Industrial Titanium Demand Forecast
2013

Kevin J. Cain
Overview and 5-Year Forecast

an

Joint Venture
Key Findings

- The world’s population will rise more than 25% from 2010 to 2040 reaching 9 billion.
- A majority of the population growth will reside in Africa, India, China and other developing countries.
- The global economy is expected to grow an average of 2.8% per year from now through 2040.
- Economic growth in the developed countries will be led by the USA.

• 7.1 billion now ~ 10 billion by 2050

Regional GDP Growth

Source: IMF 5 year forecast: April 2013 (growth at constant prices)
Key Findings

- The world’s population will rise more than 25% from 2010 to 2040 reaching 9 billion.
- A majority of the population growth will reside in Africa, India, China and other developing countries.
- The global economy is expected to grow an average of 2.8% per year from now through 2040.
- Economic growth in the developed countries will be led by the USA.

Industries for Ti consumption

- Energy
- Chemical Processing
- Desalination
Energy Outlook

- Global energy demand will increase by 35% over the next 30 years.
- Approximately 65% of that growth will come from developing countries.

Source: Exxon Mobil
Energy Outlook

- Oil & Gas
- Power Generation
The role of unconventional fuel

- Global liquid fuel supply & resources

Liquid fuel supply by type

- Conventional crude and condensate
- Deepwater
- Tight oil
- Oil sands
- Natural Gas
- Other
- Biofuels

Million barrels per day oil equivalent

Source: EIA
The role of unconventional fuel

- Conventional vs. Unconventional Gas

**Natural gas supply**

- Rest of world unconventional
- North America unconventional
- Rest of world conventional
- North America conventional

**North America natural gas demand by supply type in 2040**

- Unconventional
- Local Conventional
- LNG

80%

By 2040, close to 80% of North America gas supplies will be produced from local unconventional resources

Source: ExxonMobil
• Demand for oil is forecasted to increase by 30% over the next 30 years (Exxon Mobil).
• Natural gas is likely to increase 60%. Growth in unconventional supplies to account for 60% of the increase (Exxon Mobil).
• Use of titanium
  • Deepwater platforms
  • FPSO’s (Floating Production, Storage & Offloading Vessel)
  • LNG plants
  • Degasification plants
  • Water filtration / purification plants
  • Heat transfer equipment
• Approximately 3500 MT to 5000 MT will be consumed per year over the next 5 years. *(Source: Internal estimate).*
Energy Outlook

- Oil & Gas
- Power Generation
World Net Electricity Generation


* CAGR: Compound Annual Growth Rate
The role of unconventional fuel

- Remaining global natural gas resources

<table>
<thead>
<tr>
<th>Region</th>
<th>Unconventional</th>
<th>Conventional</th>
</tr>
</thead>
<tbody>
<tr>
<td>North America</td>
<td>4.0</td>
<td>0</td>
</tr>
<tr>
<td>Latin America</td>
<td>2.8</td>
<td>0</td>
</tr>
<tr>
<td>Europe</td>
<td>1.6</td>
<td>0</td>
</tr>
<tr>
<td>Africa</td>
<td>3.1</td>
<td>0</td>
</tr>
<tr>
<td>Middle East</td>
<td>4.8</td>
<td>0</td>
</tr>
<tr>
<td>Russia Caspian</td>
<td>6.6</td>
<td>0</td>
</tr>
<tr>
<td>Asia Pacific</td>
<td>4.8</td>
<td>0</td>
</tr>
</tbody>
</table>

World total: 27,900 trillion cubic feet

Source: ExxonMobil
• New Online Capacity

Source: Internal estimate

* CAGR: Compound Annual Growth Rate
Electricity: Titanium Demand

- Approximately 7000MT to 8000MT will be consumed per year over the next 5 years.
- Use of titanium
  - Welded tubes
  - Tube sheets
  - Heat transfer equipment

