**CLEANTECH PARTNERS INC / WISCONSIN FOCUS ON ENERGY
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PROJECT OVERVIEW

Award Number: DE-EE0002780

Project Title: Creating Jobs through Energy Efficiency Using Wisconsin's Successful Focus on Energy Program

Project Period: January 15, 2010 through March 30, 2012

Recipient Organization: CleanTech Partners, Inc.
Partners: Co-Administrator: Wisconsin Focus on Energy Program
(1) Briggs and Stratton Corporation
(2) Didion Milling Incorporated
(3) Domtar Paper Company LLC
(4) Kohler Company
(5) NewPage Wisconsin System Corporation
(6) Quad/Graphics Incorporated
(7) Thilmany LLC
(8) Wausau Paper Specialty Products LLC (Mosinee)
(9) Wausau Paper Specialty Products LLC (Rhinelander)

Technical Contact: Dr. Masood Akhtar, Principal Investigator
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Thomas Reitter, Project Manager
Wisconsin Focus on Energy Program
SAIC Energy, Environment & Infrastructure, LLC
5609 Medical Circle, Suite 201
Madison, WI 53719
(O) 608 512 2702

DOE Project Officer: Charles Alsup (O) 304 285 5432
DOE Project Monitor: n/a
DOE HQ Contact: Robert Gemmer (O) 202-586 5885
DOE Contract Specialist: Angela Harshman (O) 412-386-5038

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1. **Project Objective:** Provide administrative and technical support for the completion of energy efficiency projects that reduce energy intensity and create or save Wisconsin industrial jobs, being done with financial support from our US DOE ITP FOA #44 which was awarded under the aegis of the American Recovery and Reinvestment Act of 2009.
2. **Background:** CleanTech Partners and Focus on Energy, Wisconsin's statewide resource for energy efficiency and renewable energy, have been working for a decade to promote these technologies to residents and businesses. Our industrial sector team recognized this funding opportunity as a way to work with our customers to create a bundled proposal for consideration by the DOE for funding. We worked to create a proposal representing a variety of process upgrades whose goals included reducing energy intensity by at least 25%, to save/create good jobs, and help keep these businesses competitive through lower costs and better equipment. The proposal included 9 industrial plants employing a variety of energy saving technologies to accomplish these goals.
3. **Accomplishments:** CleanTech Partners/Focus on Energy is pleased to report that all projects carried out under this Grant have been completed. Each subawardee has noted their respective individual accomplishments in their attached reports.
4. **Progress and Status:** CleanTech Partners/Focus on Energy worked with our subawardees over the last quarter to submit our final invoices and provide our assistance to complete projects as needed.

All projects have been completed. Details in the attached reports include project management, job development, and energy savings for each project. In general, these projects were well managed, dealt with challenges to stay on track, hired or preserved jobs according to plan, and achieved project savings of 25% or greater.
5. **Scope issues:** – No scope changes are noted in this reporting period.
6. **Budget and Schedule Status:** The completed spending schedule, cost share contribution schedule, and task schedule are included below.
7. **Patents:** None.
8. **Publications / Presentations:** None.

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(I) Award Name/Number: Briggs & Stratton DE-EE0002780-01

Project Title: Steam and Heating System Project

Project Period: January 15, 2010 to December 15, 2011

Recipient Organization: Briggs & Stratton, 3300 N. 124th St., Wauwatosa, WI 53222

Partners: Pearson Engineering
Rohde Brothers
Doral Corporation

Technical Contact: Richard Feustel, 3300 N. 124th St., Wauwatosa, WI 53222,
Feustel.Richard@basco.com

Business Contact: Richard Feustel, 3300 N. 124th St., Wauwatosa, WI 53222,
Feustel.Richard@basco.com

DOE Project Officer: Charles Alsup (O) 304 285 5432
DOE Project Monitor: n/a
DOE HQ Contact: Robert Gemmer (O) 202-586 5885
DOE Contract Specialist: Angela Harshman (O) 412-386-5038

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1. **Project Objective:** The design intent is to replace the high-pressure steam boiler system with a combination of more efficient hot water boilers and low-pressure steam boilers. Additionally, steam unit heaters and make-up air units located in the shop/warehouse area will be reduced in number and replaced with more efficient units.
 2. **Background:** The existing steam boiler system is oversized and inefficient resulting in inordinately high energy costs. The design intent is to replace the high-pressure steam boiler system with a combination of more efficient hot water boilers and low-pressure steam boilers. Additionally, make-up air units located in the shop/warehouse area will be reduced in number and replaced with more efficient units. Many of the existing air handlers are currently 100% outside air units. Most of the air-handling units are no longer required since much of the facility is now a warehouse. The total area involved in the project is approximately 1,000,000 square feet. Four separate buildings are involved in this project. The size and complexity of the four buildings involved in the project presents various logistic challenges. An energy audit of the entire facility was performed in 2007 and an energy study of the steam and heating systems was completed in 2009. A conceptual design has also been completed based upon the energy study. Briggs & Stratton has selected a firm to perform the engineering design/commissioning and separate mechanical contractors for the installation of new equipment to replace the steam boiler system and the air handler units. Phase I (outlying buildings) began in July 2011, Phase II (Main Plant) in January 2011 and Phase III (Offices, Test Lab, Domestic HW) in March 2011. The project will be completed in October 2011.
 3. **Accomplishments:** All Phases are complete and have been commissioned. Phase III (Heating for offices, parts washers, engineering Lab, kitchen, domestic hot water heaters)

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was completed this quarter with all 3 boilers put in service and the controls tweaked for optimal performance. No other construction for this project remains.

4. **Progress and Status:** Project Completed.

