



# IDEA2022

## Building Connections

June 6-9 | Sheraton Centre Toronto Hotel | Toronto, ON



# Industrial Heat Pumps for the Energy Transition

IDEA Toronto 6-9<sup>th</sup> June 2022

Oskar Mazur IDEA2022-057-5E2

Wednesday June 8<sup>th</sup> 2022

The Siemens Energy logo is positioned at the bottom center of the slide. It features the word "SIEMENS" in a bold, teal, sans-serif font, with the word "ENERGY" below it in a purple, sans-serif font. The background of the slide is a photograph of a city skyline at dusk, with lights reflecting on the water.

**SIEMENS**  
ENERGY

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in use

# Introduction to Siemens Energy

## We energize society



# Siemens Energy AG

## Gas and Power ("GP")

## Siemens Gamesa Renewable Energy ("SGRE")

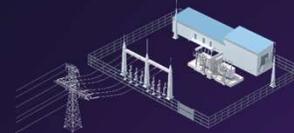
### Generation



### Industrial Applications



### Transmission



### New Energy



67% owned

### Onshore



### Offshore



Central

Distributed

H<sub>2</sub> enabled generation

H<sub>2</sub> compression and storage

Renewable connection and integration

H<sub>2</sub> Electrolyzer Systems

Power-to-X Solutions

Hybrid Solutions

>50 Gas Turbines with high hydrogen content in operation

~1500 compressors for H<sub>2</sub> duty or H<sub>2</sub> rich syngases delivered

5 HVDC connections to offshore wind parks realized

PEM electrolysis installed base

First e-Gasoline project Haru Oni

HYFLEXPOWER the power-to-X-to-power cycle

# The challenge to decarbonize heat



# The challenge to decarbonize heat via Heat pumps

## Challenge



## Technology



## Solution



## Benefits

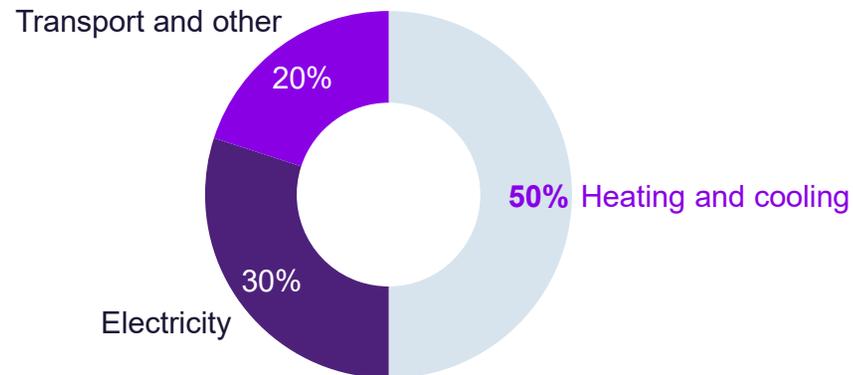


- Produce heat in a cost-effective way without combustion of any fuels
- Heat pumps applications integrated in the energy system
- Stop waste of heat
- Environmentally friendly solution with zero emissions

# The challenge to decarbonize heat

Heat in Europe is still largely produced from fossil sources

## Final energy consumption EU28



**~12,600**  
TWh (2015)

**50%**



of final energy used is heat:  
That's nearly double the  
amount of electricity used

