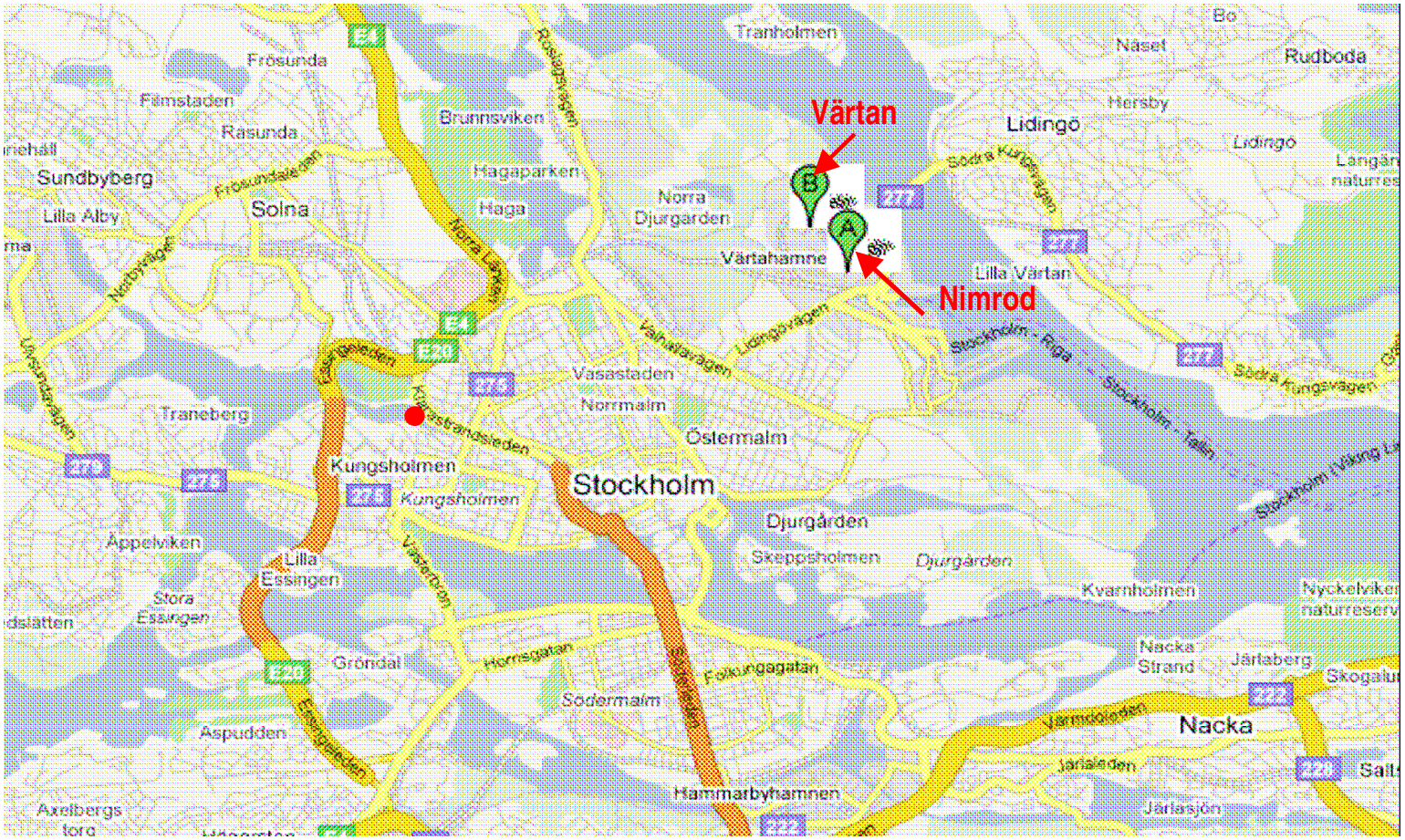
Installation records - Heat pumps Stockholm



