Master Brewers Association of the Americas
Dedicated to the technology of brewing.
MBAA Annual Conference

# Identifying Hidden Opportunities in Your Operations: Benefits of a Total Plant Approach

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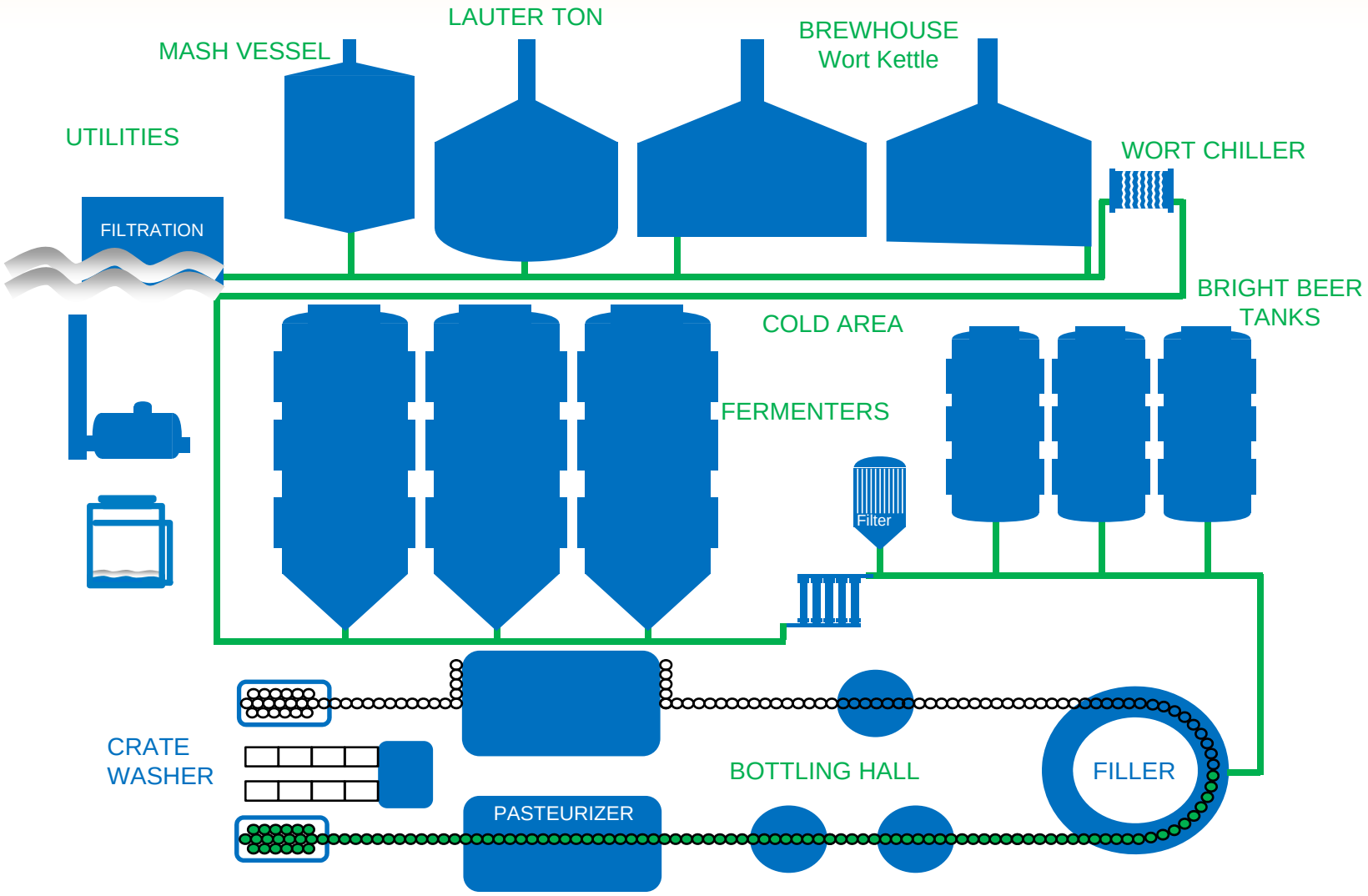
# Agenda

- Brewery overview
  - Holistic perspective
- Key performance indicators (KPIs)
  - Brewery-specific goals
- Case studies
  - Reduction in water usage
  - Reduction in energy usage
  - Project prioritization
- Baseline tracking
- Open discussion / Q&A

