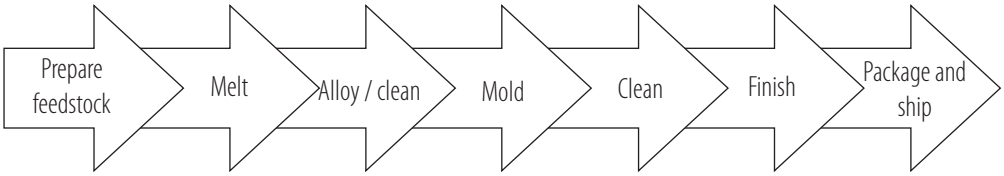
Non-Ferrous Metals Operations

Sub-sector Description

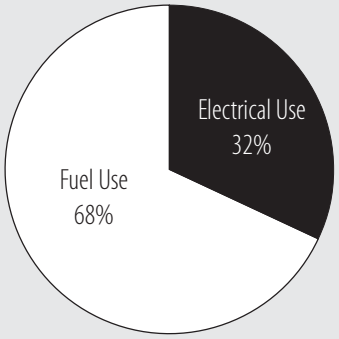
This industry includes facilities primarily engaged in the casting of non-ferrous metals (except aluminum) or smelting non-ferrous metals using electrolytic or other processes.

Facility Type	SIC	NAICS		Facility Type	SIC	NAICS
Lead smelting and refining	3339	331419		Non-ferrous die castings	3364	331522
Bronze die castings	3366	331522		Secondary non-ferrous metals	3341	331492
Copper foundries	3366	331525				

Process Information



Energy Use[1]



Benchmarks

Thermal and electrical benchmarks were unable to be reliably derived from facility-specific energy use, sales, employee numbers, and area data. For more information about the benchmarking study that MnTAP conducted and how to determine if your facility may have energy efficiency opportunities remaining, view the report Web pages at http://www.mntap.umn.edu/resources/DOC/index.html.

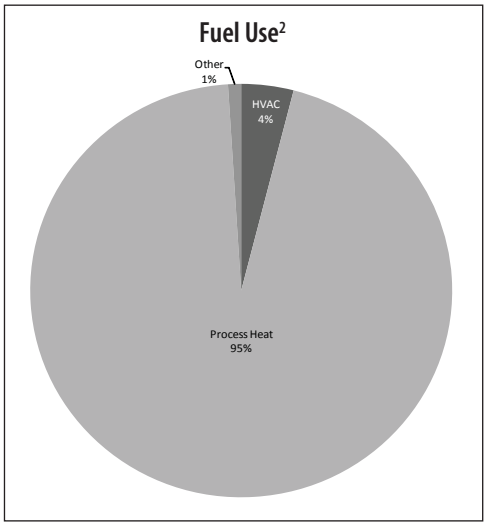
Savings Potential

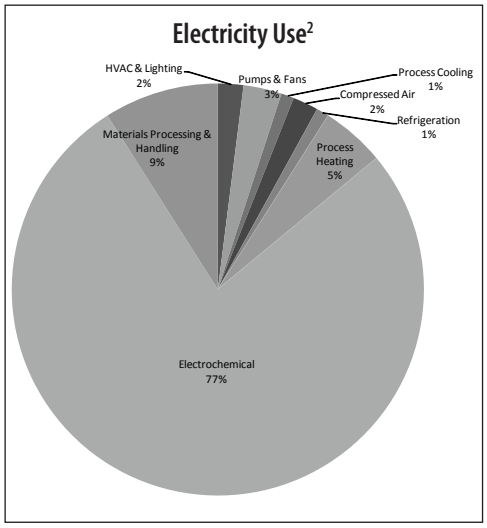
Opportunities and technologies for energy conservation were identified for facilities within this sub-sector. Industry case studies and reports of implementation were used to determine what opportunities may be available and achievable savings from those opportunities. However, additional energy conservation measures may apply to your facility. The tables on Page 2 of this summary reflect a number of energy conservation measures available for this sub-sector.

