Industrial Water Systems
Virtual INPLT Training & Assessment

Session 7

Tuesday – July 2nd, 2024

10 am – 12:30 pm

Water Virtual INPLT Agenda

- **Week 1 (May 21st) – Introduction to Industrial Water Assessment and Plant Water Profiler**
- **Week 2 (May 28th) – Understanding System Level Water use**
- **Week 3 (June 4th) – True Cost of Water**
- **Week 4 (June 11th) – Plant Water Profiler Working Session**
- **Week 5 (June 13th) – Identifying Water Savings Opportunity**
- **Week 6 (June 25th) – Virtual Treasure Hunt**
- **Week 7 (July 2nd) – Estimating Water Savings Opportunities**
- **Week 8 (July 9th) – Industrial Water System VINPLT Wrap-up Presentations**

Agenda – Session Seven

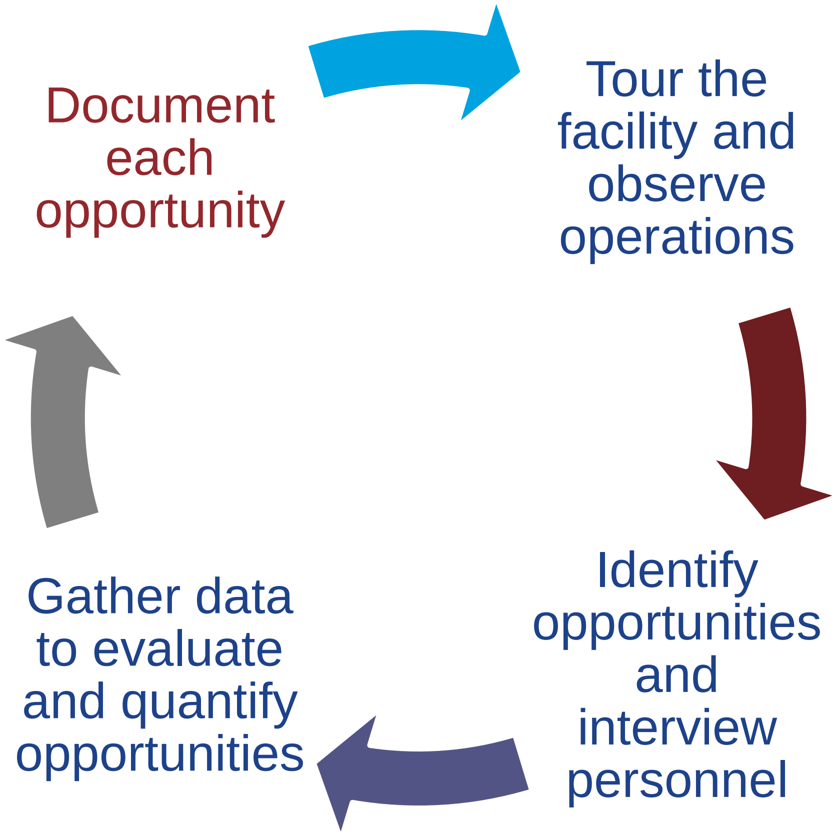
Today's Content:

- Resources for Treasure Hunt
- Resources to Estimate Savings
- National Alliance for Water Innovation (NAWI)

U.S. DEPARTMENT OF ENERGY

Better Buildings is an initiative of the U.S. Department of Energy

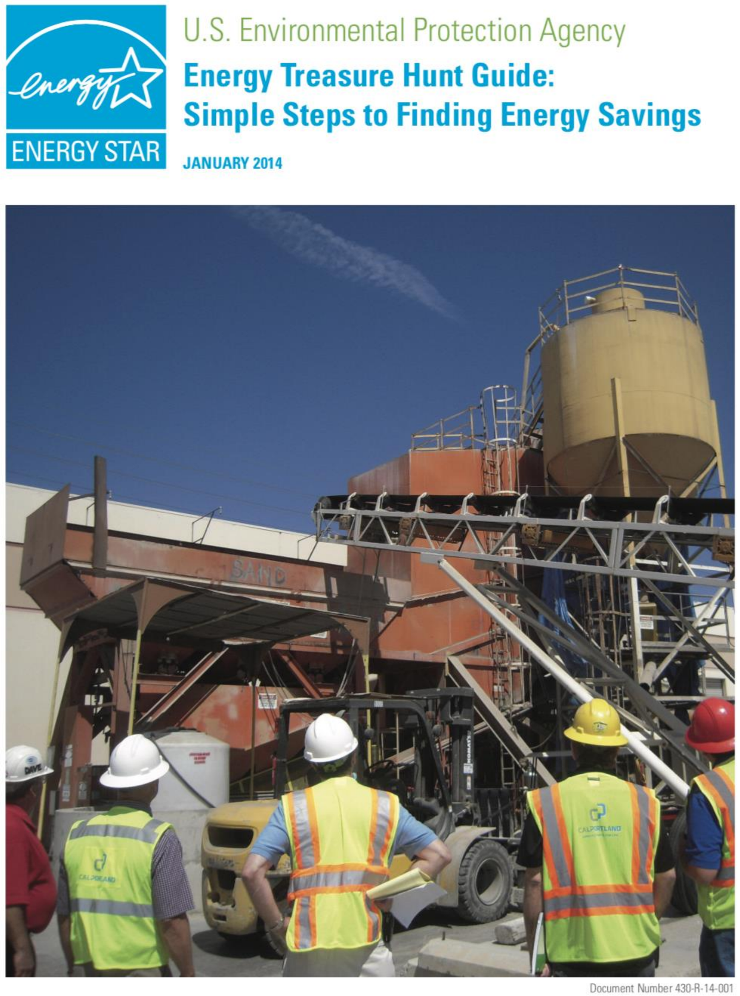
Treasure Hunt Event



Energy Star – Treasure Hunt Guidance Document

FOUR PHASES FOCUSED ON RESULTS: A comprehensive Energy Treasure Hunt has four distinct phases:

- **Preparation**: Schedule discussions with your organization or facility’s leadership to obtain their support. Gather data on current energy usage and costs, equipment specifications, and operating parameters.
- **Pre-Training**: Meet with facility team leaders to confirm roles and responsibilities and Energy Treasure Hunt agenda. Pre- training should begin at least one week before the onsite event.
- **Three-day Onsite Event**: Teams identify and quantify energy-saving opportunities at an onsite three-day event. Summarize and present the results for management review.
- **Follow-up**: Develop a schedule for pursuing the energy reduction opportunities identified during the Energy Treasure Hunt.



DOE Treasure Hunt Toolkit

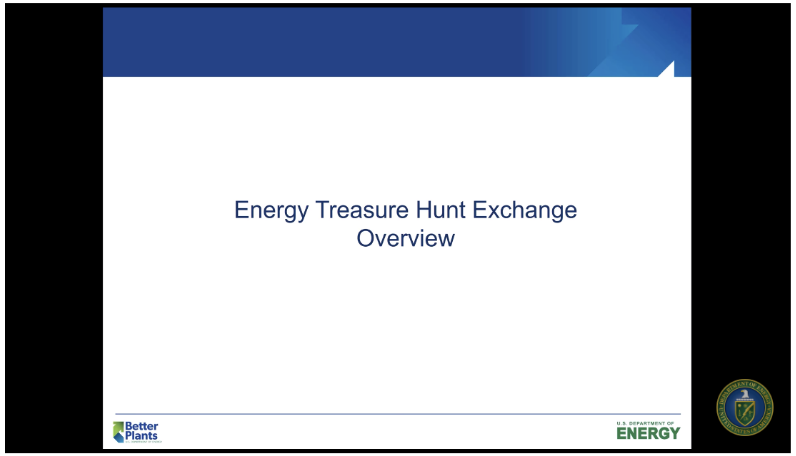
READY TO START YOUR OWN TREASURE HUNT?

The Department of Energy has developed the necessary tools and materials, collectively known as the Energy Treasure Hunt Toolkit, to help with each individual phase of the treasure hunt process. This toolkit provides the treasure hunt facilitator with the tools needed to effectively plan and prepare for the event, successfully run it, and track the results. **Explore the resources listed below to prepare for your Treasure Hunt and execute the three phases.**

Start by reading the Treasure Hunt Overview and watching the webinar to the right.

This overview of the Energy Treasure Hunt Toolkit provides information on the different stages of the treasure hunt, as well as the materials in the toolkit.

[READ OVERVIEW]



Download the Treasure Hunt Toolkit and begin your search

Explore the Treasure Hunt module in MEASUR

https://betterbuildingssolutioncenter.energy.gov/better-plants/energy-treasure-hunts

DOE Tools for Treasure Hunt

WHAT DOES AN ENERGY TREASURE HUNT LOOK LIKE?

Phase 1 and 2	Phase 3	Phase 4
Event Logistics • Save the Date (template) • Event Agenda (template) Facility Information • Data collection sheet • Plant Water Profiler • Plant Energy Profiler Diagnostic Equipment	Treasure Hunt Opening Presentation System Specific Handouts Documenting Opportunity • MEASUR Treasure Hunt Module • Excel Based tools Water Savings Calculators	Close out presentation (template) Project Implementation Tracker

Handouts

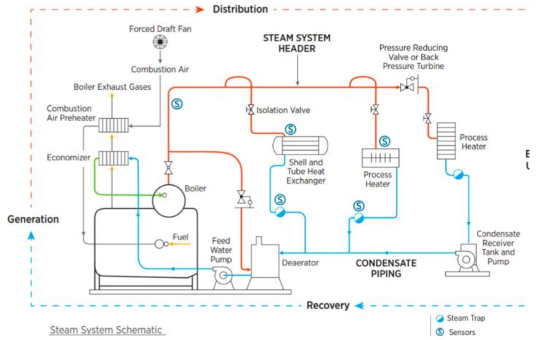
- System specific handout sheets are provided by DOE to help participants identify and quantify energy savings opportunities.

- Three sets of handouts for each system type is available;
  - System Checklist
  - Data Collection Sheet
  - System Cheat Sheet

- **The handouts are not meant to be all encompassing**

- Participants should only use the handouts as a tool to get started and not solely rely on it

Handouts



Steam System Schematic

Best Practices

1.) Reduce Steam demand and pressure
2.) Optimize Fuel/Air Ratio
3.) Fix Steam Traps
4.) Insulate Pipes and Tanks
5.) Recover condensate/ flash steam and capture water & heat
6.) Preheat boiler feed water
7.) Install automated blowdown controls
8.) Optimize deaerator vent rate
9.) Adjust steam system based on production
10) Identify and close off dead legs (unused to sections of steam header)

Steam System - Data Collection Sheet

Energy Treasure Hunt

Measure	Data to Collect	Data	How to Collect
Common System Data	How many boilers?		
	How many boilers are running?		Interview the operators
	Boiler capacity(s) (BTU or lbs./hour)		From panel
	Total generation capacity (lbs./hour)		From panel
	Average steam generation rate (lbs./hour)		From panel
	Average boiler blowdown rate		Interview the operators
	Current System Pressure		From pressure gauge in header line
	Highest Pressure on header		Interview the operators
	Highest Pressure Required at floor		Interview manager/ personnel on the floor
	Stack Temperature		
Steam Leaks	How many leaks/ defective traps		Approximation based on the ones found
	Diameter of the leak		Ultrasonic Leak Detector / visual determination
	Pressure on line		From nearby pressure gauge
	Hours of operation of the leak(or boiler)		

Steam System – Cheat Sheet

Energy Treasure Hunt

Rule of Thumb

- Average efficiency of a steam boiler is 80%.
- 10PSI drop in header pressure is 1% energy reduction
- Every 10.7 F rise in boiler feedwater temperature yields ~1% steam energy savings
- Unmaintained steam system - 15% to 30% of traps failed.
- Ideal, maintained steam system – 5% of traps failed.

