

Contract No. R009-020
“Dakota Spirit AgEnergy Cellulosic Biorefinery”

Submitted by Great River Energy
Principal Investigator: Sandra Broekema

PARTICIPANTS

Sponsor	Cost Share
Great River Energy	\$ 501,347
Great River Energy (In-Kind)	\$ 373,307
North Dakota Industrial Commission	<u>\$ 500,000</u>
Total Project Cost	\$1,374,654

Project Schedule – 12 months
Contract Date – December 29, 2010
Start Date – October 1, 2010
Completion Date – March 31, 2012

Project Deliverables:
Status Report: March 1, 2011 ✓
Final Report: March 31, 2012 ✓

OBJECTIVE/STATEMENT OF WORK:

This work will expedite the development phase of a project to build a commercial scale cellulosic biorefinery near Spiritwood, North Dakota. This proposed biorefinery, using a proven Danish technology, will convert wheat straw and/or corn stover to higher value energy products such as cellulosic ethanol, C5 molasses and purified lignin pellets. This work includes the development of the pre-FEED study and Financial Model for the overall facility. The scope of work includes budgetary costs estimates, schedules, technology scale up and conversion to U.S. standards, process and equipment design packages, and general layout drawings and site survey.

STATUS

Contract has been signed.

The March 1, 2011 report has been received and a link to the status report is available on the website. Portions of the Executive Summary of the Report state:

A formal “Feedstock Supply and Product Marketing Study”, factored estimate of capital cost and internal financial models have been completed. Our analysis and models show that in order to be economically feasible, a smaller scale plant will be the preferred and most probable path for success. Higher than expected capital investment and feedstock costs are the two main drivers in a plant concept that is not financeable at 20 MPGY. By reducing the scale of the plant to 8 MGPY, the delivered cost of feedstock is reduced, due to decreased collection and transportation costs coupled with higher residue productivity closer to the plant location. Capital cost is also reduced in total and further improvements can be achieved by creating a phased in hybrid plant approach to leverage mature balance of plant infrastructure with larger overall economies of scale.

<u>Phase I – 50 MGPY</u> Conventional dry mill ethanol plant “backbone”	<u>Phase II – 8 MGPY</u> Cellulosic “bolt on” front end	<u>Phase I & II – 58 MGPY</u> Hybrid biorefinery plant
Provides foundation of positive cash flow for overall project finance	Incremental investment in smaller scale specialized core technology has lower CAPEX and OPEX	Winning combination of new & existing technology

The strategy for success now is to create a phased in “hybrid” biorefinery to leverage the mature economics of a 50 MGPY conventional dry mill ethanol plant (backbone) while establishing a solid foundation of positive cash flow for the full development. Raising the E10 Blend Wall to E15 has created a brief window of opportunity for a conventional facility using combined heat and power and corn oil extraction to achieve a D-RIN qualification. The mature technology allows us to build out the entire balance of plant at the most economical rates, and provides a significant jump start in the development and construction process. By phasing a conventional facility with a scaled down “bolt on” cellulosic front end, we also reduce the total installed cost to our original plan. An 8 MGPY cellulosic front end is still considered “commercial scale” and reduces the feedstock requirements to about 192,000 tons per year – which would be available within a much more economic draw radius. Our preliminary financial analysis of this hybrid approach shows significant promise.

Final Report – March 31, 2012

The Final Report has been received. The non-confidential report is available on the website. In part the Executive Summary states:

Dakota Spirit AgEnergy, LLC was formed to develop and build a commercial scale cellulosic Biorefinery adjacent to Great River Energy’s combined heat & power plant in Spiritwood, North Dakota. Great River Energy dedicated key personnel and formed a multi-organization project team to develop the project.

Dakota Spirit AgEnergy evaluated the Inbicon 20 MGY cellulosic technology and determined that it was not economically feasible in a green field application at this time. The second generation (2G) technology is quite expensive at roughly \$20 per installed gallon of capacity due to its current demonstration scale, compared to mature conventional first generation (1G) technology at \$2 per installed gallon of capacity. Additionally, the uncertainties associated with cellulosic feedstock and storage logistics created considerable risk.

The project team determined that there could be economic advantages to combining first and second generation technologies together. The mature first generation technology would provide a foundation of cost effective technology and balance of plant components at a larger commercial scale, and a smaller scale second generation addition would allow for a more cost effective cellulosic feedstock supply radius with slightly less risk.

Dakota Spirit AgEnergy is now moving forward as a Phase 1 Biorefinery to establish the sustainable foundation for future growth. Dakota Spirit AgEnergy is currently awaiting a “renewable fuels” D code RIN certification under RFS2 from the EPA. Once the designation is secured, a Private

Placement Memorandum will be issued to invite private equity to finance the project. We currently expect project financing to be finalized in the June/July timeframe and break ground shortly thereafter. The construction lead time is 18 months, projecting a plant start-up in early 2014.

This contract is now closed.

4/11/12