Estimated Fuel Savings: **13%**

Estimated Electric Savings: **10%**

Energy Use Footprints





Fuel Savings Estimate and Opportunities

Improvement / Opportunity	Estimated Payback	Reported Savings	Overall Savings
Furnace Optimization			
Isothermal melting technology using immersion heaters in a series of melting bays[3]		60-65%	
Reverberatory furnace improvements[4] (oxy-fuel staged combustion, and new refractories)		25%	
Stack or tower melting furnaces[5]		47%[7]	
Use waste heat from hot combustion gases to preheat combustion air		2.5%	
Use waste heat to produce steam to drive a steam turbine generator		7.4%	
Adjust burners for efficient operations		3.7%	
Replace fossil fuel equipment with electrical equipment[6]		5.9%	
TOTAL FUEL SAVINGS ESTIMATE			**13%**

Electric Savings Estimate and Opportunities

Improvement / Opportunity	Estimated Payback	Reported Savings	Overall Savings
Process Improvements and Optimization			
Reduce compressed air pressure to minimum required	< 1 year	0.3%	
Compressor - upgrade controls, install common header, reduce pressure, eliminate uses, close lines, eliminate leaks	< 1 year	3.9%	
Eliminate leaks in inert gas and compressed air lines/valves	< 1 year	1.5%	
Utilize energy-efficient belts and other improved mechanisms	< 1 year	0.3%	
Facility Improvements			
Utilize daylight whenever possible in lieu of artificial light	< 1 year	0.6%	
Install occupancy sensors	1 year	1.0%	
Utilize higher efficiency lamps and/or ballasts	< 1 year	4.4%	
Facility HVAC improvements, install vinyl strip, air curtains, etc, insulate glazing, walls, ceilings, and roof	1 year	7.7%	
Lighting improvements- turn off, occupancy sensors, lower fixtures, skylights, better efficiencies, etc.	1 year	0.78%	
Use more efficient light source	< 1 year	1.0%	
TOTAL ELECTRICAL SAVINGS ESTIMATE			**10%**

References

1 IAC Industrial Assessments. DOE. http://iac.rutgers.edu/database/assessments.php

2 DOE Industrial Technologies Program Manufacturing energy and carbon footprints. http://www1.eere.energy.gov/industry/pdfs/aluminum_footprint.pdf, Manufacturing Energy and Carbon Footprint Sector: Alumina and Aluminum (NAICS 3313), page 2. NOTE: This footprint identifies NAICS 3313 manufacturing processes which include alumina and primary processing and some extrusion processes otherwise seen in the non-ferrous sub-sector. However, it is reasonable approximation of the non-ferrous brass and bronze casting industry energy use for this sub-sector.

3 Various citations, http://www1.eere.energy.gov/industry/aluminum/pdfs/itm.pdf http://www.apogeetechinc.com/apogeeadvancedheating.htm, http://apps1.eere.energy.gov/industry/bestpractices/energymatters/articles.cfm/article_id=271

4 DOE ITP, "Improving Energy Efficiency in Aluminum Melting" project fact sheet, July 2001.

5 "Energy-Efficient Stack Melter for Aluminum Die Cast", NYSERDA, February 24, 2006, http://www.nyserda.org/programs/industry/lexington_die.asp. Also "High-Productivity Aluminum Melting. . . that offers High Quality, too" Foundry Management and Technology, December 13, 2007, www.foundrymag.com/classes/article/article-draw.aspx?HBC=frontpage&CID=77106.

6 IAC, http://iac.rutgers.edu/database/findassessment.php?ID=UD0742

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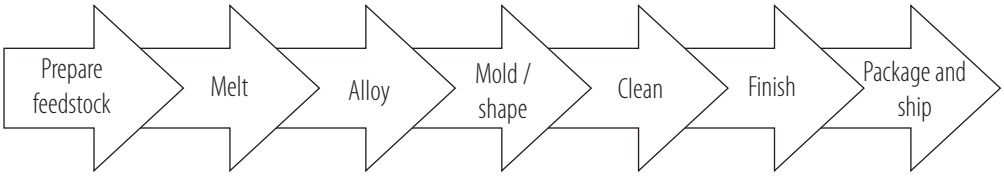
Steel Products

Sub-sector Description

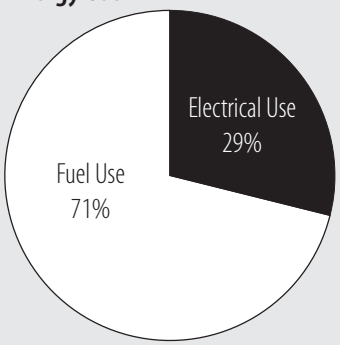
Facilities in this sub-sector are engaged in manufacturing steel investment castings or steel castings (non-investment). Investment molds are formed by covering a wax shape with a refractory slurry. After the refractory slurry hardens, the wax is melted, leaving a seamless mold. Investment molds provide highly detailed, consistent castings. Facilities in this industry purchase steel made in other facilities to manufacture products.

