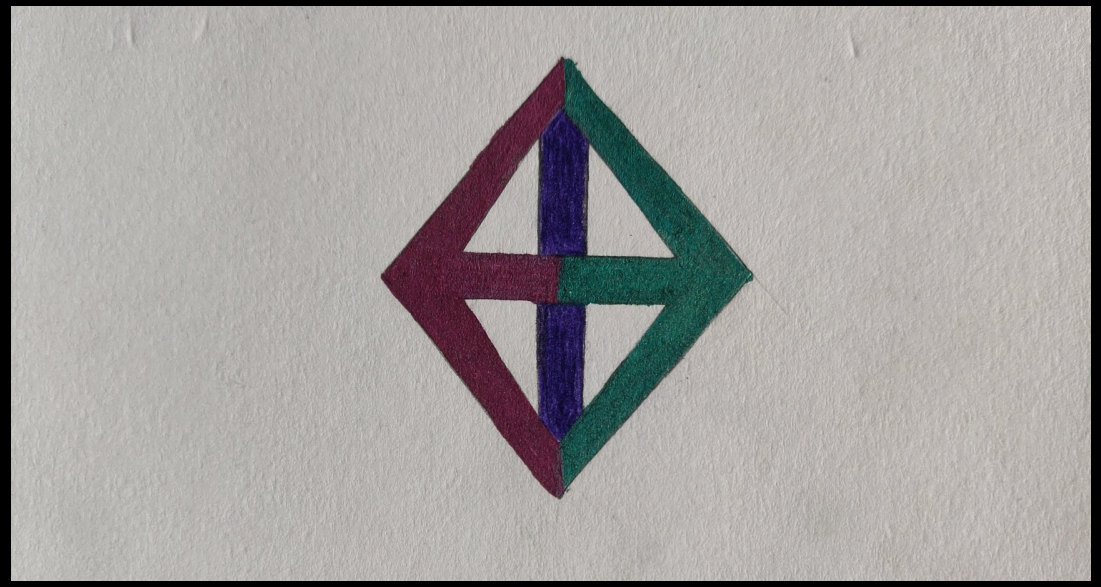
020
02025
2025

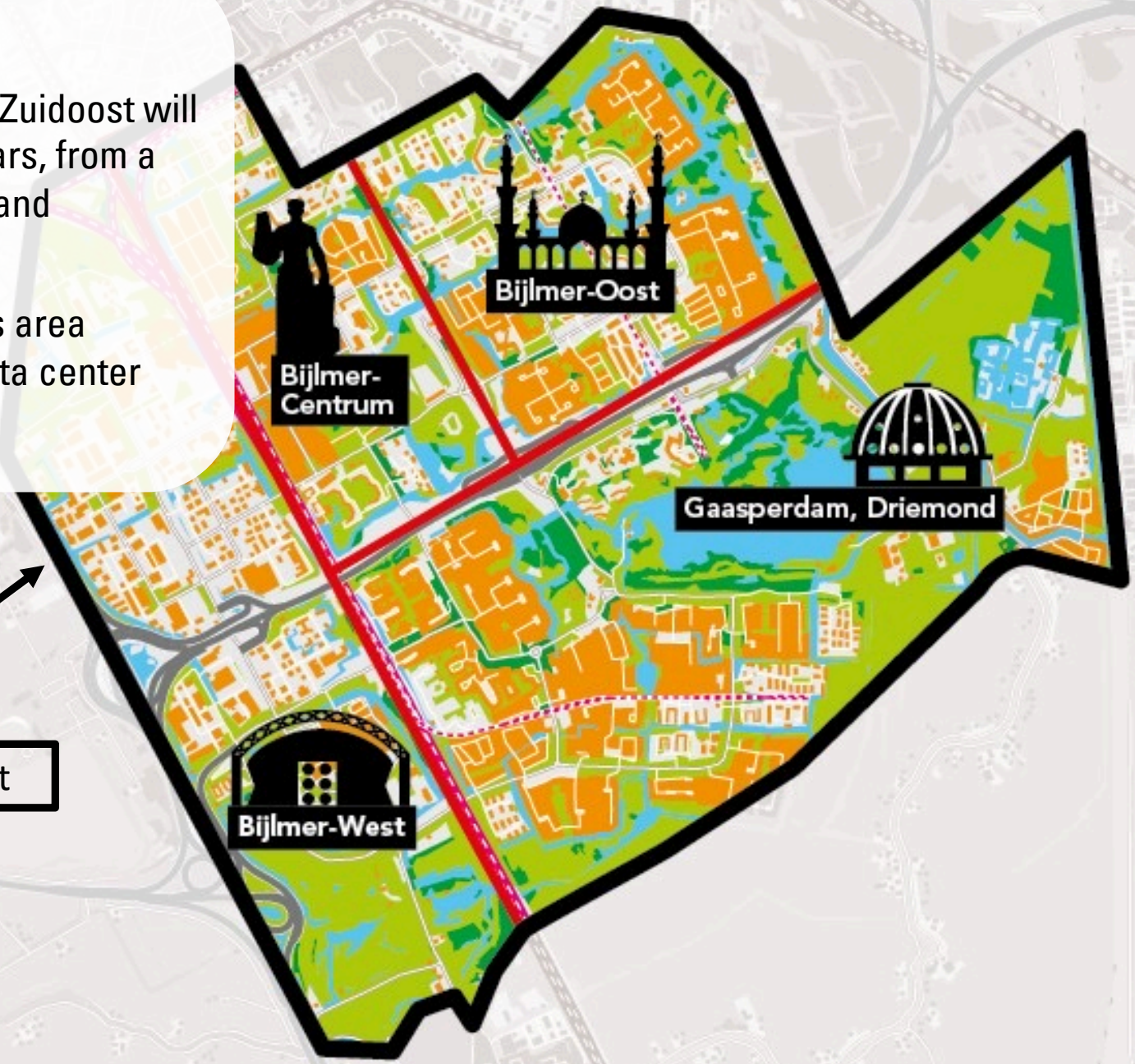


02025 – Data Center Heat in Amsterdam Zuidoost

A little color and context!

In the coming years, Amsterdam Zuidoost will be transformed in the coming years, from a working area into a lively, green and ecological urban center.

My proposal is that as part of this area transformation we can unlock data center heating in Amsterdam.

