Lean Green Project
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Minnesota Technical Assistance Program

University of Minnesota
Overview
Overview: The Company, Uponor

• Polyethylene pipe (PEX) extrusion
• Plumbing, radiant heating/cooling, fire safety
  – Residential
  – Commercial
Overview: The Project

• New extruder system
  – Faster production
  – Higher operation cost
    • Same proportion as production gain
  – No net gain for Uponor

• **Goal:** Minimize operational costs through reduction of energy, water, and other inputs, using Lean tools and philosophies
Approach: Lean Manufacturing

- Philosophy based on continuous improvement
  - Minimize waste
    - Defective product
    - Overproduction
    - Waiting
    - Non-/Under-utilized talent
    - Transportation
    - Inventory
    - Motion
    - Excessive processing
Extrusion Overview
Extrusion Overview
Prioritizing Efforts

Tools
Value Stream Maps

• Lean visual tool to help analyze a process’ current state and plan a future state
Value Stream Maps

- Enterprise MN
- Energy (Electricity)
- Water
- Compressed Air
- Nitrogen Gas
Pareto Charts

- Highlights high-impact factors
  - Histogram + Cumulative Percentages

**Example** Pareto Chart of Client Complaints per Product

- **Number of complaints**
  - Vital few
  - Trivial many

Cumulative %

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A3 Project Management

- Story of a project
  - Background/Problem
  - Root Cause Analysis
  - Goals
  - Action Items
  - Follow Up/Verification

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Action Item: Optimize Curing

• Initial State
  – All settings at 100%
  – Product within specifications

• Final State
  – All settings at 70%
  – Product still within specifications
  – $55,300 annual savings
Action Item: Insulate Extruder

• Reduce heat loss to reduce consumed electricity
  – Heating elements
• 200 – 250 °C
  – Reduce to 43 °C
• Energy reduction
  – $2,600 annual savings
• More safe workplace
Action Item: Switch To Comp. Air

- **Initial State**
  - Nitrogen

- **Final State**
  - Compressed Air
  - $1,300 annual savings
  - No 100% $N_2$ fumes released
Action Item: Redundant Blower

- **Initial State**
  - Cooling Tank 1 → Cooling Tank 2 → Air Blower → Measure → Cooling Tank 3 → Air Blower → Measure → Coil

- **Final State**
  - Cooling Tank 1 → Cooling Tank 2 → Cooling Tank 3 → Air Blower → Measure 1 → Measure 2 → Coil

- $650 annual savings
## Action Items

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Initial State</th>
<th>Future State</th>
<th>Reduction</th>
<th>Annual Savings</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optimize Curing Process</td>
<td>115.2 kW</td>
<td>38.4 kW</td>
<td>76.8 kW</td>
<td>$55,300</td>
<td>In Progress (95%)</td>
</tr>
<tr>
<td>Insulate Extruder Barrel</td>
<td>3.7 kW</td>
<td>0.1 kW</td>
<td>3.6 kW</td>
<td>$2,600</td>
<td>In Progress (75%)</td>
</tr>
<tr>
<td>Switch from Nitrogen to Compressed Air</td>
<td>12 ft³/hr N₂</td>
<td>12 ft³/hr Air</td>
<td>12 ft³/hr N₂</td>
<td>$1,300</td>
<td>In Progress (95%)</td>
</tr>
<tr>
<td>Remove Redundant Blower</td>
<td>0.9 kW</td>
<td>0 kW</td>
<td>0.9 kW</td>
<td>$650</td>
<td>In Progress (50%)</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>119.8 kW,</strong> 12 ft³/hr N₂</td>
<td><strong>38.5 kW,</strong> 12 ft³/hr Air</td>
<td><strong>81.3 kW,</strong> 12 ft³/hr N₂</td>
<td><strong>$59,800</strong></td>
<td></td>
</tr>
</tbody>
</table>
Internship Benefits

• Project Management
• Models
  – Cost Analysis
  – Energy Flow
• Lean Manufacturing Principles
Q & A