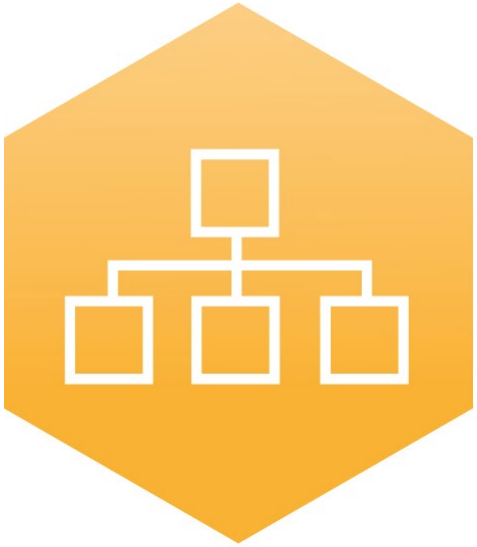
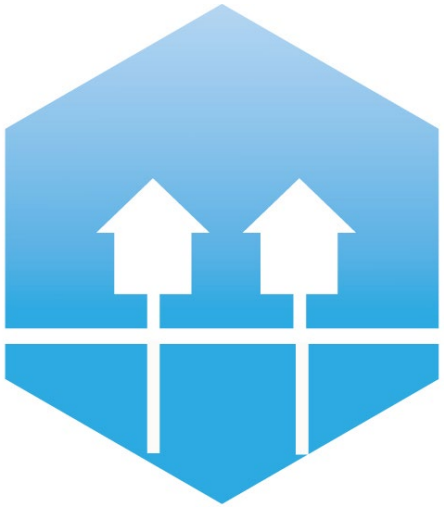
Integration of waste heat and renewables into district heating systems in East-Netherlands

Prof. Dr. Ir. Richard van Leeuwen
Research group sustainable energy systems
Saxion University of Applied Sciences
The Netherlands





AALBORG UNIVERSITY
DENMARK

4DH
4th Generation District Heating Technologies and Systems

Contents

4DH
4th Generation District Heating Technologies and Systems

1. Dutch heat transition challenge
2. Options to accelerate the heat transition
3. Dutch approach
4. Existing district heating networks
5. New district heating developments in East-Netherlands
6. Case 1: Hengelo large industrial waste heat DH
7. Case 2: Ede green DH
8. Case 3: Wezep small industrial waste heat DH
9. Conclusions
10. Outlook