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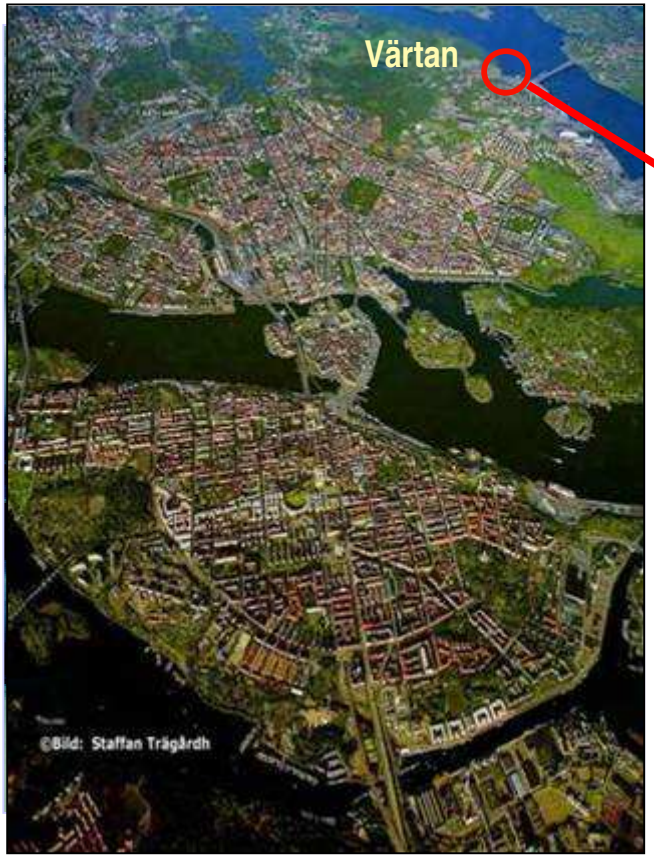
Värtan Ropsten, Stockholm - heat source: sea water

Vaertan Ropsten in Stockholm



Värtan Ropsten, Stockholm - heat source: sea water

Number of units	6
Type	UNITOP® 50 FY
Refrigerant	R134a / R22
Heating capacity total	180'000 kW
District heating temp. in/out	50 / 80°C
Cooling medium	Sea water, direct
Cooling medium temp. in/out	2.5 / 0.5°C [t_0=-3°C]


Hot water storage tank

6 units into successful operation since 1985

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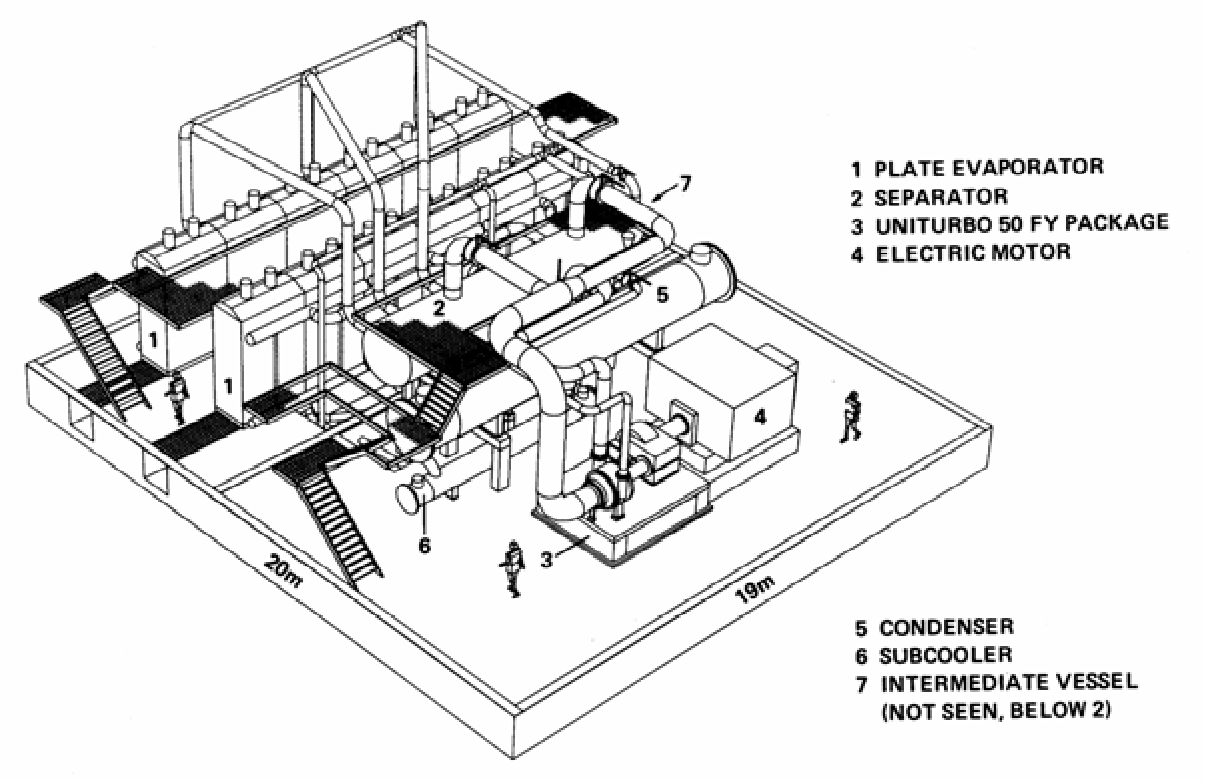
Värtan Ropsten, Stockholm – heat source: sea water



