Russell Heinen
Senior Director of Technology & Analytics

“A US Chemical Renaissance”
The Chemical Industry is a key enabler of modern living.

Investments driven by cost advantage, proximity to demand centers and technology.

Demand growth driven by penetration of low-cost end-use products aligned with consumer markets.

Understanding the entire value-chain is essential for long term success.
Demand for Basic Chemicals Driven By Durable/Non-durable Goods

- Basic chemicals & plastics are the feedstocks for many consumer goods
- Fundamental economic growth drives basic chemical demand
- Sustained global GDP growth is needed to support new basic chemical capacity in the next five years
The Demand Pull On Chemicals Starts With Consumers

Consumers

Retail

Energy

Petrochemicals

Consumer Goods

Derivatives
Chemical Investments Seek A Sustainable Advantage

Energy & Feedstocks
...make up 60-70% of the costs of chemical production. Investments seek a competitive advantage in energy and feedstock costs.

Demand Growth
Proximity to demand growth essential without distinct cost or technology advantage. Trade access is also key.

Technology
Technology to enable competitive production costs, economies of scale, high performance products. First to market is important.
Energy and Hydrocarbon Feedstock Costs: Key Drivers In Chemicals Manufacturing

**Propylene**

**Ethylene**

**Butadiene**

**Mixed Butylenes**

**Methane/Hydrogen**

**Benzene**

**Toluene**

**Xylene**

**Pygas**

- Benzene
- Toluene/Xylene
- Heavy Aromatics
- C5/C6 Non Aromatics

**Methanol Synthesis**

**Ethylene Unit**

- Raffinate

**Butadiene**

**Mixed Butylenes**

**Propylene**

**Ethylene**

**Fuel Oil**

**Methanol**

**Methane/Hydrogen**

**Gas Processing Unit**

- Naphtha
- Gas Oil
- Propane
- Ethane
- Butane
- Condensate

**Steam Reformer**

**Gasifier**

**Coal**

**Gas**

**REFORMER**

**BTX Extraction**

**Ethylene Unit**

**FCC**

**Reformer**

**Raffinate**

**FCC**
Global Chemical Capacity

![Global Chemical Capacity Chart](chart.png)
The Global Wave is Cresting in 2014

Capacity Additions

Million Metric Tons

- Other
- Middle East
- Northeast Asia
- North America

Global Spending Crests This Year

Capacity (Million MT)

<table>
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<tr>
<th>Capacity Delta</th>
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<tbody>
<tr>
<td>150</td>
</tr>
<tr>
<td>120</td>
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<tr>
<td>90</td>
</tr>
<tr>
<td>60</td>
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<td>30</td>
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</tbody>
</table>

Global Spending Crests This Year

Capacity (Million MT)

Spend $ 2012 Billion


Capacity Delta  Spend $ 2012

IHS Chemical
Rice Global E&C Forum – July 11, 2014
The United States ripple - Size is a Matter of Perspective

- The wave in the US is just building
- Capacity additions currently peak in 2017 at 31 million metric tons
- North America capacity will increase 39% from 2013 level
The US is more than a ripple - Size is a Matter of Perspective

- The wave in the US is just building
- Capacity additions currently peak in 2017 at 31 million metric tons
- US capacity will increase 39% from 2013 level
North America: Riding the Wave

- Watching the wave build
- Are there enough trained surfers?
- Surf board availability
  - Made in China?
- Stingrays, jellyfish and storms
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US Spending Accelerates in 2014
US Spending Accelerates in 2014

$50 Billion in 3 years

Spending
Capacity Additions

Capacity (Million MT)
Spend $ Billion

0 5 10 15 20 25 30
0 5 10 15 20 25
Why is this happening?  

...Fracking

US Natural Gas Production

US Oil & Gas Prices

IHS Chemical
Rice Global E&C Forum – July 11, 2014
Methanol Cost Curve

Production Cost $/MT

Cumulative Production 1000 MT

- ME
- US
- NEA

2008
2014
Ethylene Cost Curve

Production Cost $/MT vs. Cumulative Production 1000 MT

- ME
- US
- NEA

2008
2014

IHS Chemical
Rice Global E&C Forum – July 11, 2014
Significant Investment Plans by Foreign Participants, *Many New or Returning Faces*

2012 FDI Flows to the US, MM$

- **Chemicals**, 235,000
- **Transport Equipment**, 190,000
- **Petroleum & Coal**, 118,000
- **Other**, 71,000
- **Food**, 32,000
- **Electrical equip & Appliances**, 39,000
- **Beverages/Tobacco**, 47,000
- **Primary/Fabricated Metals**, 47,000
- **Minerals**, 53,000
- **Computer & Electronics**, 61,000
- **Machinery**, 86,000
- **Other**
The Wave Keeps Building

*Change in outlook since last year*

![Capacity Addition Graph](image)

