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# The next level of data center cost efficiency and sustainability

*Erik Rylander, Head of Stockholm Data Parks at Fortum Värme*  
*DCW Hong Kong, May 24. 2017*

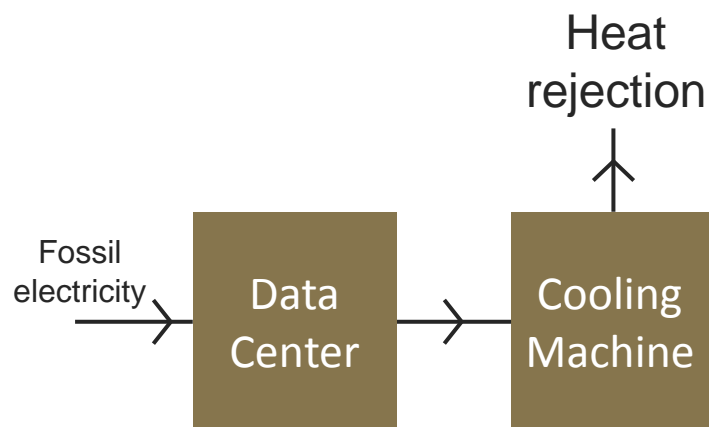
**STOCKHOLM**  
**DATA PARKS**  
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Imagine a place where the  
energy is green and excess  
data center heat isn't wasted.  
Imagine Stockholm.

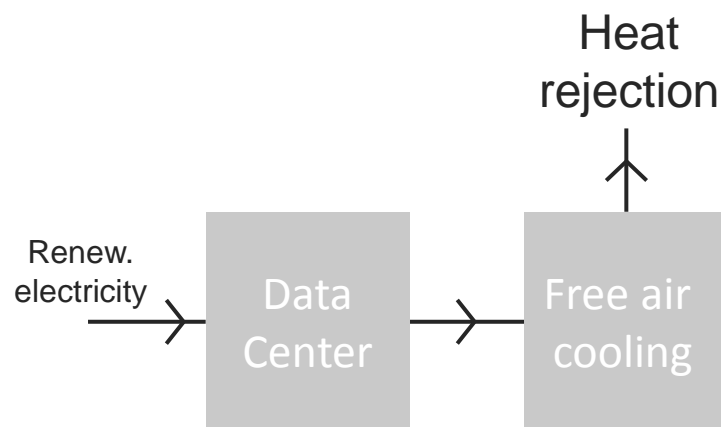
The Stockholm Data Parks initiative will contribute to  
completely phasing out fossil fuels in Stockholm by 2040.

# Green computing redefined

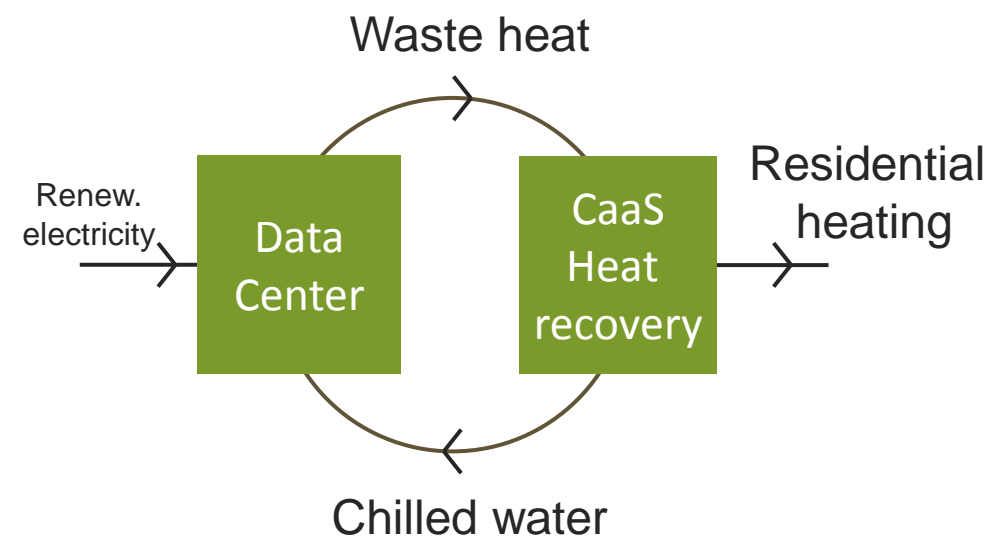
## From Brown....