Improve Boiler Combustion Efficiency

Excess, %		Combustion Efficiency: Flue gas Temperature minus combustion air Temperature, F				
Air	Oxygen	200	300	400	500	600
9.5	2.0	85.4	83.1	80.8	78.4	76.0
15.0	3.0	85.2	82.8	80.4	77.9	75.4
28.1	5.0	84.7	82.1	79.5	76.7	74.0
44.9	7.0	84.1	81.2	782.2	75.2	72.1
81.6	10.0	82.8	79.3	75.6	71.9	68.2

Calculating Steam Cost

Energy required to produce one pound of saturated steam, BTU					
Operating Pressure, psig	Feed water Temperature, F				
	50	100	150	200	250
150	1178	1128	1078	1028	977
450	1187	1137	1087	1037	986
600	1184	1134	1084	1034	984

$$\$/1000\ lbs\ of\ steam = \frac{\$/MMBTU \times 1000\ lbs \times Btu/lb}{Combustion\ Efficiency \times 10^{6}}$$

Insulate Steam and Condensate Lines

Heat Loss per 100 feet of Uninsulated steam, line, MMBTU/yr				
Line Diameter, Inches	Steam Pressure, psig			
	15	150	300	600
1	140	285	375	495
2	235	480	630	840
4	415	850	1120	1500
8	740	1540	2030	2725
12	1055	2200	2910	3920

Heating Value of Fuels

	Units	LHV	HHV
Natural Gas	Btu/CF	1,050	1,050
#2 Fuel Oil	BTU/Gal	138,300	138,300
#6 Fuel Oil	BTU/Gal	150,500	150,500
Propane	BTU/CF	92,000	92,000
Coal - Bituminous	BTU/lbs	14,100	14,100

* Higher Heating Value (HHV): Total energy from combustion process
* Lower Heating Value (LHV): Assumes heat of condensation cannot be recovered

Steam Trap Failure

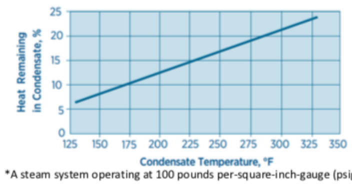
Obvious Signs
- Steam flashing
- Water Hammer
- Pump cavitation

Less Obvious signs
- Higher than necessary pressure
- Excessive condensate & Chemical losses
- Condensate water too hot
- Boilers running continuously

Losses with steam Trap Failure

Trap Orifice Diameter (inches)	Steam Loss, lb/hr: 15 psig	100 psig	150 psig	300 psig
1/32	0.85	3.3	4.8	-
1/16	3.4	13.2	18.9	36.2
1/8	13.7	52.8	75.8	145
3/16	30.7	119	170	326
1/4	54.7	211	303	579
3/8	123	475	682	1,303

Return Condensate to Boiler



*A steam system operating at 100 pounds per-square-inch-gauge (psig), with makeup water at 55°F. For other conditions use formula to the right.

Calculating %Heat Remaining in condensate using formula

$$Heat\ remaining\ in\ condensate\ (\%) = \frac{h_{condensate} - h_{makeup\ water}}{h_{steam} - h_{makeup\ water}} \times 100$$

*h - enthalpy

Example

$h_{condensate}$ at $180\ F = 148\ Btu/lb$; $h_{makeup\ water} = 23\ Btu/lb$

h_{steam} at $100\ psig = 1{,}189\ Btu/lb$

$$Heat\ remaining\ in\ condensate\ (\%) = \frac{148-23}{1189-23} = 11\%\ (as\ in\ graph)$$

Documenting TH Opportunities

- An opportunity detail sheet is a tool that helps organize and document information about identified opportunities

- Each opportunity should have an individual “opportunity sheet”

Information captured

- Description
- Implementation costs
- **Water/Energy Saved**
- Cost Savings
- Payback Metrics

Info	Title:		Plant:	0
			Business Unit:	
	Process / Equipment:		Originator:	
			Date:	Set to Today

Description			
Current Situation (Before Energy Treasure Hunt)		Projected Situation (After Energy Treasure Hunt)	
Annual Operating Hours	Number of Units	Annual Operating Hours	Number of Units
Hours /Day	Eg. Number of leaks, Number of equipment to be turned off etc.	Hours /Day	Eg. Number of leaks, Number of equipment to be turned off etc.
Days/Month		Days/Month	
Months		Months	

* This section is part of the description and the values are not used in calculations.

Energy units		Energy Use Before TH (Energy units/yr)	Energy Use After TH (Energy Units/yr)	Energy Savings (Energy Units/yr)
Electricity	- kWh			0.0
Gas	- MMBTU			0.0

Implementation Cost		$/unit	Projected Annual Savings	
Engineering Services:		$ 0.10	Electricity	$ -
Material:	$ -	$ 6.50	Gas	$ -
Labor: Contract		$ -	Compressed Air	$ -
Labor: In House		$ -	Other Fuel	$ -
Other:	$ -	$ -	Steam	$ -
Other:	$ -			
Other:	$ -	$ 20.00	Water	$ -
Other:	$ -	$ -	WWT	$ -
Other:	$ -			
			Other Savings	
Total:	$ -		Total:	$ -
			Simple Payback Period (yrs):	

Cost Description:

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**

Getting Started

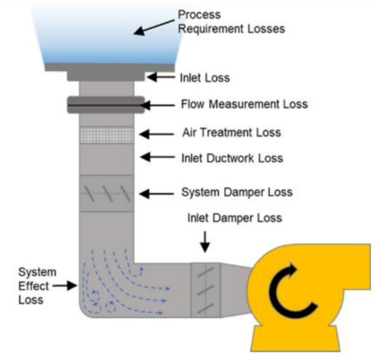
- Start an assessment
- View Assessment Dashboard
- Use Properties & Equipment Calculators
- Help and User Experience
  - Change Settings
  - View Tutorials
  - Manage Custom Materials
  - Provide Feedback
  - Translate

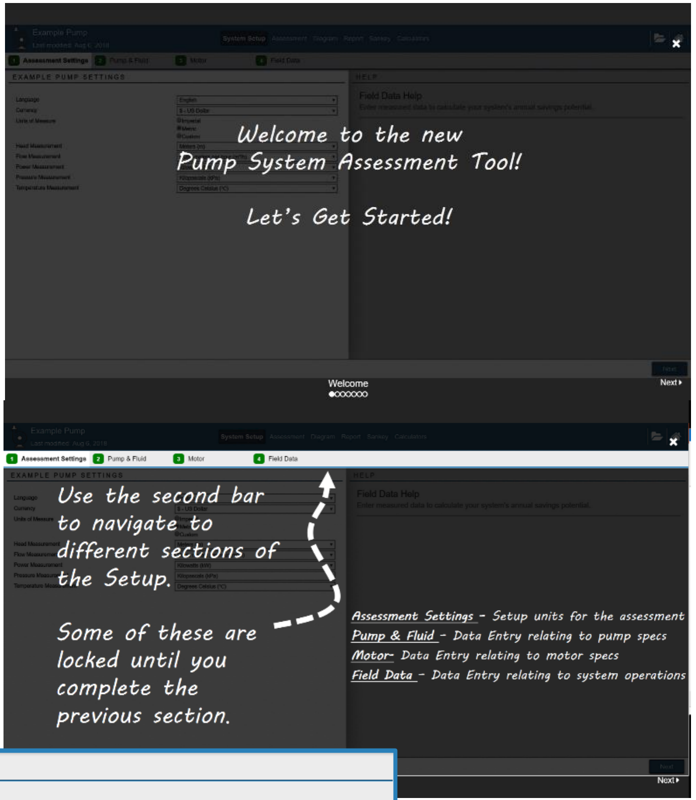
Key Features - Help Text & Tutorials

- Tutorials
  - Help to get started using tool
- Help text for each data entry field
  - Diagrams to help understand where to obtain data
  - Can switch between help or results being shown by default

Estimate Inlet Pressure

This calculator is to estimate inlet pressure when inlet pressure cannot be directly measured, by estimating potential pressure losses. Losses can be estimated using information from fan/accessory manufacturers or by consulting references such as AMCA Publication 201 – Fans and Systems.





RESULTS | HELP

Charge Material Help

Enter measured data to calculate your system's annual savings potential.

Savings Suggestions

Explore possibilities of lowering the final product temperature
Preheating the charge or load material entering the furnace
Pre-drying to reduce moisture content of the load entering the furnace
Maintain charge feed rate as close to the rated capacity as possible
Consider possibility of reducing endothermic reactions by controlling process conditions

Note: These energy saving measures are for guidance only. Not all measures are applicable under all operating conditions. There may additional measures when considering specific situations and the user is encouraged to review and apply the appropriate measures

HELP

Motor Help

Enter measured data to calculate your system's annual savings potential.

Motor RPM

Motor RPM is the nameplate speed of the motor.
This value is used with the line frequency to determine the number of motor poles. This, in turn, is used (along with motor class and size) to estimate motor efficiency and output shaft power for the measured electrical power or current conditions.

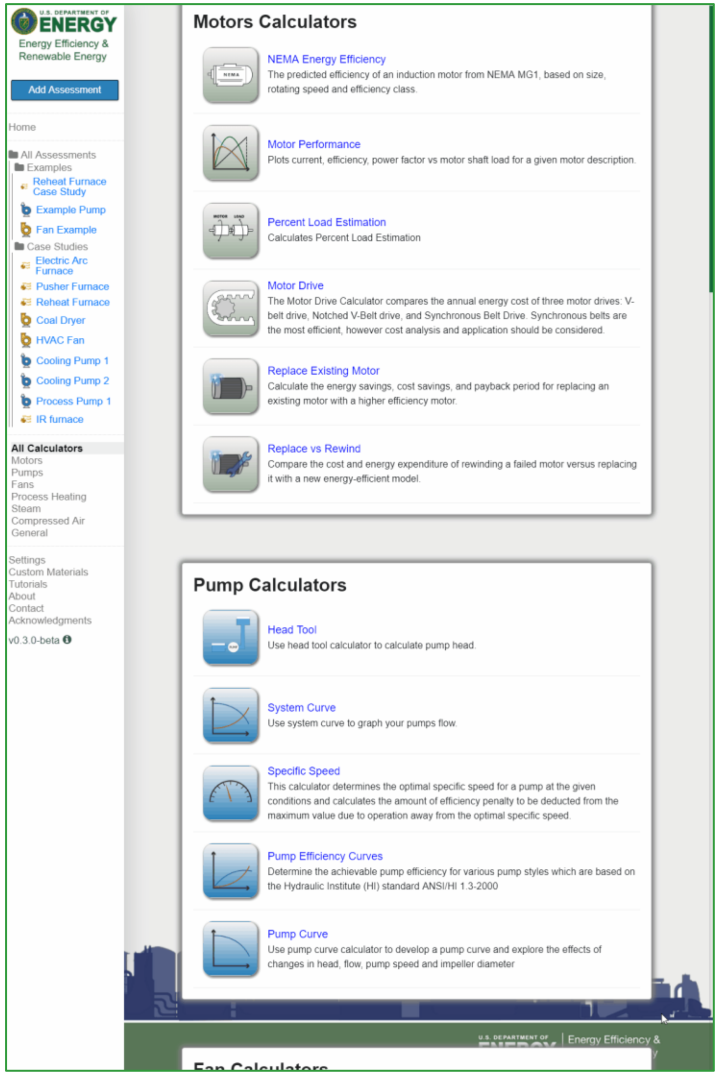
Efficiency Class	Line Frequency	Minimum	Maximum
Standard Efficient	60 Hz	540 rpm	3600 rpm
Standard Efficient	50 Hz	450 rpm	3000 rpm
Energy Efficient	60 Hz	540 rpm	3600 rpm
Energy Efficient	50 Hz	450 rpm	3000 rpm
Premium Efficient	60 Hz	1080 rpm	3600 rpm
Premium Efficient	50 Hz	900 rpm	3000 rpm

Treasure Hunt Module

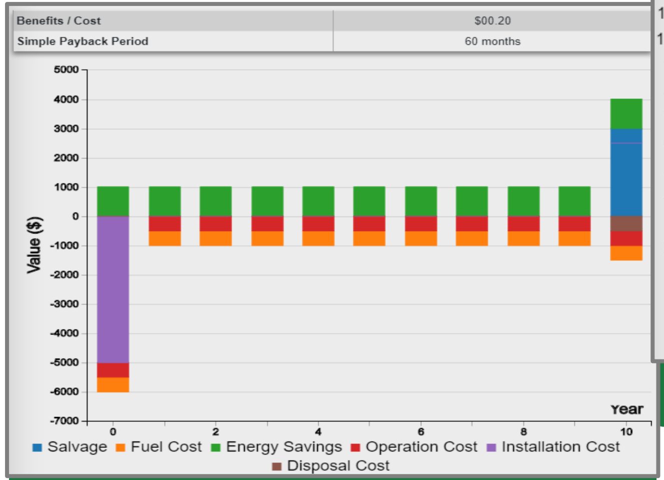
- Find low/no cost energy savings opportunities in motor systems, process heating, compressed air, lighting, etc.

