

# Energy Efficiency Opportunities at Carley Foundry

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**Driven to Discover<sup>SM</sup>**

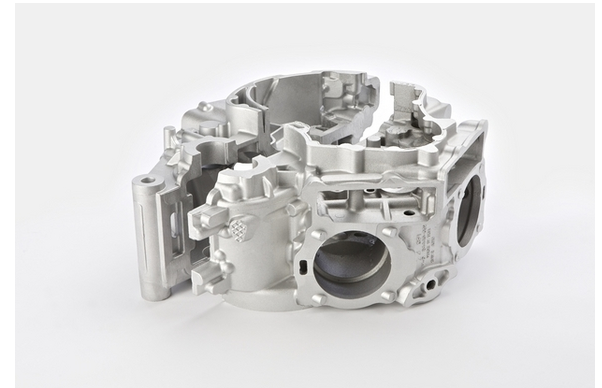


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# Company Background

## Carley Foundry

- Founded in 1955 by Frank and Lois Carley
- Produce premium aluminum castings for a wide range of production needs
- Use a combination of permanent iron molds, sand molds, and wax molds to create castings
- Located in Blaine, Minnesota
- Have over 400 full time employees



# Project Overview

- Reduce energy consumption at Carley
- Gain a better understanding of how energy is used

# Incentive to change

- Lower operating costs
- Produce environmentally responsible castings
- Stay ahead of competition