Facility Type	SIC	NAICS		Facility Type	SIC	NAICS
Steel investment foundries	3324	331512		Steel foundries	3325	331513

Process Information



Energy Use[1]



Benchmarks

Thermal and electrical benchmarks were unable to be reliably derived from facility-specific energy use, sales, employee numbers, and area data. For more information about the benchmarking study that MnTAP conducted and how to determine if your facility may have energy efficiency opportunities remaining, view the report Web pages at http://www.mntap.umn.edu/resources/DOC/index.html.

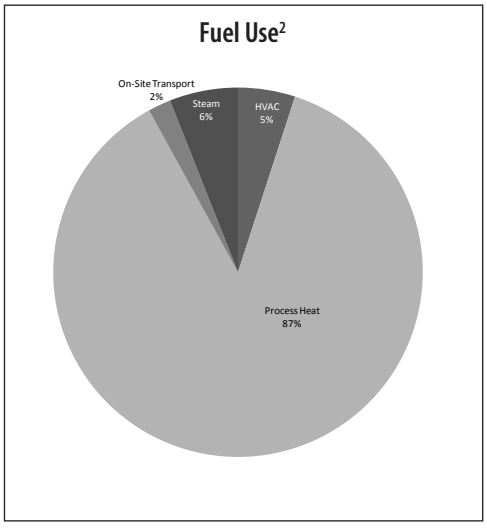
Savings Potential

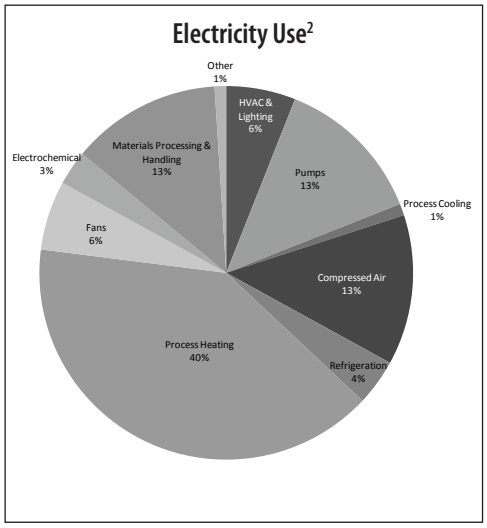
Opportunities and technologies for energy conservation were identified for facilities within this sub-sector. Industry case studies and reports of implementation were used to determine what opportunities may be available and achievable savings from those opportunities. However, additional energy conservation measures may apply to your facility. The tables on Page 2 of this summary reflect a number of energy conservation measures available for this sub-sector.

Estimated Fuel Savings: **20%**

Estimated Electric Savings: **15%**

Energy Use Footprints





Fuel Savings Estimate and Opportunities

Improvement / Opportunity	Estimated Payback	Reported Savings	Overall Savings
Fired Heater Optimization			
Near net shape/strip casting[3]	< 1 year	90%	
Analyze flue gas for proper air/fuel ratio[4]	< 1 year	27%	
Use waste heat from hot flue gases to preheat combustion air[5,6]	1-2 years	18-21%	
Preheat combustion air with waste heat[7]	< 1 year	11%	
Use heat in flue gases to preheat products or materials, including scrap[8]	1-2 years	11%	
Improve combustion control capability[9]	2-3 years	17%	
Recover waste heat from equipment[10]	< 1 year	17%	
TOTAL FUEL SAVINGS ESTIMATE			**20%**

Electric Savings Estimate and Opportunities

Improvement / Opportunity	Estimated Payback	Reported Savings	Overall Savings
Process Improvements and Optimization			
Existing furnace optimization - maintenance and repair of refractory and closures, heat recovery where appropriate		15.4%	
Compressor - upgrade controls, install common header, reduce pressure, eliminate uses, close lines, eliminate leaks		1.5%	
Turn off furnace cooling tower fans and pumps after furnace has cooled		6.4%	
Turn off shakeout dust collector when not in use		5.8%	
TOTAL ELECTRICAL SAVINGS ESTIMATE			**15%**

References

1 IAC Industrial Assessments. DOE. http://iac.rutgers.edu/database/assessments.php

2 DOE Industrial Technologies Program Manufacturing Energy and Carbon Footprints, http://www1.eere.energy.gov/industry/pdfs/steel_footprint.pdf, Sector: iron and steel (NAICS 3311, 3312), page 2.

