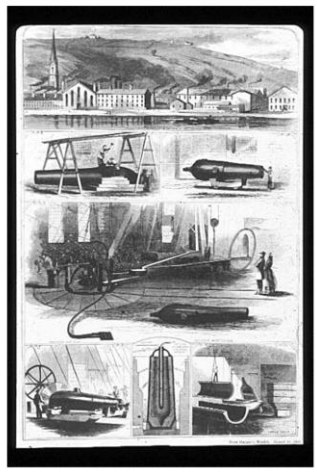
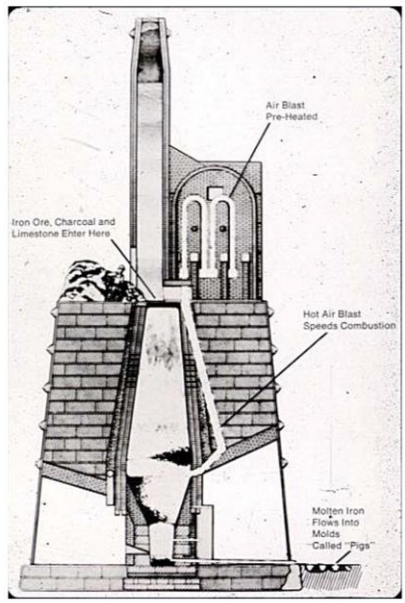
Pollution Prevention Opportunities for Foundries

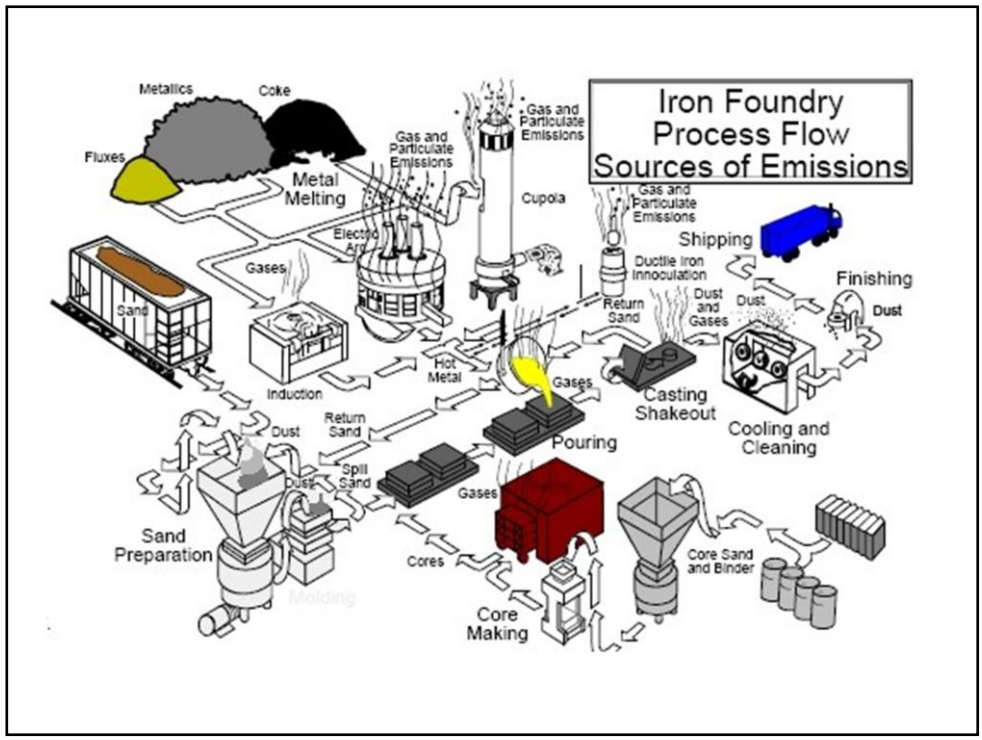


Office of Compliance Assistance & Pollution Prevention

Welcome to pollution prevention opportunity training for the metal casting industry. Foundries have significant opportunities to reduce wastes and cut costs through pollution prevention activities.



The foundry industry in North America was well established before the United States became a nation.



The foundry process has many points or sources where wastes may be generated. This also affords multiple opportunities to devise waste and cost reduction strategies.

Common Foundry Wastes

- Scrap patterns (wood, plastic, metal, wax)
- Adhesive wastes
- Solvents from cleaning
- Green and core sands
- Damaged cores
- Wastewater (if mold is water-cured)
- Spent plaster
- Risers, runners, spurs (from gating)
- Metal fins
- Sand blasting sands
- Steel shot blast
- Used oils
- Waxes
- Plastics
- Waste resins and binders
- Slag
- Bag house dust
- Wet scrubber sludge
- Spent ladles
- Spent refractory
- Solvents
- Acids
- Salt baths
- Coatings
- Quench bath or sludges
- Cutting oils

This list contains many of the common waste products associated with foundry operations of various configurations. Most, if not all, of these materials have economically viable recovery and reuse options in foundry or other industrial processes .

