



IDEA2021

Powering the Future: District Energy/CHP/Microgrids
Sept. 27-29 | Austin Convention Center | Austin, Texas

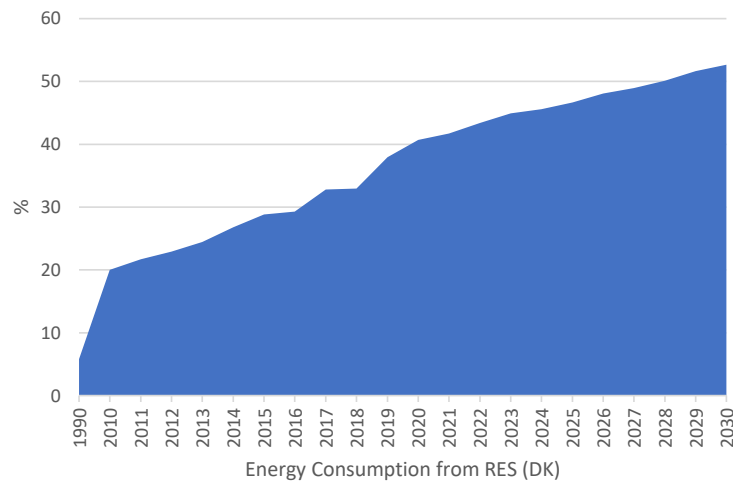


Large Scale Heat Extraction from Facebook Data Center to Local District Energy Network, Odense Denmark

Jens O. Hansen, Ramboll

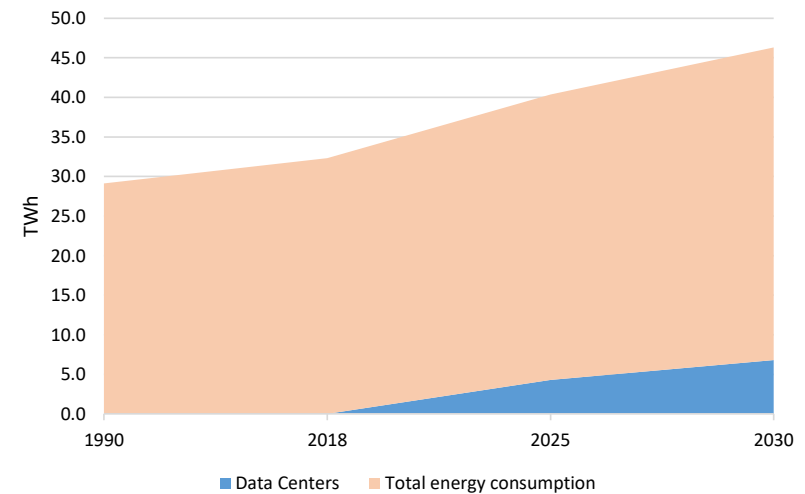
The challenge of data centers

40.7 % of annual electricity consumption comes from renewable energy sources (2020).



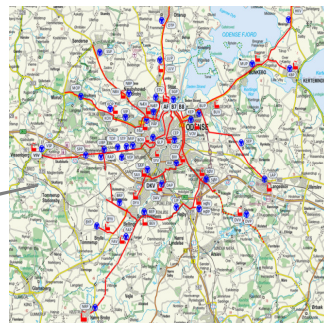
[2020 Basisfremskrivning – Danish Energy Agency \(ens.dk\)](#)

- 2025: 11% of the total electricity consumption.
- 2030: 15% of the total electrical consumption.



Key facts about the district energy utility

Fjernvarme Fyn



Distribution:

- 65.000 connections (and meters)
- 75 miles transmission lines (176-194°F)
- 1350 miles distribution lines (158-167°F)