Calculators

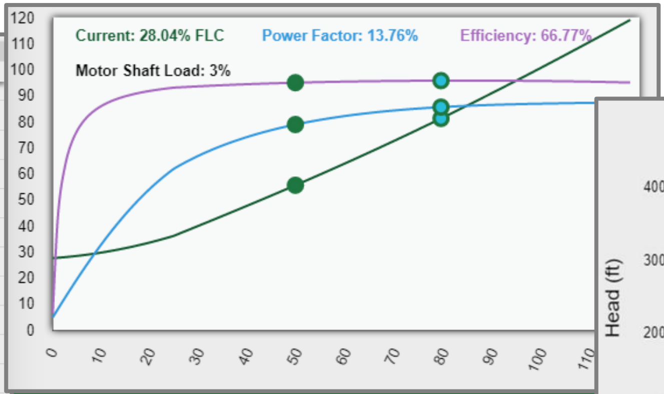
- 50+ Stand alone Calculators
  - Motors
  - Pumps
  - Fans
  - Process Heating
  - Steam
  - Compressed Air
  - Lighting
  - General
- Most have graphical results



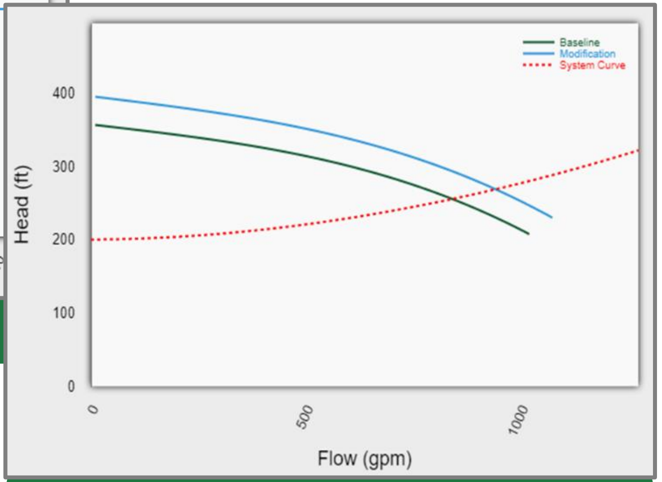
Example Calculators



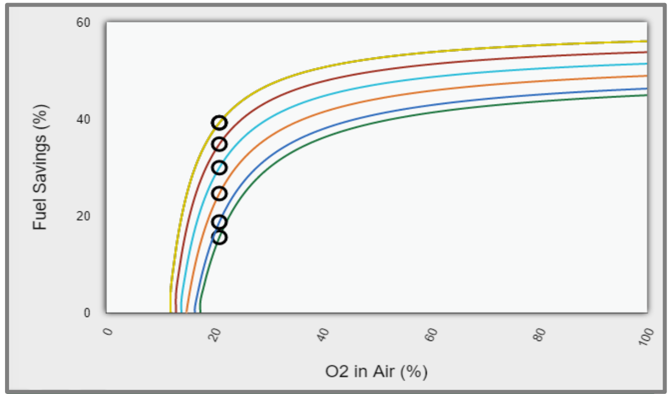
Cash Flow Diagram



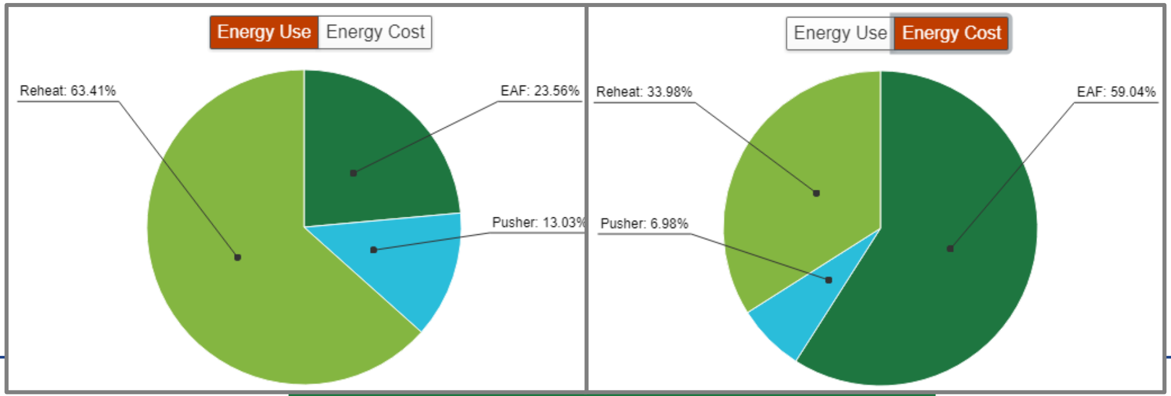
Motor Performance



Pump Curve

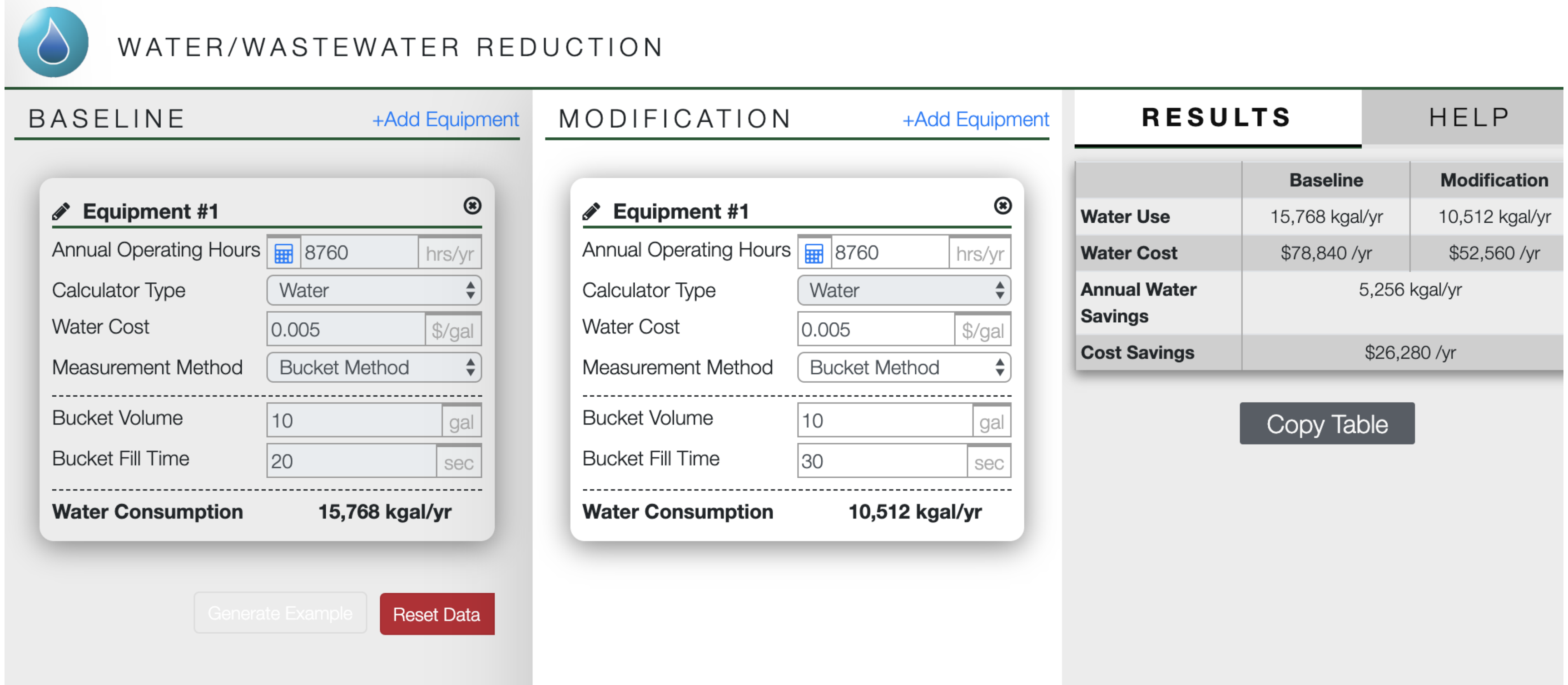


O_2 Enrichment



Pre-assessment

Treasure Hunt Calculator for Water

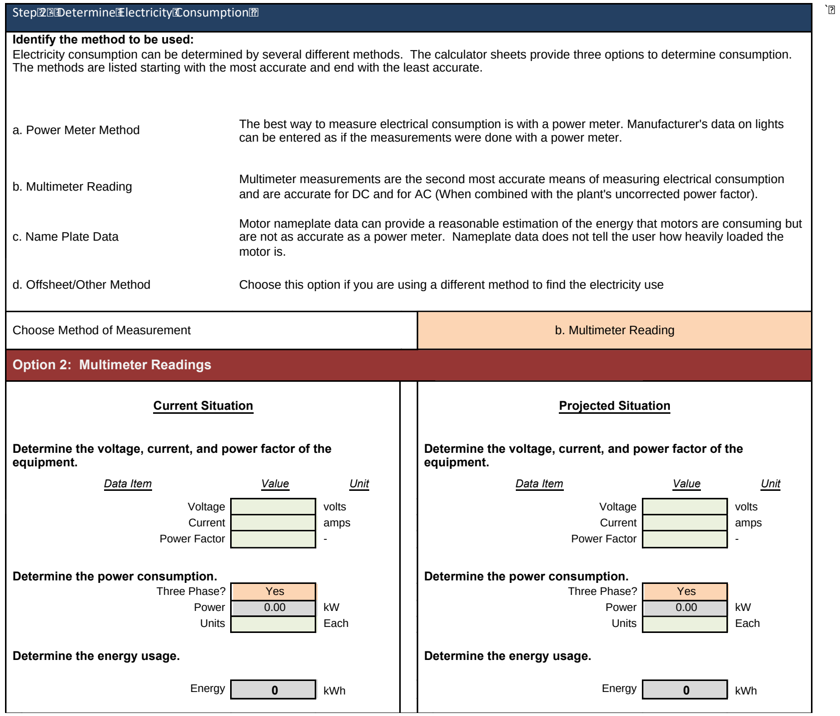


To estimate the savings associated with typical operational opportunities, e.g. Scheduling the equipment, reducing the load on the equipment etc.