DC & DH Plant Katri Vala, Helsinki

heat source: treated waste water

District heating / cooling production “Katri Vala”, Helsinki, Finland

5 x UNITOP® 50 FY

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DC & DH Plant Katri Vala, Helsinki

heat source: treated waste water

Dim.: 12.5 x 7.5 x 5.5 m – Weight: 120to (in operation)

5 x UNITOP® 50 FY

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DC & DH Plant Katri Vala, Helsinki

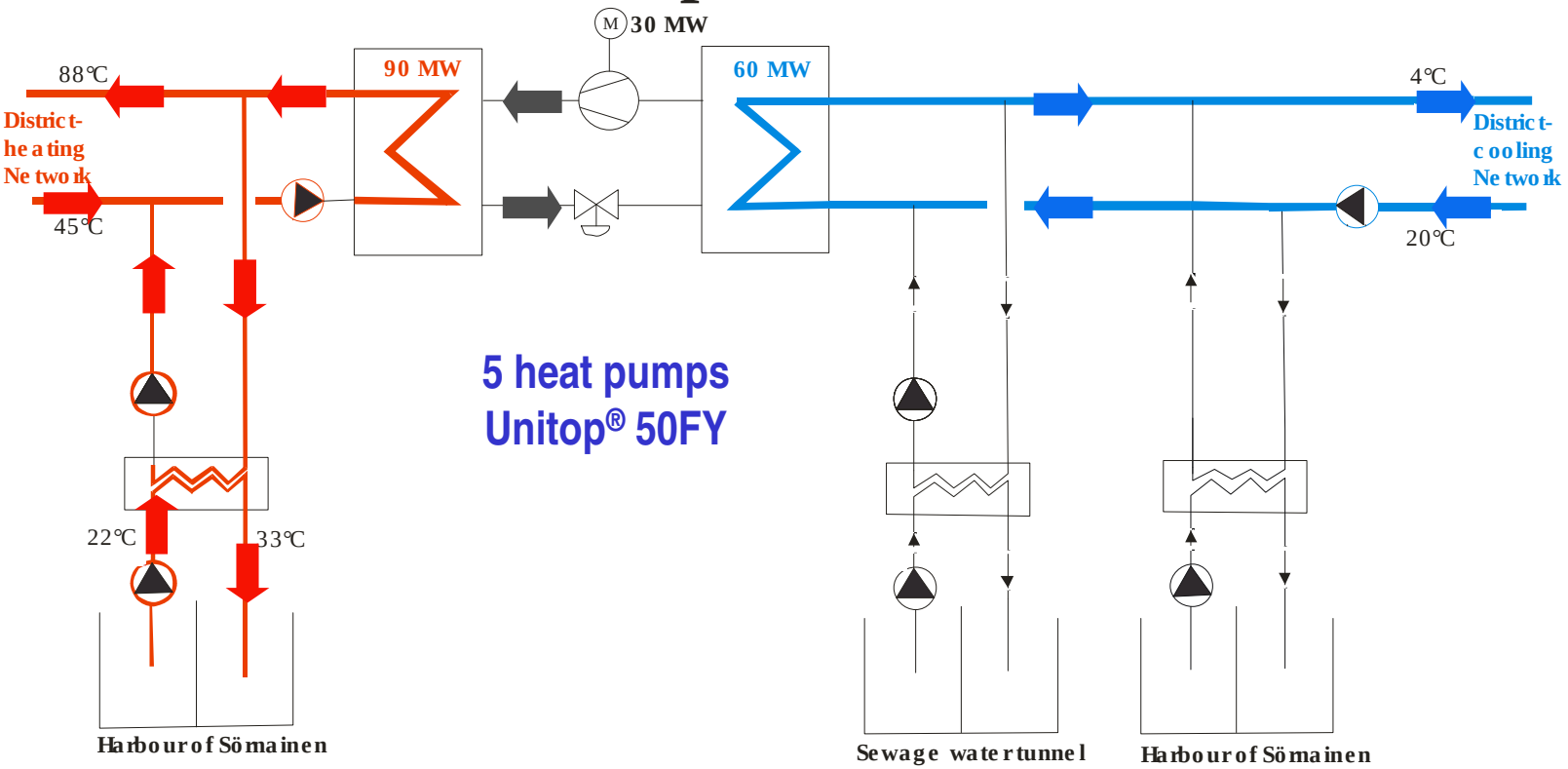
heat source: treated waste water

Heating & cooling in summer – heating with treated sewage water in winter

	Summer	Winter
Number of units	5	5
Type	UNITOP® 50 FY	UNITOP® 50 FY
Refrigerant	R134a	R134a
Cooling medium	District cooling water	Sewage water, indirect
Cooling capacity	60'000 kW	60'000 kW
Cold water temp. in/out	20.0 / 4.0 °C	10.0 / 4.0 °C
Cold water flow	3'225 m3/h	8'600 m3/h
Heating water temp. in/out	45.0 / 88.0 °C	50.0/62.0°C (up to 88°C)
Heating water flow	1850 m^3/h	6'105 m^3/h
Power at terminal	30'565 kW	23'850 kW
Heating capacity	90'565 kW	83'850 kW
Coeff. of performance	2.96	3.51
produced energy, total	*150'000 kW_{th}*	
overall cop	*4.91*	

