



## **Industrial Water Systems** **Virtual INPLT Training & Assessment**

Session 8

Tuesday – Aug 3<sup>rd</sup>, 2021

10 am – 12:30 pm



# Water Virtual INPLT Agenda

- **Week 1 (June 15) – Introduction to Industrial Water Assessment and Plant Water Profiler**
- **Week 2 (June 22) – Understanding System Level Water use**
- **Week 3 (June 29) – True Cost of Water**
- **Week 4 (July 6) – Plant Water Profiler Working Session**
- **Week 5 (July 13) – Identifying Water Savings Opportunity**
- **Week 6 (July 20) – Virtual Treasure Hunt**
- **Week 7 (July 27) – Estimating Water Savings Opportunities**
- **Week 8 (August 3) – Industrial Water System VINPLT Wrap-up Presentations**



# Agenda – Session Eight

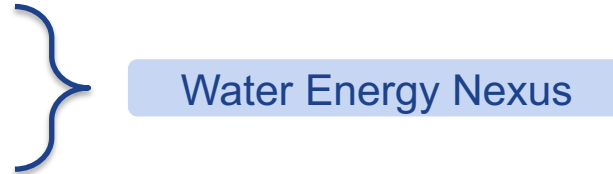
## Today's Content:

- Virtual INPLT Training – Review
- Presentation from Participants
  - Patrick Maag - Broadman Foods
  - Tyler Rodey - Plenco
  - Carlos Eduardo Muzete – Bridgestone
  - Robert Baird - General Motors
  - Others
- Q&A



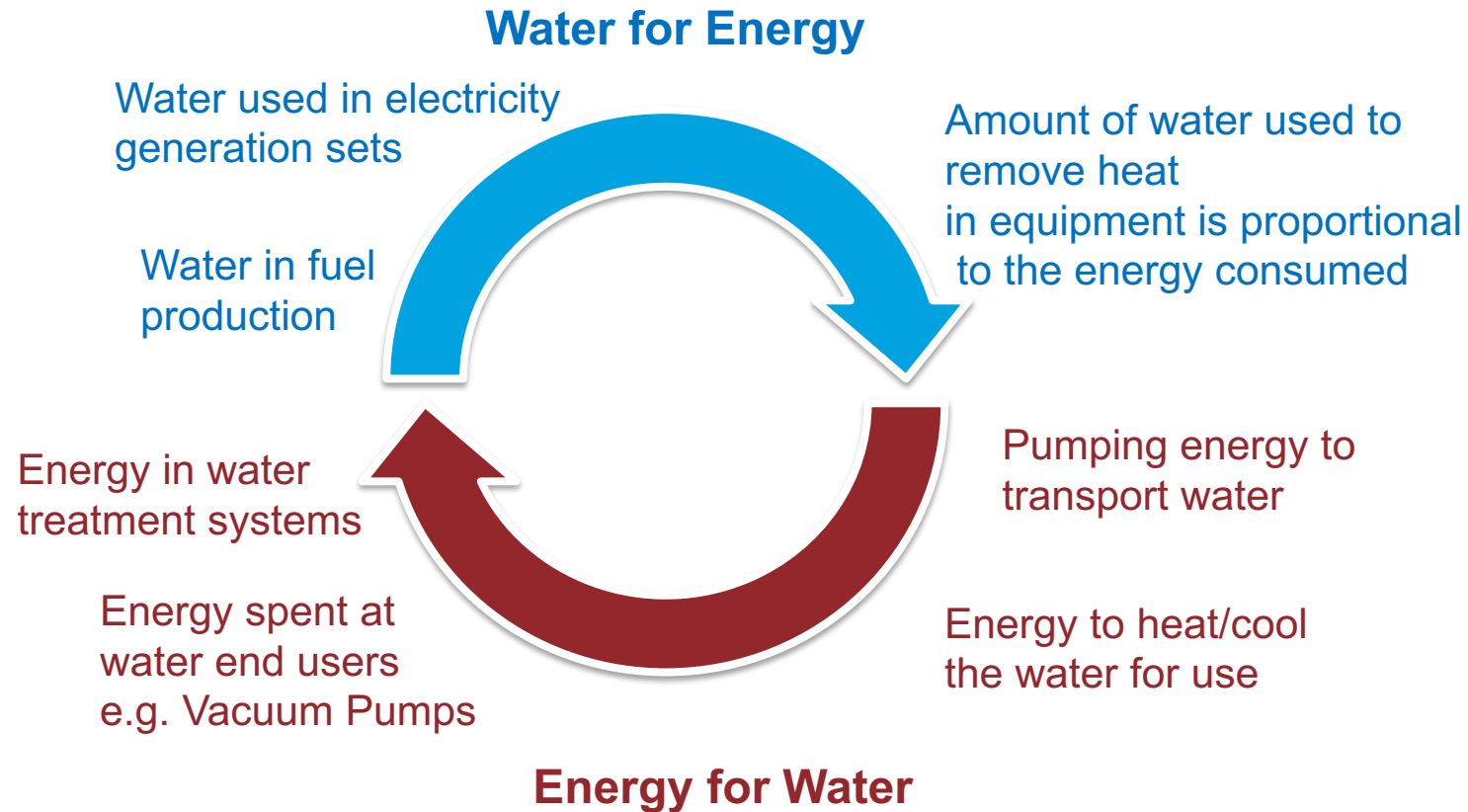


# Drivers of water efficiency in Manufacturing

Cost savings	<ul style="list-style-type: none"><li>• Cost of <b>purchasing</b> water for facility</li><li>• Cost of <b>material</b> for water and wastewater treatment</li><li>• Cost of <b>discharging</b> wastewater</li><li>• Cost of energy for <b>heating and cooling</b> water</li><li>• Cost of energy for <b>pumping</b> water</li></ul> 
Business risks	<ul style="list-style-type: none"><li>• Scarcity – <b>Risk of disruption</b> of water supply to plant due to drought conditions, regional scarcity etc.</li><li>• Regulatory – Risk of increased <b>government regulation</b> on water use and pollution regulations</li><li>• Disruption of water supply in supply chain</li></ul>
Reputation risks	<ul style="list-style-type: none"><li>• Sustainability strengthens public trust and helps create better relationship for business</li></ul>