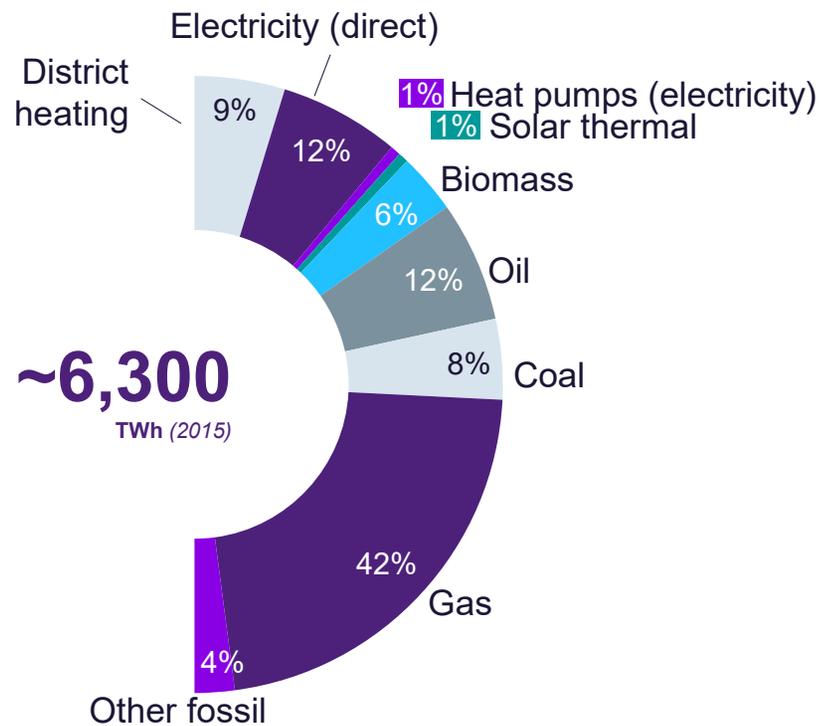
**2/3** of which

is produced from fossil fuels:  
That's ~40% of energy-related  
CO<sub>2</sub> emissions

## The challenge to decarbonize heat

Heat in Europe is still largely produced from fossil sources

### Heating and cooling in EU28 by carrier



## Decarbonizing the heat sector requires

- Efficiency improvements (e.g., thermal insulation, use of waste heat)
- **Replacement of fossil fuels** with renewables or renewable power



# An introduction to heat pumps

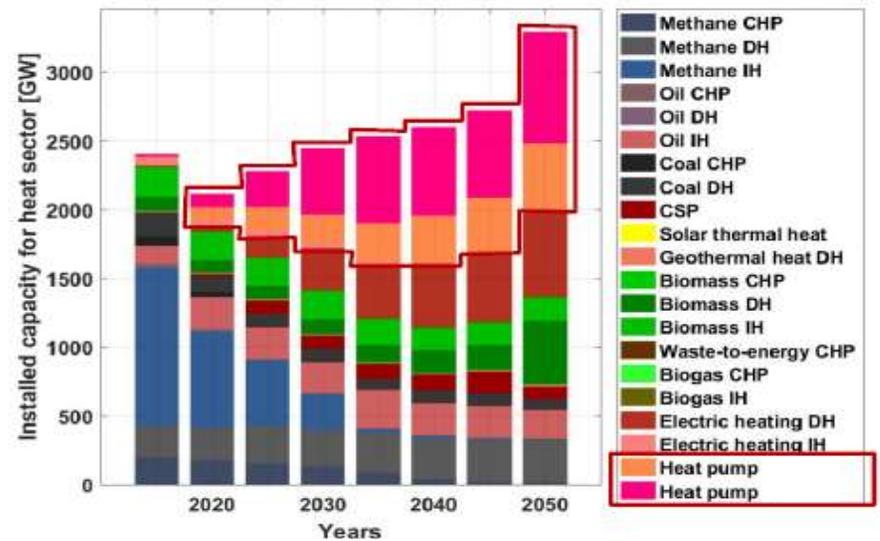
## European heat sector transition

### Heat pumps

will play an important role in the future heat sector.

### Heat production

with fossil fuels are predicted to quickly decrease at the same time as the installed heat capacity need to increase.



Source: Energy Transition in Europe Across Power, Heat, Transport and Desalination Sectors, DBU and Mercator Stiftung

