Biomass to Drop-in Fuels: Demonstration Capability of Rentech’s BioEnergy Center of Excellence

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$150 Million Fully Integrated Biomass Synthetic Fuels, Power and Chemicals Facility
Introduction to Rentech

• Established in 1981
• Employees: 250+
• Revenue: ~$200 million
• Publicly-traded: NYSE AMEX: “RTK”
• Locations:
  o Los Angeles, CA (Headquarters)  o Natchez, MS
  o Commerce City, CO (BECE location)  o Honolulu, HI
  o Atlanta, GA  o East Dubuque, IL
• 30 years of technology operating experience
• 40 years of syngas production experience
• Nitrogen fertilizer facility: 600K tons/y
• BioEnergy Center of Excellence “BECE”
  o $150 Million Fully Integrated Biomass Synthetic Fuels, Power and Chemicals Facility
## Clean Energy Technologies

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<tbody>
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<td></td>
<td>Finely ground virgin biomass: sugarcane bagasse &amp; wood</td>
<td>Wood, agricultural residues, straw, switch grass, &amp; energy crops</td>
<td>Syngas from any carbon-bearing materials</td>
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<td>Products:</td>
<td>Hydrogen, Optimized for fuel</td>
<td>Power; fuels &amp; power</td>
<td>Hydrocarbons for synthetic fuels; specialty chemicals</td>
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<td>Readiness:</td>
<td>Proven at pilot scale; To be proven at demo scale at PDU w/ aid of $23M DOE grant</td>
<td>Proven at commercial scale; Deployable today</td>
<td>Proven at demonstration scale; Deployable today</td>
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Energy Technology: Integrated Value Chain

- Bagasse
- Ag Waste
- Grass
- Switchgrass
- Wood / Timber
- Other Biomass

Rentech’s Biomass Gasification Technologies

- Rentech-ClearFuels
- Rentech-SilvaGas

Combined Cycle Power (third party)

- Natural Gas

Rentech’s Steam Methane Reformer (third party)

Cellulosic Fuels Technologies (third party)

- Rentech Fischer-Tropsch Process

Upgrading

Renewable Power

Renewable Fuels
Energy Products

Certified Fuels from Rentech’s FT Technology

Diesel: Audi 1000 Mile Drive
Certified Jet: United Airlines Flight
Lower tailpipe emissions

Low carbon footprint & cellulosic RINs

Other Cellulosic Fuels
- Cellulosic ethanol and other fuels from our biomass gasification technologies
- Fuels can qualify for cellulosic RINs

Renewable Hydrogen
- Produced from biomass by Rentech-ClearFuels gasifier

Renewable Power
- **Renewable baseload** power; no backup required
- **Close** to interconnection and transmission

Diesel: Audi 1000 Mile Drive
Certified Jet: United Airlines Flight
Lower tailpipe emissions

Low carbon footprint & cellulosic RINs
BECE: BioEnergy Center of Excellence

• Integrated systems for BioFuel, Renewable Chemical, and Power Production; Biomass Gasification; Hydro-Processing; Catalyst Development and Testing Labs for Collaborative Technology Advancement(s)
  o Platform for development of BioEnergy technologies for commercial deployment
  o Designed to be highly flexible – “Plug and Play” for innovative new technologies
  o Produces ultra clean, certified aviation and diesel fuels, naphtha, power and chemicals
  o $23 million DOE grant for a Rentech-ClearFuels biomass gasifier with an additional $13 million invested by Rentech

• Produced Ultra-clean diesel & aviation fuels and naphtha
  o Diesel fuel meets ASTM, D97566 and EN 590 specs
  o “Drop in” fuels

• Testing syngas and fuels from variety of feedstocks:
  o Wood Waste  o Bagasse
  o Corn Stover  o MSW/RDF
  o Natural Gas  o Others

• $150 million technology and R&D center
  o 70 scientists, engineers, technicians and operators
  o 3 catalyst development and evaluation labs
  o 1 analytical and fuels testing lab
  o 1 wax/catalyst separation technology lab
Rentech-ClearFuels IBR Project

- A strong project team
  - URS Corporation; Linde/Hydro-Chem; Hawaiian Electric; National Renewable Energy Lab & Hawaii Natural Energy Institute
  - On-time and on-budget project execution

- Jointly submitted competitive proposal and received $23 million grant from DOE under the American Recover and Reinvestment Act, Rentech provided the remaining $13 million of funding for $36 million project

- Mechanically Complete of 20 ton-per-day biomass gasifier in Nov 2011 and current under startup and process optimization stage

- Rentech-ClearFuels gasifier will be demonstrated in 2012 during a series of 3 campaigns using sugar cane bagasse, virgin wood waste, & a combination of the two for the production of ASTM certified renewable jet and diesel fuels
ClearFuels IBR Performance

- Total ~ accumulative 100+ hrs stable operation in producing Biomass-Derived Syngas
- Steady Feed handling system & reformer operation
- Preliminary data indicates:
  - High Carbon Conversion to Gas
  - Consistent Low Tar Content (~15 PPMV) after water scrubber
  - Stable Syngas Composition
BECE

BTL Process Walk Through
Southern Pine White Chip Feedstock

* Courtesy of Steven Taylor from University of Auburn
ClearFuels Gasifier
Syngas Conditioning Unit
FT Reactor
UOP Product Upgrading
End Product: “Drop-In” Fuels