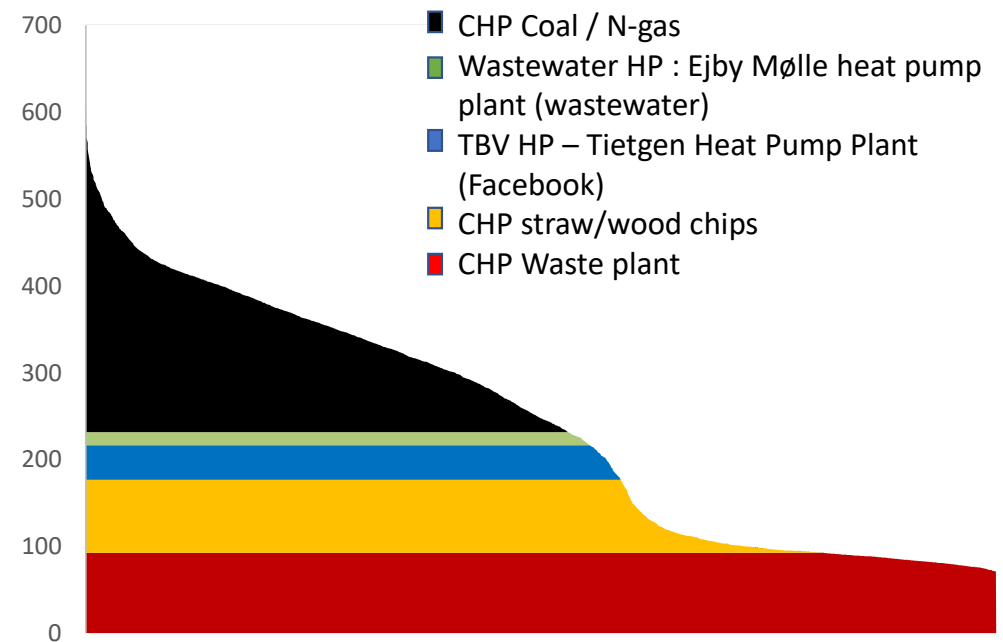
Production units

- Coal CHP (unit 7): 322 MW / 1672 MMBTU/hr [322/490 MW], 200.000 t coal per year
 - Converted to natural gas from 2022-2029
- Straw CHP (unit 8): 32MW / 300 MMBTU/hr (power/heat), 200.000 t straw per year
- Waste CHP (unit 11-13): 20 MW / 358 MMBTU/hr MW (power/heat), 300.000 t waste per year
- Wood Chips CHP (DKV): 80.000 t wood chips per year
- Oil and gas peak and reserve load, 24 units
- Small scale industrial surplus heat (~10 suppliers)
- Data center (Facebook): 150 MMBTU/hr heat with heat pumps

