Wisconsin Institute for Sustainable Technology

Annual Report

October 2014

Wisconsin Institute for Sustainable Technology
University of Wisconsin-Stevens Point

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Contents

Research, laboratory services and education provided by the Wisconsin Institute for Sustainable Technology (WIST) help businesses and organizations meet their goals in ways that make more sustainable use of natural resources. Technology and ideas developed by WIST and its partners will spur economic growth in Wisconsin and the region and help preserve a healthy environment for future generations.

WIST is an institute within the College of Natural Resources at the University of Wisconsin-Stevens Point. It is a multidisciplinary institute powered by the energy and expertise of faculty, staff and students across the UW-Stevens Point campus. Major funding for WIST operations has been provided by the US Department of Agriculture National Institute of Food and Agriculture.

A Note From the Director

Paul Fowler
Executive Director

It's always a pleasure at this time of year to reflect and report on WIST's achievements in the past twelve months. This year is no exception.

Our year started with a one-off opportunity to bid for significant capital and revenue funds from the University of Wisconsin System. As you will read in this report, two of the bids we submitted were successful netting close on $4.3m to support WIST activities through June 2015.

Alongside delivering on the outcomes of the grants, WIST has continued to grow its fee for service work with local, regional and national businesses. We have completed thirty one projects in the past twelve months with several other significant industry funded projects close to completion.

WIST has also assumed day-to-day management of research and outreach activities at the University's Waste Education Center. Working with staff and faculty in the College of Natural Resources soils and waste and water resources disciplines, we have brought new industry funded projects to that location to help support its infrastructure and equipment needs as well as deliver first class results for industry sponsors.

The WIST staff has expanded since I wrote last year and that is to help meet the increased workload that our efforts have generated. You can read WIST staff profiles in the back pages of this report.

Please take a moment to read through the report and if you have any questions or need further information on any aspect of WIST's work then please do not hesitate to contact me at 715-346-3767.

Economic Development Incentive Grants

A new program from the University of Wisconsin System taps the talent and innovative spirit of campuses across the state to strengthen Wisconsin's economy

From left, Eric Singsaas, Karyn Biasca, and Paul Fowler pose in the Capitol Rotunda during a visit to Madison for a recognition event for grant recipients of the UW System Economic Development Incentive program.

When the state of Wisconsin and UW System announced in 2013 a call for proposals focused on economic development initiatives, WIST responded quickly. The institute focuses on all three legs of the sustainability stool, including economic sustainability. WIST's mission is to develop sustainable technologies, processes and ideas that can be transferred to business and industry to spur economic gains.

The Economic Development Incentive Grant program, as it was titled, also placed a premium on applications that included collaborative efforts, another WIST strong suit. The institute teamed with the UW-Stevens Point Department of Paper Science and Engineering for one proposal, and with a private company, American Science and Technology, for another. Two other collaborative project proposals from WIST were not funded in the 2013 round. In addition to the awards to WIST and its partners, System awarded a third grant to UW-Stevens Point for its Aquaculture Business Incubator and Aquaponic Innovation Center: Economic Development for Emerging Agricultural Industries ($677,500).

Statewide, the program awarded $22.5 million to university campuses. “This represents the Wisconsin Idea at its best,” said then-UW System President Kevin P. Reilly in a news release announcing the grant awards. “We are investing university resources to address key state priorities. These investments will help drive regional economic development and advance new educational and research initiatives to support traditional and emerging Wisconsin industries.”

In a separate news release from UW-Stevens Point, Chancellor Bernie Patterson said he was excited about the opportunities these grants bring to the university and to central and northern Wisconsin. “A major initiative within our ‘Partnership for Thriving Communities’ strategic plan is economic development," Patterson said. "Our vision for the university is to be more sensitive to community issues and more responsive to community problems so we all prosper."

Collaborative Research Facility for Development and Commercialization of Biorefinery Technologies: Cellulose Pilot and Processing Lab

Project period: FY2013-15
Award amount: $2,837,596.
Principal Investigator: Eric Singsaas

Project Description:
The Cellulose Pilot and Processing Lab 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.

Economic Development through Innovation in Specialty Paper, Packaging and Converting

Project period: FY13-15
Award amount: $1,445,336
Principal investigators: Paul Fowler, Karyn Biasca

Project Description:
The project will help Wisconsin’s specialty paper, packaging and converting sectors add new revenue streams to their operations, preserve and add jobs and grow the state’s economy. Specifically, the project includes upgrades to the UW-Stevens Point pilot paper machine to enable improved education and training as well as trial-run production of laminated and coated papers for packaging and other applications; equipment additions to the university’s laboratories to allow testing and evaluation of these products for manufacturers; a new fine art paper developed at UW-Stevens Point will receive trademark protection, additional grades of the paper will be developed and arrangements will be made to market and distribute this niche product; a compostability testing service recently developed at UW-Stevens Point will be improved by automation in order to better serve industry needs for new product development; and new, advanced courses for paper industry employees will be created, and existing courses will be improved.

Pilot Coating and Laminating

New equipment will foster research, development, and education in specialty papers

Specialty paper is a growing segment in the papermaking industry. The term encompasses a wide range of paper applications including coated and laminated paper. Innovation in these products can drive sustainability gains, for example by providing longer shelf life for food or enabling such environmentally friendly end-of-product-life solutions as compostability or recyclability.

Embracing market needs and opportunities, UW-Stevens Point installed a new pilot coating and laminating line in July. The equipment was manufactured by Faustel, a Germantown, Wis., company. Purchase and installation was funded by an Economic Development Incentive (EDI) Grant from the University of Wisconsin System. WIST staff, along with faculty and students of the paper science and engineering program, immediately began training on the machine, learning its capabilities with the help of Faustel engineers. Roland Gong, an assistant professor in the UW-Stevens Point paper science and engineering department, has a strong interest in coating and lamination and will be involved in WIST research and development work.

