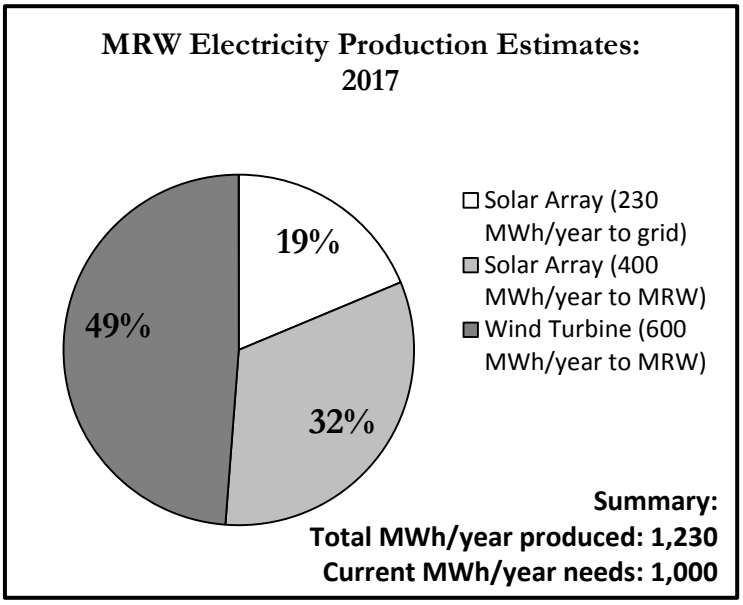
October 2016

Mark Richey Woodworking Inc.

Renewable Energy and Energy Efficiency

Summary

Through a number of improvements and key management decisions between 2005 and 2016, Mark Richey Woodworking Inc. (MRW) has implemented several alternative energy and renewable energy systems in their facility (including a biomass boiler, 600 kW wind turbine, and 500 kW solar array), and has risen as a leader in their industry in terms of energy efficiency measures implemented at the facility. By 2017 the facility is expected to, on average, produce more electricity than it currently needs to operate, which will allow them to operate more or less off the electric grid. The wind turbine produces 60% of the facility's total electricity needs of about 1,000 megawatt hours (MWh) per year. The solar array is projected to produce 630 MWh per year, thereby meeting MRW's current electricity needs and allowing the facility to send electricity back to the grid. The excess generating capacity will allow MRW to expand production while still using renewable electricity (See the chart to the right). The biomass boiler heats the 85,000 square feet facility powered by waste sawdust and woodchips. This case study also examines equipment investments made by MRW to improve energy efficiency in production.



Background

Mark and Teresa Richey founded the business in 1981. MRW specializes in producing high-end custom architectural millwork wood products for their corporate, institutional, and residential clients. As a result of the 2005 move to Newburyport, company leadership was able to evaluate operations and chose to upgrade the abandoned facility that they purchased by investing in new equipment and incorporating energy efficient practices into their operations. The company is highly committed to alternative energy options, energy efficiency, and working with the MA Office of Technical Assistance (OTA) to find solutions. More details on MRW's environmental stewardship can be found on their website: www.markrichey.com/sustainability.

Biomass Boiler

As a result of Mark Richey's forward-thinking vision, the company successfully installed the first biomass boiler in a Massachusetts woodworking shop using wood scraps from the production floor to

heat the facility. MRW retrofitted two existing silos at the Newburyport facility to store ground wood scraps over the warmer months until they can be burned in the colder months.

During the winter, MRW uses their 200 horsepower MAWERA biomass boiler to heat water that is distributed throughout the shop walls to create radiant heat. The company's wood waste, including machine waste (planer shavings, sawdust, sander dust, etc.), and ground scraps from raw wood, plywood and particle board materials is ground and then utilized in the biomass boiler. Any wood scraps that have been painted, laminated with plastic or melamine resins, or contain any other non-wood material (including chemical flame retardants and metal pieces) are separated out from the grinding process and disposed of as solid waste. On coldest days of the year, the facility uses some natural gas to supplement the heat provided by the biomass boiler.

The $600,000 investment (including the price of the boiler, grinder, and retrofitting of the silos) has paid for itself in 10 years since the installation. In addition to cost savings achieved by using wood scraps as fuel and eliminating wood scrap disposal and removal costs, the new heating method prevents the facility from getting cold because the heat does not need to be turned off overnight. This improves productivity as it creates a more comfortable work environment for workers during the winter.

Wind Turbine

To supplement their electricity needs, MRW looked into various alternative energy options. In 2009, MRW installed a 600 kilowatt wind turbine to produce electricity for the facility. MRW took advantage of a 30% tax credit and received a grant for $480,000 from the Massachusetts Technology Collaborative to offset the $2.2 million installation cost. The company also receives renewable energy credits.

The installation required MRW to invest time and money into working with experts and engineers to find the best option for their location and energy needs. The payback period for the $2.2 million cost of the wind turbine was 8 years and MRW expects to use this particular turbine for at least 15 years and up to 25 years.

Since 2009, MRW has produced about 5,000 MWh of electrical power with the turbine. Before 2009, they were consuming about 800-900 MWh of electricity per year; since then that amount has increased. Assuming an average of 1,000 megawatt hours of electrical consumption per year since 2009, MRW has generated about 60% of their total electricity requirement using the wind turbine. Due to the high pace of growth that the company is experiencing, in 2016 the company looked into increasing its capacity to produce electricity by alternative means.

