Fortress Proppants Ltd.

Ceramics versus Resin Coated Supply Dynamics

“Frac Sand Logistics and Supply Chain 2013”
November 20\textsuperscript{th} and 21\textsuperscript{st}
Houston, Texas
Overview

Understanding dynamics in proppant pricing...

Benchmarking ceramic and resin coated supply chains against sand...

Analyzing whether ceramic and resin coated proppants currently offer a cost-effective alternative to natural sand.

Forecasting the future trends of resin coated and ceramic proppants...
A Thought

- I know everything I know...

- I have very little idea of, or are not very comfortable with understanding, what I do not know...
Conventional versus Non-Conventional Wells

- We are in the world of non-conventional wells

- The conventional world has not gone away (but is certainly currently in the background)
Proppant Selection - Considerations

1) Technical
2) Logistics
3) Preferences
4) Quality
5) Risk
6) Economics
1) Technical - Reservoir

- Strengths or stresses
- Pressures
- Temperatures
- Fracturing fluid chemistry
- Downhole chemistry
- Other
1) Technical - Reservoir

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- **Pressures**
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1) Technical - Reservoir

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- Temperatures
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- Downhole chemistry
- Other
Technical cont’d – Not Good
Technical cont’d – Much Better
1) Technical cont’d - Proppant

- Conductivity
- Strength
- Sustainability
- Durability
- Size
1) Technical cont’d - Proppant

- Conductivity
- **Strength**
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- Durability
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1) Technical cont’d - Proppant

- Conductivity
- Strength
- Sustainability
- Durability
- Size
1) Technical cont’d – Proppant Types

- Sand
- Ceramic
- Resin Coated Sand
- Resin Coated Ceramic

Confidential
1) Technical cont’d – Proppant Selection

Well Depth, ‘000 feet versus Closure Pressure, psi

Confidential
2) Logistics

- Origin
- Destination
- In-Between
- Handling
- How
Proppant Selection

3) Preferences

4) Quality

5) Risk
Proppant Selection

3) Preferences

4) Quality

5) Risk
Proppant Selection

3) Preferences

4) Quality

5) Risk
6) Economics

Proppant Pricing - 2013

<table>
<thead>
<tr>
<th></th>
<th>High</th>
<th>Low</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resin Coated</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ceramic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resin Coated</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

US$/Ton
6) Economics cont’d

Proppant Pricing – Average Price 2010 and 2013

<table>
<thead>
<tr>
<th>Average Pricing</th>
<th>Per ton</th>
<th></th>
<th>Per Pound</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Proppant Type</td>
<td>2010</td>
<td>2013</td>
<td>2010</td>
<td>2013</td>
</tr>
<tr>
<td>Sand</td>
<td>105</td>
<td>65</td>
<td>0.0525</td>
<td>0.0325</td>
</tr>
<tr>
<td>Resin Coated Sand</td>
<td>625</td>
<td>375</td>
<td>0.3125</td>
<td>0.1875</td>
</tr>
<tr>
<td>Ceramic</td>
<td>800</td>
<td>650</td>
<td>0.4000</td>
<td>0.3250</td>
</tr>
<tr>
<td>Resin Coated Ceramic</td>
<td>1,250</td>
<td>900</td>
<td>0.6250</td>
<td>0.4500</td>
</tr>
</tbody>
</table>
6) Economics cont’d

Proppant Price Changes – 2010 to 2013

- Sand
- Resin Coated Sand
- Ceramic
- Resin Coated Ceramic

High
Low
Average
### Price Changes – 2010 to 2013

<table>
<thead>
<tr>
<th>Proppant Type</th>
<th>Price Change (2010 to 2013)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
</tr>
<tr>
<td>Sand</td>
<td>-50.0%</td>
</tr>
<tr>
<td>Resin Coated Sand</td>
<td>-44.4%</td>
</tr>
<tr>
<td>Ceramic</td>
<td>-28.6%</td>
</tr>
<tr>
<td>Resin Coated Ceramic</td>
<td>-30.0%</td>
</tr>
</tbody>
</table>
6) Economics cont’d

Logistics – Comparative Shipping Costs - $ / Ton

![Graph showing comparative shipping costs for three routes: A to D, B to D, and C to D. The routes are categorized by barge, rail, and road.]
North America Sand, Resin Coated Sand, Ceramics, and Resin Coated Ceramics In Thousand Tons per Year
Proppants as a Percentage of the Market

- Sand
- Resin Coated Sand
- Ceramic
- Resin Coated Ceramic
# Production Capacity

## Proppant Production Capacity (and Usage)

<table>
<thead>
<tr>
<th>Proppant Type</th>
<th>Capacity (‘000 Tons)</th>
<th>Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand</td>
<td>45,000</td>
<td>29,136</td>
</tr>
<tr>
<td>Resin Coated Sand</td>
<td>2,680</td>
<td>2,688</td>
</tr>
<tr>
<td>Ceramic</td>
<td>Unknown</td>
<td>2,694</td>
</tr>
<tr>
<td>Resin Coated Ceramic</td>
<td>As Needed</td>
<td>6</td>
</tr>
</tbody>
</table>
Conclusions

1. Understanding dynamics in proppant pricing
- How much has the price of ceramics been impacted with the introduction of suppliers from China and is this significant competition to frac sand?
  - The price has been impacted, but not significantly different from other proppant types.
  - It is not a significant competitor to frac sand.
Conclusions

2. Benchmarking ceramic and resin coated supply chains against sand

- How do they compare in relation to costs, capacity and security of supply?
  - Costs are “unique”.
  - Capacity is likely not an issue.
  - Security from a production standpoint is low risk, logistics is the challenge.
Conclusions

3. Analyzing whether ceramic and resin coated proppants currently offer a cost-effective alternative to natural sand.
   ▪ Not cost-effective alternatives.
Conclusions

4. Forecasting the future trends of resin coated and ceramic proppants
- Will demand increase, remain stable or fall away?
  - Demand will increase.
Fortress Proppants Ltd.