# Water - Energy Nexus : Interdependence at facility level



Even if water is cheap, the correlating impact water use has on energy can make it expensive



# Quantifying water risks in your region

## Physical Risks – Quantity

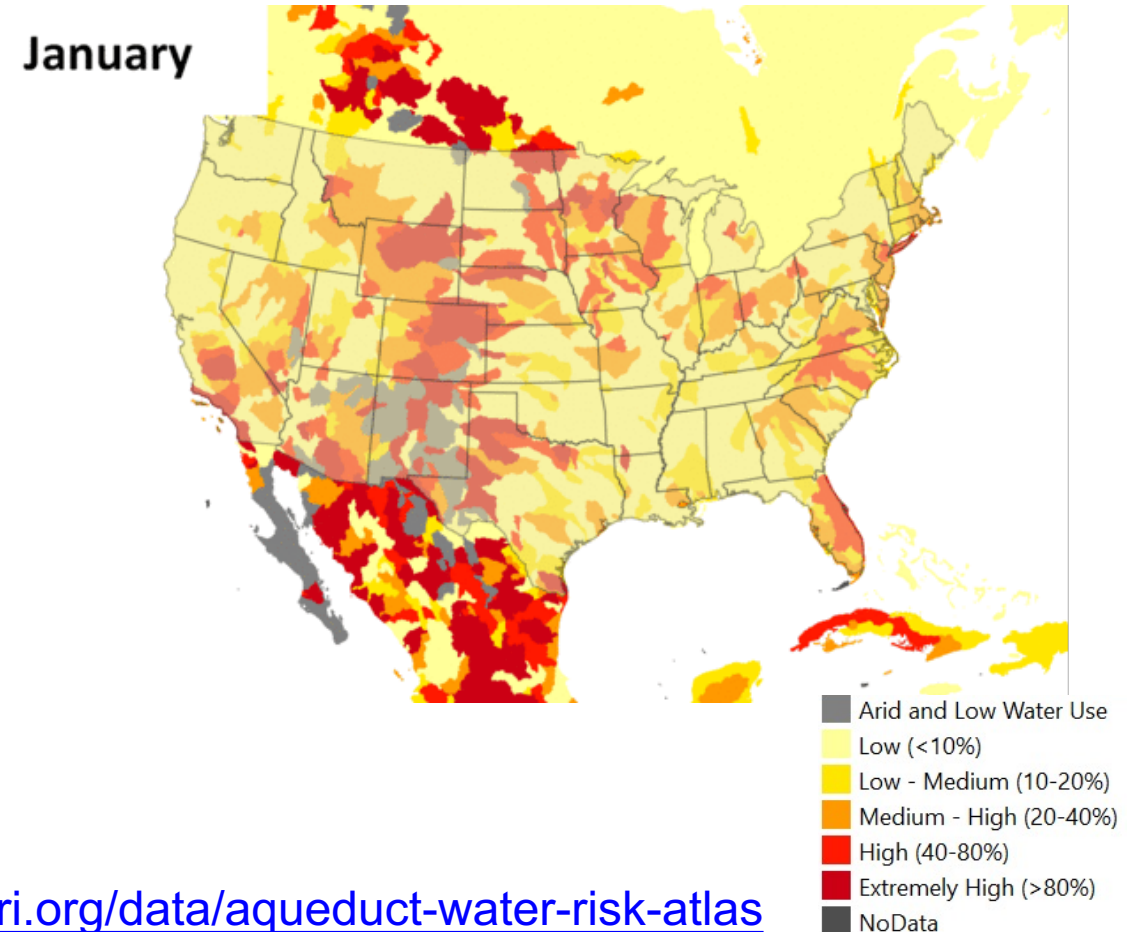
Measure's risk related to too little or too much water Eg. Water Stress

## Physical Risk – Quality

Measure's risk related to water that is unfit for use. Eg. Untreated Connected Wastewater

## Regulatory and Reputation Risks

Measures risk related to uncertainty in regulatory change and perception with the public. Eg. Environmental, social, and governance risk



<https://www.wri.org/data/aqueduct-water-risk-atlas>



# Barriers to Industrial Water Use Reduction

- Lack of reliable data of industrial water use -- the extent of water-use related risks is unknown
- Lack of understanding of hidden costs of water use
- Lack of incentives from utility & state government