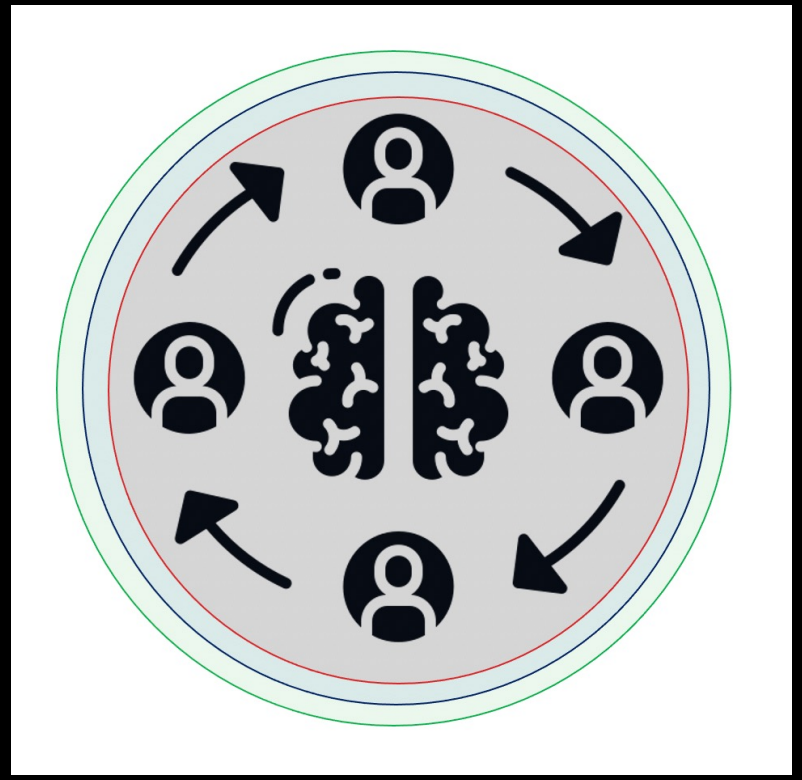


Zuidoost

Amstel III and ArenAPoort

020
02025
2025

Data Center Heat



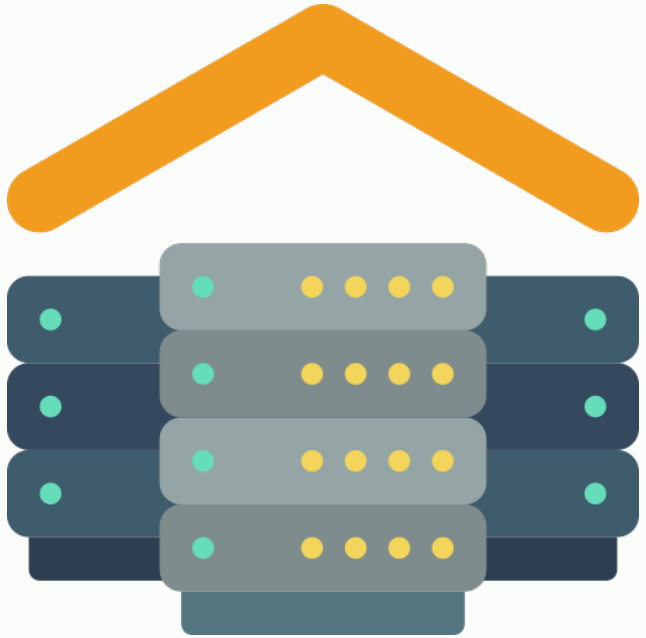
Economic case for data center heat in Amstel III en ArenAPoort

The research I did focussed on the existing data center AM7 in Amstel III and ArenAPoort. In principle, this data center with a capacity of 10MW$_{peak}$ produces enough heat to service about 23.000 houses.

As the heat is generated either way when operating the data center, it is economically and environmentally sensible to use this heat.

In a nutshell, this technology offers a available alternative to natural gas heating in Amsterdam Zuidoost - thus it is about energy transition.

(AM7)

