A World Leader in Titanium

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Allegheny Technologies Inc  VSMPO-AVISMA Corporation

Joint Venture
Industrial Titanium Demand Forecast 2016

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Overview & 5 Year Forecast

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Near Term Market Influences

• Oil prices fixed in the $40 to $50 per barrel range, the “new normal”

• New technologies have ushered in a new era of energy abundance and diversity

• Major demand shifts between the various markets

• New government policies are being created to address climate change
Industries for Ti consumption

- Energy
- Chemical Processing
- Desalination
Energy Outlook

• Oil & Gas

• Power Generation
Scraping the Barrel
2016 capital expenditure forecast of 10 large publicly-traded oil companies, billions

Source: FactSet | WSJ.com
Upswing
Brent crude-oil, continuous front-month contract

$120 a barrel

Thursday: $50.89

Source: WSJ Market Data Group

THE WALL STREET JOURNAL.
Oil Refinery
(photo courtesy of SATORP)
Worldwide Rig Count

Source: Baker Hughes
• Oil & Gas infrastructure demand cycle is expected to reach bottom in 2016 / early ‘17.

• The over supply of oil and gas is expected to come into balance with demand by 2018.

• Rising oil and gas prices are expected to generate additional investment in 2018 through the end of our forecast period.
Energy Outlook

• Oil & Gas
• Power Generation
Electricity demand by region
Thousand TWh
Primary inputs to power

![Graph showing primary inputs to power from 1965 to 2035. The graph indicates a decrease in the percentage of energy from Oil, an increase in the percentage of energy from Gas, and a steady increase in the percentage of energy from Renewable sources.](image-url)
Combined Cycle Gas Power Plant
• Global power demand is expected to grow through 2040.

• Fuel mix changes significantly; coal losing and renewable and combined cycle gas gaining and nuclear holding steady.

• Growth rate of carbon emissions slows considerably; still not enough to satisfy policy makers, more changes on the way.

• Concern of power plant over capacity in China.
China’s Coal-Plant Binge Deepens Overcapacity Woes

China is building power plants it doesn’t need amid low coal prices and local efforts to create jobs.
Upside potential influenced by

- Renewable energy growth
- Government policies to reduce CO² emissions
- Capacity rationalization in China
- Energy efficiency gains

Moderate Titanium Growth
**Petrochemicals;** producers of olefins, ethylene, methanol, etc.

**Inorganic chemicals;** acids, compounds (sodium, phosphate, etc)

**Industrial Gases;** hydrogen, argon, nitrogen, etc.

**Plastics**

**Chlor-Alkali**
CPI “Mega Trends”

Increases in GDP impact consumer goods, fertilizers, fabrics, etc

Climate change; increased use of shale gas & shale gas liquids

Urban construction; building materials

Transportation; more cars & trucks, hydrocarbons for fuel, plastic parts, etc
Chemical demand by region

Quadrillion BTUs

- Rest of World
- Key Growth
- India
- China
- OECD32
- United States

2000 2020 2040
• Expected growth through the end of the decade
• $80 billion of new petrochemical projects already announced
• Positive titanium demand through the forecasted period.
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)
• Key to Thermal technology is its application in large volume desal plants. The current oil price makes these projects less justifiable.
• In MENA, it’s reported that for several countries, their basic water needs are covered.
• Through improved flexibility, efficiency and lower operating costs versus thermal, reverse osmosis is now being considered for a broader range of desal designs.
• Flat to a declining titanium market.
Industries for Ti Consumption

Energy
- Oil and gas
- Power Generation

Chemical Processing
- Petrochemical; producers of olefins, ethylene, methanol, etc.
- Inorganic chemicals; acids, compounds (sodium, phosphate, etc)
- Industrial Gases; hydrogen, argon, nitrogen, etc
- Plastics
- Chlor-Alkali

Desalination
Secondary Markets

- Mining
- Shipbuilding
- Cathodic Protection
- Automotive
- Recreation & Consumer
- Architecture
Oil & Gas; believed to reach bottom in 2016, second half 2017 is expected to bring moderate growth.

Power Generation; Increased funding for renewables, improved energy efficiency and capacity rationalization is expected to keep this segment from expanding beyond a moderate level.

Desalination; Ti industry will string together three positive shipment years: 2015, 2016, 2017. Currently there are no “signature” thermal projects in the forecasted for 2018. Only one is in our forecasted 2019.

The Chemical process industry is a broad and diversified market segment. It continues to show signs of expansion and growth in the out years.

The secondary markets are expected to remain active and comprise 15% to 20% of the overall.
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* Does not include shipments within Russia and China
THANK YOU

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