District Cooling
Water Resource Management

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OUTLINE

• GCC Construction Projections
• District Cooling Overview
• Benefits of District Cooling
• GCC District Cooling Facts & Figures
• Water Resource Management
• Moving Forward
GCC Region Construction Figures

• Increase demand due to rise in population & other milestone events.
• In 2010 over $200 billion construction contracts awarded (40% buildings, 40% energy, 20 infrastructure).
• > $900 billion real estate projects are estimated to be underway.
• In the coming few years, > 65% of GCC projects fall under “Buildings”

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District Cooling System consists of:

1. Central chilled water plant
   The plant has reliable and efficient industrial chillers. It is monitored 24 hours a day by qualified operation teams.

2. Pipe distribution network
   Chilled water moves to the buildings through insulated steel pipes.

3. Customer connection
   The chilled water reaches the customer at 5.5 °C, where it is cooled by transferring the heat through the energy transfer station.
District Cooling in Qatar

The Pearl-Qatar
West Bay-Doha

Katara
Mushaireb

Qatar Foundation
Qatar University

Lusail
Barwa City

Al Waab City
New Doha International Airport
Benefits of District Cooling

• Energy Efficient: DC offers energy saving of more than 40-60% compared with conventional air-conditioning systems).

• Environmental Advantage: Energy Savings Translate to Lower Power Generation Requirements, Hence; less CO2 & other greenhouse gases and contaminants to the environment.

District Cooling | Air Cooled Chiller | Window Type | Split Unit
Benefits of District Cooling

• Architectural Benefits: reduces customer plant space by 70%, clean roof (sky gardens, PV systems, etc).
• Less Noise & Vibration.
• Decentralized Plume.
GCC District Cooling Facts & Figures

• DC has proven to be the solution to the challenge of ‘environment, energy and economy’.
• It has been implemented world-wide since the turn of the 20th century & in the GCC region as early as the 1960’s.
• DC has vastly grown throughout the GCC region in the last few years.
• Current DC capacity is approximately 3-million TR & expected to reach over 7-million in the coming 3-4 years.
Water Resource Management

DC relies on water for its operations to make-up for:

– Cooling Tower Evaporation and Drift Losses.
– Blow Down due to Increased Solids Concentration.

DC discharges a portion of the required water out of the plants: to get rid of the concentrated minerals and solids due to evaporation.
Water-Cooled Chillers w/Cooling Towers
Water Type & Source Options

• Potable, RO, & Light-Grey Water:
  ➢ No Special Equipment Design
  ➢ Minimal Chemical Treatment
  ➢ Most Advantageous To Use

• TSE Water:
  ➢ Special Equipment Design (Filtration, Polishing)
  ➢ Additional Chemical Treatment
Water Type & Source Options

• Sea Water Make-Up:
  ➢ Special Condenser & Cooling Tower Design
  ➢ Additional Filtration and Chemical Treatment
  ➢ Different piping material & arrangement

• Direct Sea Water Make-Up:
  ➢ No Cooling Tower Required
  ➢ Length of the Pipeline to be Laid Depends Upon Temperature Of Sea Water
  ➢ Higher Pumping Flow Rates and Pressures
  ➢ Special Condenser Design
  ➢ Special Chemical Treatment
  ➢ Different piping material & arrangement
Flexibility in Make Up source/Discharge

Make up water

Fresh Water

Cooling Tower

Condenser 1

Condenser 2

85°F

95°F

Blow down Water

Storm/Sewer

Irrigation

Other Applications

Your Environment Is Our Priority
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Flexibility in Make Up source/Discharge

Make up water

Treated Sewage
Effluent

Pretreatment

Cooling Tower

Condenser 1
85°F

Condenser 2
85°F

Blow down Water

Sewer

Irrigation

Other Applications
Flexibility in Make Up source/Discharge

Make up water

Sea Water

Cooling Tower

85°F

Condenser 1

85°F

Condenser 2

95°F

95°F

15

Blow down Water

Ocean

www.qatarcool.com
Anticipated Cooling Water Requirements-GCC

Million m³/yr

<table>
<thead>
<tr>
<th>System Configuration</th>
<th>Current (3-M TR)</th>
<th>~ 2015 (7-M TR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decentralized</td>
<td>45.9</td>
<td>107.2</td>
</tr>
<tr>
<td>District Cooling</td>
<td>36.7</td>
<td>85.8</td>
</tr>
<tr>
<td>Estimated Saving</td>
<td>9.2</td>
<td>21.4</td>
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</tbody>
</table>

Basis of Calculations & Assumptions:
- GCC DC Companies’ utilize Efficient Water Management Processes.
- 50% Utilization of total DC Capacity.
- Study/Survey of Decentralized Systems Water Performance is underway. Expected to consume 25% over DC.
Water Resource Management
Continuous Improvement

• Steps Taken to Reduce Water Consumption
  – Proper Chiller & Cooling Tower Maintenance
  – Advanced Automation & Monitoring
  – Water Quality Enhancement Through Mechanical and Chemical Systems
  – Blow Down Recycling
  – Collaboration with Water Treatment Experts
Qatar Cool Plant Performance

<table>
<thead>
<tr>
<th>Performance Parameters</th>
<th>Year 2007</th>
<th>Year 2010</th>
<th>Year 2011</th>
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</thead>
<tbody>
<tr>
<td>Electrical Power Consumption (kW/TR-Hr) (Industry Standard=1-1.1)</td>
<td>1.23</td>
<td>0.93</td>
<td>0.94</td>
</tr>
<tr>
<td>Water Consumption (US Gal/TR-Hr) (Industry Standard=2.0-2.1)</td>
<td>2.06</td>
<td>1.88</td>
<td>1.84</td>
</tr>
</tbody>
</table>

**QC Water Saving @ West Bay ONLY (2009-2012) = 236,765 m³ (around 15% from Industry Standard)**
## Makeup Water & Discharge Quantities @ Different Water Sources

**Million m³/yr**

<table>
<thead>
<tr>
<th>Water Source</th>
<th>Current (3M TR)</th>
<th>~ 2015 (7M TR)</th>
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<tbody>
<tr>
<td></td>
<td>Makeup</td>
<td>Blow down</td>
</tr>
<tr>
<td>Potable</td>
<td>36.7</td>
<td>7.3</td>
</tr>
<tr>
<td>TSE–Polished</td>
<td>40.4</td>
<td>8.3</td>
</tr>
<tr>
<td>Direct TSE</td>
<td>49.5</td>
<td>18.6</td>
</tr>
<tr>
<td>Sea</td>
<td>88.1</td>
<td>56.6</td>
</tr>
</tbody>
</table>
BLOWDOWN WATER

LEVEL TRANSMITTER

BLOWDOWN WATER TANK

TRANSFER PUMPS

HV 3006

BACKWASH SUMP PIT

HV 3007

IRRIGATION TRANSMISSION LINE TO LAKES

COOLING TOWER BLOWDOWN WATER

P - 4A

P - 4B

User: sssssssss
Moving Forward

• This paper presented the flexibility of district cooling systems in relation to the make-up and discharge water, making it capable of providing an optimized solution when combined with other applications.

• Combining DC with other applications requires collaborative efforts among DC Providers, Utility Agencies, Regulatory Agencies, & Law Makers.