**Reduced justification for potentially expensive water use reduction projects**

**This is changing ...**



# Conducting a Water Use Assessment

Step 1. Baseline water use

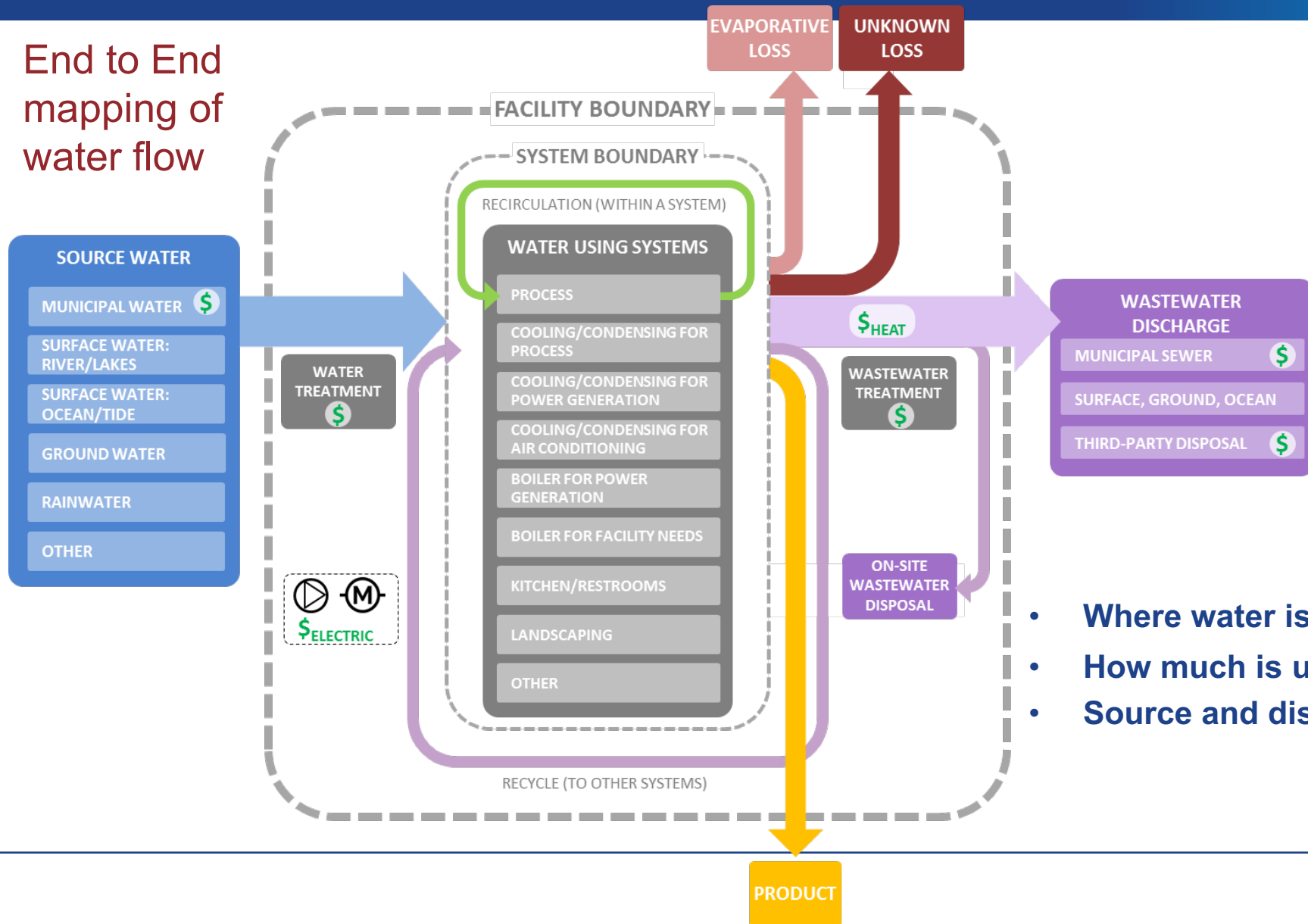
Step 2. Quantify true cost of water

Step 3. Identifying Water savings opportunity



# Step 1. Baseline water use

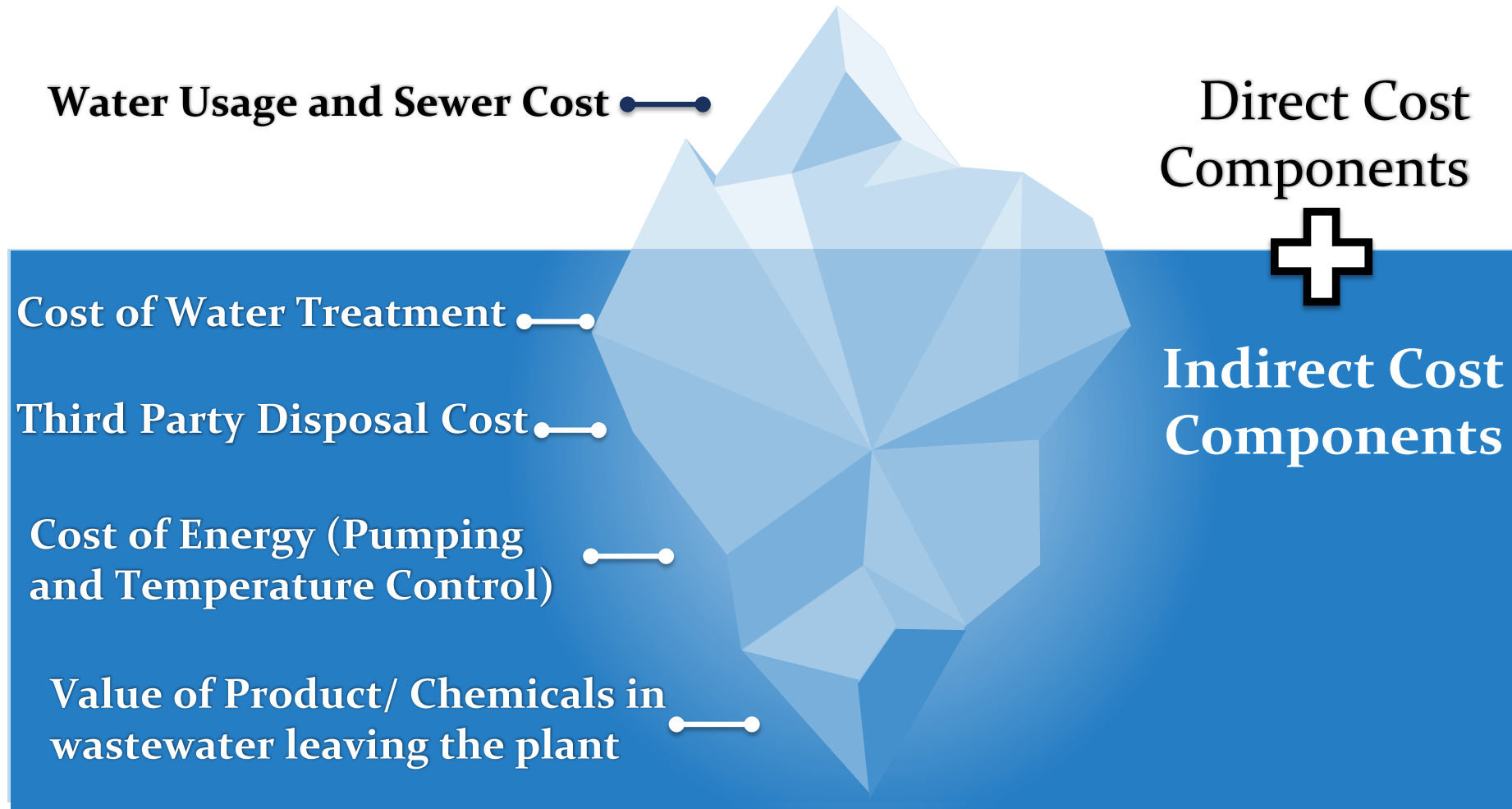
End to End mapping of water flow



- Where water is used
- How much is used