Steve Janisch and Tom Umbach of Faustel Corp. prepare to unload the main unit of the coating and laminating machine.

"Roland is our first point of contact from a technical standpoint," said Paul Fowler. "He's got a great background in coating and laminating."

Gong, whose graduate study at Western Michigan University focused on paper coating and particularly the paper pigment coating process, has worked on coating and lamination since 1998 as a printing and packaging engineer. His work has included cigarette packaging and liquid packaging.

The Faustel machine can handle paper, film, foil and nonwovens on roll sizes up to 300mm wide and at speeds of up to 30m/min. We can undertake gravure roll and slot die coating techniques with water-based or solvent-less formulations, and dry bond laminating.

WIST will use the pilot line for small-scale production runs, product development runs and tests with various substrates. Our goal is to undertake contract research or collaborative research and development with specialty paper manufacturers and converters, and coating additive manufacturers.

In addition to its use by WIST, the pilot coating and laminating line enhances teaching and learning in the paper science and engineering program at UW-Stevens Point. For example, Gong will be using the new machine in his paper coating and converting class.

Coatings are applied at the front end of the pilot machine. Interchangeable units allow for a variety of application materials and methods.

Roland Gong, assistant professor in paper science and engineering at UW-Stevens Point, describes capabilities of the Faustel Pilot Coating and Laminating Line.

Compostability

WIST first offered compostability testing for paper and bioplastics in November 2012. Since then, the institute has worked to continually improve its facilities. Executive Director Paul Fowler said there's good reason for the considerable effort aimed at its compostability testing service.

"We think there's going to be a real need there, a real desire on the part of suppliers of packaging and users of packaging to have those certified by third parties as being compostable," Fowler said. "It's about diverting materials from landfills. I think the compostability lab will grow to become a significant part of WIST operations, in the context of a broader field of view which says, how else can we divert materials."

Other ways could include repulpability and recyclability, Fowler said, and WIST is already working in both those areas.

Seeing the potential in the testing service, WIST hired a full-time compostability laboratory manager in December. Amber Davidson is a UW-Stevens Point graduate with a BS in water resources and minors in soil science and in business administration. One of her main tasks has been shepherding a process to obtain certification of the laboratory from the Biodegradable Products Institute (BPI.)

"If we are a BPI-certified lab, when we test the product and it passes, so it's compostable, that company is able to use the BPI logo on their product," Davidson said. That logo, which represents rigorous standards, lends credibility and makes it easier for consumers and others to be assured that a product will compost as expected.

Davidson said that at the Specialty Papers Conference she recently attended, interest in compostability was strong.

"A lot of companies are starting to realize the importance of compostability, along with recyclability, along with repulpability," Davidson said. "They're starting to become really concerned with the end of life of their product. They're realizing that society is really pushing for sustainability, trying to find ways to reduce, reuse and recycle."

Companies are interested in learning more about the testing process, Davidson said, and are frequently surprised that it can take up to six months for a full trial to be completed.

Because the trials can take months to complete, WIST took another important step this year in automating the CO_2 capture and data recording. One of the steps in a compostability test is a biodegradation trial, in which material being tested is placed in a closed vessel, and instruments record the amount of CO_2 generated during decomposition; the release of CO_2 is then compared to that of cellulose decomposition.

Before automation, reading and recording CO_2 levels was a time-consuming process that effectively limited the number of tests WIST could run, and limited data collection to once-daily. Now levels are recorded hourly, providing more and better-quality data, and allowing WIST to increase the number of trials it can perform simultaneously. As demand for the service has grown, the increased capacity has already paid off. At the moment, the laboratory is running at full capacity. But Davidson is scheduling work now for dates when space will become available as trials are completed. The automation and BPI certification work was funded by an Economic Development Incentive Grant (see pages 6-7).

During the biodegradation trial for compostability testing, material is kept in closed vessels in a temperature-controlled environment.

Major strides for WIST compostability testing this year

- Full-time manager hired for compostability laboratory
- Currently working to obtain laboratory certification by the Biodegradable Products Institute
- Automated data capture to generate more and better-quality data
- Increased capacity of testing facility to serve more customers

Amber Davidson, WIST compostability laboratory manager, checks equipment in the laboratory.

Cellulose Pilot and Processing Laboratory

- Fermentation laboratory installed at UW-Stevens Point
- Post-doctoral researchers hired in biochemistry and engineering
- Analysis laboratory at UW-Stevens Point conducting trials with variety of plant materials
- Pilot-scale biorefinery being constructed at American Science and Technology in Wausau

Raghu Gurram, WIST research associate in chemical engineering, works with the bench-top fermenters in a WIST lab.

Start-up companies and entrepreneurs as well as established pulp and paper operations will be able to draw on the facilities and expertise of the Cellulose Pilot and Processing Laboratory (CPPL) now under development by WIST.

Eric Singsaas, research director at WIST, explains that the concept behind the CPPL is to link different research fields to more effectively develop new processes to work with biomass and to derive value-added materials.

"It brings together the world of pulp and paper processing and biotechnology," Singsaas said. "There's been a lot of work in the past in cellulosic ethanol, but that has existed primarily in the biotech world. And then there's of course a lot of expertise in cellulose processing in pulp and paper. But there hasn't been a lot of crossover between the two."

