Louisiana 25x’25 Renewable Energy Roundtable

New Orleans, LA
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Presented by: John B. Howe
Vice President, Public Affairs
About Verenium

Two commercially-focused, synergistic business units supported by R&D

- Significant market opportunities
- Unmatched in-house “know-how”
- Strong IP estate
- Infrastructure development skills
- Two years of execution success
Our corporate strategy

MAXIMIZE first-mover advantage in cellulosic ethanol production to become worldwide business partner, employer of choice

BUILD, OWN OPERATE cellulosic ethanol production facilities to maximize operational control, economic return for shareholders

LEVERAGE global partnering / licensing to efficiently extend reach of technology & know-how

OPTIMIZE current leadership position in industrial enzymes by accelerating commercial focus, profitable growth opportunities

EXTEND leading-edge R&D capabilities across the organization to exploit range of business opportunities
Next-generation biofuels: Capitalizing on the confluence of global trends

Traditional Drivers

- Climate Change
- Energy Security
- First Gen. Limits

Immediate Drivers

- Unstable oil prices
- New Farm Bill
- New Energy Law

Cellulosic Ethanol

From renewable cellulosic biomass
Energy law provide significant market potential

Market is widely expected to be “short” cellulosic ethanol for the foreseeable future

2007 EISA Renewable Fuels Mandate

<table>
<thead>
<tr>
<th>Year</th>
<th>Cellulosic Biofuels Billion Gallons / Year</th>
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<tbody>
<tr>
<td>2010</td>
<td>0.10</td>
</tr>
<tr>
<td>2011</td>
<td>0.25</td>
</tr>
<tr>
<td>2012</td>
<td>0.50</td>
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<tr>
<td>2013</td>
<td>1.00</td>
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<tr>
<td>2014</td>
<td>1.75</td>
</tr>
<tr>
<td>2015</td>
<td>3.00</td>
</tr>
<tr>
<td>2016</td>
<td>4.25</td>
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<tr>
<td>2017</td>
<td>5.50</td>
</tr>
<tr>
<td>2018</td>
<td>7.00</td>
</tr>
<tr>
<td>2019</td>
<td>8.50</td>
</tr>
<tr>
<td>2020</td>
<td>10.50</td>
</tr>
<tr>
<td>2021</td>
<td>13.50</td>
</tr>
<tr>
<td>2022</td>
<td>16.00</td>
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CEtOH: favorable energy input and GHG emission profile compared to gasoline & grain ethanol

Fossil energy requirements of different fuels

Feedstocks and GHG profile

- Corn ethanol: 19% reduction
- Natural gas: 28% reduction
- Biomass: 52% reduction
- Sugarcane ethanol: 78% reduction
- Cellulosic ethanol: 86% reduction
Verenium: applying the **full potential** of industrial biotechnology

Proven industrial biotech expertise required to attain low-cost production goals

- Multiple biomass sources:
  - Sugarcane bagasse,
  - Energy cane,
  - Sorghum,
  - Switchgrass,
  - Etc.

- Industrial Biotechnology
  - World-class Expertise
    - Enzymology
    - Engineering
    - Biology

- Biofuels
The Verenium process: getting to ethanol

1. Delivery & Storage
2. Handling & Prep
3. Acid Hydrolysis of Hemicellulose
4. Liquid/Solid Separation
5. Pentose (C5) Fermentation
6. Cellulose Hydrolysis and Ethanol Fermentation (C6)
7. Beer Well
8. Distillation
9. Residue to the Boiler
10. Ethanol is ready for shipment to market
The Verenium Production Process: 
*Delivery and Storage*

Once delivered to site, we have a well understood process for managing the bagasse pile.
The Verenium Production Process: 
First-stage Hydrolysis of C5 Sugar Stream

- Dilute acid steam explosion hydrolyzes hemicellulose to 5 carbon sugars and produces a cellulose “cake”
- Utilize “off-the-shelf technology” from pulp and paper industry optimized for our process
The Verenium Production Process: Liquid / Solid Separation