3 LBNL Energy Analysis Department, "Emerging Energy-Efficient Technologies in Industry: Case Studies of Selected Technologies", May 2004, http://ies.lbl.gov/iespubs/54828.pdf, pages 4-9.

4 http://iac.rutgers.edu/database/findassessment.php?ID=UM0326

5 http://iac.rutgers.edu/database/findassessment.php?ID=UM0189

6 http://iac.rutgers.edu/database/findassessment.php?ID=UA0027

7 http://iac.rutgers.edu/database/findassessment.php?ID=MS0191

8 http://iac.rutgers.edu/database/findassessment.php?ID=SD0280

9 http://iac.rutgers.edu/database/findassessment.php?ID=MA0538

10 http://iac.rutgers.edu/database/findassessment.php?ID=UM0330

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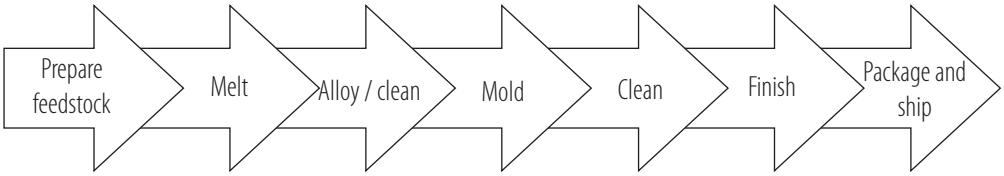
Iron Operations

Sub-sector Description

Facilities in this sub-sector pour molten pig iron and iron scrap into molds to manufacture castings such as cast iron man-hole covers, cast iron pipe, or cast iron skillets. Facilities in this industry purchase iron made in other establishments.

Facility Type	SIC	NAICS		Facility Type	SIC	NAICS
Grey iron castings	3321	331511		Malleable iron foundries	3322	331511

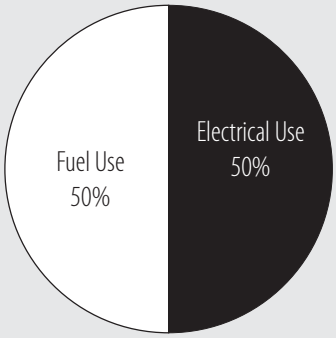
Process Information



Benchmarks

Thermal and electrical benchmarks were unable to be reliably derived from facility-specific energy use, sales, employee numbers, and area data. For more information about the benchmarking study that MnTAP conducted and how to determine if your facility may have energy efficiency opportunities remaining, view the report Web pages at http://www.mntap.umn.edu/resources/DOC/index.html.

Energy Use[1]



