Alaska World Affairs Council
Northrim Oil and Gas Speaker Series

Natural Gas as The 21st Century Economic Game Changer: Could Petrochemicals Help Alaska to Up Its Game

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- Reserves: Our use of the term “reserves” in this presentation means SEC proved oil and gas reserves.
- Resources: Our use of the term “resources” in this presentation includes quantities of oil and gas not yet classified as SEC proved oil and gas reserves. Resources are consistent with the Society of Petroleum Engineers 2P and 2C definitions.
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Shale Gas Changes the Game

US Natural Gas Production, 1990 to 2040

- Shale Gas
- All Other Gas Sources
- LNG
- Gas to transport
- Gas to liquids
- Gas to power
- Gas to Chemicals

Source: Department of Energy
What is Shale Gas and Where is the NA Supply?

Innovations in technology make shale gas more readily available

An abundance of shale gas basins exist in North America

Source: National Energy Board
Chemicals: Building Blocks for Modern Society

Raw Materials

- OIL
- GAS

Base Chemicals → Intermediates → Specialties → Consumers

Innovation and Technology ➔ Adding Value to Hydrocarbons

Packaging  
Carpet  
Detergents  
Pipe

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**Petrochemicals is a Global Business**

### Key Players

1. BASF
2. ExxonMobil
3. Sabic
4. Dow Chemical
5. Sinopec
6. Royal Dutch Shell
7. DuPont
8. LyondellBasell
9. Mitsubishi Chemical
10. Ineos Holdings

### Ethylene Production by Region (million metric tons)

- **Asia**: 60 (2022), 40 (2012), 20 (2007)
- **Middle East**: 15 (2022), 10 (2012), 5 (2007)

Source: IHS
Three Keys to Success for Chemical Investments

- Access to low cost raw materials
- Access to growing markets
- Competitive and stable investment climate

Production Costs per ton

Cumulative Ethylene Capacity (million tons)

Source: IHS
Lessons From Fast Growing Chemical Production Centers

Case Studies

US Gulf Coast
- 95% of US capacity located in the Gulf Coast
- Ethane feedstock accounted for 65% of ethylene production in 2012, a 15% increase in 10 years

Middle East
- Middle East increased production from 2.5 to nearly 20 million metric tons from 1990 to 2010
- Production accounted for 18% of global production in 2012

China
- Production increased by 5X in 10 years
- Capacity expansions continue to be announced in the area

Source: IHS
Gas Decouples from Crude as Shale Production Grows

Products made from gas sold at crude related price

Source: IHS
North America Becomes More Competitive Globally

2007 Production Costs

2013 Projected Production Costs

Source: IHS
**Chemicals Demand Grows Faster than GDP, Gas and Oil**

Global demand change since 1980

- Oil
- Gas
- GDP
- Ethylene

![Graph showing demand change]

*Building blocks for modern society*

- Ethane → Ethylene → Polyethylene
Developing Economies Drive Chemicals Growth

Significant scope for more plastic consumption with increased wealth

Plastics Consumption per capita (kg) vs. GDP per Capita ($)

Population 1 bn
- US
- Japan
- EU

Population 5.5 bn
- Brazil
- India
- China
- Africa
- World Average

Source: Various publicly available data
Competitive and Stable Investment Climate

- Think long term
- Competitive fiscal policies
- Strong community support
- Predictable regulatory framework
- Proactive economic development strategy
- Project execution capability
  - Infrastructure
  - Land
  - Skilled labor
Economic Impact of Chemicals Investment

INVESTMENT PHASE
(building the facility)

- **$2.8 billion** economic output during peak construction year
- **10,000** Direct jobs
- **18,000** Total jobs

OPERATION PHASE
(ongoing operations)

- **$4.8 billion** annual economic output
- **400** Direct jobs
- **2,000 up to 8,000** Total jobs

 Across 10 county region

Source: Pennsylvania Economy League of Greater Pittsburgh: Regional Economic Impact Analysis of Proposed Petrochemical Facility
Scope and Scale of a Petrochemical Complex

Construction  Steam and Utilities  Furnace

Shell’s Facility in Singapore
Chemical Investment Opportunities in Appalachia

- Advantaged feed
- Close proximity to end-use industries
- Strong local/regional support
- Benefits local economy

Polyethylene (PE)

- Ethylene
- Co-monomer

Polyethylene resin

- Pipe
- Bottles
- Film
Summary: Big Opportunities for Chemicals in North America

- Abundant supplies of natural gas boosts prospects for NA Chemicals

- Chemicals Industry is responding to take advantage of low cost raw materials with new investments

- Many new units announced for the Gulf Coast but other locations are becoming attractive as gas production expands

- Growing Chemicals exports will flow to Asia and South America
Information Resources

- Local Alaska Business Contacts
  - Curtis Smith  +1-907-646-7182
  - Peter Scott   +1-907-771-7240

- http://www.shell.us/aboutshell/projects-locations/alaska.html

- Shell Media Line – 713-241-4544

- 2012 Annual Report and 2012 Sustainability Report available through www.shell.com