With the pilot scale biorefinery at American Science and Technology (AST) in Wausau, and the analysis laboratory and fermentation laboratory at WIST, Singsaas hopes to bridge those worlds. The CPPL project is funded by a UW System Economic Development Incentive grant (see more about the grant on pages 6-7).

Cellulose is the most common organic material on earth and the most common building block of living things.

Six bench-top fermenters installed in a WIST lab at UW-Stevens Point allow simultaneous testing with multiple parameters.

"Once you have converted the cellulose into fermentable sugar using the fermentation system you can make lots of different products," Singsaas said. Some of the bioproducts that CPPL staff have made from cellulose include compounds used in bioplastics and rubber products.

The CPPL also has equipment and expertise to discover and commercialize new biochemicals found in biomass. For example, in its analysis laboratory, WIST currently is exploring sumac and alder as a source material for valuable organic compounds.

Lignin, along with cellulose and hemicellulose, is a product of biomass fractionation. Lignin is the second-most abundant organic compound behind cellulose, and also has great potential as a building-block compound for new, value-added products.

AST, under contract from UW-Stevens Point, is scaling up its pilot plant by designing, building, assembling and operating a fractionation reactor that can process two tons of biomass per day. Currently AST has capability to process about 200 kg per day. In the past several years, AST and UW-Stevens Point have collaborated on the development of technologies to fractionate various lignocellulosic materials for the production of valuable products such as fiber, sugar, and pure lignin.

The facility will be flexible enough to make pulp using different kinds of processes, including Kraft, soda, organosolv and steam explosion.

To match the pulp production, AST will also purchase and install hydrolysis reactors with about 12,000 gallons capacity to hydrolyze about one ton of pulp to glucose per day. And since lignin potentially will be one the most important products, AST will design and build a new reactor to recover and dry lignin.

Finding Value in By-products

"At WIST, we look at waste streams and how to better utilize them. That's a common theme that's threaded through many of our projects."
—John Baldus, director of laboratory services

Eric Singsaas, center, tours the Cedar Grove composting facility near Seattle, WA. WIST has made prototype compostable table service ware -- forks and spoons -- using lignin, a by-product of the pulp and papermaking process.

Although WIST is organized with separate divisions of research and laboratory services, the work in one area often overlaps and enhances work in the other. An ongoing example of that is work by WIST for Cosmo Specialty Fibers, a West Coast pulp mill.

John Baldus, director of laboratory services, led a study this year to analyze the market potential of products that could be derived from waste streams at the mill. The market study was partly built on earlier work by WIST researchers and laboratory specialists to analyze the sugar content of residual fiber and liquor generated at the Cosmo mill.

The market study was funded by the Washington State Department of Commerce, and the analysis provided a view of current and emerging opportunities in the bioeconomy field. Cosmo is using knowledge gained from that study to pursue two products that potentially can be commercialized within a year.

Another project currently underway at WIST is an analysis of sludge from four different Wisconsin pulp and paper mills. Sludge is a residual product of pulp and papermaking and typically mills incur a cost to dispose of it.

However, sludge is a cellulose-rich product.

"Depending on the sludge it's anywhere from 30-70 percent cellulose," said Eric Singsaas, WIST director of research. "There's an opportunity to combine the biotechnology side of what we do in the Cellulose Pilot and Processing Laboratory with our understanding and analysis of the cellulose-rich product to make new kinds of products."

The CPPL also has expertise and equipment to evaluate and analyze opportunities in different waste or by-product streams, such as from agricultural processing operations.

Another opportunity to add value to a by-product is in finding new uses for lignin. This material is produced during the fractionation process of biomass. Lignin in most pulp mills and in most biorefinery concepts, is burned for its heat value.

"But we understand that the chemistry of lignin allows you to do a lot more interesting things with it and make more value-added products with it," Singsaas said. "There's a lot of potential there."

Substantial literature exists about what can be made from lignin – fuels, plastics, adhesives, and concrete additives.
"Lots of work has been done at the laboratory scale but there's never been a facility that allows you to test these things at a larger scale, to test the economics of them as far as I know," Singsaas said.

The CPPL will provide that capability. Given the increasing interest in lignin, commercializing uses of it is another goal of the facility.

Laboratory Services

- Delivered on new and innovative laboratory needs for industrial customers (see sidebar opposite for example)
- Assisted in grade development for RiverPoint® fine art paper
- Conducted market analysis of product potential of residual materials at a West Coast pulp mill
- Conducted repulpability trials
- Expanded compostability testing services and automated procedures in compostability laboratory

Lindsey Hoffman, WIST papermaking and laboratory project specialist, monitors a production run of RiverPoint fine art paper. WIST laboratory staff helped develop three grades of RiverPoint.

John Baldus

For laboratory services director John Baldus, the past year has been about team-building.

"The goal was to build a team that worked together that would serve the industry needs in a timely manner," Baldus said.

Reflecting on the year, he sees success in that effort. "We've got a pretty neat team right now," Baldus said.

Staff members are learning from each other, understanding the different educational backgrounds and skills that each brings, and using that knowledge to add to the work WIST performs. "So the breadth and depth of services are beginning to expand, I think with a greater understanding of all the different components that are lab services," Baldus said.

One new aspect of laboratory services is in inviting industry customers to make process changes on the pilot paper machine, without impacting the machine's availability for use in education. As an example, Baldus noted that one company brought a piece of equipment that was designed for fiber reclamation in white water. Along with WIST staff, the company was able to modify the pilot paper machine with their equipment, conduct an analysis, disconnect their equipment, and make the machine available for educational use immediately after.

A key to success in the past year has been the ability to respond quickly to new customer needs, such as the process modification, or the laboratory study underway for Siemens (see sidebar).

