WOCA 2015 – Plenary Session – May 5th

CHINESE FLY ASH
SUPPLY & INTERNATIONAL TRADING

Asian Coal Ash Association
ITIBMI
Coal Ash Solutions
Supply & Demand vs Geography

International Trade

• Challenges:
  • Supply/Demand
  • Logistics
  • Infrastructure
  • Transport costs
  • Quality

• Solution:
  • Engagement

Summary
Supply and Demand vs Geography

• Uneven urban development
• Production shifted further west:
  • Closer to coal resources
  • Further from key metropolitan centers
• Fly ash surplus: 200-300 million tons/yr
• Without game changing solution will continue for at least 20-30 years

Utilisation rates

<30% 30-80% 85-105%
International trade

Increased interest in importing Chinese fly ash from:

- US
- Australia
- Middle East
- Vietnam – April 2015: DPM agreed to allow Nghi Son Cement to pilot import over the 2015-16 period.
Drivers

Strategic
- Diversify supply chain
- Position in the market
- Use as negotiating leverage in dealing with dominant suppliers

Tactical
- Low/diminishing supplies
- Reduction in coal power production
- Artificial barriers
- Threatens profitability/existence of some stakeholders

Existential

Drivers
Research

- CAS primary research:
  - Fly ash suppliers
  - Material characteristics
  - Logistics
  - Projected delivered costs to Australia, USA and Middle East
Opportunities

- A number of opportunities to increase exports of cement grade fly ash.
- Support from potential suppliers/governments
- Legal and operating environment greatly improved
Challenge: Supply/Demand

- How do importers of Chinese ash:
  - Secure unallocated resource?
  - Ensure long-term supply stability?
  - Ensure long-term price stability?

Demand high in coastal regions
Competition = higher material prices
Challenge: Logistics Infrastructure

**Origin**
- Transportation method available/compliant?
  - Covered truck
  - Tanker truck
  - Rail tanker
- Capacity to load 10K – 30K ton ships at viable port?
- Storage?
- Ship to ship transfer required?
- Investment vs ROI

**Export**
- Capacity to unload 10K – 30K ton ships
- STS transfer required?
- Storage?
- Investment vs ROI

**Import**
- Capacity to load 10K – 30K ton ships at viable port?
- Storage?
- Ship to ship transfer required?
- Investment vs ROI
Challenge: Transport Costs

Distance covered

Means of transportation
• Truck to rail
• Rail to ship
• Ship to ship

Number of transfers

Volumes shipped
• 10K, 30K bulk vessel
• Frequency of shipment
• Scale

Ocean freight market
• Currently 10 yr low
• Opportunity to lock in low prices

Value of Cargo
• Higher value ash
• 40-55% aluminum
• Specialty (CeraTech)
### Chemical Analysis

<table>
<thead>
<tr>
<th>Component</th>
<th>SiO₂</th>
<th>Al₂O₃</th>
<th>Fe₂O₃</th>
<th>CaO</th>
<th>MgO</th>
<th>SO₃</th>
<th>Na₂O</th>
<th>K₂O</th>
<th>LOI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Avg.</strong></td>
<td>52.3</td>
<td>27.2</td>
<td>5.9</td>
<td>2.4</td>
<td>1.1</td>
<td>0.3</td>
<td>0.5</td>
<td>1.4</td>
<td>4.8</td>
</tr>
<tr>
<td><strong>Range</strong></td>
<td>32.1-60.1</td>
<td>19.5-55.0</td>
<td>1.5-15.4</td>
<td>0.8-14.0</td>
<td>0.8-2.1</td>
<td>0-2.4</td>
<td>0.2-1.3</td>
<td>0.7-2.7</td>
<td>0.3-20.5</td>
</tr>
</tbody>
</table>

### Mineral Phase

<table>
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<tr>
<th>Glass</th>
<th>Crystalline</th>
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<tbody>
<tr>
<td>75-90%</td>
<td>10-25%</td>
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</table>

### Particle Size:

**GB1596-2005:**

<table>
<thead>
<tr>
<th>Class I</th>
<th>Class II</th>
<th>Class III</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤12%</td>
<td>≤25%</td>
<td>≤45%</td>
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</tbody>
</table>

- Great variation in classification, milling capabilities.
- >90% of Chinese producers lag substantially behind US, European, Australian producers in knowledge/expertise.
- Coastal regions typically more advanced – extra capacity, lower overall costs?
Solution: Engagement

Upstream improvements
• Coal milling
• Coal blenders

Downstream improvements
• Grinding
• Classification
• Carbon/Hg removal

Coal supply
• Regions close to coal production
• Long-term supply
• Variability minimised
• Mine-mouth power stations

Quality Inspection Regime
• 100% inspection before shipment/payment
• Master standards/tolerances
• Commercial terms attached

Engage with your supply chain
Summary

- Abundant material
- Infrastructure at Origin, Export and Import
- Effect on ROI?
- Logistics complexity/cost
- Quality – Comprehensive Engagement
Thank you!

www.asiancoalash.org
www.waste-reuse.com
www.coalashsolutions.com

Visit the Coal Ash Asia booth in the Exhibition Hall

Join us at Coal Ash Asia!
September 20-24th

谢谢！

David Harris
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### Structural Barriers to Innovation/Utilisation:

- Disconnect between research and commercialisation
- Disconnect between State Owned Enterprises and entrepreneurs

<table>
<thead>
<tr>
<th>Factors for Success</th>
<th>State Owned Enterprises</th>
<th>Entrepreneurs</th>
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<tbody>
<tr>
<td>Financial resources</td>
<td>Access (Limited)</td>
<td>Abundant (Limited)</td>
</tr>
<tr>
<td>Human resources</td>
<td>Abundant (Limited)</td>
<td>Abundant (Limited)</td>
</tr>
<tr>
<td>Market access</td>
<td>High (Limited)</td>
<td>High (Limited) (rely on gov’t or SOE support)</td>
</tr>
<tr>
<td>Distribution</td>
<td>High (Struggle)</td>
<td>High (Struggle) (rely on gov’t or SOE support)</td>
</tr>
<tr>
<td>Government support</td>
<td>High (Low - Moderate)</td>
<td>Abundant (High)</td>
</tr>
<tr>
<td>Agility</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Innovation culture</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Aversion to risk</td>
<td>High - very high</td>
<td>Low</td>
</tr>
<tr>
<td>Drive</td>
<td>Low</td>
<td>Very high</td>
</tr>
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Recommendations:

Policy: Government
- Incentives for SME's
- Funding for SME's

Strategy: SOE's
- Foster culture of innovation?
- Early stage investment
- Acquisition

Strategy: Entrepreneurs
- Pragmatic product development vs revenue model
- Alignment of interests with carefully-selected partners
- Near to mid-term exit strategy