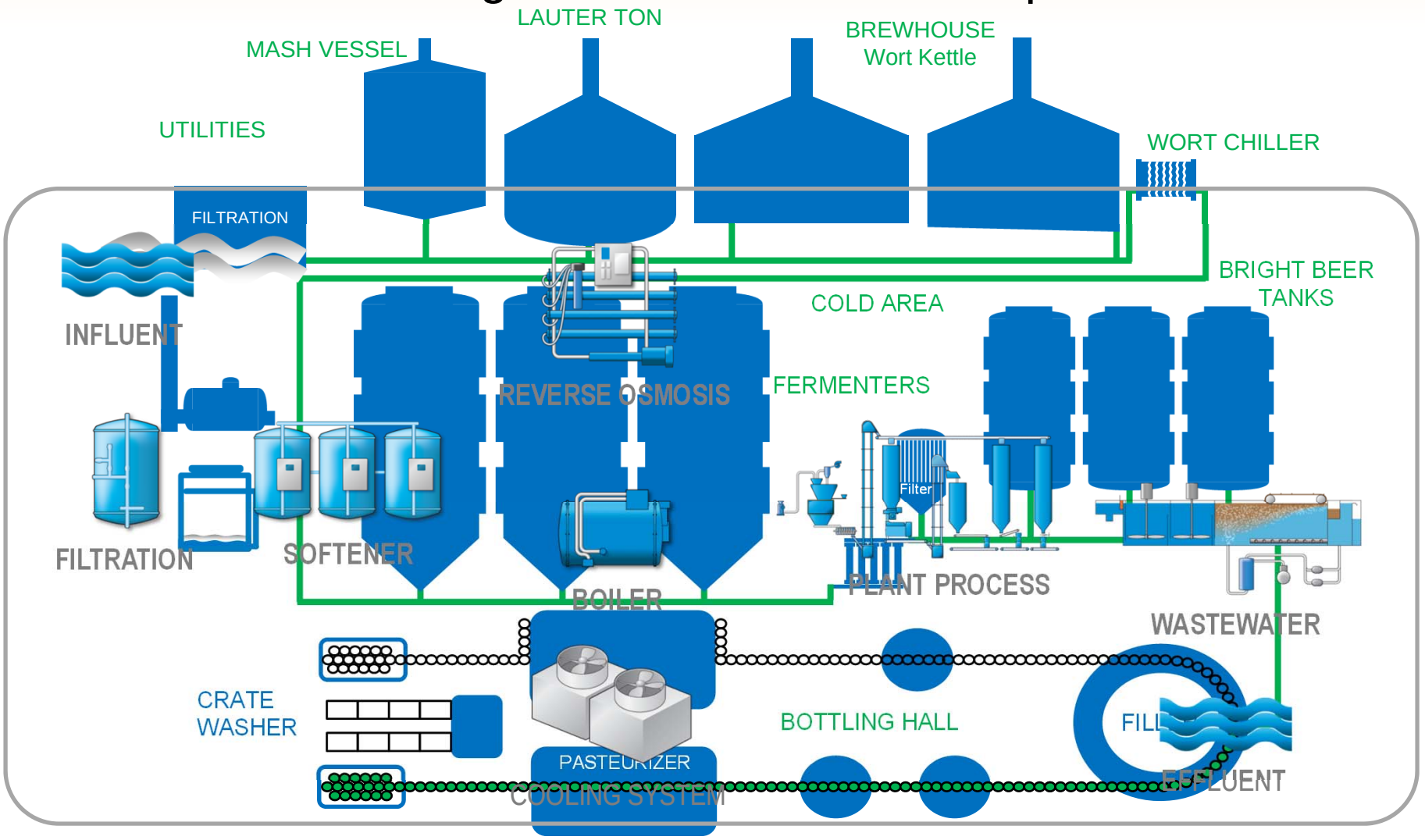


# Brewery Overview



# Holistic Approach

## Understanding Your Interconnected Operations

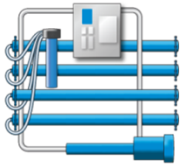


# Holistic Approach

Understanding Your Interconnected Operations

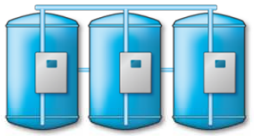
## Water Treatment

INFLUENT

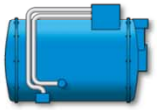


REVERSE OSMOSIS

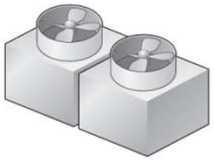
FILTRATION



SOFTENER

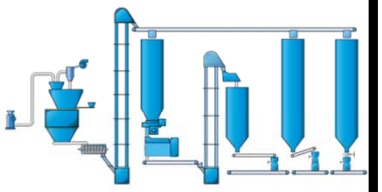


BOILER



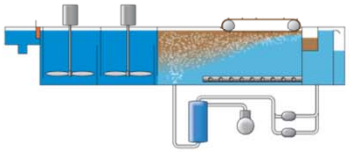
COOLING SYSTEM

## Cleaning & Sanitization



PLANT PROCESS

## Wastewater Treatment



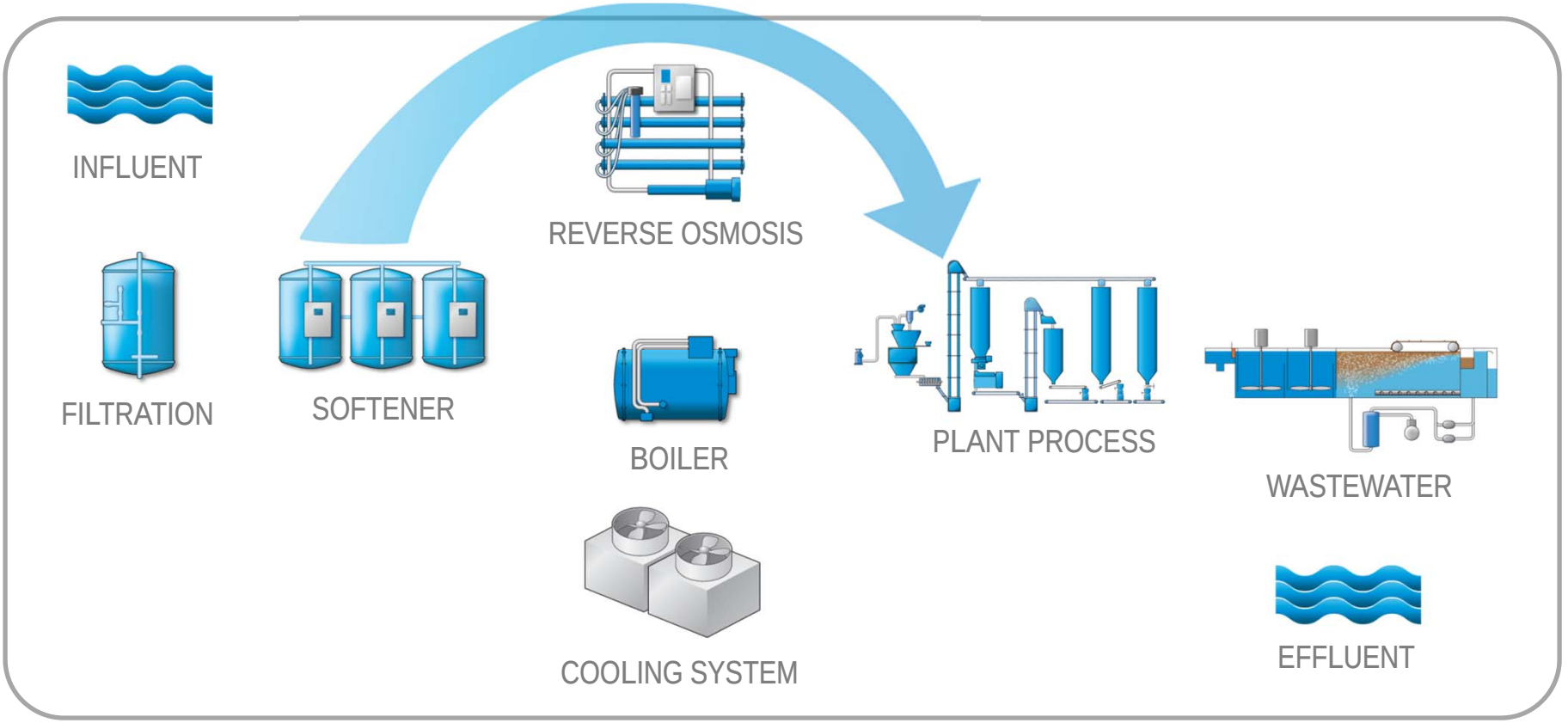
WASTEWATER

EFFLUENT

# Holistic Approach

## Understanding Your Interconnected Operations

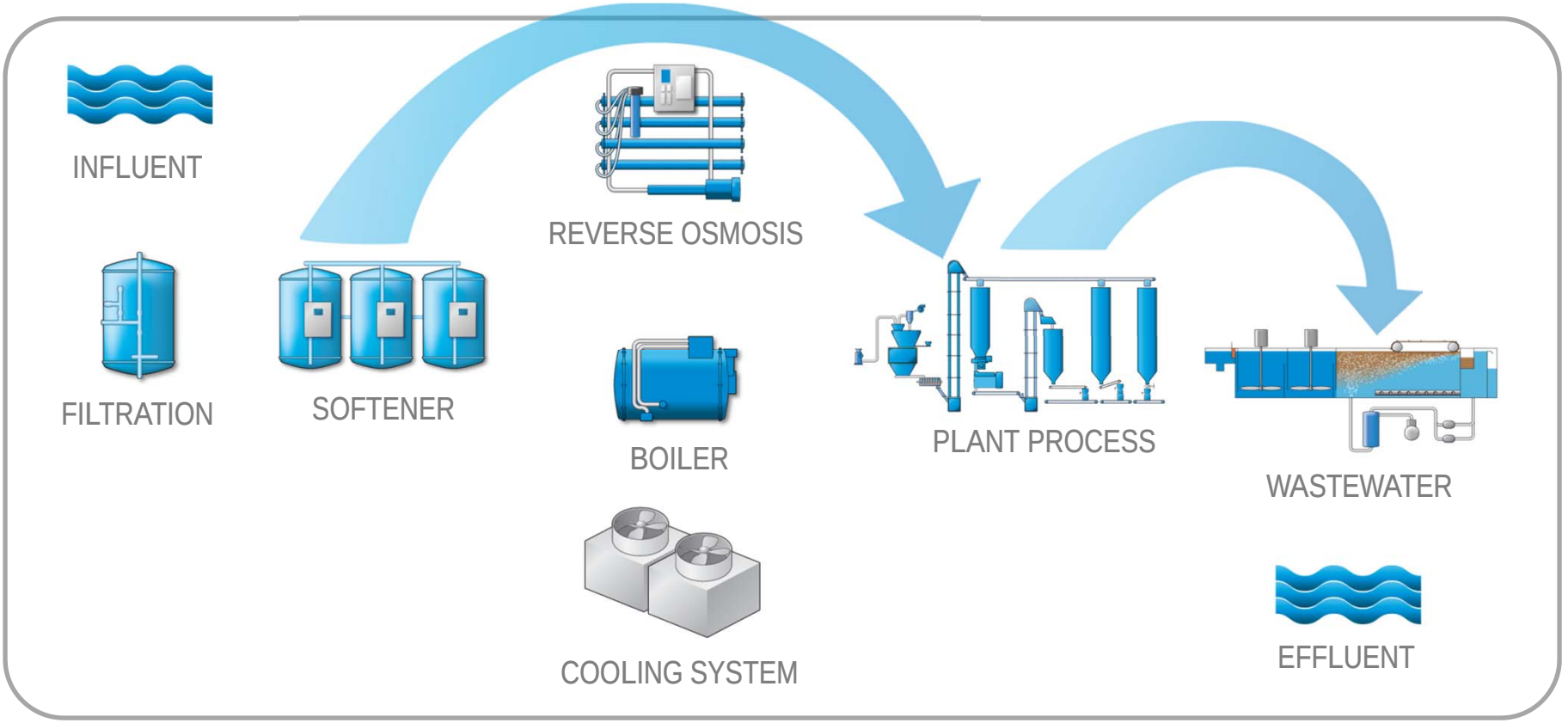
### Water quality impacts cleaning efficiency



