Water and Energy Efficiency at Fulton Beer Company

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MnTAP Advisor: Michelle Gage
On-Site Supervisor: Paul McDonald
Company Overview

• History
  • Founded in 2009 out of Minneapolis garage
  • Purchased 20 bbl taproom/brewery in 2010
  • Built 80 bbl production facility in 2013

• Current Status
  • Ranked 100th largest craft brewery
  • 43 employees
  • Produce 33,000 bbl/year
Motivations for Change

• Brewing is water intensive
  • Takes 4-9 barrel of water per barrel beer

• Breweries produce strong effluent
  • ~10,000 mg/L COD
  • ~1,000 mg/L TSS

• Costly strength charges to treat wastewater
Reasons for MnTAP Assistance

• Audit energy and water usage
• Identify opportunities for reduction
  • Water consumption
  • Energy consumption
  • Wastewater strength
• Give recommendations with associated savings and ROI
Approach

• Map water usage throughout the facility
  • Flow meters
  • Observe processes

• Investigate brewery effluent strength and volume
  • Wastewater reports (Volume, COD/TSS)

• Determine highest strength discharges
  • Perform COD/TSS analysis on discharges
Water Usage Map

City Water
- Brewhouse: 60%
- Cellar: 8%
- CIP Skid: 3%
- Packaging: 29%

Beer
- Spent Grain: 35%
- Sewer: 17%

Spent Grain
- Beer: 8%

Sewer
- City Water: 3%

Fulton Beer Yearly Waste Water
- Volume: 3,500,000 gal
- COD: 8,000 mg/L
- TSS: 800 mg/L
- COD Rate: $0.111/lb
- TSS Rate: $0.222/lb
- Cost: $25,000
Investigation Strategies

• **Water Consumption**
  - Focused on highest consumption
    - Packaging lines, brewhouse
  - Talked with employees
    - Obvious waste or reduction ideas

• **Effluent Strength**
  - Focused highest TSS/COD level discharge
    - Yeast dumps in cellar
    - Hot trub in brewhouse
## Recommendation: Canning Line

- **Reuse internal rinse water for external rinse and reduce flow**
  - **Current State**
    - City water used for internal/external rinse
  - **Why**
    - External rinse removes beer/foam
    - Internal rinse water should be suitable
  - **Solution**
    - Use internal rinse for external rinse

### Recommendations

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>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>Use Internal Rinse for External Rinse, reduce flow</td>
<td>115,000 gallons</td>
<td>$50</td>
<td>$1,100</td>
<td>1 month</td>
<td>Implemented</td>
</tr>
</tbody>
</table>
Recommendation: Canning Line

Before

After
**Recommendation: Bottling Line**

- **Recirculate vacuum pump cooling and sealing water**
  - **Current state**
    - 5.25 gal/min of city water dumped down drain
  - **Why**
    - Pump could reuse water if cooled
  - **Solution**
    - Add cooling coil, reclamation vessel and pump

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<tbody>
<tr>
<td>Recycle Loop on Vacuum Pump</td>
<td>230,000 gallons</td>
<td>N/A</td>
<td>$2,100</td>
<td>N/A</td>
<td>Recommended</td>
</tr>
</tbody>
</table>
Recommendation: Kegging Line

- **Fix broken valve on kegging line**
  - **Current state**
    - Broken valve causes hot water overflow in caustic bay
  - **Why**
    - No need for water overflow
  - **Solution**
    - Replace broken valve

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<tr>
<td>Fix Broken Valve on Caustic Bay</td>
<td>71,000 gallons 500 therms</td>
<td>$25</td>
<td>$1,000</td>
<td>1 month</td>
<td>Recommended</td>
</tr>
</tbody>
</table>
Recommendation: Brewhouse

• Add spray nozzles kettle
  • Current state
    • Brewers spent hop bed to remove trub
  • Why
    • Reduce water use
    • Reduce waste volume
• Solution
  • Install Flatjet spray nozzles on side of kettle

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<tr>
<td>Add Spray Nozzles to Kettle</td>
<td>42,000 gallons</td>
<td>$2,900</td>
<td>$450</td>
<td>6.5 years</td>
<td>Recommended</td>
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Recommendation: Effluent Strength

- **Evaporate high strength waste**
  - **Current status**
    - Yeast and cold trub goes to drain
    - Causes high COD/TSS
  - **Why**
    - Evaporator prevents waste from touching effluent
  - **Solution**
    - Dewater yeast and mix with spent grain

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<td>Evaporate yeast water</td>
<td>20,000 gallons</td>
<td>$50,000</td>
<td>$9,100</td>
<td>5 years</td>
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**Recommendation: Boilers**

- **Insulate boiler head plates**
  - **Current state**
    - Uninsulated head plates
  - **Why**
    - 240°F head plates radiate a lot of heat
  - **Solution**
    - Add removable thermal blanket insulation to head plates

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<td>Install head boiler plates</td>
<td>700 therms</td>
<td>$3,000</td>
<td>$400</td>
<td>7.5 years</td>
<td>Recommended</td>
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### Recommendation Summary

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<td><strong>Total Savings</strong></td>
<td><strong>478,000 gallons water 1,200 Therms</strong></td>
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Personal Benefits

• Gained valuable experience
• Built confidence
• Interface with variety of people
• Learned about the brewing process and waste
• Organizational skills
Questions