Energy Efficiency Analysis
Gerdau – St. Paul

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Company Overview

• Global Steel Manufacturing Company
• Began Operations in 1901
• Operates in 14 Countries Worldwide
• Largest Producer of Long Steel in the Americas
• Leader in Steel Recycling in North America
• Strong Mission and Values
Company Overview

- Saint Paul, Minnesota – Steel Mill

End Product

Roll Mill / Reheat Furnace

Melt Shop

Shredder
Motivations for Change

- Utility Rates are Rising
- Sustainability Concerns
- Pollution Reduction
- Quality and Reliability
- Remain Competitive
Approach

• Work with Employees to Determine Areas of Possible Improvement
• Gather Process Data
• Research More Efficient Options
• Quantify Savings Potential
• Determine Implementation Costs
• Relay Results and Attempt to Move Forward
Projects

• Electrical Savings
• Water Savings
• Natural Gas Savings
• Waste Reduction
Combustion Air Supply

- **Current System**
  - 125hp Blowers
  - Inlet Guide Vane Flow Control
  - Typical Damper Settings
    - 15 - 30% Open
  - Annual Operating Cost
    - 900,000 kWh $\rightarrow$ $65,000
Combustion Air Supply (cont.)

- **Proposed System**
  - Variable Frequency Drive (VFD) Flow Control
  - Annual Savings: 640,000 kWh → $49,000
  - VFD Install Estimate: $74,100
  - Payback Period: 1.6 Years
Shear Clutch Cooling

- Current System
  - Pneumatic Venturi Blower
  - Consumes 68 CFM of Compressed Air
    - Equivalent Load on Compressor – 16hp
  - Produces 1,700 CFM of Cooling Airflow
  - Annual Operating Cost
    102,000 kWh → $7,400
Shear Clutch Cooling (cont.)

- Proposed System
  - Electric Blower
  - Produces 3,000 CFM of Cooling Airflow
  - Annual Savings
    94,000 $kWh \rightarrow $6,800
  - Blower Install Cost
    $19,200
  - Payback Period - 2.8 Years

Annual Savings: 94,000 kWh \rightarrow $6,800
Compressor Intake Air

• Current System
  – Oil Free Screw Compressor
  – Draws Air Supply from Inside Room
  – Compressor Room is 14°F Warmer than Outside
  – Annual Operating Cost 3,125,000 kWh → $225,000
Compressor Intake Air (cont.)

- Proposed System
  - Intake Cooler Air from Outside
  - Studies Suggest 2.5% Annual Electric Savings
  - Annual Savings $78,000 kWh → $5,600
  - Ducting Cost Estimate $4,000
  - Payback Period - 9 Months
Compressor Cooling

• Current System
  – Closed Loop Evaporative Cooling
  – Annual Operating Cost
    3,600,000 gallons of water → $43,400
Compressor Cooling (cont.)

• Proposed System
  – Closed Loop Dry Cooler
  – Annual Savings Estimate
    3,100,000 gallons of water → $19,700
  – Implementation Estimate $76,000
  – ROI 3.9 Years
North Ladle Pre-Heater

• Current System
  – Natural Gas Fired Ladle Heating
  – Ambient Combustion Air Supply
  – 2,300°F Gases Exhausted to Surrounding Room
  – Annual Operating Cost
    162,000 therms → $86,000
North Ladle Pre-Heater (cont.)

- Proposed System
  - Exhaust Gas Energy Recuperation
  - 900°F Combustion Air Supply
  - Annual Savings Estimate
    82,000 therms → $43,500 *
  - Recuperator Cost Estimate
    $140,000
  - Payback Period 3.2 Years
Leak Testing

• Current System
  – Ultrasonic Leak Detection
  – Annual, Quarterly, and Monthly Leak Test Routes

• Identified & Fixed Leaks
  – 7 Gas Leaks Were Found
    • Oxygen – 2,130,000 ft$^3$
    • Compressed Air - 4,260,000 ft$^3$
    • Natural Gas - 73,000 ft$^3$
    • Annual Savings → $9,800
Leak Testing (cont.)

- Proposed System
  - Prioritize Leak Fixes
  - Install Leak Testing Solution Stations
    - Estimated Cost ~ $1,000
## Summary

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Annual Reduction</th>
<th>Annual Savings</th>
<th>Payback Period</th>
<th>Status</th>
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</thead>
<tbody>
<tr>
<td>Install VFD Units on Combustion Air Fans</td>
<td>640,000 kWh</td>
<td>$49,000</td>
<td>1.6 Years</td>
<td>Recommended</td>
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<tr>
<td>Install Electric Blower for Shear Clutch Cooling</td>
<td>94,000 kWh</td>
<td>$6,800</td>
<td>2.8 Years</td>
<td>Recommended</td>
</tr>
<tr>
<td>Duct Cooler Air to Main Compressor</td>
<td>78,000 kWh</td>
<td>$5,600</td>
<td>9 Months</td>
<td>Recommended</td>
</tr>
<tr>
<td>Install Dry Cooler for Compressor Cooling</td>
<td>3,100,000 gallons water</td>
<td>$19,700</td>
<td>3.9 Years</td>
<td>Recommended</td>
</tr>
<tr>
<td>Install Recuperator on Ladle Pre-Heater</td>
<td>82,000 therms</td>
<td>$43,500</td>
<td>3.2 Years</td>
<td>Recommended</td>
</tr>
<tr>
<td>Fix Identified Gas Leaks</td>
<td>6,400,000 ft³ of gases</td>
<td>$9,800</td>
<td>Immediate</td>
<td>Completed</td>
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</tbody>
</table>
Additional Analysis Required

- **Post Heater Process**
  - Possible Temperature Control
- **Shredder Motor Idle Avoidance**
  - Motor Shutdown
Personal Benefits

• Communication Skills
• Experience in an Industrial Setting
• Gained Knowledge through Real-World Engineering Problems
• Experience Writing Reports
Questions?