ESA-071-2 Public Report - FINAL

Company	Rochester Metal Products Corp	**ESA Dates**	November 26 – November 30, 2007
Plant	Rochester, IN	**ESA Type**	Process Heating - PHAST
Product	Iron Foundry	**ESA Specialist**	John Clarke

Brief Narrative Summary Report for the Energy Savings Assessment:

Introduction:

Rochester Metal Products Corp. has been producing quality gray iron castings since 1937 and began as a captive supplier to two manufacturers of hand-push lawn mowers. It has remained under the same family ownership since its founding and is now selling all but 1% of its products to over 250 non-captive customers from coast to coast. Sales have more than doubled over the past ten years. The increased sales can be attributed to a dedication to *Quality, Service and Efficiency* by our entire team.

Their 200,000 square foot facility is designed to serve a wide range of casting requirements from .75 pounds to 50 pounds. Rochester offers casting design assistance for new products, from original concept to prototyping and final production. They take great pride in more than six decades of commitment to meeting their customers' needs through short cycle times, on-time deliveries with consistent quality and competitive prices.

Objective of ESA:

The objective of the ESA was four fold:

1. Introduce the PHAST program to plant personnel.
2. Train plant personnel on the use of the PHAST program by applying it to real world applications. During this phase, assess the strengths and weakness of the analysis and develop methods to ensure an accurate outcome.
3. Facilitate a discussion of fuel savings opportunities among the participants.
4. Identify and quantify specific energy savings opportunities. Estimate required resources. Focus on projects that fall within the corporate payback targets.

Focus of Assessment:

During the ESA, the participants investigated the thermal performance of:

1. The 2 ea gas-fired pre-heaters used to dry the scrap prior to introduction in the melting furnaces
2. The preheating operation of the transfer ladles used to supply molten metal to the ductile and grey iron casters.

Approach for ESA:

Working with plant personnel, the agenda was altered to obtain the most valuable outcome. In brief, the process went as follows:

Discussed the overall process and provide plant personnel time to determine the best target(s) for the analysis. This discussion included:

A. The ESA and Save Energy Now program
B. Program and Plant expectations
C. A preliminary discussion of required steps.

1. Target Equipment Identification

- Identify which process heating device(s) will be used for the assessment. Suggested criteria includes:
  - A. The equipment type should represent a significant use of energy.
  - B. There should be a means to collect operating data from the equipment that will be entered into the PHAST program for analysis.
  - C. Participants should suspect the machine(s) represents significant energy savings opportunities.

The Group decided to examine the performance of the Ladle Preheating Operating and the Scrap Preheaters in that it represented the largest natural gas use in the facility.

2. Review Heat Supply and Demand (Sankey Diagram)

3. Review the PHAST program – illustrating what data would need to be collected

4. Collected Basic Information for entry into the PHAST program.
   - a. Cost of energy inputs – natural gas and electricity.
   - b. Installed simple metering to determine approx flow of gas to the ladle preheating station.
   - c. Collected heating frequency for ladle heaters
   - d. Collected flow information from the Preheater exhaust and dust collection system.
   - e. Entered work flows and specific heats of materials being processed
   - f. Estimated furnace surface areas.
   - g. Estimate internal pressure.
   - h. Measured temperatures of work into and out of Preheater
   - i. Calculated approximate ambient air flows areas around the Preheater

5. Entered the above data into the PHAST program as well as other spreadsheets for analysis.

6. Created a spreadsheet to summarize information using outputs from the PHAST program.

7. Discussed ongoing and potential projects aimed at improving system energy efficiency. Determined which projects would be complementary to existing initiatives. Discussed the error resulting from various assumptions made when exact measurements where not obtainable.

8. Perform “what if” analysis for various energy savings opportunities.

9. Currently, the transfer ladles are preheated each shift using a compressed air / natural gas torch. These are manually positioned over the ladle and the fuel / air ratio is adjusted by eye. A meter was installed in the natural gas supply line and the operator was asked to approximate the torch intensity commonly used. The measured flow rate with a typical torch firing setup was 800 SCFH. This value was used for the analysis.

   Observation indicates there was limited convective heat transfer at the bottom of the ladle. The analysis indicated the systemic efficiency of this heating method was about 5%. The group conceptualized a heating device that would ensure adequate flow at the bottom of the ladle that would result in a payback of less than one year. PHAST was used to calculate the expected efficiency of the new system and the annual energy savings was determined. Other benefits include improved refractory temperature uniformity that may increase the life of the ladle’s lining as well as consistent temperatures precluding the need to use molten metal to finish heating the ladle before it is put into service.

   One ladle type, for the Hunter casting machine was analyzed in detail and the results were proportionally applied to the ladles used to transfer metal to the DISA casting machine.

   The next piece of equipment analyzed was the two scrap preheater / dryers. These machines consist of a large transfer feeder covered with a refractory lined hood equipped with burners. The burner fire down and the scrap is heated by direct flame impingement and radiant heat transfer. The scrap heated varies greatly in size and geometry and there is significant clearance around the transfer feeder and the hood to prevent material fouling. While these gaps ensure reliable conveyance, they provide a significant path for ambient air to enter the hood and reduce combustion efficiency and dilute the products of combustion before the heat can be transferred to the scrap. There is also a dust collection system that creates a significant negative pressure at the discharge of the hood. The preheater also communicates between the scrap storage building and the melt shop. The unheated scrap storage building operates at a higher pressure than the melt shop so unheated air flows through the preheater further reducing efficiency. Various measurements were made to determine the losses resulting from this ambient air infiltration. It was calculated

that the preheater was operating at about 20% efficiency. A number of methods to exclude ambient air was discussed and the group felt the project could be executed in cautious steps to ensure the modifications did not lead to an unacceptable number of jams. When all possible ambient air is excluded, the preheater will operate between 50 to 60%. The systems' upgrade will not only save natural gas – the higher discharge temperature will result in a decrease in the electric energy required to melt the scrap.

10. The group presented their finding to the plant's management group.

General Observations of Potential Opportunities:

Near Term opportunities

Improve the Ladle Heater would save 4,654 mmBTU / Year.

Improved Preheater performance would save 18,748 mmBTU / Year and 2,012,800 kWh / Year.

Both of the above projects represent less than 1 year paybacks on the investments required to achieve the savings.

Management Support and Comments:

Management recognizes further study is required to fully access the efficacy of the recommendations but is strongly committed to the continued reduction of natural gas and electrical consumption.

DOE Contact at Plant/Company: (whom DOE would contact for follow-up regarding progress in implementing ESA results.)

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