‘Efficient Energy for Smarter Cities’
Delta T Syndrome, Why & How?

10th December 2018
“Sustainability is our top priority”

: His Highness Sheikh Mohammed Bin Rashid Al Maktoum
1. Present case studies- **Delta T** optimization.

2. What is the impact of **Delta T** on Facilities / Buildings and District cooling Plants.

3. How ‘Delta’ as a company is helping operate energy efficient smart cities?
• Inefficient use of chilled water system, draining the benefits of district cooling system itself.

• Higher electrical consumption at the District cooling plant.

• Higher electrical consumption at the secondary and distribution lines due to over pumping of chilled water.

• Higher equipment life cycle cost.
Typical causes of Delta T

- Inadequate / wrong control logic.
- Wrong Index point selection and its set point, generally not evaluated using Hydronic model.
- Lack of proper commissioning.
- Un-calibrated/ non-operational flow control valves.
- Operators / user education.
- Change of design especially in ‘Shell & Core’ building arrangement.
- Design issues, lack of provisions for a proper counter checks.
**Typical Example**

- **Main ETS (Cold side)**
- **CV**
- **HEX**
- **T<sub>S</sub>**
- **T<sub>R</sub>**
- **T<sub>1</sub> L25 to L64**
- **T<sub>2</sub> L22 to L50**
- **T<sub>H</sub>** (Hot side)

**TT Terms:**
- **T<sub>SC</sub>** – TT at cold side supply line
- **T<sub>RC</sub>** – TT at cold side return line
- **T<sub>SH</sub>** – TT at hot side supply line
Methodologies

Data Analysis

Design Review

Design Simulation

Hydronic Calculation

Recommendations

Implementation

Index point

Recommissioning/adjustments

Trail Runs

Fine Tuning

INTELLIGENTLY DIFFERENT
Case 1

Due Diligence - Delta T

- Project: Residential & Offices
- Cooling capacity: 9,900 TR.
- Location: Dubai.
- Developer: NDA.
- Status: Study completed.
The overall Delta-T on the secondary side was low as compared to the design Delta-T of 9.0°C.

The supply temperature on the secondary side was higher compared to the primary side.
Design review – Chilled Water Flow

- As per the load profile, additional Chilled water was being pumped compared to the corresponding design flow required.

- The extra flow pumped in BB06 (107%) & BB07 (98%) was very high.
<table>
<thead>
<tr>
<th>Buildings</th>
<th>Load as per heat load calculation (TR)</th>
<th>Load based on cooling area (TR)</th>
<th>Capacity of HEX connected (TR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BB01</td>
<td>567.11</td>
<td>508.00</td>
<td>1462</td>
</tr>
<tr>
<td>BB02</td>
<td>521.2</td>
<td>481.34</td>
<td>1142</td>
</tr>
<tr>
<td>BB03</td>
<td>398.11</td>
<td>386.20</td>
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<tr>
<td>BB06</td>
<td>253.88</td>
<td>234.81</td>
<td>990</td>
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<tr>
<td>BB07</td>
<td>417.47</td>
<td>386.34</td>
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<tr>
<td>BB10</td>
<td>272.54</td>
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<tr>
<td>BB13</td>
<td>447.53</td>
<td>434.30</td>
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</tbody>
</table>
Delta T

Cost Savings
Operating the chilled water system as per design conditions of the building by manual changes on pumps and control valves.
Simulation Results

Flow Trend Pre-Simulation

Flow Trend Post-Simulation
Simulation Test Results

**Delta T Pre-simulation**

![Diagram showing temperature differences before simulation for BB06 and BB07 buildings.]

- **BB06**: Delta T = 4.64°C, Delta T Meter = 6.55°C
- **BB07**: Delta T = 6.18°C, Delta T Meter = 7.23°C

**Delta T during Simulation**

![Diagram showing temperature differences during simulation for BB06 and BB07 buildings.]

- **BB06**: Delta T = 8.00°C, Delta T Meter = 9.12°C
- **BB07**: Delta T = 7.17°C, Delta T Meter = 9.24°C

Legend:
- **Blue**: DELTA BTU Meter Delta T
- **Red**: Primary side Delta T
- **Yellow**: Secondary side Delta T
• Index circuit is the FAHU-BH-R-1 located on the roof.

• Existing location of DP switch is valid.

• Recommended index point set-point value is 93.7 kPa.

• Recommended pump head value is 317 kPa.
Due Diligence & Implementation

- Project: Mixed use development
- Cooling capacity: 12,000 TR.
- Location: Abu Dhabi.
- Status: Fine tuning.
• The overall Delta-T on the main ETS was 3.42°C.
As per the load profile, additional Chilled water was pumped compared to the corresponding design flow required.

The extra flow pumped on the main ETS was 149% compared to the design flow.
Root Causes

1. Controls logic.

2. Non-industrial grade pressure transmitters.

3. Integration of PT with CHW pumps.

4. Bypassed flow control valves.

5. Lack of CHW balancing provisions.

Results

Delta T Pre & Post - Implementation

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>Buildings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before</td>
<td>3.42</td>
</tr>
<tr>
<td>After</td>
<td>7.8</td>
</tr>
</tbody>
</table>

I N T E L L I G E N T L Y D I F F E R E N T
DTP Analysis

DPT function test

Time (Minutes)

Flow/Load

Delta T

Flow

Series1

Set point

INTELLIGENTLY DIFFERENT
How is Delta helping operate energy efficient smart cities

1. Lowering the energy consumption on secondary side pumping system.

2. Improving the efficiency of DCPs by ensuring they get the correct return water temperature.

3. Overall cost savings for all stake holders by optimized use of chilled water.
“Head quartered in the world’s most iconic smart city, Dubai, Delta is adding value to the **Sustainability goals** by staying **True** to our **Values** and being **INTELLIGENTLY DIFFERENT.”

CEO,
Delta District Cooling Services.
Thank you!

Appreciate your patience…..!