

SURPLUS INDUSTRIAL HEAT

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EASY COMFORTABLE LOW COST

AGENDA

- Definition
- Difference in surplus heat
- Some exsamples from Viborg

DEFINITION OF SURPLUS HEAT

- What is surplus heat?
 - Energy recovered from a production process – the energy is used for heat.
- What is not surplus heat
 - Utilisation of flue-gas – this is primary energy that could have been used better.
- In Denmark surplus heat normally is bound with taxes if used.

DIFFERENT SOURCES

- Process
 - Cooling of product 40-60 °C
 - Melting +100 °C
 - Burning (calcination, roasting among others) 60 °C
 - Drying depend on produkt
- Supply
 - Cooling 30-40 °C
 - Compressed air 60-70 °C
- Server 25-40 °C
- Waste water 7-30 °C

DIFFICULTIES

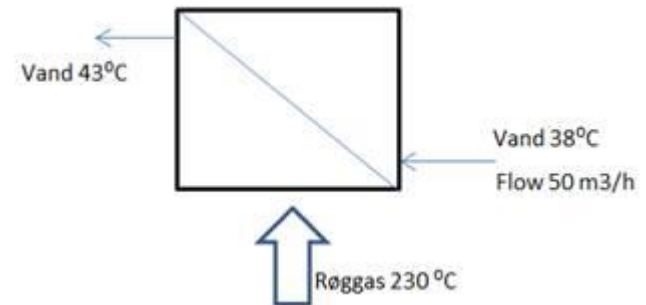
- The surplus heat is not always continues – how do we set the price?
- The temperature is not always the same as the district heating company – how do we boost it?

HOW TO BOOST TEMPERATURE

- If the temperature is too low for district heating, it can be boosted by
 - Heat pump
 - Mixing cold and hot water, if it's close to a transmission pipe.
 - Usage of reserve boilers
 - (send it into the return pipe)

HEAT FROM COFFEE ROASTER

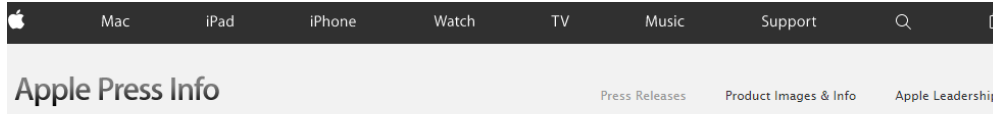
- Peter Larsen Coffee in Viborg sell coffee.
- In the process the coffee beans is roasted, to get the right flavor.
- The oven is heated with natural gas.
- The oven is used 8 hr. a day 5 days a week
- The temperature is very high after the process 90-500 °C
- To use the surplus heat a flue-heat exchanger is used
- We expect 500 MWh of surplus heat



HOSPITAL IN VIBORG

- Many of the hospitals operating equipment needs cooling, so do the server and in summer also comfort cooling.
- Instead of many small coolers, they install a large heat pump.
- They use a large amount in winter for heating the hospital but in summer they have something they don't use.
- Temperature is 60-65 °C
- We expect 4000 MWh surplus heat

23. FEBRUARY 2015



Apple
State
CORK
Europ
centra
custo

The two data centres, each measuring 166,000 square metres, are expected to begin operations in 2017 and include designs with additional benefits for their communities.

"We are grateful for Apple's continued success in Europe and proud that our investment supports communities across the continent. We're committed to green energy."

Apple
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In Viborg, Denmark, Apple will eliminate the need for additional generators by locating the data centre adjacent to one of Denmark's largest electrical substations. The facility is also designed to capture excess heat from equipment inside the facility and conduct it into the district heating system to help warm homes in the neighboring community.