Source: https://www.armstronginternational.com/knowledge/resources-library/calculators/steam-loss

Excel Version of Treasure Hunt Tools

Opportunity detail sheet helps document the projects and the calculators helps quantify the savings



Step 2: Determine Electricity Consumption

Identify the method to be used:
Electricity consumption can be determined by several different methods. The calculator sheets provide three options to determine consumption. The methods are listed starting with the most accurate and end with the least accurate.

a. Power Meter Method	The best way to measure electrical consumption is with a power meter. Manufacturer's data on lights can be entered as if the measurements were done with a power meter.
b. Multimeter Reading	Multimeter measurements are the second most accurate means of measuring electrical consumption and are accurate for DC and for AC (When combined with the plant's uncorrected power factor).
c. Name Plate Data	Motor nameplate data can provide a reasonable estimation of the energy that motors are consuming but are not as accurate as a power meter. Nameplate data does not tell the user how heavily loaded the motor is.
d. Offsheet/Other Method	Choose this option if you are using a different method to find the electricity use
Choose Method of Measurement	b. Multimeter Reading

Option 2: Multimeter Readings

Current Situation

Determine the voltage, current, and power factor of the equipment.

Data Item	Value	Unit
Voltage		volts
Current		amps
Power Factor		-

Determine the power consumption.

Three Phase?	Yes	
Power	0.00	kW
Units		Each

Determine the energy usage.

Energy	0	kWh

Projected Situation

Determine the voltage, current, and power factor of the equipment.

Data Item	Value	Unit
Voltage		volts
Current		amps
Power Factor		-

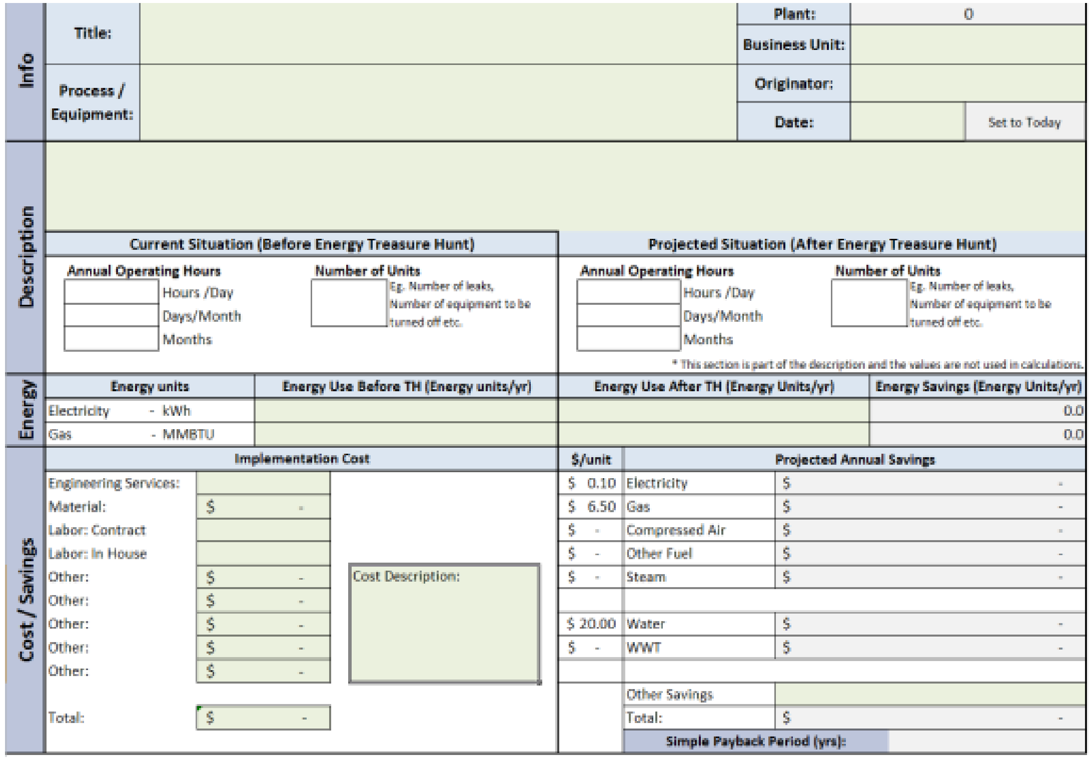
Determine the power consumption.

Three Phase?	Yes	
Power	0.00	kW
Units		Each

Determine the energy usage.

Energy	0	kWh

Treasure Hunt Calculators



Info

Title:		Plant:	0
		Business Unit:	
Process / Equipment:		Originator:	
		Date:	Set to Today

Description

Current Situation (Before Energy Treasure Hunt)		Projected Situation (After Energy Treasure Hunt)	
Annual Operating Hours	Number of Units	Annual Operating Hours	Number of Units
Hours /Day	Eg. Number of leaks, Number of equipment to be turned off etc.	Hours /Day	Eg. Number of leaks, Number of equipment to be turned off etc.
Days/Month		Days/Month	
Months		Months	

* This section is part of the description and the values are not used in calculations.

Energy

Energy units	Energy Use Before TH (Energy units/yr)	Energy Use After TH (Energy Units/yr)	Energy Savings (Energy Units/yr)
Electricity - kWh			0.0
Gas - MMBTU			0.0

Cost / Savings

Implementation Cost		$/unit	Projected Annual Savings	
Engineering Services:		$ 0.10	Electricity	$ -
Material:	$ -	$ 6.50	Gas	$ -
Labor: Contract		$ -	Compressed Air	$ -
Labor: In House		$ -	Other Fuel	$ -
Other:	$ -	$ -	Steam	$ -
Other:	$ -			
Other:	$ -	$ 20.00	Water	$ -
Other:	$ -	$ -	WWT	$ -
Other:	$ -			
			Other Savings	
Total:	$ -		Total:	$ -
			Simple Payback Period (yrs):	

Cost Description:

Opportunity Sheets

Resources in MEASUR applicable to Treasure Hunts

Treasure hunt module helps create and track opportunity sheets for documenting TH activities

Calculators help quantify the savings associated with an identified opportunity

The results from the calculator are used to populate the opportunity sheets.

Two types of Utility Efficiency Calculators are available

I. **Treasure Hunt General Calculators**
   - To estimate the savings associated with typical operational opportunities, e.g. Scheduling the equipment, reducing the load on the equipment etc.

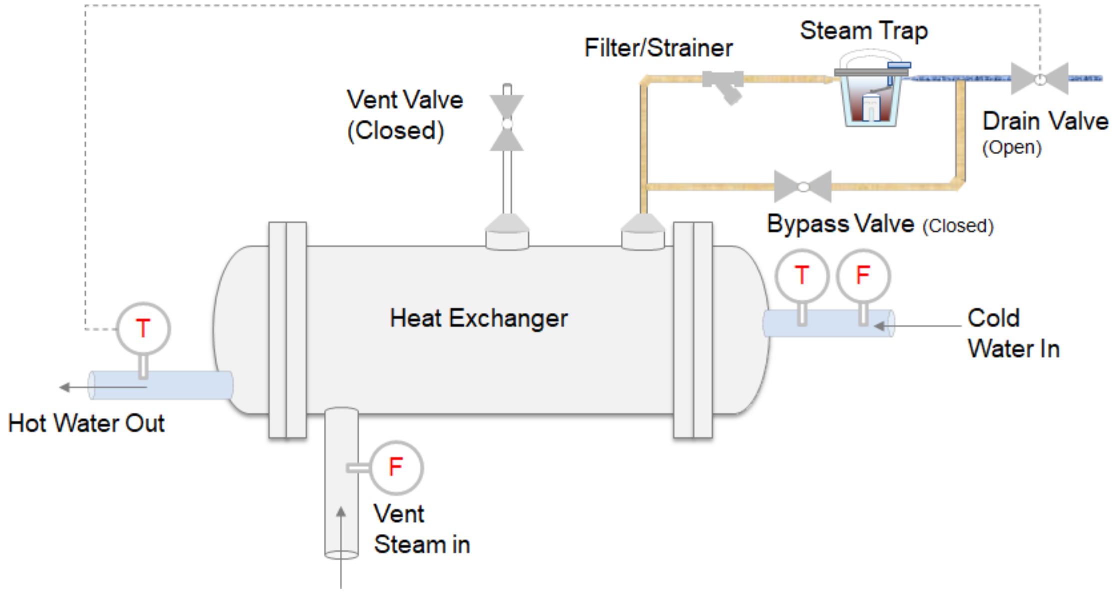
II. **Opportunity Specific Calculators**
   - Available for some common opportunities that cant be easily quantified using the treasure hunt calculator e.g. cooling tower, boiler etc.

Participants can use their own method or tool to quantify savings, however, the result of the calculation and description still needs to be captured in a standard opportunity sheet.

Vent Steam to Heat Exchanger

- Calculates energy and water cost saving when vent steam is used to heat hot water.

- The steam source can be deaerator water tanks, flash steam from condensate return tank or any other equipment / process that vents steam into the atmosphere.

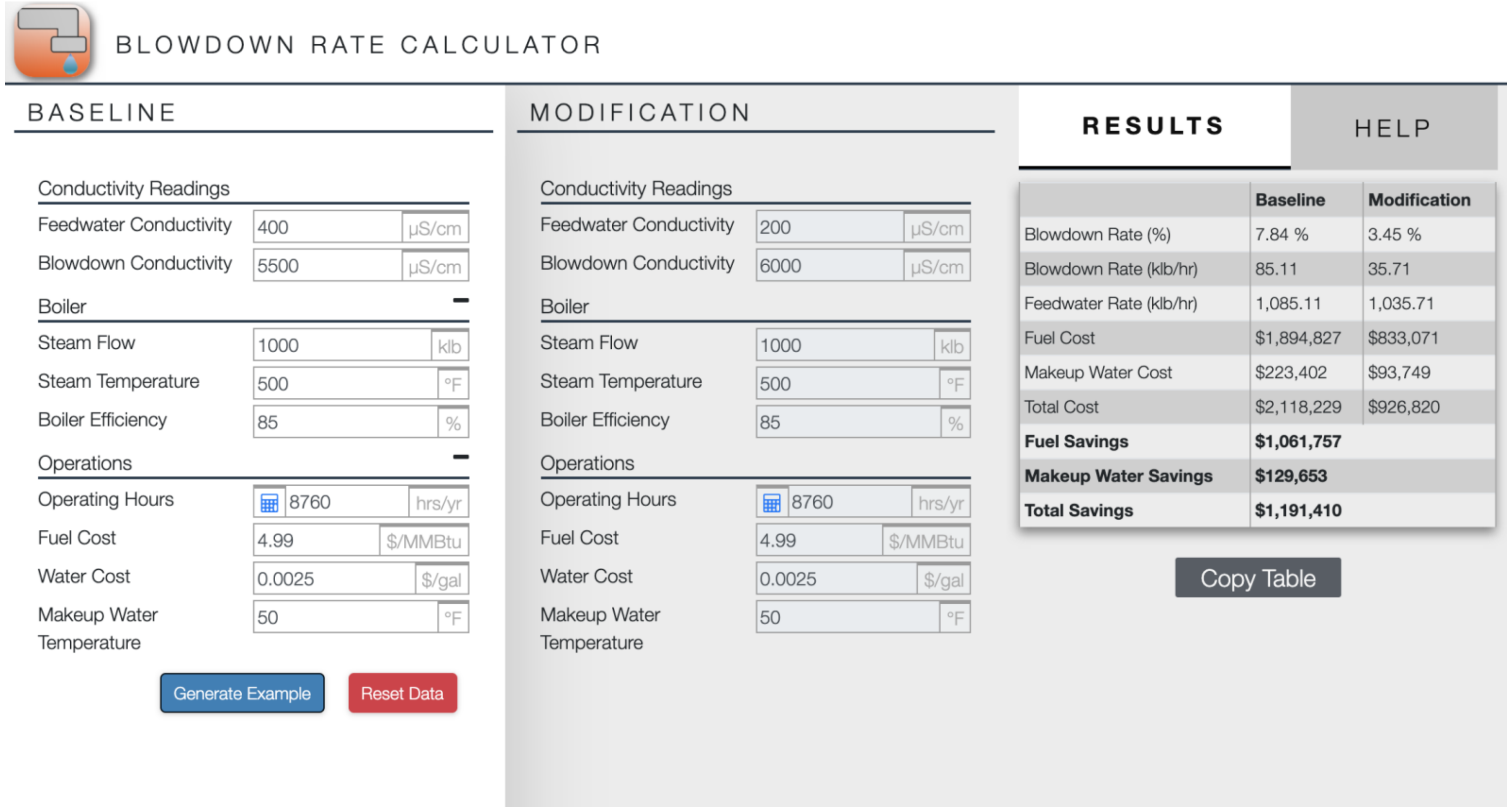


Savings from

- Elimination of energy used to heat water that will be heated by using vent steam.