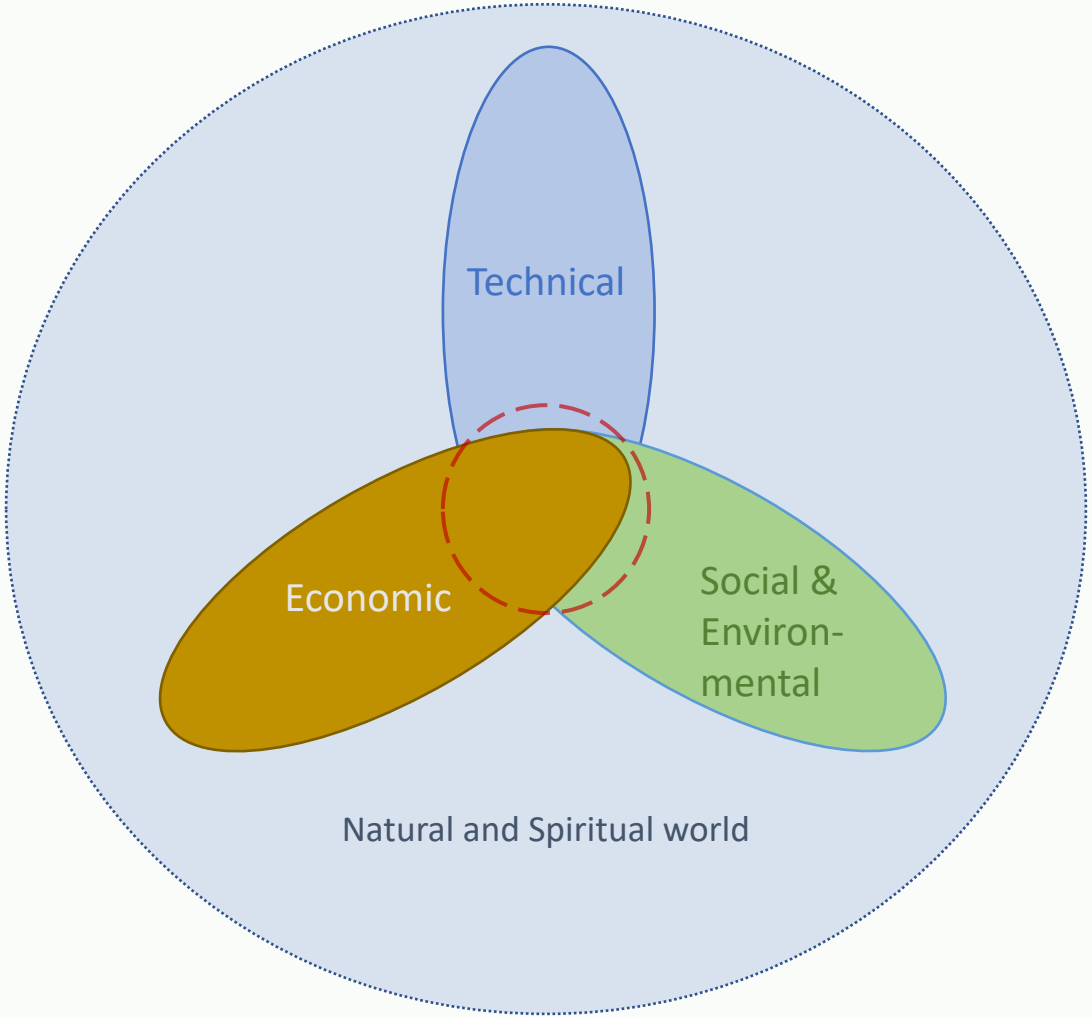


Electricity$_{in}$

Heat$_{out}$

Technology in a nutshell: 'Data center heat' as alternative energy source to natural gas (in Amsterdam Zuidoost)

The analysis I do



Data Center Heat in Amstel III en ArenAPoort [1]

AM7 Data Center Heat: ~35 °C

Vs.

Existing High Temperature District Heating Network: ~120 °C

-

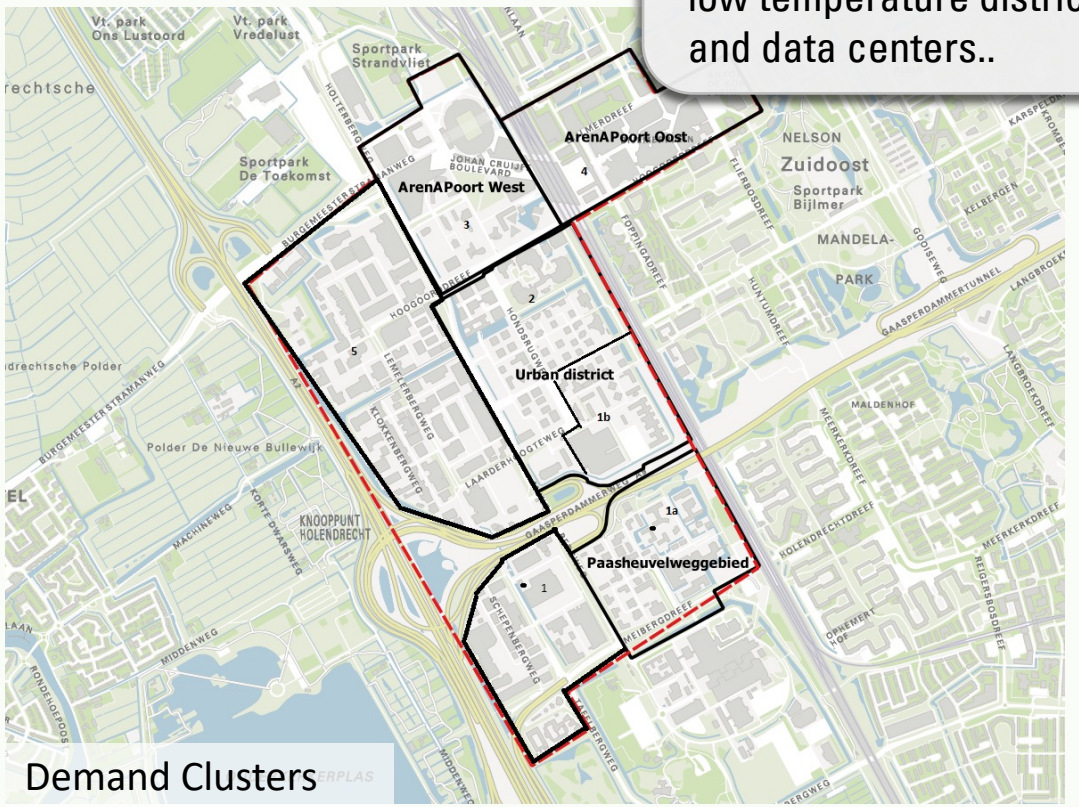
<u>Low temperature district heating network</u>

(ca. 2100 m):

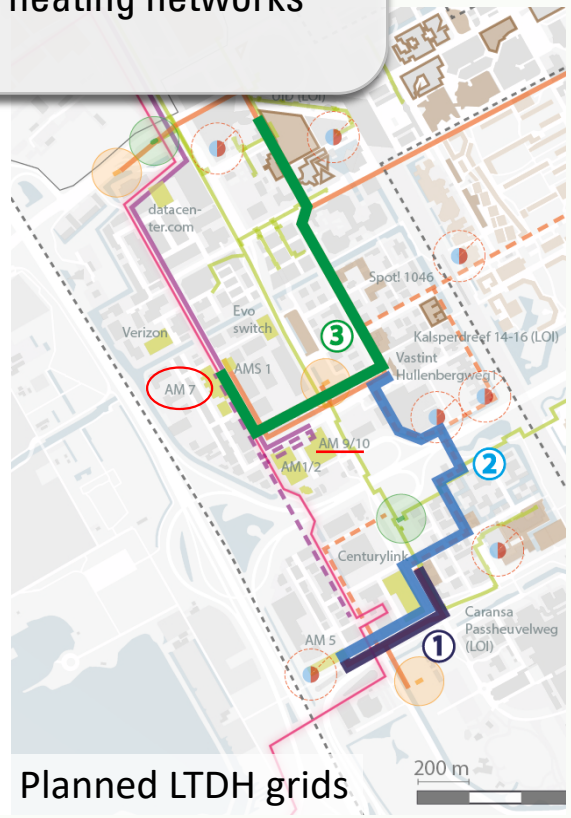
“Trace 3” (green line)

as “5th Generation District Heating and Cooling (5DHC) Network”

Below, you can see the project overview. To the left, the demand clusters in the area are displayed. And to the right, the planned low temperature district heating networks and data centers..



Demand Clusters



Planned LTDH grids

Here, the large temperature difference is also highlighted (in green). Therefore, also the reasoning for a low temperature network.

Data Center Heat in Amstel III and ArenAPoort [1]

AM7 Data Center Heat: ~35 °C

Vs.

