WATER REDUCTION IN THE WATER INTENSIVE BREWING INDUSTRY

JULIE SMITH, PE, OPTIMIZATION ENGINEER

3/20/14
Brewery Water Reduction - Overview

- Corporate Goals and Score Carding
- Water Usage in the Brewery
  - Processes
  - Sources
- Evolution of Water Reduction
- 2012 Water Reduction Projects
- Short Interval Control
- 2013 Water Reduction Projects
- 2013 Results
- Conclusions
Corporate Sustainability Goals

- Energy Usage of 120 MJ/HL by 2015
  - Electricity
  - Steam
  - Vehicle Fuel
- Water Usage of 3.18 HL/HL by 2012
- Zero Waste to Landfill by 2015
- CO$_2$ Self-Sufficiency of 85% by 2015
- 50% Reduction in Green House Gas by 2020

BHAG – 4$^{th}$ Brewery or Better in MillerCoors
### MillerCoors

#### Monthly Indicator

<table>
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<tr>
<th>Monthly Indicator*</th>
<th>Mthly Actual</th>
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#### Water (hl/hl)

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### Monthly/YTD/Budget KPI

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<td>Reduced Usage</td>
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*Monthly Indicator relative to 2009-2011 usage rates. Linear regression model factors include brewed, packed, weather, rainfall, electrical generation.

NP: Nothing Planned
Brewery Process Overview

- Malting
- Brewing
- Fermenting
- Conditioning
- Packaging
- Warehousing
Brewery Water Value

- Value of Water
  - Temperature
  - Treatment
  - Chemicals

- Beer!
- Condensate – Hot/RO
- Hot CIP water
- Ambient water – A Water, B Water
- Chemicals
- Cooling Water
- Wastewater
- “Clean” Wastewater

High $ ▲

Low $ ▼
Evolution of Water Reduction

Where do we Start??

I. Stop the Bleeding
   - Leaks
   - Turn it off

II. Process Changes
   - Simple
   - Complex

III. Focus on Energy
   - Water Will Follow

IV. Capital Projects
   - Metering
   - CO2 Scrubber
   - Condensate/Flash Steam Recovery

V. Water Re-Use
Golden Brewery Water Wins - 2012

- All Teams – Leaks – Steam, Plant Air, Water
- Beer Processing - Cold Sanitization in Cellar 12 Filtration, C10, SPF
- Packaging
  - Water Savings – Dry Lube, Spray Nozzle Pressure Reduction
  - Green Shut-Downs
- Turbine
  - Pump Seal Water Savings
  - Close Eye Wash Drains
  - Frick Evaporative Condenser – Less Energy, More Water
- Short Interval Control – Initiate Concept
- Facilities –
  - Waterless Urinals
- Condensate Return – WH2 CIP HE, NB1 6th Floor CIP HE, NB4 Cond Equalization HE
- Water Plant – “A” Water Pressure Reduction, Supply Valve Replacement
- Brew House
  - Decrease Water Brews
  - CIP Reductions
Savings Opportunities – Water and Wastewater

PACKAGING SEWER LINE FLOW RATES

FLOW RATE, gal/min

Nov-11 Dec-11 Feb-12 Apr-12 May-12 Jul-12 Aug-12 Oct-12 Dec-12 Jan-13 Mar-13

East Line
West Line
WH3
WH1
TOTAL
GOLDEN BREWERY DAILY ENERGY AND WATER USAGE

**Energy**
- Total Steam Usage: 5,132,351 MJ
- Total Electrical Usage: 1,363,424 MJ
- Total Usage*: 7,215,783 MJ
- **Total:** 151 MJ/HL

*Trend Data*
- **Week to Date:** 197 MJ/HL
- **Month to Date:** 202 MJ/HL

*Includes Steam corrected for Boiler Efficiency and Condensate Return Electricity and Vehicle Fuel

**Water**
- A Water Usage: 54,052 BBLs
- B Water Usage: 66,560 BBLs
- Total Usage: 120,621 BBLs

* Trend Data
  - **Week to Date:** 4.02
  - **Month to Date:** 4.41

**Graphs:**
- Energy Usage for Current Week (MJ)
- Water Usage for Current Week (BBL)
- Energy Usage for the Month (MJ)
- Water Usage for the Month (BBL)
Golden Brewery Daily Scorecard
With Area Breakout

Enter Day: 11/20/2013 (mm/dd/yyyy)
Packaged Volume (BBLS) 49,059
Brewed Volume (BBLS) 13,500

