Economic Development Incentive Grant 2013-14 Annual Report

Institution Name(s): University of Wisconsin-Stevens Point	Project Title: Collaborative Research Facility for Development and Commercialization of Biorefinery Technologies: Cellulose Pilot & Processing Lab
Principal Investigator: Dr. Eric Singsaas	**Person submitting Report: Stacy Schwenke**
Email: Eric.Singsaas@uwsp.edu	**Contact Phone #: 715-346-3668**
Grant Award Amount: $2,837,596	**Report Date: June 30, 2014**
Grant Funding Spent (to date): $337,112.48	**Date project began: January 1, 2014**
	Date project ends (projected): June 30, 2015

I. Status Report

The Cellulose Pilot and Processing Lab (CPPL) will accelerate the development of the renewable materials, paper, green chemicals and biofuels industries through collaborative research and piloting facilities made available to major manufacturers, small startups, biotechnology entrepreneurs and academics who have an idea of how to convert cellulose, the most abundant natural material on Earth, into the sustainable and renewable products of the future. The CPPL will include pilot production facilities located in Wausau, Wisconsin and a series of analytical technology development laboratories located in Stevens Point, Wisconsin.

Summary of Objectives

This is an 18-month effort that will result in the development of a pilot biorefinery that will support a portfolio of sustainable, renewable, and affordable alternative energy and biorefinery technologies. The supported research and development will utilize and modify existing state of the art technologies, as well as develop new technologies, and facilitate collaboration between industry and academia.

Personnel and Hiring

In order to establish the fermentation and digestor laboratories at UWSP and establish initial projects, two researchers with specialized knowledge and experience were required to be hired.
Status: WIST hired two postdoctoral research associates, with hiring date effective July 1, 2014: Dr. Raghu Nandan Gurram, research associate in chemical engineering; and Dr. Alex S. Rajangam, research associate in microbiology.

Position descriptions were submitted to AVC Jore January 31. All EAA paperwork approved and positions were advertised March 17 and application screening began April 11. Eight candidates were phone interviewed May 1-2. Four Candidates were brought to campus for interviews May 13-20. Offers were made May 19 for Raghu and May 28 for Alex.

Businesses assisted

Status: Cellulose center staff and students began a comprehensive analysis of cellulose residuals (sludge) from four regional mills. The aim is to evaluate the cost and available mill residual resource for feed-in to ethanol plants or production of other biobased chemicals. Residuals were sampled from NewPage mills in Wisconsin Rapids and Duluth, the Domtar mill in Rothschild and the Expera (formerly Thilmany) mill in Kaukauna.

We signed a nondisclosure agreement with Flambeau River Papers in Park Falls, WI.

WIST staff completed a market analysis of biobased products for Cosmo Specialty Fibers, Cosmopolis, WA. The report was delivered to their investors, Gores Group in Los Angeles, CA on April 10. Gores Group approved piloting of selected process and has created a committee to study further investment in the biobased chemicals space. Cosmo Specialty Fibers initiated a contract with the cellulose center for Dr. Singsaas to supervise piloting. The contract runs from June 1-September 30.

Fermentation laboratory, including equipment purchase and installation

Fermentation facilities at UW-Stevens Point will be modified to improve capacity.
Status: WIST laboratory staff has begun the process of renovating room D005 Science for a fermentation laboratory. Six equipment vendors were evaluated based on price, performance and delivery status. Staff placed orders for six 0.5L off-the-shelf fermenters (Mini Bio Bundle) and one 20L pilot fermenter (20 L Bio Bench) from Applikon. Delivery of the 0.5L models is expected in September. 20L model will be delivered by first quarter of 2015.

Scheduled fermentation experiments

Status: Fermentation experiments will be scheduled when the laboratory installation is completed.

Marketing and communications

Status: American Science and Technology (AST), under contract from the University of Wisconsin Stevens Point, has contracted with Jim Lunt LLC to handle marketing and client communications. Jim Lunt was selected because of his extensive experience and contacts in the biorefinery and bio-based products sectors.

Pilot digester laboratory, including design and construction, laboratory preparation and digestor installation

Status: American Science and Technology (AST), under contract from the University of Wisconsin Stevens Point (UWSP), has been assigned to build upon its past experiences and expand its current pilot biorefinery. In particular, AST is going to scale up its pilot plant by designing, building, assembling and operating a scale up pilot fractionation reactor that can process 2 ton of biomass per day. This is a 15 month task which started from April 1, 2014 and shall be completed by September 30, 2015.