Existing High Temperature District Heating Network: ~120 °C

-

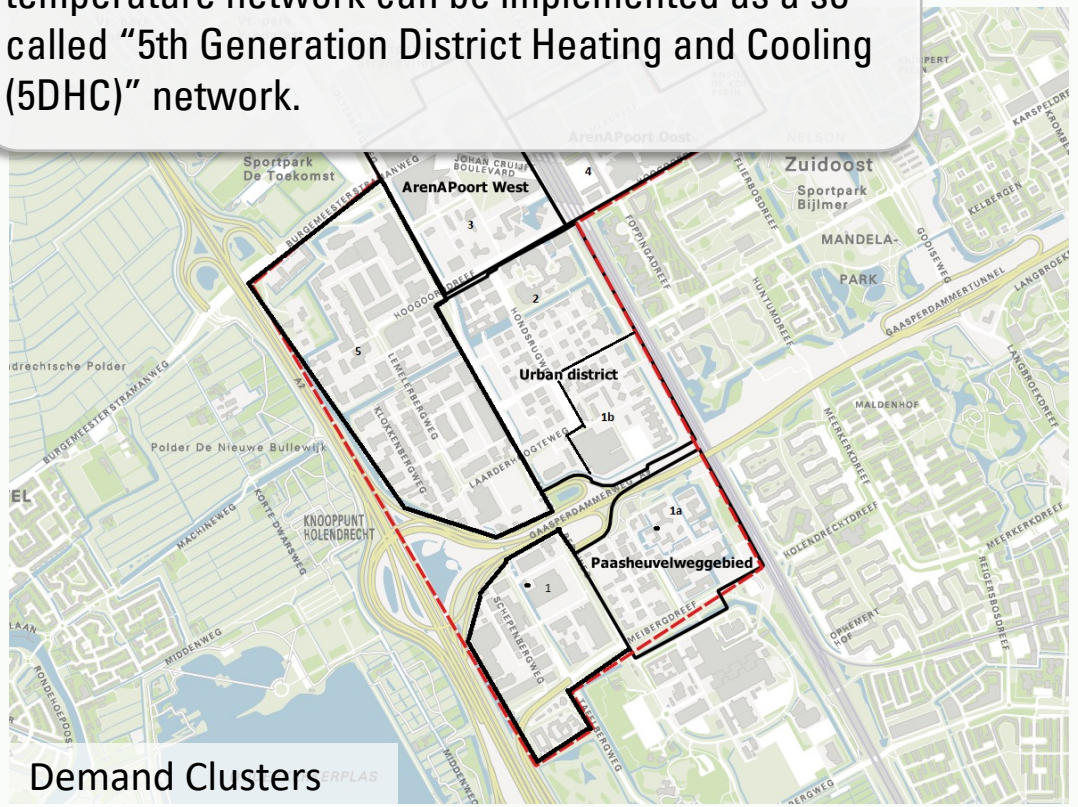
<u>Low temperature district heating network</u>

(ca. 2100 m):

"Trace 3" (green line)

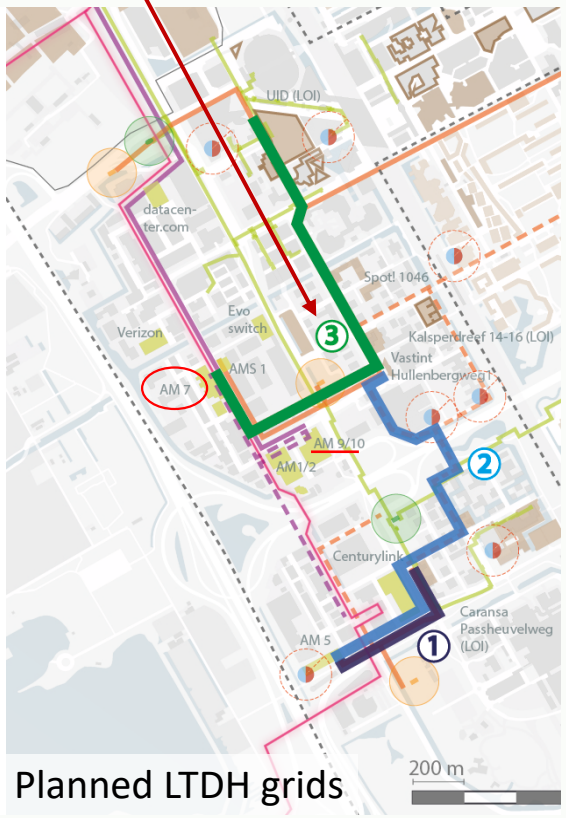
as "5th Generation District Heating and Cooling (5DHC) Netwerk"

The proposal I am explicitly making is that this low temperature network can be implemented as a so-called "5th Generation District Heating and Cooling (5DHC)" network.



