LUIS HERNANDEZ

SCHOOL: Iowa State University

MAJOR: Mechanical Engineering

YOKOHAMA TWS

CHARLES CITY

COMPANY PROFILE:

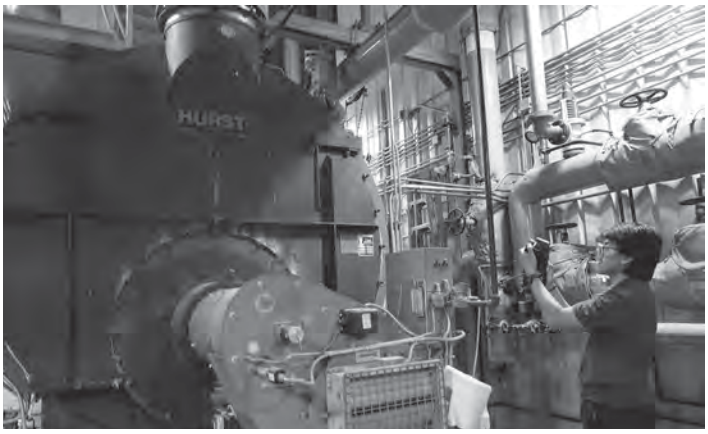
Yokohama is a tire and wheel company based in Tokyo, Japan. Previously operating as Trelleborg Wheel Systems, the Charles City, Iowa, plant was recently acquired to produce tractor tires, manufacturing around 8,500 tons of tires per year. Now operating as Yokohama TWS, the plant is a leading global supplier of tires and complete wheels for agricultural and forestry machines, materials handling, construction vehicles, motorcycles and other speciality segments. Yokohama TWS, a partner of leading original equipment manufacturers, offers highly specialized solutions to create added value for its customers. The plant operates 24 hours a day, 6 days a week, and employs 150 team members.

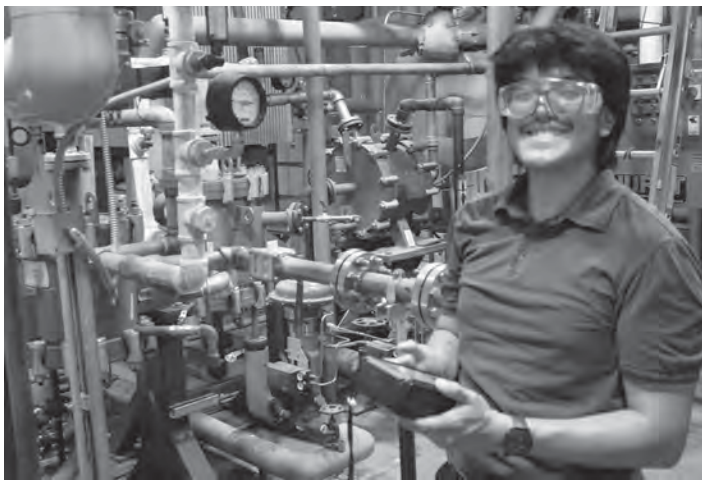
PROJECT BACKGROUND

Steam is the primary resource used in the curing process of tires and Yokohama relies on boilers running constantly to produce that steam. Seeking to improve the operating efficiency of the boiler and steam system, the company joined with the Iowa Pollution Prevention Intern Program to complete an assessment of the boiler and steam system and establish a baseline to better understand costs and improvement opportunities. The intern was then tasked with researching and recommending improvements that could lead to reductions in utility use and associated costs.

INCENTIVES TO CHANGE

Yokohama TWS is committed to continuous improvement of environmental stewardship at every level of the production process. The Charles City plant is ISO 14001 certified and continually strives to use resources more efficiently and improve the impacts of the operation on the environment and on human health. Improving the efficiency of the operating systems at the plant will assist Yokohama TWS to reduce environmental emissions while maximizing profits. Optimizing the boiler and steam system will provide savings of natural gas, water, and pre-treatment chemicals, and could reduce emissions.





RESULTS

Optimize Boiler Efficiency: Currently, the building heat is provided by five direct-fire natural gas furnaces. A 500-horsepower boiler is used to produce steam for use in the curing process for the tires and runs continuously at a relatively low load. Boilers operate more efficiently at a higher load so using steam to help heat the building would increase operating efficiency. A recommendation was made to purchase steam coils, steam traps, pipes, and valves to deliver steam to the furnaces that provide heat for the plant during the winter. The steam coils would be installed inside the current furnaces where steam would enter the coils and liquid condensate would leave. The latent heat of the water would be extracted and sent to the prep and curing departments. Yokohama will need to follow up with the vendors to supply the steam coils and any additional piping needed.

