

Mikkel Willum

25-04-2023



HOFOR

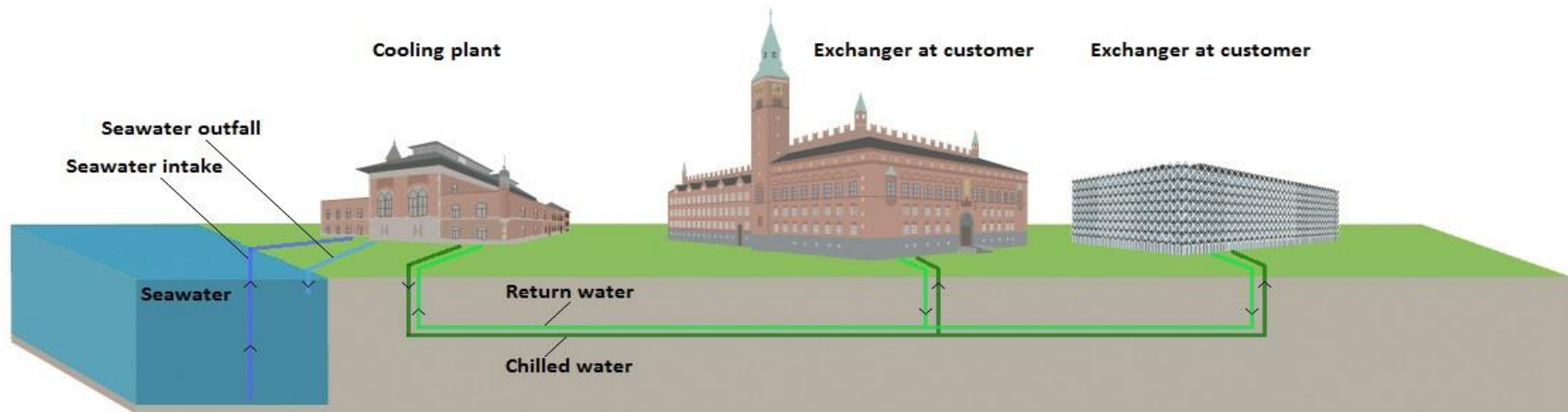
Greater Copenhagen
Utility



District Cooling

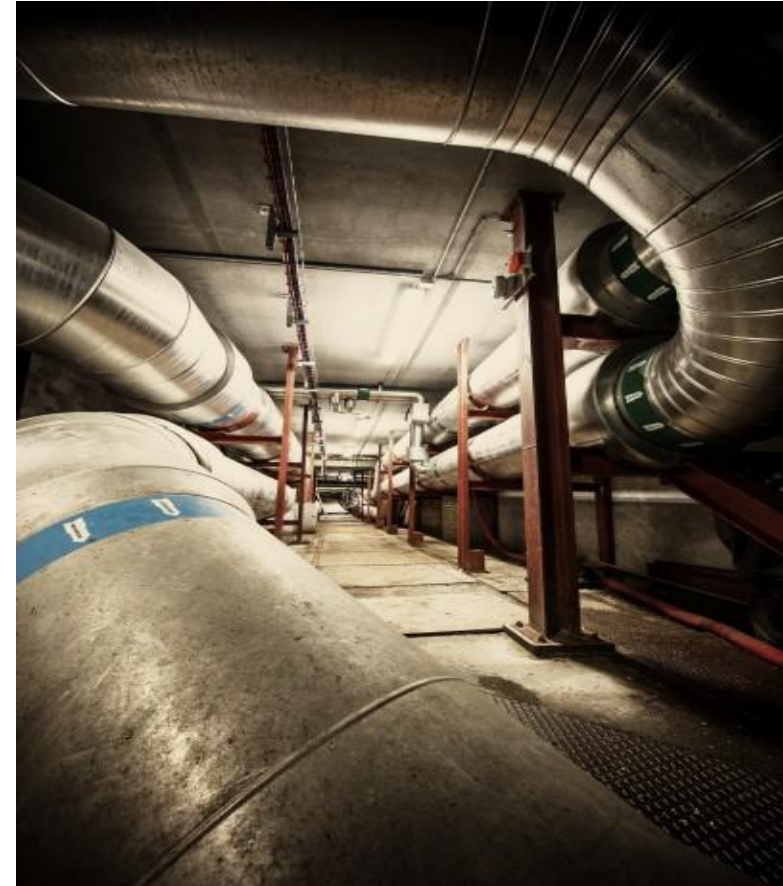
The Installation

- The chiller and the condenser are replaced by a single exchanger
- Cold district cooling water is exchanged to the internal distribution system