AALBORG UNIVERSITY
DENMARK

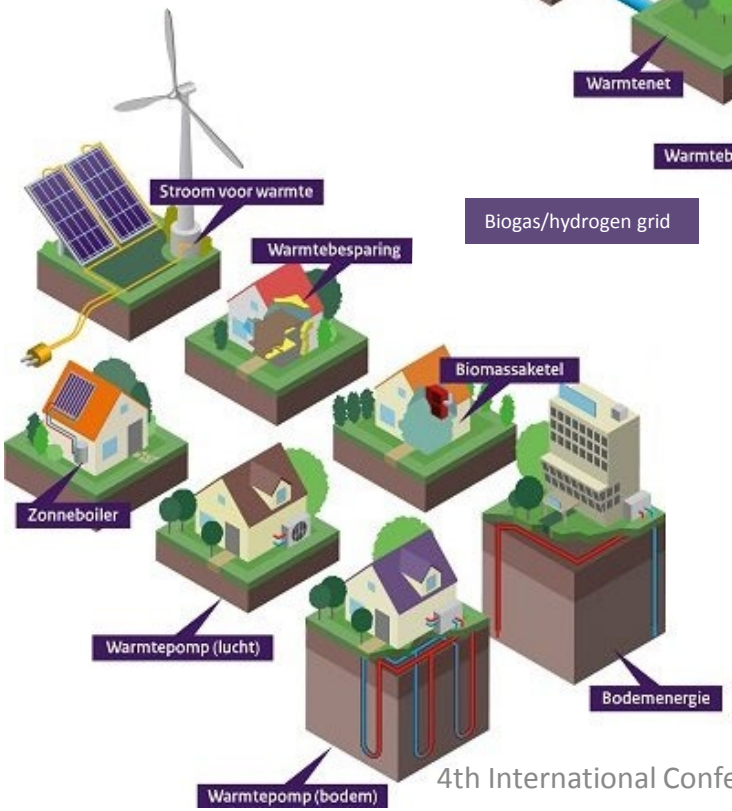
Dutch heat transition challenge

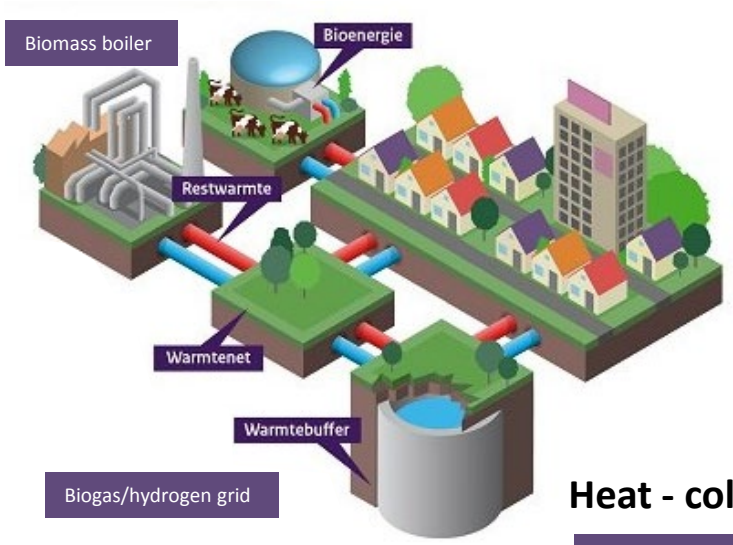
4DH
4th Generation District Heating Technologies and Systems

Options to accelerate heat transition

4DH
4th Generation District Heating Technologies and Systems

Heat - individual

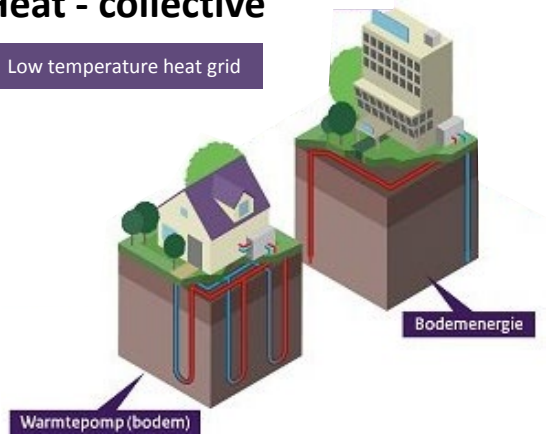




High temperature heat grid

Heat - collective

Low temperature heat grid



Basic legislation for district heating business in the Netherlands

4DH
4th Generation District Heating Technologies and Systems

Summary Dutch heat law obligations:

