The Implementation of Blowdown water Recycle for District Cooling Plants

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In line with Dubai Government’s strategy to conserve water resources and as part of our commitment to reduce the consumption of desalinated water in district cooling, we deployed several Reverse Osmosis plants in our JBR, DHCC and DIFC plants.

- DHCC – TSE – RO (for make-up)
- DIFC – TSE – RO (for make-up)
- JBR RO – Blowdown Recycling

This presentation discusses the implementation of reverse osmosis technology to recycle 70% of the cooling towers blowdown water and reuse it back in the cooling process.
The Jumeirah Beach Residence (JBR) is one of the most prestigious residential areas in Dubai.
It is served by a district cooling plant equipped with centrifugal chillers capable of delivering 60,000 TR per hour at peak load.
The cooling towers would generate a daily 1000 m$^3$ of blowdown water.
The Situation:

• The blowdown water was transported by Tankers to the municipality STP due to the unavailability of any connection with their network.

• Huge OPEX associated with the transport of blowdown water by tankers.

• 20-25 tankers daily during periods of peak load.
The Objective:

• Reduce Blowdown water wastage

• Reduce the cost associated with Blowdown water tankers.
The Solution:

• Reverse Osmosis plant recycling ~70% of the Blowdown water.
JBR RO – Blowdown Recycling

1000 M3/day – Blowdown Recycling RO plant
The Process: 1000 M3/day – Blowdown Recycling RO plant
JBR RO – Blowdown Recycling

Recovering 65-70% of the total Blowdown water.

JBR - Blowdown Rate Reduction

Blowdown (IG/TR)

2009  2010  2011  2012  2013  2014

Blowdown Rate
Reduced Cooling Tower Make UP requirement by ~16% from 2009 till 2014 (increased CoC)
Reduced the No. of Tanker trips and the cost associated with it by 60%.

<table>
<thead>
<tr>
<th>Year</th>
<th>Imp. Gal.</th>
<th>CT Blowdown</th>
<th>RO production</th>
<th>Waste Water (RO reject)</th>
<th># of 10,000 IG tankers</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009 (before RO)</td>
<td>18,540,000</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>1854</td>
</tr>
<tr>
<td>2014</td>
<td>22,260,000</td>
<td>15,000,000</td>
<td>8,800,000</td>
<td></td>
<td>880</td>
</tr>
<tr>
<td>2015</td>
<td>24,600,000</td>
<td>17,000,000</td>
<td>9,800,000</td>
<td></td>
<td>980</td>
</tr>
</tbody>
</table>
**The Results:**

- Reduced water wastage by 60%.
- Increased the Cycles of Concentration on the Cooling Towers and improved water efficiency.
- Indirectly reduced the carbon emissions by reducing the number of daily tankers by 60%.
- Implemented an economically viable solution – paid back its capital investment in less than 3 years.
The Challenges:

• The chemical nature of the cooling tower blowdown water
• The temperature of the blowdown water.

The combination of both factors resulted in the RO feed being aggressive and shortening the lifetime of the RO membranes.
Value-Added Engineering:

- Installed a PHEX to cool the RO feed water down to temperatures within the proposed RO membrane manufacturer projections.
The Results:

• Salt passage of the membranes reduced from 9.3% down to 6.6% (improved product water quality).

• Recovery increased from 70% up to 75%. (increased production).

• Delta P on the membranes has improved. Reduced from 2.87 bar down to 2.2 bar.
Future developments:

1- Conducting studies to introduce TSE water into the JBR plant utilizing the same RO plant.
THANK YOU