DC & DH Plant Katri Vala, Helsinki

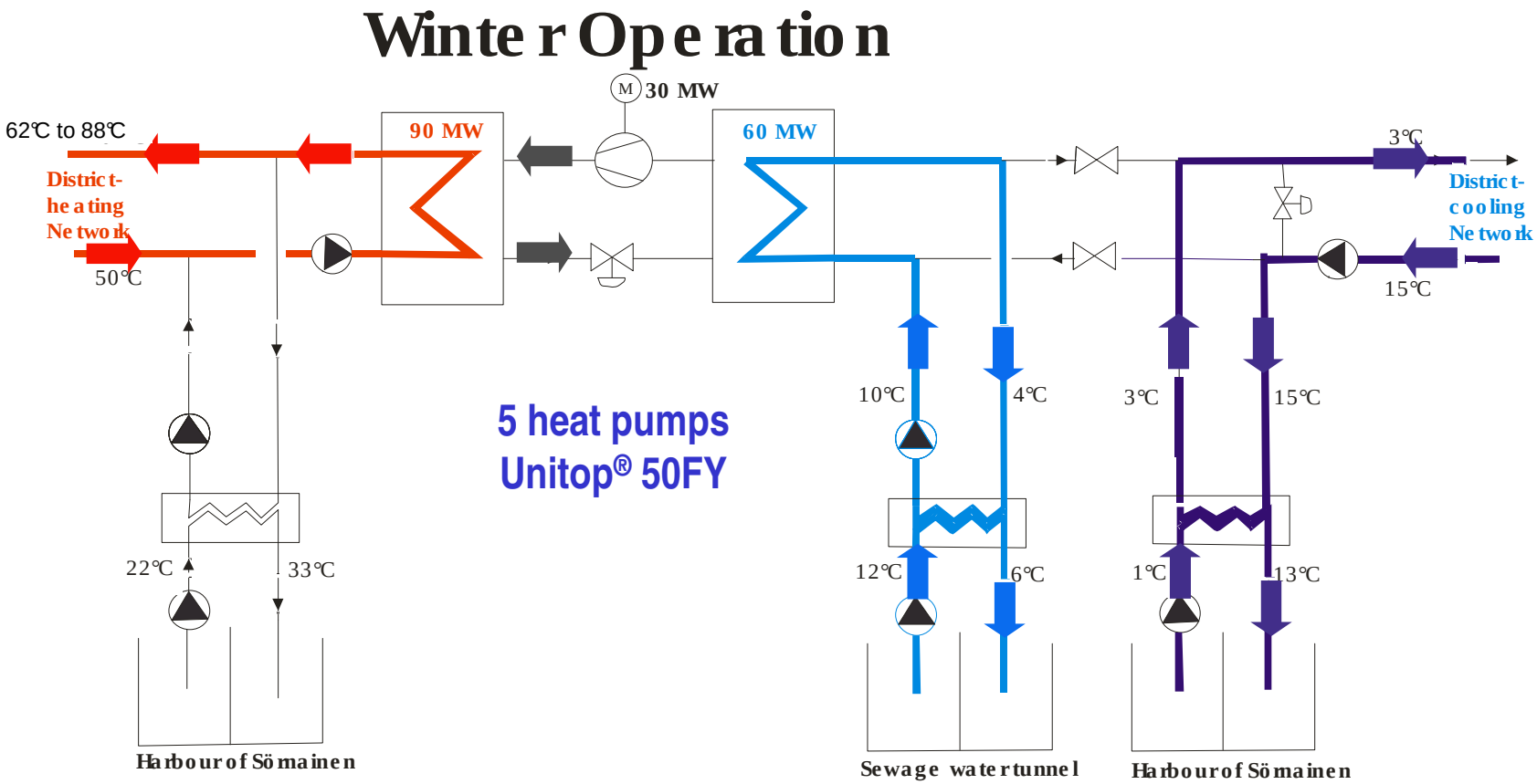
heat source: treated waste water



Typical flow sheet

DC & DH Plant Katri Vala, Helsinki

heat source: treated waste water



Typical flow sheet

Morbegno – heat recovery from gas motor cooling water

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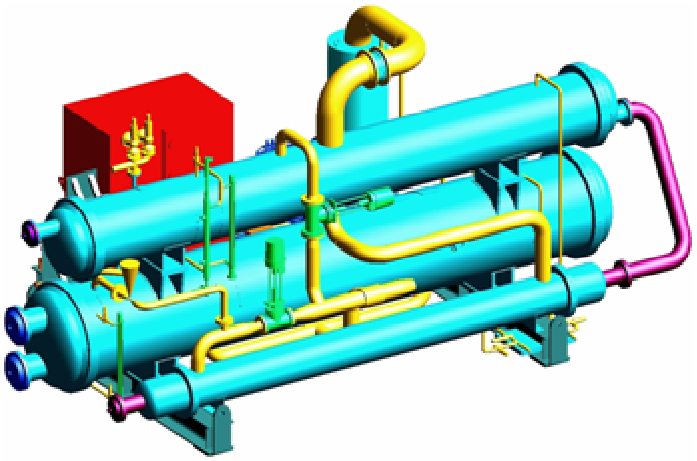
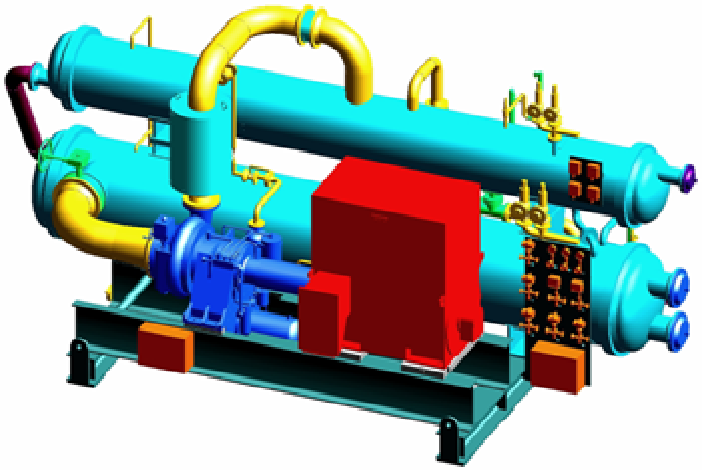
Morbegno – heat recovery from gas motor cooling water

District heating for Morbegno (SO), Italy

Number of units	1
Type	UNITOP® 33 CY
Heating capacity	3’740 kW
District heating temp. in/out	60 / 84°C
Gas motor cooling water	46 / 40°C
COP [heating]	4.294