Pollution Prevention Opportunities for Foundries (as outlined in this training)

- Alternative resins, catalysts, washes, release agents
- Scrap/raw material specification, storage, handling
- Advanced melting, holding, cooling
- Innovative molding
- Sand reuse/recycling
- Byproducts recovery/reuse
- Water conservation
- Energy Efficiency

Many opportunities exist for making significant waste and cost reductions in common foundry operations. The opportunities outlined in this training have been researched form a wide variety of foundry industry, academic and government research efforts. These opportunities have been implemented by foundries successfully and have afforded significant cost savings.

Pollution Prevention Opportunity Assessment (Help for Ohio Businesses)

The Office of Compliance Assistance & Pollution Prevention (OCAPP) is a non-regulatory office at Ohio EPA and has been helping Ohio businesses since 1993. Please feel free to visit our Web site.
http://www.epa.state.oh.us/ocapp/businessasst.html

A P2 assessment is an on-site survey of a company's operations to identify and evaluate opportunities to reduce wastes and pollution. Companies can use P2 assessments to identify ways to reduce costs associated with waste generation and disposal. OCAPP will provide participating companies with a P2 assessment report that includes recommendations on improved operating practices, material substitutions, process modifications and recycling. Estimated economic and environmental benefits may also be provided, to illustrate potential waste reduction savings.

For more information, visit
http://www.epa.state.oh.us/ocapp/p2/p2assmnt.html

When trying to reduce wastes and waste associated costs remember that you are not alone!! There are many resources, including, free pollution prevention assistance from OCAPP. OCAPP has helped several metal casting facilities in Ohio identify significant waste reduction opportunities.

Evaluate All Chemical Formulations

- Mold release mixes often contain toluene, xylene, and/or cumene. As chemical technology advances, there are alternative mold release compounds with lower HAP/VOC contents
- Mold washes often contain alcohols or other low flash solvents
- Mold resins and/or catalysts often contain phenols, formaldehyde and or other hazardous organics
- Refractory materials may contain hazardous fibers

The first step to reducing wastes is to evaluate the waste stream and all of it's component material flows. Many reductions, particularly of hazardous materials can be made by switching or substituting non-hazardous materials. Traditional mold/core making resins usually contain organic compounds such as formaldehyde, resorcinol, isocyanates, phenols and various catalysts including metals such as lead or zinc.

A typical formulation such as a phenolic urethane binder, utilizes a phenolic resin prepared by reacting a phenol, an aldehyde, bisphenol-A-tar, and a divalent metal catalyst. OR Other formulations which might include an organic foundry binder selected from the group consisting of amine curable phenolic urethane binders, furan binders, acrylic binders, epoxy-isocyanate-acrylic binder, and epoxy-acrylic binders; and (b) a mixture of alkyl resorcinols and the mixture contains 5-methylresorcinol.

Example: Cold Box Resin Catalysts

Acid hardeners (catalysts) have been used in the Foundry industry since the 1960s, when the cold box concept was first developed. Acid catalysts are used for hardening cold setting resins in the preparation of foundry sand moulds and cores.

Catalysts are usually designed for use in specific systems such as phenolic or furanic resins. Catalysts may utilize acids containing one or more of the following aromatic hydrocarbons:

- Benzene
- Toluene
- Cumene
- Xylene

Cold box resin catalysts, provide an excellent example of a opportunity to reduce emissions by evaluating and if possible switching formulation chemistries from hazardous to non-hazardous constituents.

Alternative Chemical Formulations

- Bio-based core/mold resins (protein based, lignin based)
- Inorganic core/mold resins (silicate hydrogels)
- Low VOC solvents, adhesives, cleaners, washes (bio-based, waterborne or water-based formulations)
- Carbon Dioxide or other benign substances for carriers and cleaners
- Non-hazardous refractory materials

http://www.epa.gov/ttn/atw/ifoundry/binders/meeting.html

Recent advances in "green chemistry" (see Green Chemistry on-line training) have produced cost effective alternative materials with lower environmental and worker health impacts. Some of these materials have been innovative designs of substances based on waste materials from other industrial processes such as paper making and food processing.