# Process

Mold/Core  
Making



+ chemical binders →



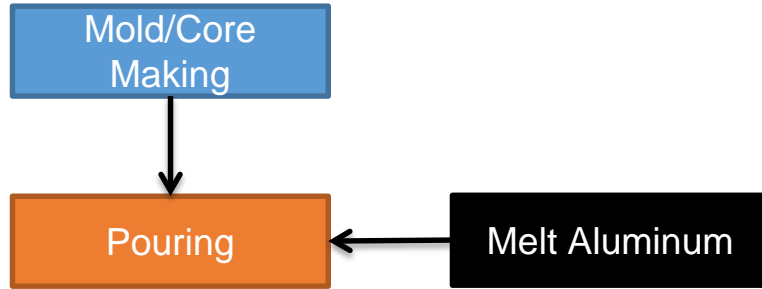
# Process

Mold/Core  
Making

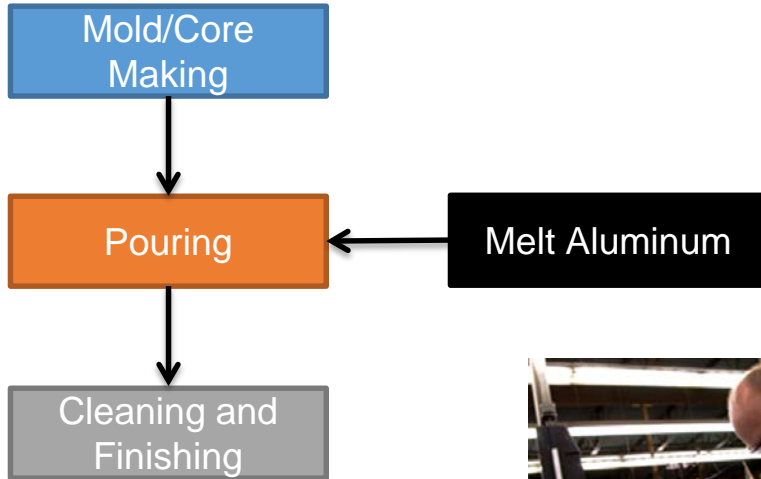
Melt Aluminum



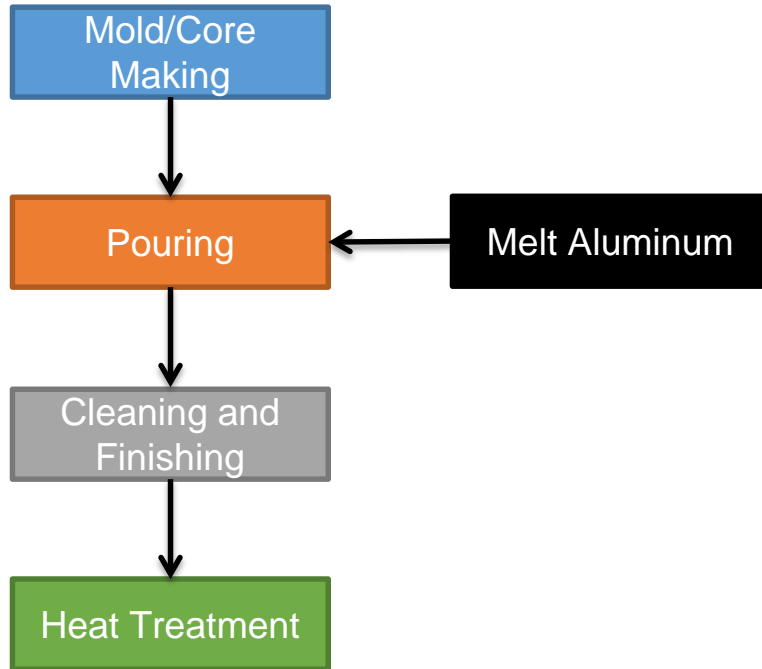
# Process



# Process



# Process



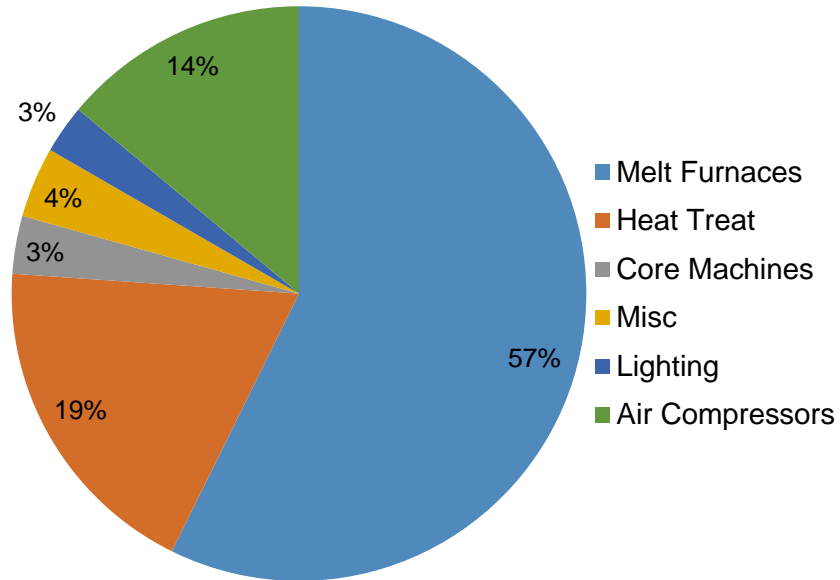


# Approach

- **Conduct an energy audit of Carley's main production facility**
  - Estimated energy use for major pieces of equipment
- **Experimented on furnaces to find exact power draw and energy consumption**
  - Attached amp clamps to furnaces and varied conditions
- **Analyzed heat treatment practices and energy consumption of quench tanks**
  - Attached amp clamps to quench tanks, analyzed demand data from Xcel Energy
- **Assessed compressed air usage**
  - Inflow was contracted to provide a supply side study from Xcel Energy Funding

# Current Electrical Use

## Carley Energy Breakdown



- Carley used 24 million kWh last year
- Furnaces will use 50-60% of all electrical energy

# Findings of Furnace Experiment and Energy Audit

- Furnaces are only used during first shift to pour castings
- Furnaces are held at high temperatures during the night
- Significant energy savings opportunity
- Only 50% of the furnaces are used during production hours

Temperature [F]	Lid Closed [kW]	Lid Open [kW]
1200	27.7	-
1300	30.7	50.9
1400	33.7	55.9
1500	36.7	60.8
Heating	70	-

# Primary Recommendation – Reduce Set Point Temperature During Inactivity

Recommendation	Environmental Savings	Implementation Cost	Annual Savings	Payback Period	Status
Set back furnace set point temperature overnight	2,112,000 kWh annually	\$2,000	\$104,000	Immediate	50% Implemented
Set back furnaces not in use during production hours	220,000 kWh annually	\$0	\$30,000	Immediate	Implemented

## Benefits

- Significantly reduce energy consumption
- No upfront costs to implementation
- No impact on production
- No effect on metal quality

# Solutions (examples below)

Recommendation	Annual reduction	Total cost	Annual savings	Payback period	Status
Set back furnaces overnight	2,112,000 kWh	\$2,000	\$104,000	Immediate	50% Implemented
Turn down furnaces not in use during production	220,000 kWh, 100 kW demand	\$0	\$20,000	Immediate	Implemented
Fix leaks identified in leak check	460,000 kWh 50 kW demand	\$8,250	\$35,000	2.5 months	Implementing
Replace vortex coolers with AC coolers	450,000 kWh	\$21,000	\$26,000	10 months	Implementing
Turn off quench tanks when not in use	400,000 kWh	\$0	\$20,000	Immediate	Recommended
Fix furnace insulation	174,000 kWh	\$2,500	\$11,000	5 months	Implementing
Stagger heating of ovens V and W	60 kW Demand	\$0	\$10,000	Immediate	Recommended
<b>Total</b>	4,012,000 kWh, 210 kW demand	\$33,250	\$259,000		



# Personal Benefit

- Gained practical experience
- Project management
- Problem solving in a real world environment
- Chance to apply coursework in real world applications

# Special thanks and additional contributions

- Randy Oehrlein
- Jon Vanyo of MnTAP
- Travis Bodick
- Ron Ingalls
- Peter Vinck and Inflow
- David Baker and the rest of CAE
- Thermtronix
- The rest of Carley's employees and operators!