- Returning condensate back to boiler reducing makeup water and treatment costs

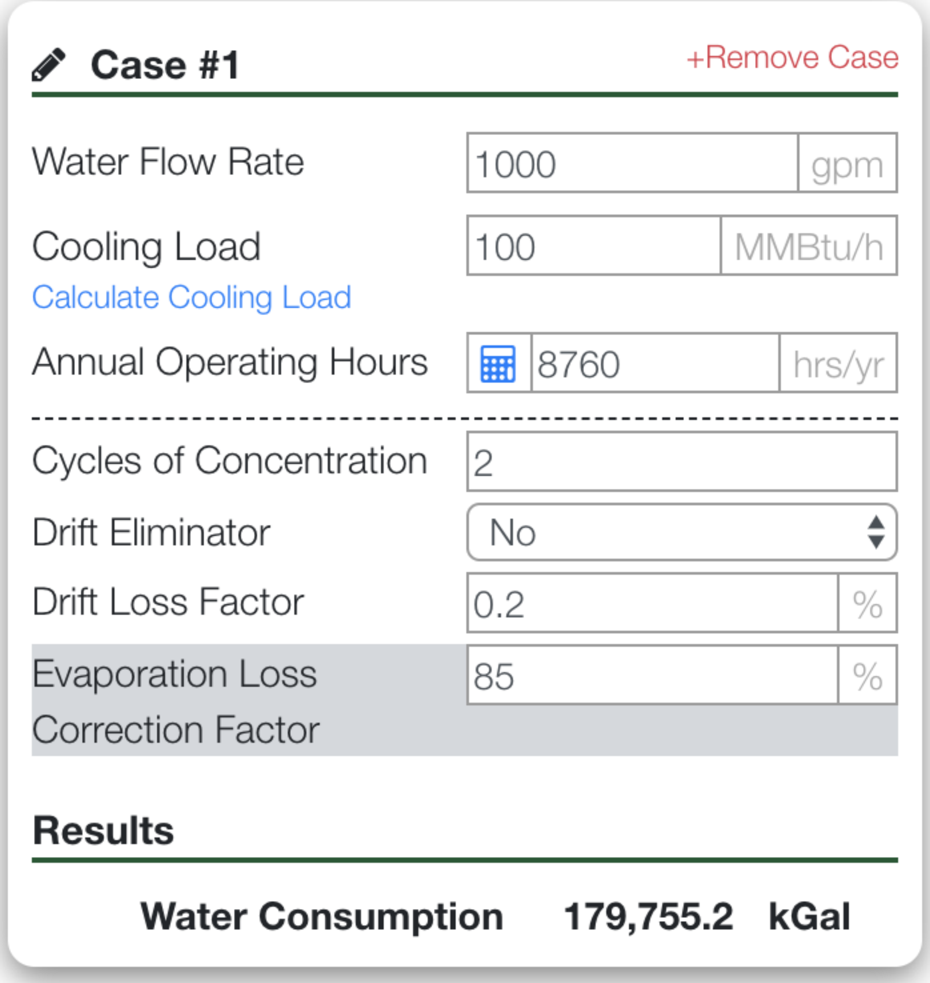
Blowdown Rate Calculator



Calculate Costs associated with boiler blowdown

Cooling Tower Water Use Calculator

Analyze the effect of drift eliminators/cycles of concentration on cooling tower water consumption and estimate the resulting water savings.



Boiler and Cooling Tower Calculator from PWP

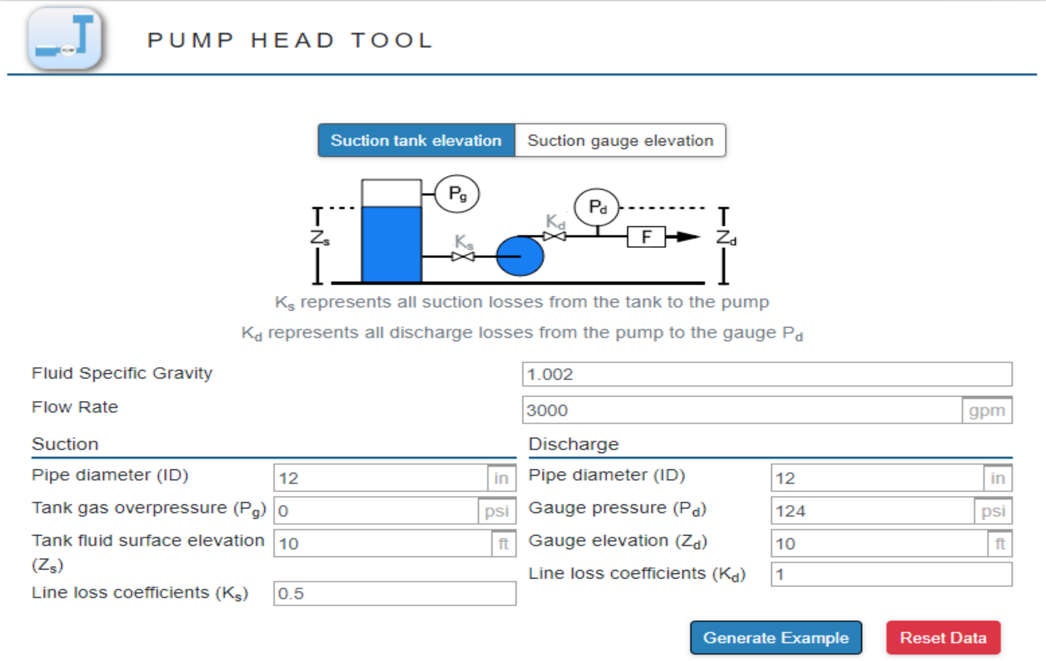
Boiler	Hours of Operation per Year	Boiler Horsepower (BHP)	Load Factor (Fraction of BHP)	Steam Generation Rate (lb/h) per BHP	Feedwater Conductivity	Makeup Water Conductivity	Blowdown Conductivity	Million Gallon per Year (% of Gross Water Use)				
								Feedwater	Makeup Water	Blowdown	Steam Lost	Condensate Return
					TDS ppm	TDS ppm	TDS ppm		Incoming	Outgoing		
Boiler for:	8,000	100.0	0.8	34.5				-	-	-	-	-
								-	-	-	-	-
								-	-	-	-	-
								-	-	-	-	-
								-	-	-	-	-

Cooling Tower	Hours of Operation per Year	Cooling Tower Tonnage	Load Factor (Fraction of Tonnage)	Evaporation Rate per 10°F Temp. Drop (%)	Temp. Drop Across Cooling Tower (°F)	Makeup Water Conductivity	Blowdown Conductivity	Million Gallon per Year (% of Gross Water Use)				
								Gross Water Use	Incoming	Outgoing		Recirculated Water
									Makeup Water	Blowdown	Evaporation	
								-	-	-	-	-
								-	-	-	-	-
								-	-	-	-	-
								-	-	-	-	-

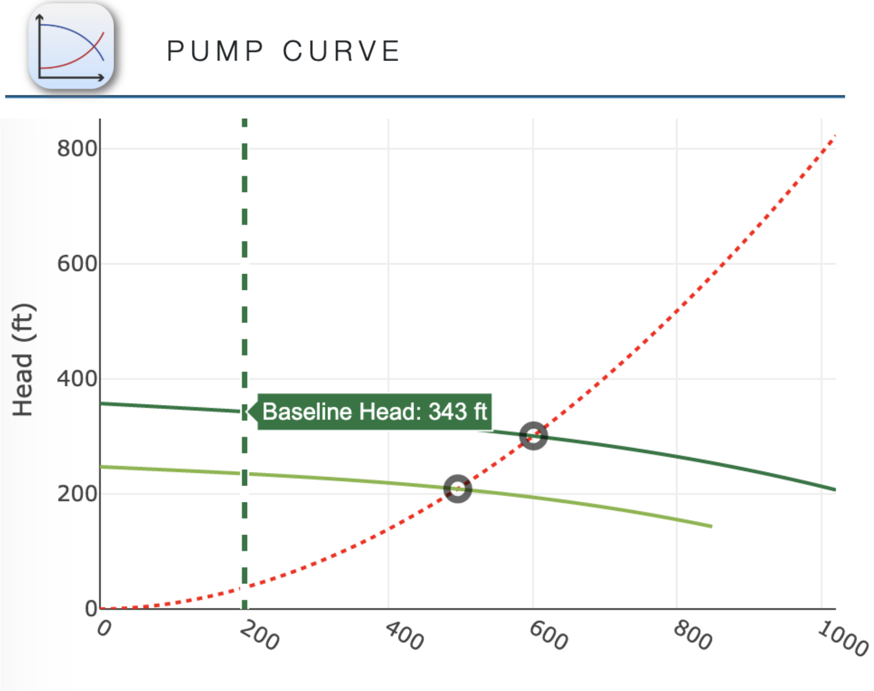
Calculators in MEASUR are similar and follow the same principals

Pumping System

Pumping system characteristics can be estimated by using the Pump Head Calculator and Pump Curves



Given a measured pressure, elevation, flow rate, and line size data calculate the head for a pump



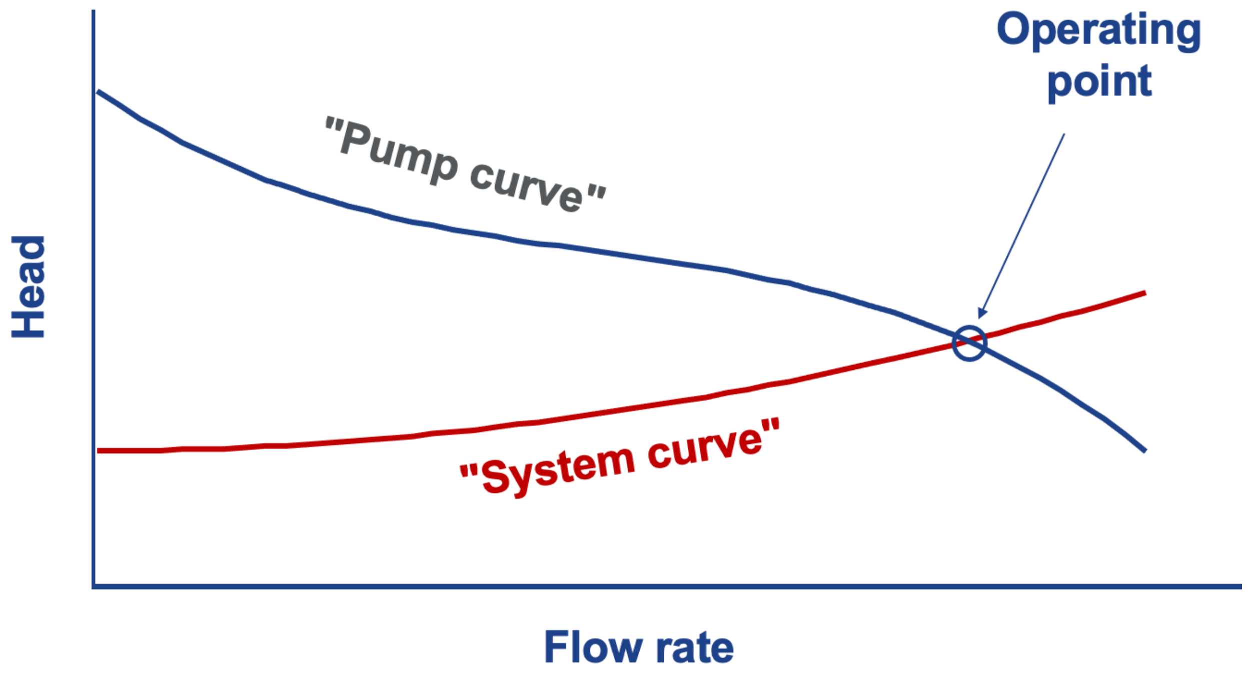
Use pump curve calculator to develop a pump curve and explore the effects of changes in head, flow, pump speed and impeller diameter.

