Titanium Use in Desalination Market
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1. Desalination Market


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<th>World contracted capacity (million m³/d) and Market Share (%)</th>
<th>Annual Growth</th>
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<tr>
<td></td>
<td>2010</td>
<td>2015</td>
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<tr>
<td>Overall</td>
<td>65</td>
<td>100%</td>
</tr>
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<td>Reverse Osmosis</td>
<td>39</td>
<td>60%</td>
</tr>
<tr>
<td>Thermal</td>
<td>26</td>
<td>40%</td>
</tr>
<tr>
<td>MSF</td>
<td>19</td>
<td>74%</td>
</tr>
<tr>
<td>MED</td>
<td>6</td>
<td>24%</td>
</tr>
</tbody>
</table>

Source: GWI

Thermal Market

- Mainly in GCC Area
- Large Projects are tendered through IWPP Model:
  - Operation and Financing provided by private companies (developers)
  - Technical solutions are optimized to minimize investments and operation costs
- Average newly contracted capacity (2010-2015): 1.8 m m³/d

=> Yearly investment in new thermal capacities:
2 500 to 3 500 m$
2. SIDEM Introduction

- SIDEM is part of VEOLIA Environment through VEOLIA Water System
- Turnover in 2009: 465 m€
- Main Activity: Design & Build Thermal Desalination Plant
- World Leader in MED Technology
- Overall Build Capacity:
  - MED: 3 000 000 m3/d (50% of World MED Capacity)
  - MSF: 1 000 000 m3/d
  - Marafiq IWPP (KSA): 800 000 m3/d
  - Fujairah 2 IWPP (UAE): 600 000 m3/d
  - Ras Laffan C IWPP (Qatar): 300 000 m3/d
2. SIDEM Introduction

Fujairah F2 IWPP
3. Titanium in Desalination Market

**Standard Utilization**

- Titanium is not used in Reverse Osmosis Technology (RO)
- Titanium in Thermal Market is mainly used in the exchangers tubes:
  - *Wall Thickness: from 0.4mm to 1.0mm*
  - *Diameter: from 15mm to 50mm*
  - *Length: from 5.0m to 25m*
- Titanium is chosen for:
  - *a high corrosion resistance*
  - *a relative competitiveness (vs. Copper Alloy, Stainless Steel)*
- **Standard Application:**
  - → Titanium Tubes are usually:
    - *In Evaporators Bundle (Partially)*
    - *In Associated Sea Water Heat Exchangers*
  - → Used where corrosion risk is high.
  - → Ti Tubes is 10% of the tube bundle – 90% is Copper Alloy Tubes
- The titanium ratio in standard cases is in average: **1.2 kg / m³/d**
3. Titanium in Desalination Market

- Heat Exchangers: 100% Titanium
- Evaporator Tubes: 95% Copper Alloy, 5% Titanium
3. Titanium in Desalination Market

Evolution of Titanium Utilisation

• MED Technology
  ➔ Lower corrosion risk
    *Al Brass is still much more competitive than Titanium: no change foreseen*
    *Stainless Steel could replace Titanium if Ti Cost increase*
  ➔ Example: 2006 – Layyah D13 (UAE) – 36,000 m3/d
    *Titanium Tube Price above Ti base 125: Titanium Tubes replaced by SS Tubes*
    *Titanium Ratio: 0 kg / m3/d*

• MSF Technology
  ➔ Higher corrosion risk
    *Copper Alloy tubes are now less competitive than Titanium tubes*
    => *Copper Alloy are replaced by Titanium tubes*
  ➔ Example: 2010 – Ras Az Zour (KSA) – 1,000,000 m3/d
    *Titanium Tube Price below Ti base 90: Copper Alloy replaced by Titanium*
    *Titanium Ratio: 6.2 kg / m3/d*

=> The relative price of metals & the technology choice will drive the use of Titanium in Thermal Plants
4. Perspectives

1st Case: Titanium and Copper price level stay stable

Titanium needs for Desal Projects vs. Technology Market Share

- MED - 100%
- MSF - 100%
- MED 70% / MSF - 30%

Ras Az Zour Project (KSA)

Ti base 100 and Cu base 100
4. Perspectives

2nd Case: Titanium price increase or Copper/SS decrease

Titanium needs for Desal Projects vs. Technology Market Share

Ti base > 125 or Cu base < 80 after 2013
Conclusion

- Water needs will lead to huge investments in Desalination Capacities in the next 5-10 years

- Thermal Technology will take an important part of these investments which will create an opportunity for Titanium producers

- However the choice of technology (MED vs. MSF) & the relative price level of metals (Ti vs. Cu) will have a huge impact on the titanium needs for thermal desalination.

- Stability of titanium prices will maximize titanium use in coming desalination project