Demand Clusters

*Proposal: "Trace 3" as **5DHC** network*



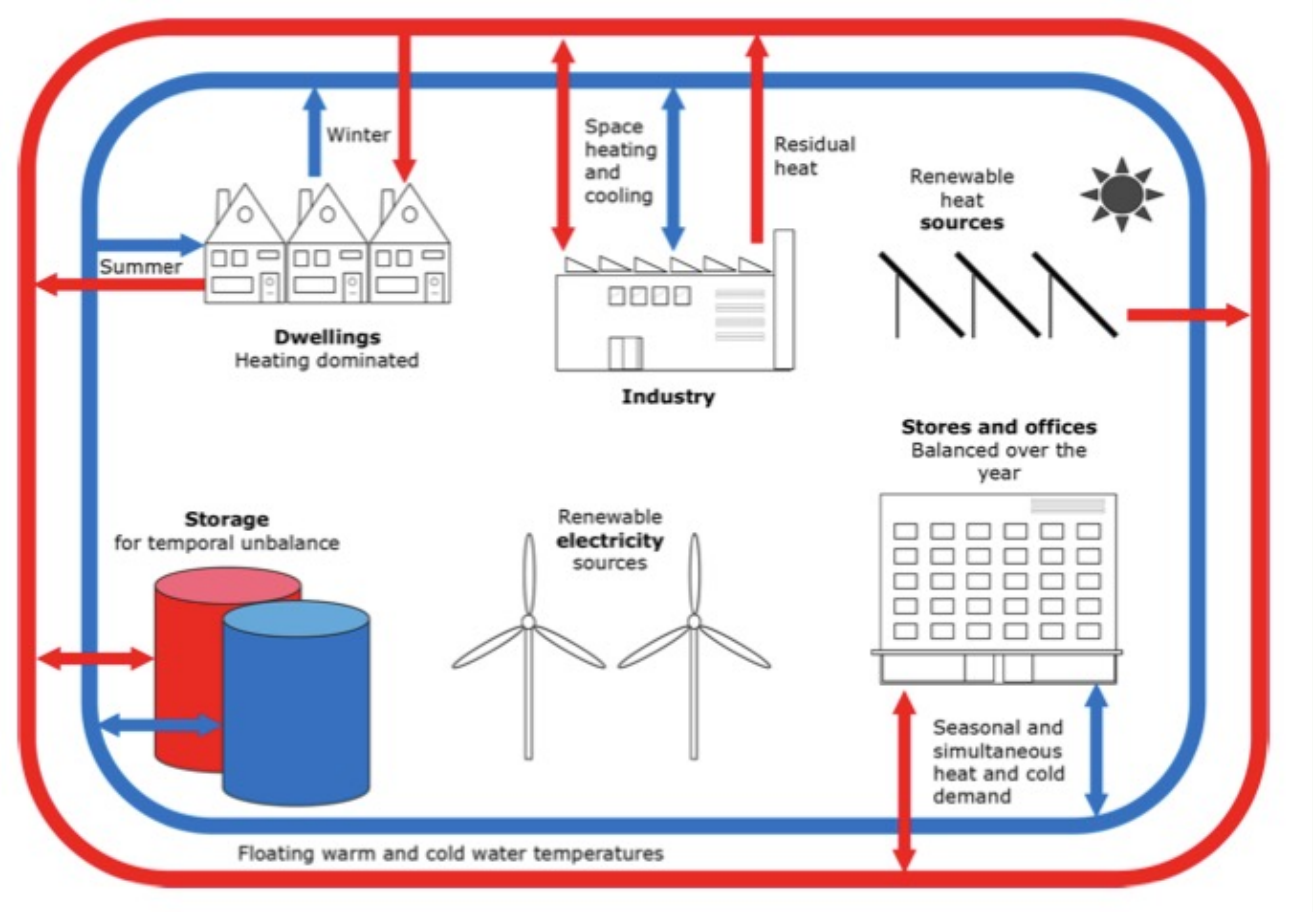
Planned LTDH grids

Alternative heating: 5th Generation District Heating and Cooling (5DHC) - Key Characteristics [2; 3; 4]

- 5DHC consists of a backbone with a warm and a cold pipe, and makes it possible for buildings to exchange energy with each other.

- Integration of heat sources in the city.
- Integration of renewable energy sources.
- Minimal energy losses due to operating temperatures close to the ground
- Prosuming across the network