Pump Curves & System Curves

The system curve represents the energy required to move fluid through the system.

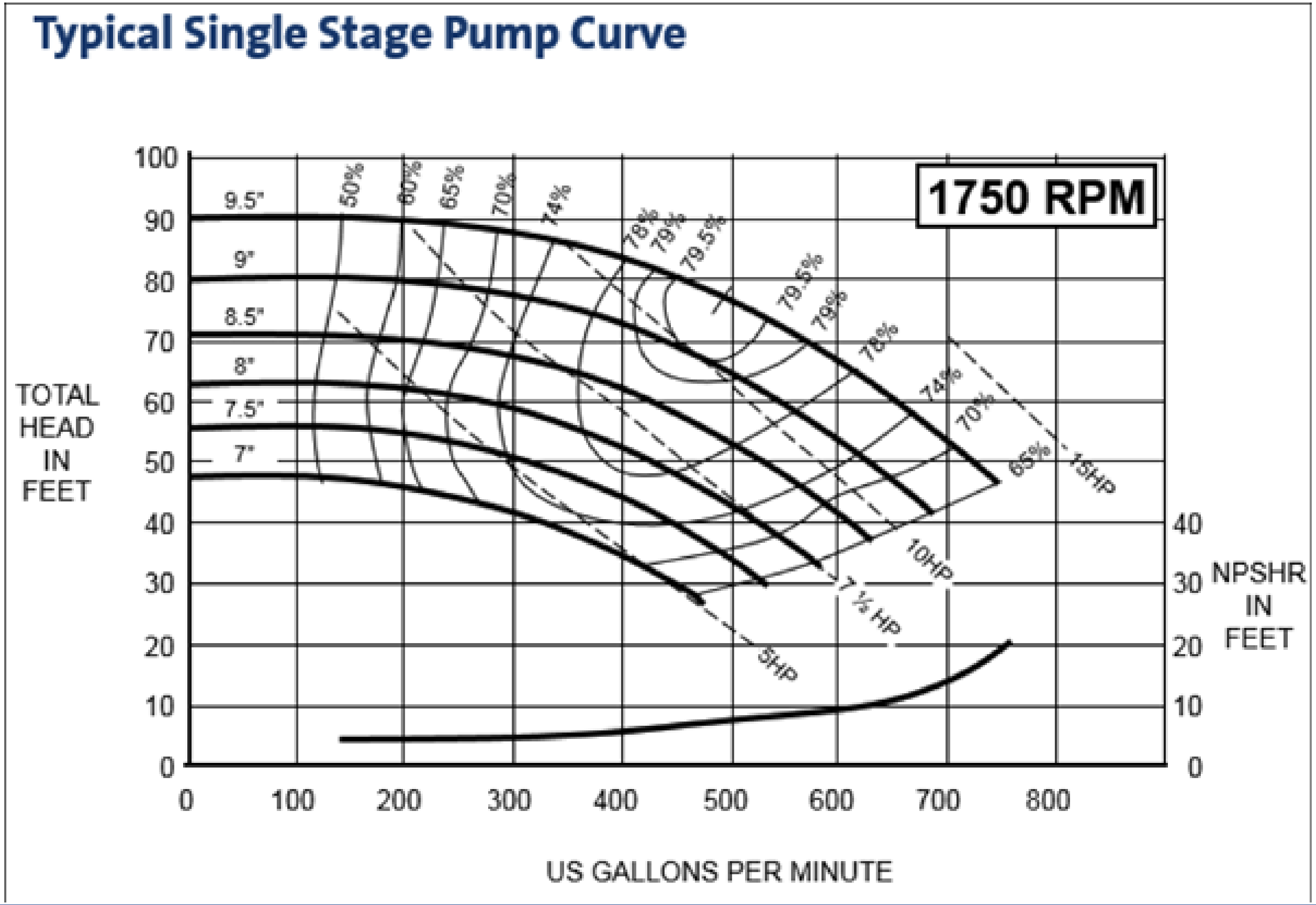
If anything in the system changes – including valve positions, flow paths, tank levels, etc., the system curve will change.

A pump curve gives the performance of a pump when working against a given system pressure to produce a flow



Knowing the system and pump curves can help optimize the flow though a pumping system

Pump performance characteristics

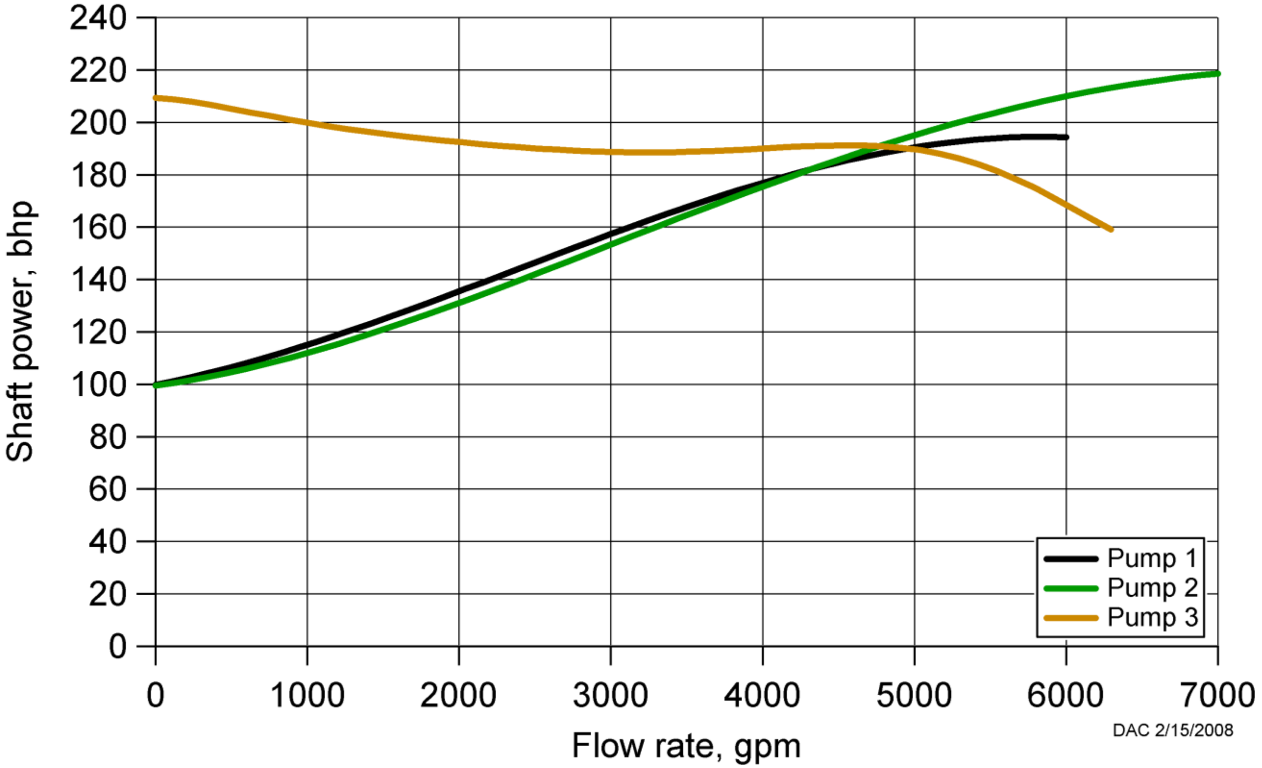


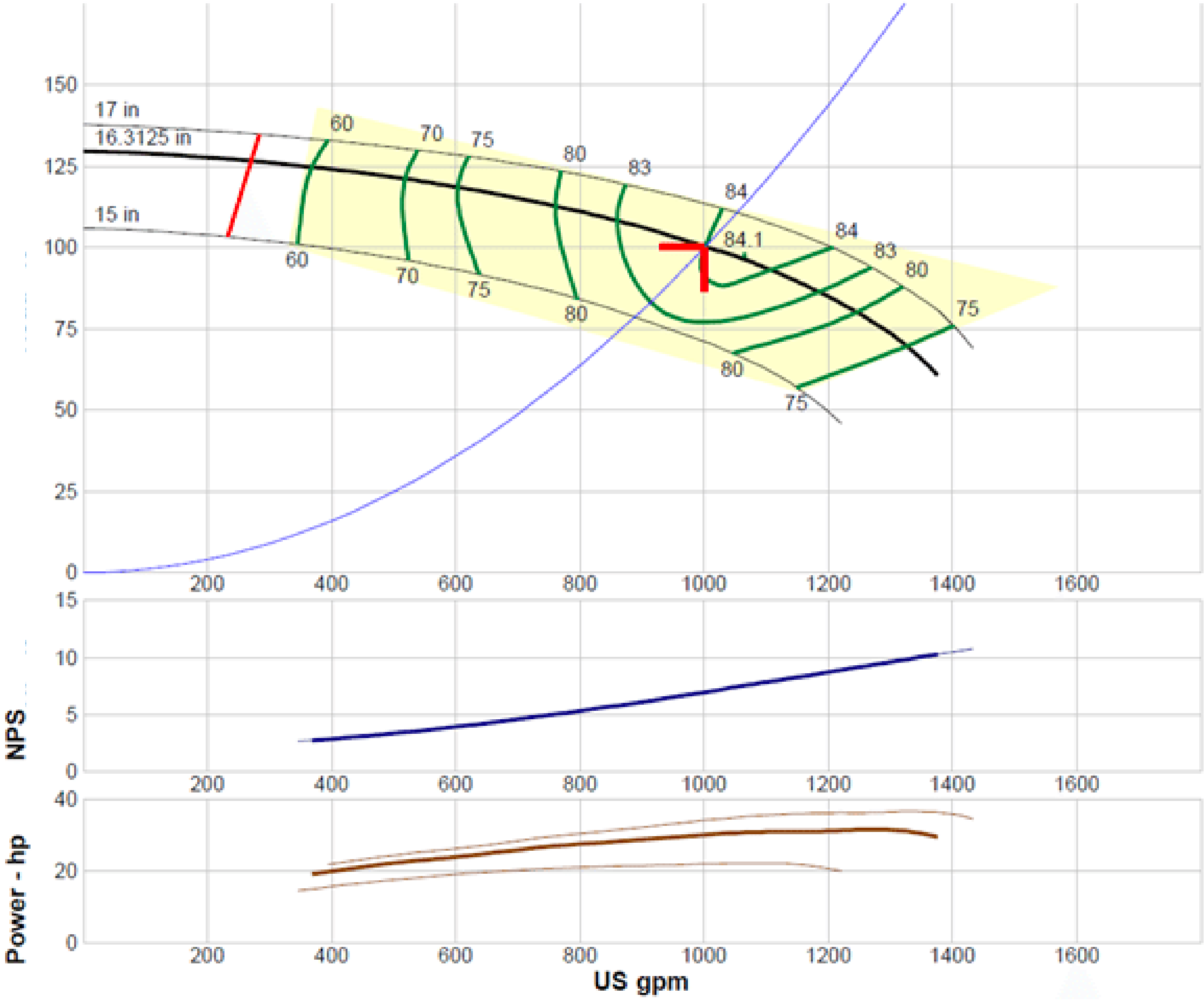
Identifying the right pump curve requires knowing the following

