Water Reduction at Electric Machinery

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Driven to Discover SM
Background

• Founded in 1891
• Custom manufactures motors and generators
• Large scale production
  • 150,000 HP
  • 200,000 KVA
Project Goal

- Completely reduce water used for non-contact cooling
- Remove chemical treatment
- Eliminate wastewater permit requirements on EM’s stormwater permit.
First Steps

• Identify sources of water use
  • Maintenance department

• Calculate total water use
  • MPCA reports

• Gather total savings potential
Gathering Data

- Test Department
  - Cliff Anderson
- Flow meters
- IR camera
- Past data
Water Reduction

• Opportunity to Eliminate Water
  • Portable Lube Systems
  • Gearboxes
  • Generators
Replacements Considered

• Water Chillers
• Large Scale Recirculation
• Air cooled heat exchangers
Opportunity for Air Cooled Heat Exchangers

- **Non-Contact Water Users**
  - 12.5 Generator
    - 480,000 GPY
  - Elliot Generator
    - 200,000 GPY
  - Misc. Air Heat Exchangers
    - 270,000 GPY
  - Other Solution
    - 830,000 GPY
  - Total Non-Contact Water Use
    - 1,780,000 GPY

Water Use Summary:

- 12.5 Generator 27%
- Elliot Generator 11%
- Misc. Air Heat Exchangers 15%
- Other Solution 47%
# Water Reduction Solutions

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Waste/Water Reductions Per Year</th>
<th>Implementation Cost</th>
<th>Net Savings Per Year</th>
<th>Payback Period</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Heat Exchangers for 12.5 Room</td>
<td>480,000 Gallons of Water</td>
<td>$3,400</td>
<td>$4,600</td>
<td>0.8 years</td>
<td>Implementing</td>
</tr>
<tr>
<td>Air Heat Exchanger for Elliot Generator</td>
<td>200,000 Gallons of Water</td>
<td>$1,000</td>
<td>$1,800</td>
<td>0.6 years</td>
<td>Implementing</td>
</tr>
<tr>
<td>Other Air Heat Exchangers</td>
<td>270,000 Gallons of Water</td>
<td>$12,600</td>
<td>$2,600</td>
<td>4.8 years</td>
<td>Incremental implementation</td>
</tr>
</tbody>
</table>
Water Recirculation

- Machine Enclosures
- Spot Welders
Opportunity for Recirculation

• **Non-Contact Water Users**
  • **Spot Welder**
    • 700,000 GPY
  • **Machine Enclosures**
    • 130,000 GPY
  • **Air Heat Exchanger Solutions**
    • 950,000 GPY
# Water Recirculation Solutions

<table>
<thead>
<tr>
<th>Recommendations</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Water Chiller for Spot Welder</td>
<td>700,000 Gallons of Water</td>
<td>$4,900</td>
<td>$6,600</td>
<td>0.7 years</td>
<td>Implementing</td>
</tr>
<tr>
<td>Water Recirculation for Machine Enclosures and Turbo Generators</td>
<td>130,000 Gallons of Water</td>
<td>$46,100 <em>Update</em> $14,000</td>
<td>$1,200 (Water) $8400 (Permit + Labor)</td>
<td>30 years <em>Update</em> 1.46 Years</td>
<td>Not Planned <em>Update</em> Planned</td>
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</tbody>
</table>
Chemical Treatment

- Sodium Bisulfite is used to Remove Chlorine
- Dripped at a consistent rate
Possible Chemical Solutions

• Intermittent Low Drip
• Automated System
# Chemical Treatment Savings

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Waste/Water Reductions Per Year</th>
<th>Implementation Cost</th>
<th>Net Savings Per Year</th>
<th>Payback Period</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automated Dosing System</td>
<td>390 Gallons of Sodium Bisulfite</td>
<td>$4,400</td>
<td>$4,600</td>
<td>&lt; 1 year</td>
<td>Implementing</td>
</tr>
<tr>
<td>Constant Intermittent Slower Drip</td>
<td>390 Gallons of Sodium Bisulfite</td>
<td>$400</td>
<td>$4,600</td>
<td>&lt; 1 year</td>
<td>Not Planned</td>
</tr>
</tbody>
</table>
## All Final Solutions

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Waste/Water Reductions Per Year</th>
<th>Implementation Cost</th>
<th>Savings Per Year</th>
<th>Payback Period</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automated Chemical Dosing</td>
<td>390 Gallons Sodium Bisulfite</td>
<td>$4,400</td>
<td>$4,600</td>
<td>&lt; 1 year</td>
<td>Implementing</td>
</tr>
<tr>
<td>Install Air Cooled Heat Exchangers</td>
<td>950,000 Gallons of Water</td>
<td>$16,500</td>
<td>$9,000</td>
<td>1.9 years</td>
<td>Implementing</td>
</tr>
<tr>
<td>Water Chiller for Spot Welder</td>
<td>700,000 Gallons of Water</td>
<td>$4,900</td>
<td>$6,600</td>
<td>&lt; 1 year</td>
<td>Implementing</td>
</tr>
<tr>
<td>Water Recirculation for Machine Enclosures</td>
<td>130,000 Gallons of Water, <em>Labor and Permit Fees</em></td>
<td>$46,100 <em>Update</em> $14,000</td>
<td>$1,200 <em>+$8,400</em></td>
<td>30 years <em>1.5 years</em></td>
<td>Not Planned <em>Update</em> Planned</td>
</tr>
<tr>
<td>Total</td>
<td>1,780,000 Gallons of Water 390 Gallons Sodium Bisulfite</td>
<td>$39,800</td>
<td>$29,800</td>
<td>1.3 years</td>
<td>Implementing</td>
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</tbody>
</table>
## Complete Water Elimination Savings

<table>
<thead>
<tr>
<th>Description</th>
<th>Waste Reductions Per Year</th>
<th>Savings Per Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Water Reduction</td>
<td>1.78 Million Gallons of Water</td>
<td>$16,800</td>
</tr>
<tr>
<td>Chemical Treatment Reduction</td>
<td>440 Gallons of Sodium Bisulfite</td>
<td>$5,200</td>
</tr>
<tr>
<td>Permit Elimination</td>
<td>Annual Permit Fee</td>
<td>$1,200</td>
</tr>
<tr>
<td>Labor Savings</td>
<td>72 Hours of Labor</td>
<td>$7,200</td>
</tr>
<tr>
<td><strong>Total Potential Savings</strong></td>
<td></td>
<td><strong>$30,400</strong></td>
</tr>
</tbody>
</table>
Personal Benefits
Thank you!