Bio-hydrogen for Power Plants

Start-up – 2 models: CHP and $H_2$

Zero cash – Investor pitches & SBIRs

Seed level – seeking $1,370,000

Peter J. Schubert, Ph.D., P.E., Inventor, Founder, Managing Director of BMU
TransTech Energy Conference, WVU, 6-7 November 2013
Generators have internal friction
Hydrogen-cooled Turbo Generators

- $H_2$ has 40% viscosity of air
- 14x more heat capacity
- Reduced insulation damage
- High purity is best
- Make-up needed
Hydrogen Focus

• Market price is $4 per kilogram
  – NREL goal is $3.70/kg distributed\(^1\)

• NETL Energy Lab:
  – Goal and Milestones – Alternate Hydrogen Production Pathway
    **Goal:** By the end of 2013, optimize, integrate and make available an alternative economic and environmentally responsive hydrogen production pathway and reforming system to produce decentralized hydrogen.\(^2\)

Bio-Hydrogen

- Indirectly-Heated Pyrolytic Gasification (I-HPG)
  - Novel, unconventional gasification method
  - US Patent 8,465,562 awarded 18 June 2013
  - Converts biomass to H\(_2\)/CO syngas

- Hydrogen at $1.12/kg
  - High-purity (7-9’s)
  - Energy self-sufficient process

- Ready to scale-up
  - Funds sought to prove 6x:
    - $1,370,000
    - 2 years
Market Opportunity

• **Current Practices for Hydrogen**
  – On-site electrolysis of water, compressors, moderate-pressure storage
  – Tank cylinder storage
  – SMR

• **Opportunity**
  – Reduce costs
  – Reduce emissions of fossil carbon
  – Promote local economy
  • farmers provide non-food ag residues
  • Wood-working factories provide sawdust

• **Scope for thermal power plants**
  – 600 coal-fired US\(^1\) 104 nuclear
  – 2400 coal-fired globally\(^2\) 437 nukes
  – 1200 new plants planned\(^3\)

• **Size of hydrogen market**
  – US at $70,000,000/year (estimated)
  – Global demand growing 4.1%/year\(^4\)

2 [http://www.worldcoal.org/resources/frequently-asked-questions/](http://www.worldcoal.org/resources/frequently-asked-questions/)
Competitive Advantages

• Patented and proven biomass gasifier
• Ability to scale - from farms to power plants
• **Low-cost** hydrogen on-demand
  – Moderate-pressures only
  – Wide turn-down ratio
• **Less fossil carbon**
• Local sources
Business Strategy

• **Combined heat and power (CHP) at farm/factory scale**
  – Business plan rev. 3 in-progress, 3 investor pitches so far
  – Seeking $2.4M, then $1.0M in Year 2 to commercialize
  – Biochar as leading money-maker

• **High-purity hydrogen for turbo generators**
  – Seeking $1.37M to build 6x prototype
  – Obtain economic performance data

• Modular scale-up to match customer needs
  – May choose dual-source to reduce risk
  – Future: co-fire syngas
Sales and Marketing

• Place S/N 1 in 2014 @ HE
• All HE plants in 2015
• Across Indiana 2016
• Midwest & beyond ‘17-8
• “Specialty” product alongside CHP/Biochar
• Expand – co-fire syngas
• Augment – H\textsubscript{2} storage
Company

- Biomass Unit Ops, LLC
  - Start-up created by the tech transfer arm of the Indiana University System (IURTC).
  - BMU is based on issued and pending patents invented by Prof. Peter J. Schubert

- Leadership Team:
  - Dr. Joe Trebley, IURTC, Managing Director of BMU
  - Mr. John Craun, CEO in-waiting
    - One of 13 Entrepreneurs-in-residence