Energy Efficiency Opportunity Analysis
Consolidated Precision Products
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Minnesota Technical Assistance Program
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Company Overview

- Consolidated Precision Products is an aerospace foundry.
- Produces high precision aluminum and magnesium castings for NASA rockets, military and commercial aircraft, among others.
- 550 employees, two shifts, ~20 hour/day runtime
Incentives for Change

• Rising facility utility costs
  – Natural Gas
  – Electric

• Abundance of high temperature exhausts

• High potential for energy reclamation
Reasons for MnTAP Assistance

• Gather performance data on ovens, quench tanks, and fluidized bed
• Identify new opportunities for energy reduction
  – Prioritize changes using simple payback methods
Approach

• Learn about the sand casting process
• Understand the workings of heat-treat, quench tanks, and fluidized beds
  – Qualitative analysis
  – Quantify
• Efficiency Analysis
• Find additional opportunities
Sand Casting Process

• Molds prepared
• Molten metal poured
• Sand removed on cooling
  – Shake out
  – Fluidized Bed
• Finishing
• Heat Treat
• Aging
Heat Treat

- Oven types:
  - Gas
    - Direct Fire
    - Sealed Tube (least efficient)
  - Electric (higher efficiency)
Oven 4: Plug in Recuperator

Opportunity:

• Most used sealed tube heat treat oven
• Inefficient because flue gas at temp >1400F
• Has four burners, running at 60% currently
## Oven 4: Plug In Recuperator

### Solution
- Recuperator will increase efficiency to 71%
- Combustion air preheat to >600F

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Environmental Savings</th>
<th>Implementation Cost</th>
<th>Annual Savings</th>
<th>Payback Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Install Plug-In Bayonet Ultra Recuperators on Oven 4</td>
<td>12690 therms</td>
<td>$15,510</td>
<td>$5,711</td>
<td>2.7 years</td>
</tr>
</tbody>
</table>
Opportunity:

• Overpowered burner
• Custom exhaust stack getting damaged
  – Very expensive
• Repair costs alone warrant change
Quench Tank for Oven 19

Solution:

- Reduce burner capacity from 20 therms/hr to 8.3 therms/hr
- Increased efficiency from 56.5% to 72.5%

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</thead>
<tbody>
<tr>
<td>Change setup to reduce burner capacity on quench tank for oven 19</td>
<td>2770.1 therms/year</td>
<td>$3869.67</td>
<td>$1246.95/year</td>
<td>3.1 years</td>
</tr>
</tbody>
</table>
Opportunity:

- Runs 24/7
- Flue exhausts at 805°F!
- So much energy wasted! (77,500 therms/year)
Heat Exchanger for Fluidized Bed

Opportunity:
• Install Heat Exchanger to use heat during the winter.

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</tr>
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<tr>
<td>Install Heat Exchanger for Fluidized Bed Flue Gases</td>
<td>4.45 therms/Hr</td>
<td>$40,000</td>
<td>$20,465</td>
<td>2 years</td>
</tr>
</tbody>
</table>

Minnesota Technical Assistance Program
Magnesium Pour Tipper Ladles

Opportunity:

• Tipper ladles drop temperature quickly
• Very small pouring window
• Have to use smaller quantity pots for pouring
Magnesium Pour Tipper Ladles

Solution

• Insulate ladles

• Will allow for an additional 15-20 minutes of magnesium pouring time

• Reduce/eliminate need for smaller pots
Mag Pour Burner Management

Opportunity:

- All burners for melting magnesium switched on at 3am
- Some not poured until between 9 and 11am
- Unnecessary gas consumption
Mag Pour Burner Management

Solution

- Manage burner start times

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<tbody>
<tr>
<td>Manage Mag Pour Burner Start Times</td>
<td>43130 therms Gas Annually</td>
<td>$0 – Change burner management strategy</td>
<td>$19,408.5</td>
<td>instantaneous</td>
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</table>
Opportunity:
• Too many leaks!

Solution:
• Flow rate meters installed
• Costing them $30,000 annually!
• Xcel

Compressed air audit
Motor and Belt Drive Survey

Opportunity:
• Over 150 motors and belt drives, efficiency unknown, some very old

Solution:
• Belt drive survey through Xcel
• VFDs, soft starters, more efficient replacements
• Rebates from Xcel
<table>
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<tr>
<th>Option</th>
<th>Energy saved (per year)</th>
<th>Implementation Cost</th>
<th>Cost Savings (per year)</th>
<th>ROI Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oven 4</td>
<td>12,690 Therms</td>
<td>$15,600</td>
<td>$5,711</td>
<td>2.7 years</td>
</tr>
<tr>
<td>Quench Tank</td>
<td>2771 Therms</td>
<td>$3869.67</td>
<td>$1246.95</td>
<td>3.1 years</td>
</tr>
<tr>
<td>Fluidized Bed</td>
<td>38980 Therms</td>
<td>$40,000</td>
<td>$20,465</td>
<td>1.95 years</td>
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<tr>
<td>Mag Pour Insulation</td>
<td>218.65kW during use</td>
<td>$515</td>
<td>Refer to recommendation section under energy efficiency options</td>
<td>N/A</td>
</tr>
<tr>
<td>Option</td>
<td>Energy saved (per year)</td>
<td>Implementation Cost</td>
<td>Cost Savings (per year)</td>
<td>ROI Period</td>
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<tr>
<td>Mag Burner Procedure Management</td>
<td>43130 Therms</td>
<td>$0</td>
<td>$19,408</td>
<td>Immediate</td>
</tr>
<tr>
<td>Repair compressed air leaks</td>
<td></td>
<td>$1000 (labor)</td>
<td>$30,000</td>
<td>12 days</td>
</tr>
<tr>
<td>Motor and Belt Drive Survey</td>
<td>N/A</td>
<td>Small thanks to Xcel Rebates</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>TOTAL</td>
<td>97,571 Therms + 218.65kW during mag pour</td>
<td>$60,984.7</td>
<td>$76,830</td>
<td>9.5 months</td>
</tr>
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**Summary**

- **Energy saved (per year):**
  - Mag Burner Procedure Management: 43130 Therms
  - Repair compressed air leaks: N/A
  - Motor and Belt Drive Survey: N/A
  - TOTAL: 97,571 Therms + 218.65kW during mag pour

- **Implementation Cost:**
  - Mag Burner Procedure Management: $0
  - Repair compressed air leaks: $1000 (labor)
  - Motor and Belt Drive Survey: Small thanks to Xcel Rebates
  - TOTAL: $60,984.7

- **Cost Savings (per year):**
  - Mag Burner Procedure Management: $19,408
  - Repair compressed air leaks: $30,000
  - Motor and Belt Drive Survey: N/A
  - TOTAL: $76,830

- **ROI Period:**
  - Immediate
  - 12 days
  - N/A
  - 9.5 months
Personal Benefits

• Opportunity to utilize knowledge on heat treat, electrical engineering, etc.
• Improved communication skills
• Learned some PLC programming
• Real world exposure
Questions?