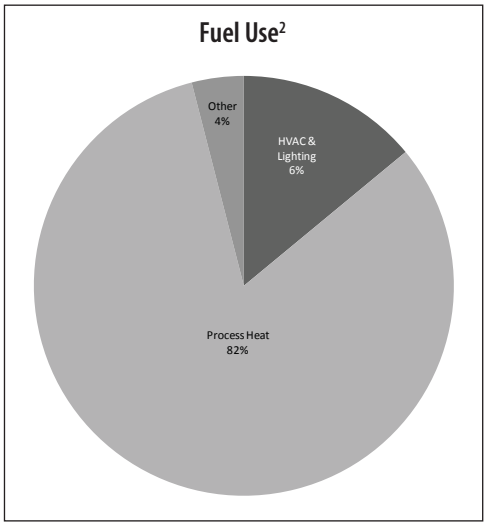
Savings Potential

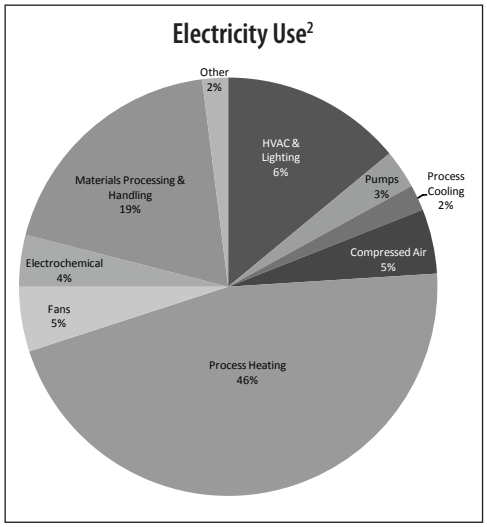
Opportunities and technologies for energy conservation were identified for facilities within this sub-sector. Industry case studies and reports of implementation were used to determine what opportunities may be available and achievable savings from those opportunities. However, additional energy conservation measures may apply to your facility. The tables on Page 2 of this summary reflect a number of energy conservation measures available for this sub-sector.

Estimated Fuel Savings: **17%**

Estimated Electric Savings: **20%**

Energy Use Footprints





Fuel Savings Estimate and Opportunities

Improvement / Opportunity	Estimated Payback	Reported Savings	Overall Savings
Fired Heater Optimization			
Air-to-air heat exchanger for preheating combustion gas for metal charge heating[3]	3-5 years	Unknown	
Relocate equipment to more efficient location[4]	< 1 year	14%	
Improve combustion control capability[4]	< 1 year	14%	
Adjust burners for efficient operation[5]	< 1 year	21%	
Use waste heat from hot flue gases to preheat combustion air[6]	< 1 year	36%	
Recover waste heat from equipment[7]	< 1 year	20%	
Use waste heat from flue gases to heat space conditioning air and cover open vessels[8]	2 years	30%	
Use heat in flue gases to preheat products or materials (like scrap)[8]			
TOTAL FUEL SAVINGS ESTIMATE			**17%**

Electric Savings Estimate and Opportunities

Improvement / Opportunity	Estimated Payback	Reported Savings	Overall Savings
Process Improvements and Optimization			
Insulate bare equipment	< 1 year	1.2%	
Increase insulation thickness	< 1 year	0.9%	
Utilize energy-efficient belts and other improved mechanisms	< 1 year	0.3%	
Use most efficient type of electric motors	3 years	1.1%	
Use multiple speed motors or ASD for variable pump, blower and compressor loads	3 years	2.2%	
Use ASD to replace motor-generator set, throttling system, or mechanical drives	1 year	0.3-0.9%	
Install compressor air intakes in coolest locations	< 1 year	1.0%	
Upgrade controls on compressors	< 1 year	3.2%	
Use / purchase optimum sized compressor	< 1 year	2.3%	
Reduce the pressure of compressed air to the minimum required	< 1 year	1.0%	
Eliminate or reduce compressed air used for cooling, agitating liquids, moving product, or drying	< 1 year	3.7%	
Eliminate leaks in inert gas and compressed air lines/ valves	< 1 year	2.2%	
Use synthetic lubricant	< 1 year	2.0%	
Turn off equipment when not in use	< 1 year	2.0%	
Facility Improvements			
Install occupancy sensors	1 year	0.8%	
Utilize higher efficiency lamps and/or ballasts	3 years	0.8%	
Use more efficient light source	1-2 years	1.7%	
TOTAL ELECTRICAL SAVINGS ESTIMATE			**20%**

References

1 IAC Industrial Assessments. DOE. http://iac.rutgers.edu/database/assessments.php

2 DOE Industrial Technologies Program Manufacturing Energy and Carbon Footprints http://www1.eere.energy.gov/industry/pdfs/foundries_footprint.pdf, Manufacturing Energy and Carbon Footprint Sector: Foundries (NAICS 3315), page 2.

3 Focus on Energy case study, "Heat Recovery System Boosts Product Output, Reduces Energy Costs for Primary Metals Business, http://www.focusonenergy.com/files/Document_Management_System/Business_Programs/B_GI_MKCS_MotorCastings.pdf.