## To Grey....



## To Green



A data center load of 10 MW can heat around 20 000 modern residential flats



An aerial photograph of Stockholm, Sweden, showing a dense urban landscape with numerous buildings, streets, and green spaces. The city is situated on islands and connected by bridges. A large body of water, likely the Baltic Sea, is visible on the right side of the image. The text "STOCKHOLM DATA PARKS" is overlaid in large, white, bold letters, and "GREEN COMPUTING REDEFINED" is overlaid in smaller, white, bold letters below it.

# STOCKHOLM DATA PARKS

## GREEN COMPUTING REDEFINED



Stockholms  
stad



 Stockholm  
The Capital of Scandinavia

ELLEVIO





# Stockholm Data Parks

# Your Hub for Northern Europe

- 100+ m market within 30 milliseconds roundtrip

## Short Time To Market

- Sites and infrastructure prepared

## Low cost

- Green power at 0.04 Euro/kWh
- Paid for data center heat reuse
- OPEX saving of \$50-100 million over 10 years for a 10 MW data center load

## Unparalleled sustainability

- Net climate positive



# Stockholm, Sweden

## – Center of Innovation and Entrepreneurship

### Proven business environment

- Best country for Business 2017 (Forbes)

### Strong engineering heritage

- 4th city in the world with most billion \$ startups.
- Per capita, Stockholm is 2nd in the world after Silicon Valley

### Extensive and robust infrastructure

### Stable climate and political situation

- No natural disasters
- No war since 1814

Stockholm 10th city globally for HQs of Forbes2000 companies



Ranking	Global HQ	No.
1	Tokyo	132
2	London	57
3	Hong Kong	57
4	New York	54
5	Beijing	50
6	Seoul	47
7	Paris	45
8	Taipei	29
9	Houston	25
10	Stockholm	23
11	Mumbai	21
12	Osaka	19
13	Sydney	17
14	Singapore	17
15	Bangkok	17

Source: Forbes, ORBIS database, the Stockholm Business Region (SBR) and the Oresund Institute



Billion dollar+ software companies founded since 2003



# The Fortum Group



## Nordic market position

- 1 Heat
- 2 Electricity sales
- 3 Power generation

## Key indicators 2015, Fortum Group

Sales	EUR 4.8 billion
Operating profit	EUR 1.4 billion
Employees	8,800

# District heating in Stockholm

## – the enabler of data center heat reuse

District heating in Stockholm – a system built out since the 50's

- Efficient and sustainable heating of residential areas and offices
- Water based heat transport
- 2 800 km underground piping
- >10 000 buildings connected (95% in central Stockholm)
- 12 TWh/y heat supply





# Stockholm – Heat Recovery City

More than 30 years' experience of capturing and reusing excess heat

- Industrial processes
- Sewage water
- Data centers

Stockholm has a unique position to realize heat recovery on a large scale

- The cold climate means heat has value
- With more than 10 000 buildings connected to the heating network, it represents a “heat sink” of 12 TWh

A data center load of 10 MW can heat around 20 000 modern residential flats



# Customer References



"For me, heat recovery is part of making data centers greener. The collaboration we have with Fortum Värme makes it possible for us to use the excess energy for residential heating in a financially attractive way. This is a perfect example of a technical solution that combined with the cold climate makes the Nordics a great place for building datacenters. We continue to innovate and work with Fortum Värme and are right now exploring how the cooling and heat recovery can be defined for our future expansion."

Peder Bank  
Managing Director,  
Interxion Nordics



"The fact that we are based in Stockholm with its vast district heating and district cooling networks has opened for a new way of thinking about cooling, sustainability and solutions that are unbeatable financially, which translates to significant benefits for our data center customers."

Gustaf Bergquist  
CTO  
Bahnhof



"We have worked hard to connect our Stockholm data centers to the district heating/cooling network to enable heat recovery of the excess heat. The vast district heating network in Stockholm provides an ideal and secure solution for heat recovery which is a perfect match with our data centers."