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Morbegno – heat recovery from gas motor cooling water

Morbegno - heat recovery from gas motor cooling water

Placing of SEM Morbegno heat pump

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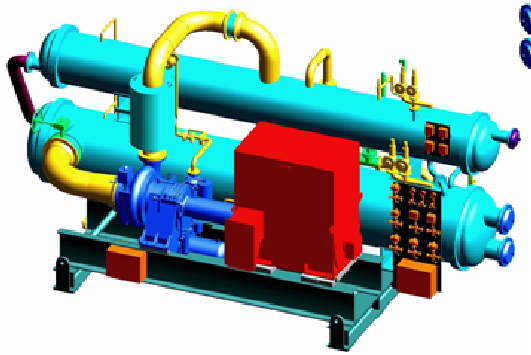
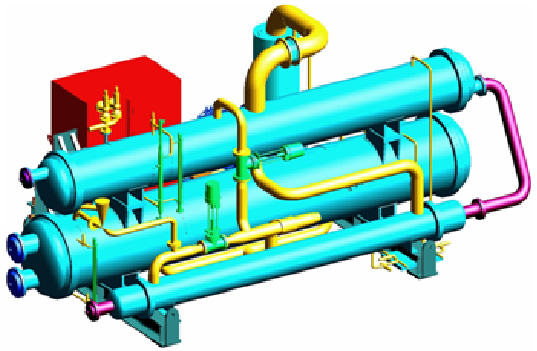
KICOX – heat recovery from dyeing process

KICOX *(Korea Industrial Complex Corp.)*

KICOX – heat recovery from dyeing process

Type	UNITOP® 28CY	
Design	Winter	Summer
Heat source capacity	4’184kW	3’442kW
Heat source in/outlet	27.7° /19.4°C	36.4° /29.5°C
Heating capacity	5’579kW	4’652kW
Heating water in/outlet	33° / 73°C	40° / 80°C
Power consumption motor term.	1‘394kW	1‘270kW
COP	4.001	3.662