The challenge of the local district energy utility

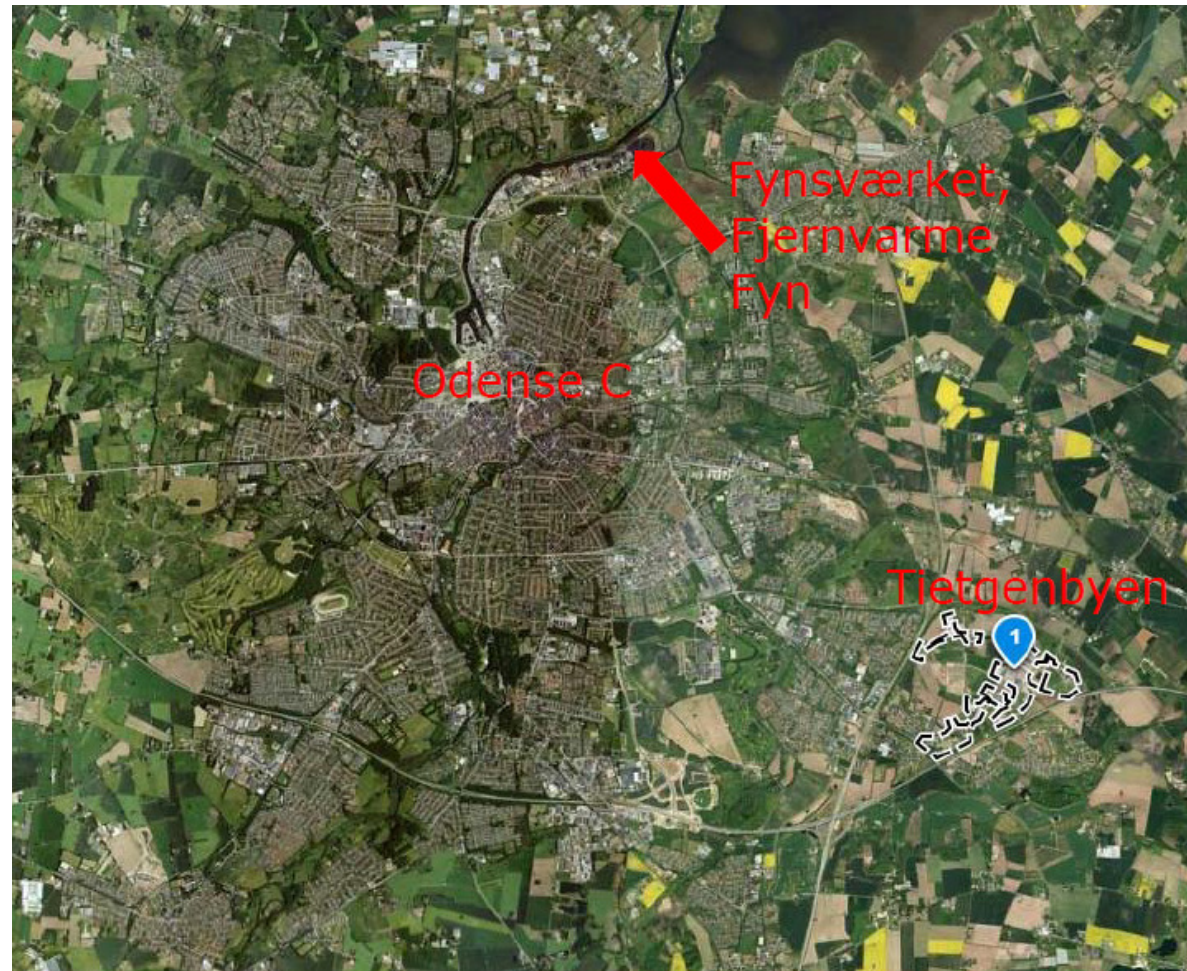
Fjernvarme Fyn

- Coal Plant to be converted to natural gas in 2022
- N-gas plant closed in 2029
- Large scale data center in backyard



The Location

- Odense: Birthplace of Hans Christian Andersen
- 180,000 inhabitants
- Facebook: 5 miles from main CHP plant



The datacenter

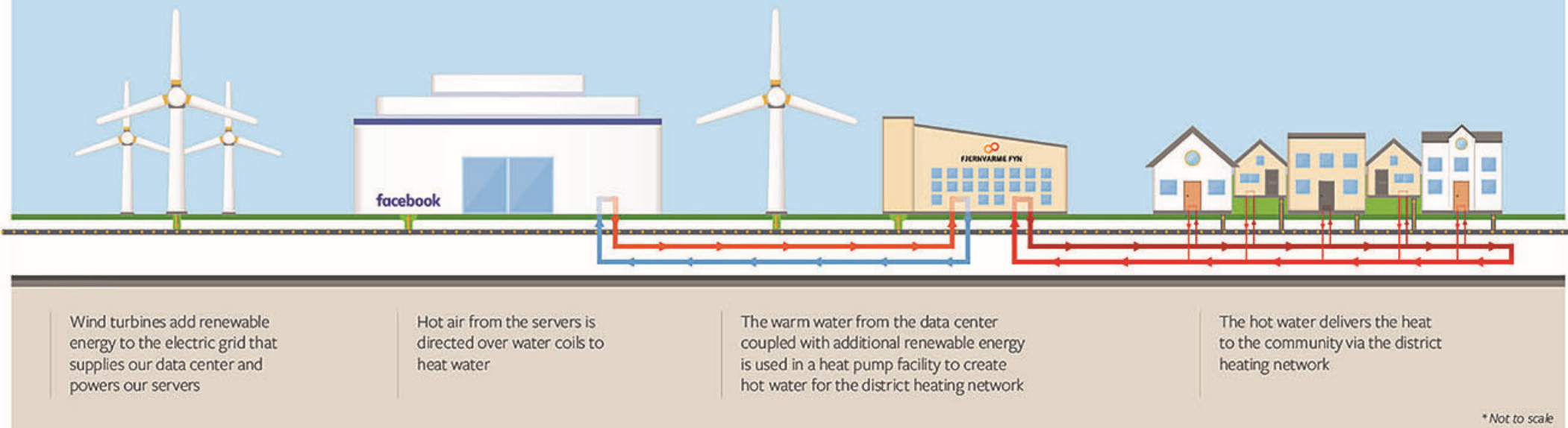
- Proximity to main electricity transmission grid and Fjernvarme Fyn's distribution grid
- Data halls
 - 285,200 sq.ft (constructed)
 - 285,200 sq.ft (constructed)
 - 420,000 sq.ft (under construction)
- Each original data hall consists of 4 data halls with its own cooling system