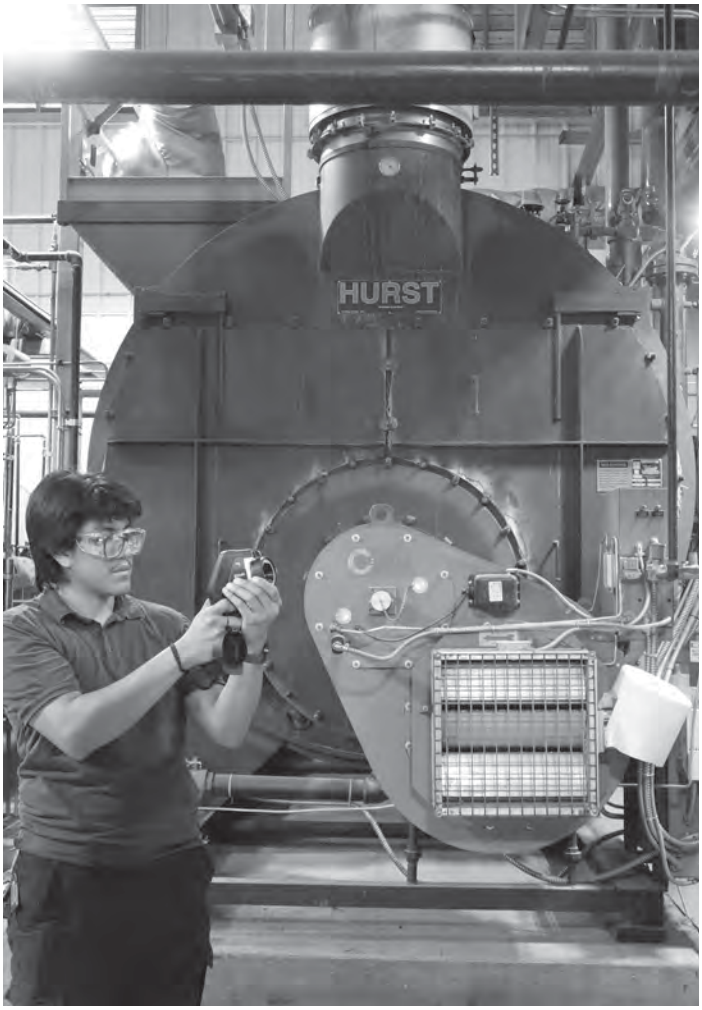
Install Boiler Natural Gas Meter: The boiler is a large energy user in the plant. Natural gas is currently only metered coming into the building without being narrowed down to specific systems. Submetering can help the boiler operators monitor natural gas usage and identify process trends and variances with real time data. Research shows that increased awareness

with submetering can reduce energy consumption by 3 to 5 percent. Submetering the boiler and other large energy users is recommended. The intern researched natural gas meters and identified a viable in-line option. Installation could be completed by the in-house maintenance team during a plant shutdown.

Re-route Boiler Blowdown: Blowdown steam and water from the boiler are cooled and then directed to the drain. Reusing this hot water is very attractive because it is the same temperature as steam (210°C). Using this blowdown as feedwater is not feasible because it would need to be thoroughly cleaned and chemically treated before it re-entered the boiler. Instead, the blowdown steam and water could be sent to the flash tank where the heat would be distributed to the heat exchangers that preheat the boiler feedwater, thus increasing the efficiency of the boiler.

Replace Spiral Heat Exchanger: A spiral heat exchanger preheats feedwater for the boiler. This heat exchanger is designed for a more complex process that is not applicable to the tire making process. A plate and frame heat exchanger has a simpler design that could increase heat transfer efficiency by 20 percent. Thus, a recommendation was made to replace the spiral heat exchanger with a plate-and-frame heat exchanger to increase efficiency and reduce associated costs. Yokohama will need to contact a vendor to purchase the new heat exchanger. Installation of the new heat exchanger could be done by the in-house maintenance team.

Insulate Cold Domestic Water Pipe: The incoming cold-water pipe for domestic water is located on the mezzanine inside the boiler room where the water regularly reaches temperatures exceeding 100°F. Because the cold-water pipe is not insulated, the high temperature of the boiler room causes the pipe to sweat and condensate, potentially causing damage to underlying equipment. Maintaining this pipe at the coldest temperature would optimize the heat transfer rate. Installing insulation around the 22 feet of pipe would help maintain the colder temperature and reduce condensate before it is fed into the first heat exchanger. The insulation could be installed by an in-house maintenance team.



ENVIRONMENTAL AND ECONOMIC SAVINGS TABLE

PROJECT	ANNUAL COST SAVINGS	ANNUAL ENVIRONMENTAL RESULTS	STATUS
OPTIMIZE BOILER LOAD	$9,577	24,067 therms	RECOMMENDED
INSTALL BOILER NATURAL GAS METER	$6,900	17,337 therms	RECOMMENDED
RE-ROUTE BOILER BLOWDOWN	$3,560	4,496 therms	RECOMMENDED
REPLACE SPIRAL HEAT EXCHANGER	$2,300	5,780 therms	RECOMMENDED
INSULATE COLD DOMESTIC WATER PIPE	$906	2,276 therms	RECOMMENDED