4 http://iac.rutgers.edu/database/findassessment.php?ID=IA0428

5 http://iac.rutgers.edu/database/findassessment.php?ID=MI0016

6 http://iac.rutgers.edu/database/findassessment.php?ID=UA0025

7 http://iac.rutgers.edu/database/findassessment.php?ID=IA0432

8 http://iac.rutgers.edu/database/findassessment.php?ID=ND0346

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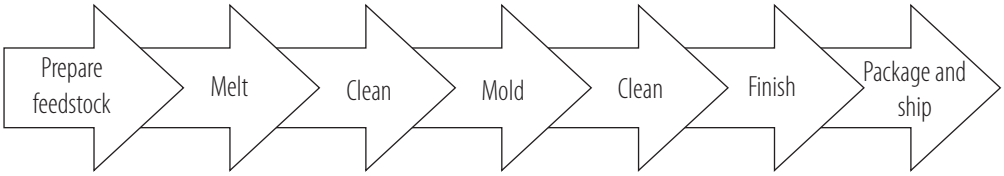
Aluminum Operations

Sub-sector Description

This sub-sector includes facilities that handle aluminum in a variety of ways: refining, recovering aluminum from scrap or dross, alloying purchased aluminum, manufacturing aluminum primary forms, or producing products from aluminum through casting processes.

Facility Type	SIC	NAICS		Facility Type	SIC	NAICS
Aluminum foundries	3365	331524		Aluminum die casting	3363	331521
Aluminum smelting (secondary)	3341	331314		Primary aluminum	3334	331312

Process Information

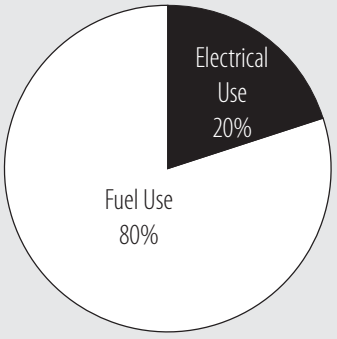


Benchmarks

The following thermal and/or electrical benchmarks were derived from facility-specific energy use, employee numbers, and area data for the facilities that MnTAP analyzed. These benchmarks can be used to predict how efficient your facility is in comparison to peer facilities. If your facility's energy use is less efficient than your peers, there may be energy conservation opportunities available. The benchmarks included have been tested for reliability; however, they should be used with some caution. For more information on the benchmarking study including how to use the benchmarks, view the report Web pages at http://www.mntap.umn.edu/resources/DOC/index.html.

	Most efficient 25%	More efficient 25%	Less efficient 25%	Least efficient 25%
kWh/employee	< 20,734	20,734 - 32,105	32,105 - 49,713	> 49,713
therms/square feet	< 4.80	4.80 - 7.17	7.17 - 10.71	> 10.71
therms/employee	< 2,615	2,615 - 3,445	3,445 - 4,537	> 4,537

Energy Use[1]



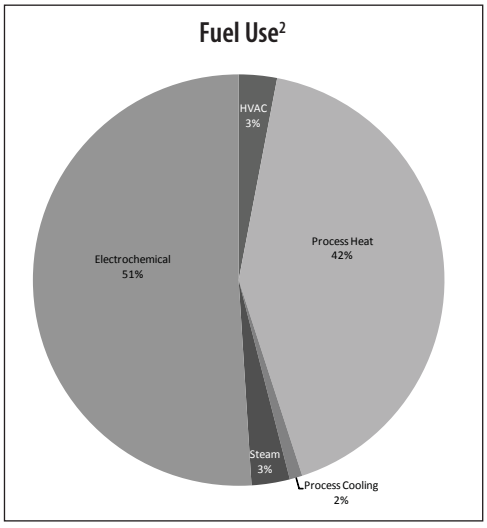
Savings Potential

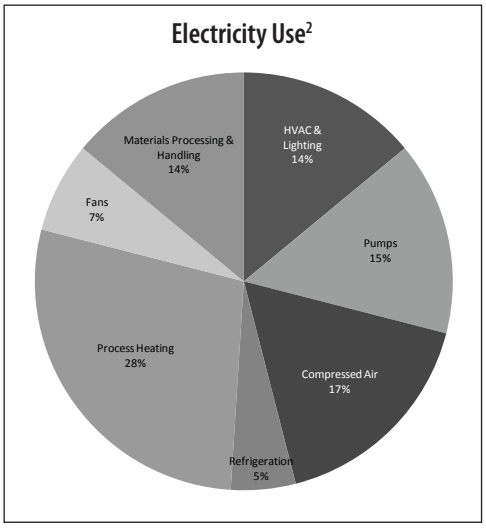
Opportunities and technologies for energy conservation were identified for facilities within this sub-sector. Industry case studies and reports of implementation were used to determine what opportunities may be available and achievable savings from those opportunities. However, additional energy conservation measures may apply to your facility. The tables on Page 2 of this summary reflect a number of energy conservation measures available for this sub-sector.