- Manufacturer
- Model Number
- Diameter of impeller
- Associated motor system

In addition to head, pump curves are also drawn against
- Shaft power
- Efficiency
- Net positive suction head required (NPSHR)

Reading Flow from power curves

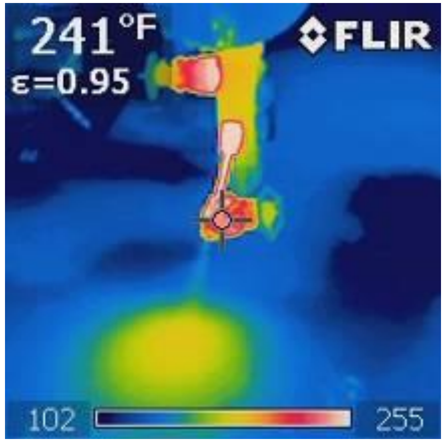




When reading flow rate from graph, double check flow rate using power and head

Steam Leaks

- Steam leaks occur everywhere but most common places are:
  - Flanges and gasketed joints
  - Pipe fittings
  - Valves, Stems and packings
  - Steam traps
  - Relief valves
  - Pipe failures, etc.



- An “order of magnitude” steam loss estimate can provide enough information to determine if the repair must be made immediately, during a future shutdown, or online

- Pipe failures (steam leaks) often present a “safety issue” that demands immediate attention

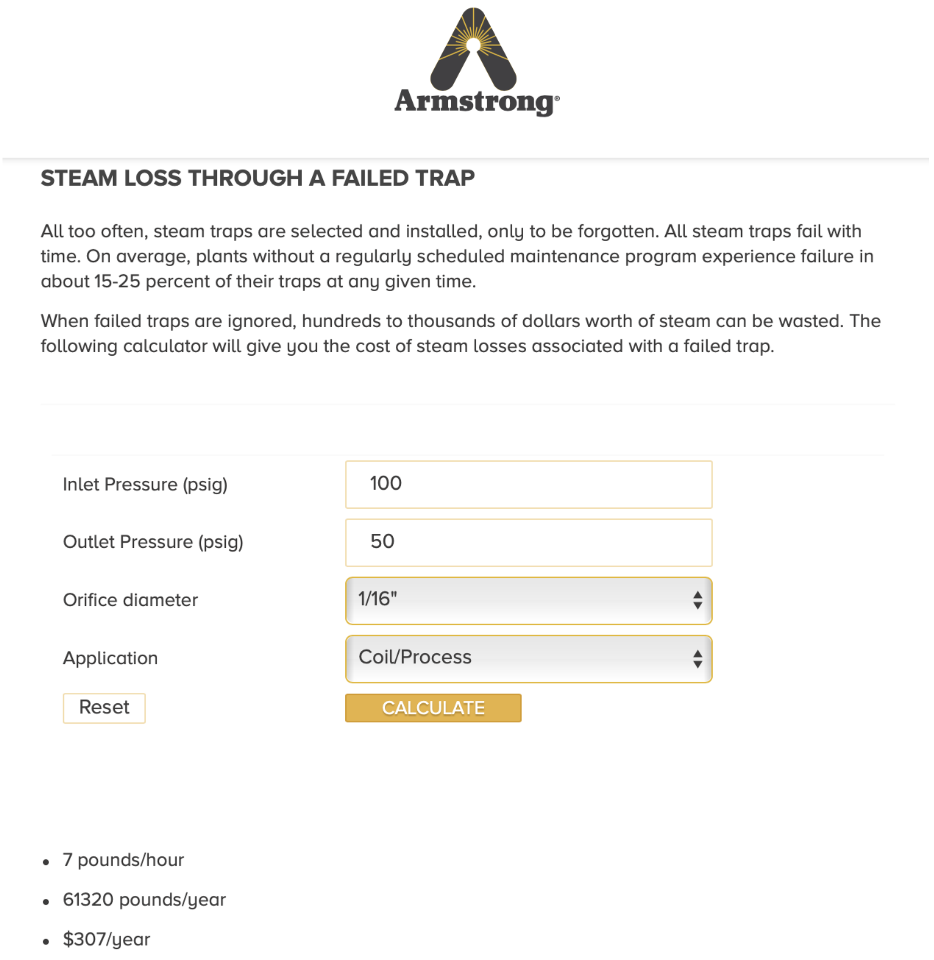
Steam Leaks

Orifice Diameter [inch]	Leak Rate [lb/hr]						
	Steam Supply Pressure [psig]						
	20	50	100	150	300	400	500
1/16	3	6	11	16	30	39	49
1/8	13	25	43	62	119	157	195
3/16	30	55	98	140	268	353	439
1/4	53	98	174	249	477	628	780
5/16	82	153	271	390	745	981	1,218
3/8	118	221	391	561	1,073	1,413	1,754
7/16	161	300	532	764	1,460	1,924	2,388
1/2	210	392	695	998	1,907	2,513	3,118
	3	18	43	68	143	193	243
	Discharge Pressure [psig]						
Discharge coefficient		0.6	dimensionless				

Third party Tools - Steam Trap Loss Calculator

- The calculator will give you the cost of steam losses associated with a failed trap.

- Leak rate calculated from size of orifice and pressure



Source: https://www.armstronginternational.com/knowledge/resources-library/calculators/steam-loss

Third party Tools - Water Leak

Water cost calculator tool to show how much water and cost associated with a leak

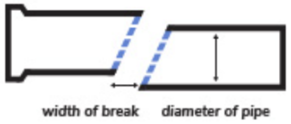
Leak rate calculated from size of leak and pressure

Water Leak Calculator

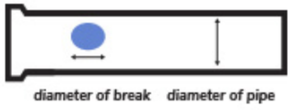
Leak Information

Select your break type to get started:

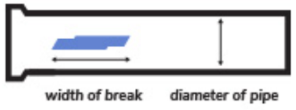
Circular Break



Hole in Pipe

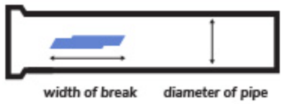


Rectangular Break Along Pipe



Your Water Loss Results

Rectangular Break Along Pipe



Length of Break: **.01 feet**

Width of Break: **.01 inches**

Pressure in Pipe: **35 PSI**

Cost of Treated Water: **$ per 1,000 gallons**

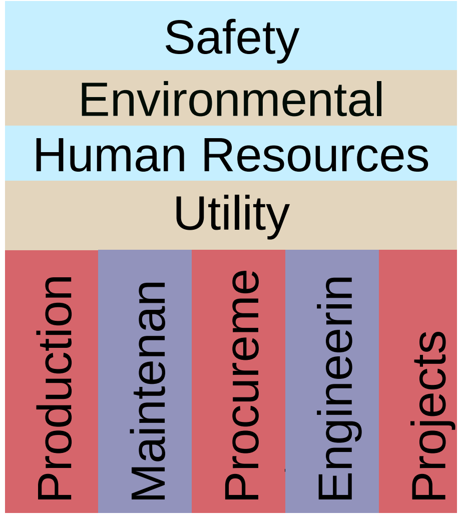
0.19
Gallons Lost Per Minute

274
Gallons Lost Per Day

99,864
Gallons Lost Per Year

Treasure Hunt – Best Practices

- Include participants from across all operations and from outside the host facility
- Operational opportunities can be ideally identified when facility is ideal. Treasure hunts should ideally start on Sundays which typically a non-production day for many facilities
- Target 3 teams of 5 participants, select focus areas based on your facility
- Energy and water treasure hunts can be done together
- Have an effective follow through
  - Have a closing meeting with all stakeholders including management
  - Assign specific tasks to people



Presenting the Results

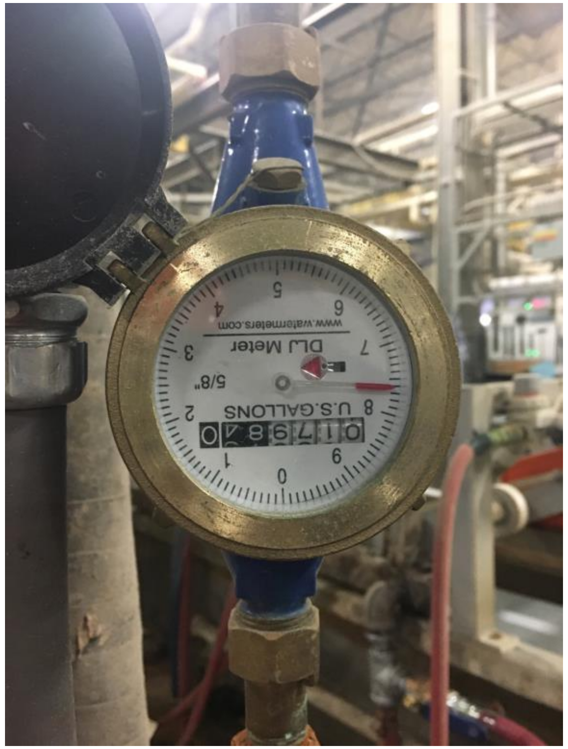
- Present results in the language of the management
  - Tie it to facility/ organizational priorities
- Include next steps for each measure
- Include the best practices that you found along with opportunities
- Keep it brief and visual

Closeout presentations helps make immediate discissions and identify steps of actions