- **2013**
- **2014**

- **50% increase**
The Wave Keeps Building

Change in outlook since last year

Capacity Addition

2013

2014

Million metric tons

2013 2015 2017 2019 2021 2023

50% increase

Top Capacity Additions by 2024

- Ethylene
- Methanol
- Propylene
- PE
- Urea
- Ammonia
- Chlorine
- EDC
- PVC
- VCM

Planned
Anticipated

Million metric tons

0 5 10 15
The Wave Crests in 2017 but…

• New players continue to enter the water
• Others remain on shore waiting to see how good the surf is
• Feedstock availability continues to expand keeping pricing attractive
• This wave has the potential to keep building
US: Riding the Wave

• Most of the announced projects are in Texas and Louisiana

• Companies are concerned that project costs may increase sharply due to:
  – Labor availability
    • Cost of attracting and keeping
  – Productivity
A Self-fulfilling Prophesy?

- Costs remain a major growing concern
- Most announcements seem to include healthy escalations as a result
- Are expectations driving cost?
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Calling All Surfers

• Labor is the major concern
  – Engineering
  – Skilled
  – Unskilled
Labor is a Major Project Cost

- Skilled and unskilled labor represent 35% of project cost
Labor is a Major Project Cost

- Skilled and unskilled labor represent 35% of project cost
- Add engineering and project management total labor related costs total 46%
- Based on this it is easy to see why this is a major concern
EPC’s Backlogs* Have Significant Increased

* Selected public companies
EPC’s Backlogs* Have Significant Increased

* Selected public companies
Skilled Labor is a Major Concern

- **Key concerns**
  - Project foremen
  - Welders
  - Pipefitters
  - Electricians
- **Rates are rising**
- **Companies are being proactive**
- **Higher rates encourage relocations**

**USGC Skilled Labor Index**

- Welders
- Pipefitters
- Electricians

Index 2005 = 1.0

Is the Sky Really Falling?

- Survey consistently trending down
- 6 month expectation always higher
- Are expectations driving cost up?

![IHS/PEG ECCI Labor Chart](chart.png)

<table>
<thead>
<tr>
<th>Month</th>
<th>Current</th>
<th>6 Month Out</th>
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<td>May-12</td>
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<td>70</td>
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<tr>
<td>Aug-12</td>
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<td>65</td>
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<tr>
<td>Nov-12</td>
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Is the Sky Really Falling?

- Survey consistently trending down
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IHS/PEG ECCI Labor

- Yellow line: Current
- Green line: 6 Month Out

[Graph showing data points from May 2012 to May 2014 with a downward trendline and fluctuating values]
Other Labor Costs

• To attract and retain workers companies are also providing:
  – Good dining facilities
  – Per-diems
  – Retention bonuses
  – On-site smoking areas

• Productivity issues
What About Costs?

- Current outlook anticipates wage increases of 5% to 7% per year through 2017
- Unskilled labor rises slower at 4 to 6%
- Compounded impact on total project costs could be 6% depending on project duration
North America: Riding the Wave

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Getting the Right Board When You Need It

• Major concerns
  – Lead times on major items
  – Some equipment has limited suppliers
  – Will metal prices remain in check
Equipment Lead Times

- Some increases in lead times evident
- Many long lead time items already ordered
- Some specific items have posed issues
- LNG project equipment has not been ordered
Equipment Costs Have Been Stable

- Upstream activity has had only moderate impact
- Steel prices have been soft for last 24 months
- Suppliers remain optimistic
Equipment Cost Wave

- Global market provide many sourcing potentials
- Steel and labor cost will support moderate increases
- Equipment cost increase on average are 1.5% above inflation
Can we Off-shore?

- Prefabrication offshore is one countermeasure
- China growing as alternate supply option for some equipment
- Modularization option provide one way to move project forward and reduce site labor requirements
Project Cost Escalation Outlook

Market Index

- Labor
- Equipment
- Steel
- EPM

Index 2000 = 100

Project Cost Escalation Outlook

Market Index

North American Index

Index 2000 = 100


Index 2000 = 100


Labor
Equipment
Steel
EPM
North America: Riding the Wave

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Hazards

- Factors that could cause problems:
  - Permit delays
  - Regulatory changes
  - Hurricanes
Permitting

- Many projects are awaiting permits – approvals taking up to 16 months
- Texas GHG permit situation adds new unknown.
- Environmental groups impacting process
Regulatory Impacts

- Regulatory issues can significantly impact a project schedule
- Climate change related rules already impact costs
- Continued debate on shale’s footprint
Weather Watch

• Hurricanes are hard to predict
• Impact of Katrina and Rita were profound
• Strengths and weaknesses of being in the USGC
Conclusions

• The wave will continue to build
  – New project will be added

• Project delays can be anticipated
  – Permitting is biggest risk here

• Project costs will increase from current levels
  – Labor is the main risk factor
  – Average project cost increases generally below levels anticipated by many

• Modularization can help mitigate delays and labor risks
Better Hold On for a Good Ride

The Texas Outlook can be simply summed up in one word –

Great

You might give some serious thought to thanking your lucky stars you're in Texas