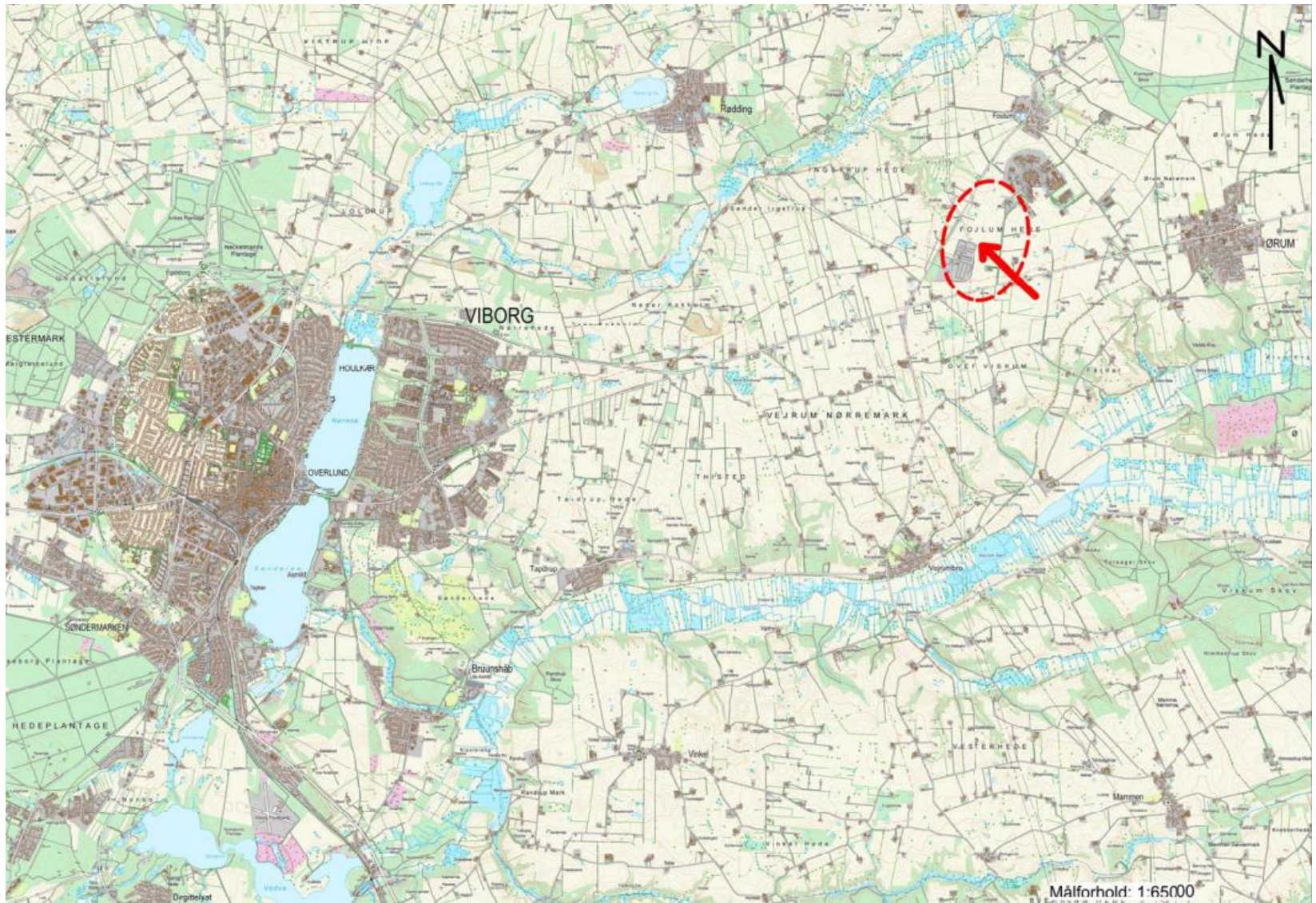
"We believe this is a great opportunity for us to work with the local community and the government in Ireland and Denmark and develop energy systems that take advantage of their strong wind resources. Our commitment to environmental responsibility is good for the planet, good for our business and good for the European economy."

The two data centres, each measuring 166,000 square metres, are expected to begin operations in 2017 and include designs with additional benefits for their communities. For the project in Athenry, Ireland, Apple will reconvert a building previously used for growing and harvesting non-native trees and restore native trees to Derrydonnell Forest. The project will also provide an outdoor education space for local schools, as well as a walking trail for the community.

In Viborg, Denmark, Apple will eliminate the need for additional generators by locating the data centre adjacent to one of Denmark's largest electrical substations. The facility is also designed to capture excess heat from equipment inside the facility and conduct it into the district heating system to help warm homes in the neighboring community.

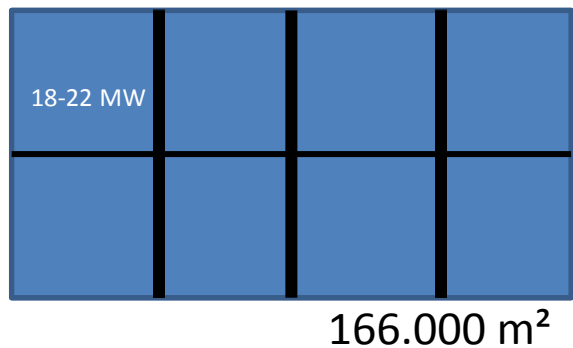
Apple designs Macs, the best personal computers in the world, along with OS X, iLife, iWork and professional software. Apple leads the digital music revolution with its iPods and iTunes online store. Apple has reinvented the mobile phone with its revolutionary iPhone and App Store, and is defining the future of mobile media and computing devices with iPad.

WHERE

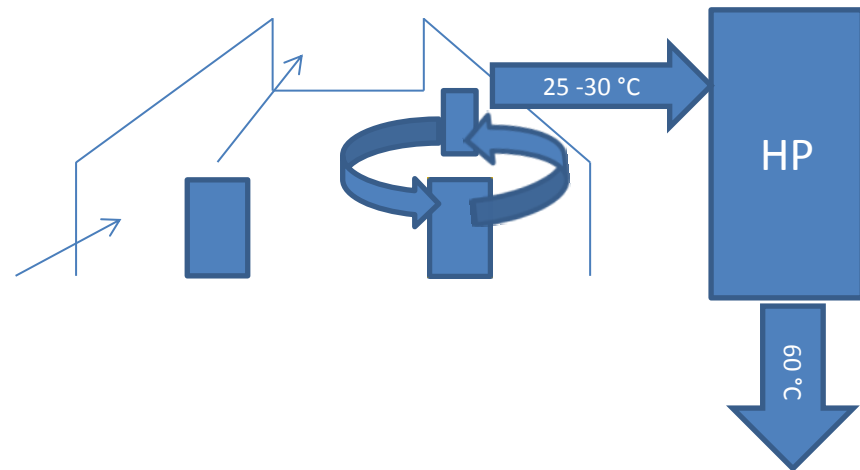


THE DATA CENTER

Size



Cooling/ surplus principle



- The temperatures shown is an example
- We expect more than we can use