Water Conservation, Industrial Cooling Challenges and Titanium
Industrial Process Cooling: A Balancing Act

Sustainability

Plant Design

Efficient

Reliable

Profitable

Water

Energy
# Heat Exchanger Services Employing Titanium

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<th>Heat Exchanger Service Type</th>
<th>Power Gen</th>
<th>Refining</th>
<th>Chemical / Petrochem</th>
<th>LNG FLNG</th>
<th>Desalination</th>
<th>District Cooling / Heating</th>
<th>Mining / Metals</th>
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Craig Thomas

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Industrial Process Cooling Methods

Recirculating Water
Evaporative Cooling

Once Through Water
Direct or Indirect
Industrial Cooling Water Challenges

- Availability
- Sustainability
- Environmental impact
- Corrosion / erosion
- Fouling
- Materials & capital cost
- Treatment & operating cost
Industry Trends & Best Practices

LNG

District Cooling

Petrochemical
District Cooling

Green Cities – Sustainable Future?
District Cooling: Energy & Water In the Balance

- Energy Savings: Up to 30%
- Water consumption: Up to 100 Gal / person / day
- Limited fresh water for industrial use.
- Sustainable Solutions:
  - Seawater
  - Treated Sewage Effluent (TSE)
20 Year Life Cycle Cost Example
District Cooling Plant

2008 study based on using DEWA municipal water (Dubai) used for evaporative cooling tower make-up.
Material Selection: Chiller Tubes

- **Titanium:**
  - Immune to corrosion / erosion
  - 2X Chiller CAPEX
  - Efficiency loss vs. copper alloy: - 4 % KWT
  - May be offset by increased water flow rate

- **Copper Alloys:**
  - At risk with TSE or seawater
  - TSE requires expensive treatment or “polishing”.
  - Tubes must be kept clean, no room for error.
  - Can’t use ID enhancement in seawater—erosion.
Summary

• Water cooled systems are more energy efficient than air cooled.
• Remote plant sites have limited access to fresh water.
• Urban plant sites can conserve fresh water by using seawater or wastewater.
• Restriction on fresh water use for industrial cooling are increasing.
• Wastewater must be treated at considerable expense to be suitable for most alloys.
• Titanium is immune to the corrosive effects of seawater and wastewater.
• Titanium offers developers and engineers a flexible and sustainable solution to changing water conditions.
Thank you!