District Cooling – Technological solutions & environmental benefits

Joakim Nilsson
Partner
Devcco – District Energy Venture
Talking points

• Brief introduction Devcco
• Demand for cooling
• District Cooling basics
• Sources and technologies
• System architecture
• Environmental (and other) benefits
• Examples
Devcco is a private, independent company owned by its founding Partners. Devcco team members have led the development of District Cooling in Stockholm, Amsterdam, Lusail and Honolulu. The management team has a background from Fortum and Capital Cooling in Sweden.
European cooling index (ECI) in a contour map computed from information from 80 urban locations in Europe

Source: EcoHeatCool
District Cooling - Basics

Source: A vision towards 2020 – 2030 – 2050, DHC+ Technology Platform
Why DH for DC

Heat (50%) Fuel (100%) Losses (15%) Electricity (35%)
**Why DH for DC**

DH infrastructure is dimensioned for *winter operation*,

*in summer operation its capacity is not fully used!*
Other sources & technologies

- DC production
- Free cooling
- Heat (absorption cooling)
- Electricity (Compressor chillers, Heat pumps, …)
- Cold storage
- Air
- Water (lake, river, sea, underground water)
- DH system
- Waste incineration
- Combined Heat & Power
- (Industrial) Waste heat

Co-funded by the Intelligent Energy Europe Programme of the European Union

(IEE/11/977) / Duration: 01/06/2012 - 30/11/2014
**Technical option** | **EER***
---|---
Conventional building installation | 1.5 – 3.5
Industrial chillers w. efficient condenser cooling | 5 - 8
Free cooling | 25 - 40
Absorption chiller (electricity) | 20 - 35
Absorption chiller (heat) | 0.7 – 0.9

*EER = (System Seasonal) Energy Efficiency Ratio. This states the output of annual useful cooling energy per unit of energy input in the system.*
A fully developed DC system typically utilizes a mix of technologies and sources in order to optimize efficiency and life cycle cost!
Environmental (and other) benefits

- PEF - Less primary energy use
- CO2 - Smaller carbon footprint
- Less refrigerant use and leakage
- Noise reduction in city center
- Makes roof tops available for other uses
- Offloads electric grid in summer
- Reliable and stable for customers
Zagreb opportunities

- Surplus heat from CHP-plants – low cost and low primary energy source
- Steam network – high temperatures beneficial for absorption cooling
- Cooling water from river Sava – perfect match with absorption cooling. Cold enough for free cooling?
- Seemingly high demand in 2×2 km area
- Customers - established relations and used to DH
- Public buildings - anchor customers?
Öresundskraft in Helsingborg provides offices, public buildings and industries with district cooling since 1998.

In order to meet a growing demand and to utilize surplus heat, Devcco has been engaged for business re-engineering.

The new cooling production will be based on a mix of absorption cooling, free cooling from the sea and conventional chillers in combination with a day and night storage.

General information:
• Cooling Energy demand: 20 GWh/year
• Network length: 6 km
• System temperatures: 6/16°C
Capital Cooling has carried out several successful District Cooling projects in European cities like Stockholm, Gothenburg, Amsterdam, Vienna and Copenhagen. On the following pages the Stockholm, Gothenburg and Amsterdam projects are described in greater detail.

Stockholm

- Stockholm is the capital of Sweden with 1.2 million inhabitants.
- The first cooling delivery was made in 1995 after initializing the project in 1994.
- In 2006 the network provided cooling solutions to approximately 100 customers and approximately 540 buildings with a total demand of 300 MW with an output of total 400 GWh.
- During the main years of investments 1997-2001 about 200 M€ where invested.

General Information On The Project

Development of project in GWh
Zuidas is located along the highway A10 between Schiphol Airport and the City of Amsterdam. It is a commercial hub where commercial buildings dominates.

General Information on the Project

- The project was initiated by Capital Cooling and developed and realized through a partnership established in 2003 between Capital Cooling and Nuon.
- The first contracted customer was ABN Amro’s head office contracted in 2005.
- The DC system was taken into commercial operation in 2006. Lake water is utilised.
- The district cooling systems capacity is designed for a peak customer demand of 75 MW.
- Contracted customers include financial corporations, international hotels, hospitals, law firms, IT companies.
- Additional project Zuid Ost Lob is also of a comparable size to the system in Zuidas.

Benefits from project

- The district cooling system in Zuidas will reduce 70% of the CO₂ emissions that would come from conventional chillers.
- This DC project meets with margin the 50% CO₂ target for the area that the municipality of Amsterdam has set up as a local environmental directive for new developments.
Example Honolulu: Energy Efficiency with DC/SWAC

HSWAC, Honolulu Sea Water Air Conditioning
Capital Cooling: investor & Management
Capacity 28,000 TR
Investments 250 MUSD
Construction start 2011
84,000 tons of CO2 emissions reduction annually
Sea Water intake at 1700 ft

Increased Energy Efficiency when Converting from conventional Air Conditioning to District Cooling

Example: commercial building
- 40% of total electricity consumption
- with DC 5%
- Savings 35%

Honolulu: Electricity use in Buildings

<table>
<thead>
<tr>
<th></th>
<th>Air Conditioning</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage</td>
<td>60%</td>
<td>40%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>District Cooling</th>
<th>Others</th>
<th>Energy Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage</td>
<td>35%</td>
<td>5%</td>
<td>60%</td>
</tr>
</tbody>
</table>
Thank you!