- Source and discharge



## Step 2. True Cost of Water





# Step 3: Identifying Water Savings Opportunity

**Water efficiency can reduce cost, improve resilience and reduce environmental impacts.**

- Recycle and Reuse Water
- Efficient Design
- Implementing new technologies
- Optimized Operations
- Behavioral Improvements
- Proper Maintenance

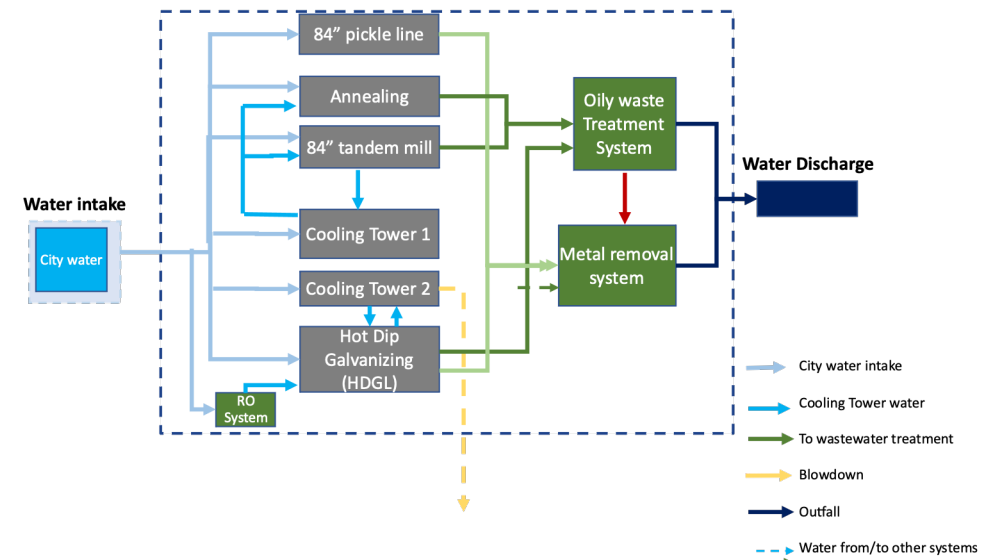
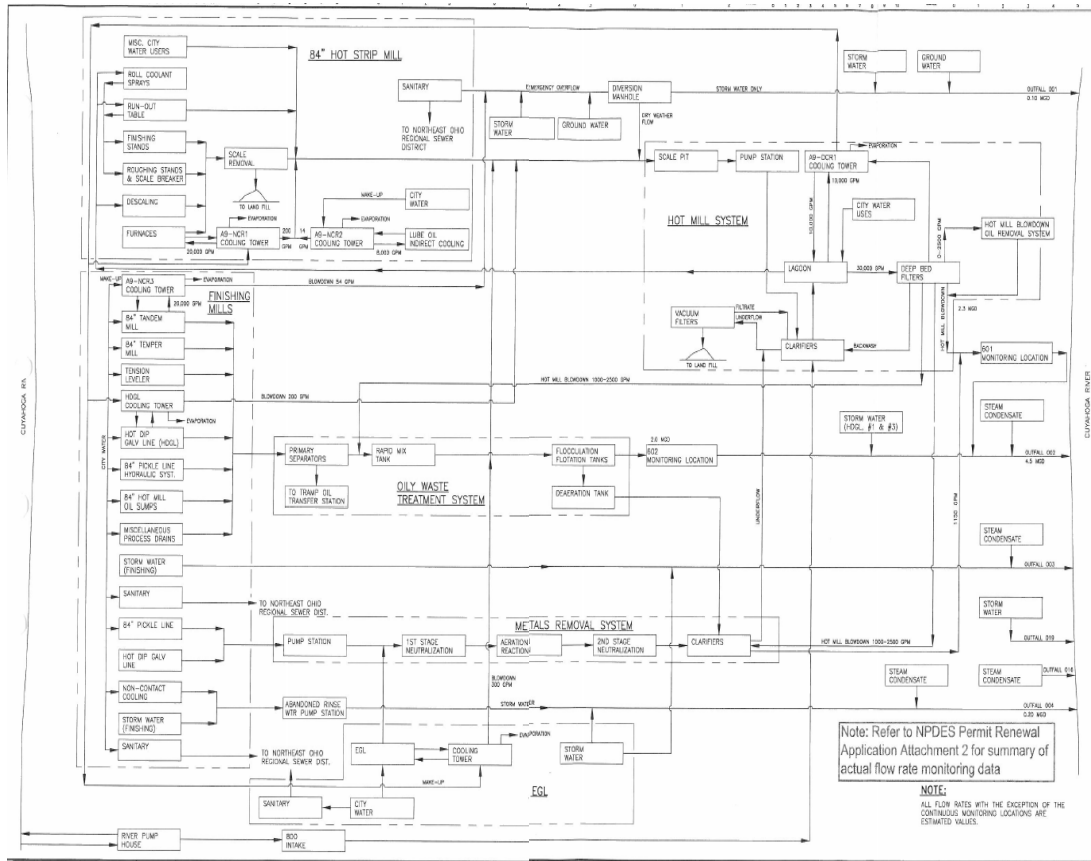