In the past several years, AST and UW-Stevens Point have collaborated on the development of technologies to fractionate various lignocellulosic biomass sources into their ingredients and the explore production of valuable products such as fiber, sugar, and pure lignin. During this period of collaboration, AST developed and built a pilot production plant and UWSP added the required equipment to establish laboratories for technology development and analytical support. The CPPL is a continuation of the ongoing collaboration and expansion of the pilot plant and analytical services facilities, capabilities, and shared resources.

Overall, this project is expected to add two more employees and maintain six employees, all in Wausau, WI.

Task One - Design

This task is to design a new, larger unit to increase AST's capacity of biomass treatment from its current level of 200 Kg to about 2 ton/day. For this task, AST will use its past experiences in operating its pilot plant to design a

new Process Flow Diagram (PFD), Process Instrumentation Diagram (PID), Floor Plan (FP), and Materials flow diagram (MFD). To reduce costs, AST will try to capitalize on most of its current equipment. This task is expected to take about 2 persons and 3 months to complete.
Status: AST has completed the design of its Process Flow Diagram (PFD) and initial quote package. To further improve its capabilities, AST hired Baisch Engineering. During the reporting period, the team of AST/Baisch Engineering has completed and submitted a general spec to various vendors to obtain their formal quotes. Attachment "A" is AST's quote package including the PFD. This task is about 85% complete, only slightly behind schedule. To speed up the process, more manpower has been assigned to this task.

Task Two - Reactor Fabrication

This task will be contracted out to a fabrication shop, due to the size, pressure, and temperature requirements of the reactor. This task is expected to take about 9 months to complete and requires one full time engineer from AST, plus materials and fabrication costs.
Status: Through Baisch Engineering, AST has sent technical specifications to about 8 vendors. The submitted package is AST's wish list and negotiations are now underway to determine how much of AST's wish list can be achieved with the available funds during the project's time frame.

Task Three - Installation

The equipment built by the fabrication shops will be delivered to the AST plant in Wausau and will be installed by AST's experts. The AST team has acquired the necessary experiences to assemble this biorefinery. This task is expected to take about one year and three engineers and technicians to complete. This task also is expected to sustain two jobs and allow AST to hire one new full time employee.
Status: This task has not started yet.

Task Four - Marketing

For this task AST will utilize all possible means, including hiring nationally known experts, web-based advertising, and social media to publicize CPPL's capabilities and services. In particular AST is planning the following:

Direct Marketing: While the new pilot plant is being built, AST will hire a new aggressive marketing specialist to introduce CPPL to big biorefineries, biomass producers, and biomass users.
Status: AST has already signed an agreement with Mr. Jim Lunt, who is a well know expert in the field of biorefineries. AST has made a trip to Charlotte, NC to meet with Mr. Lunt and provided him with initial information packages to bring him up to speed. Based on the limited time that we can afford from him, we expect him to become helpful within the next two or three months.

Web-based and social media marketing: In addition to direct introduction, AST will use web based marketing and social media to spread the news about the new cellulose R&D center. The sales pitch will focus on how the collaboration between State, University, and private industries can implement new technologies to expand their market share or to save their current business.
Status: AST has not started web-based marketing yet.

Task Five - Other Equipment

While the new pilot reactor is being built, as time and funds permit, AST staff will either identify vendors or design and fabricate the required equipment for the balance of the biorefinery. In particular, AST will perform the following subtasks:

Solvent recovery: To match the pulp production, AST will identify and purchase a screw press or a horizontal centrifuge to remove as much solvent as possible from the digested pulp. This subtask is expected to take about 1 month to identify and purchase the necessary equipment and 6 months to install and prepare them for use.
Status: This task has not yet started.

Pulp washing system: To match the pulp production, AST will purchase another horizontal centrifuge to remove water from the washed pulp. This task will take about 1 month to identify and purchase the necessary equipment and 6 months to install and prepare them for use.
Status: initial conversations with Flowtegg and GAE have started to identify a system for separation of solid from liquid. The final negotiations will be done after the fractionation reactor is ordered.

Pulp drying: To match its new production capabilities, AST will design and build a drying room that can dry 2 tons of pulp up to 90% solid content in three to four days.
Status: A drying room for two tons of pulp has been designed and is being built. This room is expected to dry pulp up to 90% solid. All the equipment and parts have been purchased and the unit is expected to become operational within the next two to three months.

Hydrolysis: To match the pulp production, AST will also purchase and install hydrolysis reactors with about 12,000 gallons to hydrolyze about one ton of pulp to glucose per day. This process will be followed by the separation of the unreacted fibers from the sap and the dehydration of the sap. This task will take about 9 months to complete.
Status: This task has not yet started.