# Holistic Approach

## Understanding Your Interconnected Operations

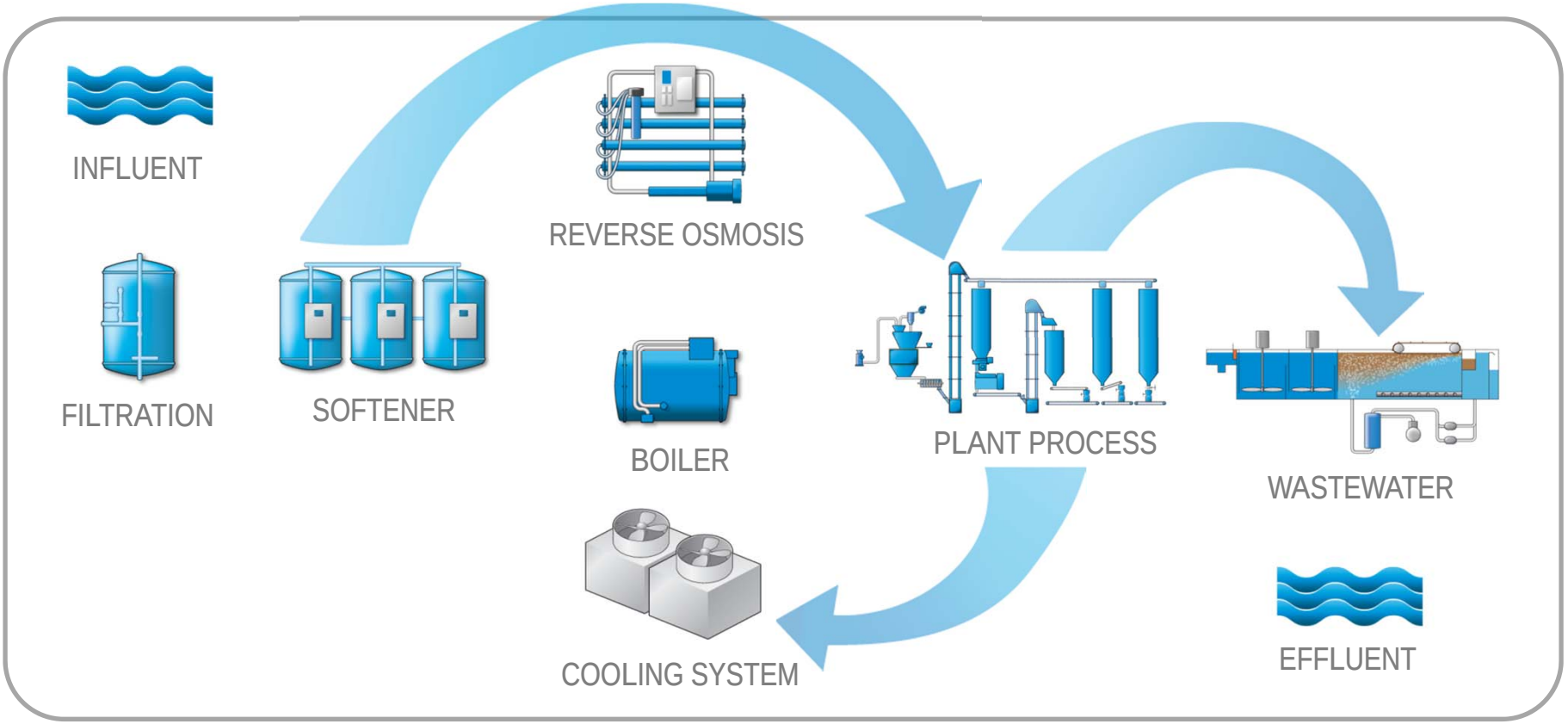
### Cleaning chemistry affects wastewater treatment



# Holistic Approach

## Understanding Your Interconnected Operations

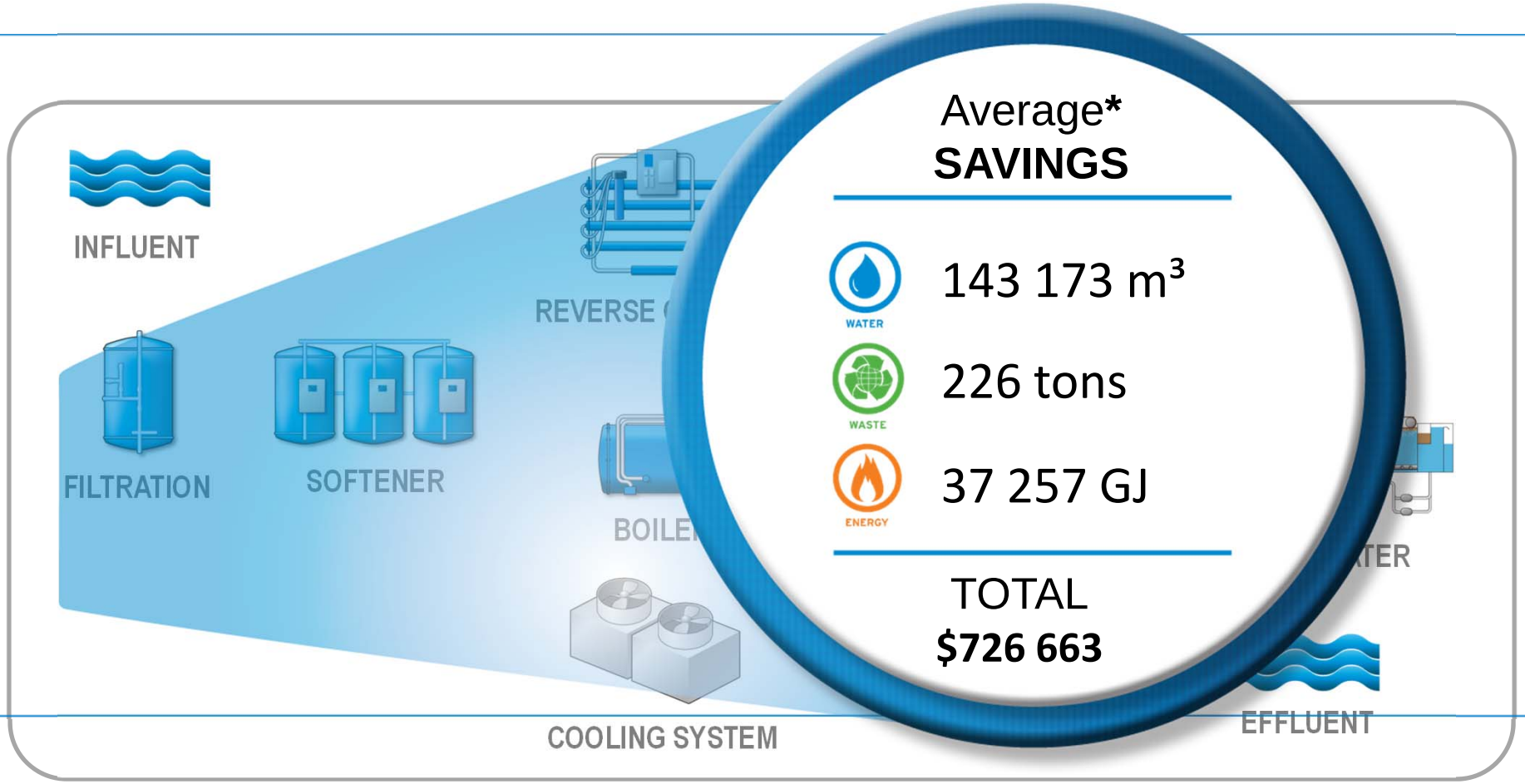
**Water and heat/energy from one process can be used in another**