- **Job Creation and Preservation:** All subcontractors involved reported a significant bolster in their work load due to this project. The general contractors for Phase 1, 2, and 3 reported retaining and even hiring multiple personnel as a result of the work required for this project.
- **Project Management and Resources:** The project tracked well and was not hindered by DOE reporting. A few obstacles were encountered but nothing that was not overcome with flexibility and good coordination. Initially the project started slow and behind schedule due to delayed final approval of the DOE grant (~6 months). Once this was overcome, this project flowed right through its 3 phases with only minor setbacks from outdated or poorly operating equipment. These issues required adding resources to improve efficiency and in the end, resulted in even more efficient system than planned.
- **Energy Benefits:** It is not easy to measure the energy consumption before and after this project and attribute it to the project implementation. Submetering was not in place before this project and only is in place after this project for the large loads installed as part of this project. In addition, changes in weather, personnel, operations, production, and equipment make this a moving target. During this project, more than 100 additional office personnel began working in this facility, three production lines and two R&D labs were added. Utility company bills for the period 2008 - 2011 show a decrease* in electric usage (3,285,000 kWh or 13%) and project attributable decrease in natural gas usage (336,000 therms or 16%). (The decrease in electric usage is primarily attributed to a major lighting upgrade. Electric usage has increased in 2009 – 2011 primarily attributed to increased personnel and production.)

5. **Scope issues:** NONE. PROJECT COMPLETED.

6. **Budget and Schedule Status:** NONE. PROJECT COMPLETED.

7. **Patents:** NONE. PROJECT COMPLETED.

8. **Publications / Presentations:** NONE. PROJECT COMPLETED.

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(2) Award Name/Number: **Didion Milling** **DE-EE0002780-02**

Project Title: **Drying and Moisture Removal Optimization**

Project Period: January 15, 2010 through March 31, 2012

Recipient Organization: Didion Milling, Inc., 501 S Williams Street, PO Box 495,
Cambria, WI 53923

Partners: >\$25,000

Alliant Energy – cost-sharing through Shared Savings loan program	Miron
A&B Process Systems	Natural Chem Group
A+ Construction	Perten Instruments
Aaron Equipment Company	Philadelphia Mixing Solutions
AdvanceBio	Pipers Mechanical
Aerotek Energy	Precision Drive and Control
Alfa Laval	Redstone Moore Company
Alro Steel Corporation	Schneider Industries, Inc
Apache Stainless Equipment Corp.	Separators Inc.
Badger Welding Supplies	Skilled Trades Services
Baisch Engineering	STOC Products
Brown Tank LLC	T&R Electric
Butters Fetting	Todd's Specialized Rigging LLC
Central States Group	Tradesmen International
Centrifuge Repair & Engineering	Tramco
Columbia Pipe & Supply Co.	United P&H Supply
Crane Engineering Sales	Viking Electric Supply
Dawes Crane	Werner Electric Supply
Dodge Concrete	Wisconsin Dept of Natural Resources
Dorner Company	
ECMS	
Endress+Hauser	
ER Controls	
Express Insulation	
Faith Technologies	
Ferguson Enterprises	
GEA Westfalia Separator	
GoIndustry DoveBid	
Guenther Supply	
Harry Davis	
Holt Electric	
Ideal Crane Rental	
Industrial Process Technology	
Liquid Process Equipment	
Maas Companies	
Mechanical Systems Inc	
Midwest Towers	

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Technical Contact: Chad Carter, 501 S Williams St, PO Box 495, Cambria, WI 53923, office 920.348.5868 x*830, fax 920.348.6203, ccarter@didionmilling.com

Business Contact: Tonya Umbarger, 520 Hartwig Blvd, PO Box 400, Johnson Creek, WI 53038, office 920.699.3633 x30, fax 920.699.3628, tumbarger@didionmilling.com

DOE Project Officer: Charles Alsup (O) 304 285 5432

DOE Project Monitor: n/a

DOE HQ Contact: Robert Gemmer (O) 202-586 5885

DOE Contract Specialist: Angela Harshman (O) 412-386-5038

1. Project Objective:

Didion Milling, Inc. is the parent company of Didion Ethanol, LLC, a 50 million gallon per year ethanol plant, hereafter referred to as "Didion". Didion's primary objective is to significantly decrease electricity and natural gas consumption at its plant. Didion will accomplish this objective through a variety of process improvements. A secondary objective of this project is to maintain and increase employment opportunities through business growth and market development.

2. Background:

Didion Ethanol, LLC is committed to reducing its energy consumption per unit produced. Didion Ethanol determined that the best way to achieve this objective was to reduce its dryer runtime, remove fouling components of the dryer, and increase fermentation capacity.

3. Accomplishments:

All phases complete and commissioned.

4. Progress and Status: PROJECT COMPLETED.

The first quarter of 2012 held a celebration of accomplishments for Didion as all projects related to the Department of Energy grant were completed and successfully running. The final items completed in Q1 2012 included the insulation installation, tie-ins and piping under the Yield Enhancement project. Commissioning of both the Yield Enhancement and Dryer Optimization projects were also complete.

Job Creation and Preservation

Didion Milling, Inc is an excellent display of what the ARRA fund was all about – job creation and preservation/retention. Due to the DOE grant project, we were able to become a more efficient ethanol operation and add a business line that required a number of staff additions. Due to the increased business and decreased energy costs going right to the bottom line, Didion Milling, Inc was and is able to retain positions when it would have been a questionable layoff period. Our ethanol operations have retained the original 32 positions and added 21 positions due to the increased volume of ethanol produced and the additional products.

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Through this grant, we were also able to employ higher than projected temporary, construction jobs during the tenure of the grant projects. Originally, Didion estimated to hire 75 temporary construction jobs and employed directly and through subcontractors approximately 105 temporary construction jobs.

Project Management and Resources

Didion's DOE grant projects were a huge success, but also shared a fair number of road blocks.

Throughout the project, Didion DOE project managers wanted to be rest assured that we were using the most current technology in the engineering of our new process design. This brought on delays in permit applications and the number of major steps that follow.

Due to the type of project that our DOE grant entailed, it required a number of permits including a Conditional Use Permit and subsequent revision, Variance Permit, seven Building Permits and a very complex change to our Air Permit. Most of these required a public hearing and the Air Permit required multiple public hearings. The permitting process bogged down our timeline to procure equipment. All of these things added to pushing out completion dates of our projects.