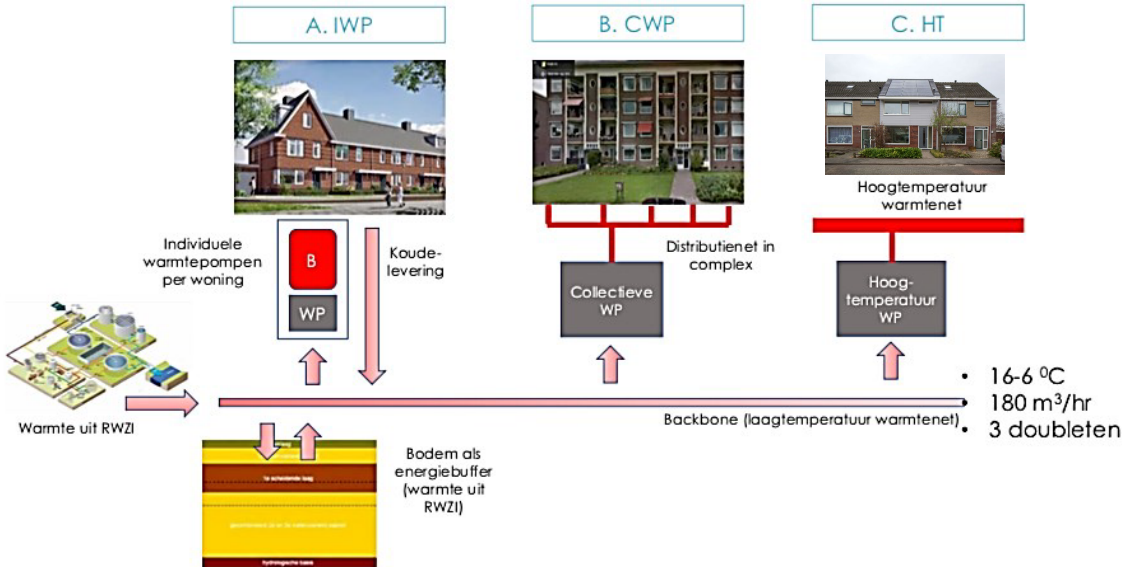
- **Register as supplier at ACM (Authority Consumer & Market)**
- **Permit to supply heat (prove adequate organization, financial and technical qualities)**
- **Contract between heat supplier and customers**
- **Measurement of supplied heat**
- **Social aspect: Maximum heat supply price (incl. VAT):**
  309,52 + 24,05/GJ [euro/y] → Not More Than NG!
- **Maximum onetime connection fee: 1038 euro**
- **Maintenance and troubleshooting organization**
- **Penalty in case of heat supply disturbance: 20 euro/4 hours**

AALBORG UNIVERSITY
DENMARK

Integral approach

- Optimal temperature?

- House renovation programs
- Social housing corporations:
  - First to renovate
  - First to connect
- Empowering neighbourhoods



Complex governance!