# Tools and Techniques



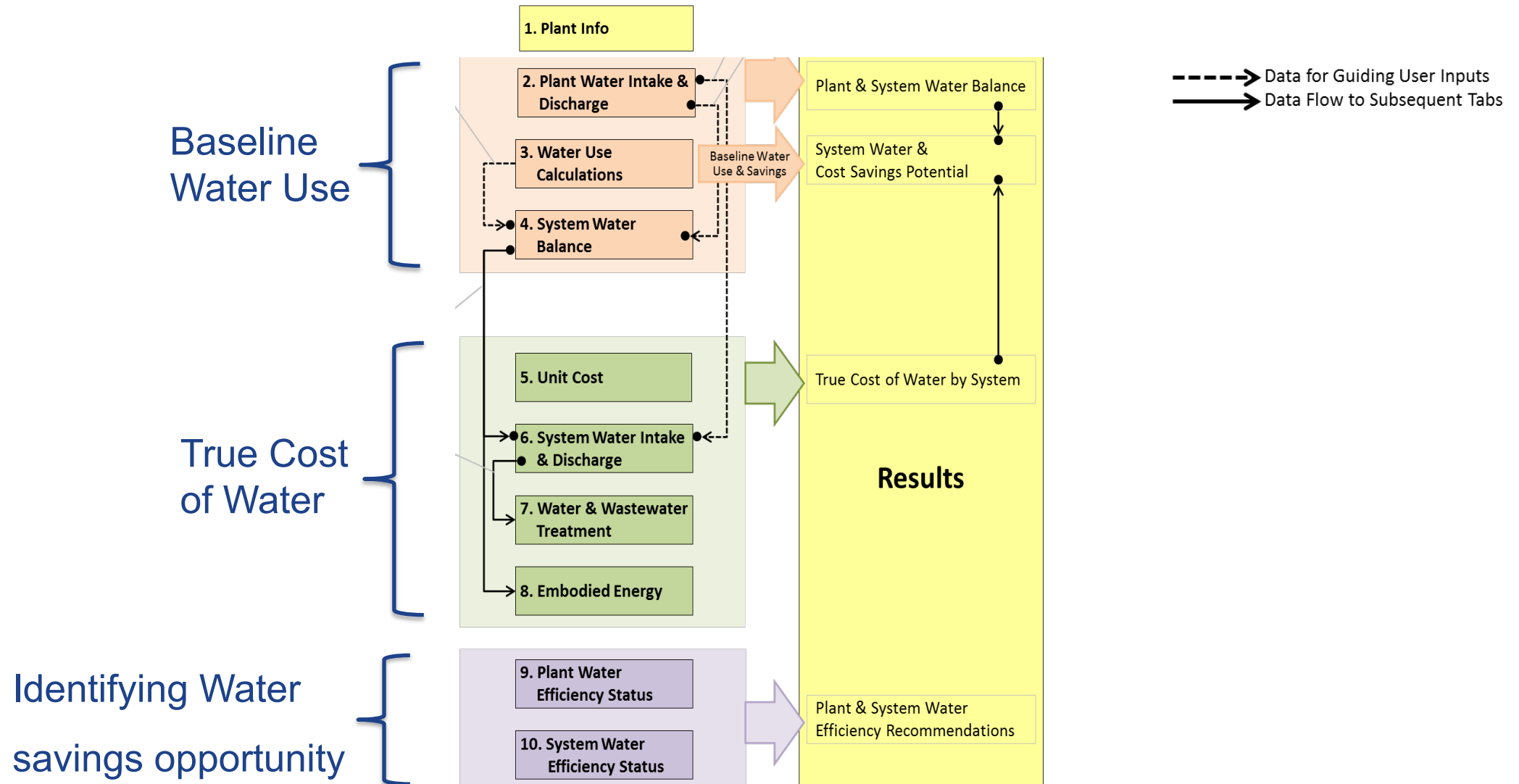
# An ideal water flow diagram makes baselining simpler



For a baseline assessment and water balance, water flow across each system or group need to be known