The procurement of equipment ended up being an unanticipated hurdle. Didion did its due diligence to receive a number of quotes on items ranging from new, American-made, new, Foreign-made and Used. This process, coupled with the longer than anticipated lead times to receive equipment proved to push out our estimated completion dates.

The fear of looming government shutdowns was felt on the contractual side of the contract.

Didion is incredibly proud of our talented workforce that led a large portion of the work to be done insourced. Our team has an incredible work ethic that got the job done once we had a plan set before us

Energy Benefits

Didion's per unit energy consumption prior to the implementation of any of the DOE grant projects was much higher than what it is today. Our actual energy savings is only through the commissioning of 4 of the 6 projects. Since the final two projects have come online since receiving our last utility bills, we have projected our true savings of the DOE grant projects once our future utility bills reflect the final two projects online.

The success of the project is truly shown in the results found below.

Energy	Usage Prior to DOE Grant Projects	Actual Savings (~93% completed = 4 of 6 projects online)	Projected Savings (100% completed = 6 of 6 projects online)
Natural Gas	30,581 BTU per gallon Average	26,297 BTU per gallon thru January 2012 14% Savings with 4 of	25% Savings Projected with 6 of 6 projects online

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		6 projects online	
Electricity	0.867 KWH per gallon Average	0.82 KWH per gallon thru January 2012 5% Savings with 4 of 6 projects online	10% Savings Projected with 6 of 6 projects online

5. **Scope issues:** – NONE. PROJECT COMPLETED.
6. **Budget and Schedule Status:** NONE. PROJECT COMPLETED.
7. **Patents:** NONE. PROJECT COMPLETED.
8. **Publications / Presentations:** This quarter, Didion was featured in an article by the Midwest Governor's Association, which mentioned the Department of Energy grant award projects.

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(III) Award Name/Number: **Domtar Paper Company** DE-EE0002780-03

Project Title: **Rothschild #3 Wood Waste Boiler Air Systems Upgrade**

Project Period: January 15, 2010 through December 15, 2011

Recipient Organization: Domtar Paper Company, LLC
200 North Grand Ave.
Rothschild, WI 54474

Partners: Jansen Combustion & Boiler, Inc
Clean Tech Partners, LLC
(Others TBD)

Technical Contact: Bernie Lakus
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Rothschild, WI 54474
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Bernie.lakus@domtar.com

Business Contact: Bernie Lakus
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Rothschild, WI 54474
Ph 715-355-6346
Fax 715-355-6215
Bernie.lakus@domtar.com

DOE Project Officer: Charles Alsup (O) 304 285 5432
DOE Project Monitor: n/a
DOE HQ Contact: Robert Gemmer (O) 202-586 5885
DOE Contract Specialist: Angela Harshman (O) 412-386-5038

1. **Project Objective:** Install a new over fire air system on #3 Wood Waste Boiler. The new OFA system will allow for a maximum firing rate approximately 30% above the boiler's current average firing rate. This additional biomass steam generation will significantly reduce the mill's use of natural gas for steam generation in its other boilers. This project will also help to keep the mill economically viable to sustain approximately 400 mill jobs.
2. **Background:** The new over fire air system proposed for #3 Wood Waste Boiler will also allow the boiler to be in compliance with particulate and CO emissions at a maximum firing rate approximately 30% above the boiler's current average firing rate. This additional generation capacity will displace natural gas fuel used in the mill's other boilers thereby also reducing NOX emissions from these boilers. Also since wood waste combustion is carbon neutral, the mill's green house gas emissions will be reduced with this project.

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3. **Accomplishments:** The project has been completed with all equipment having been installed, commissioned, and put into operation as of Friday November 4th 2011.
4. **Progress and Status:** Project has been successfully operating as planned since startup and is achieving significant energy savings.
 - a. Job Creation/ Preservation: This project helped sustain the jobs of 400 mill employees and created approximately 24 temporary construction jobs during the project duration of approximately 3 weeks.
 - b. Project Management and Resources: Coordination of multiple contractors working around the clock to execute the work within the two week boiler outage was achieved safely, on schedule, and within budget.
 - c. Energy Benefits: Compared to the first three quarters of 2011, (51,000#/hr avg. steaming rate), to the last two weeks of 2011, (66,000#/hr avg. steaming rate), we have already achieved an increase of 29.4% in the output of this boiler directly displacing natural gas with biomass steam production.
5. **Scope issues:** NONE. PROJECT COMPLETED.
6. **Budget and Schedule Status:** NONE. PROJECT COMPLETED.
7. **Patents:** NONE. PROJECT COMPLETED.
8. **Publications / Presentations:** NONE. PROJECT COMPLETED.

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(IV) Award Name/Number: Kohler & Company DE-EE0002780-04

Project Title: Recovery Act: Interest Creating Jobs Through Energy Efficiency Using Wisconsin's Focus on Energy Program

Project Period: 5/5/2010-1/31/2012

Recipient Organization: Kohler Co.

Partners/Contractors: Rohde Brothers, Inc.
Ceramic Drying Systems Ltd.
Graybar Electric Co., Inc.
Plymouth Industries, Inc.
Faith Technologies, Inc.
American Air Environmental
Bowe's Demolition
CleanTech Partners, Inc.
Alliant Energy Corp.

Technical Contact: Peter A. Pavelic for Kohler Co.

Business Contact:

DOE Project Officer: Charles Alsup (O) 304 285 5432

DOE Project Monitor: n/a

DOE HQ Contact: Robert Gemmer (O) 202-586 5885

DOE Contract Specialist: Angela Harshman (O) 412-386-5038

1. **Project Objective:** Kohler Co. energy efficiency initiative for the Kohler Wisconsin campus. The objectives are to the deployment of energy efficient technology, energy savings and to preserve/retain jobs.

2. **Background:** The project comprises of three phases:

Phase 1: Foundry energy efficient lighting
Phase 2: Hot water generation energy optimization
Phase 3: New energy efficient ware dryers

3. **Accomplishments:**

The project has been completed, is running, and no other construction remains.

4. **Progress and Status:**

Phase 1: Foundry energy efficient lighting: None, project phase complete.