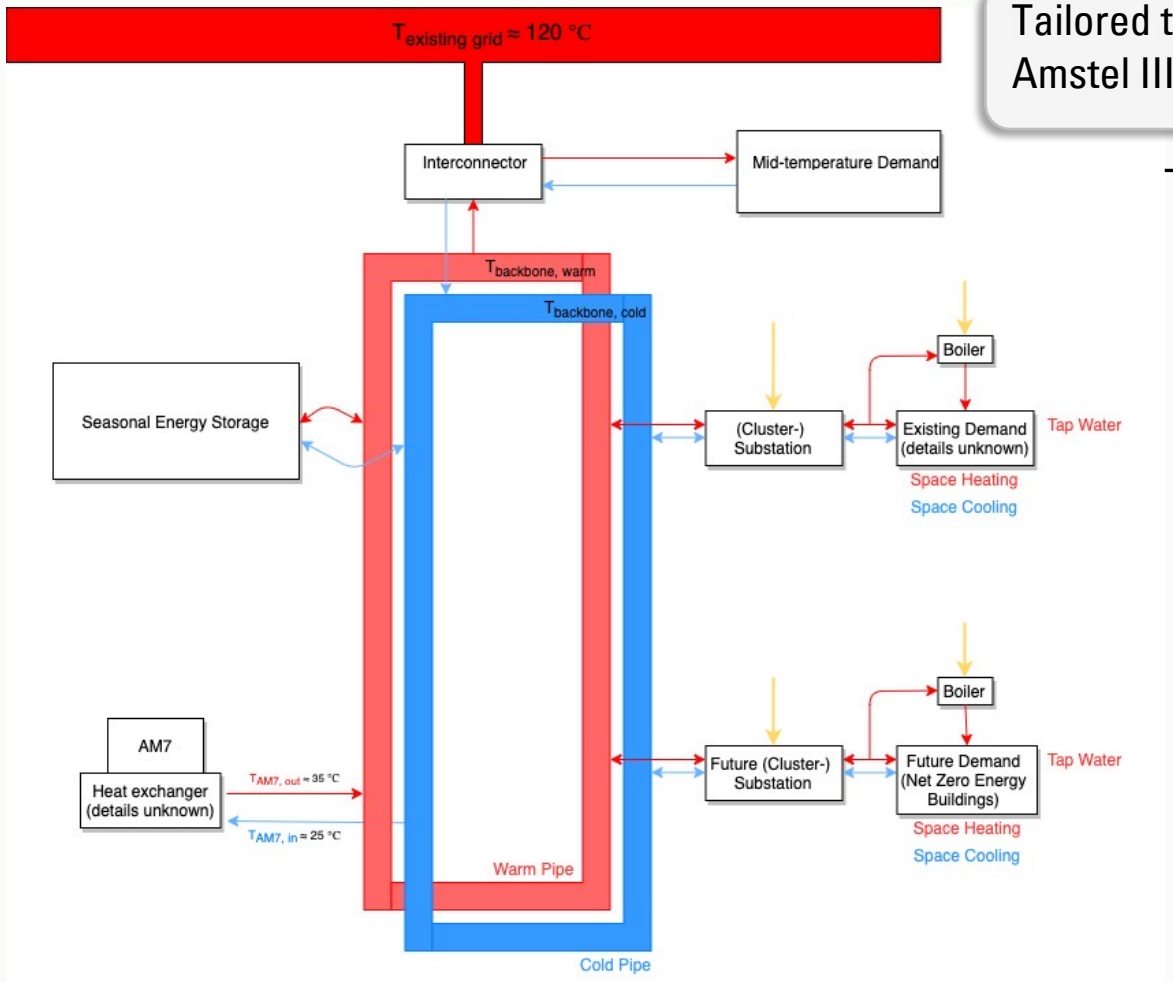
Heat out = Cold in



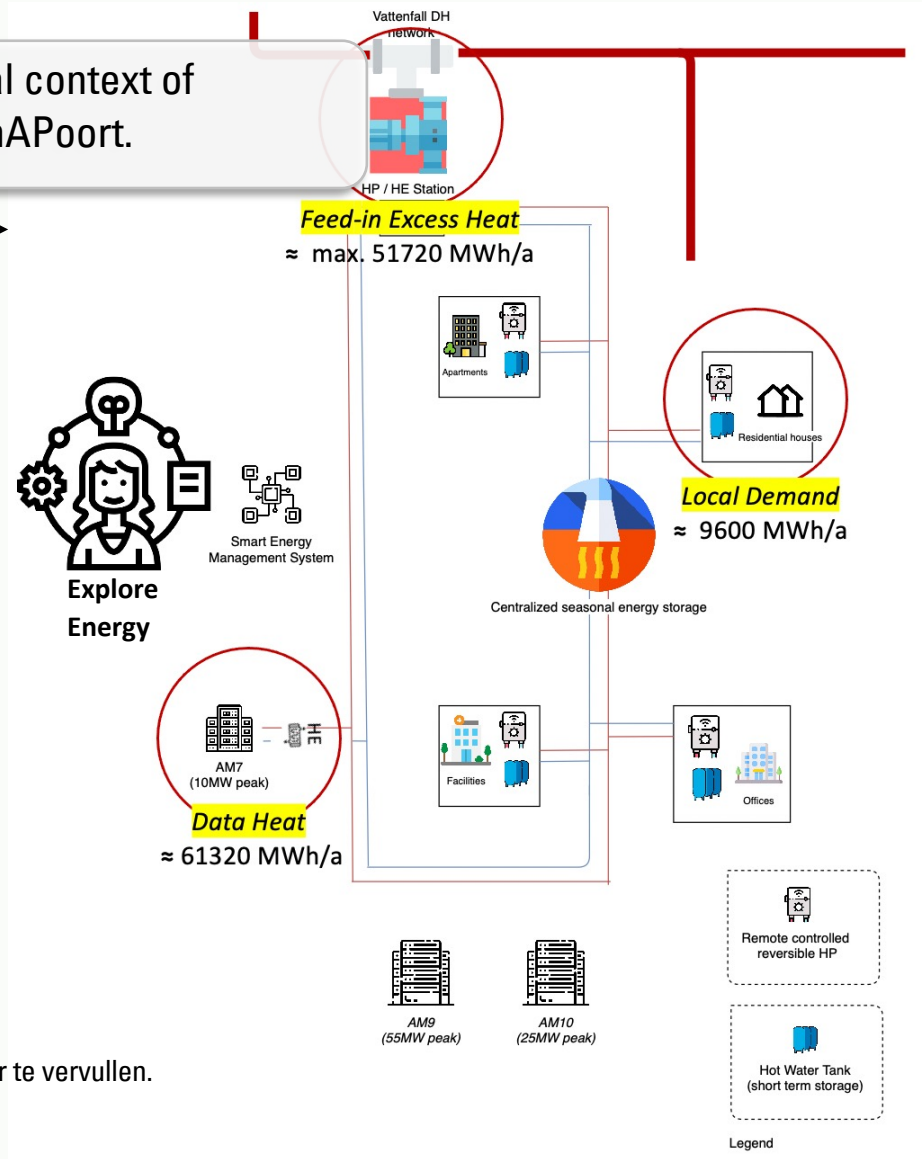
Example 5DHC in Herleen, The Netherlands:
https://www.mijnwater.com

Picture source: Boesten et al. (2019) - 5th Generation District Heating and Cooling as a solution for renewable urban energy supply [2]

(Blueprint) Design for 5DHC Energy Network in Amstel III and ArenAPoort [1]