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<th>Actual MJ</th>
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Energy Usage (MJ)

Water Usage (BBL)
Golden Brewery Water Reduction - 2013

- Reduce Kettle Evaporation – 0.03 HL/HL
- Packaging Shut off B Water to Full Can Rinser – 0.023 HL/HL
- C14 Fire Pump Seal Water Leak Repair – 0.02 HL/HL
- Aging Recovery of CIP Rinse – 0.015 HL/HL
- Brewing Shut off Dead Leg Bleeders DA Manifold – 0.004 HL/HL
- UOPS Correct Condensate Leak to GBL – 0.015 HL/HL
- Prevent Hot A Water Overflow – 0.11 HL/HL
- 4-Can Condensate Recovery – 0.001 HL/HL
- Facilities Turf Reduction Water Savings – 0.006 HL/HL
- Facilities Evaporative Cooling Reduction – 0.023 HL/HL
- Brewing FIT Water Savings – 0.059 HL/HL
- PWTP Waterless Dechlorination – 0.003 HL/HL
- C12 Hot Water Heater for Liquid Adjunct Pump – 0.016 HL/HL
- UOPS B1 Cooling Water Evap Reduction – 0.044 HL/HL
- C11 Cold Sanitization – 0.011 HL/HL
- YDP CIP Re-Use of Still Bottoms – 0.005 HL/HL
- Packaging Vacuum Pump Seal Water Reclaim – 0.005 HL/HL
- Gov Cellar – re-use sanitation water for flushing tanks and headers – 0.00057 HL/HL
- Brewing Hot Water Cycle Time Reduction – 0.025 HL/HL
- Brewing Reduce Wort Cooler CIP Flush Rates – 0.0028 HL/HL
- 7-Bottle Warmer Reduced Water Changes – 0.0005 HL/HL
- Fermenting CIP Pulse Cleaning – 0.024 HL/HL
- YDP B-Water Overflow Valve Corrected – 0.019 HL/HL
- C12 Basement Hot Water Heat Replacement – 0.01 HL/HL
- UOPS C1 Cooling Tower Evap Reduction – 0.15 HL/HL

1 HL/HL = 300 MG/Yr
600 gpm
Golden Brewery Water Reduction - 2013

B1 Lake Makeup

Water Flow, gpm

Golden Brewery Water Reduction - 2013

C1 Lake Evaporation Rates - 2013 vs 2014

C1 Lake Evaporation, gal/day

Month

Nov-13 Jan-14 Mar-14 Apr-14 May-14 Jun-14 Jul-14 Aug-14 Sep-14 Oct-14 Nov-14 Dec-14
Flash Steam Recovery Heat Exchanger

30 Million LBS/yr steam
3.6 Million gal/yr condensate
Water Re-Use/Recovery

- YDP use of still bottoms
- Liquid Adjunct Pump Recirculation
- Vac Pump seal water recirc
- CIP Pre-rinse
- Packaging Recliam Cascade
Water Re-Use/Recovery

Packaging Cascade

Empty Can/Bottle Rinser

Full Bottle Rinser
or
Seal Water

Can Crusher

Sewer

Clean Use

Dirty Use
Golden Brewery Water Reduction - 2013

Total-Water Reduction 2013 vs 2012

Gallons/Month

0  20,000,000  40,000,000  60,000,000  80,000,000  100,000,000  120,000,000  140,000,000  160,000,000

Jan  Feb  Mar  Apr  May  Jun  Jul  Aug  Sept  Oct  Nov  Dec

2012  2013
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#### Total Energy (MJ/hl)

- **Warning:** Below Glide Slope Target
- **Above Glide Slope Target**
- **Between Stretch & Glide Slope Target**
- **Below Stretch Target**

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**Note:** Monthly Indicator relative to 2012 usage rates. Linear regression model factors include brewed, packed, weather, rainfall, electrical generation.
Conclusions

1. Leadership
2. Scorecarding
3. Culture
4. Shared Learnings
5. Start Simple – Build Momentum
6. Process Changes
   • Minimum Cost
   • High Impact
7. Capital Projects
   • High Cost
   • Impact Depends on Culture
“NEVER DOUBT THAT A SMALL GROUP OF THOUGHTFUL, COMMITTED PEOPLE CAN CHANGE THE WORLD. INDEED, IT IS THE ONLY THING THAT EVER HAS.”

Margaret Mead