Phase 2: Hot water generation energy optimization: Task 3.2 and Task 3.3; completed the hot water heater installation and commissioning for the Brass Bldg.. Completed measurement and verification (Task 3.4) for the hot water heaters installed in the Pottery Bldg. and Brass Bldg.. Project phase complete.

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Phase 3: New energy efficient ware dryers: Completed fine tuning ware drying cycles for the different product categories. Task 4.2 and 4.3; completed final commissioning of heat recovery system. In January, the ware dryer supplier was on site and completed commissioning and punch list for the ware dryers. Task 4.4; completed data collection for measurement and verification for the complete system (ware dryers and heat recovery system). Project phase complete.

Job creation and preservation: Due to the economic recession, it is difficult to determine the exact number of direct jobs created or preserved. During onsite construction of the project, there were four (4) Kohler Associates overseeing the project. In addition, over the course of construction, there were over thirty-one (31) construction workers involved with the project (not all at the same time). Based on the project cost (\$3,472,080) divided by \$92,000 per equivalent full-time job, we estimate that there were 38 jobs created or preserved. We would expect the breakdown of these jobs are 28 manufacturing jobs from purchased equipment and 10 construction jobs (either created or retained).

Project management and resources: Overall, the project stayed on track except for two significant delays: 1) Kohler contract review and approval of the DOE contract (added roughly 6-months to the project overall timeline), and 2) several ware dryer heat exchanger coils ruptured during the initial equipment startup and shakedown. As a result, the coils needed to be replaced which pushed out the project completion date by roughly 4-months. Kohler was able to find a vendor that could furnish replacement coils within 12-weeks which helped to complete the project within a reasonable timeframe.

Energy benefits: Implementation of the project has resulted in energy savings as follows: 172 kW in electric demand reduction, 1,150,593 kWh electric savings, and 329,051 therms natural gas savings (or 66% energy reduction).

- 5. **Scope issues:** NONE. PROJECT COMPLETED.
- 6. **Budget and Schedule Status:** NONE. PROJECT COMPLETED.
- 7. **Patents:** NONE. PROJECT COMPLETED.
- 8. **Publications / Presentations:** NONE. PROJECT COMPLETED.

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(V) Award Name/Number: NewPage Wisconsin System DE-EE0002780-05

Project Title: New Cleaner System for #14 Paper Machine

Project Period: January 15, 2010 through December 15, 2011

Recipient Organization: NewPage Wisconsin System
510 High Street
Wisconsin Rapids, Wisconsin 54495

Partners: None

Technical Contact: Doug Freeman
P.O. Box 8050
Wisconsin Rapids, Wisconsin 54495
Phone: 715-422-3246
Fax: 715-422-3886
Doug.freeman@newpagecorp.com

Business Contact: Doug Freeman
P.O. Box 8050
Wisconsin Rapids, Wisconsin 54495
Phone: 715-422-3246
Fax: 715-422-3886
Doug.freeman@newpagecorp.com

DOE Project Officer: Charles Alsup (O) 304 285 5432
DOE Project Monitor: n/a
DOE HQ Contact: Robert Gemmer (O) 202-586 5885
DOE Contract Specialist: Angela Harshman (O) 412-386-5038

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1. **Project Objective:** This project is to replace the 8" cleaners on #14 Paper Machine with new high efficiency 6" cleaners. Five new stages of cleaners will be purchased for the #14 Paper Machine headbox approach flow system. Use of these new cleaners will allow vacuum conditions in the first three stages, resulting in reduced power requirements.
 2. **Background:** The New Cleaner System for #14 Paper Machine Project has the following Goals:
 - A successful Technology Deployment of a new cleaner system where:
 - Purchase a five stage, 6 inch cleaner system for #14 Paper Machine along with the necessary headers and piping to allow the use of the deaerator system vacuum to assist the cleaner system pumps.
 - Install this replacement cleaner system using the new technology.
 - Successfully commission and start-up this cleaner system without affecting the downtime of #14 Paper Machine.
 - Operate this cleaner system at the prescribed quality levels.
 - Realize a savings of approximately 2,970 MWh annually with a demand reduction of 349 kW. The overall energy savings for this system is 45%.

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- Provide the following employment opportunities:
 - Provide construction jobs during a two month period of time for 5 construction employees.
 - Provide additional job security for the 900 employees at Wisconsin Rapids Mill by reducing production cost.

Accomplishments in previous quarters have been installation of the project and the successful implementation of the project. The complete system is up and running under vacuum which provides the energy savings desired. The system is running well and achieving some of the energy goals.

3. **Accomplishments:** The system has been monitored since the May 2011 installation. The #14 PM has gone through a substantial production increase and the system has been running well and achieving its energy reduction goals at higher production rates.

In summary:

- The project is running successfully and meeting the operational needs to Wisconsin Rapids Mill.
- The project is working at a higher production rate than originally designed.
- The energy savings have been reached at the higher production rate. This project has helped us avoid additional energy usage at the higher production rate.

We are very pleased with the results of this project, both in energy and operational performance.

4. **Progress and Status:** The project is complete. The results of this project are seen below.

This project assures the production jobs on #14 PM will be retained as the paper machine continues to be a top performer at the Wisconsin Rapids Mill. Numerous jobs were created for the fabrication, install, and commissioning of the new cleaner system. This is evidenced by the multitude of union man hours seen in the archived labor time sheets. Over 5,500 manhours of labor were spent installing this system.

Management of this project provided a challenge due to the unfortunate and untimely passing of the original Project Manager. Progress was kept on track by the Wisconsin Rapids Mill engineering department until another project manager was assigned. Sourcing of required parts also posed a problem as a supplying company entered into bankruptcy and ultimately shut down. Alternative solutions were generated with the collaborative efforts of the Wisconsin Rapids Mill and Andritz engineers and required parts that were not delivered were fabricated on-site with contracted local union labor. An additional complication was the need to operate #14 PM at maximum capacity due to favorable orders. This forced us to postponed installations until we had sufficient downtime to do the job properly.