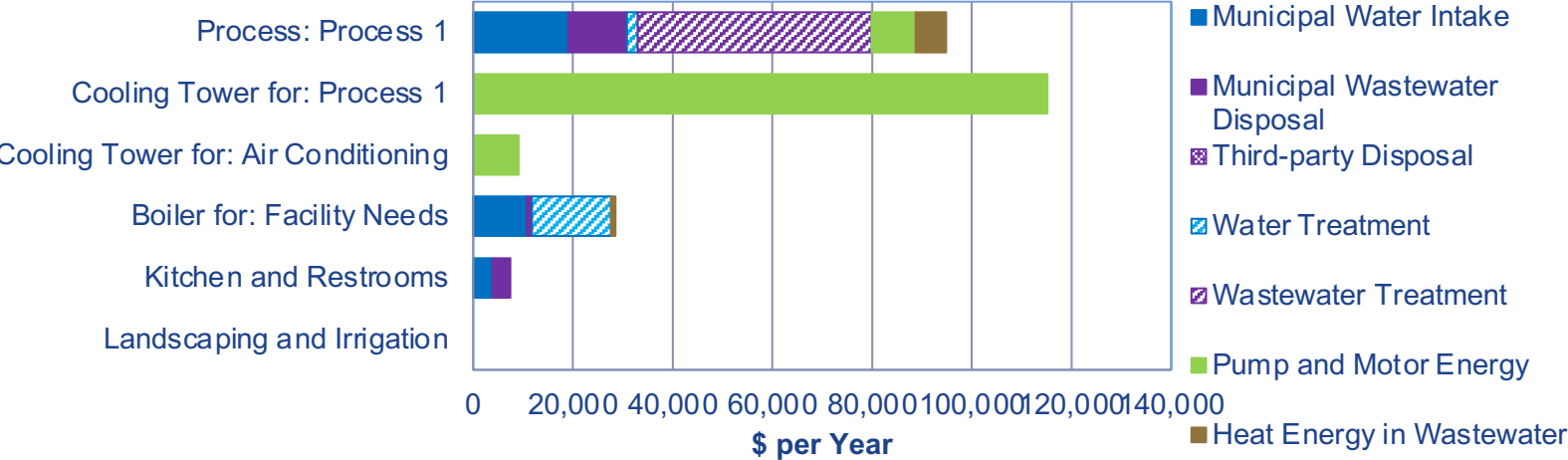
# PWP Tool to help streamline water assessment



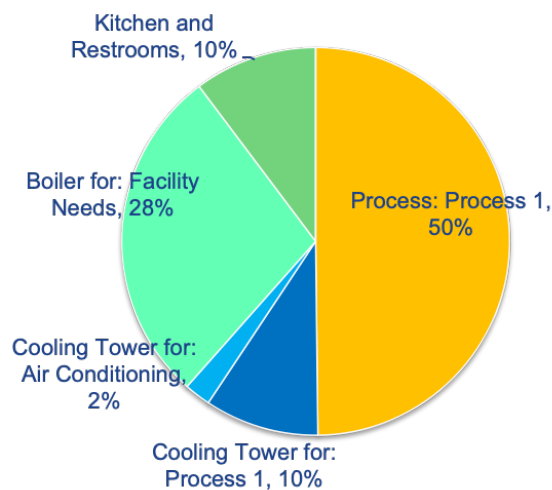


# PWP results

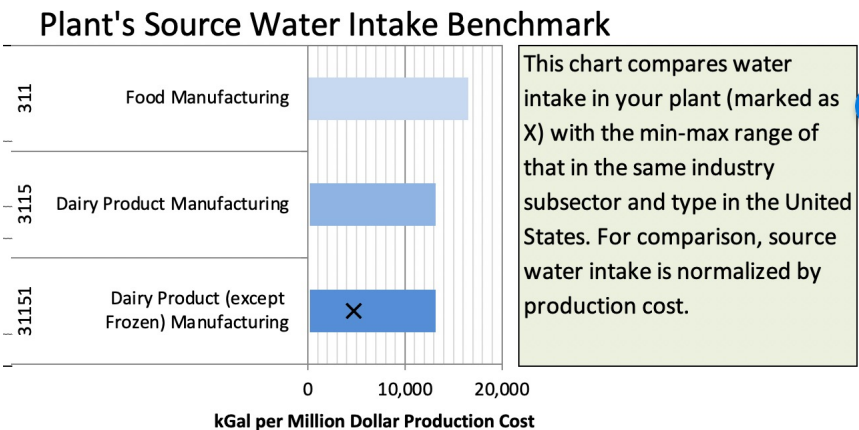
## True Cost of Water



## Water Intake by System



## Comparison with Industry Average



## Water Imbalance by System

Water-Using System	Incoming Water Outgoing Water		Water Imbalance		
	Million Gallon per Year		Million Gallon Per Year	% of Incoming Water	% of Total Loss
Process: Process 1	6.8	6.405	0.395	5.8%	87.2%
Cooling Tower for: Process 1	1.3	1.3	-	-	-
Cooling Tower for: Air Conditioning	0.3	0.27	0.03	10.0%	6.6%
....					
PLANT TOTAL	15.5	15.047	0.453	16.5%	100.0%