Estimated Fuel Savings: **14%**

Estimated Electric Savings: **19%**

Energy Use Footprints





Fuel Savings Estimate and Opportunities

Improvement / Opportunity	Estimated Payback	Reported Savings	Overall Savings
Process Heat Optimization			
Reverberatory furnace improvements (oxy-fuel staged combustion, and new refractories)[3]		25%	
Iso thermal melting using immersion heaters in a series of melting bays[4]		60-65%	
Stack or tower melting furnaces	3 years	47%[5,6,7]	
Improve combustion control capability[8]	< 1 year	2-39%	
Re-size charging openings or add a movable door on equipment	< 1 year	3.9%	
Use waste heat from hot flue gases to preheat combustion air[9]	< 2 years	2-29%	
Insulate bare equipment and increase insulation thickness	< 1 year	0.6-3%	
Use heat wheel or other heat exchanger to cross exchange building exhaust air with makeup air[10]	< 1 year	2.7%	
Cover open crucibles and ladles	< 1 year	2.0%	
Analyze fuel gas for proper air/fuel ratio[11]			
Facility Improvements			
Use waste heat from flue gases to heat space conditioning air	< 1 year	2.0%	
Recover heat from air compressor	< 1 year	4.6%	
TOTAL FUEL SAVINGS ESTIMATE			**14%**

Electric Savings Estimate and Opportunities

Improvement / Opportunity	Estimated Payback	Reported Savings	Overall Savings
Process Improvements and Optimization			
Insulate bare equipment	< 1 year	2.0%	
Use optimum thickness insulation	< 1 year	4.3%	
Utilize energy-efficient belts and other improved mechanisms	< 1 year	5.6%	
Use most efficient type of electric motors	2-3 years	6.4%	
Use multiple speed motors or ASD for variable pump, blower and compressor loads	< 2 years	3.8%	
Compressor - upgrade controls, install common header, reduce pressure, eliminate uses, close lines, eliminate leaks	< 1 year	3.9%	
Facility Improvements			
Facility HVAC improvements, install vinyl strip, air curtains, etc, insulate glazing, walls, ceilings, and roof	1 year	7.7%	
Lighting improvements- turn off, occupancy sensors, lower fixtures, skylights, better efficiencies, etc.	1 year	0.78%	
TOTAL ELECTRICAL SAVINGS ESTIMATE			**19%**

References

1 IAC Industrial Assessments. DOE. http://iac.rutgers.edu/database/assessments.php

2 DOE Industrial Technologies Program Manufacturing Energy and Carbon Footprints, http://www1.eere.energy.gov/industry/pdfs/aluminum_footprint.pdf, Sector: alumina and aluminum (NAICS 3313), page 2. NOTE: This footprint identifies NAICS 3313 manufacturing processes which include alumina and primary processing and some extrusion processes otherwise seen in the non-ferrous sub-sector. However, it is reasonable approximation of the aluminum industry energy use for this sub-sector in its emphasis on fuel energy use.

3 DOE ITP. "Improving Energy Efficiency in Aluminum Melting." July 2001.

4 http://www1.eere.energy.gov/industry/aluminum/pdfs/itm.pdf; http://www.apogeetechinc.com/apogee-advancedheating.htm; http://apps1.eere.energy.gov/industry/bestpractices/energymatters/articles.cfm/article_id=271

5 "Energy-Efficient Stack Melter for Aluminum Die Cast." NYSERDA. February 24, 2006. http://www.nyserda.org/programs/industry/lexington_die.asp.

6 "High-Productivity Aluminum Melting. . . that offers High Quality, too" Foundry Management and Technology, December 13, 2007,

7 www.foundrymag.com/classes/article/articledraw.aspx?HBC=frontpage&CID=77106.

8 IAC http://iac.rutgers.edu/database/findassessment.php?ID=WV0190

9 IAC http://iac.rutgers.edu/database/findassessment.php?ID=WI0519

10 IAC http://iac.rutgers.edu/database/findassessment.php?ID=UM0174

11 IAC http://iac.rutgers.edu/database/findassessment.php?ID=UD0726

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