The Global Chemical Industry: US, China and Global Status and Opportunities, 2015

August 28, 2005
American Chemical Society

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Opportunities in China Over the Next Decade

- China will be the growth driver for global manufacturing
- Population of 1.3 billion growing at 0.6% per year
- Growing per capita sales position China for explosive growth in chemicals
- New capacity situated near low-cost feedstocks or proximity to markets
Global Chemical Shipments by Segment

- Pharma: 26%
- Petrochemicals: 17%
- Polymers: 14%
- Coatings: 5%
- Consumer Products: 12%
- Ag. Chemicals: 5%
- Other Specialties: 14%
- Adhesives: 1%
- Inorganics: 4%
- Ind. Gases: 2%

Global Shipments: $2.2 trillion

Source: ACC
Global Chemical Shipments by Country/Region, 2004

<table>
<thead>
<tr>
<th>Country/Region</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>23%</td>
</tr>
<tr>
<td>Western Europe</td>
<td>34%</td>
</tr>
<tr>
<td>Japan</td>
<td>10%</td>
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<tr>
<td>Canada/Mexico</td>
<td>2%</td>
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<tr>
<td>Latin America</td>
<td>6%</td>
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<tr>
<td>China</td>
<td>9%</td>
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<tr>
<td>India</td>
<td>2%</td>
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<tr>
<td>Africa &amp; Middle East</td>
<td>4%</td>
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<tr>
<td>Central/Eastern Europe</td>
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<tr>
<td>Other Asia/Pacific</td>
<td>9%</td>
</tr>
<tr>
<td>Global Shipments</td>
<td>$2.2 trillion</td>
</tr>
</tbody>
</table>

Source: American Chemistry Council
Global Chemical Shipments by Country/Region, 2014

- United States: 19%
- Western Europe: 26%
- Japan: 8%
- China: 12%
- India: 3%
- Africa & Middle East: 5%
- Central/Eastern Europe: 4%
- Latin America: 6%
- Canada/Mexico: 2%
- Other Asia/Pacific: 15%
- Global Shipments: $3.5 trillion

Source: American Chemistry Council
Global Chemical Industry Prospects

Average % Growth (1994-2004)
Average % Growth (2005-2015)

Source: American Chemistry Council
Chemical Sales per Capita (2004)

Source: ACC, Census
Projected Global Chemical Industry Growth Rates

Source: American Chemistry Council
Ethylene Consumption Growth (2004-2014)

- US: 1.7%/yr
- Middle East: 10.3%/yr
- China: 10.8%/yr

Source: SRI
Direct Investment

Currently, China accounts for less than 2% of direct investment in chemicals by US companies.

Direct investment in China has grown 6-fold since 1994, while direct investment in the chemical industry in China has grown by 7.5 times.

Chemical DIA: $107.8 billion

- European Union: 58%
- Canada: 13%
- China: 2%
- Latin America: 10%
- Africa/Middle East: 1%
- Other Asia/Pacific: 9%
- Other Europe: 4%
- Japan: 3%

Source: Bureau of Economic Analysis
Direct Investment in Chinese Chemical Industry Accelerating

Source: Bureau of Economic Analysis
New Ethylene Capacity
Announced and Speculative (2004-2014)

- Middle East: 38%
- North America: 9%
- Asia: 42%
- Other Advantaged: 3%
- Other: 8%

Source: SRI
Structural Changes in US

- US market mature
- Competitive advantage from low energy prices lost
- US chemical industry now a net importer
- Manufacturing base shifting abroad
- Growth in service sector, less chemical use
- Chemical capital investment lagging compared to rest of world
Natural Gas Costs around the World
($US per million BTUs)

USA: $9.70
Canada: $8.25
UK: $5.65
Belgium: $5.65
Russia: $1.20
Qatar: $0.70
Trinidad: $1.60
North Africa: $0.80
Japan: $5.20
South Korea: $5.20
Taiwan: $5.10
China: $4.85
Argentina: $1.60
Bolivia: $1.65
Australia: $3.85

Source: American Chemistry Council
US Chemical Industry Trade Balance by Sector

$ billion

Source: American Chemistry Council
US Chemical Trade - China

Source: USITC
Direct and Indirect Chemistry
Content of Selected Products

- Plastic bottles
- Carpet
- Grain farming
- Paper
- Medical supplies (ex. Pharma)
- Upholstered furniture
- New Residential Construction
- Motor vehicles
- Computers
- Construction machinery
- Petroleum refining

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US – China Trade: By Category

Source: USITC
US Innovation

- Service innovation – Some US producers are offering higher value added services rather than molecules.
- Biotechnology – 8% of US chemical sales are derived from biotechnology.
Changes in US Chemical Industry Structure

Source: American Chemistry Council
Regional Chemical Sales, Per Capita Chemical Sales, and Population Growth

Note: Bubble size represents chemical sales in billions of dollars

Source: American Chemistry Council
Conclusions

- China will become a major producer of chemicals within the next decade, accounting for 12% of global chemicals by 2014.
- Chinese manufacturing and export sectors will continue to strengthen.
- Large, increasingly affluent population will generate domestic demand.
Conclusions

- US will continue to be a leading producer, however its global share will decline.
- US will lead in innovation – new materials, processes and services.
- US production will shift towards pharma, with slower growth in basics and agricultural chemicals.