REFERENCE EXERGI PROJECT, STOCKHOLM, SWEDEN | 2020

# Siemens Energy is providing Stockholm with a climate neutral district heating and cooling supply



## PROJECT TYPE

Heat & Green Municipalities



Combined heat and power



Heat pumps



Efficiency



CO<sub>2</sub>

CO<sub>2</sub>-savings

2022-06-08



Deep decarbonization

4000 MW district heating network  
880 MW comes from **heat pumps**

400 MW district cooling net work  
89 MW comes from **heat pumps**

# An introduction to heat pumps



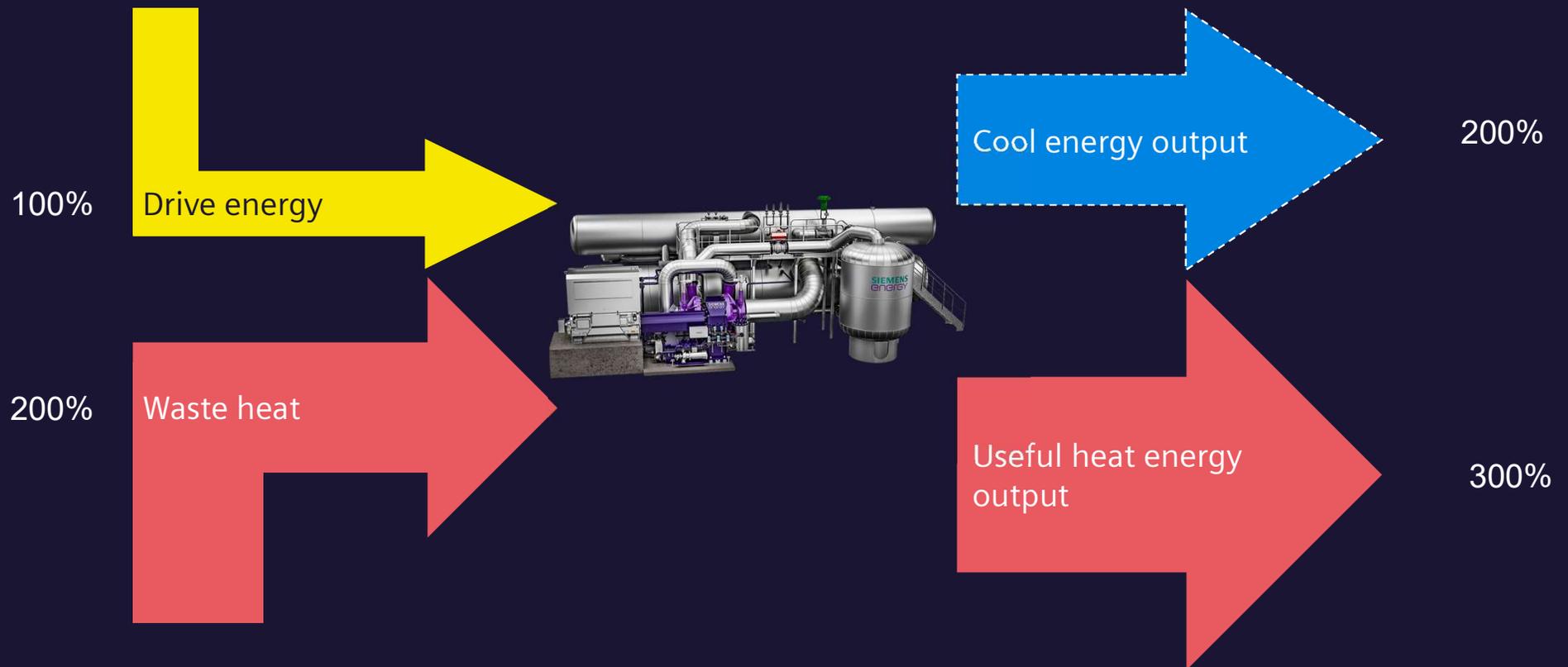




2022-06-08

# An introduction to heat pumps

## What is the benefit of a heat pump?



# Heat pumps at Siemens Energy



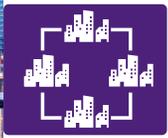
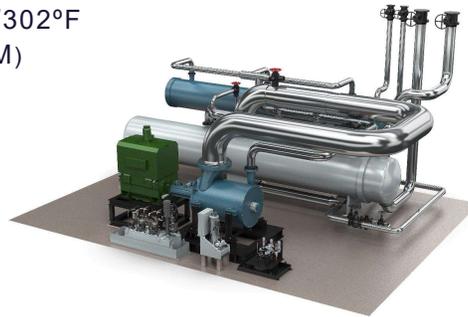
# Heat pumps at Siemens Energy address both district heating and industry applications

## TWO COMPLEMENTARY PRODUCT LINES ...



### SHP-STC-XX W/S

HIGH TEMPERATURE HEAT PUMP  
5–70 MW, UP TO 150°C/302°F  
(HOT WATER OR STEAM)



### SHP-C600/C750

BASED ON PROVEN DESIGN (SINCE 1980s)  
UP TO 45 MW<sub>th</sub>, UP TO 100°C / 212°F (HOT  
WATER) OR UP TO 25 MW<sub>th</sub> COOLING