Lignin recovery: Since lignin potentially will be one the most important products, we have to be able to recover it and dry it to at least 95% solid content. For this task, a new reactor must be designed and built. This task will take about 3 months for conceptualization, 6 months for building, and 2 months for installation.
Status: This task has not yet started.

Other Equipment: In addition to the equipment mentioned, if funds and time permit, AST will design and build other required parts, equipment, and systems to further enhance the biorefinery for CPPL usage.
Status: No additional required equipment has been identified yet.

Task Six - Integration
As the equipment is purchased/built and installed, the system will be tested and debugged to make sure all the equipment, piping, valves, and instruments are working properly. This task is expected to take two technicians for one year.
Status: This task has not yet started.

Task Seven - Operation
After all equipment is installed and tested, AST will operate the integrated system to provide R&D services for any potential customers as well as for internal R&D. For this task, the operation costs will be provided by the customers (biomass owners and users who want to rescue their investments and diversify their product portfolios). To operate the larger biorefinery, AST expects to hire and train one more new employee. Altogether, this task is expected to sustain six employees in Wausau, WI.
Status: This task has not yet started.

Task Eight - Reporting
On a quarterly basis, AST will report all of its activities and progresses for each task. AST reports will include number of hours worked on the various projects, potential customers contacted or worked with, and up to date expenses for the reporting period.

Issues / Recommendations
AST is slightly behind the planning schedule. This is due to difficulties that vendors seem to have with building such a large pressure vessel. AST and its consultant are trying to negotiate with vendors to see what compromises are needed to achieve the same goal.

Future Work
AST shall continue working on tasks one and two as its top priorities. AST and Baisch Engineering will continue working and negotiating with vendors and manufacturers to find the best compromises to get the largest reactor that can be made for this project. AST will also continue working with Jim Lunt to provide him with enough information so that he can effectively talk on behalf of CPPL and market its services.

Employment
As planned, during the reporting period, AST hired one new employee to bring the total of employees in Wausau from 4 to 5. Within the next reporting period, AST expects to hire one more person for the Wausau plant.

II. Updated Goals/Performance Metrics and Assessment Plans
The attached Excel spreadsheet and this document report the current status of project goals/performance metrics, anticipated completion date(s), actual completion date(s), and assessment plans.

Number of jobs created: Five jobs were projected to be created and six have been created. One additional technical staff was hired at AST in 1Q 2014. Two postdoctoral associates, one laboratory chemist were hired in WIST laboratory. WIST Biorefinery laboratory has employed three student researchers since January 2014.

Number of jobs retained: Four jobs were projected to be retained and five have been retained. AST retained four and technical positions. WIST laboratory retained one postdoctoral associate position, Dr. Shona Duncan.

Number of businesses assisted: Four businesses were forecast to be assisted in the first full project year and eight businesses were forecast to be assisted overall; six have been assisted to date.

III. Project/Program Budget and Expenditures

Please provide a report of project/program expenditures detailed by category and source of funds.

Table 1 Expenditure Report for 2013-14

January-June 2014 Expenses	Original	Actual	Remaining
Salary	497,971.95	55,377.77	442,594.18
Fringe	208,067.06	16,733.78	191,333.28
Travel	22,350.00	20,178.69	2,171.31
Supplies	53,499.96	9,533.02	43,966.94
Equipment	290,955.48	147,360.72	143,594.76
Subcontracting	1,495,000.08	72,323.02	1,422,677.06
Indirect	269,751.70	15,605.48	254,146.22
	2,837,596.22	337,112.48	2,500,483.74

Actual expenditures are below pace because of lead time required for drafting of specifications, procuring of bids and scheduling of installation. Expenditures are projected to increase in the next six months. Salary expenditures are behind pace because of the lead time required to hire staff.

IV. Changes

American Science and Technology has contracted with Baisch Engineering, Appleton, WI, for design and supervision of the pilot plant build.

