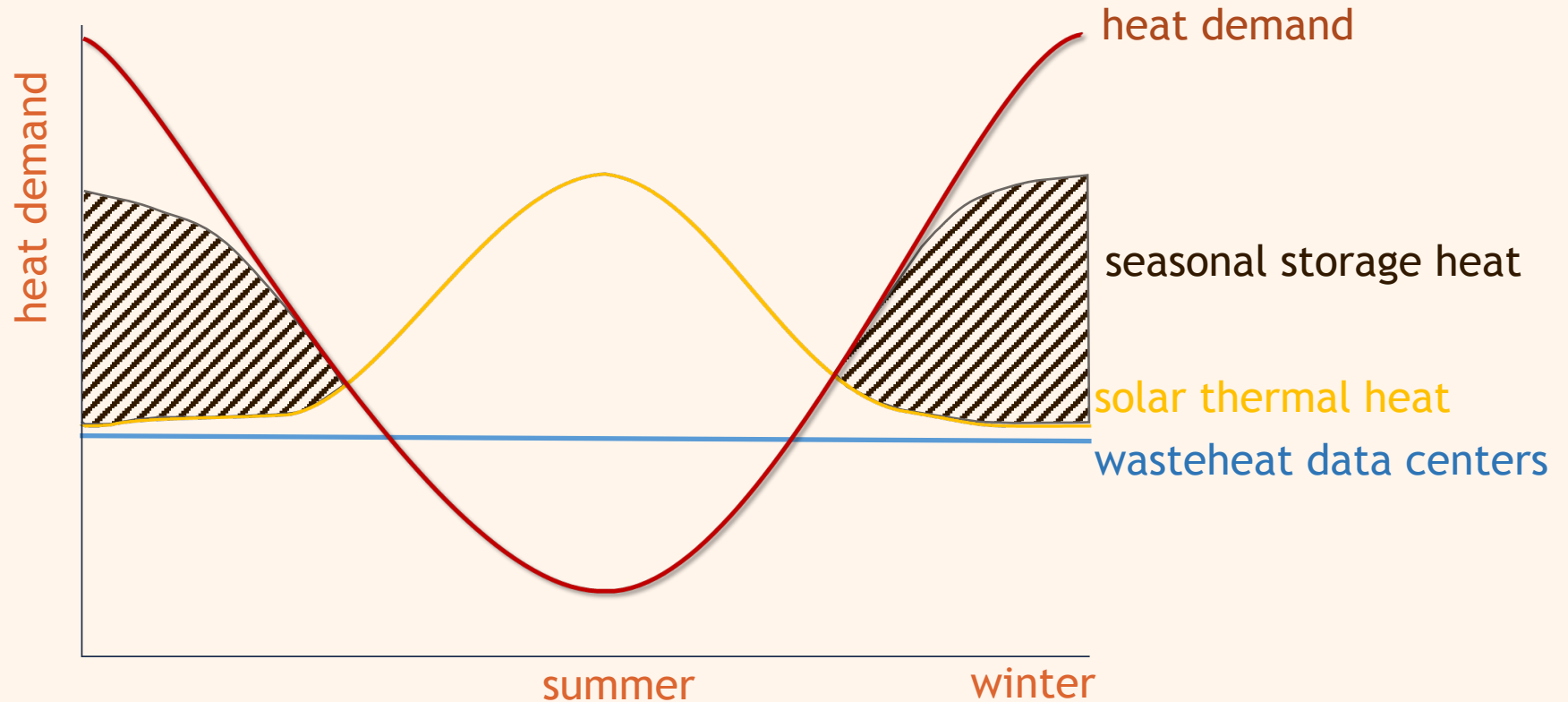
# Demand vs production of wasteheat + solarheat