HOFOR District Cooling General

- First plant in operation May 2010
- Some profit generated – all reinvested
- Increased influx of customers has led to better capacity utilization
- Operation time
 - ▶ High energy performance on building site
 - ▶ Copenhagen is found on middle latitude (56°N)
- 113 costumers (buildings connected)
 - ▶ Hotels
 - ▶ Offices
 - ▶ Healthcare and research
 - ▶ Malls
 - ▶ Cultural, archives and museums



HOFOR A/S

The organization



VAND



SPILDEVAND



FJERNVARME



FJERNKØLING



BYGAS



VIND



ENERGI-
PRODUKTION

- Denmark's largest utility company within our core areas
- More than a million customers in Copenhagen
- Owned by the municipality
- Our income and expenditure must be balanced
- Highly regulated
 - But District Cooling is very liberal (commercial property/business only)



District Cooling

The Production



Seawater exchanger

- Renewable energy source
- Environmentally friendly
- Exposed to fouling!
- No chemical or other treatment of seawater



Chiller

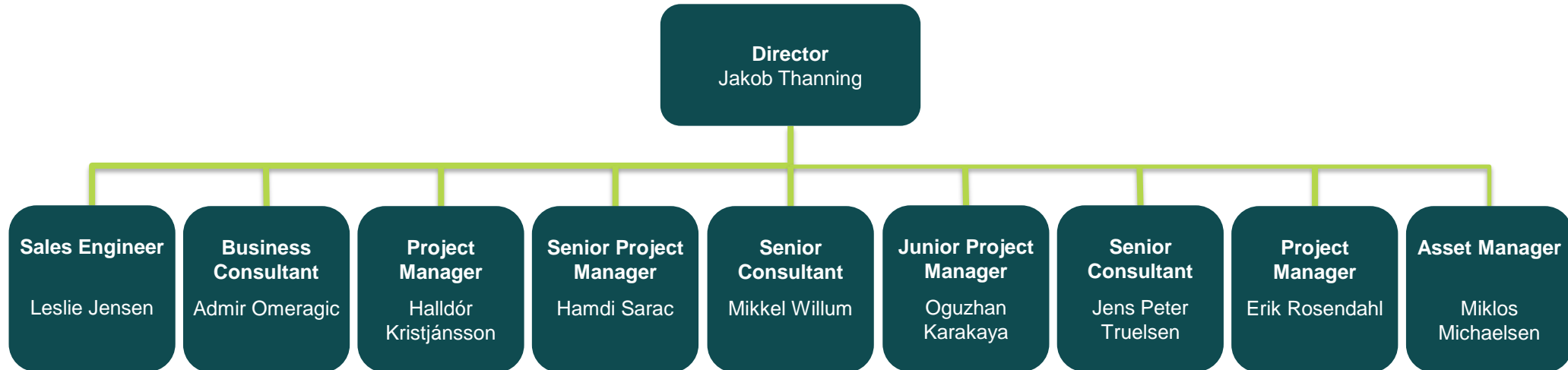
- Peak loads
- Adjustable
- The condenser part of the chiller is cooled by seawater
- Exposed to fouling!
- No chemical or other treatment of seawater

COOLING SUPPLY AND CONDITIONS

- ▶ Market conditions – costumeres are free to buy their own local compressor
- ▶ Reliable: more than 99,9 percent uptime
- ▶ 6/16 (contract terms)
 - ▶ Maintaining a reasonable dT is an persistant task
- ▶ Contract, up to 20 years depending on costumers needs
- ▶ Finansiël terms, standard-price (but fully negotiable to meet costumers businessmodel)
 - ▶ Connection fee
 - ▶ Energy as metered
 - ▶ Capacity fee

HOFOR District Cooling

HOFOR FJERNKØLING A/S



➤ Business model

- | | | |
|------------------------|---|--------------------------------------|
| ▶ Running the business | ➡ | 10 employees have the responsibility |
| ▶ O&M | ➡ | Contractors |
| ▶ Construction | ➡ | Contractors |
| ▶ Billing | ➡ | Contractors |

RENEWABLE COOLING PRODUCTION

- ▶ Danish electrical grid 2022:
50% windpower, 8% PV
(and 42% hydro, nuclear, coal, waste incineration, gas, biomass)
- ▶ Seawater enable us to have a high condenser efficiency
- ▶ Free cooling when seawater $< 6^{\circ}\text{C}$
- ▶ Renewable share of cooling supply $> 90\%$
 - ▶ DeltaRenewable=10% (?)

