



U.S. Department of Energy Energy Efficiency and Renewable Energy

Bringing you a prosperous future where energy
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INDUSTRIAL TECHNOLOGIES PROGRAM

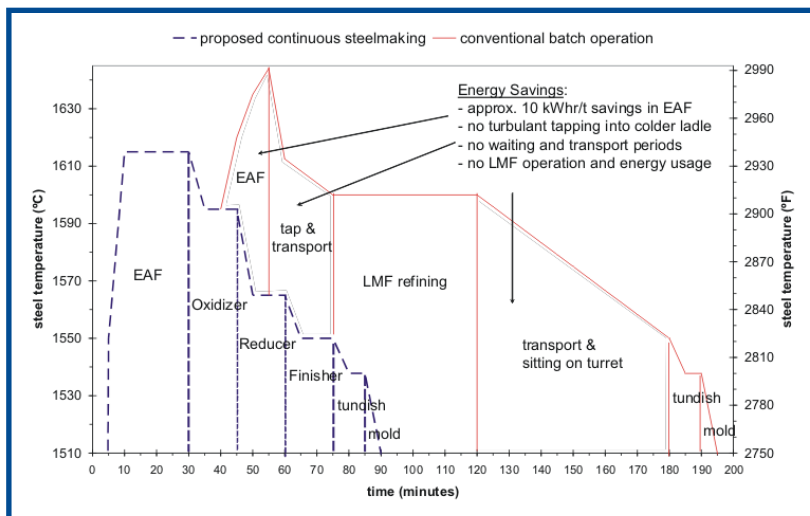
Process to Continuously Melt, Refine, and Cast High Quality Steel

Continuous transfer process could replace current ladle operations

The purpose of this project is to conduct research and development targeted at designing a revolutionary steelmaking process. This process will deliver high quality steel from scrap to the casting mold in one continuous process and will be safer, more productive, and less capital intensive to build and operate than conventional steelmaking. The new process will produce higher quality steel faster than traditional batch processes while consuming less energy and other resources.

In the continuous steelmaking process, three contiguous vessels connect the electric arc furnace (EAF) with the continuous casting process, replacing current batch ladle operations. The vessels are designed for fast, near-equilibrium reactions to ensure a large degree

of control, productivity, and flexibility. They will also reduce maintenance in the oxidizing conditions of the EAF and the oxidizer, and in the reducing conditions of the reducer and finisher. The use of two vessels in series with similar near-equilibrium conditions allows for optimum refining and minimizes variations in fluid flow (residence time distributions) and composition (chemistry, inclusion), thereby contributing to the reliability and flexibility of the process. This sequential refining and the near-equilibrium, steady-state operation of the continuous process increases refining and reduces alloy and flux consumptions compared with the current EAF-LMF (ladle metallurgy facility) steelmaking route.



Comparison of steel temperatures and processing time (from melting to casting) between proposed continuous process and a typical scrap-based continuous steelmaking operation



Applications and Benefits

- Shortens processing times and ensures constant operation at optimum conditions
- Improves metallurgical results
- Reduces heating and heat losses from preheating and refractory thermal cycling while decreasing auxiliary meltshop energy
- Reduces consumption of deoxidants and electrodes
- Decreases capital investment

Project Participants:

University of Missouri-Rolla
(Principal Investigator)

