

Contract No. R-008-018
“Biomass Testing Laboratory for Physical & Thermal Characteristics of ND Feedstock”

Submitted by North Dakota State University
Principal Investigators: Gustafson and Cannayen

PARTICIPANTS

Sponsor	Cost Share
NGPRL USDA-ARS	\$125,053
NGPRL USDA-ARS	\$ 99,947 (in-kind)
North Dakota Industrial Commission	<u>\$225,000</u>
Total Project Cost	\$450,000

Project Schedule – 24 months
Contract Date – November 23, 2010
Start Date – June 1, 2010
Completion Date – October 31, 2012

Project Deliverables:
Status Report: November 30, 2010 v
Status Report: April 30, 2012 v
Final Report: June 30, 2012 v
Additional Final Report: October 31, 2012 v

OBJECTIVE/STATEMENT OF WORK:

The goal of this project is to establish a Biomass Testing Laboratory to evaluate physical and thermal characteristics of diverse ND feedstock and the densified biomass products. The lab will be a joint venture between NDSU and USDA-ARS in Mandan. The lab will provide North Dakota with a way to measure quality of biomass feedstocks, producing a unique industry and market database of performance characteristics. The funding provided by the North Dakota Industrial Commission/Renewable Energy Program will be utilized to purchase four pieces of equipment: Thermo Gravimetric Analyzer; MTI Universal Testing Machine; Environmental Control Chamber; Bomb Calorimeter.

STATUS

Contract has been executed and the matching funds have been verified.

March, 2011

Additional time (March 1) was granted to the Contractor to provide the first Status Report. The report was received in March and detailed information was provided regarding the purchasing process and actual purchasing of the four pieces of equipment. A number of outreach activities have taken place highlighting the capabilities of the Biomass Testing Laboratory: NDSU Agriculture Communication News; Customer Focus Group; 2010 Annual Highlights of NDSU ND Agricultural Experiment Station and NDSU Extension Service; Renewable Energy Day at the Capitol; and 2010 Research Results & Technology Conference

April, 2012

Due to a number of factors--flooding, installation delays, faulty equipment components that required additional time in working with the equipment supplier to determine cause and then replacement of the faulty component(s)--NDSU was delayed in submitting their second status report. An amendment has been requested and approved extending the date for the second status report and also extending the date for the final report.

May, 2012

Status Report II has been received and includes information regarding the installation of the equipment; reports on the initial testing; and the outreach activities to increase the awareness of biomass utilization, quality aspects and necessity of a testing lab.

July, 2012

The final report has been received and is posted on the website. An amendment has been requested and approved allowing for an additional final report which will include information on the results of work conducted on the equipment purchased under this project. In addition Igathinathane Cannayen has been named as the Principal Investigator due to the untimely death of Dr. Cole Gustafson.

The final report includes the following summary:

“This comprehensive final report on the project entitled “Biomass Testing Laboratory (BTL) for Physical and Thermal Characteristics of Feedstock of North Dakota” presents background of the need; methodology followed; test material processing; description and operation principle of four major pieces of equipment; results, analysis, discussion, and interpretation; outreach activities highlighting the BTL capability; news items on the BTL; future work and recommendations; and appendices for more detailed information.

“A substantial void exists among producers and processors of North Dakota biomass regarding its quality, suitability for densification, and energy applications. Evaluation of the physical and thermal characteristics of raw and processed biomass forms the important phase of evaluation of baseline data. This information guides various efficient operations of biomass processing and handling as well as aiding in development of new processes.

“This two year, \$450,000 (total with 1:1 cost match) equipment grant project established a “Biomass Testing Laboratory”. Four major pieces of equipment (thermal analyzer TGA/DSC, universal testing machine, environment control chamber, and calorimeter) were purchased, installed and tested successfully. Although the installation process was faced with some unforeseen installation issues and delayed the progress, the equipment is now in order and ready for experiments and production of research results.

“Results generated from numerous experiments that were presented on appropriate sections provide good insight on the quality (physical, mechanical and thermal) characteristics of the ND biomass feedstocks. Future studies will include the effect of moisture content, maturity stage, anatomical component differences, effect of storage, etc., on the various physical, mechanical, and thermal properties of several ND biomass that the BTL specializes. The BTL has become fully functional from June 2012.”

November 1, 2012

The final report with information on the final purchases made with this funding was delivered and is now posted on the Industrial Commission/Renewable Energy Program website. Included in the final report is information on future work. It states, in part, “Having established the NDSU Biomass Testing Laboratory at NGPRL with four major pieces of equipment and demonstrated the measurement, analysis modeling, and interpretation, the future work will be relatively simple but more productive. Biomass samples from the immediate fall harvest from NGPRL and other samples from NDSU research stations will be subsequently studied and results will be cataloged. Future studies will include the effect of

moisture content, maturity stage, anatomical component difference, effect of storage, etc., on the various physical, mechanical and thermal properties of biomass that the BTL specializes. The results on the quality of the biomass along with statistical analysis will enable to rank and select the suitable biomass feedstocks for industrial applications.”

The final statement in the report is:

“Biomass testing laboratory being well equipped with equipment capable of determining the biomass feedstocks and their products quality through physical, thermal, mechanical and storage properties is poised to produce results and serve the local, industrial and academic needs of North Dakota.”

A presentation regarding this project will be given to the Renewable Energy Council at their November meeting. This project is now complete.

11/9/12