Alternative Binder Formulations

Bio-based formulations-

GM Bond™:

- Protein-based binder used for internal cores at aluminum, iron and steel foundries
- Made from renewable, natural resources
- Developed at General Motors R&D Center
- Hormel Foods granted sole license to evaluate the product
- CERP study: Reduced VOCs and HAPs by 90%
- Currently working with GM Gray Iron Foundry in Saginaw, MI

An excellent example of this green chemistry approach is the development of the protein based alternative core resin GM Bond™ This approach utilizes the waste product from food processing to produce a renewable, less toxic and more economical binder material. The following slides illustrate the emission reductions and cost savings of utilizing this material.

Alternative Binder Formulations

- GM Bond™:
- 90% Emission Reductions vs. conventional resins
- Reduced operating costs
- Easier to rid the metal casting of its internal sand core, eliminating the need to heat or hammer parts
- Recyclable
- Create stronger, more complex cores
- Reduces pollution

http://www.epa.gov/ttn/atw/ifoundry/binders/hormel10-26-05.pdf

Significant emission reductions and cost savings are not mutually exclusive principles. In this case operating costs were reduced by switching materials. Companies who continually practice pollution prevention find new ways to save money and improve product quality.

Case Study: Pride Cast Metals, Inc. Cincinnati, OH

GMBOND® Cores

Benefits:

Using pre-made cores molded with GMBOND® sand binder, Pride Cast Metals was able to:

- Achieve significantly lower costs per casting
- Significant reduction of toxic emissions released during the casting process
- Significantly reduce the time spent manually removing cores, thereby increasing the number of castings processed
- Maintain good surface finish

http://www.gmbond.com/pdfs/info/PrideCastCasestudy.pdf

This Ohio company enjoys both cost reductions and emission reductions by utilizing the simple pollution prevention technique of material substitution. This technique can be applied to processes successfully at your facility as well.

Alternative Binder Formulations

- GM Bond Contact:
- Dave Parker, Hormel
- Tel. 859-823-1586
- daparker@hormel.com
- www.gmbond.com

Above is the vendor contact information for the GM Bond™ product*.

***Vendor and process information provided in this presentation is not an endorsement of the Ohio EPA**

Alternative Binder Formulations

120 Valley Court • Oak Ridge, TN 37830 • PH: 865-482-5717 • FAX: 865-482-1281

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LK Binder

The LK Binder is a water-based, alkaline pH binder liquid.

LK Binder

When powders are added to this binder liquid, a water-insoluble coating results. Coatings produced by addition of powders to this binder liquid have moderately good hardness on drying and have high water-resistance, being nearly completely water-insoluble on thorough drying. Outgassing is minimal and essentially complete by a temperature of 150 C. The binder has a moderate ability to suspend solids and generally produces medium viscosity coatings with most refractory powders. The binder liquid has a long shelf life [>12 months]. A lithium-potassium silicate results for the high-temperature binding, allowing LK Binder to be used in all atmospheres to about 800 C or somewhat higher depending on interactions with the added powder material.

http://www.zypcoatings.com/Datasheets/LKbinder/LKBinder.htm

Additional binder alternatives are readily available for lowering the environmental and health impacts of many existing chemical formulations. Water based formulations of binders and coatings will have significant potential over many organic solvent formulations.

Alternative Mold Making Process

Resin/CO2 Core and Mold Making Process: Emission Characterization for ECOLOTEC™

T. Penko, Foseco, Cleveland, Ohio

The Resin/CO2 process provides greatly improved environmental air emissions performance, along with cost-effective highproduction core and moldmaking. This process offers the metalcasting industry a viable alternative to replace many applications in which less environment-friendly gas-cured binder systems are in prevalent use today.

Non-flammable, water-based system

Exceptionally low free phenol and formaldehyde

No isocyanates, peroxides or heavy metals

No noxious fumes at mixing, coremaking or shakeout

No effluent generated, low overall VOCs

Lower applied cost

http://www.moderncasting.com/archive/WebOnly/1005/WebOnly1005.pdf

http://www.fosecomet.com/index.php?option=com_content&task=view&id=105&Itemid=155

Carbon dioxide is another viable alternative to organic solvents. Carbon dioxide has been utilized in a number of green chemistry strategies, replacing many organic solvents as a cheaper, more effective and less toxic alternative.

Alternative Core Adhesives

Hot Melt Foundry Adhesives- hot melt adhesives are comprised of 100% solids, containing no solvents or water. Significant reductions in air emissions are possible by utilizing this approach.

Examples:

3M Scotch-weld 3738
http://multimedia.mmm.com/mws/mediawebserver.dyn?xxxxxxfDPlLxR9Yxj9YxxxAQshSdK3HS-

Tecbond 601 Foundry Adhesive

http://www.freemansupply.com/Tecbond601FoundryA.htm

Bostik Hot Melt Adhesive

http://www.bostik-us.com/products/index.asp?fa=subCategories&divisionId=4&categoryId=11&subCategoryId=19

http://www.gluguru.com/bostik_hot_melts.htm

An additional cost effective strategy is to use the highest possible solids content of a material to reduce air emissions. Hot melt materials utilize this principle in a cost effective alternative approach to solvent borne adhesives.

