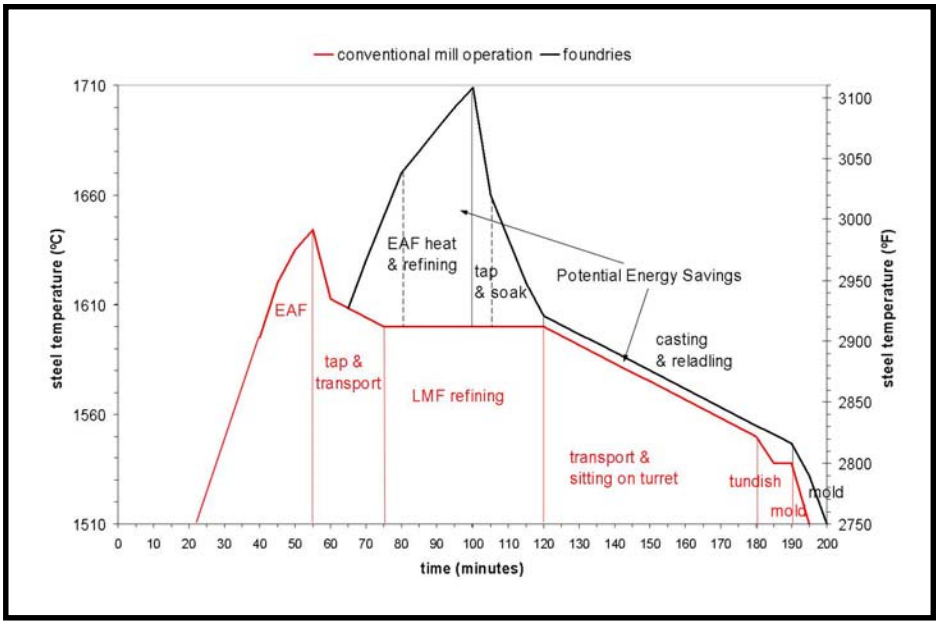
Melting Efficiency Improvement

Energy efficiency improvements seen in other industries, such as the wrought steel industry, have not been achieved by the metal casting industry because most steel foundries have not made major changes to their melting equipment, practices, and technologies. The theoretical amount of electrical energy required to melt steel and heat it to a tap temperature of 2912°F (1600°C) is 377 kWh/mt. Most steel foundries consume 500 - 800 kWh/mt in melting, 35-100 percent in excess of the theoretical electrical energy requirement. Energy losses during melting are multiplied by yield losses during casting and finishing, which can often be as high as 40 percent. When including the energy losses during melting and casting operations, electrical energy used by steel foundries can be 3.0 to 6.0 times the theoretical energy requirement.

Researchers at the University of Missouri-Rolla are performing a comprehensive study of the variability in melting practices used by the steel foundry industry and evaluating the effects of this variability on energy consumption. This study will determine practices that are successful in reducing energy consumption and develop new melting practices/technologies to improve the energy efficiency of melting in steel foundry operations. The energy improvements in steel foundry melting operations that will result from this research have the potential to make a major impact on the overall energy consumption and costs for steel foundries.



The temperature-time history of a heat of steel in a foundry and a mini-mill. The area under the curve conceptually illustrates the energy usage. Best practices in the foundry should eventually approach the mini-mill.

Benefits for Our Industry and Our Nation

- *Development of new melting technology/practices to improve melting in steel foundries.*
- *Increased melting yield in steel foundries.*
- *Reduced melting energy.*

Applications in Our Nation's Industry

This research will determine successful practices in reducing energy consumption and the costs of operation, and develop new melting practices/technologies to improve the energy efficiency of melting in steel foundry operations.

Project Description

The goal of this research is to study steel foundry melting operations to understand the energy use and energy requirements for casting applications, define variations in energy consumption, determine technologies and practices that are successful in reducing melting energy, and develop new melting techniques and practices to improve the energy efficiency of melting in steel foundry operations.

Specific objectives of this research focusing on melting efficiency improvement are:

- A comprehensive summary of the variability in melting practices used by the steel foundry industry and the effects this variability has on energy consumption.
- Determining areas of opportunity for steel foundry energy savings through technical improvements in melting operations.
- Better understanding of the effects of scrap melting on overall steel foundry efficiency (energy consumption, metallic yield, and chemistry).
- Development of a computer model to intelligently evaluate the important factors that determine energy efficiency in melting operations of steel foundries.
- Validation and demonstration of energy savings through industrial trials in both induction and electric arc furnace melting foundries.

Milestones

Results to Date

1. Research on wrought industry energy usage has been completed.
2. A final report has been prepared on the research of energy usage in the steel casting industry.
3. Opportunities have been identified for technology transfer from wrought to steel casting industry, with industry trials conducted at 13 facilities.

Future Milestones

1. Complete laboratory study of factors affecting energy consumption during melting in foundries.
2. Construct energy model of steel foundry melting operations.

Project Partners

University of Missouri-Rolla
Rolla, MO
Steel Founders Society of America
Crystal Lake, IL
Cast Metals Coalition Partnership
Charleston, SC
American Cast Iron Pipe Company
Birmingham, AL
American Centrifugal
Birmingham, AL
Atlas Castings, Tacoma, WA
Bahr Bros. Mfg., Inc.
Marion, IN
Magotteaux, Brentwood, TN
Pacific Steel Casting Company
Berkeley, CA
Matrix Metals, Richmond, TX
Southern Alloy Corporation
Sylacauga, AL
Spokane Industries, Spokane, WA
Stainless Foundry & Engineering, Inc., Milwaukee, WI

A Strong Energy Portfolio for a Strong America

Energy efficiency and clean, renewable energy will mean a stronger economy, a cleaner environment, and greater energy independence for America. Working with a wide array of state, community, industry, and university partners, the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy invests in a diverse portfolio of energy technologies.

U.S. Department of Energy
Energy Efficiency and Renewable Energy
Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable

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