THE ROLE OF DISTRICT COOLING IN THE FUTURE SMART ENERGY SYSTEMS

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Along with economic growth people are putting more focus on fulfilling their comfort needs.

Cooling demand in Europe is growing:
- Commercial cooling demand is estimated to be only 27% saturated
- Residential cooling demand is estimated to be only 5% saturated

In USA and Japan the saturation is 80%/65% and 100%/85% respectively.

Europe is in unique position to achieve cooling in a smart, energy efficient and environmental friendly way by introducing district cooling from the beginning of the cooling trend.
What is the risk if we do not consider DC?

› Not so favorable building add-ons
What is the risk if we do not consider DC?

› General oversizing of equipment
  – Building level cooling units will be designed for peak load + reserve

› District cooling benefits
  – As demand varies between users the DC system can take advantage of it when it comes to investing in cooling capacities
  – Large thermal storages can be used to:
    › Optimize the cooling production
    › Reduce capacity investment
    › Smooth electrical load due to cooling
What is the risk if we do not consider DC?

› **Unnecessary energy waste**
  – Building level cooling units will generally be oversized to the demand at hand
    › Units will be designed for peak load
    › Vast majority of the unit lifetime it will be operated at part load
  – Most cooling users will not have expertise to ensure optimum operation of their cooling units
    › Experience in the U.S. shows that the average fouling in water-cooled chillers results in 17% increase in energy consumption

› **Cooling is the core business of District Cooling Companies**
  – The DCC will ensure optimum operation of their cooling units!
  – The surplus heat from the cooling units could further be used in the district heating system!
What is the risk if we do not consider DC?

› Fuel lock in
  – Decentralized solutions are typically electrically driven

› District cooling is fuel independent
  – It can use any free cooling sources available
  – Heat from the district heating system
  – etc.

District cooling

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- etc.
Typical growth of district cooling systems

› Real cases show that once district cooling systems are built, they tend to grow very fast, until the market is saturated.
How to map district cooling potentials?

› Ramboll has developed a simple and effective way to quickly estimate the potentials for district cooling

› When the circle intersect each other they indicate the district cooling system could be economical
District cooling substations

› District cooling substations are build on decades of experience with district heating, while specially optimized for the low dT and the low temperatures.
Common challenges with district cooling

- Large upfront investments
- Finding space for the district cooling facilities:
  - Technical components (in a building),
  - Thermal storage
  - Pipe network installation (large dimensions), especially in city centre areas
- Ensuring noise reduction of very large chillers / heat pumps
- Low temperature difference between the supply and return (low dT syndrome)
- Fast growth once initiated

All of those challenges can be solved with good preparation work, high quality solution and focused operation.
Drivers for district cooling

› Power drivers:
  – Economy of scale
  – Environmental friendly
  – Fuel/source independent

› Example of general drivers
  – Space saving at buildings
  – Higher energy efficiency
  – Flexibility for optimizing cooling production over time and cooling sources.
  – Reduces and optimizes electrical consumption
  – Reduced HFC handling
  – Silent operation at connected buildings
  – Maximum energy security
Conclusions

› Everywhere district cooling systems are installed they experience rapid growth

› District cooling can lead the way to reduce environmental impact from cooling of buildings through its
  - Source independent nature
  - High energy efficiency - Large scale advantages
  - Utilization of simultaneity in the cooling demand
  - Implementation of renewable energy
  - Absorption cooling if waste heat is available – From existing district heating sources

› Economic optimization with thermal energy storages
  - Large accumulator tanks
  - ATES (aquifer thermal energy storage)
  - UTES (underground thermal energy storage)
  - Pit storage
Conclusions

› District cooling can deliver the heat from the buildings to the district heating system – lowering the price of district heating

› District cooling adds to the energy security through its multi-source nature

› District cooling can act as a load shifting technology for the electrical grid

› **District cooling is the smart solution for the smart energy system of the future**
Thank you for your attention

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