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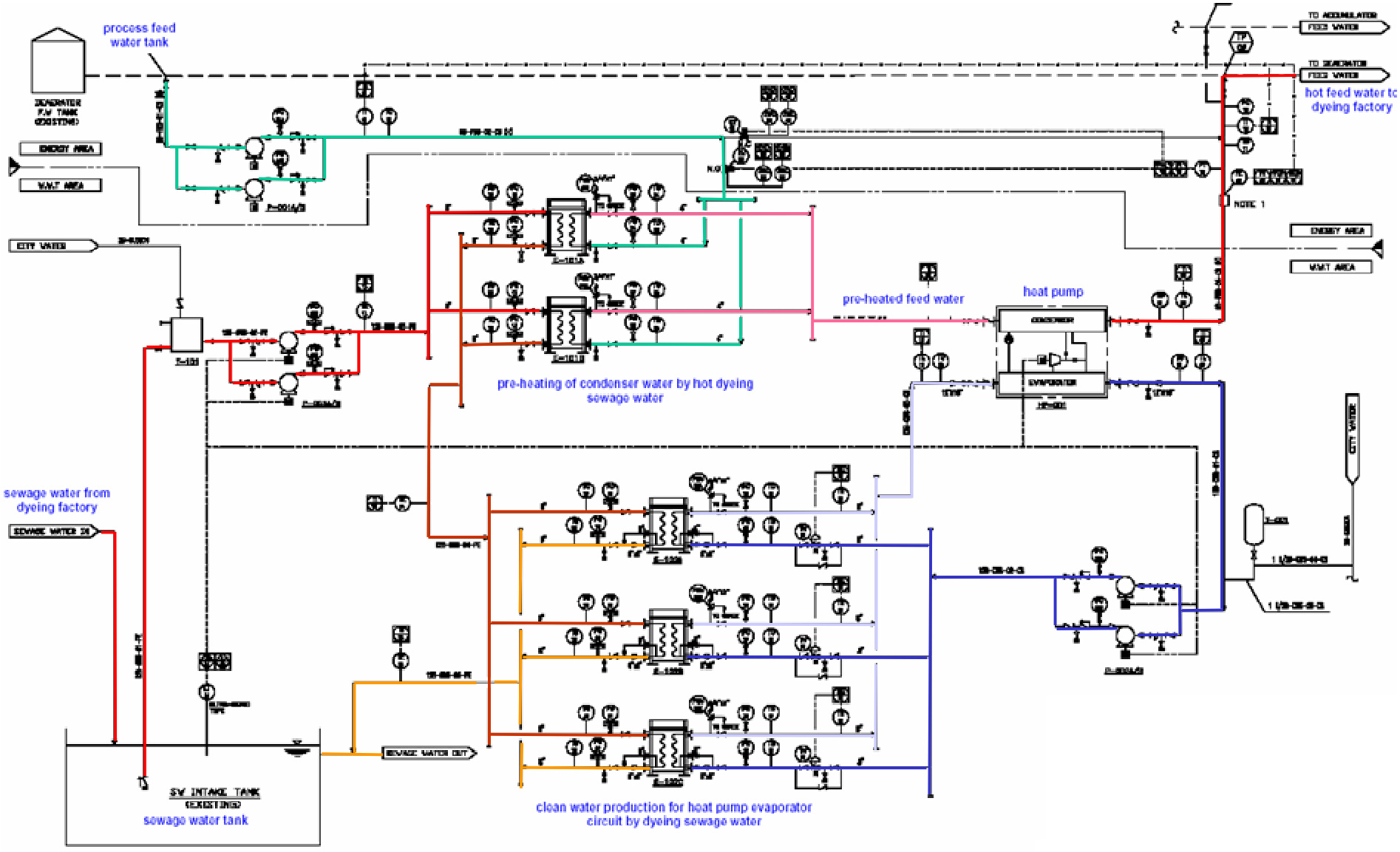
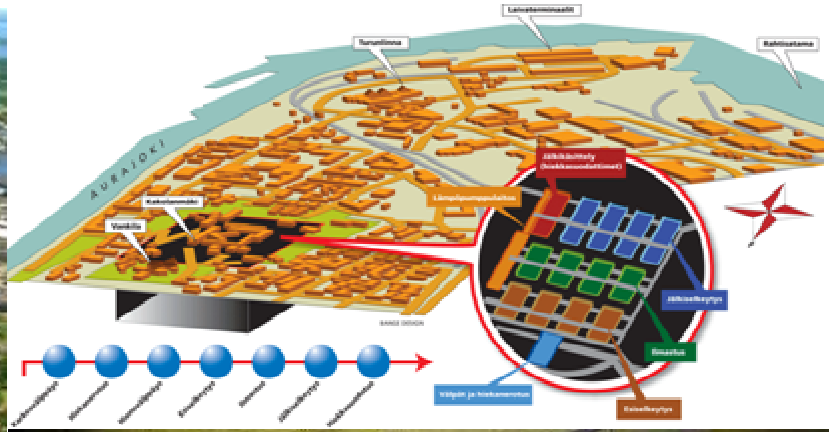
KICOX – heat recovery from dyeing process