Alternative Mould Washes & Release Agents

Water based formulations-

Water based mould and core washes provide an environmentally friendly solution by replacing alcohol and other organic compounds. The water based slurries are much safer to use and also reduce operator exposure to volatile organic compounds (VOC's).

Water based release agents can drastically reduce emissions of solvents such as chlorofluorocarbons and 1,1,1-trichloroethane

http://www.ashchem.com/ascc/castings/release.asp

Water based chemistries also provide viable economic opportunities to replace organic solvents in a variety of formulations including mold washes. Water based formulations may have economic savings over solvents especially when considering emission permitting or control costs. Cost effective drying techniques such as IR (infrared) lamps can speed production even beyond what conventional agents such as alcohol could achieve.

Water based coatings & Infrared Drying

Decatur Foundry, Inc.-

Decatur Foundry, is a small-run jobbing foundry in Decatur, Illinois, which specializes in iron castings. The castings industry has been moving away from quick-drying, solvent-based coatings to slower drying, environmentally safer water-based coatings, creating a bottleneck in the production process.

Decatur chose infrared/forced air units as a replacement for conventional electric-resistance ovens. Instead of warming the air in contact with the mold's surface, the new short-wavelength infrared systems radiate heat directly to the surface of the mold, quickly driving out moisture. In addition, the system requires no warm-up time, so it is only on when in use. These advantages resulted in decreasing drying time by 85 percent.

Achievements:

Replacement on the first production line (cost: $12,000) reduced annual energy consumption by 120 MWh, or $9,000. New infrared units were subsequently installed on two new lines.

Organic solvents were eliminated and improved product quality virtually eliminated the need for additional polishing.

Mold failure rates fell and new units freed up floor space.

Eliminating the drying bottle neck reduced labor costs and increased productivity.

Enhanced efficiency and productivity allowed Decatur to add two new lines, increase employment by 13 percent, and increase sales from $5.9 million to $10 million.

http://www.aceee.org/p2/p2cases.htm#decatur

This company was able to eliminate organic solvents, speed production, reduce costs and grow their business.

CO2 Blasting of Core Boxes

Case Corporation-

Replacing Solvent Cleaners with a CO_2 Pelletizer-Blasting Unit

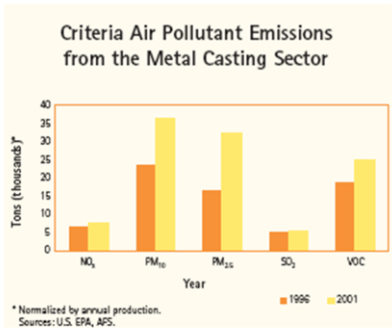
Installation of the CO2 pelletizer-blasting unit has improved the workplace by eliminating the use of methyl alcohol (a flammable solvent) and methylene chloride (a potential carcinogen), and consequently has also reduced VOC air emissions

The use of the CO2 pelletizer-blasting unit has reduced cleaning time by approximately 50%. This reduction in labor costs, coupled with an adjustment in the cost of cleaning materials, has net an annual cost savings of approximately $69,000.

http://www.p2pays.org/ref/04/03161.htm

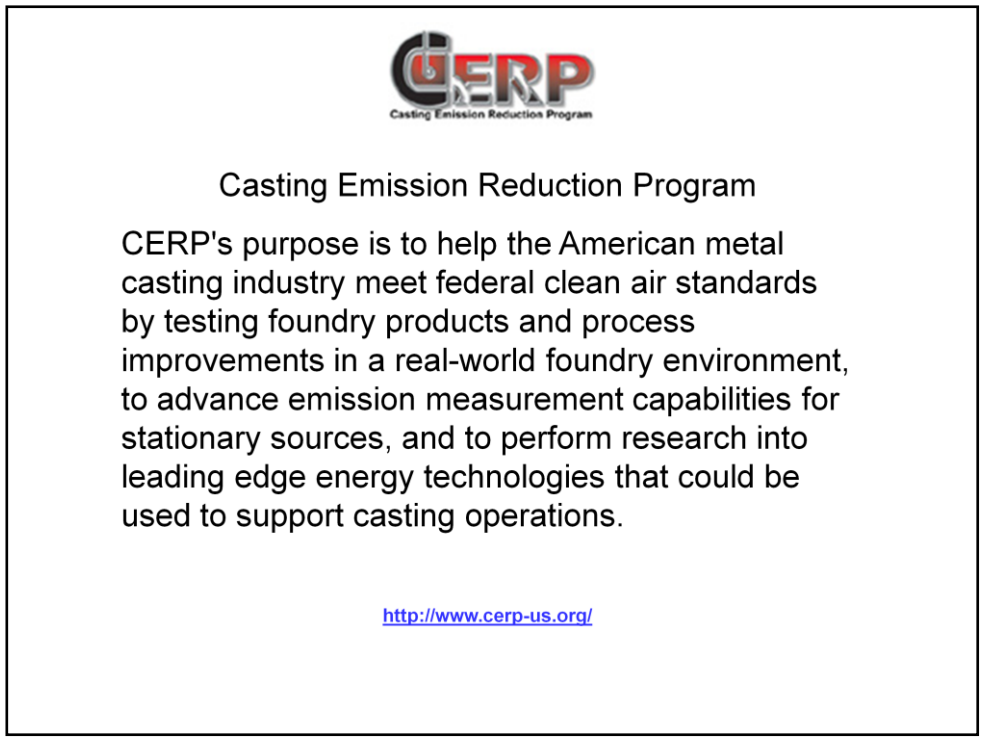
Carbon Dioxide can also serve as a cost effective replacement for organic solvent cleaners. This technique has been found to be faster and more effective in a wide variety of cleaning scenarios.

