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VSMPO-AVISMA Corporation

Joint Venture
Industrial Titanium Demand Forecast 2015

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Overview & 5 Year Forecast
• A 50% drop in oil prices and the rapid reduction in capital spending.
• Energy mix changes; away from coal and oil to natural gas and renewables.
• New sources of energy have emerged.
• Demand shifts between the various global markets.
• New government policies are being created to address climate change.
Global Population Growth Continues
7.35 billion now ~ 10.16 billion by 2050


Regional GDP Growth

Source: IMF 5 year forecast: April 2015 (growth at constant prices)
Industries for Ti consumption

- Energy
- Chemical Processing
- Desalination
World energy consumption, 1990-2040

history

1,000

quadrillion Btu

800

600

400

200

0

1990
2000
2010
2020
2030
2040

projections

Non-OECD

OECD
Energy Outlook

• Oil & Gas
• Power Generation
Worldwide Rig Count

Source: Baker Hughes
Demand for Oil Over the Next 20 Years Increases 15-20%

Source: BP Energy Outlook 2035
Natural Gas Production Will Increase by 40-50% Over the Next 20 Years

*million tonnes oil equivalent

2015 2020 2025 2030 2035
• Demand for oil is forecasted to increase by 15% to 20% over the next 20 years (Exxon Mobil)

• Natural gas is likely to increase 45-50%. Growth in unconventional supplies to account for 60% of the increase.

• Use of titanium
  - Deepwater platforms
  - FPSO’s (Floating Production, Storage & Offloading Vessel)
  - LNG plants
  - Floating LNG plants
  - Water filtration / purification plants
  - Heat transfer equipment

• 2015 is estimated to drop by 20% to 25% from 2013/14 levels. Expansion is forecasted to occur in 2017 and beyond.
**Exxon, BHP Billiton Get Approval for Scarborough FLNG**

- **Gas Treatment**
  - Remove condensates, brines, hydrogen sulfides & carbon dioxide

- **Liquefaction**

- **Transport**

- **Statistics**
  - 495 meters long x 75 meters wide
  - Process 6-7 million tons per annum of LNG
  - Location: W.Australia

Source: www.offshoreenergytoday.com
Energy Outlook

- Oil & Gas
- Power Generation
World Net Electricity Generation

- OECD Americas: 3.2% CAGR
- OECD Europe: 1.3% CAGR
- OECD Asia: 3.5% CAGR
- Europe and Euraisa: 3.2% CAGR

*Energy production comprises commercially traded fuels, including modern renewables used to generate electricity.

*Energy consumption comprises commercially traded fuels, including modern renewables used to generate electricity.

Source: BP Energy Outlook 2035
Energy Demand – Global Power Generation

2000 DATA
144 Quadrillion BTUs

- Oil: 9%
- Gas: 19%
- Coal: 43%
- Nuclear: 21%
- Renewables: 8%

2040 FCST
291 Quadrillion BTUs

- Oil: 3%
- Gas: 17%
- Coal: 33%
- Nuclear: 28%
- Renewables: 19%

Source: Exxon Outlook for Energy: A View to 2040
GW Forecast by Fuel Type – new on-line capacity

Source: BP Energy Outlook 2035 & Uniti Titanium Marketing Intelligence
Energy Demand by Type

2000 DATA
418 Quadrillion BTUs

- Oil: 38%
- Gas: 22%
- Coal: 13%
- Nuclear: 6%
- Renewables: 21%

2040 FCST
717 Quadrillion BTUs

- Oil: 32%
- Gas: 26%
- Coal: 19%
- Nuclear: 15%
- Renewables: 8%

Source: Exxon Outlook for Energy: A View to 2040
Electricity: Titanium Demand

- Approximately 6000MT will be consumed per year over the next 5 years.
- Use of titanium
  - Welded tubes
  - Tube sheets
  - Heat transfer equipment

Source: Internal estimate
• 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
  - PTA (pure terephthalic acid); polyester film and filter production
  - Urea/ammonia nitrate; crop fertilizer
  - Chlorine/caustic soda
  - Natural Gas Liquids (NGL), ethane and propane for use in plastics and other building block chemicals.
The multibillion dollar Baytown expansion will create 10,000 jobs at peak construction. Source: ExxonMobil “An interview with Neil Chapman”

Construction at Chevron Phillips Chemical’s Cedar Bayou 1-Hexene plant in Baytown will be completed in early 2014. The expansion there and at other Chevron Phillips plants along the Gulf coast was prompted by low natural gas prices. (Chevron Phillips) Source: Chevron Phillips

Bechtel-Linde Consortium to build Large-scale Ethylene Plant at ExxonMobil Baytown Complex
• 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 be 10,000MT per year for the next 5 years.
Industries for Ti Consumption

• Energy
  - Oil and gas
  - Power Generation

• Chemical Processing
  - NGL’s
  - PTA
  - Urea
  - Chlorine / Caustic

• 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)
Technology Split – 2013 to 2018

Contract Value ($ million)

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

Source: Desaldata Forecast, June 2013
Desalination Forecast Drivers

- Industry rather than municipal is strongest driver
- The Saudi Water Authority (SWCC) plans to invest $80b by 2025. (Arabianbusiness.com)
- Fastest growing economic regions also have the lowest amount of fresh water; India, China and the Middle East
- Copper (copper alloy desal tubes) release into the sea from Gulf Coast desal plants is becoming problematic and will drive future technology in favor of titanium.
- Titanium consumption is estimated to be in the 2000MT per year range with the possibility to grow to 3000MT by 2020.
Industries for Ti Consumption

- Energy
  - Oil and gas
  - Power Generation
- Chemical Processing
  - NGL’s
  - PTA
  - Urea
  - Chlorine / Caustic
- Desalination
• Others
  ➢ Mining
  ➢ Cathodic Protection
  ➢ Automotive
  ➢ Recreational
  ➢ Shipbuilding / Marine
  ➢ Architecture
Industrial Titanium Demand Forecast
History and Forecast

* Does not include shipments within China and Russia.
Thank You!

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