Bayou Steel

Nucor Steel

Nucor-Yamato Steel

SMI-Steel

TXI-Chaparral

Gerdau Ameristeel

Core Furnace Systems

Proware-Metsim

Heraeus Electronite

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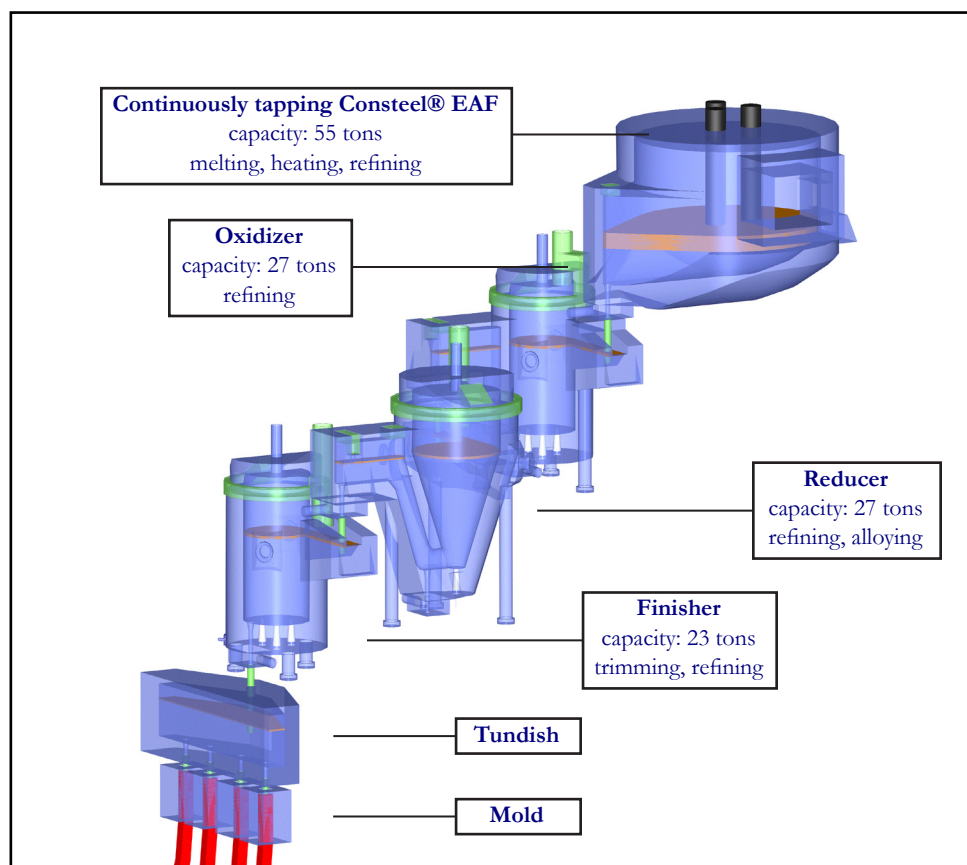
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PROJECT PLANS AND PROGRESS:

- | | | | |
|-------|--|-------|---|
| 1 | Process Design | 1.2.2 | Coupled model of vessels – Complete 9/04 |
| 1.1 | Collect necessary operating data from partners and literature | 1.2.3 | Fluid flow modeling of process - In progress |
| 1.1.1 | Collect literature - Complete 8/03 | 1.2.4 | Simulation of refractory performance - In progress |
| 1.1.2 | Visit and survey industrial partners – Complete 8/03 | 1.3 | Vessel connector design – Complete 12/04 |
| 1.1.3 | Complete literature and industrial partner survey report – Complete 3/04 | 1.4 | Industrial Trials/Laboratory Experiments to Validate Design – Complete 3/05 |
| 1.2 | Process simulation | 1.5 | Final Report – Scheduled 4/06 |
| 1.2.1 | Thermodynamic model of vessels - Complete 6/04 | | |



Transparent side view of novel, scrap-based, fully continuous steelmaking process

Steel Program

The Steel Industry of the Future (IOF) subprogram is based in the Industrial Technologies Program (ITP) within the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy. The subprogram works with the steel industry to promote development of more energy-efficient and environmentally sound technology for steel processing. Guided by industry-identified research and development priorities, ITP's steel portfolio addresses those priorities that offer the greatest potential for energy savings in cokeless ironmaking, next-generation steelmaking, and yield improvement. To learn more about Steel IOF activities, visit the program web site at: www.eere.energy.gov/industry/steel/

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.

For more information contact:
EERE Information Center
1-877-EERE-INF (1-877-337-3463)
www.eere.energy.gov



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