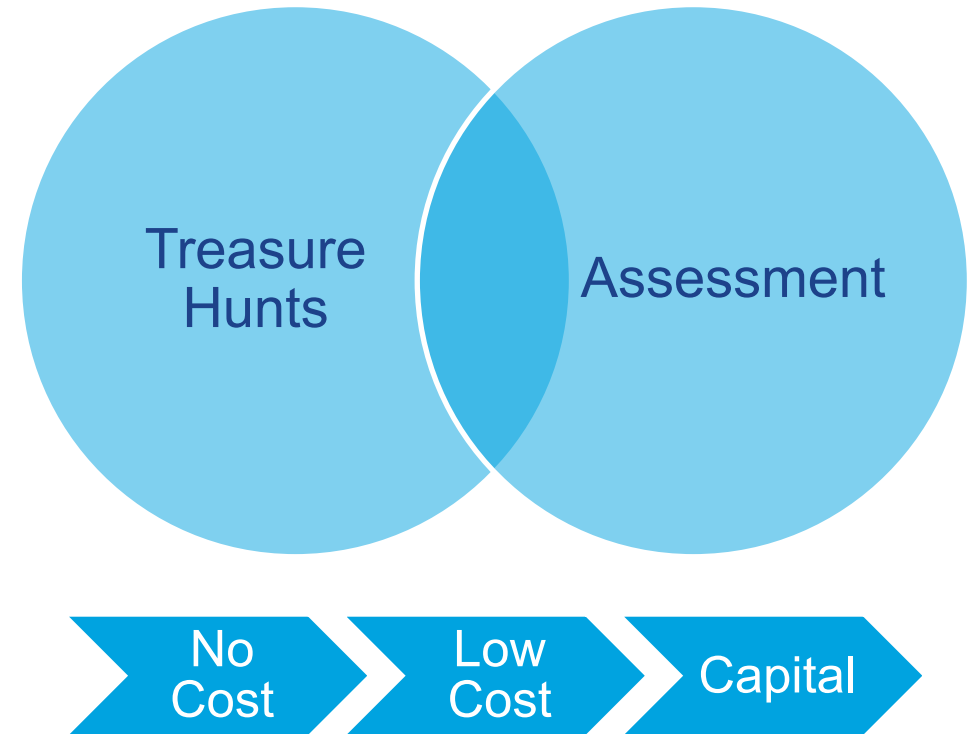
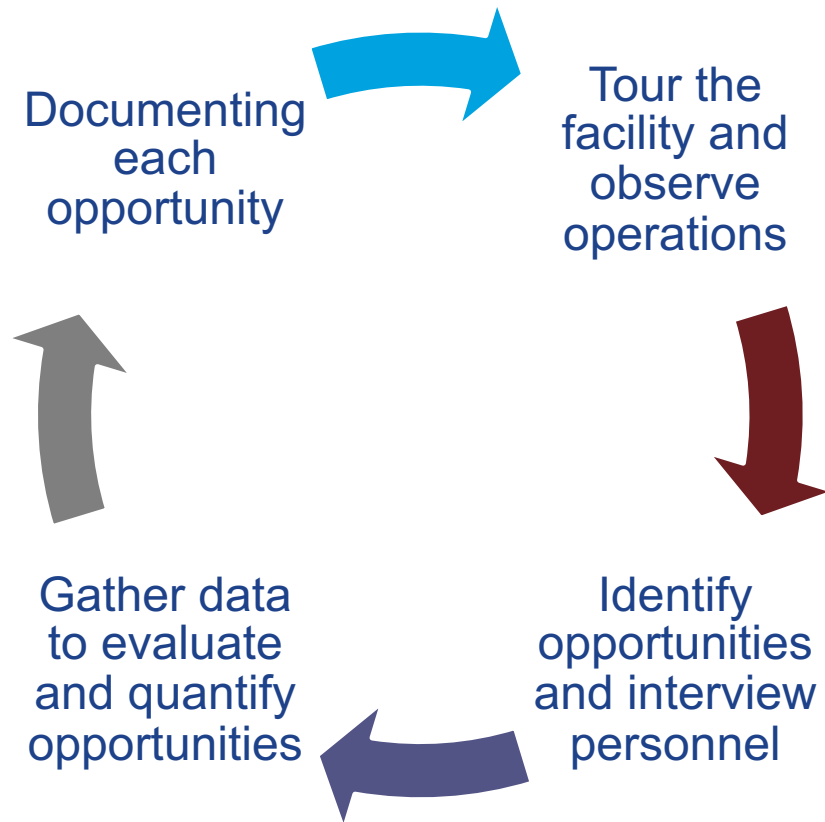
# Diagnostic Equipment

- Instruments and data loggers for onsite data collection





# Treasure Hunt approach to find opportunity





# DOE Tools for Treasure Hunt

## WHAT DOES AN ENERGY TREASURE HUNT LOOK LIKE?





# Integrated Energy Software - MEASUR



- All system level software tools will be available to through **one platform**
- Includes system modelers and individual calculators for **field validation**
- Includes **built-in guides** and **tutorials**



# MEASUR – Treasure Hunt Module

**Treasure Hunt Example**  
Last modified: [icon]

Facility Basics **Find Treasure** Treasure Chest Report

Find ways to save your hard earned treasure!

Use one of the following calculators to determine savings opportunities within your manufacturing facility.

Once an opportunity has been found, save the opportunity to your "Treasure Chest".

Add more details to each opportunity by clicking the [icon] icon and filling out an opportunity sheet.

Click the "Treasure Chest" tab to view a summary of your found treasure.

Filter Calculators by Utility Type:

### Lighting Replacement

The calculator is designed to quantify the energy savings associated with lighting opportunities.

### Replace Existing Motor

This calculator calculates the energy savings, cost savings, and payback period for replacing an existing motor with a higher efficiency motor.

### Upgrade Motor Drive

The Motor Drive Calculator compares the annual energy cost of three motor drives: V-belt drive, Notched V-Belt drive, and Synchronous Belt Drive.

### Natural Gas Reduction

This calculator is used to quantify the energy savings associated with reducing natural gas usage.

### Electricity Reduction

This calculator is used to quantify the energy savings associated with reducing electricity usage.

### Compressed Air Reduction

This calculator reduces the compressed air use. Real description needed.

### Custom Savings Opportunity

This calculator provides a space to add a Treasure Hunt Opportunity without using a calculator (such as after having done off-sheet calculations). Enter Baseline and Modification Utility use to calculate savings.