The resulting savings of this project are realized through a drop in required head of 28 feet. At the same time as we implemented this project, the production rate on #14 PM was substantially increased. The result is that the project allowed for the system to run at lower pressure by 28 feet at the higher operating rate of #14 PM. This represents a 43% reduction in the power required in the system which at the new production rates is a 371 kW savings or 3,120 MWh savings in electricity for Wisconsin Rapids Mill. This exceeds the energy savings that were first envisioned by the project.

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- 5. **Scope issues:** –None. Project Completed.
- 6. **Budget and Schedule Status:** None. Project Completed.
- 7. **Patents:** None. Project Completed.
- 8. **Publications / Presentations:** None. Project Completed.

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(VI) Award Name/Number: **QuadGraphics** DE-EE0002780-06

Project Title: **Automated Lighting Controls**

Project Period: January 15, 2010 through December 31, 2011

Recipient Organization: Quad/Graphics, Inc.
 N63 W23075 Hwy 74
 Sussex, WI 53089

Partners: Orion Energy Systems, Inc.

Technical Contact: Steve Hinkens
 N63 W23075 Hwy 74
 Sussex, WI 53089
 Ph. 414-566-2887 Fax 414-566-9488
 steve.hinkens@qg.com

Business Contact: Same as Technical Contact

DOE Project Officer: Charles Alsup (O) 304 285 5432

DOE Project Monitor: n/a

DOE HQ Contact: Robert Gemmer (O) 202-586 5885

DOE Contract Specialist: Angela Harshman (O) 412-386-5038

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1. **Project Objective:** Install intelligent addressable wireless controllers on new light fixtures that will use built-in motion sensors, time of day schedules, ambient light sensors and local controls to reduce the annual electrical consumption of the lighting systems by 40 - 50 %.
 2. **Background:** This project was initiated, conceived and implemented due to the need to reduce the cost of lighting our manufacturing facilities. We replaced approximately 10,000 fluorescent hi-bay lighting fixtures in the production areas of five Wisconsin printing facilities with new fixtures that have advanced technology. The technology includes new optically efficient reflector design, energy efficient long life lamps and individually programmable wireless controllers. The wireless controllers will provide individual ballast control of each fixture for lighting levels of 100%, 60% or 0% based on operating requirements. Controlled fixtures will be assigned to lighting zones established above and adjacent to each piece of production machinery or work processing area. Lighting zones will be controlled and monitored via Quad/Graphics' building management system to provide proper lighting levels in each production area. The control of lighting will be reliant on occupancy sensing, ambient lighting sensing where appropriate, as well as scheduled event control.
 3. **Accomplishments:** Completed installation of lighting fixtures at all locations. Control program training was completed. Trouble shooting and commissioning was completed for all locations. The project is complete, all areas are functional and there is no further construction or installation remaining.
 4. **Progress and Status:** Project was completed by the end of the 3rd quarter. All five of the project sites have been fully commissioned and are fully functional on the customer's Building Automation System. Each site is currently running the lighting system at 60% of

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power, (the dimmed level) 100 % of the time, thereby saving 40% of electrical usage vs. the previous system. Some of the locations have implemented motion and ambient light controls in applicable locations to further enhance the electrical savings. These improvements are ongoing.

Job creation and preservation: The project produced work for two contractors and the main vendor for the project. The electrical contractor that installed the new fixtures in the five locations had a total of 3,265 billable hours or the equivalent of 1.63 job-years of work, assuming 2,000 hours per job-year. The main vendor had a total of 2,300 billable hours on the project, the equivalent of 1.15 job-years. The subcontractor responsible for the programming within the owner's Building Automation System had a total of 2,350 billable hours, the equivalent of 1.18 job-years. All told, 3.96 job-years were produced as a result of this project.

Project management and resources: The project management for this project went very well. I think this was due in large part to the amount of time we had to plan and organize the project before the actual start date. Many of the bugs and kinks were worked out in the planning stages including contracts, site surveys, engineering, equipment procurement, programming configuration and scheduling of the work. The equipment installation went extremely well due to good coordination between the owner and the contractors. Communication lines were kept open due to daily and weekly meetings, emails and phone calls. Troubleshooting and commissioning presented some challenges but all sides were cooperative, making for smooth completion of the projects at each location.

Energy benefits:

kWh Before: 19,219,200 kWh After: 10,153,152 kWh Saved: 7,687,680
% Saved: 40%

kW Before: 2,200 kW After: 1,320 kW Saved: 880
% Saved: 40%

Therms Saved: none

As mentioned in "progress and status" above, there are continuing efforts to save even more kWh through the use of motion and ambient light controls and more precise time of day and production related scheduling. We expect to save an additional 5-8% through the use of these methods.

5. **Scope issues:** –None. Project Completed.
6. **Budget and Schedule Status:** None. Project Completed.
7. **Patents:** None. Project Completed.
8. **Publications / Presentations:** None. Project Completed.

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(VII) Award Name/Number: **Thilmany LLC** DE-EE0002780-07

Project Title: **#15 Paper machine Hood Efficiency Improvement**

Project Period: January 15, 2010 through December 15, 2011

Recipient Organization: Thilmany LLC
600 Thilmany Road, Kaukauna, WI 54130

Partners: Metso Papers, USA Inc., Air systems; Coenen Mechanical LLC, W2662 Sievert Road Seymour, WI 54165-8305; Faith Technologies, 2662 American Drive, Appleton, WI 54914.

