World Primary Energy Demand Forecast by IEA

*Million Tonnes of Oil Equivalent


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Total Energy Infrastructure Investment Needed from 2005-2030

Total investment = $20.2 trillion (in $2005)

Source: IEA World Energy Outlook 2006
Natural Gas Infrastructure Needs

> Large amount of infrastructure work

> Large capital commitments for expansion as well as maintaining current infrastructure – and stable and fair regulatory climate to attract capital

> Increased demand for labor, materials and engineering services to put the infrastructure into place

> Land Use, Right of Way Access (ROW), and Regulatory affects
Major North American Pipeline Projects

- Keystone: 1,845 miles, 30"
- Rockies Express: 1,679 miles, 36” & 42”
- Midcontinent Express: 500 miles, 36” & 42”
- Southeast Supply Header: 270 miles, 36” & 42”
- Gulf South East Texas Expan.: 242 miles, 42”
- Carthage to Perryville: 172 miles, 42”
- Kinder Morgan Louisiana P/L: 140 miles, 42”
- Gulf South Southeast Expansion: 110 miles, 36”
### Potential Pipeline Project Requirements

<table>
<thead>
<tr>
<th>Year</th>
<th>Miles (24” – 48”)</th>
<th>Current Annual Capacity</th>
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</thead>
<tbody>
<tr>
<td>2007</td>
<td>2,795</td>
<td>ERW up to 24” 3400 miles</td>
</tr>
<tr>
<td>2008</td>
<td>3,200</td>
<td>DSAW 24” &amp; up 3200 miles</td>
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<tr>
<td>2009</td>
<td>1,571</td>
<td></td>
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</tbody>
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### Construction

- For 2007
  - 40 spreads and 14,000 workers required
  - 16 – 20 spreads and 3,500 – 4,000 workers!*

*Anecdotal industry estimates (Source: Jacobs Consultancy)
Hurdles to Building Critical Infrastructure

Costs have risen significantly in recent years for labor, materials and services
Costs Have Risen Significantly in Recent Years

U.S. Nat Gas Land Pipe Construction Costs ($1000/mile)

[\%’s indicate fraction of total costs due to materials]

Source: US FERC, Oil & Gas Journal
Hurdles to Building Critical Infrastructure

> Costs have risen significantly in recent years for labor, materials and services

> Strain on qualified technical and construction talent
Strain on Qualified Technical and Construction Talent

Source: 2007 INGAA Foundation Study “Securing our Future: Developing the Next Workforce”
Hurdles to Building Critical Infrastructure

> Costs have risen significantly in recent years for labor, materials and services
> Strain on qualified technical and construction talent
> **Competition globally for materials and services**
Competition Globally for Materials and Resources

> The China Syndrome
  • Auto Industry Facts
    − Currently 14,000 new cars hit the road each day
    − China is laying an additional 52,700 miles of highway
  • Real Estate Facts
    − Building 7.5 Billion sq. ft. per year of new commercial and residential buildings
    − Represents more sq. footage than all the malls and strip malls in the US, basically builds the entire U.S. retail system each year
  • Steel Production Facts
    − In 1996, the U.S. and China accounted for 13% of the world’s steel production and by 2005 the U.S. had declined to 8% and China had jumped to 35%
  • Energy Facts
    − World’s second largest consumer of crude oil and consumes more coal than the U.S., Japan, and the U.K. combined

> The effect is the need for more energy, more concrete, more space, etc.
> A similar trend is underway in India

Source: AG Edwards Weekly Geopolitical Report, China’s Pollution Problem
Hurdles to Building Critical Infrastructure

- Costs have risen significantly in recent years for labor, materials and services
- Strain on qualified technical and construction talent
- Competition globally for materials and services
- Land use and ROW restrictions
Land Use and ROW Restrictions

> Restriction on leasing of land for exploration
  • 100+ TCF already restricted from exploration and development in the U.S. alone

> A recent experience:
  • We followed procedure to received FERC approval for a project
  • Numerous Open Houses with the public
  • After we received approval a landowner objected to the project and threatened legal action
  • As a result, FERC reopened the process and cost $ millions more!
We can lower these hurdles by…

> In the interim

- Leverage global markets to supplement domestic resources (e.g. sunset of protective tariffs on pipe)
- Encourage students not interested in four year colleges to pursue technical school degrees / career path – joint industry / academic effort initiative
  - IPAA and Houston Area High School Technology Program
- Open dialog between state and local governments and special interest groups regarding land and ROW access
- Engender sense of urgency
We can lower these hurdles by…

> Long Term

- Supporting efforts to encourage enrollment in engineering and science at the university level and promoting our industry to future workforce
- Educating government that all out effort is essential for maintaining affordable energy
  - Efficiency
  - Renewables
  - Clean coal technology
  - And a lot of gas and oil
Educating Government-Green House Gas Legislation

Source: Interstate Natural Gas Association of America (INGAA) 2007
Conclusions

> Projected demand growth for energy calls for $20 trillion cumulative global infrastructure investment through 2030

> Significant incremental talent required to execute the largest build out since post-WWII era expansion

> Excessive hurdles complicate building necessary infrastructure

> Overcoming these hurdles will require creativity and efficient resource management