Zilkha Black® Pellets
The Clean, Renewable Alternative to Coal

Renewable Power from Coal Plants
Biomass Pellets Trade Asia
Seoul, Korea
September 23-24

www.zilkhabiomass.com
An advanced wood pellet is:

- Grindable
- Low-dust
- Water-resistant
- Can be burned in existing steam turbine power plants
- Co-fired up to 100%
- Minimal capital expenditure

Certified sustainably harvested

Carbon neutral compared to traditional fossil fuels
Zilkha Accomplishments

- Construction nearly complete on 275,000 metric tonne/yr Black pellet plant in Selma, Alabama (U.S.)
- Selma plant output sold under long term contract to European utility
- First license agreement executed with third party covering multiple sites in Northeast U.S.
- Zilkha announced a second, larger plant located in Monticello, Arkansas (U.S.)
- Additional offtake being negotiated to be supplied by Zilkha and additional licensee plants
Zilkha Black® Pellet Advantages for Korea and SE Asia

- Reduced shipping cost means delivered energy cost in line with white pellets, but with better performance than white pellets
- Greatly improved safety and reduced storage costs compared to white pellets or chips

Korean companies can benefit from Black pellets:
  - Genco’s who begin with co-firing can move up to a 100% conversion in the REC market
  - Trading houses who source fuel for those Genco’s can also supply fuel to commercial and industrial customers
  - Engineering companies and boiler/burner manufacturers can provided guidance and services to Genco’s and commercial/industrial market
Zilkha Business Model: Emission Driven Market

- Europe and Asia are focused on SOx, NOx, and CO₂ reduction and have mandates and incentives in place today
- North America is focused on SOx, NOx, and Hg with tighter emissions standards that require significant capital investment
- Our current customers are European utilities who have experience burning biomass in pulverized coal-fired units
- We serve this market with a better product—Zilkha Black® pellets
  - Patented Zilkha technology
  - NOT torrefaction
  - Durable, water resistant pellet with reduced dust and better safety
  - Drop-in replacement for coal with minimal capital investment
# Zilkha Black® Pellet Advantages

<table>
<thead>
<tr>
<th>Key Criteria</th>
<th>Zilkha Black® Pellets</th>
<th>Conventional White Pellets</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HANDLING</strong></td>
<td>Water-resistant</td>
<td>Disintegrate upon water contact</td>
</tr>
<tr>
<td><strong>LOGISTICS</strong></td>
<td>19.5 GJ per bdmt 750 kg/m³</td>
<td>17.0 GJ per bdmt 640 kg/m³</td>
</tr>
<tr>
<td><strong>DUST</strong></td>
<td>98% durability index 99% is &gt;74 microns (low-risk)</td>
<td>96.5% durability index Dust particles prone to explosion</td>
</tr>
<tr>
<td><strong>SAFETY</strong></td>
<td>No self-heating Minimal off-gassing</td>
<td>Self-heating common Off-gassing significant</td>
</tr>
<tr>
<td><strong>GRINDING</strong></td>
<td>25-35 grindability index 15 hp-hr/mt mill energy demand</td>
<td>15-20 grindability index 26 hp-hr/mt mill energy demand</td>
</tr>
<tr>
<td><strong>COMBUSTION</strong></td>
<td>Higher ignition potential at 16.28 [kJ/kg fuel/°C]</td>
<td>Lower ignition potential at 12-14 [kJ/kg fuel/°C]</td>
</tr>
</tbody>
</table>

1) **COST:** Zilkha Black® pellets contain and retain more energy than white

2) **SAFETY:** Zilkha Black® pellets are safer than white

3) **DROP-IN:** Zilkha Black® pellets grind and burn more like coal than white

**Significant capex and opex avoided by customer**

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Zilkha Black® Pellets Perform Like Common Coals