"What won that Siemens project was Justin Hall's ability to build a lab device that advanced that customer's goal for wastewater treatment," Baldus said. "I think that speaks to our flexibility, our ability to listen to customer needs and respond nimbly to meet their needs."

Water recovery and re-use at oil and gas processing facilities

WIST is working on a project to develop sustainable processes to recapture and re-use water at oil and gas processing operations around the world. The research is being done for Siemens, which ranks as one of the world's largest corporations and is a major force in water technology and engineering with €75.9 billion in revenue at the end of fiscal 2013. Its facility in Rothschild employs about 150 people, and is the global headquarters for research and development activities associated with treating water in the oil and gas industry.

Bill Cunningham, Siemens manager for biological processes, said research at UW-Stevens Point provides an opportunity for Siemens to "train up" students at the undergraduate or graduate level, and build long-term relationships where UW-Stevens Point becomes a feeder source for future employment candidates.

Justin Hall, WIST instrumentation specialist, helped plan the project, designed equipment needed for the work, and is performing the experiments. As a UW-Stevens Point graduate in water resources, Hall is excited to be working on a project so closely aligned with his education and interests.

Justin Hall, WIST instrumentation specialist, checks readings as part of a project to determine methods to recover water at oil and gas processing facilities.

RiverPoint® Fine Art Paper

RiverPoint fine art paper drew a crowd at the Southern Graphics International Conference in San Francisco in March 2014. WIST and students from the Department of Art and Design hosted a trade show booth at the conference. The booth included display of student artwork printed on RiverPoint using a variety of printmaking techniques, demonstrating the versatility of the paper. While the paper was initially marketed by WIST, a licensing agreement secured commercial distribution. See the story on the following pages.

New Product Licensed for Distribution

A big year for RiverPoint®

- RiverPoint® name granted registered trademark protection
- Two additional grades of RiverPoint fine art paper developed
- RiverPoint licensed for distribution throughout U.S. and Canada by Pacon Corp. under its Strathmore® Artist Papers brand
- Original RiverPoint 100 percent cotton paper continues to be made at UW-Stevens Point; marketed as Strathmore RiverPoint Series 500
- Series 300 and Series 400 Strathmore RiverPoint printmaking paper licensed for production at a Wisconsin specialty paper mill

Matt Meszaros, right, a new product development manager with Pacon, describes the new Strathmore RiverPoint fine art paper at the product launch at Art Materials World, in Pittsburgh, Pa, in April. Hosted by the International Art Materials Association (NAMTA), Art Materials World is the major annual industry trade show.

In what may be a first for UW-Stevens Point, a product developed on campus has been licensed for commercial production and distribution nationally and in Canada. RiverPoint fine art paper was developed collaboratively by faculty, staff and students in the College of Art and Design, the Department of Paper Science and Engineering, and WIST. The initial idea was to create a more affordable, high quality paper for use by visual art students at UW-Stevens Point. It took several trials, with art students and faculty testing the paper and providing feedback for the papermakers. The team developed a paper of 100 percent cotton fiber with characteristics ideal for a wide variety of printmaking techniques.

In 2013, a "soft launch" of RiverPoint fine art paper at the Southern Graphics Council International Conference in Milwaukee tested broader interest in the paper. Using marketing materials developed by the Design Center at UW-Stevens Point, visual arts students and paper science and engineering students staffed a trade show booth. The paper was well-received and WIST then marketed the paper through its website, and fulfilled orders over the next year to students and artists in 16 states.

Print and broadcast news media picked up on the RiverPoint story, which led to inquiries from potential commercial partners. Pacon Corp., a major supplier of art paper, saw a market need for a complete line of printmaking papers, and worked with WIST to develop two additional grades of RiverPoint. The new grades include a lightweight "300" series, a heavyweight "400" series, and the original RiverPoint, marketed as "500" series paper.

Grade development was funded by an Economic Development Incentive grant from UW System. UW-Stevens Point will receive royalties from paper sales for the next five years, which will be reinvested in education and research at the university.

RiverPoint is now a protected trademark.

Art work by Lanea Zagrezebski, left, a UW-Stevens Point art student, was chosen by Pacon to be featured on pads of RiverPoint 300 Series printmaking paper; her name is on every pad. Bob Erickson, right, professor in printmaking at UW-Stevens Point, holds a prototype pad as he announces the award in April.

A student retrieves a sheet of RiverPoint art paper from a water bath, where it had soaked in preparation for a printmaking technique. Students use the paper in a variety of ways, including for bookmaking.

Focal Point Conference

Focal Point 2013: Frontiers in Packaging was held October 22 at UW-Stevens Point

Wayne Wegner, global director of sustainability at Bemis, discussed innovations in flexible film packaging at Focal Point 2013: Frontiers in Packaging.

2013 Conference Report: Institute links university to key Wisconsin businesses with one-day conference

The third annual Focal Point conference drew more than 70 attendees from businesses and economic development agencies, and the audience included product development specialists, sustainability directors, research directors, packaging engineers, and executives and owners. Attendees travelled from as far afield as Georgia, Washington, Pennsylvania and North Carolina for the event.

The conference zeroed in on packaging innovation and the recurring message from presenters was the positive role packaging can play in sustainability. Although packaging is sometimes seen as a waste-generator, advances in both materials technology and in manufacturing processes are providing opportunities to reduce waste through better packaging.

Wayne Wegner, global director of sustainability at Bemis, noted a United Nations study found that a third of food produced for human consumption is wasted or lost. Reducing food waste has become a priority for government, industry and consumers. One solution is packaging innovations that have created new materials to extend the shelf life of food and reduce spoilage. These "flexible films," in the parlance of the packaging industry, are tailored to the particular properties of specific foods, Wegner said, so the plastic film that protects a head of iceberg lettuce is not the same film that protects potatoes or bananas or apples.