**REPURPOSE | REUSE | REDUCE**

# Proven Results from Partnerships

## Delivering Improved Profits




Averages based on Total Plant Assessments conducted and implemented at 45 food and beverage manufacturing and processing facilities.

# Determining Your Business Drivers

## Product quality


- Food and product safety
- Product quality
- Brand image

## Operational efficiency


- Total cost of operation reductions
- Improved productivity

## Sustainability


- Water
- Energy
- Waste

# Assessment Scope

Reduce Water


Reduce Energy

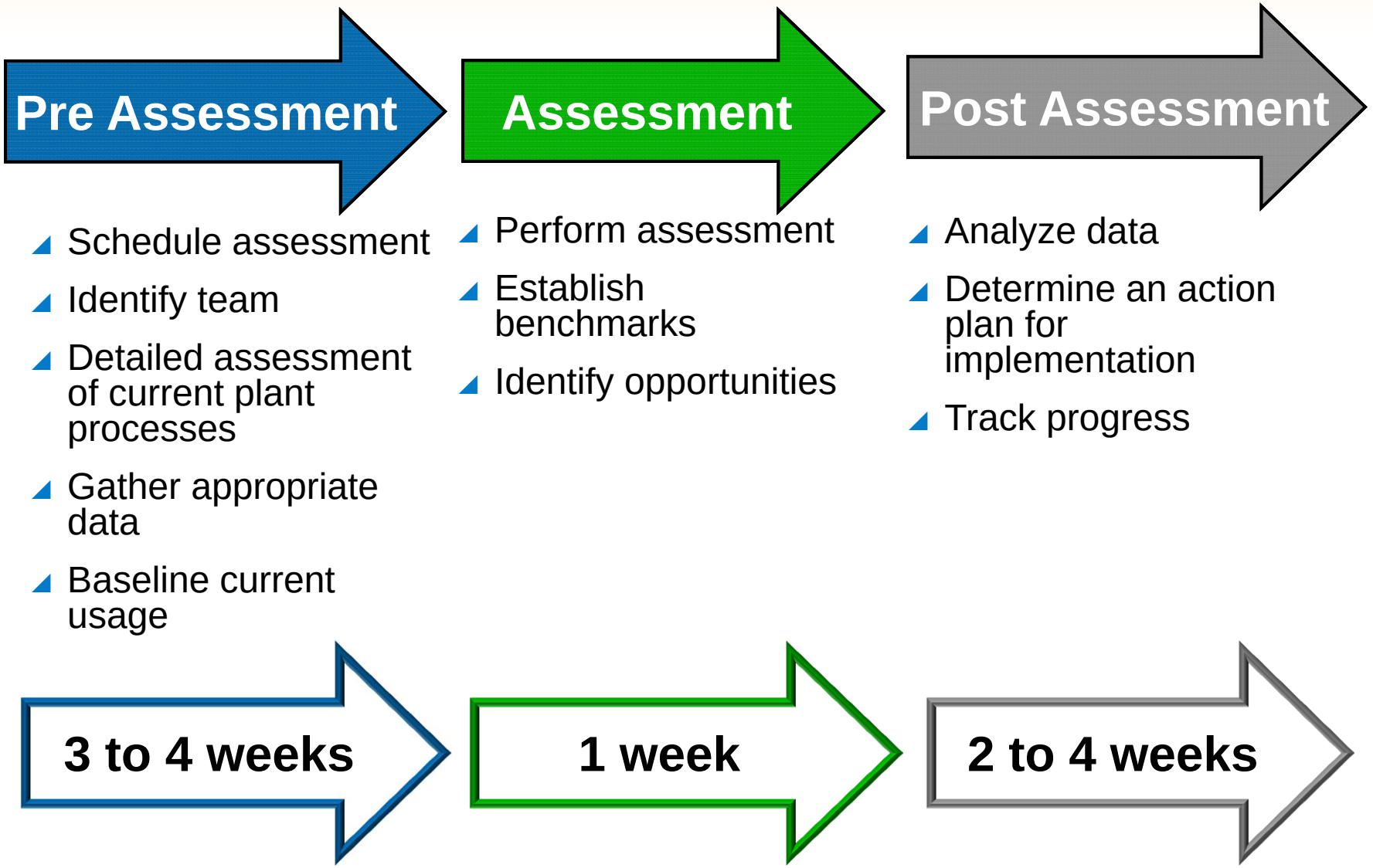

Increase Productivity


Waste Stream Impact

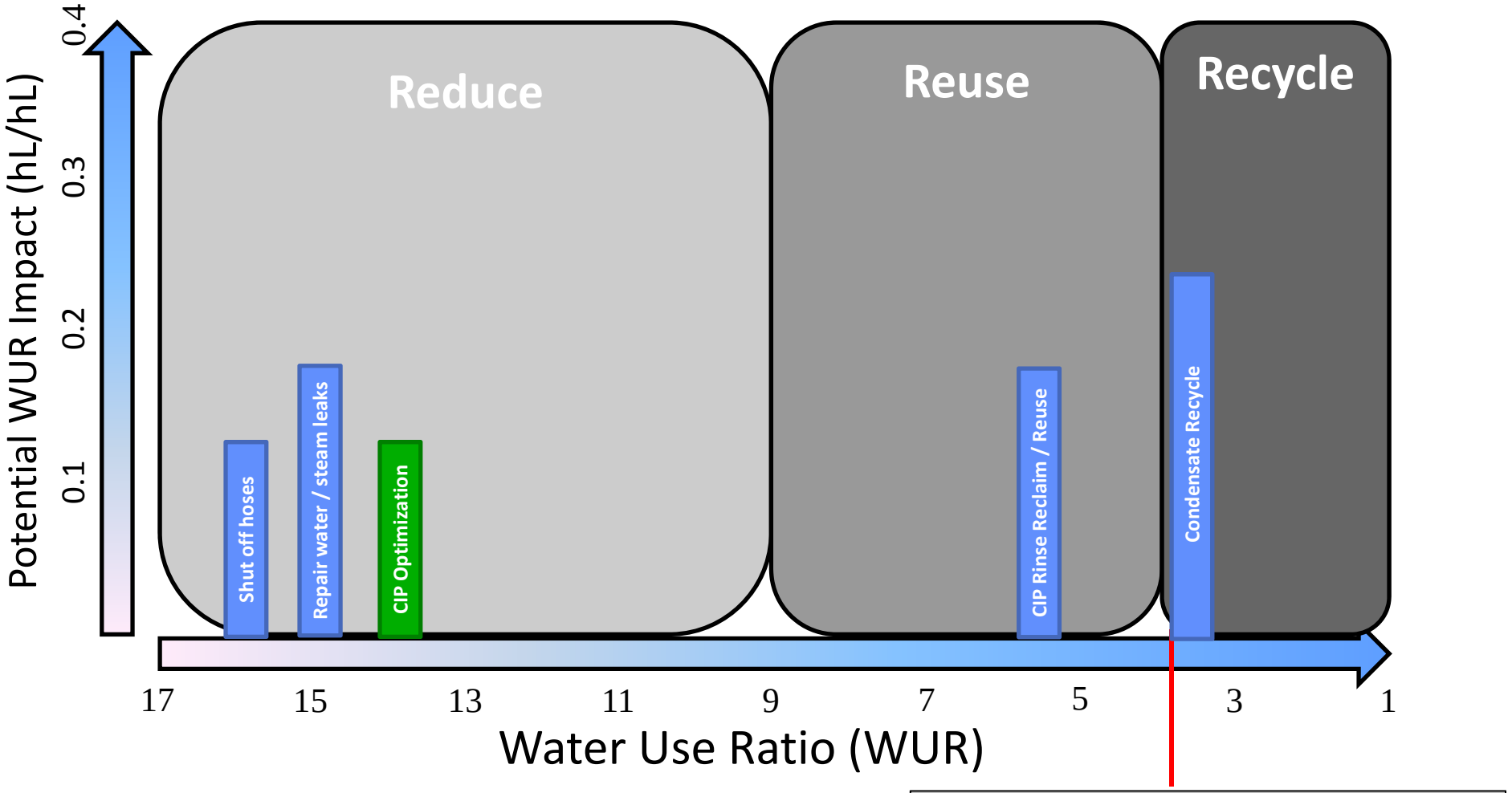

Maintain and Improve Product Quality


Reduce Total Costs

# Assessment Process



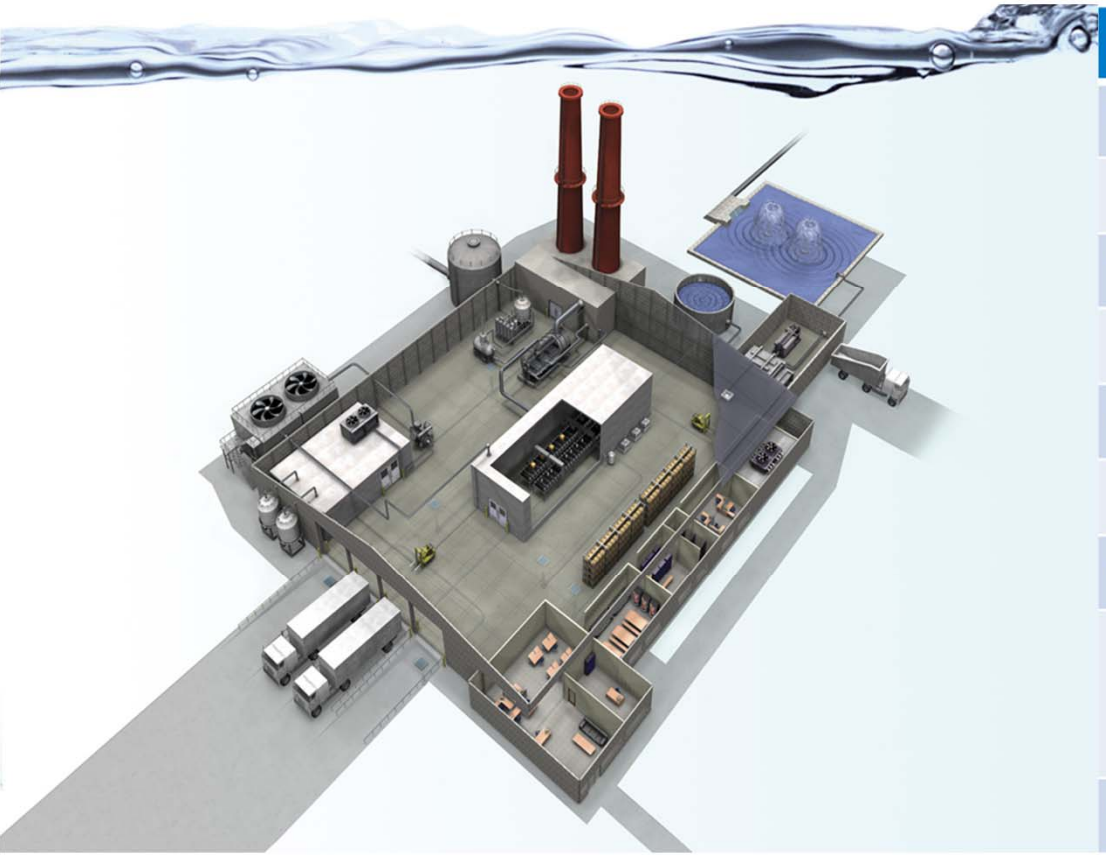
# WUR Optimization Continuum




Industry Average = 3.66

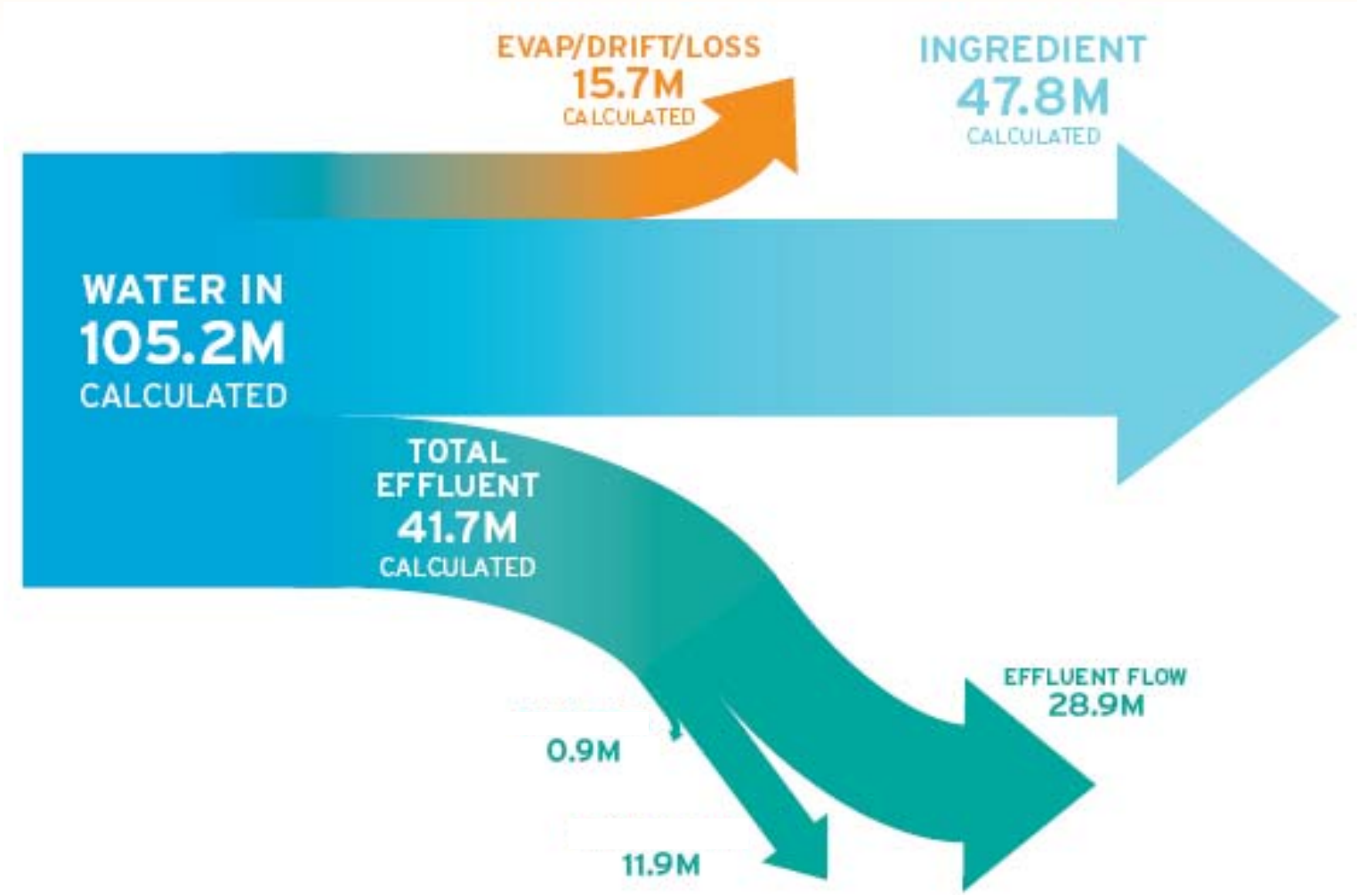
* 2013 BIER Water Stewardship Benchmarking Study

# Brewing Industry Water & Energy Norms



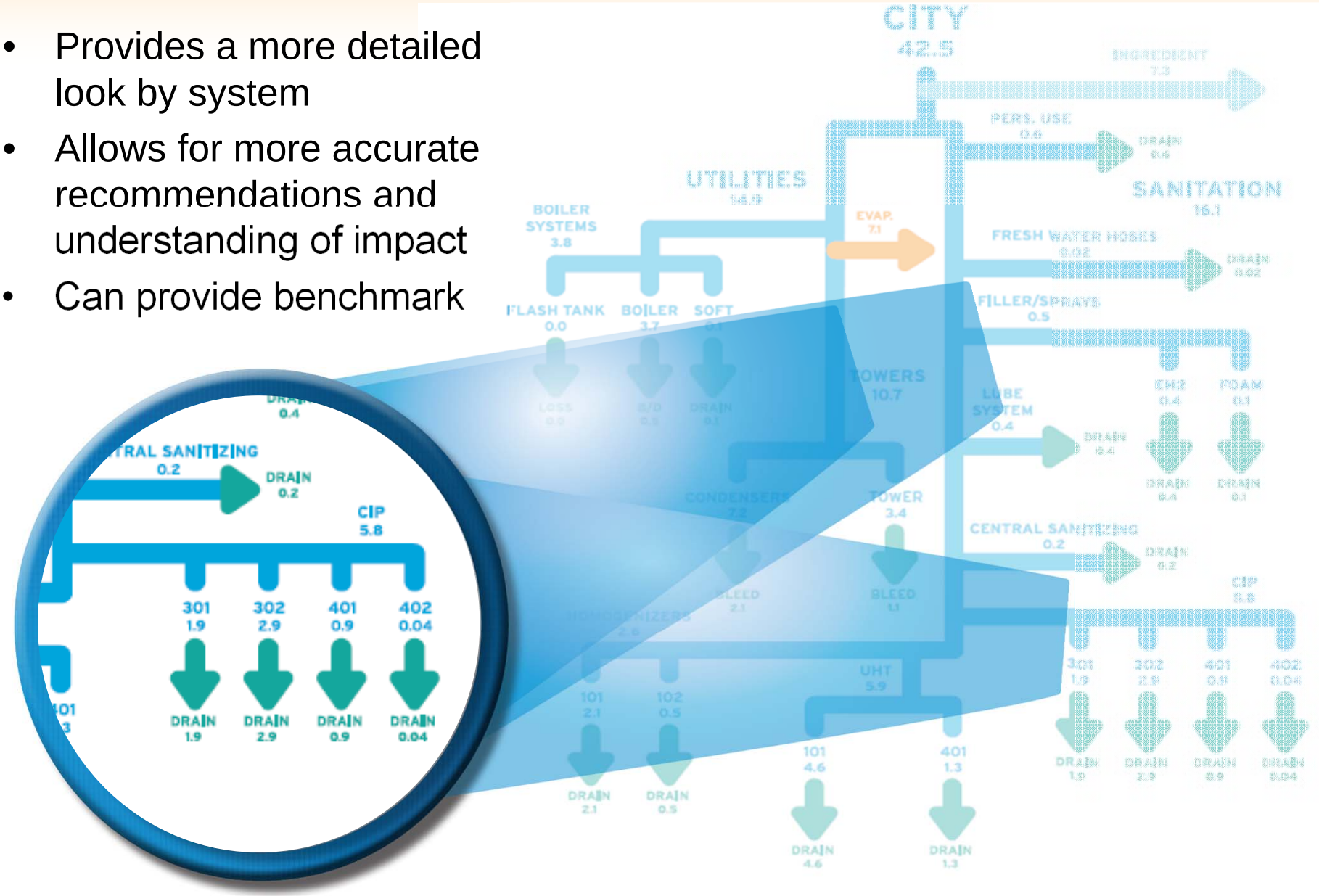
| Parameters | Norms |
|---|---|
| Water | 2.5 – 6.5 hl/hl |
| Energy | 75 – 180 MJ/hl |
| Steam | 29 – 78 kg/ hl |
| Condensate | 60 – 95 % |
| Natural gas | 2.4 – 3.9 m3/ hl |
| Electricity | 7.8 – 11.8 kWh/ hl |
| Chillers (% of total electricity) | 40 – 50 % |
| Waster water | 295 – 490 lit/ hl<br>0.5 – 1.5 kg BOD/ hl<br>0.8 – 2.5 kg COD/ hl |
| Waste water sludge | 0.6 kg/ hl |

# Plant Water Balance



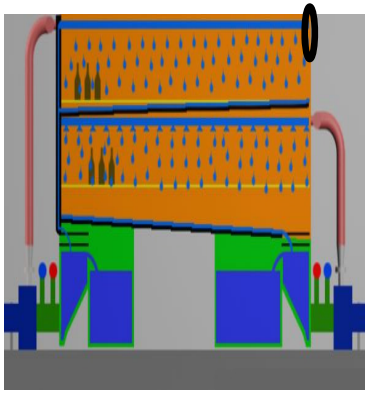
# Plant Water Balance (Detailed)