- Hydrolyzed bagasse (mixture of C5 sugar syrup and cellulose fiber) sent to liquid/solid separation system where C5 sugar syrup is washed and separated from cellulose fiber
- C5 syrup sent to C5 Fermentation process
- Washed cellulose (C6 cake) sent to C6 fermentation process
The Verenium Production Process: *Fermentation of Mixed Sugars*

Two organisms for fermentation:
- V5 for C5 fermentation
- V6 for C6 fermentation
- Saccharification of cellulose by enzymes produced on-site
C5 and C6 “beers” blended and stored in a “beer well,” then run through traditional three-stage distillation process (stripping, rectification, and dehydration) to produce fuel grade ethanol.
**Feedstock strategy: dedicated energy canes and grasses**

- Sufficient biomass available in the U.S. to more than meet RFS demand
- Energy cane among the highest yielding agricultural feedstocks

<table>
<thead>
<tr>
<th>Feedstock</th>
<th>Technology</th>
<th>Ethanol Yield Gallons / Acre</th>
<th>Feedstock Yield Dry Tons / Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Cane - FL</td>
<td>Cellulosic</td>
<td>1,830</td>
<td>20 dry tons</td>
</tr>
<tr>
<td>Switch Grass – U.S.</td>
<td>Cellulosic</td>
<td>732</td>
<td>8 dry tons</td>
</tr>
<tr>
<td>Wheat Straw</td>
<td>Cellulosic</td>
<td>168</td>
<td>80 gal/dry ton</td>
</tr>
<tr>
<td>Corn Stover</td>
<td>Cellulosic</td>
<td>240</td>
<td>80 gal/dry ton</td>
</tr>
<tr>
<td>Softwood</td>
<td>Cellulosic</td>
<td>400</td>
<td>80 gal/dry ton</td>
</tr>
<tr>
<td>Sugar - Brazil</td>
<td>Sugar Fermentation</td>
<td>653</td>
<td>4.82 tons (sucrose)</td>
</tr>
<tr>
<td>Sugar – U.S.</td>
<td>Sugar Fermentation</td>
<td>493</td>
<td>3.64 tons (sucrose)</td>
</tr>
<tr>
<td>Corn – U.S.</td>
<td>Grain – Dry Mill</td>
<td>402</td>
<td>4.2 wet tons*</td>
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Leading the market in advancing CEtOH technology to commercial scale

2007 – Pilot Plant
- ~ 50,000 gallons/year
- Primarily bagasse, energy cane

2008 – Demo Plant
- 1.4 MGY
- 1st of its kind in U.S.
- Fully integrated, large-scale cellulosic ethanol facility
- Primarily bagasse, energy cane
- Built to test wide range of feedstocks, enzymes
- Completed start-up, 65% completed commissioning

2011 – 1st Commercial Plant
- ~36 MGY
- $250 - $300M (est.)
- Expect to build with BP
- Plan to break ground 2H09
- Located in southeast U.S.
- Additional facilities to follow as soon as practical
Commercial development:
Near-term focus on southeast US

- Ultimately national / global play; Gulf region is first leg
- Initial focus: position 6 projects for close between 2009 and 2011

- Commercial sites in development
  - Grass/energy cane/bagasse
  - Local agricultural partners
  - Good logistical interfaces
  - Some co-located

- Three energy crop plantations
  - ~100 acres / plantation
  - Energy cane and sorghum
  - Energy cane expandable in two years to 17k acres
  - Validation platform for growers
BP Partnership:
Significant accelerant for commercial-scale development

Assembling core capabilities across the value chain to accelerate commercial-scale cellulosic ethanol production

Agronomics  Technology  Development  Operations  Marketing

Biomass cultivation and logistics  Gene discovery, enzyme development & novel microbes  Engineering, finance, licensing & partnerships  Assets & property processes  Commercial off-take, logistics & marketing

Proprietary
Enzymes & microbes that enable production of ethanol from a wide array of feedstocks
Thank You!
Questions?

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