Another example of packaging innovation was presented by Gopal Iyengar of NewPage Corporation in Stevens Point. He described the company's new LittleFoot™ packaging material. The company named it to reflect the idea of reducing the carbon footprint, making the smallest possible impact on the environment. The packaging is a specially coated paper that is laminated with other material layers; the packaging provides good moisture and oxygen barrier properties but is compostable.

Lisa Bauer-Lotto, who implements sustainability strategies for Green Bay Packaging, noted that packaging itself is often made from recycled material. And she described changes at Green Bay Packaging that have dramatically reduced resource use in the manufacturing process. Bauer-Lotto said that while some changes in packaging are in response to new regulations, consumer demand is the greater driving force behind sustainability innovations.

Presenters also discussed options for end-of-product-life. WIST recently developed a compostability test to help companies developing new products for the sustainable packaging market. The test determines if a material is compostable under industrial composting conditions.

Other presenters included keynote speaker Jeffrey Keithline, a partner in the law firm Keller and Heckman LLP, who discussed regulatory issues; Amanda Humes, packaging engineer with ConAgra; Paul Gardner, Recycling Reinvented; Jeff Timm, Timm Consulting; Chris Reitmeyer, IPS Testing; and Paul Fowler, WIST.

Conference delegates heard from speakers on aspects ranging from regulatory issues in food packaging to end-of-product-life challenges and solutions.

Education

In December, 2013, WIST provided its first webinar, joining a trend toward increased online delivery of educational material. Webinar software has become more widely available and easier to use for both presenters and audience. Coupled with the convenience and cost-saving of learning without traveling, this makes webinars an attractive option for the right material.

Dave Vachavake developed and delivered the two-hour webinar, “Safe Methods to Prevent Bacteria-Generated Gas Explosions in Pulp and Paper Mills.” Vachavake worked in the pulp and paper industry for more than 20 years. He was a technical superintendent at the Tomahawk, Wis., PCA mill when that mill experienced an explosion from bacteria-generated gas.

While webinars have advantages in time- and cost-savings for participants, they can’t duplicate the hands-on experience provided in WIST’s papermaking courses. These courses combine morning classroom sessions with afternoon sessions operating the UW-Stevens Point pilot paper machine or other paper production and testing equipment. With funding from an Economic Development Incentive Grant, WIST revised and updated it Hands-on Papermaking course and developed two additional courses, “Introduction to Papermaking Additives” and “Measuring and Controlling Formation.”

All three courses are being provided in fall 2014 without cost to participants, in a pilot offering funded by the grant. Participants will be required to complete post-course evaluations and surveys, and their supervisors will be asked to complete surveys about the effectiveness of the courses.

WIST also co-sponsored and co-hosted a one-and-a-half day workshop, “Safe Products, Made Safely: Green Chemistry Tools for Business,” in November 2013. The workshop provided a framework for evaluating the best approaches and tools for businesses in meeting goals to eliminate or reduce the use of toxic chemicals in consumer products and processes throughout the supply chain.

A student in WIST's Hands-on Papermaking course adjusts controls on the university's pilot paper machine during an afternoon session.

Education division highlights

- Provided its first webinar: "Safe Methods to Prevent Bacteria-Generated Gas Explosions in Pulp and Paper Mills"
- Revised and updated Hands-On Papermaking
- Developed two new hands-on courses: "Introduction to Papermaking Additives" and "Measuring and Controlling Formation"
- Organized Focal Point 2013: Frontiers in Packaging
- Co-sponsored Safer Chemicals workshop and co-hosted the event at UW-Stevens Point

Gerry Ring, at right front, provides a morning lecture during a Hands-on Papermaking course at UW-Stevens Point. In the afternoon, the class moves to the paper machine for hands-on experience. Ring retired as chair of the Department of Paper Science and Engineering Department in 2013 but continues to teach WIST courses and consult on WIST paper development projects.

Promoting Student Success

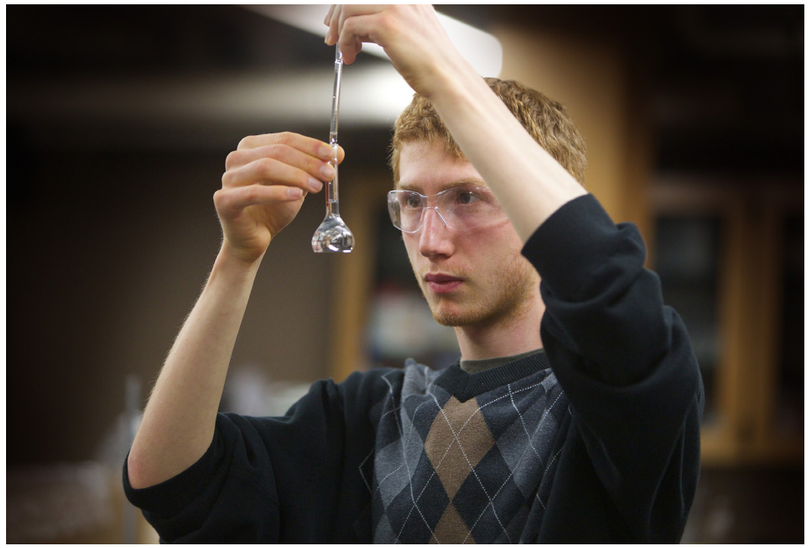
Students gain real-world experience working on WIST laboratory service and research projects

At the start and end of a paper production run, there is inevitably some paper produced that does not meet specifications. That was true during production runs for RiverPoint® paper, the fine art paper developed at UW-Stevens Point. The paper couldn't be marketed but it was of 100 percent cotton fiber, a valuable material that WIST did not want to discard. The fiber could be used in other papers. (RiverPoint is made of virgin cotton fiber).