Technical Contact: Thomas Piette, 600 Thilmany Road, Kaukauna, WI 54130
P(920)766-8511, F(920)766-8780, tom.piette@thilmany.com

Business Contact: Thomas Piette, 600 Thilmany Road, Kaukauna, WI 54130
P(920)766-8511, F(920)766-8780, tom.piette@thilmany.com

DOE Project Officer: Charles Alsup (O) 304 285 5432
DOE Project Monitor: n/a
DOE HQ Contact: Robert Gemmer (O) 202-586 5885
DOE Contract Specialist: Angela Harshman (O) 412-386-5038

- 1. Project Objective:** The purpose of this project is to install heat exchangers to recover sensible and latent heat from the paper machine exhaust. This heat is transferred to four distinct heat sinks:
- Air to air heat exchangers transfer heat directly from hood exhaust stacks No. 1 and No. 3 (HE #1 and HE #3) to the air supply to #15 paper machine's hood system for the two Pocket Vent systems (PV-1 and PV-2).
 - Indirect air to liquid heat exchangers transfer heat from HE #2 to the paper machine process white water system.
 - Indirect air to liquid heat exchangers transfer heat from HE #2 to the paper machine shower white water system.
 - Indirect air to liquid heat exchangers transfer heat from HE #1 and HE #2 to a glycol heating system. The heat absorbed by the glycol solution is transferred to ~250,000 cubic feet per minute (cfm) of outdoor air through four existing building air make-up units.
- Recovery of the heat improves the efficiency of four systems that used only steam as a heat source. Domestic manufacturing and construction jobs were created by this project. Improving the cost competitiveness of the machine improves job security for Thilmany Papers employees.

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2. **Background:** Conventional paper machines use 75 tons of air to produce one ton of paper. Paper machine #15 used steam for 100% of the heat required to raise the air temperature from ambient temperature to 190° F. Steam was also the sole source of heat for the paper machine white water system, which is intended to be operated at a temperature of 125° to 130°. No heat recovery units were installed on #15 paper machine. Three paper machine exhausts discharged humid, high temperature air to the atmosphere, wasting heat and causing inefficiency.

3. **Accomplishments:**

- a. The Main Dryer Section Closure was received from Metso. The closure installation was completed during the final week of September. The Closure is working as designed to prevent hot humid air from spilling to the machine room. A photograph of the closure is appended.
- b. An electronic level sensor was added to the glycol expansion tank. This instrumentation sends a signal to the mill's process information system and will be used to identify and correct any leaks that might form in the glycol system.
- c. The steam condensate line from the glycol heater was rerouted to assure gravity drainage of the steam condensate to the building heat condenser. This action corrects a problem with condensate pooling in the condensate line and has eliminate the potential for system damage caused by water hammer.

4. **Progress and Status:**

System Performance

Improving energy efficiency is one of the strategies employed to decrease operating cost for this paper machine and for the business to assure that this machine continues to operate and provide employment to the entire staff.

The initial project scope included recovery of 11.1 MMBtu per hour of heat with the objective of heating air to the pocket vent system and to building make-up air units, including one new make-up air system. The scope and systems were improved between July 2009 and May 2010 to increase the heat recovery. In addition to air to air heat exchangers to heat incoming air to the pocket vent system, a patented heat exchanger design was used to transfer heat indirectly to the whitewater in the machine silo and to whitewater that is re-used for machine showers. Similar heat exchangers were used to transfer heat to ethylene glycol systems for building heat.

The change in the scope of the project increased nominal heat recovery from the original design level of 11.1 MMBtu/h to 20.9 MMBtu/h. The project spending budget changed from the original budget of \$2,142,200 to \$2,211,000. The difference was funded by Thilmany, LLC.

Job Creation

Job creation was consistent with the original plan. The project helped to maintain employment for the equipment designer/supplier, the U.S. steel industry, electronics manufacturers and suppliers, piping supply companies and others. The total project cost for equipment and installation for the project was \$2,208,000. Using a multiplier of \$92,000 per job, this equates to the creation of 24.0 jobs throughout the supply chain. Some of this job creation was documented with records. For example:

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- Records from Davis Bacon wage statements show that contractors worked 4,700 hours on site during construction. The general contractor estimated an additional 700 hours were worked by contractors off-site.
- Coenen Mechanical Incorporated (CMI), the general contractor, benefited greatly from this job. CMI was able to keep its senior tradespersons working in spite of a poor economy, because of this job.
- Thilmany had two employees working on the project. The senior process control engineer documented 185 work hours on the project and Thilmany's project Manager documented 180 hours on the project.
- An on site contract electrical engineer logged 190 hours on the job.
- Pre-engineering for the project provided approximately 200 hours of work to employees at a local engineering firm.
- The general contractor served as the construction manager. He was on-sight almost every day throughout the course of construction during the second half of 2010.

Project Management

Project management throughout design and construction proceeded very well. From July 2009 to April 2010, Thilmany and its suppliers studied alternatives for the project to improve performance and increase energy efficiency. This effort resulted in the selection of Metso USA as the turnkey supplier of the heat recovery equipment. Coenen Mechanical, a local contractor, was the general contractor for the project.

The scope change to include heating of water increased the nominal heat recovery from 11.1 MMBtu/h to 20.9 MMBtu/h. The additional heat is supplied to the paper machine white water systems which supply a year round heat sink for the energy. The change in scope caused the project cost to increase 3.2%. All of the additional cost was borne by Thilmany, LLC.

The project stayed on track from the start of the project until the performance test was attempted in January 2011. The test showed that a new damper would need to be installed in after section pocket vent air duct in order to balance air supplies to the hoods. Metso supplied and installed the air damper. A second performance test was scheduled for March 2011. This had to be postponed because of a boiler failure. The test was completed in May 2011. The test showed that the system met its performance guarantee. The test also identified the need to install a cover for the upper portion of the hood opening at the sheet exit from the main section hood. The hood closure was manufactured by Metso and it was installed in September 2011. This action completed the significant construction activities.

The cost for each of the modifications was borne by Metso, based upon the performance guarantee. (Thilmany paid the cost difference from a fixed panel to a movable panel for the hood closure for its own benefit.)

Although construction was not completed until later in 2011, the project operated throughout the year, albeit at lower efficiency than after completing the hood closure.

The original intent of the project was to improve the energy efficiency of the hood's pocket vent and building heating systems by more than 25%. The revised project added the goal of improvement to the efficiency of white water heating by more than 25%. In operation, the project meets and often exceeds expectations.

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Measurements of the system during the performance test provide the best data to document the scope of improvement that resulted from this project. Prior to the project, 100% of the heat supplied to the pocket vents, building heat, white water (silo) and clarified white water for showers was supplied by steam. Now, 80% to 90% of all of the heat required by to heat air for the pocket vents, building air make-up units and for white water heating is supplied by heat recovered with the hood efficiency system.