Solar Energy

In order to reach their goal of 100-percent onsite renewable energy production, MRW installed a 500 kilowatt solar array in 2016, which covers about ¾ of the roof. It's estimated that the array will produce about 630 MWh of electricity per year. That would put the facility's electrical production at about 1,230 MWh per year (more than they currently need). Company leadership anticipates continued growth and wants to prioritize operating without electricity from the grid.

The company optimized the timing of the solar array by first replacing the facility's roof on schedule. Instead of replacing the roof with the same or standard roofing materials, MRW installed a roof made of a fully adhered 0.08 inch thermoplastic polyolefin (TPO) white membrane with welded seams to create a sturdy base for the solar array. The white color of the new roof material reduces the temperature of the roof, which reduces the amount of energy needed to cool the facility and increases the efficiency of the solar panels.

MRW received a 30% tax credit for the solar array and receives renewable energy credits from the SREC-II program. MRW expects a 2-2.5 year payback on the full cost of the $1 million installation of the solar array. That cost does not include the cost to replace the roof.

Renewable and Alternative Energy Projects

Project	Approximate Total Cost	Incentives	Pay-back period	Benefit
Biomass Boiler, Retrofitted Silos, Grinder	$600,000		10 years	Cost savings of $60,000/year since 2007
Wind Turbine	$2.2 million	• Mass Technology Collaborative Grant: $480,000 • 30% tax credit • Wind RECs	8 years	Produces ~ 60% of MRW's electricity needs (about 600 MWh/ year)
Solar Array	$1 million	• 30% tax credit • SREC - II	2 to 2.5 years (projected)	Produces ~ 40% of MRW's current electricity needs.

Energy Efficiency Facility Improvement & Checklist System

Besides investing in equipment to produce energy, MRW also takes great pride in investing in equipment that saves energy over time. The facility recently installed several Goff's G2 High Speed Doors between the finishing area and the rest of the work floor. These open and close within seconds and save electricity used by the make-up air system. Also, MRW is upgrading the fluorescent lights (T-5s) that have been in the production area since they began upgrading the Newburyport facility in 2005. In 2016, MRW will make the transition to LED lights which will likely cost $100,000, but the electricity savings over time for the LED lights will be approximately 40%. The LEDs will also last for 50,000 hours as opposed to the T-5's which last approximately 8,000 hours.

Another important investment for MRW was an Ecogate computerized dust collection system. As an "intelligent ventilation system," the Ecogate system has led to significant energy cost reductions because it can digitally monitor the whole facility by opening and closing air velocity measuring gates. This ensures that the ventilation air velocity is optimized for each job. This is especially useful at the MRW facility as each job requires the use of a different set of equipment; customization of the airflow capabilities allows the facility to save electricity. Mark Richey estimates that 60% of the facility's electricity usage goes to powering the dust collection system. He also estimates that the Ecogate system has led to approximately $30,000 per year in savings since its installation in 2005. In addition to the electricity savings, the initial $115,000 cost of the system was offset by a National Grid rebate that

covered approximately 90% of the initial cost. More recently, after OTA specialists recommended that the company look into variable drive compressor systems, MRW installed a Kaeser variable speed air compressor. This reduces MRW's use of electricity by allowing the facility to adjust power output to the compressor, rather than merely the on-off functionality of traditional systems.

MRW's staff takes great pride in maintaining the equipment to ensure that wasted energy is minimized. Mike Ort, the Facility Manager, ensures that all equipment is well-maintained and operating efficiently. Each year Ort goes through a pre-winter maintenance checklist that covers everything from door sweeps to the dust collection system. Repair activity is recorded in the facility's Hazard Abatement & Equipment Repairs Log. The compressed air system is also inspected more regularly to prevent leaks and wasted energy. In 2011, OTA advised MRW that the common problem leak areas in the compressed air system include couplings, hoses, tubes, fittings, pipe joints, quick disconnects, FRLs (filter, regulator, and lubricator), condensate traps, valves, flanges, packings, thread sealants, and point-of-use devices.

Energy Efficiency Projects

Project	Approximate Total Cost	Incentives	Pay-back period	Benefit
Computerized Dust Collection System	$115,000	National Grid rebate for 90% of the cost	1 year	$30,000/year
Switch from T-5s to LEDs	$100,000	Unknown	Unknown	Use 40% less electricity for lighting.

Conclusion

Mark Richey Woodworking continues to search for ways to integrate energy efficiency and cost savings into its business model. By understanding that long term cost savings will offset the installation costs of the equipment mentioned in this case study, MRW has established itself as a company that thinks about its own growth while keeping the best options for the environment in mind. MRW seeks to lead by example and provide educational opportunities to fellow businesses and the community. School groups are often welcomed to tour the facility and see the wind turbine and the biomass boiler. Mark Richey hopes that soon his company will not be the exception in the area of pursuing alternative energy. He sees companies like his as the future of manufacturing in Massachusetts and is willing to help other companies that reach out to him for advice on pursuing sustainable energy options.

This case study was prepared by the Office of Technical Assistance and Technology (OTA), a branch of the Massachusetts Executive Office of Energy and Environmental Affairs. The OTA helps businesses and other organizations improve their environmental performance by helping them comply with relevant regulations, reduce toxics use, and conserve energy, water, and other resources.
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Office of Technical Assistance and Technology, 100 Cambridge St, Suite 900, Boston, MA 02114