## ... TO SERVE THE NEEDS OF OUR CUSTOMERS



HEAT SUPPLY

~5 - 70 MW<sub>th</sub> per unit  
**17 – 238 Mbtu<sub>th</sub>**



TEMPERATURES

up to **150°C / 302°F**



ENVIRONMENT FRIENDLY WORK MEDIUM

low **GWP** and **ODP**



VARIOUS DRIVE CONCEPTS

**electrical or mechanical**

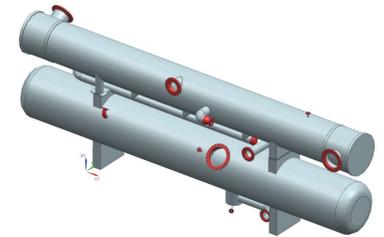
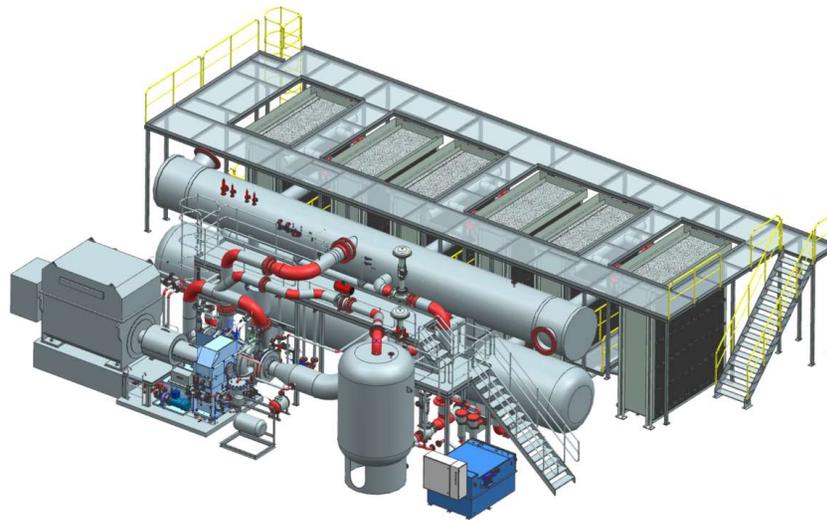


SCOPE OF SUPPLY

**component up to turnkey supply**

# Heat pumps at Siemens Energy

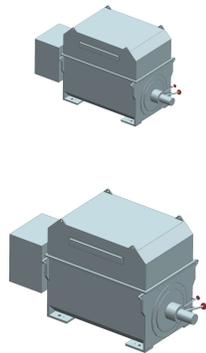
## Heat Pump Platform SHP-C600/C750



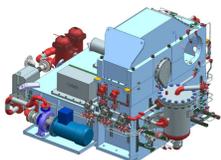
Tube Heat Exchanger



Falling Film Heat Exchanger



Motor  
Modular sizes



Compressor skid



Cooling Compressor  
Module size 15 – 25MWth



Compressor C600  
Module size 15 – 40MWth



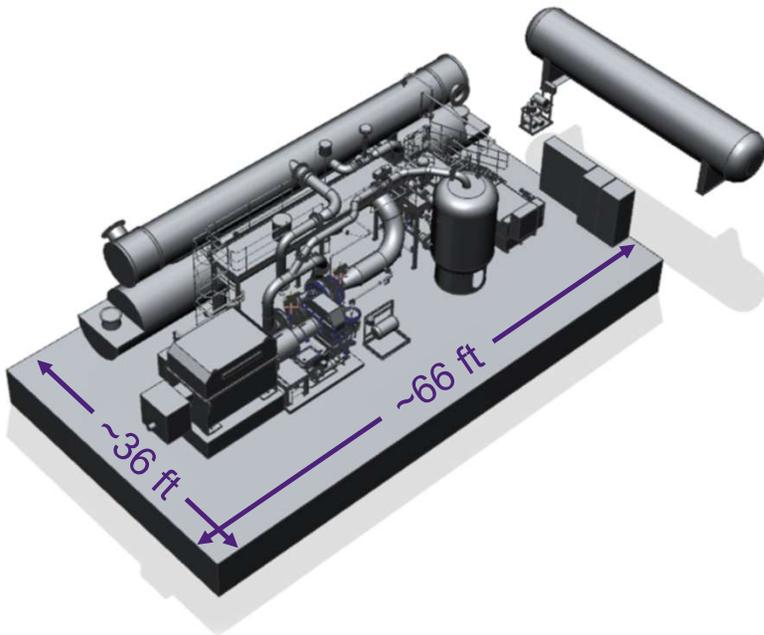
Compressor C750  
Module size 25 – 45MWth