All of the heat supplied to four of the buildings Air Make-up Units (AMU's), totaling 250,000 ACFM, is guaranteed to be supplied by the hood efficiency system down to an ambient temperature of 21 degrees F. Thilmany's operating experience shows that heat recovery is better than planned and steam is not used until temperatures approach single digits. Steam is used for building heat primarily when the machine is not operating.

Virtually all of the heat supplied to the white water systems is supplied by the hood efficiency system. The exception is that steam is used during machine starts from cold conditions (after chemical clean-ups for example).

There are also unbudgeted savings of electrical power as a result of the use of variable frequency drives for the machine's exhaust fans and the use of compressed air to eliminate condensation on sheet scanners at the main hood sheet exit point was eliminated after the main section hood closure was installed. It is estimated that the drives are savings 46 kW based upon fan speeds during the performance test. The power savings for elimination of the use of compressed air at the main hood opening is not estimated but it is substantial. A total of six 3/8" stainless steel tube extensions were used to blow moist air away from scanners using the mill's compressed air supply (65 psig). The system of 3/8" nozzles was removed from the machine.

In summary, the project met or exceeded its expectations for saving energy by capturing waste heat and by decreasing power requirements for ventilation.

5. **Scope issues:** None. Project Completed.
6. **Budget and Schedule Status:** None. Project Completed.
7. **Patents:** None. Project Completed.
8. **Publications / Presentations:** None. Project Completed.

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(VIII) Award Name/Number: Wausau Paper Mosinee DE-EE0002780-08

Project Title: **#4 PM Efficiency Upgrade Project**

Project Period: 01/15/2010 through 12/15/2011

Recipient Organization: Wausau Paper Specialty Products LLC
100 Main Street
Mosinee, WI 54455

Partners: Kadent Johnson Inc., Airtherm Corporation, GL&V USA Inc.,
Baisch Engineering, Tweet Garot, Van Ert Electric, Werner
Electric and Supply

Technical Contact: Boyd Pitney, 100 Main Street, Mosinee, WI 54455
Office: 715-692-3317
Fax: 715-692-3301
E-mail: bpitney@wausaupaper.com

Business Contact: Boyd Pitney, 100 Main Street, Mosinee, WI 54455
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Fax: 715-692-3301
E-mail: bpitney@wausaupaper.com

DOE Project Officer: Charles Alsup (O) 304 285 5432
DOE Project Monitor: n/a
DOE HQ Contact: Robert Gemmer (O) 202-586 5885
DOE Contract Specialist: Angela Harshman (O) 412-386-5038

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1. **Project Objective:** The #4 PM Energy Efficiency Upgrade Project will dramatically improve the energy efficiency of the paper machine #4 manufacturing line by improving the paper stock refining process, improving the use of steam to dry the paper, and improving the hood drying system on the Yankee Dryer.
 2. **Background:** This project is composed of three parts that will enhance operating flexibility, provide significant energy efficiency improvements, and help maintain the competitive viability of this paper machine by improving product quality and lowering production costs. Energy efficiency gains will be realized in stock preparation through installation of a GL&V 34" DD4000 Series Refiner which replaces two 26" DD2000 Refiners. This Refiner will lower energy usage by 36% under no load conditions. Secondly, the steam supply and condensate drainage system will be revised with new steam supply and condensate return piping, new control valves, new condensate separators and pumps, new stationary dryer can siphons and turbulator bars, and a new steam and condensate Dryer Management Control System (DMS). The new control system will eliminate dryer flooding, improve dryer recovery following paper breaks, and reduce steam requirements across all grades. When completed, the steam and condensate upgrade portion of this project will save 48,393 MMBTU per year. Finally, replacement of two Yankee Dryer Hood Supply Fans will reduce the supply fan horsepower by 68% for the same production rates.

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3. **Accomplishments:** The Kadent Dryer Drainage Equipment was successfully started up on April 6th, 2011 and is operating reliably. The energy saving GL&V 34" Refiner was installed and successfully started up on July 7th, 2011 and is operating reliably. The energy saving Yankee Dryer Hood Fans were successfully installed and started up on December 9th, 2011. No other construction activities or startup activities remain on this project.
4. **Progress and Status:** This project was significant in that it contributed to job creation and preservation, utilizing proven project management techniques to complete successful execution, and ultimately saved energy.

a. Job Creation/Retention:

The implementation of this project created short term jobs with Miron Construction, Tweet Garot Mechanical Inc, and Van Ert Electric as well as helped retain long term positions at the Wausau Paper Mosinee Mill. This project improved uptime, quality, and energy efficiency of #4 Paper Machine and thus lowered the overall manufacturing cost structure mill. Lowering this cost structure contributed to the mill maintaining a competitive position in the marketplace, thus improving its long term viability. This successful project has helped retain machine crews and support staff on #4 paper machine. This paper machine provides a significant contribution to the mills production capacity. Therefore, the implementation of this project contributed to the long term retention of all 360 mill employees. The short and long term benefits are summarized below:

Short Term

Equipment Supplier Job Retention – 1.5 (Full time Employees) FTE
Installation Contractors Job Retention – 3 FTE
Engineering Staff Job Retention – 2 FTE
PM4 Paper Machine Crew/Stock Prep/Maintenance Job Retention – 90 FTE

Long Term

All Mill Employees Job Retention – 360 FTE

b. Project Management and Resources

This project was managed using proven project management techniques including the development of a preliminary conceptual design, development of a technical solution to individual problems or issues, frequent design reviews, constructability reviews, operability reviews, detailed scope development, early purchase of long lead equipment, a frequent view of schedule and possible changes to the installation dates. Detailed design, procurement, and construction followed the conceptual design phase. Construction was conducted on regular shutdowns of equipment and was completed in December 2011.

c. ENERGY SAVINGS

1. ANTICIPATED SAVINGS:

a. Steam and Condensate Equipment

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Per the original submission, we anticipated that this project would save 6,584 pph of steam which equated to a 27% reduction in steam energy required by Paper Machine #4. This steam savings equates to a thermal savings of 48,393 MMBTU saved during the first full year of operation.

b. Refiner Equipment and Controls

Prior to this project, Paper Machine #4 operated four refiners nearly continually (one large refiner and three small refiners). These refiners created a Total No-Load Energy Demand of 489 Hp (i.e. one large refiner pulling a no load of 135 Hp and three smaller refiners pulling 118 Hp each).

c. Yankee Hood Fans

Prior to this project, Paper Machine #4 Yankee Dryer Hood was operated using supply two fans requiring 245 Hp to operate (122.5 Hp each). This Horsepower was confirmed on November 8, 2011 prior to the installation of the new Yankee Hood Fans using amp meters located on each drives motor control center.