The Kakola Heat Pump Plant in Turku / Finland



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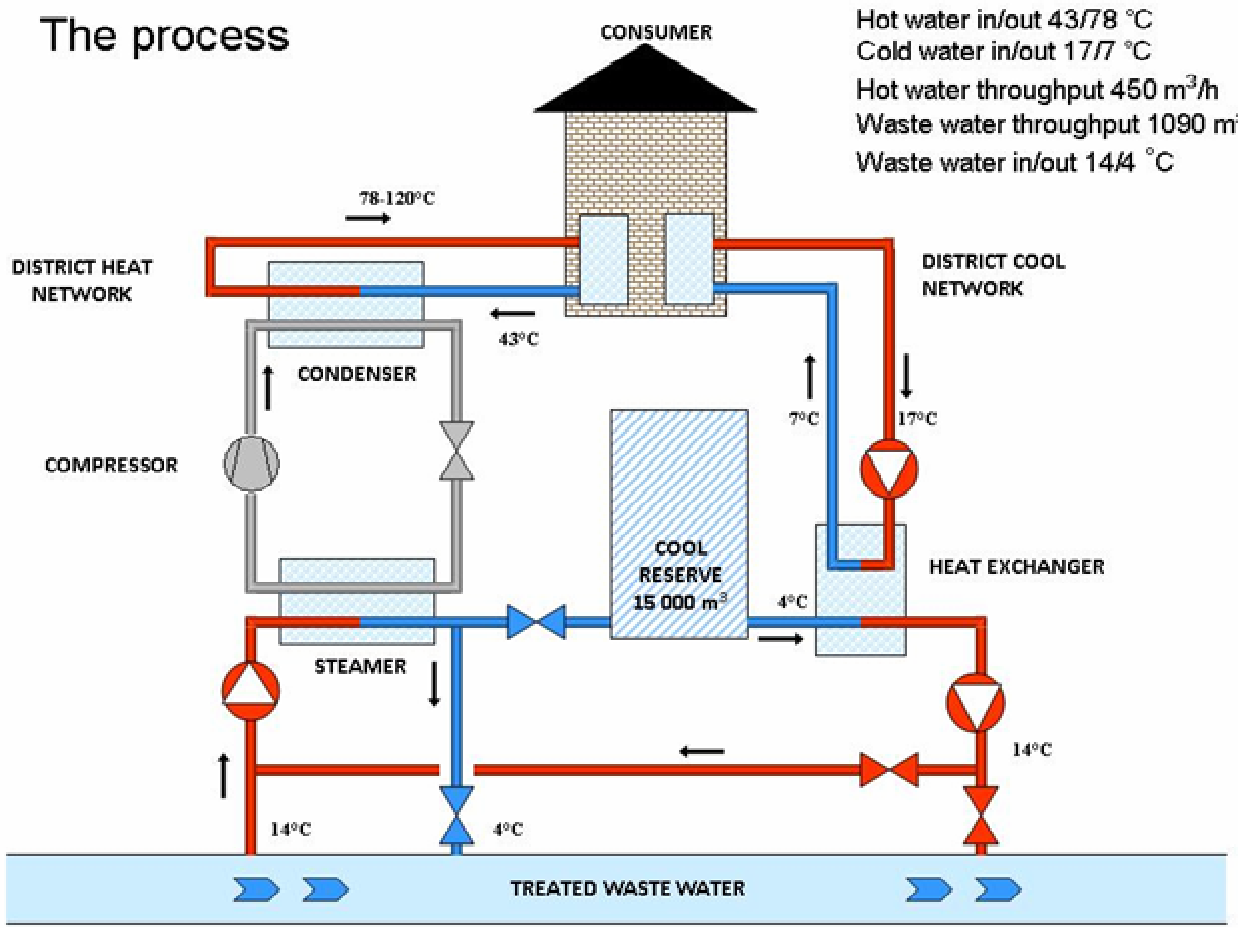
The Kakola Heat Pump Plant in Turku / Finland