Jan Sjögren  
Head of Building Operation  
Ericsson GICs



"Fortum Värme's cooling service has allowed us to make an already efficient data center even better. The straightforward connection to Fortum Värme's system gave us the opportunity to recycle energy that would otherwise have been rejected. As a bonus we doubled the redundancy of our cooling system. With the favorable economic and environmental impact, we are now looking into deploying heat recovery in our other data centers."

Jan Lundin  
Head of IT Facility Services  
H&M

More than 30 data centers are connected to Fortum Värme's district energy networks and involved in heat recovery



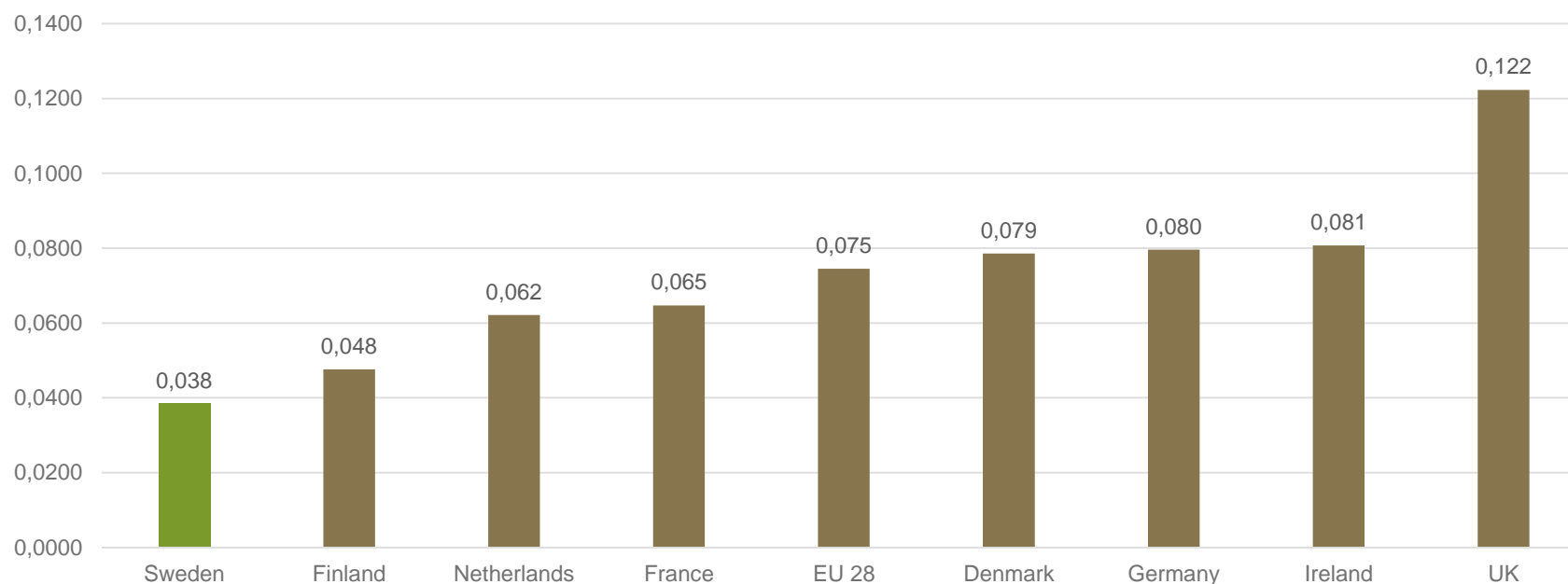


**LOW  
COST**



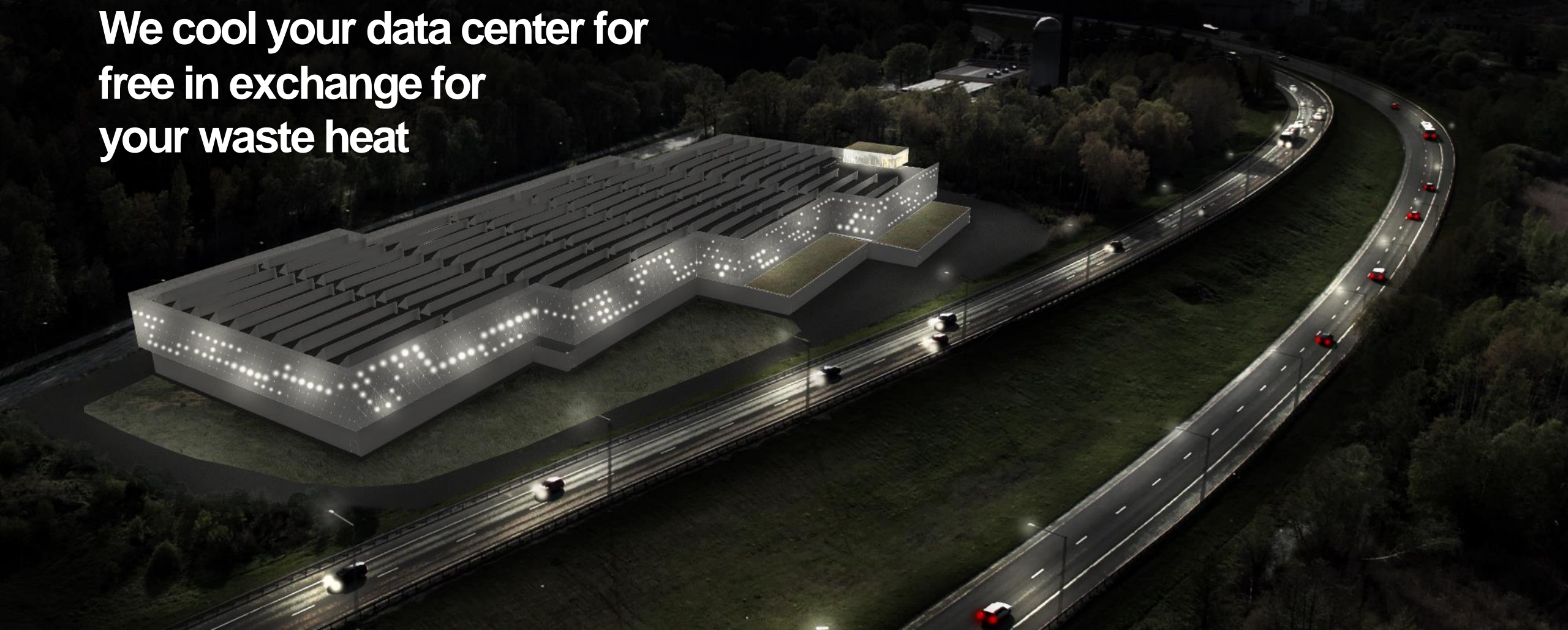
# Sweden – Electricity

70 000 MWh < Consumption < 150 000 MWh  
Excluding VAT and other recoverable taxes and levies  
Euro, per kWh, Eurostat 2016S1



# THE GREAT EXCHANGE

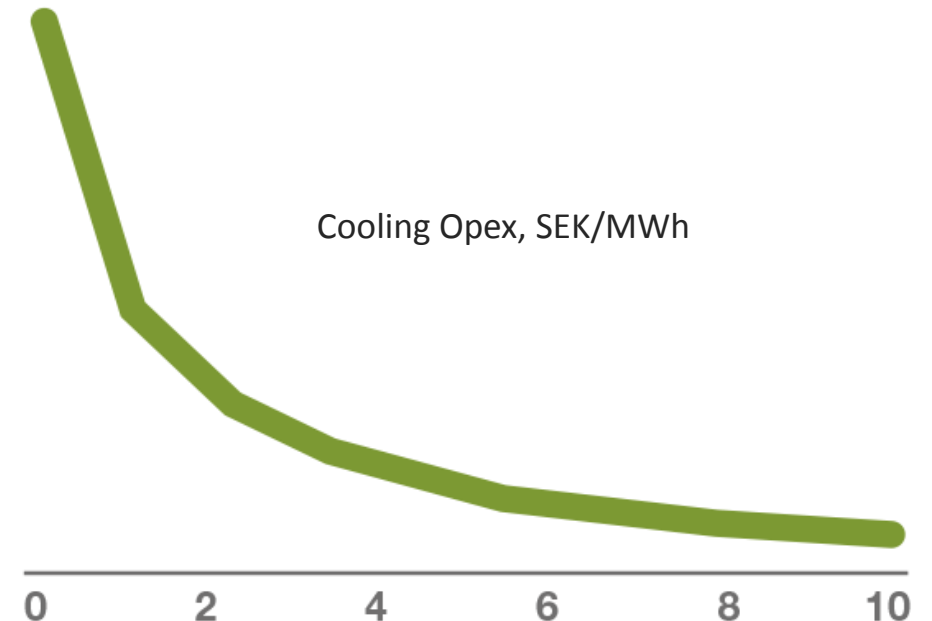
We cool your data center for  
free in exchange for  
your waste heat



