Sunflower Integrated Bioenergy Center

Sunflower Integrated Bioenergy, LLC

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SUNFLOWER ELECTRIC POWER CORPORATION
A Touchstone Energy® Cooperative
Goal is to develop a bioenergy facility that will integrate a number of commercial or near commercial renewable energy technologies with the coal-based power plant located at Holcomb Station.
Ethanol Sub-System

- Produces Ethanol

- System Inputs
  - Corn
  - Starch
  - Biogas
  - Water

- System Waste Streams
  - Distillers Grains
  - Water
  - Thin Stillage

Anaerobic Digester Sub-System

- Produces Biogas

- Digester Inputs
  - Animal Waste
  - Waste Water
  - Thin Stillage
  - Glycerol

- Digester Waste Stream
  - Methanol
  - Solids w/ nutrients
  - Water w/ nutrients
**Dairy Sub-System**

- **Produces Milk & Calves**

- **System Inputs**
  - Distillers Grains
  - Water
  - Feed grains
  - Roughage & Protein

- **System Waste Streams**
  - Animal Waste
  - Waste Water

**Bio-Diesel Sub-System**

- **Produces Bio-Diesel**

- **Bio-Diesel Inputs**
  - Oils
    - Soybean
    - Corn
    - Algae
    - Canola
    - Animal tallow
  - Methane Gas
  - Methanol

- **System Waste Streams**
  - Glycerol
Algae Sub-System

- Produces Algae Oil, Starch, Protein
- Algae Inputs
  - Water
  - Nutrients
  - Sunlight
  - CO2
- Algae Waste Streams
  - Water

Algae Reactor

- Microalgae is the most primitive plant form - typically one or two cells.
- This simple structure allows algae to be very efficient at converting sunlight, CO₂, and nutrients into oil (for biodiesel) and starch (for ethanol).
- CO₂ and NOx are consumed in the bioreactor by algae through photosynthesis and other biological processes. Algae are suspended in water with nutrients from the anaerobic digester.
- Phase 1 onsite algae study completed
Greater Profitability

- Utilization of co-products from one facility as a feedstock for another facility
- Shared infrastructure resources such as rail, road, and gas line access
- Shared management, back office, and maintenance resources
- Transportation benefits
- Power plant co-location advantages
- Over 160 new jobs
Environmental Benefits

- Carbon utilization technologies and associated carbon credits
- Utilization of waste streams as feedstocks
- Comprehensive approach to water reuse and reducing natural gas use
- Reduction in greenhouse gas emissions (CO2 and methane)
- Other emission reductions
- Water treatment and possible zero waste water discharge

Market Resilience

- Use of co-product feedstocks to hedge against market fluctuations
- Development of new oil and starch sources for biodiesel and ethanol
- Processes to reduce operating cost such as local delivery of wet distillers grain
- Portfolio approach to bioenergy technology & agricultural products
- Single owner model allows ability to flex with the market
Anaerobic Digestion

Historical and Projected Natural Gas Prices

Location Advantages

- 10,000 acre site (access to additional 30,000 acres)
- Ample water supply
- 3.6 million head of cattle in the region
- 302 million bushels of corn grown in the region
- 135 million bushels of sorghum grown in the region
- 70,000 new dairy cows in western Kansas since 1995
- BNSF mainline rail access
- Natural gas pipeline onsite
- Land zoned for heavy industrial use
- Community support for power plant and bioenergy center development
Engineering Status
• Black and Veatch has completed a model validation project

Integrated Model Status
• Full patent application on file with USPTO for integrated model

Funding Status
• KBA grant for engineering with milestones for additional funding
• Cash and in-kind contributions made by SIB, LLC partners
• In conversations with multiple capital advisory firms interested in raising debt and equity

Legislative Status
• Assisted in passing Kansas legislative Bioenergy incentives

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