Source: Internal estimate
Industries for Ti Consumption

• Energy
  • Oil & Gas
  • Power generation
• Chemical Processing
• Desalination
• Global investment in Asia and Middle East
• Capital investment shifting to North America.
  • Natural gas liquids (NGL)
  • $100b of incremental capital investment by 2025
• Global capital expenditures
  • NGL’s
  • PTA (pure terephthalic acid); polyester film and filter production
  • Urea/ammonia nitrate; crop fertilizer
  • Chlorine/caustic soda

Source: Bank of America Industry Overview May 20, 2013
• Titanium end-use applications
  • General fabrication of tanks and vessels
  • Piping systems
  • Heat transfer equipment
  • Fittings and fasteners
  • Welded tubing

• It’s estimated that the average annual consumption of titanium in the chemical process industry will range from 9,500 MT to 12,000 MT.

Source: Internal estimate
Industries for Ti Consumption

- Energy
  - Oil and gas
  - Power Generation
- Chemical Processing
  - NGL’s
  - PTA
  - Urea
  - Chlorine / Caustic
- Desalination
Desalination

- **Applications**
  - Removes salt from seawater for and potable end use
  - Clean wastewater streams (ex. Frac flow back water from shale gas)

- **Technologies**
  - Reverse osmosis (RO)
  - Thermal (MSF and MED)
Desalination

- Technology Split – 2013 to 2018

**Contract Value ($ million)**

- MED: 4,400
- MSF: 6,100
- RO & ED/EDR: 58,700

**million m³/d**

- MED: 5%
- MSF: 6%
- RO & ED/EDR: 89%

Source: Desaldata Forecast, June 2013
• Industry rather than municipal is strongest driver

• Capital expenditure will grow from $2.8b (2011) to $5.7b (2017)

• Fastest growing economic regions also have the lowest amount of fresh water; India, China and the Middle East

• Copper (copper alloy desal tubes) released into the sea from Gulf Coast desal plants is becoming problematic and could drive future technology in favor of titanium
  (Source: Dr. Ing Tobias Bleninger & Professor G.H. Jirka, PhD, Karlston Institute of Technology, Germany)
• Regional Desal Demand

Source: Desaldata Forecast, June 2013
• Capacity Forecast

Desalination: Thermal

Source: Internal Estimate * CAGR: Compound Annual Growth Rate
Thermal Capacity: Desalination

• The pipeline for titanium mill product shipments to the start-up of a desal facility can range from 1 to 3 years.

• In the last 3 years nearly 12,000MT of coil for welded tube was produced to support the Ras Al Kahir (Ras Az Zour) and Yanbu III projects.
  • Doosan Heavy Industries is the contractor on both projects.

• For the next 5 years capacity will grow at a 6% CAGR (compound annual growth weight).

• Titanium demand will range from 750MT to 2000MT per year over the next 5 years.

Source: Internal estimate
Industries for Ti Consumption

- Energy
  - Oil and gas
  - Power generation
- Chemical Processing
  - NGL’s
  - PTA
  - Urea
  - Chlorine / Caustic
- Desalination
  - MED
  - MSF
Industries for Ti Consumption

• Others
  • Medical
  • Mining
  • Cathodic Protection
  • Automotive
  • Recreational
  • Shipbuilding / Marine
  • Architecture
Industries for Ti Consumption
(Source: Architectural Titanium)
• 2011 through 2013: Average industry shipments; 33,000MT
• 2014; 29,000MT
• 2014: Decline in desalination, continued improvement in other major industrial sectors.
• From 2014 to 2018: 29,000MT to 35,000MT with support of Chemical processing, Energy and Desalination infrastructure industries.

Source: Internal estimate
Titanium Industrial Demand
History and Forecast

Historical:
- Chemical Processing
- Power
- Automotive
- Metallurgy
- Oil & Gas
- Chlor-alkali
- Desalination
- Architecture
- Shipbuilding
- Med. & other

Forecast:

Source: Internal estimate

* Does not include shipments within China
Industrial Titanium Demand Forecast
2013

THANK YOU!

Kevin J. Cain
President, Uniti Titanium

an

Joint Venture