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Find low/no cost savings opportunities and documenting them for each treasure hunt team



# Calculators

Case #1

+Remove Case

Water Flow Rate

1000

gpm

Cooling Load

100

MMBtu/h

Calculate Cooling Load

Annual Operating Hours

8760

hrs/yr

Cycles of Concentration

2

Drift Eliminator

No

Drift Loss Factor

0.2

%

Evaporation Loss

85

%

Correction Factor

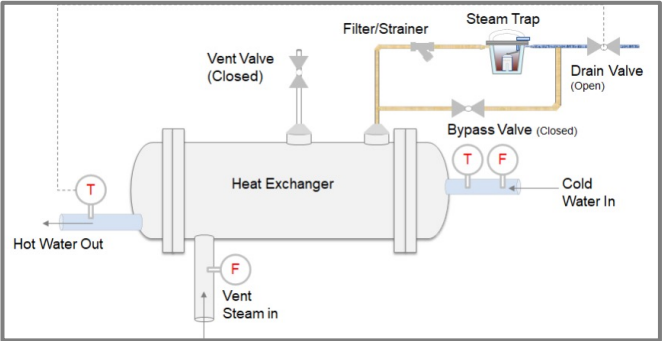
Results

Water Consumption

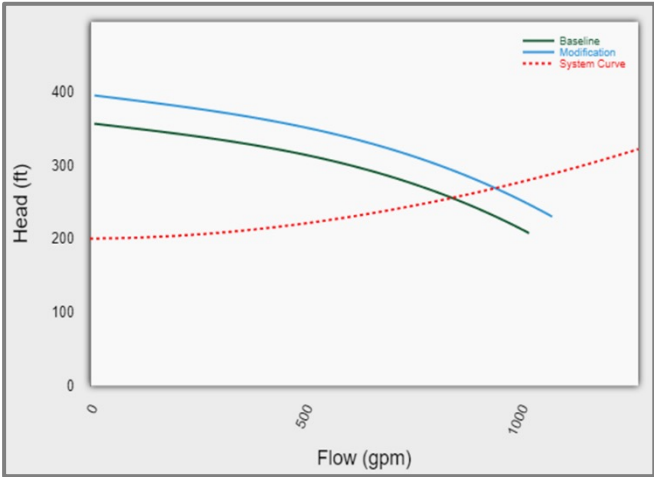
179,755.2

kGal

Cooling Tower



Vent Steam



Pump Curve

BLOWDOWN RATE CALCULATOR

BASELINE

MODIFICATION

RESULTS

HELP

Conductivity Readings

Feedwater Conductivity

400

µS/cm

Blowdown Conductivity

5500

µS/cm

Water Flow

1000

gpm

Water Temperature

500

°F

Boiler Efficiency

85

%

Operating Hours

8760

hrs/yr

Fuel Cost

4.99

\$/MMBtu

Water Cost

0.0025

\$/gal

Makeup Water Temperature

50

°F

Conductivity Readings

Feedwater Conductivity

200

µS/cm

Blowdown Conductivity

6000

µS/cm

Water Flow

1000

gpm

Water Temperature

500

°F

Boiler Efficiency

85

%

Operating Hours

8760

hrs/yr

Fuel Cost

4.99

\$/MMBtu

Water Cost

0.0025

\$/gal

Makeup Water Temperature

50

°F

Blowdown Rate (%)

7.84 %

3.45 %

Blowdown Rate (dth/hr)

1,085.11

1,035.71

Feedwater Rate (dth/hr)

1,085.11

1,035.71

Fuel Cost

\$1,804,827

\$833,071

Makeup Water Cost

\$223,402

\$93,749

Total Cost

\$2,118,229

\$926,820

Fuel Savings

\$1,061,757

Makeup Water Savings

\$129,653

Total Savings


\$1,191,410


Copy Table

Boiler Blowdown

Process Application	Water Required for Processing	Process Water Consumed in Product	Process Water Losses (Evaporation/Other)	Production Units per Year	Hours Water Used per Year	Fraction of Gross Water Use Recirculated	Total (Million Gallon per Year)					
							Gross Water Use	Source Water + Water from Other Systems	Wastewater Discharge + Recycled to Other Systems	Process Water Consumed in Product	Process Water Losses (Evaporation/Other)	Recirculated Water
Process: Steel treatment 1 & 2	97.0	-	0.1	1,270,000.0	-	-	123.19	123.19	110.871	-	12.319	-
Process: Steel treatment 3 & 4	97.0	-	0.1	1,270,000.0	-	-	123.19	123.19	110.871	-	12.319	-
							-	-	-	-	-	-
							-	-	-	-	-	-
							-	-	-	-	-	-
							-	-	-	-	-	-
Aggregated Results							123.19	123.19	110.871	-	12.319	-
Process: Steel treatment 1 & 2							123.19	123.19	110.871	-	12.319	-
Process: Steel treatment 3 & 4							123.19	123.19	110.871	-	12.319	-

Process Calculator (PWP)

 Better Plants  
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# Resources

- Water Risk Atlas: <https://www.wri.org/data/aqueduct-water-risk-atlas>
- PWP Tool: <https://www.energy.gov/eere/amo/plant-water-profiler-tool-excel-version-10-pwpex-v10>
- MEASUR: <https://www.energy.gov/eere/amo/measur>
- Treasure Hunt Toolkit: <https://betterbuildingssolutioncenter.energy.gov/better-plants/energy-treasure-hunts>
- BP Virtual Training: <https://bptraining.ornl.gov/>
- Diagnostic Loan Program: <https://betterbuildingssolutioncenter.energy.gov/better-plants/diagnostic-tools>



# Presentation from Participants



# Participant Feedback

- Key takeaways from the event
- Findings from the water assessment
- Next steps for water efficiency at your facility
- How can we improve the training



**Thank you all for attending the VINPLT on water  
efficiency in manufacturing**

**I hope the training was helpful**

**If you have specific questions, please stay online and  
we will try and answer them.**

**Alternately, you can email questions to me at  
[thirumarank@ornl.gov](mailto:thirumarank@ornl.gov)**