Reducing Air Toxics



Common air toxics from metal casting operations include organic air pollutants and metals. Organic air pollutants are primarily generated while making the core portions of the molds, shaking the mold away from the casting, and pouring the molten metal. Metals are primarily generated during the melting, pouring, and finishing processes.

A primary cost savings for foundries can be achieved by reducing the need for emissions control equipment, emission fees and permitting costs. These represent only the direct costs of emissions. Indirect costs such as worker health and future liability can represent even more significant costs.



The CERP program is an excellent resource for information on reducing toxic emissions in the casting industry. CERP represents a joint effort between the foundry industry, U.S. government and auto makers to proactively address the issue of metal casting air emissions.

Reducing Scrap

Scrap Metal Program-

The metal casting industry is one of the largest recyclers in North America, **using scrap metal as 85% of its feedstock** for ferrous casting. The industry diverts roughly 15 million to 20 million tons of scrap metal from disposal at U.S. landfills each year

- Develop vendor certification to ensure purchased scrap contains only trace amounts of hazardous constituents such as, Lead, Cadmium, PCB's etc.
- Frequently test and verify scrap quality
- Store scrap in dry, clean conditions

Examples- Timken Scrap Certification Program-

Ameristeel Scrap Specification Guidelines-
http://www.ameristeel.com/company/sr/Scrap%20Type%202.pdf

http://www.isri.org/specs

Reducing scrap associated wastes is a time honored tradition within the foundry industry. Over time these techniques have been refined and implemented very effectively by many companies. Scrap reduction is an area that also affords many foundries areas to continually improve their processes. Good procurement strategies, testing/sampling of incoming materials, proper storage/handling and blending/melting techniques should be re-examined at regular intervals. Companies can increase efficiency/profitability of scrap operations by being vigilant at continual improvement strategies

METALCASTING

Project Fact Sheet

CERAMIC COMPOSITE DIE FOR METALCASTING

BENEFITS

- Potential for significant energy savings through reduced materials consumption and more efficient use of dies
- 2 to 5 times harder than tool steels, resulting in 5 to 10 times longer useful life at a lower unit cost, with less than half the weight
- Proven stability when exposed to molten metals
- Offers resistance to corrosion, erosion, oxidation, thermal fatigue, and cracking
- Lowers unit production costs due to fewer rejected castings and less waste of failed casting dies

NEW CERAMIC COMPOSITE MATERIALS TO PRODUCE SUPERIOR, LOW COST DIE CASTING MATERIAL

Metalcasting, a major U.S. industry, has long been hampered by the high cost and short life of casting dies. Steel dies often fail prematurely due to metal-fatigue cracking, corrosion, erosion, oxidation, heat checking, and soldering when the dies are exposed to molten metals while operating under cyclic-mechanical and thermal loading. These deficiencies have contributed, in part, to the many casting-industry jobs that have moved overseas in the last 10 to 15 years.

For some applications, coatings are applied to protect the die from the damage inflicted by molten metals. However, these coatings can fail prematurely, and they tend to interfere with the welding and polishing operations needed during reworking and correcting damages in the die.

Ceramic composite materials offer a promising alternative to conventional technologies used in casting dies. Ceramic composites can deliver proven stability to molten metals and are resistant to corrosion, erosion, oxidation, thermal fatigue, and cracking. In addition, lower cost hybrid composites in the nitride/nitride-carbide family have the potential to last 10 times longer than coated steel dies at approximately 50 percent of the weight. These new composites are expected to reduce the cost of many products fabricated in the United States and create stronger competitiveness in the domestic metalcasting industry.