2. ACTUAL SAVINGS:

a. Steam and Condensate Equipment

We have documented steam savings after installation of 6,500 pph (See chart in attachment #1). This equates to a 26.6% reduction in energy required to operate Paper Machine #4. This steam savings equates to a thermal savings of 47,725 MMBTU saved on an annual basis.

b. Refiner Equipment and Controls

After installation of the new Refiner, the actual no load energy demand is 196 Hp (Refiner #1 @ 59 kW and Refiner #2 @ 87 kW, and results in a reduced energy demand savings of 1,836,055 kWh per year $\{(489-196 \text{ Hp}) \times .746 \text{ kW/Hp} \times 8,400 \text{ hours/year} = 1,836,055 \text{ kWh/year}\}$.

c. Yankee Hood Fans

After installation of the new Yankee Hood fans, two fans required a total of 52 Hp (26.3 Hp each) to operated the Yankee Hood. This results in a documented net horsepower savings of 193 Hp and a reduced energy demand savings of 1,210,722 kWh per year $(193 \text{ Hp} \times 0.746 \text{ kW/Hp} \times 8,409 \text{ hours/year} = 1,210,711 \text{ kWh/year})$. This data was collected directly from the new variable frequency drives installed on each new fan.

d. Total Project Savings:

After one full year of operation, this project is projected to save 48,393 MMBTU and 3,046,766 kWh total.

3. ADDITIONAL BENEFITS FOR THE MANUFACTURING LINE:

- a.** Attachment #2 shows additional benefits that have been realized as a result of this project. Note that Paper Machine #4 uptime and first pass quality have improved (See Attachment). Note that these benefits coincided with the startup of the Energy Efficient Steam and Condensate System and the Installation of the Energy Efficient Refiner.

5. Scope issues: None. Project Completed.

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6. **Budget and Schedule Status:** None. Project Completed.

7. **Patents:** None. Project Completed.

8. **Publications / Presentations:** None. Project Completed.

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(IX) Award Name/Number: **Wausau Paper Rhinelander DE-EE0002780-09**

Project Title: **7 PM Economizer Upgrade**

Project Period: January 15, 2010 through December 31, 2011

Recipient Organization: Wausau Paper - Rhinelander Mill
515 W Davenport St.
Rhinelander, WI 54501

Partners: Metso Paper USA, Ferguson Enterprises, Freedom Fire, Mechanical Inc., Systems Technologies, Tweet Garot Mechanical Inc., Miron Construction, L&S Electric, Liquid Process Equipment, Werner Electric, FCx Performance

Technical Contact: John Harris,
515 W Davenport St, Rhinelander, WI 54501
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Email: jharris@wausaupaper.com

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Ph. (715) 369-4181
Fx. (715) 369-4334
Email: thasbargen@wausaupaper.com

DOE Project Officer: Charles Alsup (O) 304 285 5432
DOE Project Monitor: n/a
DOE HQ Contact: Robert Gemmer (O) 202-586 5885
DOE Contract Specialist: Angela Harshman (O) 412-386-5038

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1. **Project Objective:** The primary objective of this project is to install multiple stages of heat recovery equipment on the 7 Paper Machine Dryer Hood Exhaust. Equipment includes: fans, ductwork, heat exchangers, pumps, and piping necessary to transport process fluids. Multiple stages of heat recovery will be installed to increase overall efficiency of the paper machine hood. Recovering waste heat from our process will enhance the long term viability of the Rhinelander Mill.
 2. **Background:** Energy savings and efficiency improvements are the main benefit of this project. Increasing the efficiency of the hood will reduce the amount of wasted energy leaving through the exhaust stack. The installation site is the mezzanine of #7 Paper Machine.

The equipment was installed in Q4 of 2010, and has been in full operation since 11/5/10. After completing the equipment commissioning, the project team has focused on increasing process measurement, improving control, and verifying the performance of the heat recovery system.

3. **Accomplishments:** The project has been completed, is running, and there are no open items to report.

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4. Progress and Status: The project has been in operation since 11/5/10, and was formally completed 4/20/11. The majority of construction work was completed over the summer of 2010. Multiple union contractors were used in the construction phase of this project. Wausau Paper leveraged resources from well-known and local contractors such as Miron, Mechanical Inc, Tweet Garot, and System Technologies during the construction period. Now that the project is complete, the heat recovery equipment has been saving Wausau Paper approximately \$634,000 annually. The energy savings directly affects the overall efficiency of the mill and helps retain the 479 people employed at the Rhinelander Site.

This project was highly supported by the Rhinelander Mill and across the Wausau Paper organization. The project manager was given the appropriate resources to complete the project in a timely and efficient manor. Project management tools such as Gantt charts, risk analysis tables, and monthly meetings with upper management helped keep this project on task.

The heat recovery equipment installed at the Rhinelander Mill has been performing at guaranteed levels since being commissioned on 11/5/10. The mill measures and records temperatures and flow rates of each fluid that capture heat from the #7 Paper Machine hood exhaust. This data is stored on the mill Data Historian, and real-time heat recovery data is available to the operators. The graph below plots heat recovery by month. During the first year of operation the heat recovery system captured 933,730 Therms.

4. Scope issues: None. Project Completed.

5. Budget and Schedule Status: None. Project Completed.

6. Patents: None. Project Completed.

7. Publications / Presentations: None. Project Completed.