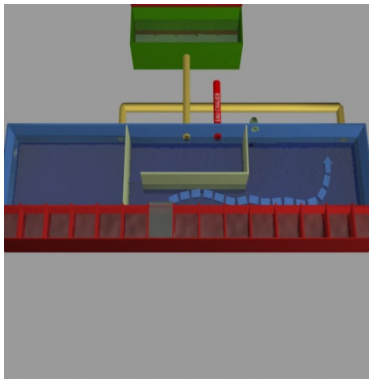
- Provides a more detailed look by system
- Allows for more accurate recommendations and understanding of impact
- Can provide benchmark



# Case Study #1 – Pasteurizer Water Reduction

1





HOUSEHOLDS:

158 278

- ✓ **Relocate non-oxidizing biocide feed from top to bottom deck**
- ✓ **Increase non-oxidizing biocide frequency**
- ✓ **Install a Weir block off plate on side opposite of the pump, top deck**

**OPERATIONAL SAVINGS IMPACT:**

| WATER | ENERGY | WASTE | PROD. | CHEMICAL |
|---|---|---|---|---|
| $ 150,000 | $ 126,402 | ($) | ($) | ($) |

**SUSTAINABILITY IMPACT:**

| WATER (hL) | ENERGY (GJ) | WASTE (KG) | PROD. (HOURS) | CHEMICAL |
|---|---|---|---|---|
| 600,000 | 22,118 | | | |

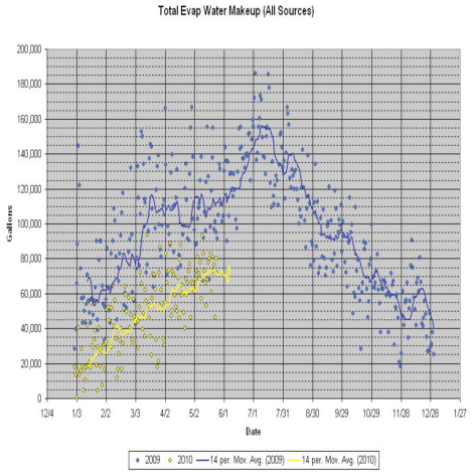
WATER ENERGY WASTE PRODUCTIVITY REDUCE COSTS

**OVERALL IMPACT:**

| | |
|---|---|
| TOTAL ANNUAL SAVINGS | $ 276,402 |
| ONE-TIME INVESTMENT | $ 5,000 |
| SIMPLE PAYBACK | Immediate; 0.17 hL/hL reduction |

# Case Study #2 – Cooling Water Blow-down Reduction Through Automation

2




- ✓ **Cycles of Concentration (COC) at 6 based on conductivity**
- ✓ **Actual COC at 3.5 based on mineral analysis, and low stress conditions**
- ✓ **Increased COC to 10 based on conductivity using on-line stress monitoring and control**

**OPERATIONAL SAVINGS IMPACT:**

| WATER | ENERGY | WASTE | PROD. | CHEMICAL |
|---|---|---|---|---|
| $ 33,000 | ($) | ($) | ($) | ($) |

**SUSTAINABILITY IMPACT:**

| WATER (hL) | ENERGY (GJ) | WASTE (KG) | PROD. (HOURS) | CHEMICAL |
|---|---|---|---|---|
| 276,000 | | | | |

WATER ENERGY WASTE PRODUCTIVITY REDUCE COSTS

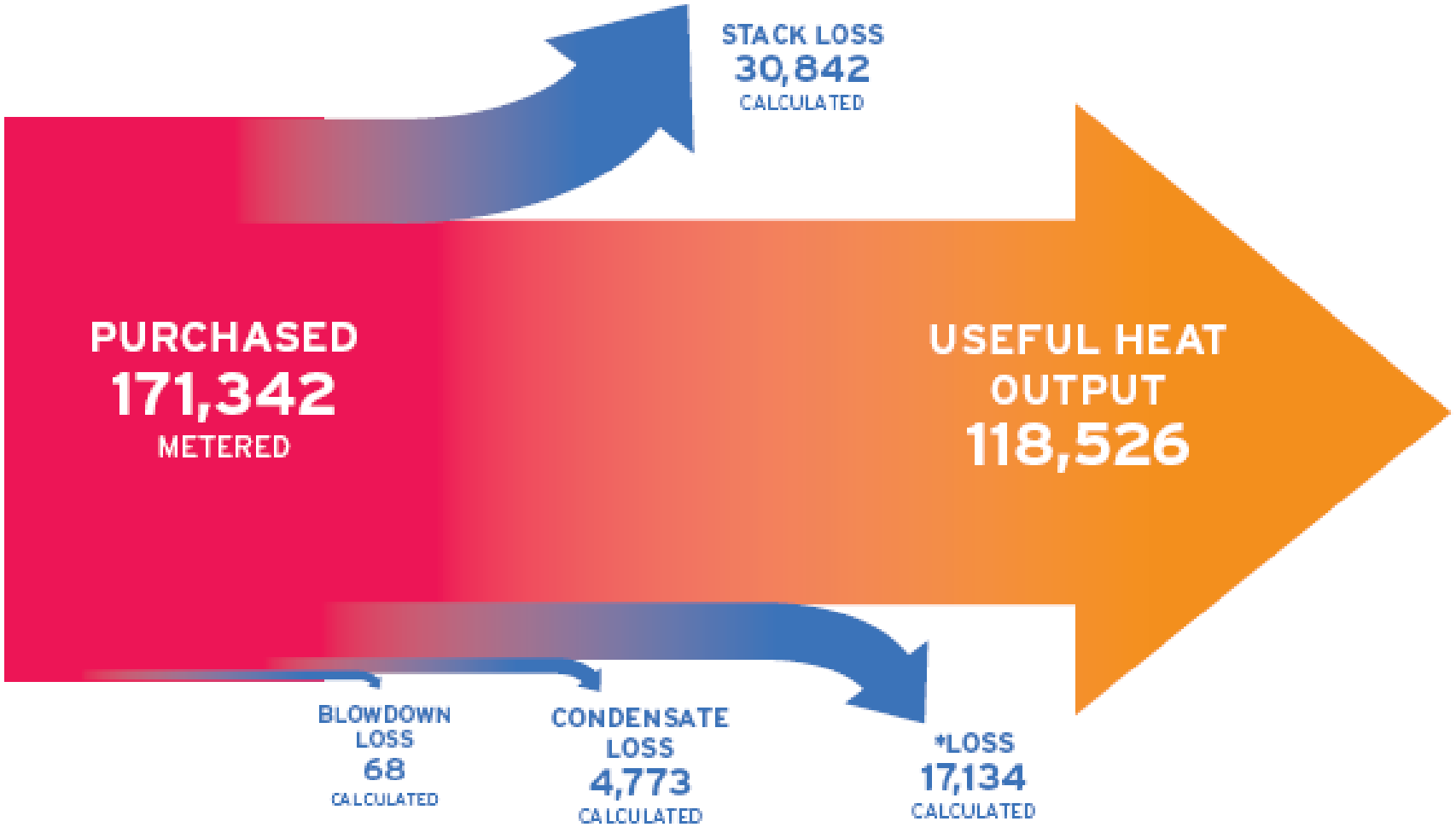
**OVERALL IMPACT:**

| | |
|---|---|
| TOTAL ANNUAL SAVINGS | $ 33,000 |
| ONE-TIME INVESTMENT | $ 10,000 |
| SIMPLE PAYBACK 3.5 months; | 0.035 hL/hL reduction |

**HOUSEHOLDS:**

72

# Plant Energy Balance




**All values in DTH**

# Case Study #3 – Energy Recovery

3

- ✓ Air Compressors and $CO_2$ Compressors require a cooling media
- ✓ Instead of utilizing a cooling tower system, cool with water supplying the 180F hot water system
- ✓ This reduces steam demand to make 180F hot water

