BIOMASS TO FURANICS PLATFORM

Bio Pacific Rim Summit
December 11, 2013

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Glucan Biorenewables Platform
Catalyzed at CBiRC with Technology from the University of Wisconsin

Goal → Economically Viable Cellulosic Biomass Plants in North America

Biomass Versatility

Furanic Chemicals

Glucan Technology

Corn Stover Oat hulls

Corn cobs

Bagasse Wood

Furfural LA DMF FDCA HMF GVL
Market: Significant Opportunity
Furan Platform

Who Cares?

- $3 billion
  Furan Platform Opportunity
  - furfural
  - HMF
  - DMF
  - FDCA

- $500 million
  Target Market
  - furfural (worldwide)
  - DMF (specialty & solvents)

- $20 million
  Proof of Platform
  - furfural (North America)
  - DMF (specialty)
The Furfural Market Opportunity

GlucanBio’s new furfural process is a game-changer

GlucanBio’s first commercial plant will deliver a reliable, cost-competitive source of furfural in North America.

Current Furfural Market Dynamics

- No North American Production
- 70% of production in China
- Reliable supply concerns
- Erratic pricing over 10 years

Furfural Pricing Over the Last Decade FOB China
Existing furfural plants use a process that was first discovered in the early 1900’s. The process is aqueous-based and energy-intensive producing significant waste streams. Over 70% of production is corn-cob based and located in China.
Technology: The GlucanBio Advantage

Gamma-Valerolactone (GVL): a proprietary solvent system

Gamma-Valerolactone provides key advantages in both the hydrolysis reaction and conversion reaction enabling co-production of products, lower energy input and better yields.

Key Advantages

- Enables separation of sugars
- Feedstock agnostic
- Minimizes degradation
- Stable solvent system
- Solubilizes lignin
- Green solvent
Technology: Front end Sugar Separation

GVL provides a mechanism to separate hemicellulose and cellulose for further processing.

C5 yield, 90% (monomer+oligomers)

C6 yield, 80% (monomer + oligomers)
Technology: Feedstock Versatility
Consistent Yields

Technology is feedstock agnostic providing the opportunity to partner with multiple companies.

160 C. 90 wt% GVL/10 wt% water. Overall 0.05 M SA.
## Cost Improvement Opportunity

### Low Cost Producer Strategy

*Techno-Economic modelling shows we can be competitive in the market*

### Operating Costs for China Production*

<table>
<thead>
<tr>
<th>Cost Component</th>
<th>Cost</th>
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<tbody>
<tr>
<td>Raw Material (50% – 60%) 10/1</td>
<td>$600</td>
</tr>
<tr>
<td>Operating Cost</td>
<td>$490</td>
</tr>
<tr>
<td>Energy (~65%)</td>
<td>$320</td>
</tr>
<tr>
<td>Total Cost</td>
<td>$1090</td>
</tr>
<tr>
<td>Gross Profit Margin (10% - 15%)</td>
<td>12%</td>
</tr>
<tr>
<td>Furfural Price - FOB China</td>
<td>$1220</td>
</tr>
<tr>
<td>Freight (to Memphis)</td>
<td>$300</td>
</tr>
<tr>
<td>Delivered Price</td>
<td>$1520</td>
</tr>
</tbody>
</table>

*Co-Production spreads raw material costs over more product volume*

*Improves yields reduce input cost (7.5/1)*

*Solvent versus aqueous process significantly reduces energy costs*

*Manufacturing in North America will save on transportation costs*

*Estimated with input from PennAKem and validated by International Furan*
GlucanBio De-risking and Scale-up

Development Stage / Value

- Validate market
- License/Create IP
- M/E balance and economics
- Technology de-risking
- Define unit ops
- Define spec for pilot
- Lab development work
- Techno-economic model

Time
- 2011/2012
- 2013
- 2014
- 2015
- 2016

Scale
- (furfural production)
- gram
- kg
- 50 MT/yr.
- 10k MT/yr.

Commercial
- Supply chain lock up
- Integrated plant
- Co-Product production
- Market entry
- Inform larger design
- Strategic investment

GlucanBio Lab
- Engineering de-risking
- Product analysis
- Customer evaluation
- Unit operations definition
- Demonstration pre-engineering
- Strategic partners

Dumesic Lab
- Solvent Selection
- Proof of concept
- Basic process
- IP creation

CBiRC
- Demonstration (continuous)
- Integrated plant
- Co-Product production
- Business de-risking
- Off-take agreements
- Customer evaluation
- Inform commercial design
- Commercial pre-engineering
- Strategic partners

Pilot (batch ops)
- Demonstration pre-engineering
- Strategic partners

Scale-up
- Gram
- Kg
- 50 MT/yr.
- 10k MT/yr.
GlucanBio Team
Experienced Start-up Team

GlucanBio team has significant experience in catalysis, engineering scale-up, intellectual property management and early stage commercialization.

Vicki Gonzalez
CEO

Jeff Fornero Ph.D.
VP Engineering

David Alonso Ph.D.
Director R&D

James Dumesic
Ph.D.
Founder, leading expert in catalytic conversion, founder of Virent

Brent Shanks Ph.D.
Founder, Director, CBiRC, 10 years with Shell Oil, catalysis expertise

Duke Leahey
IP & Licensing

Advisory Board

- Vicki Holt
  - Former CEO of Spartech
- Terry Sutter
  - Executive Advisor, Aurora Capital
- Pat Moore
  - Former CEO Smurfit Stone, ADM Board member
- Peter Keeling
  - Founder, Innovation Director, CBiRC
Strategic Partners

Company is Seeking $2MM in Series A Funding

**Strategic Partners**

- Nidus Partners
  - Bunge, Monsanto, and Novozymes
- Wisconsin Alumni Research Foundation
- NSF Phase I
- NSF Phase IB
- JDA with Large Petrochemical Company
  - Furfural Strategic Partner – In discussion
  - Raw Material Strategic Partner – In discussion
  - NSF Phase II