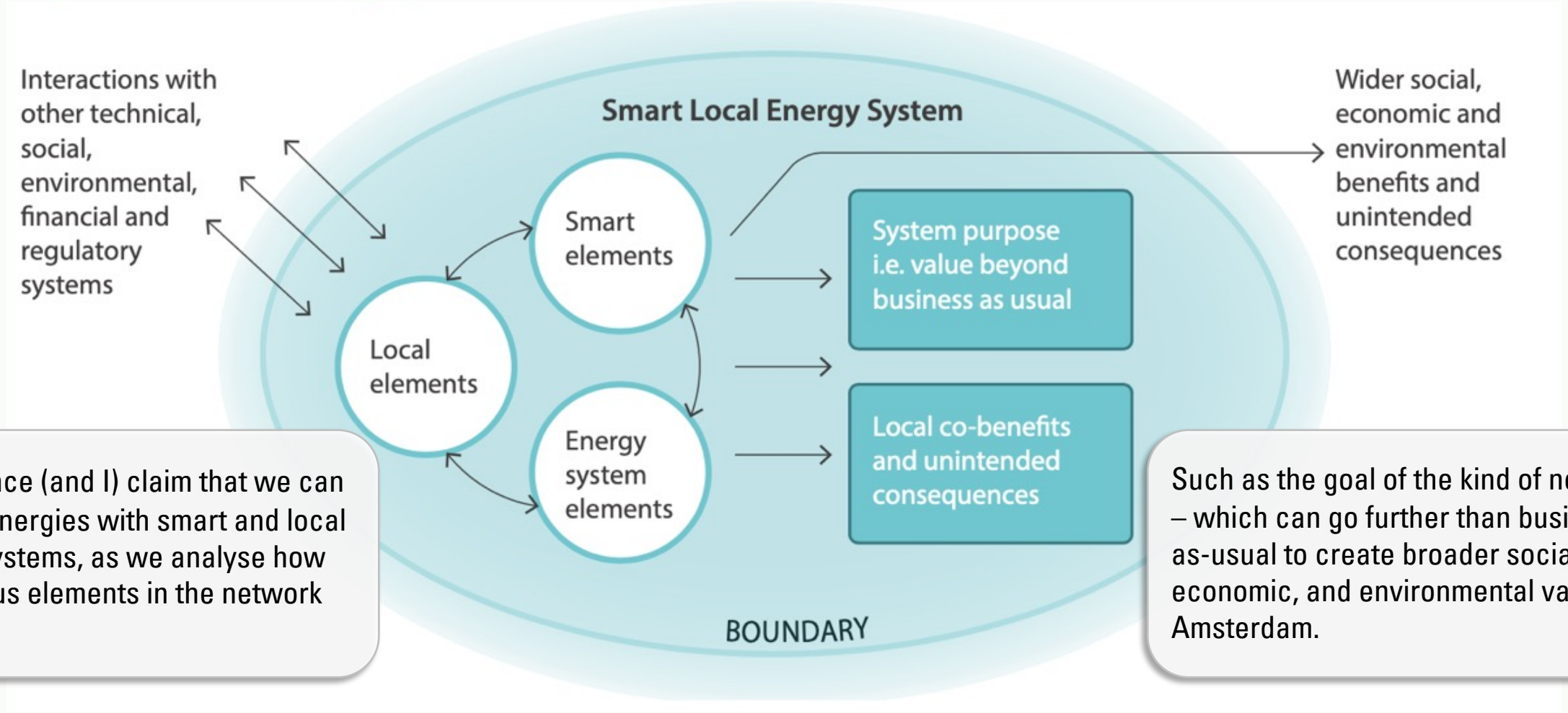


Tailored to the local context of Amstel III and ArenAPoort.



- Gedistribueerde “Cluster Substation” zijn ingezet om de temperatuur voorwaarden voor verwarming en tap water te vervullen.
- “Seasonal Energy Storage” is ingezet om temporale discrepantie tussen warmte- en koudevraag te balanceren.

Socio-technical interests + objectives



The science (and I) claim that we can create synergies with smart and local energy systems, as we analyse how the various elements in the network interact.

Such as the goal of the kind of network – which can go further than business-as-usual to create broader social, economic, and environmental value in Amsterdam.

Ford et al. (2019) - A framework for understanding and conceptualising smart local energy systems. [5]

Equinix Data center

Source

By example we can achieve this through sharing knowledge in all of Amsterdam and in this way support data center heating in Amsterdam.

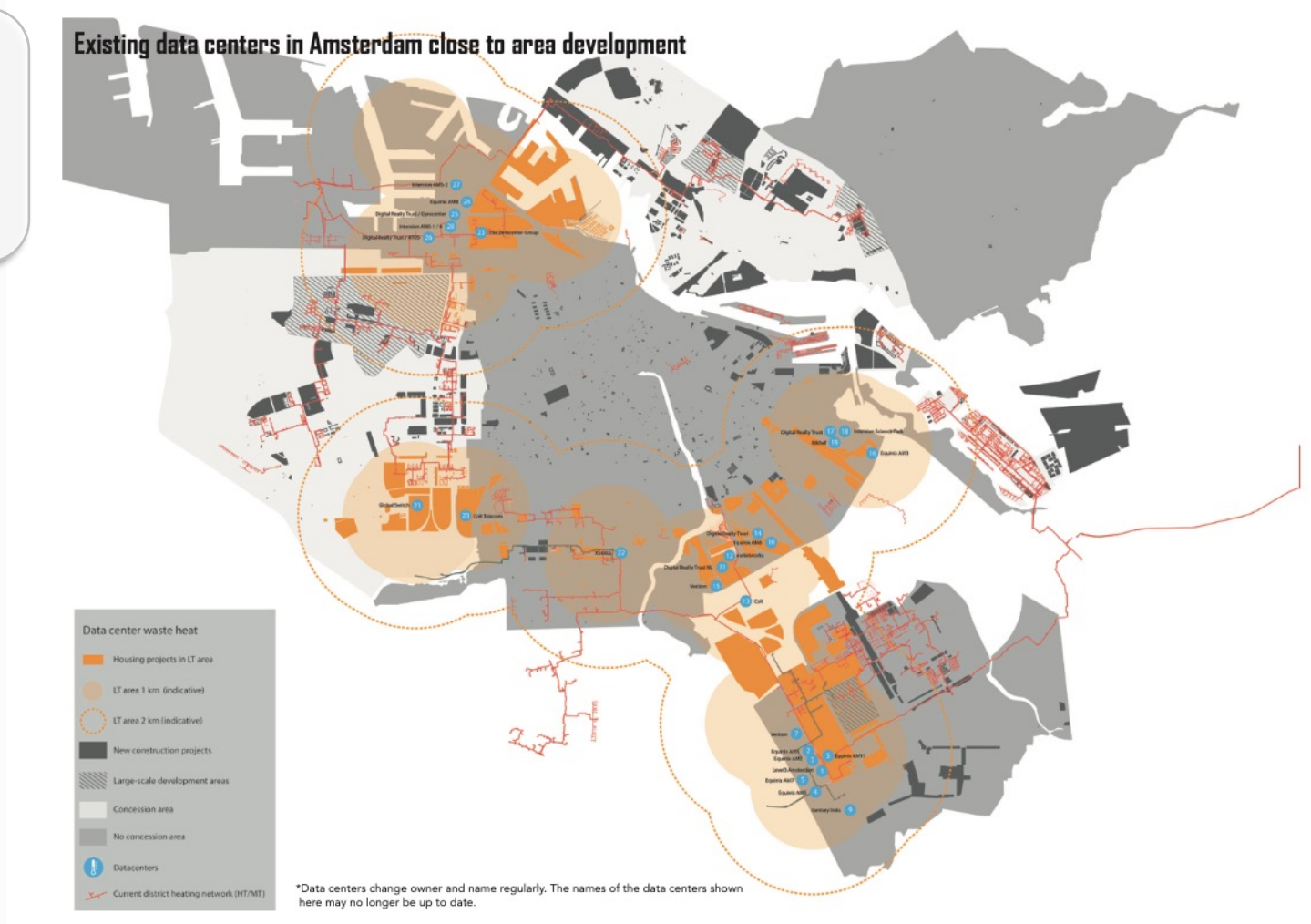
We can develop projects in parallel for a required acceleration of the Energy Transition in Amsterdam and contribute to the protection of Mother Earth.

Significant Potential for Data Center Heat in Amsterdam [6]

Existing research demonstrates that there is a significant potential for data center heat in Amsterdam, and we can unlock this potential as we work together.

Unlock Data Center Heat in Amsterdam !

- Create learnings for similar projects
- Share success stories
- Replicate & Scale



Thank you for your attention.
Time for questions!

Exchange knowledge? Collaborate?