Another possible waste savings may be achieved by re-evaluating the casting die material. Ceramic dyes last from 5 to 10 times longer at a lower unit cost than tool steels.

Reducing Foundry Sand Waste

Metal casters use almost 100 million tons of foundry sand annually, of which 10 million tons are available for reuse applications. Much of this sand is a non-hazardous byproduct that could be used for other purposes, yet only about 500,000 tons of the available sand is currently reused. Increased sand reuse represents a prime opportunity for the metal casting sector to save money and improve the environment

http://www.epa.gov/jtr/comm/sand.htm

The reduction of foundry sand waste continues to be a major cost saving opportunity area for many foundries. **Newer formulations of binder materials and sand recovery & re-use equipment have made reductions of sand possible that were more difficult in the past. Many companies have found cost effective ways to re-use this material and the competitive nature of the industry will create interest in more companies in the future.**

Foundry Sand Options

Waste Segregation

- A substantial amount of sand contamination comes from mixing the various foundry waste streams with waste sand. The overall amount of sand being discarded can be reduced by implementing the following waste segregation steps:
  - Replumbing the dust collector ducting on the casting metal gate cutoff saws to collect metal chips for easier recycling
  - Installing a new bag house on the sand system to separate the sand system dust from the furnace dust.
  - Installing a new screening system or magnetic separator on the main molding sand system surge hopper to continuously clean metal from the sand system

Newer sand recovery and re-use processes incorporate effective capture and segregation of unwanted materials from the waste sand stream. Effective systems make recovery less cumbersome and more profitable for the company.

Segregation Techniques Continued

- Separate nonferrous foundry shot blast dust (often a hazardous waste stream) from other non-hazardous foundry and sand waste streams.
- Installing a magnetic separation system on the shot blast system to allow the metal dust to be recycled
- Changing the core sand knockout procedure to keep this sand from being mixed in with system sand prior to disposal

Effective systems often take careful study to prevent unwanted materials from creating process problems.

Water/Energy Conservation Opportunities

- Use a closed loop, “dry” cooling system for electric induction furnace cooling, cooling of permanent dies, etc.
- Implement a water system with multiple re-uses of process water on the heat cascading principle.
- Consider employing heat pumps for the combined application of heat extraction and provision of chilling to process water and other fluids.
- Consider using waste heat to drive the waste-water evaporator, for sludge disposal.

http://oee.nrcan.gc.ca/cipec/ieep/newscentre/foundry/2/2_2_4.cfm?PrintView=N&Text=N

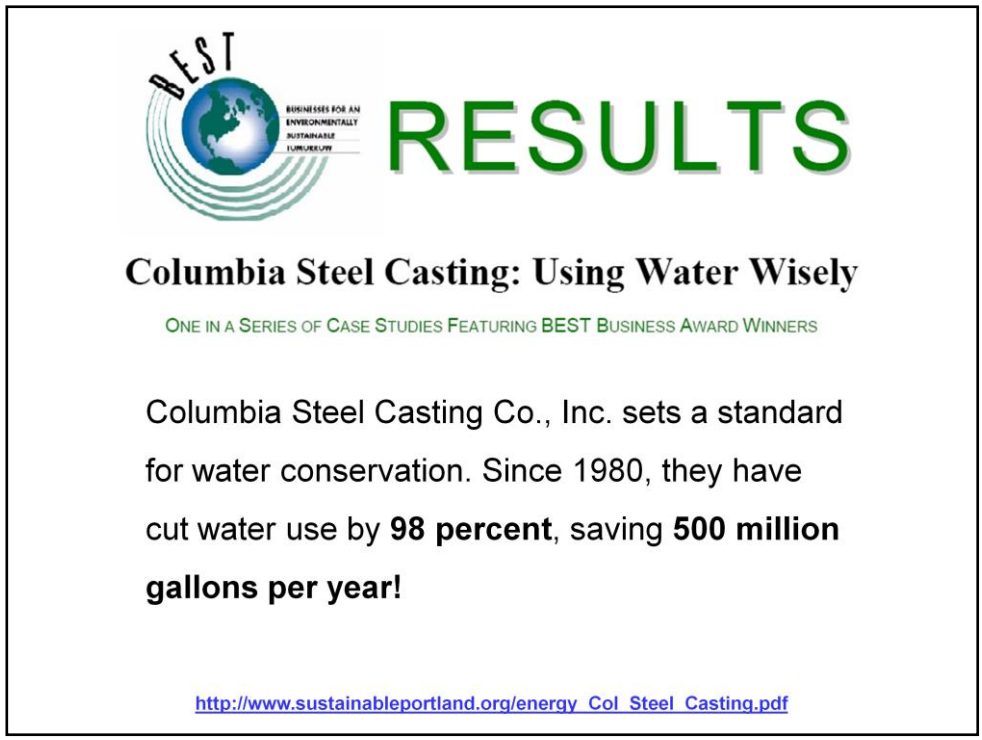
Water conservation and energy conservation are areas where companies can continually make improvements and save significant amounts of money. The metal casting industry has had strong representation in collaborative efforts with academia and government to find innovative ways to conserve and make the industry more profitable. This gives metal casting facilities a rich supply of case study and technology implementation information to work from. Many projects have demonstrated very short pay-backs and significant long term money savings. Energy in particular has the potential to be a long term cost savings area for companies who develop sound conservation strategies.