Heat Exchanger  
Modular sizes

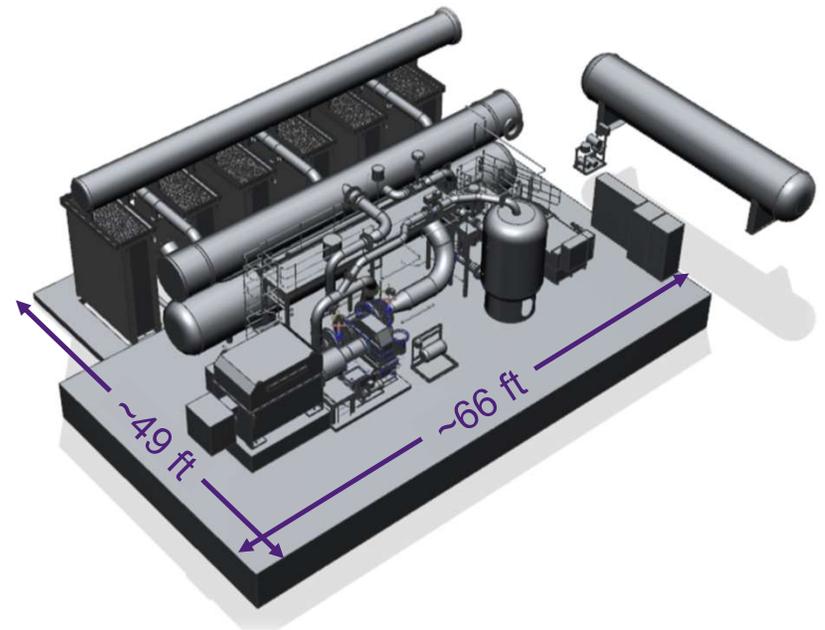
# Heat pumps at Siemens Energy

Approximate size for installation in machine room

**Evaporator – Shell & Tube Type**



**Evaporator – Panel or Falling Film Type**



Max equipment height ~18 ft

# Our heat pumps in use



REFERENCE EXERGI PROJECT, STOCKHOLM, SWEDEN | 2020

# Siemens Energy is providing Stockholm with a climate neutral district heating and cooling supply



## PROJECT TYPE

Heat & Green Municipalities



Combined heat and power



Heat pumps



Efficiency



CO<sub>2</sub>-savings

2022-06-08



Deep decarbonization

Carbon Neutral District Heating combined with District Cooling.



Installed power 880 MW<sub>th</sub> from HP >20% of total heating demand.



Up to 215 MW<sub>th</sub> from one plant

Heat Pumps continuously optimized for each location and operational demand.



