Heat re-use in Stockholm

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Agenda

- Introduction
- Experience from heat re-use at PDC
- Plans for heat re-use in Stockholm
PDC – Introduction

- PDC the largest of six national centers in Sweden
- Located at KTH Royal Institute of Technology in Stockholm
- Main system Cray XE6 with 36,384 cores, 305 TFLOPS
Stockholm

- Cold climate – we need heating in the winter
- Unique district heating AND district cooling network
Heat re-use project

- Cray could not provide what we wanted
- Own design
- Industrial components
In the computer room

**UNDER FLOOR TEMPERATURE**
Normal: 15-16°C | 59-60°F
Max: 17°C | 62°F

**HEAT RECOVERY COIL**
WATER INLET 18°C | 64°F
WATER OUTLET 28°C | 84°F

**EXHAUST**
22°C | 72°F

**CABINET**
SIDE
FRONT
FRONT
FRONT
FRONT
FRONT

**EXISTING CRAC**

**PDC Center for High Performance Computing**

**TEMPERATURE**
Normal: 35-43°C | 95-109°F
Max: 52°C | 126°F
Heat re-use facts

• Input water 20 °C (68 °F)
• Output water 28 °C (82 °F) – good enough to heat incoming air to a building
• We could use existing pipes
• Still pay-off time of 8 years
• Using district cooling in the summer
• Around 300 kW is captured of 500 kW total
• Last winter 820 MWh
Experiences

- Fun but much work
- Working with custom design is hard
- Controlling the cooling was really hard
- Works really well – no failures
- Next generation we will use a liquid cooled system and use heat pumps.
Open District Heating
A Stockholm Initiative
Fortum’s distrikt heating

Källa:
Fortum’s district cooling

Källa:
Idea

- District Heating and Cooling network exists today
- 127 computer halls in Stockholm with constant heat production
- Total 132 MW
- Reimburse computer halls for produced energy
Possibilities

1) Direct district cooling
2) Use district heating for cooling via heat pump
3) Use both district cooling and heating via heat pump
4) Cool village: co-location close to the production sites
1. Re-use to the district cooling
2. Re-use to the district heating
3. District cooling and heating combined

- Heat pump
- Heat exchanger
- District heating
- District cooling
- Computer hall
- Fjärrvärme
- Värmepump
- Datahall
- Värmeväxlare
- Fjärrkyla
Questions?

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