Water Conservation Opportunities

Case Study: ThyssenKrupp Waupaca's Closed-Loop Water Recycling System

ThyssenKrupp Waupaca's Plant 5 facility in Tell City, IN, installed a closed-loop water recycling system, replacing a system that discharged water after a single use. The system recirculates water used to cool process equipment, such as the molten iron handling equipment. The new system uses cooling towers, heat exchangers, pumps, tanks, and piping to cool and recirculate the water. Prior to the system installation, the Tell City facility was using 58 million gallons of municipal water per month. With the closed-loop system, the facility uses 18 million gallons of water per month, resulting in significant reductions in the facility's wastewater discharges, as well as its strain on the city water supply.

Water can be overlooked as a significant cost center. Even at extremely low costs per unit, water is expensive when considering the volumes involved and that companies often pay for water *3 SEPARATE TIMES (purchase cost, treatment cost and disposal cost)*.



Companies that work at continual waste reduction save significant amounts of money and resources. Case studies are abundant for finding techniques to institute these savings for your company too.

Simple Methods = Significant Water Savings

- GM Saginaw Metal Casting Operations installed a closed loop water recycle system, eliminating discharges to the Saginaw River. The plant reuses over **20 million gallons per day** of treated process water.

- The WaferTech circuit foundry in Camas implemented a water-recycling program that has significantly reduced its water use. The company recycles, reclaims and re-uses more than 51 percent of its water to meet daily production needs. During 2000, production at the facility increased by 100 percent over 1999. However, due to its water recycling program, WaferTech increased its actual water use by only 35 percent. For the year 2000, WaferTech's water recycling program **saved $853,828** in water and sewer costs.

http://www.gm.com/company/gmability/environment/plants/conserving_resources/index.html

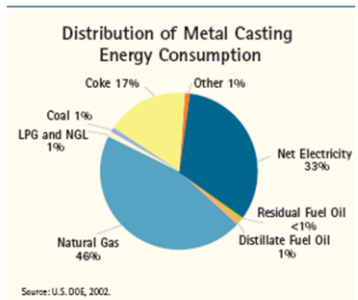
http://www.ecy.wa.gov/programs/hwtr/p2/p2success.html

Conservation and reduction strategies give companies ability to grow their business in ways that might not otherwise be possible.

Energy Efficiency = Cost savings

The U.S. Department of Energy's Industrial Technologies Program works to boost the productivity and competitiveness of U.S. industry through improvements in energy and environmental performance.

The program has identified best practices for melting and other efficiency improvement opportunities in the metal casting industry that could, if universally implemented, result in tacit energy savings of 102 trillion Btus (a 22% reduction), as well as a reduction in carbon dioxide (CO2) emissions of 6.5 million tons per year (also a 22% reduction).

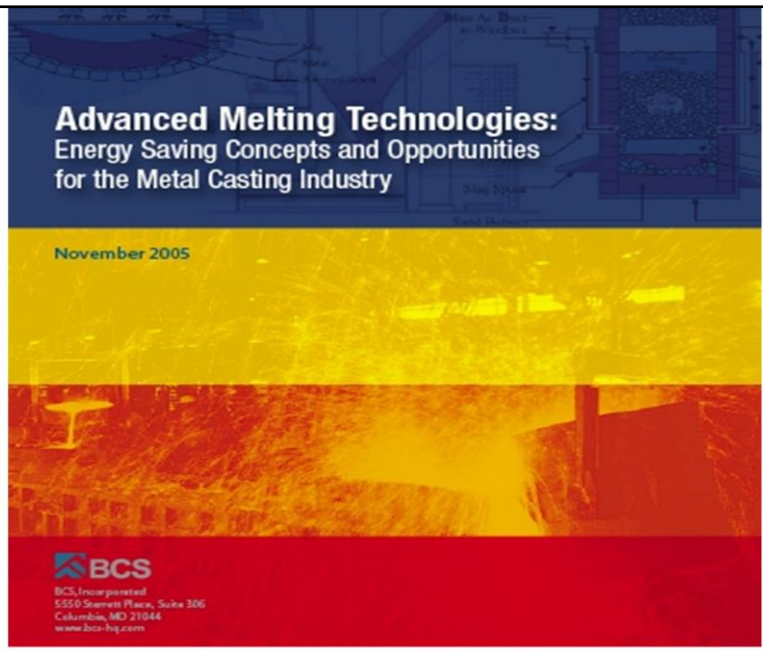


Energy efficiency has and continues to be a "hot" (no pun intended) topic for metal casting and every other energy intensive industry. Companies that position themselves to be energy efficient will gain even greater competitive advantage as energy costs continue to rise.