Source: Facebook

The system

Odense Data Center: Heat Recovery Process



Source: Facebook

The Energy Center



The Energy Plant, phase 1

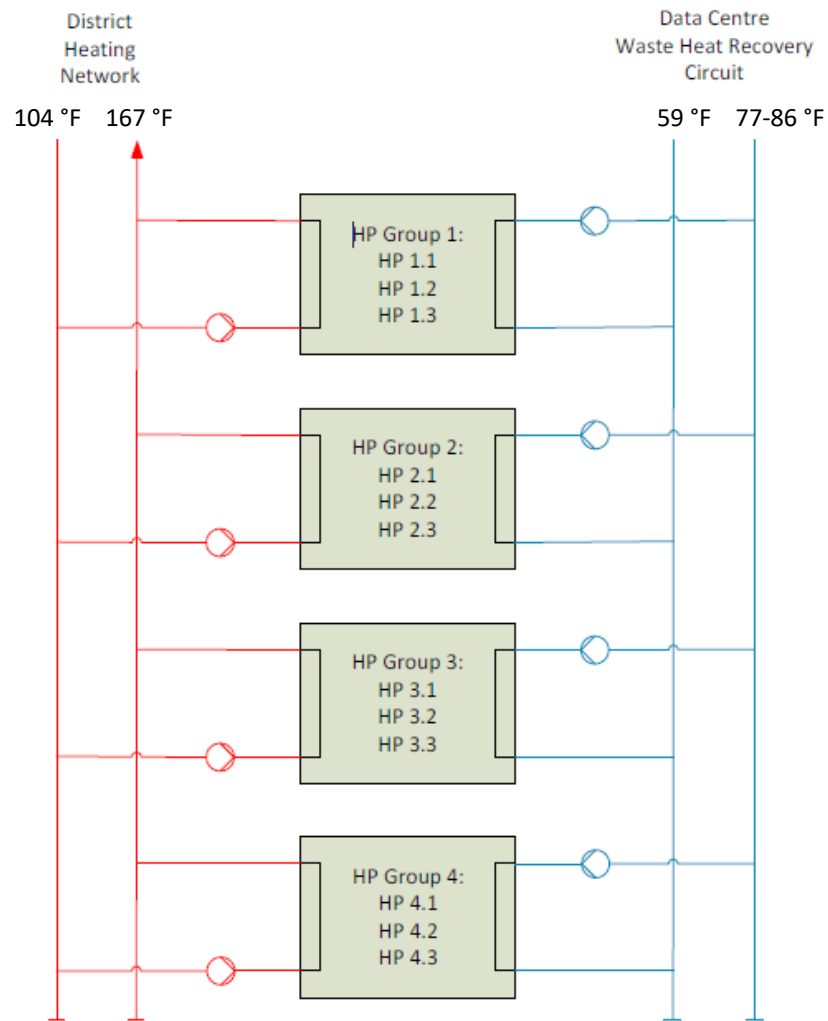
- Phase 1 design data:
 - 85 MMBTU/hr heating capacity
 - COP heat for heat pumps = 4.8
 - WHR circuit is elevated 50-54 °F at Facebook
 - District heating return temperature: 95-113 °F
 - District heating supply temperature: 158-167 °F
 - 606 pounds ammonia per heat pump
- Johnson Controls
 - Plug and Play

