Aman Ungarov

Major: Mechanical Engineering
School: Iowa State University

WOODHARBOR CUSTOM CABINETRY

MASON CITY

COMPANY PROFILE

Woodharbor Custom Cabinetry is a family owned business, originated by the Lewerke brothers in 1993. The company is housed in a state-of-the-art-facility in Mason City, Iowa. Woodharbor is a manufacturer of home, bath, and kitchen cabinetry as well as related millworks. All of the products are custom made and sold by 450 dealerships across the United States. With 210 employees, the company produces approximately 32,500 cabinets, annually.

PROJECT BACKGROUND

The primary aim of the project is to investigate and recommend a control system to actively monitor and regulate outgoing and incoming airflows in the facility. A secondary aim is to identify a more economical method for wood scrap disposal. The intern conducted a comprehensive analysis of the heating, ventilating and air conditioning (HVAC) system, solid waste management practices, and automatic finishing lines. Opportunities to reduce costs associated with energy usage and wood scrap management were presented to the company.

INCENTIVES TO CHANGE

To prevent contamination on product, Woodharbor Custom Cabinetry has taken steps to minimize dust and debris in the finishing room. Monitoring and assessment indicate that particles are entering the finish room through the airflow from the manufacturing area. The intern was tasked with seeking a solution for maintaining positive pressure in the finish room, resulting in reduced labor costs associated with reworking product. In addition, the intern explored methods for reducing wood scrap generation and diverting it from the landfill. An automated control system to reduce energy usage and improve the operating efficiency of the HVAC system was also evaluated.

RESULTS

Building Automation System (BAS): Most of the HVAC components at the facility are operated manually by the maintenance staff. The dust collection systems and majority of the make-up air (MUA) units are turned on 45 minutes before production starts and turned off up to an hour after it stops. Extended time of operation results in higher electricity and natural gas costs. The MUA unit settings are set based

on maintenance employees' predictions on the outside temperature. Implementing a BAS would result in energy savings due to proper scheduling of all of the equipment and increase system efficiency. Additionally, an ability to build positive pressure in the finish room should result in labor cost savings and wood waste reduction due to product contamination. Temperature and pressure sensors set up across the facility will help the company to monitor the current situation on the floor. The BAS would allow further expansion and improvements on the system based on company's needs.

Spray Booth Fan Operation Change: After a further look into the spray booth operations, the intern observed that exhaust fans are started before production and stay on constantly throughout the day. This is a preventative measure against the buildup of contaminants in the air. While there is a cost associated with electricity waste, the energy lost due to warm air removal during the winter presents a higher cost of natural gas use. Additionally, extended exhaust fan operation contributes to pressure loss in the finish room, increasing the chances of product contamination. Turning the fans on when production starts and shutting them off during breaks would reduce these losses, at no investment cost.

Two of the spray booths have control systems installed on them. The system recognizes when the spray gun is being used and runs the fans at their highest speeds. After a predetermined amount of time, the system drops the exhaust airflow down to 20 to 40 percent of the original output to conserve energy until the spray gun is used again. The control systems are installed at the spray booths with lower CFM values and are kept off due to a formaldehyde buildup in one of the booths. Moving the control panels onto booths with the highest CFM values would result in greater annual energy savings. Low investment cost and quick implementation time represent additional benefits of the recommendation.

Damage Prevention Training Video: A portion of the product contamination is caused by behavioral inefficiencies at the automatic finish lines. While spraying and drying of paint or finish occurs inside of the machine, the parts need to be scuffed and cleaned manually between each layer of coating. It is within this process that most of the inefficiencies related to part clean off and cart organization occur. Producing a training video for new employees was selected as a preventative measure. The video format has a low cost of production and will provide easy-to-digest content within a short module. This training should minimize the amount of dust contamination and the need for retraining, which reduces the labor cost associated with part repair. The training has the added potential to lower the risk of physical damages like dents and scratches.

Wood Scrap Diversion: Currently, all of the wood scrap is transported to a landfill, where disposal fees are incurred. The saw dust, however, is sent to a dairy farm for animal bedding at a much lower cost. Installing a wood grinder to shred the scrap and divert the chips to the dairy farm has the potential to eliminate waste disposal fees and lower transportation costs.

PROJECT	ANNUAL COST SAVINGS	ANNUAL ENVIRONMENTAL RESULTS	STATUS
BUILDING AUTOMATION SYSTEM	$27,616	201,153 kWh 4,393 therms	RECOMMENDED
SPRAY BOOTH FAN OPERATION CHANGE	$4,542	1,115 kWh 13,487 therms	RECOMMENDED
DAMAGE PREVENTION TRAINING VIDEO	$126	Time and material for rework	RECOMMENDED
WOOD SCRAP DIVERSION	$6,974	553 tons	IN PROGRESS