# Cooling as a Service and Heat recovery

- Cooling of the data center as a service is offered for free in exchange for the excess heat when the data center load reaches above 10 MW
- In a second option, the cooling is managed by the customer and Fortum Värme purchases excess heat at a price reflecting its alternative heat production cost
  - ~\$200.000 per MW heat, year

## Cooling as a Service with Heat recovery



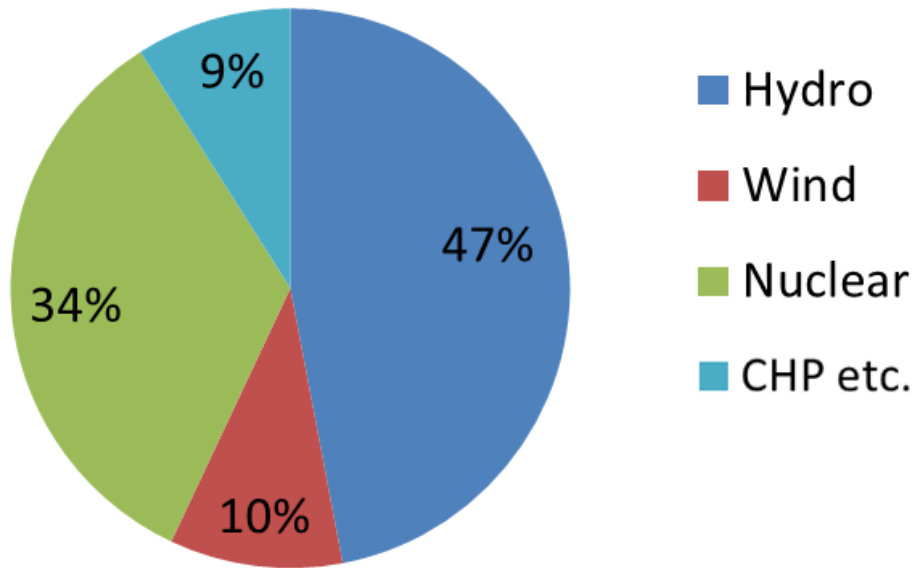


**SUSTAINABLE**

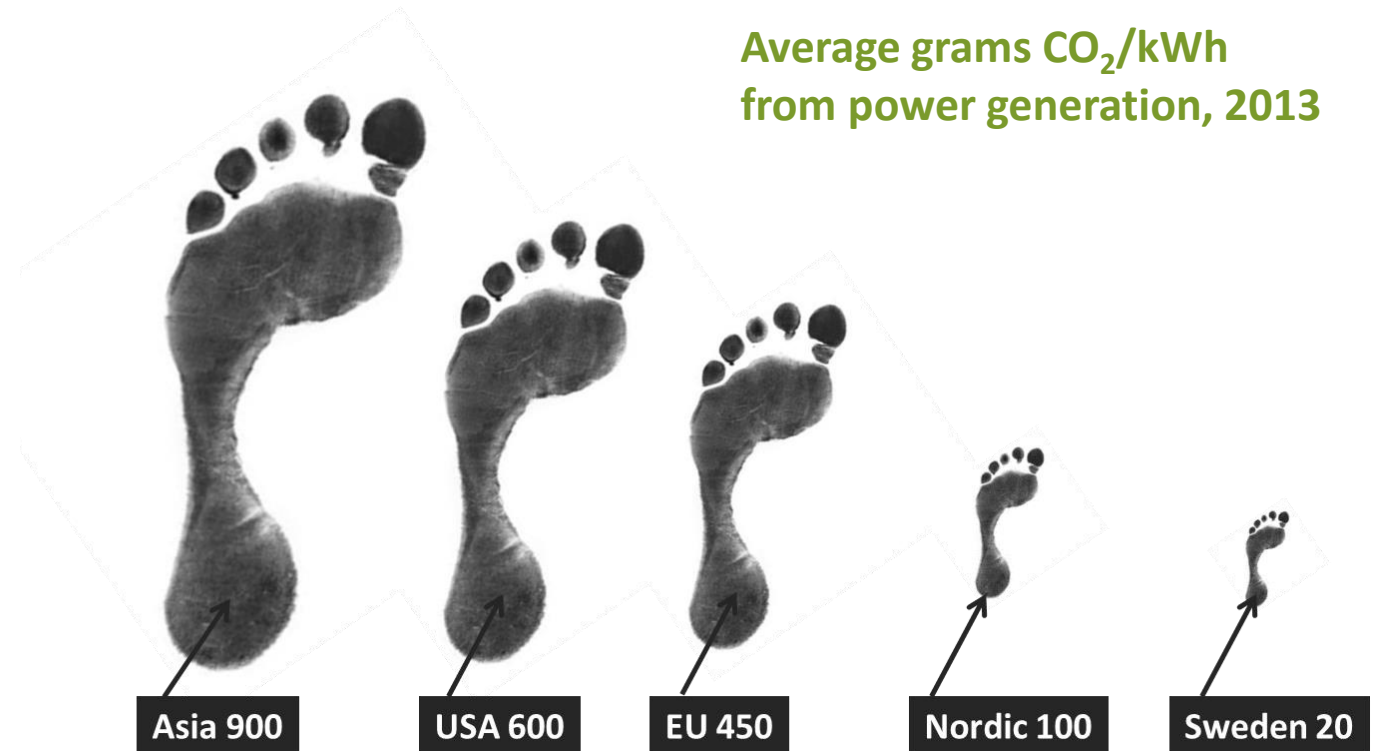


# Sweden – Generation mix and Carbon footprint

Power generation mix, Sweden 2015



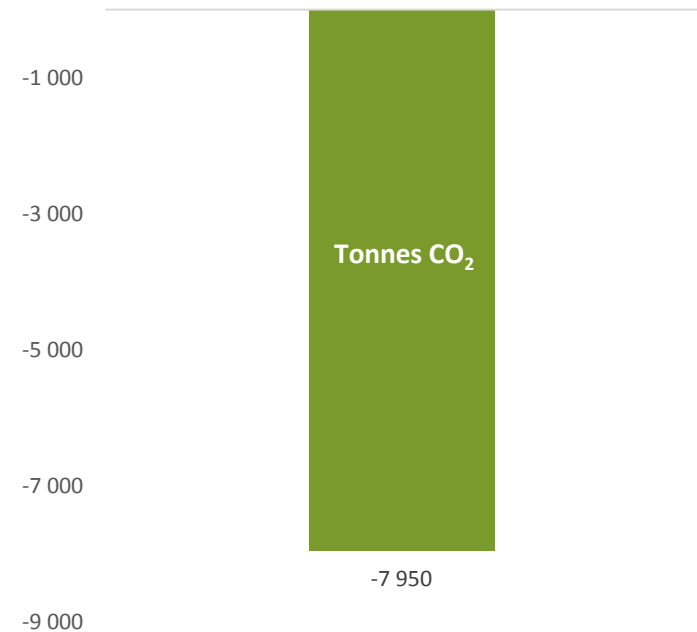
Average grams CO<sub>2</sub>/kWh from power generation, 2013



# Sustainable

- Data center heat reuse makes a significant contribution to reducing global CO<sub>2</sub> emissions by replacing more CO<sub>2</sub> intensive means of heating the city
- In Stockholm Data Parks data centers become net climate positive

**Stockholm Data Parks**  
Net CO<sub>2</sub> tonnes of a 10 MW data center load with  
renewable electricity and  
Cooling as a Service with Heat recovery







# CONCLUSION



# In Conclusion

## Low costs

- Lowest electricity price in EU
- Cooling as a service for free

## Green

- Reuse of waste heat
- Renewable electricity
- Net climate positive DC

## Short time-to-market

- Prepared sites
- Coordinated partners

## The Stockholm connection

- 100+ m market within 30 ms roundtrip
- Business and finance hub of Northern Europe
- World's largest dark fiber network



SHORT TIME-TO-MARKET



UNPARALLELED SUSTAINABILITY



LOW COST ELECTRICITY



COOLING FOR FREE



LARGE SCALE HEAT RECOVERY



PREPARED POWER



GREEN ELECTRICITY



READY TO CONNECT



***Don't waste  
your energy!***



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