Reduce Water Usage
Xcel Energy Riverside

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University of Minnesota
Driven to Discover™
Company Overview

• Electric and natural gas utility
• Headquarters in Minneapolis, MN
  • Riverside Generation: 1911
  • coal → natural gas combined cycle
• Generation energy sources:
  • coal
  • natural gas
  • nuclear
  • wind, solar, hydro
Combined Cycle
Incentives for Change

• **Reduce water usage**
  • Reduce process waste water discharge to environment
  • Decrease operational load required by equipment
    • Treatment systems
    • Pumps

• **Decrease in operational costs**
  • Treatment systems
  • Pumps
Reasons for MnTAP Assistance

• Explore opportunities for water savings
• Determine most impactful system optimizations
• Make recommendations for reducing water usage
• Initiate implementation of reduction project
Plan of Approach

• Observed systems that direct effluent water to drain
• Performed water balances on system
• Gathered information from engineers, operators, I&C
• Determine variables for optimization
• Make reduction recommendations
• Constructed plans for project implementation
Determining Beneficial Recommendations

• Determine resulting water and economic savings
• Consider required investment for reduction implementation
• Determine payback period for the project
• Recommend projects that result in significant savings
  • Water savings
  • Economic savings
  • Investment required
  • Payback period
Reverse Osmosis Recovery Increase

Opportunity:

• Reverse osmosis systems capable of operating at higher recoveries
• 75% Recovery
  ➔ 75% treated
  ➔ 25% wasted
• RO 1: Absence of concentrate flow control
• RO 2: Concentrate flow set higher than necessary
Reverse Osmosis Recovery Increase

Solution:
• RO 1: install control valve on concentrate flow
• RO 2: decrease set concentrate flow rate

Annual Savings:
• RO 1: 920,000 gallons & $2,100
• RO 2: 800,000 gallons & $1,800

* gallons of well water and operating costs of pumping and treatment
Auxiliary Heating Condensate Recovery

Opportunity:

- Condensate is sent to drain due to ionic contamination, rather than being recycled as makeup
- Previously was treated and recovered as makeup
- Increase in water usage and discharge to environment
Auxiliary Heating Condensate Recovery

Solution:
• Install treatment system with cation and mixed resin deionization
• Then recycle as makeup water to storage tank

Annual Savings:
• 3,800,000 gallons of well water
• $9,500 from pumping and treatment

Consider:
• Investigate source of ionic contaminants
Sampling System Recovery

Opportunity:
- Conductivity analyzer sampled water sent to drain
- Deionized high quality water
- Flows 8,700 hours annually
Sampling System Recovery

Solution:
• Redirect flow to nearby storage tank
• Use flexible tubing for simple implementation

Annual Savings:
• 700,000 gallons of well water
• $1,600 from pumping and treatment
Evaporative Cooler Optimization

Opportunity

• Blowdown significantly higher flow than necessary
• Unintentional
• Blowdown valve operation
Evaporative Cooler Optimization

Solution:

• Decrease continuous blowdown rate by throttling valve
• Repair blowdown valve for intermittent blowdown

Annual Savings:

• 650,000 gallons of well water
• $1,200 from pumping and treatment
## Recommended Projects

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Annual Water Reduction</th>
<th>Implementation Cost</th>
<th>Annual Savings</th>
<th>Payback Period</th>
<th>Project Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Implement treatment of recovered condensate</td>
<td>3,840,000 gal</td>
<td>$6,300</td>
<td>$9,500</td>
<td>8 months</td>
<td>Testing</td>
</tr>
<tr>
<td>Increase recovery of first reverse osmosis</td>
<td>920,000 gal</td>
<td>$3,200</td>
<td>$2,000</td>
<td>1.6 years</td>
<td>Recommended</td>
</tr>
<tr>
<td>Increase recovery of second reverse osmosis</td>
<td>800,000 gal</td>
<td>$0</td>
<td>$1,800</td>
<td>Immediate</td>
<td>Implemented</td>
</tr>
<tr>
<td>Recover water from sampling system</td>
<td>700,000 gal</td>
<td>$50</td>
<td>$1,600</td>
<td>2 weeks</td>
<td>Testing</td>
</tr>
<tr>
<td>Optimize the operation of evaporative coolers</td>
<td>650,000 gal</td>
<td>$0</td>
<td>$1,200</td>
<td>Immediate</td>
<td>Testing</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>6,910,000</strong></td>
<td><strong>$9,550</strong></td>
<td><strong>$16,100</strong></td>
<td><strong>7.1 months</strong></td>
<td>-</td>
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</tbody>
</table>
Other Projects

• Recovery of water from other sampling systems
• Use the reverse osmosis concentrate for cooling
• Install control valve on city water supply to evaporative cooler storage to avoid overfilling
Personal Benefits

• Engineering experience
• Experience in power generation
• Resourcefulness
• Self Confidence
Questions?