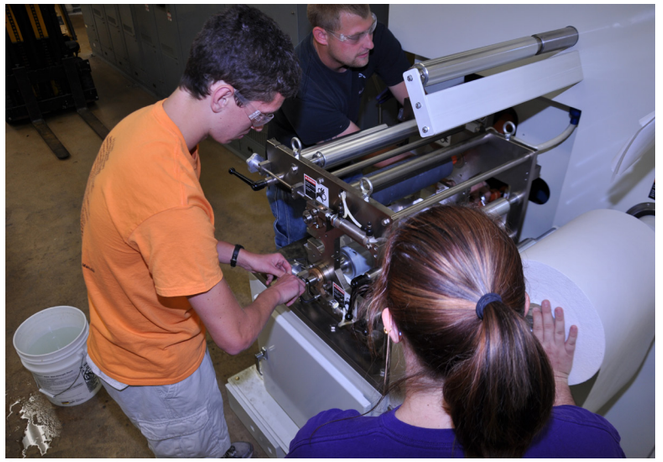
Fred Dorn, a senior in paper science and engineering at UW-Stevens Point and student employee for WIST, took on the task of developing a protocol to re-pulp the off-spec paper and WIST laboratory staff successfully recovered the fiber. Some of that recovered cotton was then used to produce a special bond paper for Chancellor Bernie Patterson to commemorate the 120th anniversary of UW-Stevens Point, and paper to mark the 40th anniversary of the UW-Stevens Point Paper Science Foundation.

Dorn was one of 17 students WIST employed over the past year. The students gained valuable experience – and a paycheck. Some students assisted on research projects, while others helped fulfil the laboratory services WIST provides to industry, such as paper testing, grade development, and chemical analyses. One student, Sam Knapp, a lab assistant in Eric Singsaas's cellulose pilot plant research, won a Fulbright Student Grant this spring. He will work on a project in Sweden to help eradicate Legionnaires' disease from water supplies worldwide. Another student employee, Lindsey Hoffman, graduated in May and is now employed full time by WIST as a papermaking and laboratory specialist.

Since its inception in 2010, WIST has provided opportunities for students to gain experience working on real projects for industry customers of the institute or in funded research projects. And WIST has gained from the work of these high-caliber, highly motivated students.



Sam Knapp, a chemistry and physics major at UW-Stevens Point, worked as a lab assistant for Eric Singsaas, WIST director of research.



Student employees change rollers on the Faustel pilot coating and laminating equipment installed this summer at UW-Stevens Point.

Dustin Ziegelman, right, helps with a project for an industry customer.

Seniors in paper science and engineering led a project to install chemical additive equipment on the pilot paper machine at UW-Stevens Point. Funding for the added equipment was from an Economic Development Incentive grant secured by WIST and PS&E. Pictured left to right are Jamie Tauscher, Jordan Hansen, and Kelli Hultman.

Conferences and Other Outreach

Sharing knowledge with other researchers, networking to expand WIST contacts and potential partners, and marketing WIST services, several staff members traveled nationally (some internationally) for the institute over the past year.

A sampling of the events attended includes:

Shona Duncan presented a poster "Conversion of cellulose-rich residuals from pulp and paper mills for biobased fuels and chemicals," at the Wisconsin Science and Technology Symposium in July. She also presented "Development of fermentation techniques for potential development of a lignocellulose biorefinery" to the Society for Industrial Microbiology and Biotechnology in St. Louis, Mo., in July.

At the Wisconsin Science and Technology Symposium in July, Eric Singsaas presented the poster "Continuous, Month-Long Production of Isoprene by Solar Energy and CO2 Capture in Fast-Growing, High-Light Tolerant Cyanobacteria" and "Conversion of Cellulose-Rich Residuals from Pulp and Paper Mills for Biobased Fuels and Chemicals." Singsaas also presented "Bioeconomy research at WIST" to the Danish Technological University at the invitation of that university. He presented "Conversion of cellulose-rich residuals from pulp and paper mills for biobased fuels and chemicals" to the 22nd European Biomass Conference and Exhibition in Hamburg, Germany in June.
Alex Rajangam presented the poster "Development of Fermentation Techniques for Potential Development of a Lignocellulose Biorefinery at a Pulp Mill" at the Wisconsin Science and Technology Symposium in July.

John Baldus was invited to participate as a panelist on the topic of sustainable packaging and end-of-product-life alternatives at Converting Influence. Baldus also hosted trade show booths at a number of conferences including PaperCon in Nashville, Tenn., the Southern Graphics Council International Conference in San Francisco, and PEERS-TAPPI in Green Bay. He attended other conferences as a delegate, including Biopolymers Symposium 2014 in Philadelphia and Sustainability in Packaging in Orlando, Fla.

Paul Fowler presented a webinar at the IBM Academy of Technology monthly meeting in September 2013, titled "WIST and Renewable Resource Use." Fowler facilitated a panel discussion at the 2013 Biovision Summit, and co-hosted a workshop "Safe Products Made Safely: Green Chemistry Tools for Business." Fowler presented "Introduction to the Wisconsin Institute for Sustainable Technology" at the UW System Sustainability Meeting at the Central Wisconsin Environmental Station in November.

Justin Hall helped host a trade show booth at PaperCon and attended several conference networking events including the International Biomass Conference in Orlando, Fla.