# Summer surplus

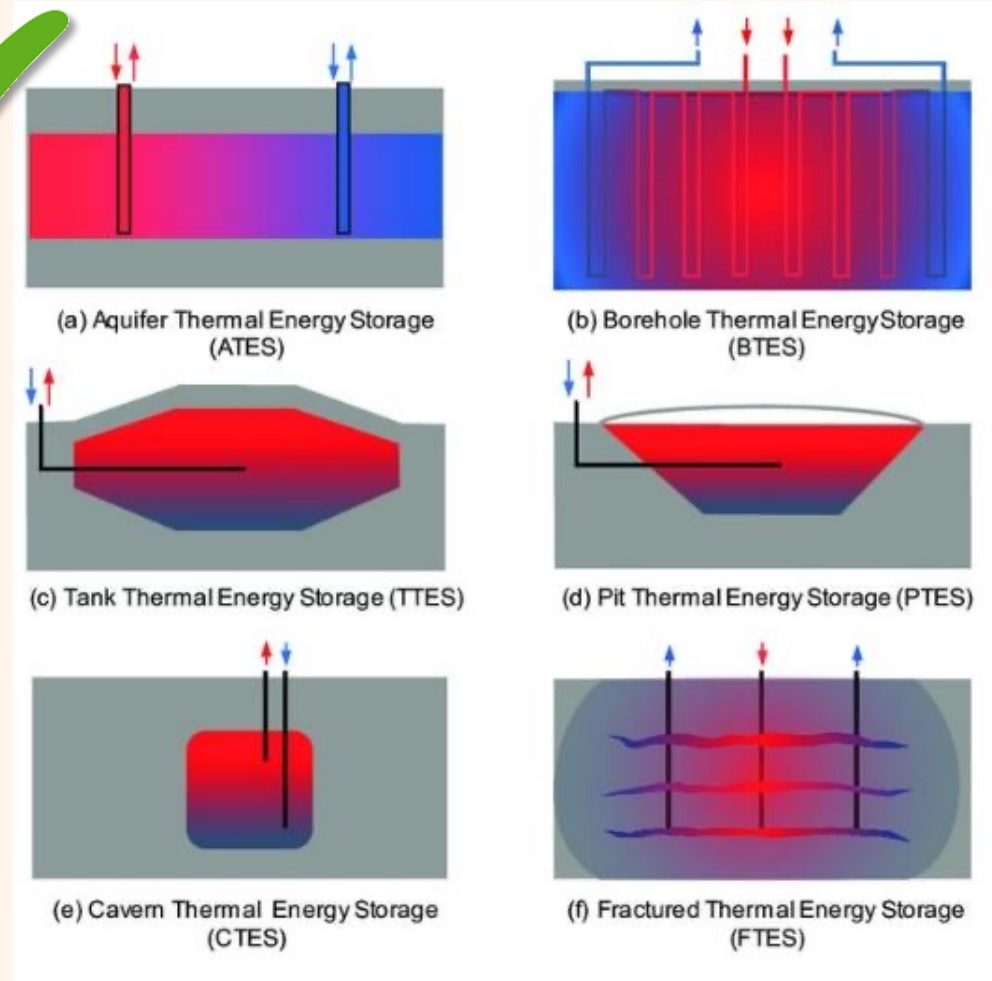
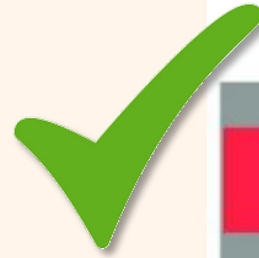