DISTRICT COOLING IS CONVENIENT

▶ Technical

- ▶ No noise and vibration
- ▶ No service activities or damage on roof
- ▶ Little areal uptake
- ▶ Beautification of cities – no condenser units on roof and facades
- ▶ Building heritage!
- ▶ Easy operation

▶ Only installation at the customer is a heat exchanger

- ▶ Customer invests in substation and owns this
- ▶ Electrical power demand can be reduced

▶ Other advantages

- ▶ Rental space becomes more attractive
- ▶ Remote reading of consumption - daily, hourly, minutely
- ▶ Easy billing and increased transparency of costs
- ▶ Easy administration

District Cooling

The Environment



- The district cooling plant uses carbon dioxide friendly energy sources
- No refrigerants – that legally needs to be phased out
- Ammonia chillers was a condition for the establishment of the company

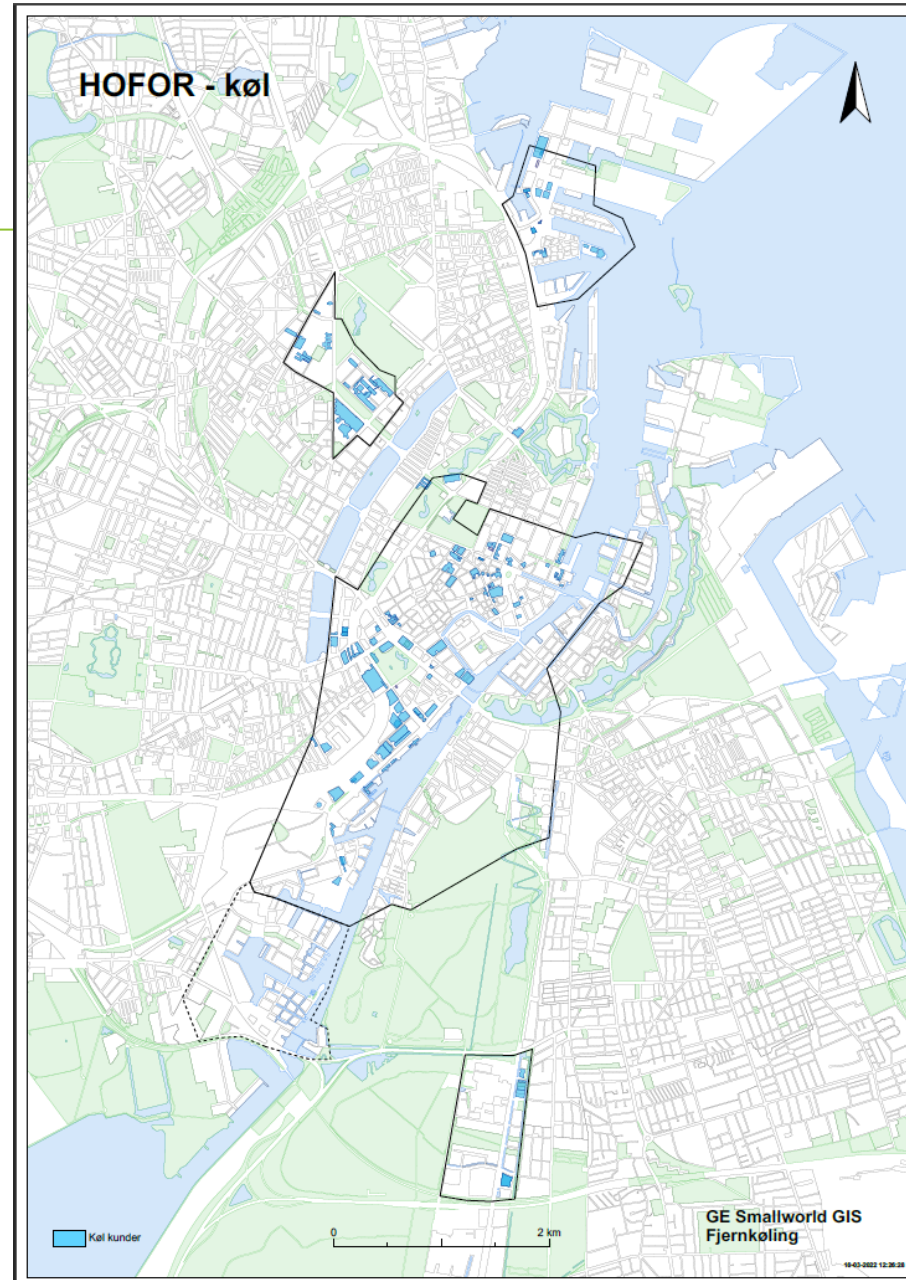
District Cooling

Room for interesting reconstruction and extensions

- Optimal use of floor and basement square meters



Customers



**Ladies and Gentlemen
Thank You for Your attention**



Additional questions are more than
welcome

For further information, please contact the district
cooling department at:

info@fjernkoel.dk or telephone +45 3395 3390