The Kakola Heat Pump Plant in Turku / Finland

The machinery hall in the cavern

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The Kakola Heat Pump Plant in Turku / Finland

Heat Pump with commissioning engineer, measured capacity: 21.5MW

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Conclusions

- Large capacity centrifugal heat pumps technology is proven for more than 30 years in waste heat recovery
- Decades of practical experience with large variety of heat sources
- Compression HPs are safe and secure in operation
- Most of the first HPs installed in 80ies are still in operation today
- High availability > 98%
- Tailor-made solutions guaranty the highest efficiency
- Flexibility of operation modes

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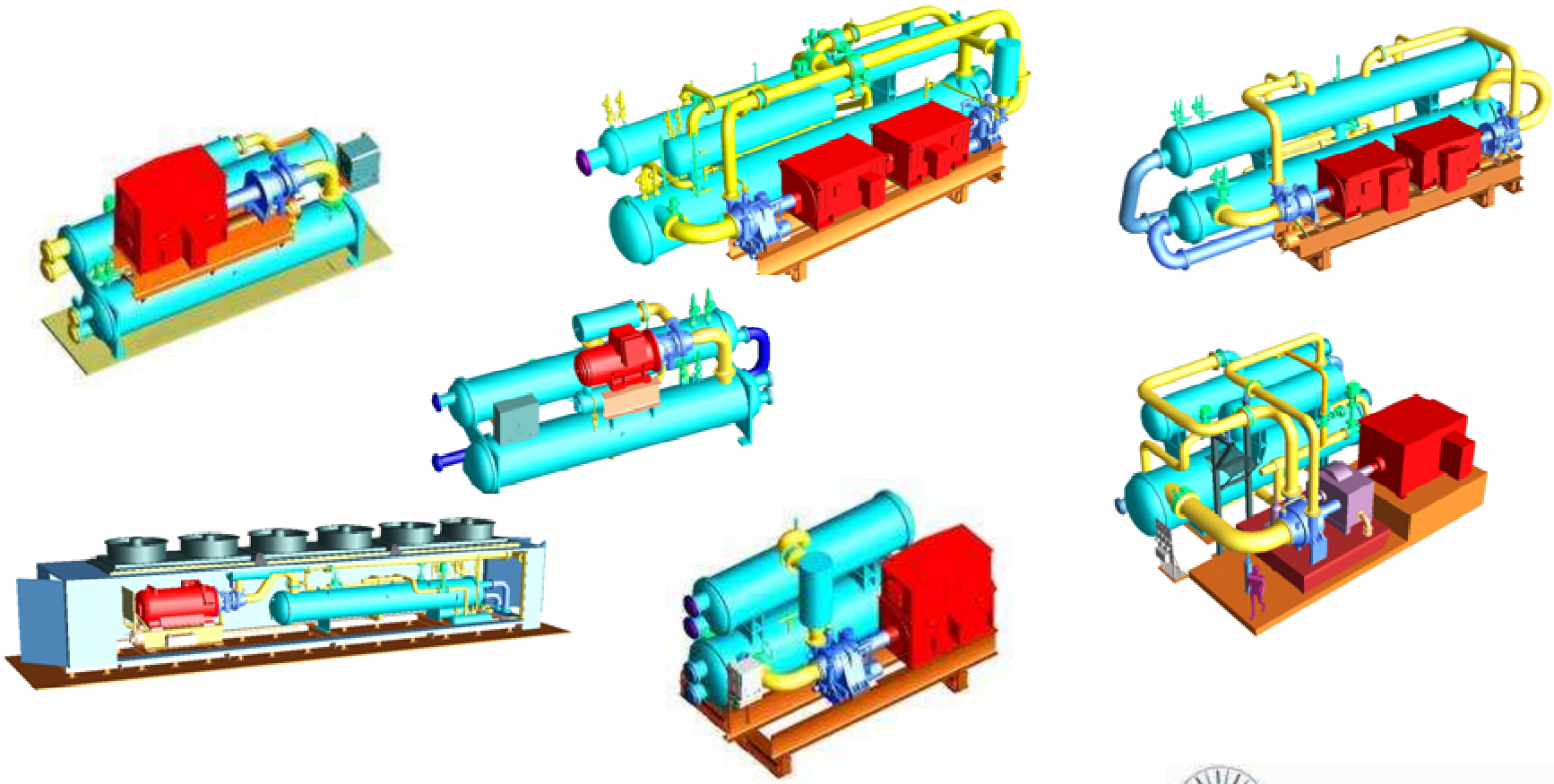
UNITOP® packaged units - tailor made products

Turbo Refrigeration Plants and Heat Pumps from Friotherm AG are engineered and manufactured entirely according to clients specifications



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