# Summer surplus -> seasonal storage

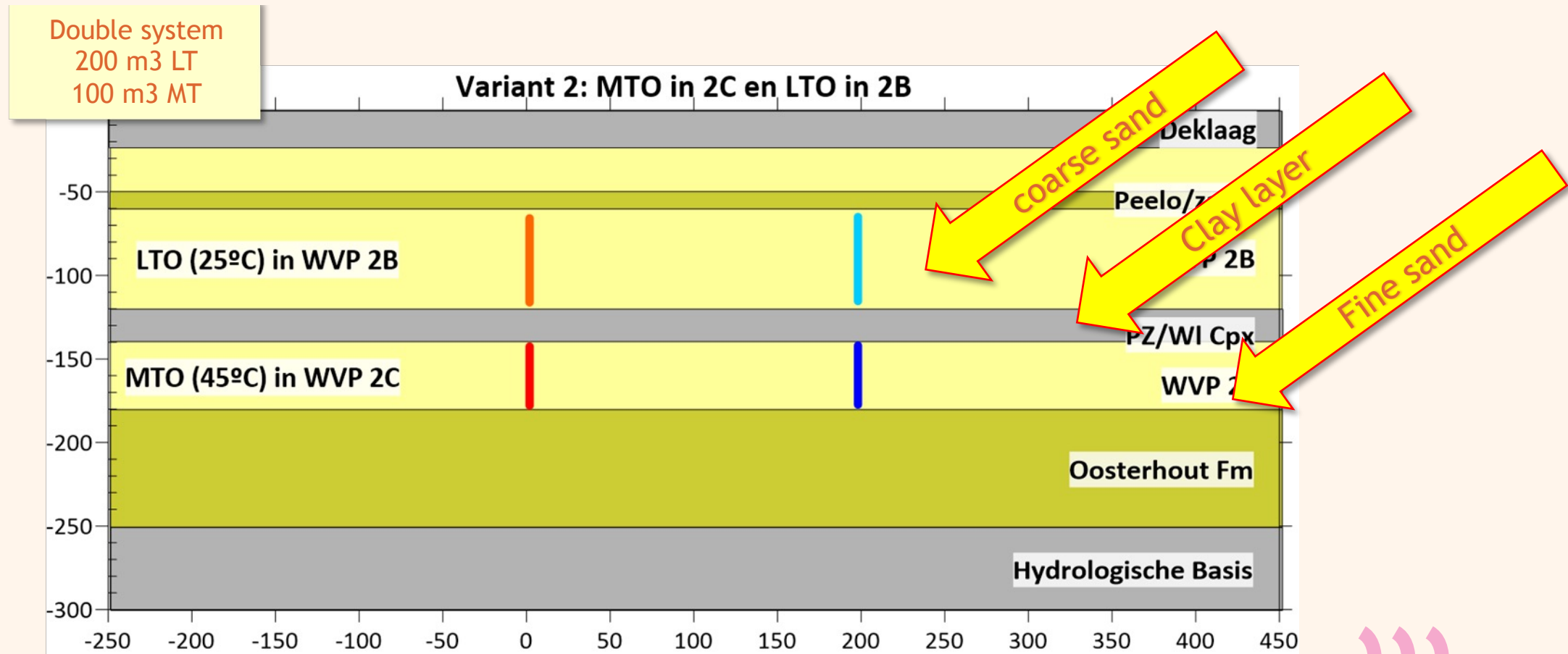


# ATES

- Limited temperatures (wasteheat)
- Proven technology
- Standard materials
- Limited investments
- No surface area needed
- Allows for both MT as LT storage
- Huge capacity



# Cross section of the ATEs







The construction of the seasonal heat storage started in the summer of 2023.

# Charge dilemma


- Waste heat = free, low temperature, easy to store
- Solar heat = buy AND use
  - Direct use in heatgrid
  - Day tankstorage
  - Seasonal storage -> heatpump -> extra electricity costs!
- Seasonal supply solar heat can vary
  - **Fill seasonal storage 100% with free waste heat -> no capacity for solar left**
  - **Leave storage space for solar -> less stored waste heat for use in winter time**
- Other questions (unloading profile, sizing, additional heatsources)