Energy Savings Opportunities

- Replacing heel melting furnaces used for iron induction with modern batch melters, which would improve tacit energy efficiency for this process by more than **32%**;
- Improving casting yield by **5%** in all metal casting industries except ductile iron pipe, for an overall tacit energy savings of **22.7 trillion Btus** per year; and
- Applying existing air/natural gas mixing methods to reduce ladle heating energy by **10%–30%.**

The metal casting industry has actively participated in identifying opportunities to save large amounts of energy from existing processes.



http://www.secat.net/docs/resources/advancedmeltingtechnologies.pdf

Several advancements in melting technologies have been made over the last few decades, but significant opportunities still exist for the metal casters to improve the melting efficiency and reduce metal loss. The implementation of the existing best practice technologies in the industry can alone save approximately 1.2 million Btu for melting a ton of iron and 3.0 million Btu for a ton of aluminum

m (or 1.2 trillion Btu per year for iron and 3.0 trillion Btu per year for aluminum).

Considering that iron and aluminum casting tonnages comprise more than 85% of the total casting tonnage, the savings potential in melting these metals promises to be substantial.

Energy Cost Savings Case Study

A. Finkl & Sons Co- Innovation in the Die Steel Forging Industry

A. Finkl & Sons Co. is one of the largest custom die steel forgers in the U.S. This fully integrated steel production facility in Chicago produces die blocks for the closed die forging industry, plastic mold and die casting die steels, custom open die forgings, and forge shop and steel mill repair parts.

Finkl's long-term program to reduce costs and improve productivity include: upgrading and computerizing equipment and building new, more efficient furnaces, including a Vacuum Arc furnace, and solid-waste recycling.

Achievements:

Energy use has declined 36 percent from 165 therms to 105 therms per ton.

99.7 percent of solid waste is reused or recycled.

Production efficiency (in terms of man-hours worked) has doubled.

Partly because of its success in pollution prevention and energy efficiency, the City of Chicago and Finkl have created a new urban manufacturing campus adjacent to an affluent residential neighborhood, preserving 10,000 jobs in the city.

http://www.aceee.org/p2/p2cases.htm#finkl

This participation by the metal casting industry has produced a wealth of available case study information to apply energy efficiency strategies to your business.

Energy Savings

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.*

Continual progress is being made in developing technology and methods for meeting the challenges of significantly reducing the costs and impacts of energy usage.

Energy Efficiency Resources

Energy Efficiency in Aluminum Melting

http://www.secat.net/docs/projects/Improving_Energy_Efficiency_in_Aluminum_Melting.pdf

Melting Efficiency Improvement

http://www.eere.energy.gov/industry/metalcasting/pdfs/umr22_fs.pdf

Compressed Air System Improvement

http://www.p2pays.org/ref/32/31236.pdf

Energy Efficiency Toolkit for Manufacturers

http://www.fypower.org/pdf/manufacturer_toolkit.pdf

Industrial Energy Assessment

http://iac.uwm.edu/Support/Resources/UWM_WI0475_Case_Study.pdf

http://iac.uwm.edu/Support/Resources/UWM_WI0454_Case_Study.pdf

A wide variety of energy efficiency information is available, specific to the metal casting industry.

Glossary of Foundry Terms

- Fin- a thin projection of metal from the casting, formed by an imperfect mold or core joint
- Dross/Slag- impurities floating on the surface of molten metal
- Mold/Mould Wash- the refractory emulsion coating used to coat cavity walls. This prevents metal from penetrating sand casting walls
- Mulling- the thorough mixing of sand, water and binder to form tempered ready-to-use molding or core sand

http://www.kiswok.com/foundry_terms.asp

This glossary of foundry terms was added to assist individuals outside the metal casting industry, who may not be familiar with many of the various terms that are specific to foundry materials and or wastes.

Questions???

Office of Compliance Assistance & Pollution Prevention

http://www.epa.state.oh.us/ocapp/ocapp.html

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The office of Compliance Assistance & Pollution Prevention is available to assist any Ohio company with more information on minimizing wastes.