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Zilkha Black® Pellets(1)</th>
<th>Russian Coal #1, G Grade(2)</th>
<th>Central Appalachian (Long Fork)(3)</th>
<th>Powder River Basin Coal-Eagle Butte(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture %</td>
<td>1.44</td>
<td>7.37</td>
<td>7.16</td>
<td>23.92</td>
</tr>
<tr>
<td>Ash, Dry %</td>
<td>0.72</td>
<td>14.1</td>
<td>11.52</td>
<td>4.65</td>
</tr>
<tr>
<td>Volatile, Dry %</td>
<td>78.53</td>
<td>35.92</td>
<td>31.23</td>
<td>33.95</td>
</tr>
<tr>
<td>Sulfur, S, Dry %</td>
<td>0.03</td>
<td>0.229</td>
<td>1.07</td>
<td>0.29</td>
</tr>
<tr>
<td>Calorific Value, BTU/lb</td>
<td>8,447</td>
<td>11,218</td>
<td>12,114</td>
<td>8,966</td>
</tr>
<tr>
<td>Calorific Value, kJ/kg</td>
<td>19,647</td>
<td>26,093</td>
<td>28,117</td>
<td>20,854</td>
</tr>
<tr>
<td>Carbon, C, Dry %</td>
<td>54.42</td>
<td>69.38</td>
<td>66.93</td>
<td>53.46</td>
</tr>
<tr>
<td>Hydrogen, H, Dry %</td>
<td>6.03</td>
<td>4.69</td>
<td>4.43</td>
<td>2.71</td>
</tr>
<tr>
<td>Nitrogen, N, Dry %</td>
<td>0.15</td>
<td>2.25</td>
<td>1.34</td>
<td>0.58</td>
</tr>
<tr>
<td>Mercury, ug/g</td>
<td>0.01</td>
<td>0.52(5)</td>
<td>0.15(7)</td>
<td>0.08(7)</td>
</tr>
</tbody>
</table>

Source:
2) LQSi Data Statistical Results By Program. SGS Minerals Services Division. 2010.
HANDLING: Black pellets are water-resistant

Zilkha Black® Pellets compared to conventional white pellets after soaking in water

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LOGISTICS: Black pellets will always be cheaper to ship

TWO DISTINCT ADVANTAGES:

1) Each tonne of Black pellets holds 15% more energy than white, 140% more than chips

2) Each ship will hold 15% more tonnes of Black pellets than white, and 115% more than chips

~30% savings with Zilkha Black® pellets vs. white pellets and ~80% vs. chips

<table>
<thead>
<tr>
<th>ZILKHA BLACK®</th>
<th>STD WHITE</th>
<th>CHIPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Calorific Value (CV)</td>
<td>19.5 GJ/mt</td>
<td>17.0 GJ/mt</td>
</tr>
<tr>
<td>Pellet Bulk Density</td>
<td>750 kg/m³</td>
<td>640 kg/m³</td>
</tr>
<tr>
<td>Cubic space onboard</td>
<td>58,500 m³</td>
<td>58,500 m³</td>
</tr>
<tr>
<td>Tonnes onboard</td>
<td>43,875 mt</td>
<td>37,440 mt</td>
</tr>
<tr>
<td>CV onboard</td>
<td>851,175 GJ</td>
<td>636,480 GJ</td>
</tr>
</tbody>
</table>

Relative freight | 1.00 | 1.34 | 5.20 |
LOGISTICS: Loads Like Coal and No Problem with Rain
SAFETY: White pellets require extra safety measures

- Fines = dust = very real explosion risk
- Explosion mitigation takes capital beyond that required to handle coal
- Venting during transportation
- Off-gassing of CO, CO₂, and CH₄
- Pellet pile self-heating

SAFETY: Black pellets limit dangerous gas emissions

- Zilkha Black® pellets tested as far less reactive than white
- Zilkha Black® pellets showed reduced oxygen depletion
- Oxygen depletion is a significant operational issue. Extra workers and other special safety restrictions are required for workers entering white pellet storage areas
- These results @ 25 C. but similar results @ 45 C.
Manufacturing of Zilkha Black® Pellets is similar to the production of standard white pellets, with the addition of our patented thermal treatment step.
First Commercial Zilkha Plant: Selma, AL (275,000 mtpy)

- First full-scale Black pellet plant
- 275,000 metric tpy
- Construction complete October 2014
- Commissioning 4Q 2014
- First Black pellets ship Q2 2015 to Europe, long term contract
- Export from Port of Mobile
- Plant staffing: 55 jobs
- Project financing

Zilkha Black Pellet Technology
Wood Yard
Dryers
Pelleting
Successful Full-Scale Testing by Utility Customers

- Over ten (10) full-scale tests completed in European coal units and additional tests planned
- Black pellets recently delivered for a power boiler test in Oct-Nov 2014 in Japan
- Unit co-firing levels from 20-70% in large units to 100% in smaller units
- Units ranged in size from 80-500 MW
- Success grinding in existing coal pulverizers (ball and roller) as well as hammer mills
- Coal mills have successfully run on 100% Black pellets
Many Paths for Korean Companies to Supply Market

Black Pellet Plants

North & South America

Southeast Asia

Korean Trading Houses

Genco and IPP Customers

Korean Engineering and Boiler Companies