UW System Incentive Grant
General Outcomes/Goals Reporting Matrix
2013-14

Incentive Grant Program Name: **Collaborative Research Facility for Development and Commercialization of Biorefinery Technologies: Cellulose Pilot & Processing Lab**
Funding Allocation: **$2,837,596**

#	Performance Outcomes Descriptions	Assessment Plan Description	Projected Goals 2013-14	Actual 2013-14 Outcomes	Projected Goals 2014-15
1	**Hiring**	UWSP Postdocs and AST Scientists	3 hires at UWSP and 2 hires at AST by June 2014	3 Postdoc positions filled at UWSP. Marketing consultant contracted by AST. Final position unfilled.	
2	**Pilot digester design and constructinon**	Build contract	Design completed and order placed by June 2014	Design process underway, 5-month delay due to subcontract approval process.	
3	**Digester lab preparation**	Facility prep	Completed by October 1, 2014	In progress	
4	**Installation**	Final installation of hydrolysis unit			Completed and installed by June 30, 2015
5	**Market digester and hydrolysis lab**	Completed marketing packet		Contract with Jum Lunt LLC for marketing research.	Marketing web site and glossy materials available by June 30, 2015
6	**Order equipment**	Off-the-shelf fermentation lab equipment	Purchase orders completed by June 30, 2014	Purchase orders completed	
7	**Equipment installation**	Facility prep and installation	Work orders completed by June 1, 2014	Work orders delayed punding discussion with UWSP facilities.	Installed by January 1, 2015
8	**Scheduled fermentation experiments**	Initial work for existing customers	Project started by September 2014	Pending fermentation lab completion.	Completed by June 2015
9	**Market Fermentation lab to outside customers**	Marketing of fermentation facility			Marketing web site and glossy materials available by June 30, 2015

UW System Incentive Grant Program
Required Program Goals/Outcomes Reporting Matrix
2013-14

Economic Development Goals and Results

Economic development program" means a program or activity having the primary purpose of encouraging the establishment and growth of business in this state, including the creation and retention of jobs, and that satisfies all of the following:

1. The program receives funding from the state or federal government that is allocated through an appropriation under ch. 20
2. The program provides financial assistance, tax benefits, or direct services to specific industries, businesses, local governments, or organizations.

Performance Categories	Goals		Actual Outcomes 2013-14	Accomplished Goal? Yes or No	Notes
	Projected 2013-14	2014-15			
# of Jobs Created	5	5	6	Yes	AST anticipates filling one additional position within the next reporting period.
# of Jobs Retained	4	4	5	Yes	
# of Businesses Assisted	4	8	6	Yes	

Additional Goals/Outcomes	Goals		Actual Outcomes 2013-14	Accomplished Goal? Yes or No	Notes
	Projected 2013-14	2014-15			
Invention disclosures	2	2	0	No	Invention disclosures pending due to delays in hiring process.
Licenses	1	2	0	No	Licensing discussions were slowed due to the 5-month delay in subcontract

UW System Incentive Grant Program
Required Program Goals/Outcomes Reporting Matrix
2013-14

Development of a Skilled and Educated Workforce

Programs that have as their objective the development of an educated and skilled workforce, such as the following:

a. Increasing the number of bachelor's, master's, and doctoral degrees awarded in fields for which occupational demand is high or in fields that the board and the department of workforce development jointly determine to be high-demand fields.

b. Increasing the number of opportunities available to students to gain work experience in their fields through internships or cooperative work experiences.

c. Increasing or enhancing research and development.

	Goals		Actual Outcomes 2013-14	Accomplished Goal? Yes or No	Notes
	Projected 2013-14	2014-15			
# of Bachelor's degrees awarded in high-demand fields					
# of Master's degrees awarded in high-demand fields					
# of Doctoral degrees awarded in high-demand fields					
# of internships created (paid)					
# of internships created (unpaid)					
# of cooperative work experiences (paid)					
# of cooperative work experiences (unpaid)					

Increasing or Enhancing Research and Development Reporting

Goals	Anticipated Completion Dates	Actual Completion Dates	Accomplished Goal? Yes or No	Notes

UW System Incentive Grant Program
Required Program Goals/Outcomes Reporting Matrix
2013-14

Improve the Affordability of Higher Education

Programs that Improve the Affordability of Higher Education for Resident Undergraduates, including:

a. Reducing the time required to obtain a degree
b. Increasing the opportunities available for high school pupils to earn credit toward a postsecondary degree; and
c. Improving the transfer of credit between institutions of higher education.

Reducing the Time required to obtain a Degree

Goals	Anticipated Completion Dates	Actual Completion Dates	Accomplished Goal? Yes or No	Notes

Increasing the Opportunities available for High School Pupils to earn Credit toward a Postsecondary Degree

Goals	Anticipated Completion Dates	Actual Completion Dates	Accomplished Goal? Yes or No	Notes

Improving the transfer of Credit between Institutions of Higher Education

Goals	Anticipated Completion Dates	Actual Completion Dates	Accomplished Goal? Yes or No	Notes
			NA	