

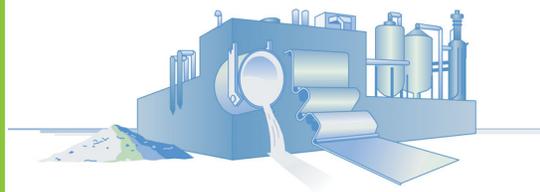
Industrial Technologies Program

E – SMARRT: Energy Saving Melting and Revert Reduction Technology

The Metalcasting industry is one of the most energy intensive industries in the United States. It is critical to the U.S. economy, as 90% of all manufactured goods contain one or more cast metal components. Metal castings are integral to U.S. transportation, energy, aerospace, manufacturing, and national defense. The industry is diverse, employing a variety of casting processes and alloys to make a wide range of products. Because the majority of metal casters are small businesses, many lack the resources to perform R&D on their own. Due to the diversity of the industry, R&D is needed to address a wide range of issues that can target the richest energy savings with the appropriate technology for the various metal casting processes and alloys.

The Advanced Technology Institute (ATI) has developed a balanced portfolio of projects to address energy-saving opportunities in the

metalcasting industry called Energy-Saving Melting and Revert Reduction Technology (E-SMARRT). E-SMARRT R&D projects are focused on energy efficiency improvements in melting technology and casting processes that do not require major capital investment from the industry. This investment strategy avoids the risk of pursuing a single technology, which even if technically and commercially successful, would only impact a single point of the industry's multifaceted energy requirements. Reduction in melting energy and revert reduction not only reduces energy consumption but also reduces overall greenhouse gas emissions and airborne particulates. The E-SMARRT program has created partnerships among researchers, over 100 industrial companies, and national laboratories to develop a research program that could reduce the metal casting industry's energy requirements by 14 percent within ten years.

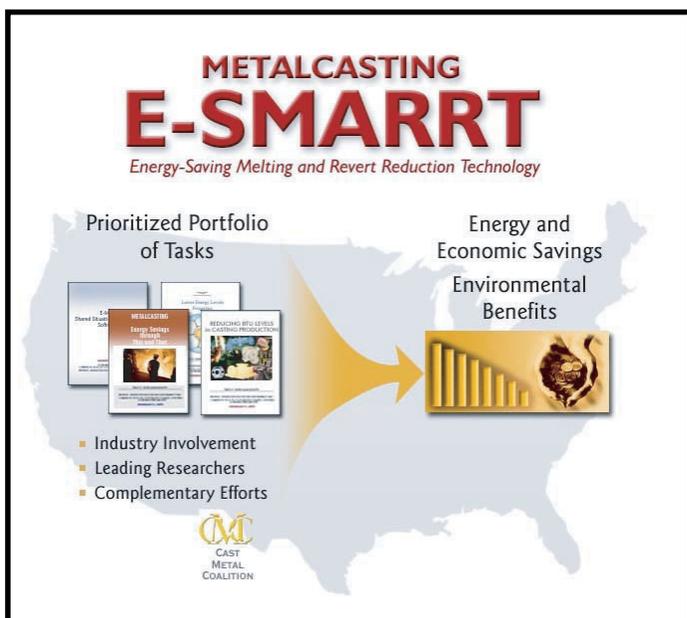


Benefits for Our Industry and Our Nation

- Reduce energy consumption by 14% over ten years.
- Reduce scrap rate and improve yield rate in the metal casting industry.
- Improve existing melting processes.
- Reduce overall greenhouse gas emissions and airborne particulates.

Applications in Our Nation's Industry

The E-SMARRT program would significantly reduce energy consumption in metal casting processes while improving important capabilities of metal castings. More than 100 metal casters, engineering firms, and suppliers "pull for" rapid adoption and broad application especially in the transportation and military weapon system industries.



Project Description

The goal of the E-SMARRT program is to improve metal casting processes to achieve an average annual reduction in energy use. The program addresses both melting and casting processes through a balanced portfolio of R&D tasks. This approach will identify processes and technological advances capable of delivering enhancements in energy efficiency and economic benefits. The portfolio is representative of the needs expressed by the metal casting industry and the metal casting industry associations, and is in alignment with the metal casting industry roadmap.

The objectives of this project are:

Advanced Melting:

- To improve melting efficiencies and practices.
- To reduce revert and molten metal holding times.
- To reduce scrap/rework costs.

Innovative Casting Processes:

- To generate 25 to 30 % of the energy savings (12 trillion BTUs/ per year).

Milestones

Collaborating with the Cast Metal Coalition (CMC) and various researchers, E-SMARRT addresses research needs identified by the metal casting industry. The E-SMARRT project focuses on melting efficiency and innovative casting process in the area of metal transfer heat loss, scrap/rework reduction, mold yield improvement, simulation tools for design, improved properties data, and castability process geometry.

The tasks for this project are:

- Aging of Graphitic Cast Irons and Machinability
- Casting Porosity-Free, Grain Refined Magnesium Alloys
- Corrosion Testing Practices-High Alloy Corrosion Program

- Design Support for Tooling Optimization
- Development of CCT Diagrams
- Development of Elevated Temperature Aluminum Alloy and Process Technology
- Feasibility of Producing Lost Foam Casings in Aluminum and Magnesium Based Alloys
- Improved Die Casting Process to Preserve the Life of the Inserts
- Improvements in Efficiency of Melting for Die Casting
- Innovative Semi-Solid Metal (SSM) Processing
- Light Metals Permanent Mold Casting
- Manufacturing Advanced Engineered Components Using Lost Foam Casting Technology
- Mechanical Performance of Dies
- Melting Efficiency Improvement
- Precision Castings
- Prediction of Wax Pattern Tooling and Final Investment Casting Dimensions
- Simulation of Dimensional Changes and Hot Tears During Solidification of Steel Castings
- Surface/Near Surface Indications-Characterization of Surface Anomalies from Magnetic Particle and Liquid Penetrant Indications
- The Development of Surface Engineered Coating Systems for Aluminum Pressure Die Casting Dies: Towards a "Smart" Die Coating

Project Partners

Cast Metals Coalition

- *Advanced Technology Institute*, Charleston, SC
- *American Foundry Society*, Schaumburg, IL
- *North American Die Casting Association*, Wheeling, IL
- *Steel Founders Society of America*, Crystal Lake, IL
- CANMET*, Ottawa, Canada
- Case Western Reserve University*, Cleveland, OH
- Colorado School of Mines*, Golden, CO
- Eck Industries, Inc.*, Manitowoc, WI
- Edison Materials Technology Center*, Kettering, OH
- INEEL*, Idaho Falls, ID
- Iowa State University*, Ames, IA
- ILZRO*, Research Triangle Park, NC
- Lehigh University*, Bethlehem, PA
- ORNL*, Oak Ridge, TN
- Ohio State University*, Columbus, OH
- University of Alabama at Birmingham*, Birmingham, AL
- University of Iowa*, Iowa City, IA
- University of Missouri-Rolla*, Rolla, MO
- Worcester Polytechnic Institute*, Worcester, MA

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

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