Steam System Solutions at Seneca Foods Corporation

Emily Hutson
Paul Pagel
Seneca Foods Corp.
Rochester, MN

• A vegetable canning and freezing plant

• The only producer of cream-style corn in the U.S.
A New Era of Energy Management at Seneca

- Changing consumer priorities and customer demands
- Cooperating resources
  - Utility companies (RPU, MERC)
  - Engineering consultants
  - Sales reps
- Growing interest in steam system improvements
Reasons for MnTAP Assistance

• Intern needed to:
  – Assist management in understanding steam system
  – Evaluate energy conservation opportunities
  – Coordinate efforts between resource companies

• Seneca had specific interest in:
  – Accumulator project
Approach

• Understand steam generation and use
• Listen to operators’ and managers’ frustrations with system
• Determine root causes
• Identify solutions
• Conduct economic analysis
Locating Areas for Improvement

Generation

Distribution

End-Use
Areas for Improvement: Generation

- Improve Economizer Operation
Areas for Improvement: Distribution

- Insulation
- Steam Trap Audit
Areas for Improvement: End-Users

- Steam Accumulator
- Wastewater Heat Exchanger
Economizer Operation
Economizer Operation

• Situation: Economizers operating inefficiently
  – Murray economizer 63% of expected heat recovery
  – Cleaver-Brooks economizers ~10% of expected heat recovery

• Solution: Repair exhaust stacks

• Results: Improve safety and efficiency
# Economizer Operation

<table>
<thead>
<tr>
<th>Economizer</th>
<th>Natural Gas Savings</th>
<th>Cost Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Murray</td>
<td>1,500 mcf/yr</td>
<td>$7,500 /yr</td>
</tr>
<tr>
<td>Cleaver-Brooks #1</td>
<td>1,340 mcf/yr</td>
<td>$6,900 /yr</td>
</tr>
<tr>
<td>Cleaver-Brooks #2</td>
<td>620 mcf/yr</td>
<td>$3,000 /yr</td>
</tr>
</tbody>
</table>
Wastewater Heat Exchanger
Wastewater Heat Exchanger

- Situation: Contaminated water exits cookers at 150°F
- Solution: Clean and repair existing heat exchanger
- Results: Recover a portion of energy to preheat boiler water
## Wastewater Heat Exchanger

<table>
<thead>
<tr>
<th>Implementation Cost</th>
<th>Natural Gas Savings</th>
<th>Cost Savings</th>
<th>Payback Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1,900(^1)</td>
<td>6,630 mcf/yr(^2)</td>
<td>$33,100 /yr</td>
<td>3 weeks</td>
</tr>
</tbody>
</table>

\(^1\) Assumed 50 man-hours of labor required.

\(^2\) Heat exchanger allows make-up water to be heated from 60° F to 110° F.
Steam Accumulator
Steam Accumulator

- Situation: Equipment causes extreme fluctuations in steam demand
- Solutions: Install accumulator to buffer boiler from demand
- Results: Better quality steam, safer operation, fewer boilers required
# Steam Accumulator

<table>
<thead>
<tr>
<th>Projected Annual Savings</th>
<th>3,570 mcf natural gas 17,000 kwh electricity 695,000 gallons water</th>
<th>$23,400</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improve Burner Efficiency</td>
<td>900 mcf natural gas(^1)</td>
<td>$4,500</td>
</tr>
<tr>
<td>Improve Steam Quality</td>
<td>2,130 mcf natural gas 695,000 gallons water</td>
<td>$10,600</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$4,200</td>
</tr>
<tr>
<td>Decrease Boiler Use</td>
<td>540 mcf natural gas(^2) 17,000 kwh electricity(^3)</td>
<td>$2,700</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$900</td>
</tr>
<tr>
<td>Decrease Equipment Damage</td>
<td></td>
<td>$500</td>
</tr>
</tbody>
</table>

\(^1\)Burner efficiency improved by 0.75%.

\(^2\)900 hours of boiler operating time when all three boilers run simultaneously. 10 mcf/hr natural gas required to keep boiler ‘on-line’ without producing much steam.

\(^3\)Electricity required for Cleaver-Brooks #2 burner air supply fan.
# Steam Accumulator

<table>
<thead>
<tr>
<th>Implementation Cost</th>
<th>Natural Gas Savings</th>
<th>Cost Savings</th>
<th>Payback Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>$184,000</td>
<td>3,570 mcf/yr</td>
<td>$23,400 /yr</td>
<td>8 years</td>
</tr>
</tbody>
</table>
# Steam Piping Insulation

<table>
<thead>
<tr>
<th>Implementation Cost</th>
<th>Natural Gas Savings</th>
<th>Cost Savings</th>
<th>Payback Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1,340(^1)</td>
<td>390 mcf/yr</td>
<td>$1,970 /yr</td>
<td>8 months</td>
</tr>
</tbody>
</table>

\(^1\)Based on prices from McMaster-Carr 117. Cost includes 40 man-hours labor required.
# Steam Trap Audit

<table>
<thead>
<tr>
<th>Implementation Cost</th>
<th>Natural Gas Savings</th>
<th>Cost Savings</th>
<th>Payback Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>$9,100&lt;sup&gt;1&lt;/sup&gt;</td>
<td>2,510 mcf/yr</td>
<td>$12,500 /yr</td>
<td>9 months</td>
</tr>
</tbody>
</table>

<sup>1</sup>Based on $168 to replace 30 failed traps, plus 10% for shipping. Assuming 45 min labor per failed trap at $38 per man-hour. Campbell-Sevey audit costs $18/trap.

---

Minneapolis Technical Assistance Program
www.mntap.umn.edu
Thank you!
Questions?