# So many questions....

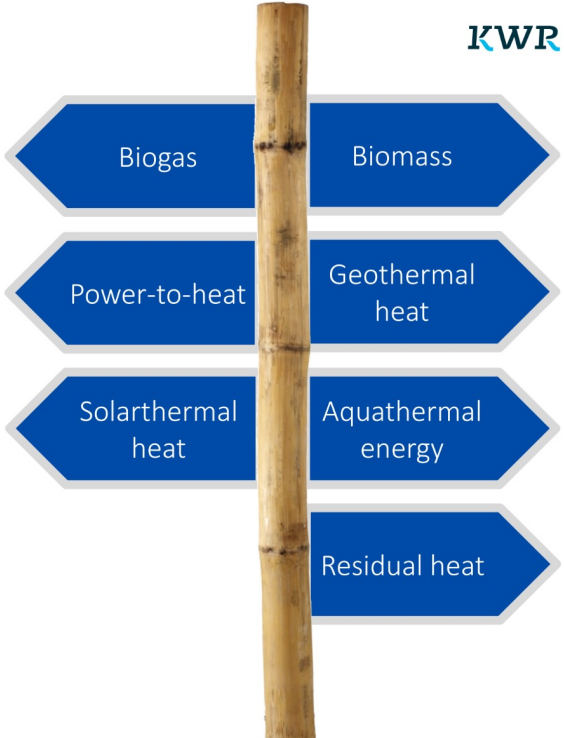
- Effect studies
  - New / other heat sources
  - More / less storage capacity
  - Growing heat demand
- Optimal loading strategy
  - PEF, CO<sub>2</sub>, NO<sub>x</sub>, €

 Beyond 2026

2035: # connections = 6 x current # connections

Heat source strategy

- Maintain an up-to-date overview of (potential) sources
- Maintain polyculture, redundancy
- increase flexibility in production and demand



Biogas Biomass

Power-to-heat Geothermal heat

Solarthermal heat Aquathermal energy

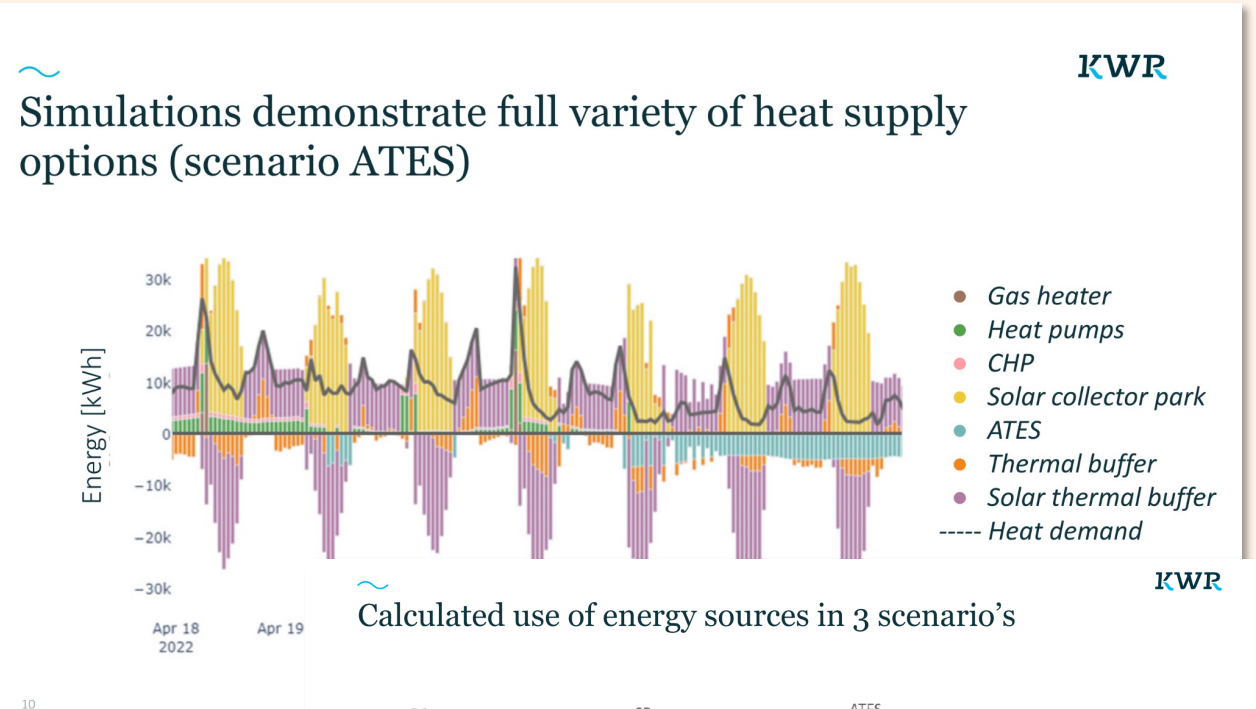
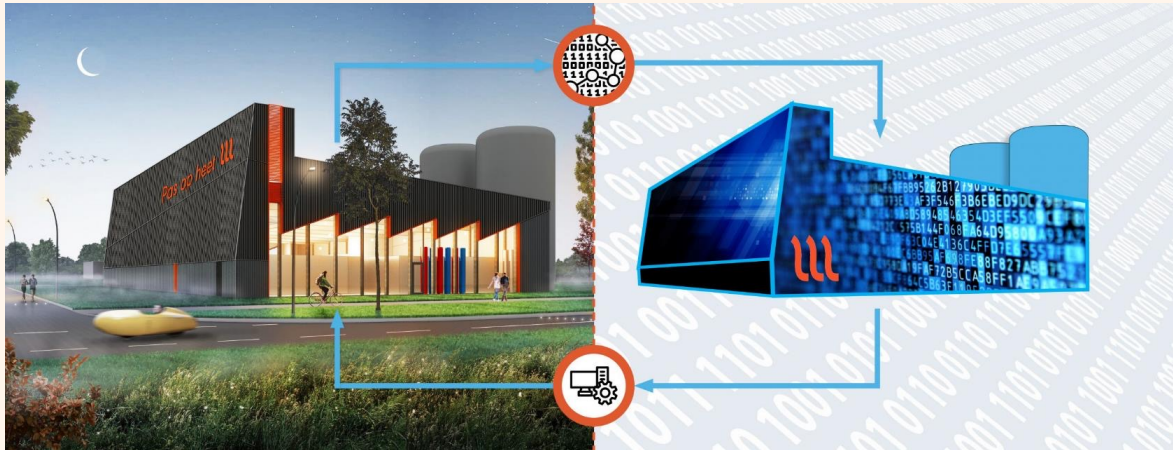
Residual heat