AALBORG UNIVERSITY
DENMARK

Public perception of district heating

4DH
4th Generation District Heating Technologies and Systems

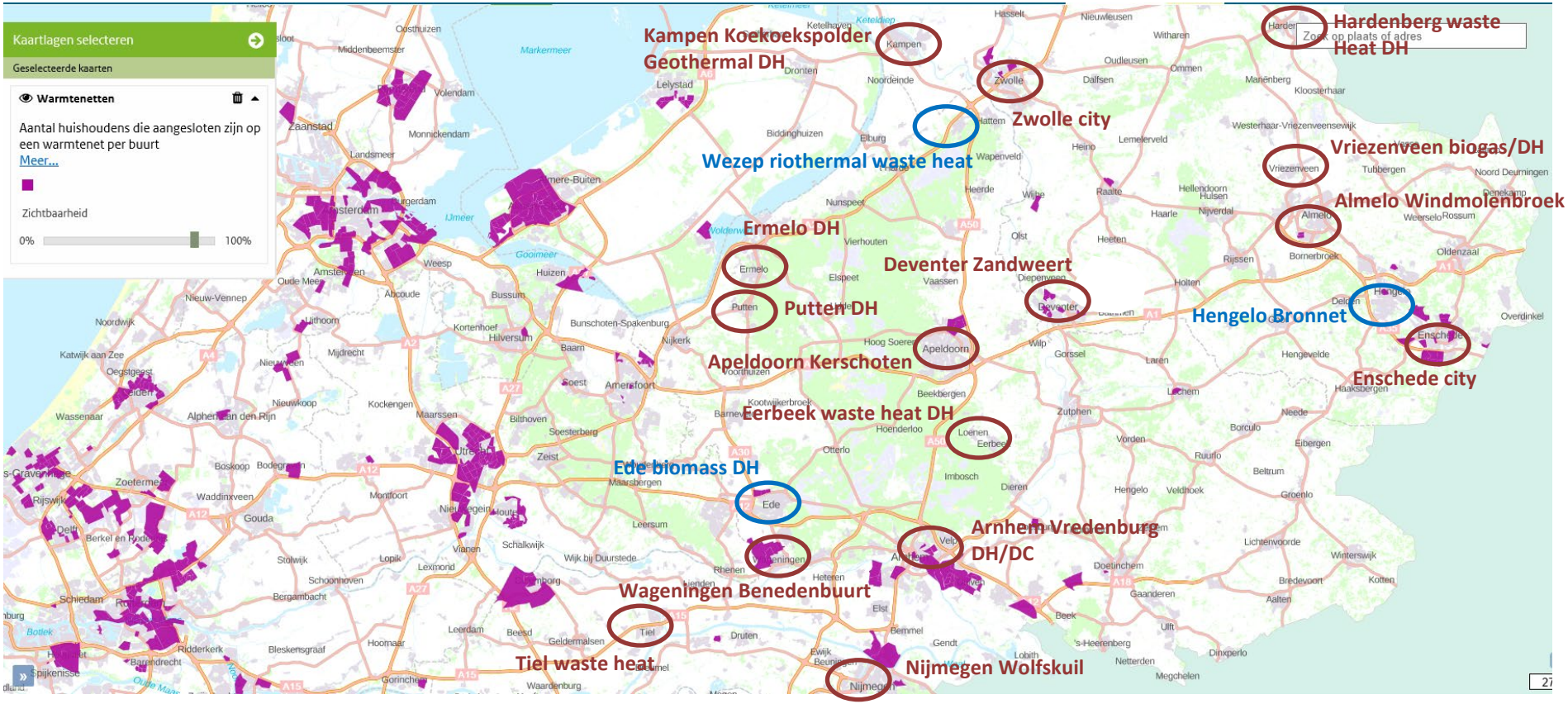
AALBORG UNIVERSITY
DENMARK

Existing DH networks and feasibility studies

4DH
4th Generation District Heating Technologies and Systems

Existing DH networks

WIEfm feasibility studies

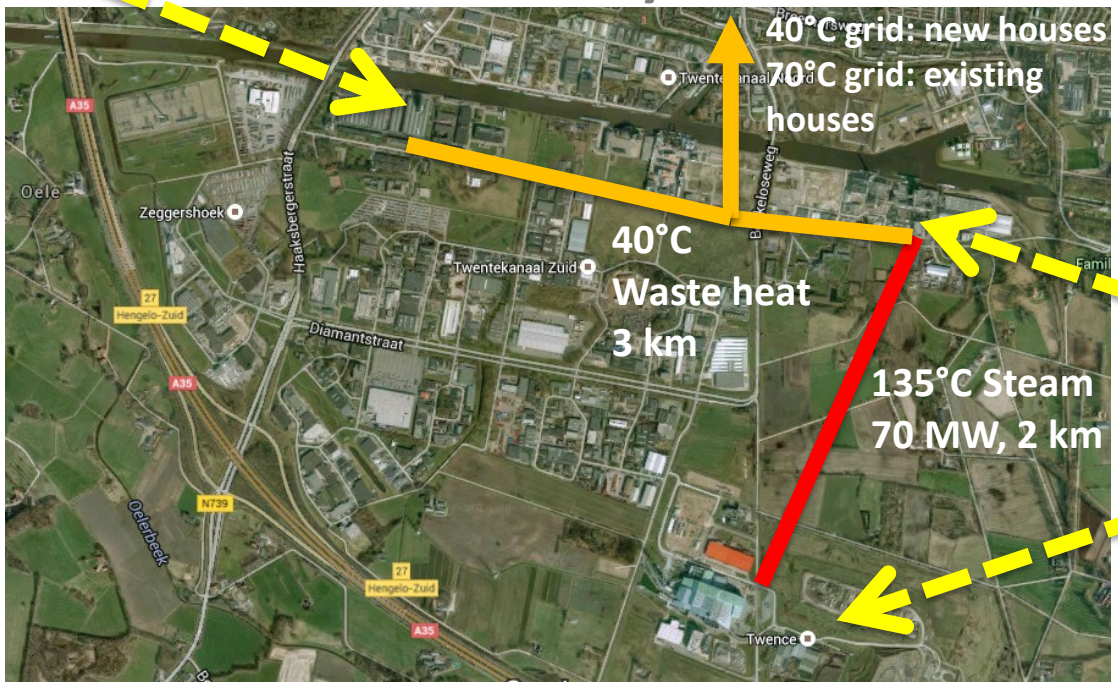


Case Hengelo: Low temperature industrial waste heat utilization

4DH
4th Generation District Heating Technologies and Systems

HTSP Bronnet

Expansion of LTDH to inner city districts



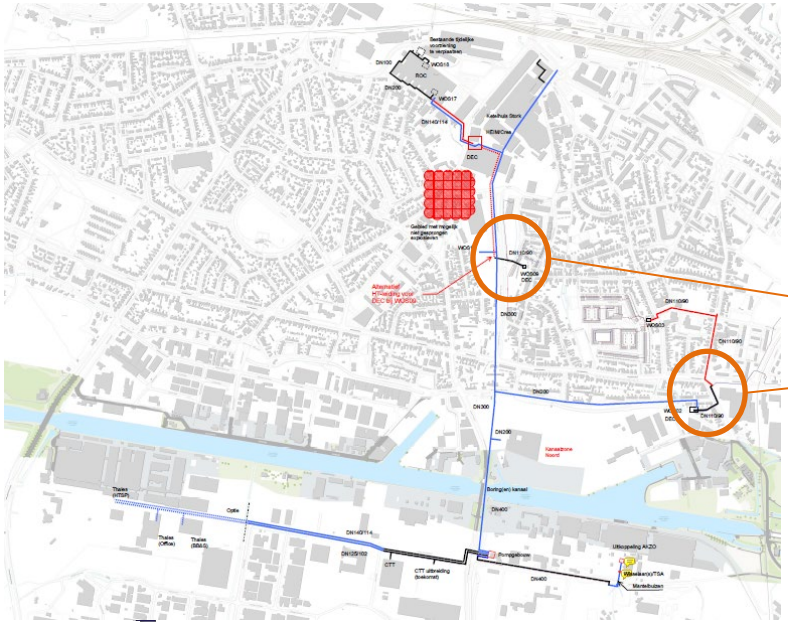
Akzo Nobel

Twence
Waste incineration
CHP

(Bronnet, 2017)

- Heat pump units 1MW$_{th}$ each
- Refrigerant NH_3 (ammonia)
- COP ~5 depending on external conditions
- Raise temperature from 40°C to 70°C

(Warmtenetwerk Hengelo BV, 2017)



Case Hengelo

Critical succesfactors

- Initial availability of industrial waste heat
- Initial takeover of small DH network
- High heat demand by industry and households
- Initial high risk investments by council and province
- Change of ownership was necessary from municipality to private companies
- Complex governance structure
- Too dependent on single heatsource?

Case Ede: green heat with local biomass

Vika Cheese factory

- Council heat vision, Vika and Kernhem DH in 2014
- Privately owned
- 2018: 18.500 customers
- 2 biomass combustion plants: steam CHP
- 3rd biomass plant end of 2018
- Plan for Smart thermal grid, open source thermal grid