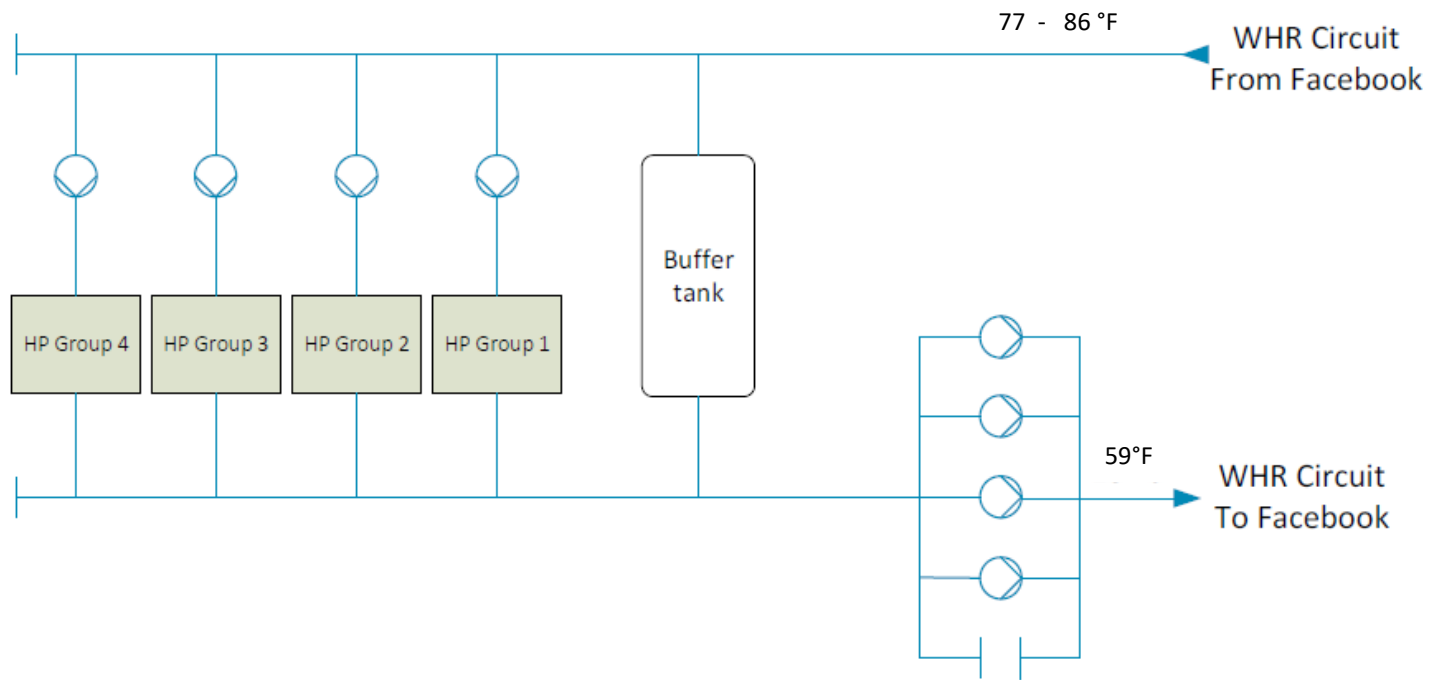


The Energy Plant, phase 2

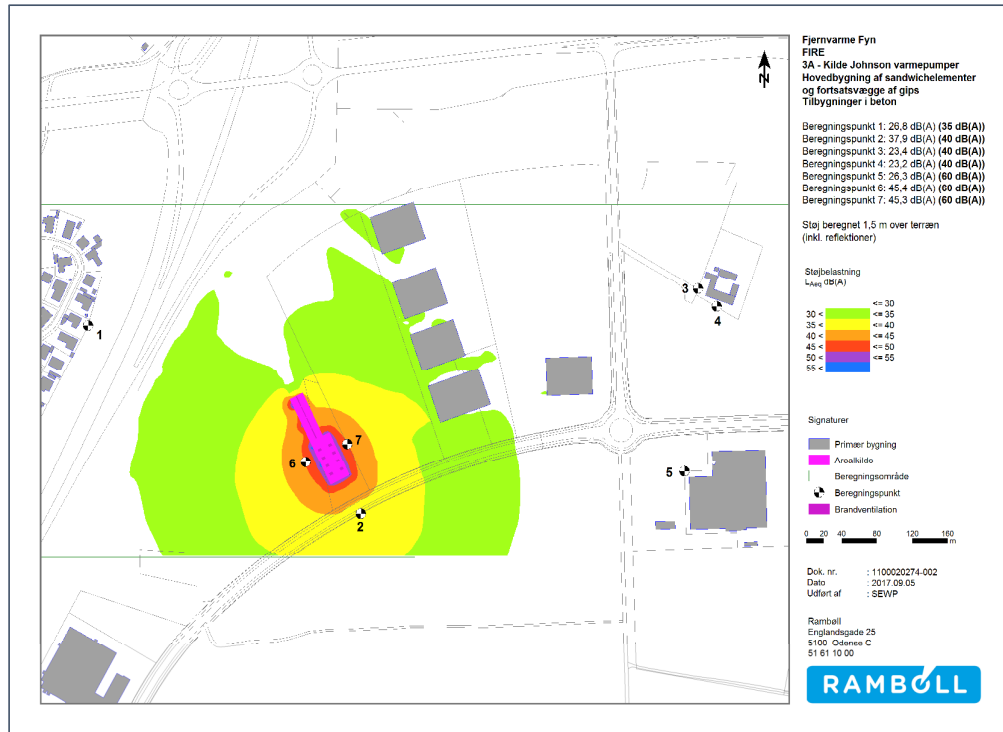
- 72 MW heating capacity
- 3 on-site build heat pumps
- COP heat = 5.1
- Ammonia:
1,874-2,535 pounds per
heat pump (6,614 pounds)