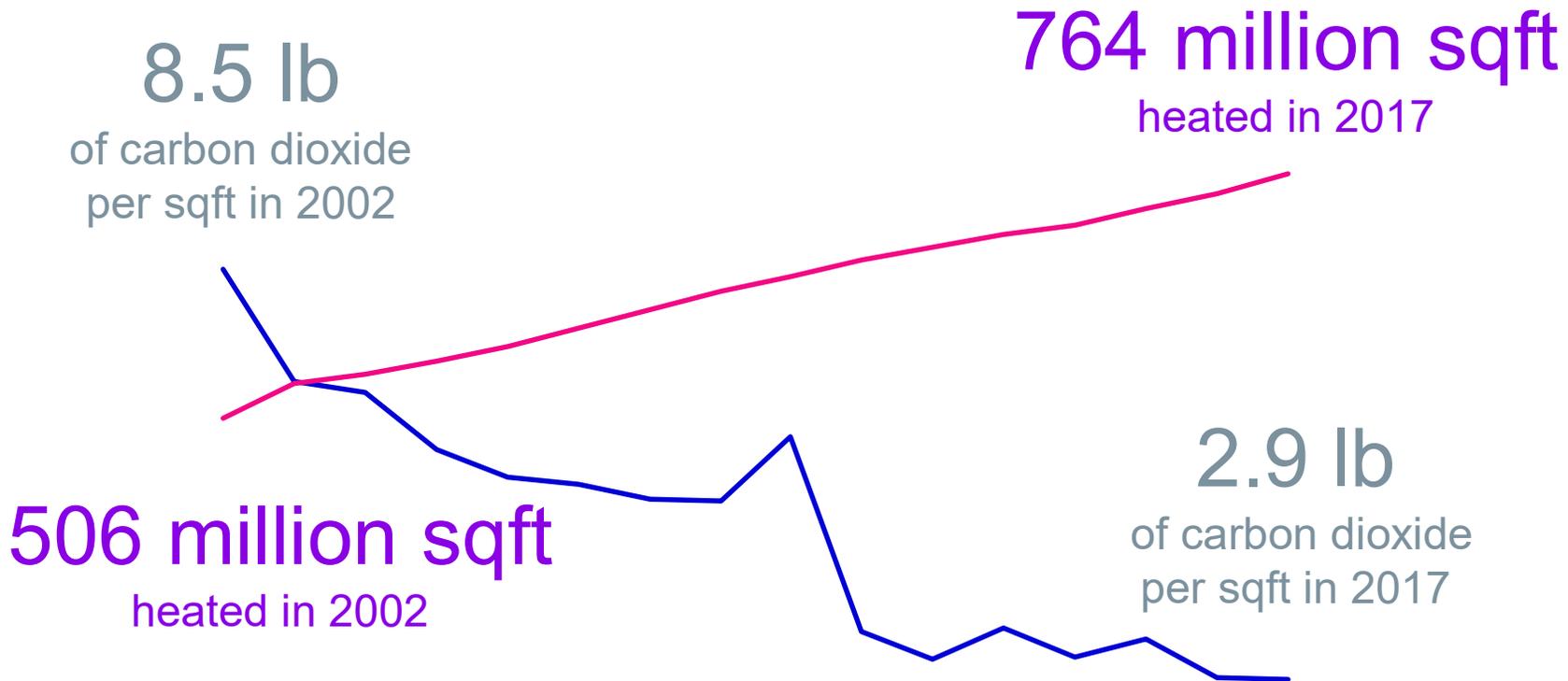
Outstanding availability in operation since 1980s



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## Lessons learned More heat, lower emissions





**The capacity of  
Stockholm's heating system  
has grown now covering**

**1,800 miles  
48M gallons**

REFERENCE MVV & GKM MANNHEIM, GERMANY | 2021

# Siemens Energy and MVV with GKM using a large-scale heat pump to do the first step towards green district heating



## PROJECT TYPE

Heat & Green Municipalities



Combined heat and power



Heat pumps



Efficiency



CO<sub>2</sub>-savings

2022-06-08



## Deep Decarbonization

### Customer Challenge/Driver

CO<sub>2</sub> neutral in the district heating production by 2030.



### Portfolio Elements

20 MW<sub>th</sub> heat pump



### Scope

Delivery of a complete heat pump SHP-C600 including full installation and commissioning



### Benefit

- Decrease the use of coal
- Use the river Rhine as heat source
- Provide 50 GWh/a heat for the district heating network
- More than 10,000 t of CO<sub>2</sub> emissions savings per year versus heat from a gas boiler at 2,500 full operating hours



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REFERENCE QWARK<sup>3</sup> PROJECT, VATTENFALL, BERLIN | MARCH 2021

# Vattenfall and Siemens Energy help advance a climate-friendly heating supply for Berlin with large scale heat pump

CO<sub>2</sub> 6'500 tons CO<sub>2</sub> savings



## PROJECT TYPE

Heat & Green Municipalities



Combined heat and power



Heat pumps



Efficiency



CO<sub>2</sub>-savings

2022-06-08



## Deep decarbonization

### Customer Challenge/Driver

Utilize unused waste-heat of district cooling as heat source for district heating



### Portfolio Elements

High-temperature heat pump (8 MW<sub>th</sub>)



### Benefit

- Avoid unused heat being dissipated into the environment
- Provide 55 GWh/a additional heat for the district heating network
- 6,500 t of CO<sub>2</sub> emissions savings
- 120,000 m<sup>3</sup> of cooling water savings



# Summary

## The challenge to decarbonize heat via Heat pumps

### Challenge



### Technology



### Solution



### Benefits



- Produce heat in a cost-effective way without combustion of any fuels



- Heat pumps applications integrated in the energy system



- Stop waste of heat



- Environmentally friendly solution with zero emissions



## Contact page



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Let's  
**energize**  
society