**OPERATIONAL SAVINGS IMPACT:**

| WATER | ENERGY | WASTE | PROD. | CHEMICAL |
|---|---|---|---|---|
| $ 929 | $ 80,669 | ($) | ($) | ($) |

**SUSTAINABILITY IMPACT:**

| WATER | ENERGY | WASTE | PROD. | CHEMICAL |
|---|---|---|---|---|
| (hL) 297,624 | (GJ) 29,706 | (KG) | (HOURS) | |

WATER ENERGY WASTE PRODUCTIVITY REDUCE COSTS

**OVERALL IMPACT:**

| | |
|---|---|
| TOTAL ANNUAL SAVINGS | $ 81,598 |
| ONE-TIME INVESTMENT | $ 100,000 |
| SIMPLE PAYBACK | 14.7 months; 0.042 hL/hL reduction |

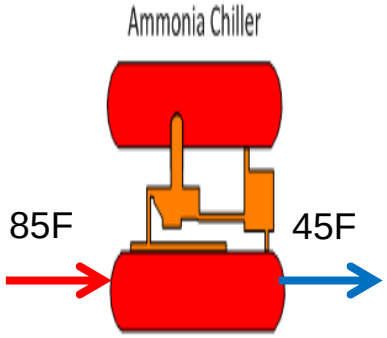
**HOUSEHOLDS:**

78 378

# Case Study #4 – Chilled Water Temperature

1

- ✓ **Due to pasteurizer operational changes, chilled water demand decreased**
- ✓ **Reduced demand allows for a higher chilled water temperature set point (35F to 45F)**
- ✓ **This increased chiller efficiency, reducing load by 100 kW/hr**




**OPERATIONAL SAVINGS IMPACT:**

| WATER ($) | ENERGY $ 40,320 | WASTE ($) | PROD. ($) | CHEMICAL ($) |
|---|---|---|---|---|

**SUSTAINABILITY IMPACT:**

| WATER (hL) | ENERGY (kWh) 720,000 | WASTE (KG) | PROD. (HOURS) | CHEMICAL |
|---|---|---|---|---|

WATER ENERGY WASTE PRODUCTIVITY REDUCE COSTS

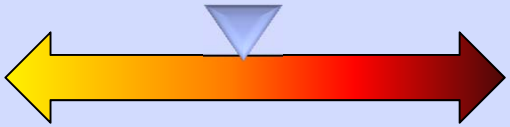
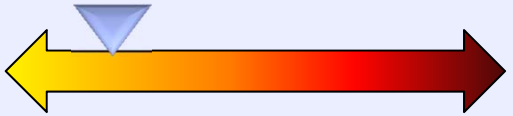
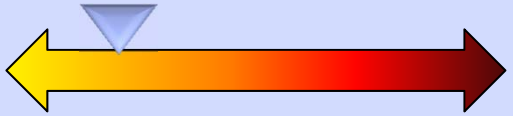
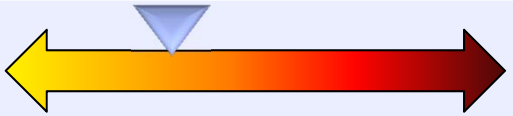
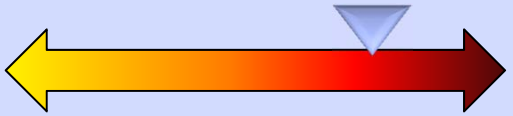
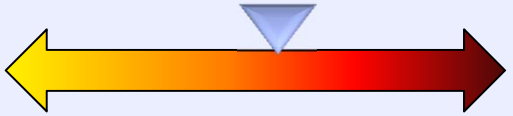
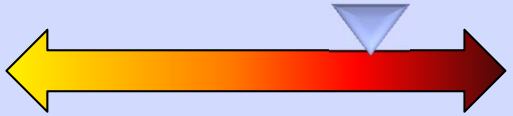
**OVERALL IMPACT:**

| | |
|---|---|
| **TOTAL ANNUAL SAVINGS** | **$ 40,320** |
| **ONE-TIME INVESTMENT** | **$ 0** |
| **SIMPLE PAYBACK** | **Immediate** |

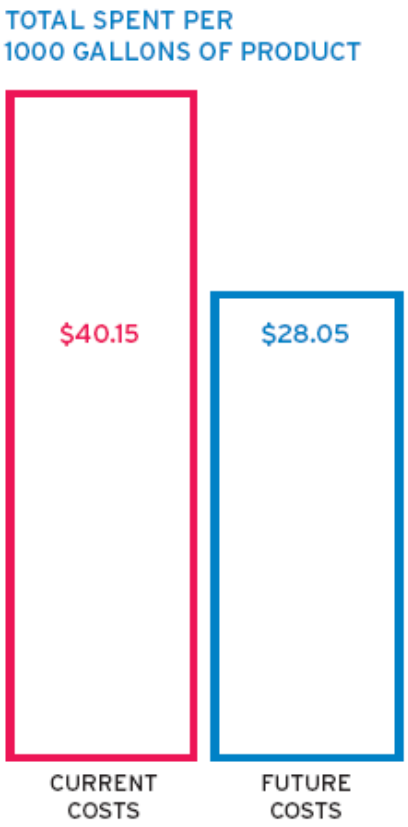
**HOUSEHOLDS:**

66

# Project Prioritization

| Project | Impact | Implementation (Easy) (Complex) |
|---|---|---|
| Filler vacuum seal pump water optimization through closed loop recirculation | 15 – 30 m3 per Bottle line/ day |  |
| Bottle internal rinse water – Recover and use as pasteurizer , cooling tower or lubrication makeup | 12 – 24 m3 per Bottle line/ day |  |
| Reuse can pre-rinse water as can wash-off water after filling | 0.5 – 24 m3 per Can line/ day |  |
| Cooling system cycles improvement or optimization | 0.02 – 0.08 hl/hl beer produced |  |
| Push/ chase water collection and reuse as makeup for cooling tower, pasteurizer, CIP or wash down | 0.5 – 1.0 hl/ hl beer produced |  |
| CIP rinse water recovery and reuse as makeup for cooling systems, pasteurizer etc. | 0.2 – 0.7 hl/ hl beer produced |  |
| Pasteurizer overflow water recycle | 5 – 10 m3 per pasteurizer/ hour |  |

# Baseline vs. Improved Metrics




## SUSTAINABILITY:

| PLANT METRIC | DEFINITION | CURRENT VALUE | AFTER PROJECTS | % REDUCTION |
|---|---|---|---|---|
| Water Efficiency Ratio | (Gals Water – Ingredient Water)/ Gals Product | 1.58 | 1.15 | 27% |
| Fuel Consumption Ratio | DTH's/1,000 Gals Product | 1.52 | 0.92 | 40% |
| Waste Loading Ratio | Lbs SOLIDS in Effluent/ 1,000 Gals Product | 57.22 | 49.00 | 14% |

## OPERATIONAL COSTS:

| | | | | |
|---|---|---|---|---|
| Water Cost Contribution | $ Water/1,000 Gals Product | $9.93 | $7.33 | 26% |
| Fuel Cost Contribution | $ Fuel/1,000 Gals Product | $15.21 | $10.64 | 30% |
| Waste Cost Contribution | $ Effluent treatment/ 1,000 Gals Product | $15.01 | $10.08 | 32% |
| Total Cost Contribution | $ Total Spend/ 1,000 Gals Product | $40.15 | $28.05 | 30% |

# Thank you!

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