6



# Research using a digital twin






Project and research supported with DEI+ subsidy from 'Rijksdienst voor Ondernemend Nederland'



# Results

- Seasonal heat storage
  - Enables combining competitive renewable heatsources
    - unlocks the use of solarheat !
    - Storing waste heat in summer for use in wintertime
  - Mitigates ‘take or pay’ risk solarheat
  - Substantially improvement of share of renewable heat in the heatgrid
  - Enabling a diversity of heatsources, making the total heatsystem more robust and less vulnerable for changes in demand or production

**Lessons learned** KWR

-  The flexible, multi-source heat strategy with solar heat, residual heat from data centers and seasonal heat storage provides a viable, multi-year approach to meet growing heat demand and increasingly ambitious sustainability goals and legislation.
-  The digital twin provides insight in the performance of the heat plant in terms of costs and sustainability, providing a means to compare different future scenarios and control strategies.
-   
  - Base case heat plant can deliver high powers at a competitive price point.
  - Solar heat without ATEs increases renewability of heat; subsidies keep prices similar.
  - ATEs (relative small capacity) already leads to substantially more efficient use of renewable energy sources (stored in summer for winter)
  - Green H<sub>2</sub> in FC instead of natural gas in a CHP greatly reduce emissions and increase the renewable power fraction. Relative pricing of green H<sub>2</sub> high.

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# Seasonal storage is the key to unlock Solarheat



Thank you for your attention

**KWR**

Groningenhaven 7  
3433 PE Nieuwegein  
The Netherlands

T +31 (0)30 60 69 511  
E [info@kwrwater.nl](mailto:info@kwrwater.nl)  
I [www.kwrwater.nl](http://www.kwrwater.nl)



@KWR\_Water



KWR



KWR\_Water



**Daniël Bakker**  
[Daniel.Bakker@kwrwater.nl](mailto:Daniel.Bakker@kwrwater.nl)  
+31 30 606 9544



**Dirk Vries**  
[Dirk.Vries@kwrwater.nl](mailto:Dirk.Vries@kwrwater.nl)  
+31 30 606 9671



**Els van der Roest**



**Theo Venema**  
+31 6 20 441 329



**Marette Zwamborn**