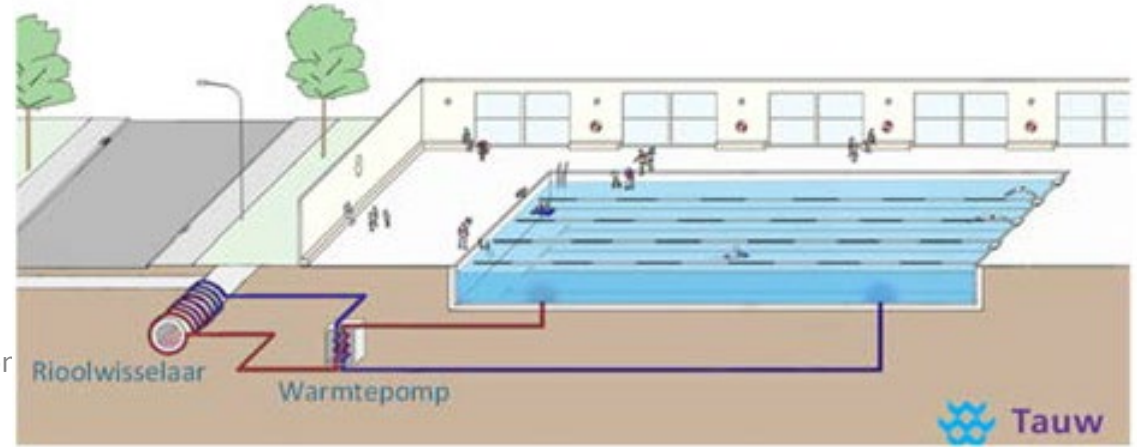
Case Ede

Critical succesfactors

- Initial availability of industrial waste heat
- Initial takeover of small DH network
- Sufficient availability of local/regional biomass resources
- Expansion strategy: first larger customers
- Active communication on sustainability and costs
- Ambitious, consistent municipal heat transition vision
- Low governance complexity
- Active participation of stakeholders

Case Wezep: small scale waste heat utilization

- **Source: potato factory waste water**
- **DH alternative for new sewer connection**
- **Non-insulated single pipe: 1 km**
- **Heat pump to supply indoor swimming pool (year-round heat demand)**
- **Potential expansion: sporting hall + housing district, building renovations required**



AALBORG UNIVERSITY
DENMARK

Case Wezep

Critical succesfactors

- DH avoids investment for potato factory
- Solid business case due to low network investments
- Low temperature heat supply → high heatpump COP
- Waste heat supplied without costs
- Low governance complexity: private ownership, 20 year contracts
- Uncertainty: continuity of the heatsource in the long term

Conclusions

- Dutch heat transition is gaining momentum > 15 new initiatives in East Netherlands
- Solid legislation framework for district heating supply
- Integral approach with building renovations increases citizen awareness
- Increase of technical, economical and governance complexity

4DH
4th Generation District Heating Technologies and Systems

AALBORG UNIVERSITY
DENMARK

Outlook

- Ambitious heat transition plan Overijssel
- Role of Geothermal sources
- Municipal heat vision in 2021
- Continued support for most promising cases
- Research focus on:
  - Advanced control strategies
  - Innovative business models
  - Changing role of municipalities, new alliances
  - Increase citizen participation

Interreg project WIEfm: District heating within the Dutch/German EU-region

4DH
4th Generation District Heating

SAXION Hogeschool Enschede

FH MÜNSTER
University of Applied Sciences

WFG
FÜR DEN KREIS BORKEN MBH

wfc
WIRTSCHAFTSFÖRDERUNG
KREIS COESFELD GMBH

AWG

kiEMT
werken aan energie- en milieutechnologie

WES
Wirtschaftsförderungs- und Entwicklungsgesellschaft Steinfurt mbH

http://www.wiefm.eu

EUROPÄISCHE UNION
Investition in unsere Zukunft
Europäischer Fonds
für regionale Entwicklung

INTERREG Deutschland Nederland

Europäische Union
Europese Unie

provincie Gelderland

provincie Overijssel

Ministerie van Economische Zaken

Ministerium für Wirtschaft, Energie, Industrie, Mittelstand und Handwerk des Landes Nordrhein-Westfalen