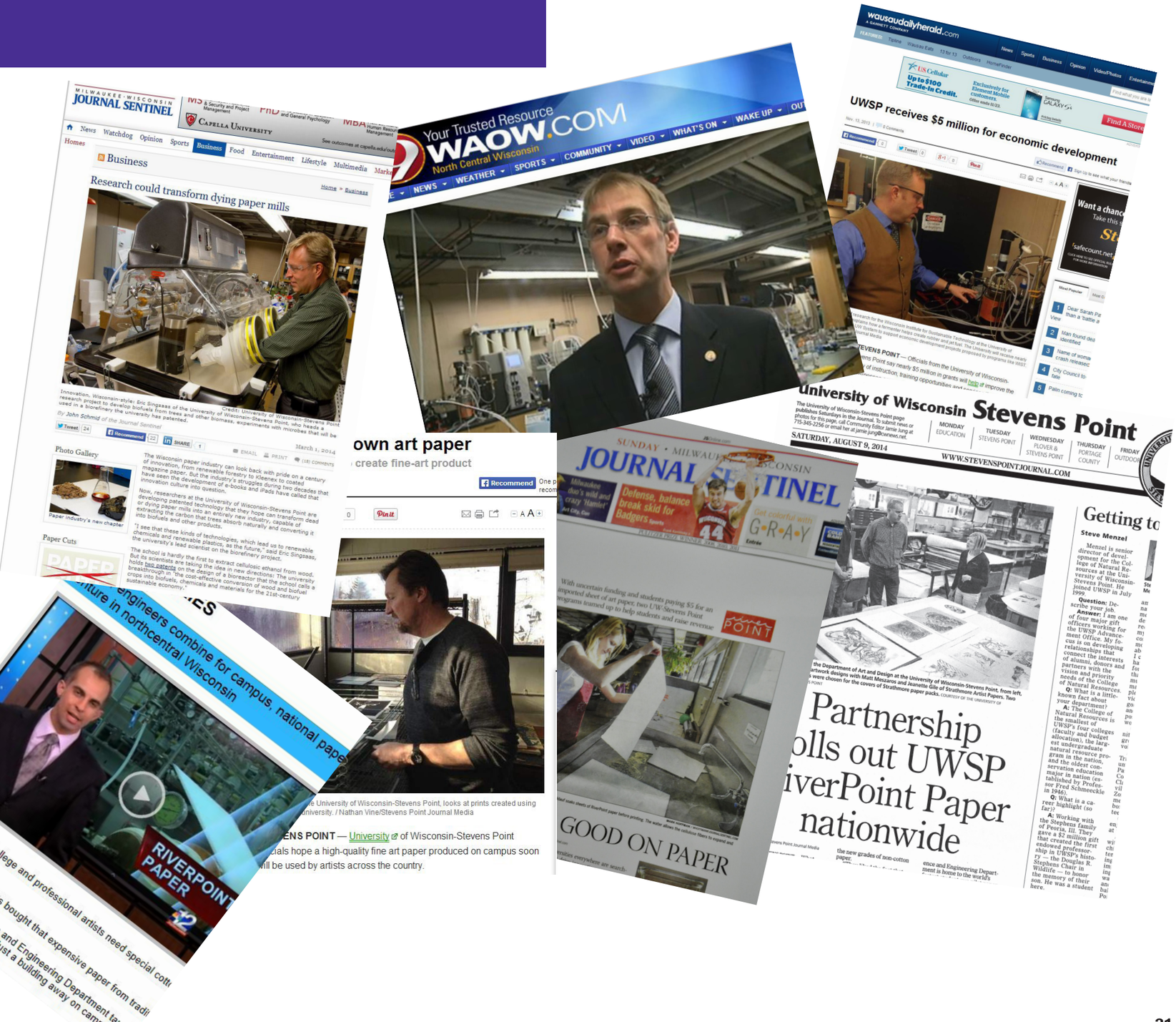
Amber Davidson, Lindsey Hoffman, Justin Hall, John Baldus and Paul Fowler hosted a trade show booth at the Specialty Papers Conference in Milwaukee in September 2014.

Communications

WIST's digital front door is its website, www.uwsp.edu/wist, which continues to be a frequent first stop for people interested in the institute's work. A monthly e-newsletter goes to approximately 1,100 subscribers across the country and internationally.

WIST research and projects were featured in both print and electronic media over the past year. John Schmid, a reporter for the Milwaukee Journal Sentinel who has written extensively about Wisconsin's paper industry, was one of several reporters who came to UW-Stevens Point to interview people who helped create RiverPoint art paper, including faculty, staff and students in paper science and engineering, art and design, and WIST. As he learned more about activities here, Schmid reported another story on WIST research, featuring an interview with Eric Singsaas.

WIST social media accounts include Twitter, Facebook and LinkedIn.



WIST Staff

Administration


Paul Fowler

Paul Fowler, WIST executive director, has 16 years of experience in contract research and development of new products and opportunities from biobased materials. At WIST, Paul is networking with public- and private-sector organizations and companies to develop new sustainable technologies with commercial applications to benefit the economy and the environment. Before taking the helm at WIST in 2010, he was director of the Welsh Institute for Natural Resources, a financially self-supporting unit at Bangor University, in Wales, UK. Paul has a Ph.D. in organic chemistry and extensive knowledge of biobased, renewable materials and applications.

Angie Hauer

Angie Hauer, WIST development coordinator, coordinates daily office activities, supplies, and correspondence. She has a bachelor's degree in resource management from UW-Stevens Point and a master's in outdoor recreation administration from Southern Illinois University at Carbondale.