I am delighted to come in touch:

aman.walia2705@gmail.com

06 85444796

Bronnen

[1] Aman, W. (2021). *Towards 5th Generation District Heating and Cooling in Amstel III and ArenAPoort.* https://openresearch.amsterdam/en/page/73662/towards-5th-generation-district-heating-and-cooling-in-amstel-iii-and arenapoort

[2] Boesten, S., Ivens, W., Dekker, S. C., & Eijdems, H. (2019). *5th Generation District Heating and Cooling Systems As a Solution for Renewable Urban Thermal Energy Supply.* Advances in Geosciences, 49, 129–136. https://doi.org/10.5194/adgeo-49-129-2019

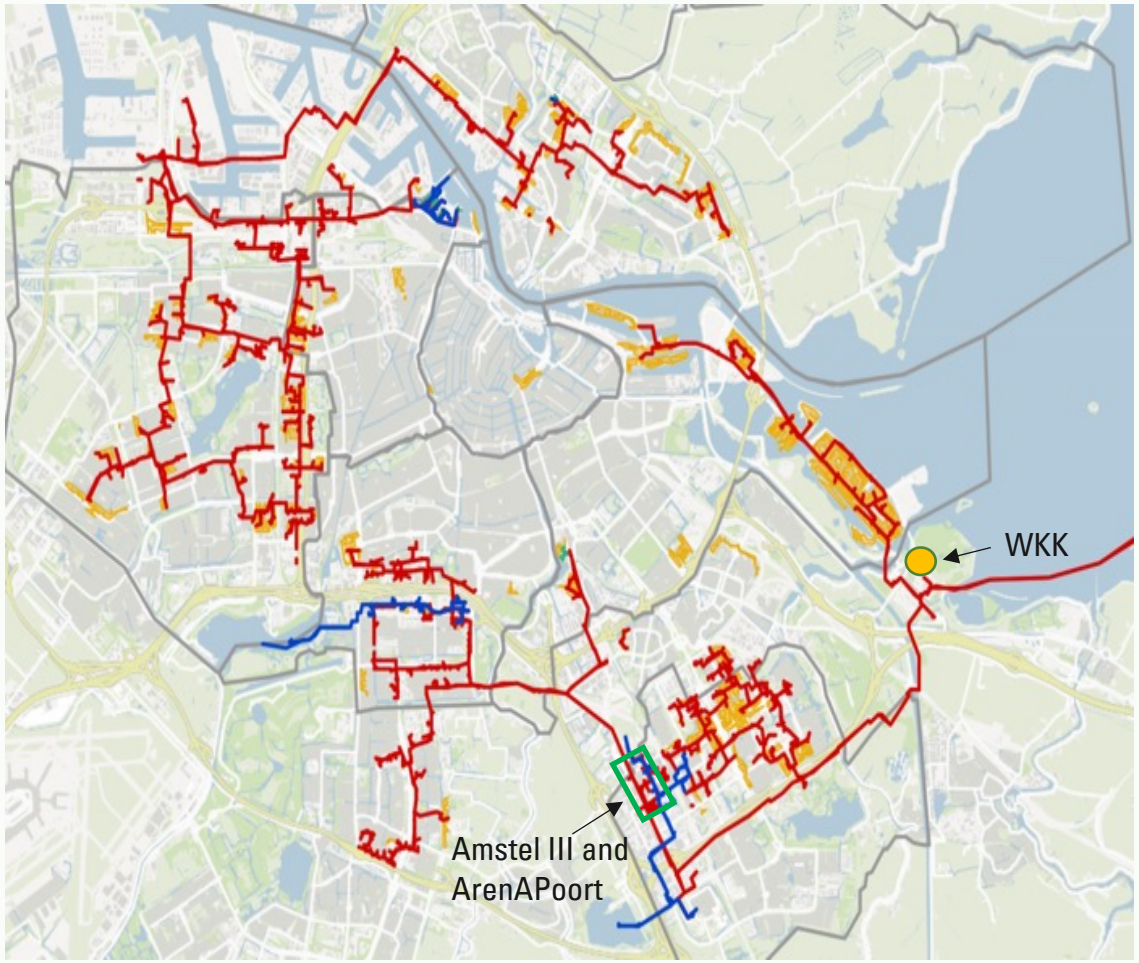
[3] Buffa, S., Cozzini, M., D'Antoni, M., Baratieri, M., & Fedrizzi, R. (2019). *5th generation district heating and cooling systems: A review of existing cases in Europe.* Renewable and Sustainable Energy Reviews, 104 (June 2018), 504–522. https://doi.org/10.1016/j.rser.2018.12.059

[4] Revesz, A., Jones, P., Dunham, C., Davies, G., Marques, C., Matabuena, R., Scott, J., & Maidment, G. (2020). *Developing novel 5th generation district energy networks.* Energy, 201, 117389. https://doi.org/10.1016/j.energy.2020.117389

[5] Ford, R., Maidment, C., Fell, M., Vigurs, C., & Morris, R. (2019). *A framework for understanding and conceptualising smart local energy systems*. EnergyREV, Strathclyde, UK. University of Strathclyde Publishing, UK. https://www.energyrev.org.uk/media/1273/energyrev_paper_framework-for-sles_20191021_isbn_final.pdf

[6] Municipality of Amsterdam (2020). *The Amsterdam Heat Guide.* https://openresearch.amsterdam/image/2020/12/3/the_amsterdam_heat_guide.pdf

District Heating in Amsterdam [1]



Picture source: https://maps.amsterdam.nl/stadswarmtekoude/?LANG=en

District heating in Amsterdam [7]:

Comparison: AM 7 = 10 MW_{piek}

- Combined Heat and Power (CHP) on natural gas, operated by Vattenfall
  - Diemercentrale 33 and 34: 266 MW_e + 180 MW_{th}
  - Hemwegcentrale 9: 435 MW_e + 260 MW_{th}
- The existing district heating networks in Amsterdam operates at high operating temperatures (~120 °C). High heat losses and high emission factors [6].
- Data Center AM7 as alternative heat source to natural gas in Amstel III and ArenAPoort.
- Moving beyond business-as-usual, and establish a novel Energy Company ("Explore Energy") to service the area with data center heat.
- Build trust with resident through active inclusion in decisions and collaboration.
- Creating incentives to participate.

Potential for Value Creation beyond Amsterdam [1]

Data Center Hubs in Europe

(FLAP - cities)

Frankfurt
London
Amsterdam
Paris