Noise analysis



Noise limitations: 45/40/40/35 dB (day, evening, night)

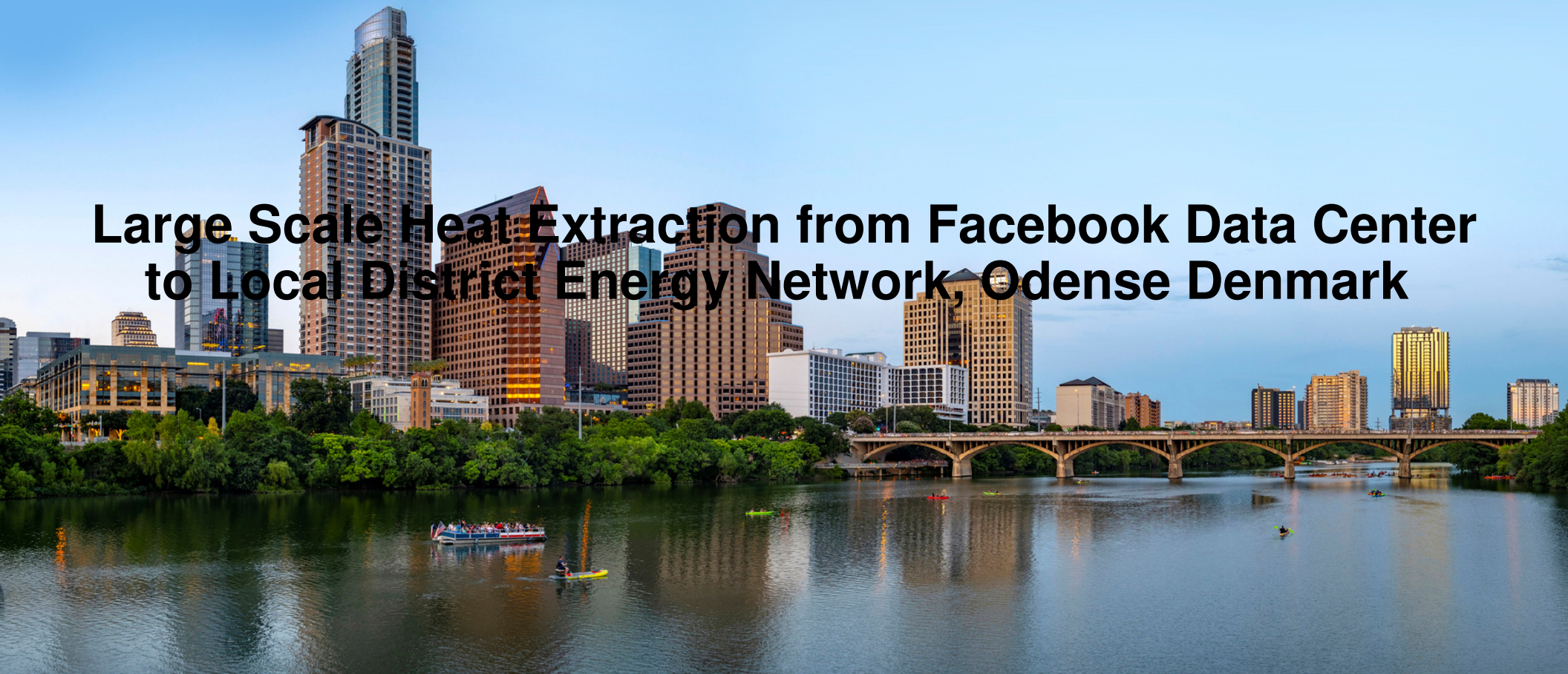
Conclusion & Lessons learned

- Early communication between data center owner and utility
- Phasing is important
- Plug and Play vs on-site build
- Commissioning is key!



Q&A

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Thank You!

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