Ron Tschida

Ron Tschida, WIST communications manager, handles public relations and outreach, institute publications and the WIST website. Before coming to UW-Stevens Point in 2005, Ron was city editor of the Bozeman Daily Chronicle in Bozeman, Mont. He has a master's degree in journalism from the University of Montana in Missoula.


Rebecca Vagts

Rebecca Vagts, WIST business manager, is responsible for the fiscal management of the WIST grants and contracts including developing budgets in grant narratives, budget review, account reconciliation, and fiscal reporting. Rebecca has an MBA with a Global Emphasis and a BS in Business Management from Upper Iowa University.

Research and Laboratory Services


John Baldus

John Baldus is the director of laboratory services for WIST. Baldus most recently worked as a bioproduct sector specialist for the Wisconsin State Energy Office. He developed and managed grant and loan opportunities in areas of sustainable energy practices. He also worked on policy development to use organic solid waste for energy using anaerobic digestion. John co-chaired a forum on anaerobic digesters at the 2012 US Biopolymers Symposium. At WIST, John is working to strengthen ties with existing customers, build new markets for WIST services, and add services to meet industry needs.


Amber Davidson

Amber Davidson is the compostability laboratory manager at WIST. She oversees the compostability testing services provided by the institute and performs laboratory tests to determine how well certain packaging composts under industrial composting conditions. In addition to laboratory work, she assists WIST in public outreach for compostability testing. She is a December 2012 graduate of the UW–Stevens Point with a BS in water resources and a minor in soil science and business administration.


Shona Duncan

Shona Duncan is a research associate at the WIST. After receiving her doctorate in biological sciences from the University of Waikato, New Zealand, in 2007, studying fungal diversity and cellulose degradation in the Ross Island historic huts, Antarctic Shona has been involved in a project investigating fungal decay mechanisms and their potential use in the biofuels industry for feedstock pretreatment and hydrolysis of carbohydrates to glucose. While working at the University of Waikato, Duncan gained experience in running bench top and 600L fermenters. She will be using that knowledge and experience while at WIST to scale up the bench top fermentation of sugars to isoprene to pilot scale (100L) capabilities.


Raghu Gurram

Raghu Nandan Gurram was appointed a research associate in chemical engineering at WIST in July 2014. He received his Ph.D. in chemical and biological engineering from the South Dakota School of Mines and Technology in December, 2013, with research focus on "Separation Techniques for an Efficient Conversion of Lignocellulosic Biomass to Biofuels." As a fermentation specialist, he got hands-on experience from lab to commercial scale bio-butanol fermentation (5 L to 1000 L) during the scale up studies at Cobalt Technologies located in Mountain View, Calif., Presently at WIST, his research focus is on biochemical conversion of paper mill wastes, Camelina sativa, and Wisconsin lignocellulosic forest residues to biofuels and value-added chemicals in establishing the source of revenue with experimental and economic feasibility studies using ASPEN PLUS software. Raghu will also be collaborating with American Science and Technology (AST) in Wausau, providing his expertise in an economic investigation of moving its pilot scale facility to commercial scale.


Justin Hall

Justin Hall is an instrumentation specialist at WIST. He provides analytical support for WIST research projects by maintaining and operating analytical instrumentation. Hall is experienced in ion chromatography, gas chromatography, liquid chromatography, and mass spectrometry. In addition to research support Justin provides laboratory services for outside companies. He is a 2011 graduate of UW-Stevens Point with a bachelor's degree in water resources and a minor in chemistry.


Lindsey Hoffman

Lindsey Hoffman carries out industry-focused projects and work performed on the UW-Stevens Point pilot paper machine as well as paper testing provided by WIST. She also coordinates student and contract work, along with providing support for the paper science and engineering undergraduate program. Lindsey graduated in 2014 with a bachelor's degree in paper science and engineering and a minor in chemistry from UW-Stevens Point.


Alex Rajangam

Alex Rajangam is a molecular biotechnologist and has worked in various projects related to biosynthesis, biodegradation and bioconversion of lignocellulosic biomass and channelizing the processed biomass to various economically viable products using microorganisms. He is an expert in metabolic engineering of microorganisms that can potentially make biofuels and other biomaterials. Alex got his Ph.D. in the field of wood biotechnology at KTH, Sweden. During his doctoral research, he worked with discovery, characterization of Carbohydrate Active Enzymes (CAZymes) involved in wood biosynthesis and degradation in poplars and wood rotting microbes, respectively. He has worked in Indo-Israel, Swedish, European, Swedish-US and ARPA-E (DOE) funded projects during his career. Currently he is working as a research associate at WIST to develop various projects by metabolic engineering of microorganisms to make biofuels by transforming cellulose-rich biomass. He will work along with other scientists at WIST to move research from lab scale to industrial scale production of various biofuels and useful biochemicals.


Eric Singsaas

Eric Singsaas is the director of research at WIST. He applies his scientific training to research in biofuel and bioproduct production, focusing on developing microbial pathways to produce isoprene from biomass. Eric received his Ph.D. in botany from UW-Madison in 1997 studying the production of isoprene from oak and kudzu leaves. He went on to investigate the impacts of increasing greenhouse gases on forest ecosystems in Free Air CO_2 Enrichment experimental systems in North Carolina and Wisconsin. He has studied biological hydrocarbon production and plant-atmosphere gas exchange, working on scales ranging from genes to ecosystems.

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The Wisconsin Institute for Sustainable Technology —

Creating sustainability solutions and economic opportunities

WIST is an institute within the UW-Stevens Point College of Natural Resources. Offices and laboratories are in the Science Building and the Dan Trainer Natural Resources Building on the UW-Stevens Point campus.

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