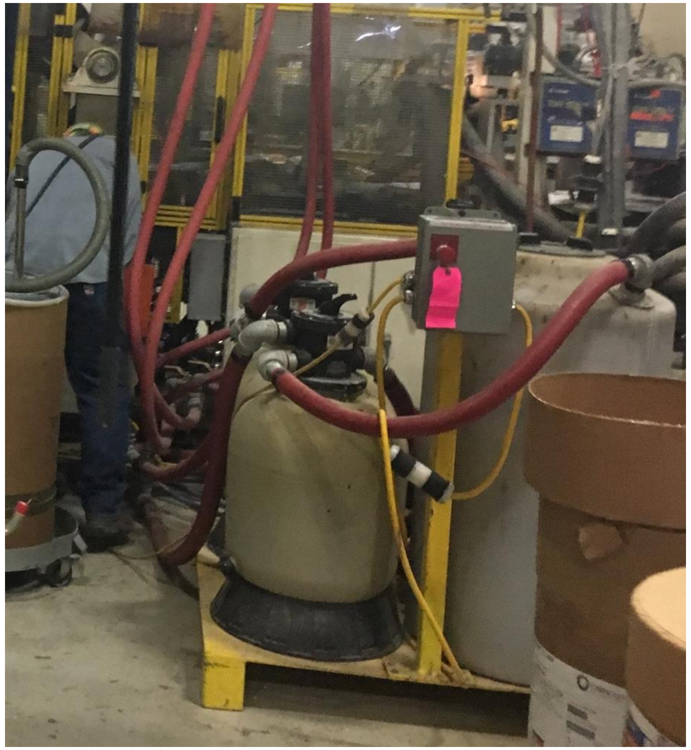
Example Presentation

U.S. DEPARTMENT OF
ENERGY

Best Practices



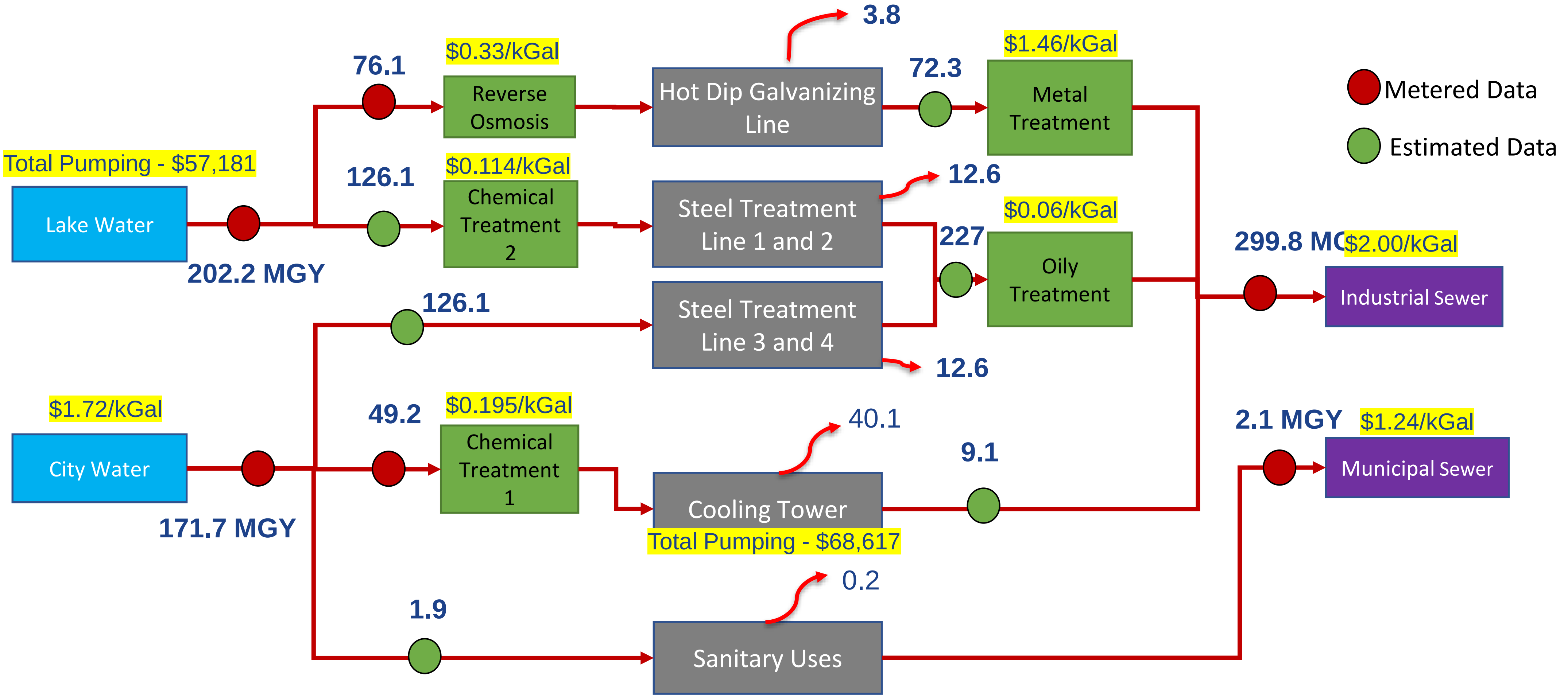
Water flow Metering



Recirculation System

High Cycles on Tower

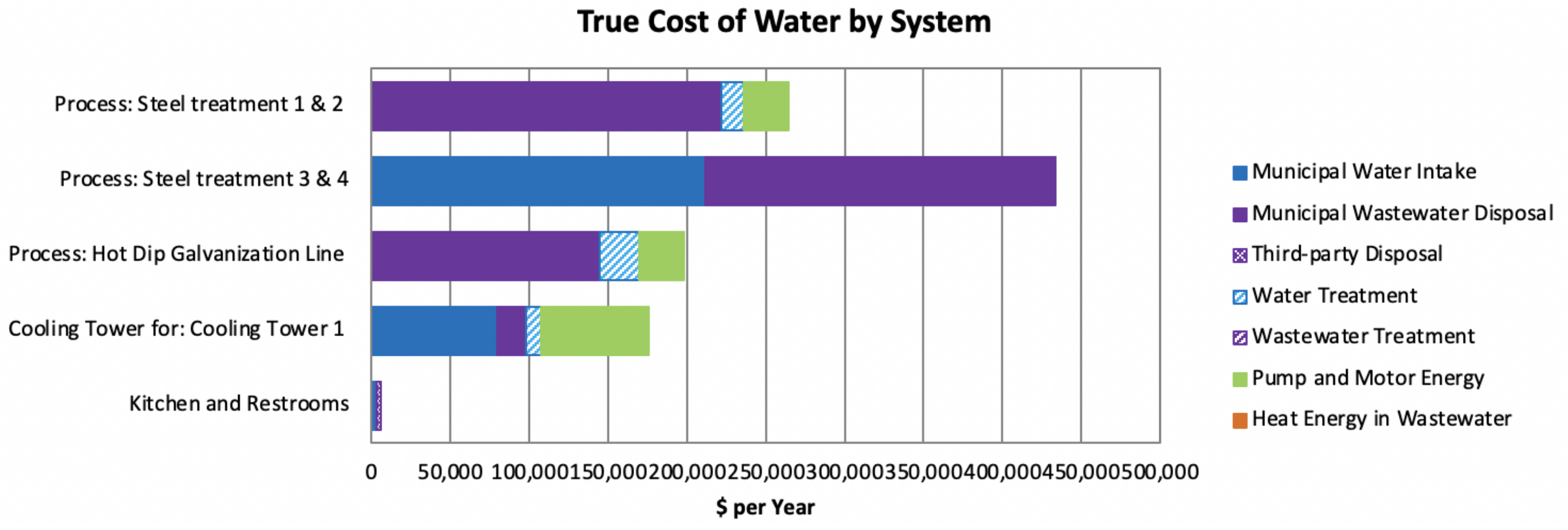
Plant Water Flows

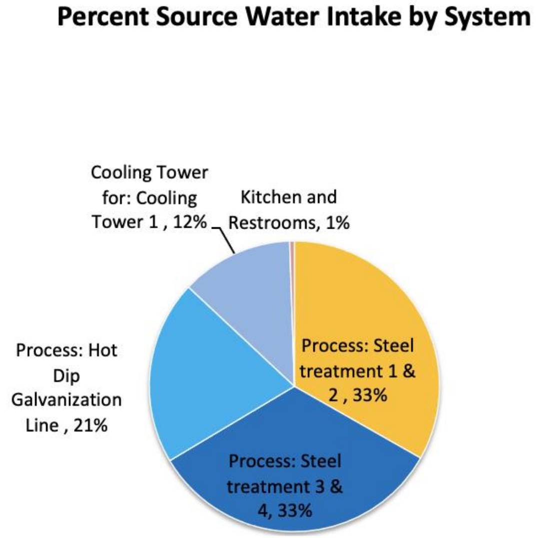


Assessment Results - True Cost of Water

Annual Water Use and Cost Summary by System

Water-Using System	Source Water Intake	Gross Water Use	Direct Costs		True Cost of Water*		True Cost/Direct Cost
	Million Gallon per Year		$/Year	$/kGal	$/Year	$/kGal	
Process: Steel treatment 1 & 2	123.19	123.19	$ 221,742	$ 1,800	$ 264,376	$ 2,146	1.192
Process: Steel treatment 3 & 4	123.19	123.19	$ 433,629	$ 3,520	$ 433,629	$ 3,520	1.0
Process: Hot Dip Galvanization Line	76.1	76.1	$ 144,590	$ 1,900	$ 198,293	$ 2,606	1.371
Cooling Tower for: Cooling Tower 1	46.4	4,727.131	$ 98,008	$ 2,112	$ 175,673	$ 3,786	1.792
Kitchen and Restrooms	1.916	1.916	$ 5,672	$ 2,960	$ 5,672	$ 2,960	1.0
PLANT TOTAL	**370.796**	**5,051.527**	**$ 903,641**	**$ 2,437**	**$ 1,077,644**	**$ 2,906**	**1.193**





Water Assessment – Key Conclusions

- Metering production water will help understand water flows better
- Water used in steel treatment is most expensive
- RO brine water needs to be investigated
- Pumping energy and recirculation can be reduced with better controls

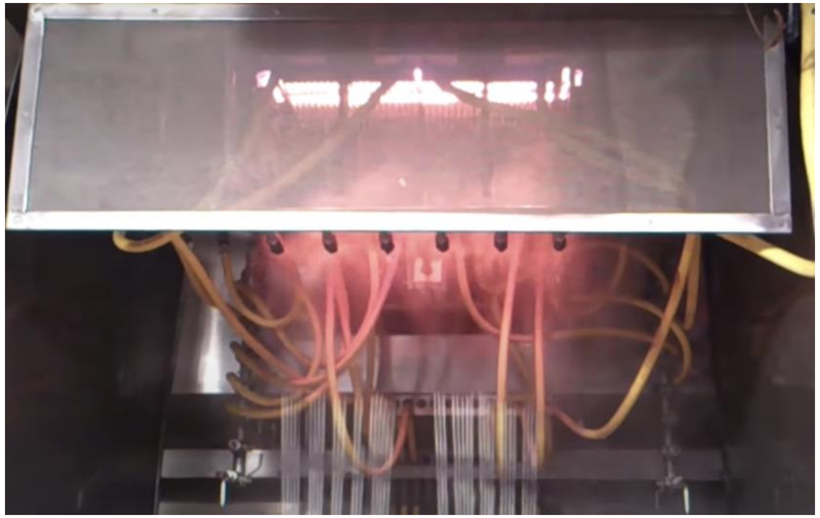
Water Savings Opportunity

- Water Treasure Hunt approach to find savings

- Two teams where formed to identify opportunities
  - Team 1 – Production
  - Team 2 – Facility

Reduce Number of Spray Nozzles per Position

It was observed that majority of nozzles spraying water at the end of positions lack contact with the glass



Automated water nozzles

Opportunity:

40 MGY used in forming tunnels (from sub metering)
90% of water used in forming is from nozzle spraying (from water balance)

Water used in nozzles = 36 MGY (90% of 40 MGY)

20% reduction of nozzles can be reduced (1 per position) – by comparing it to industry standards

True cost of water = $3.5 /kgal

Potential Cost Savings = $27,527

Low Flow Nozzles for Wash Bay

- The wash bay uses warm pressurized water for cleaning
- The flow through the nozzle is determined to be 3GPM
- Using Low flow nozzles this can be cut down by half

Reduction in Water = 1.06 MGY

Estimated Cost savings = $12,000

Implementation Cost = $100

Payback = Immediate

Additional Water Savings Opportunity

- Splash out around dip stands
- Cooling Tower replacement
- Use wireless meters to evaluate leaks, drains left open etc.

National Alliance for Water Innovation (NAWI)

Public-private partnership supported by the United States Department of Energy (DOE)

NAWI National Alliance for Water Innovation

Peter Fiske

Peter S. Fiske is the founder and Executive Director of NAWI and the Director of the Water-Energy Resilience Research Institute (WERRI) at Lawrence Berkeley National Laboratory.

Prior to joining Berkeley Lab, Fiske was the Chief Executive Officer of PAX Water Technologies, Inc. PAX Water pioneered the use of biomimicry to develop innovative and energy-efficient technologies for the water industry.

Fiske has also led research team at Lawrence Livermore National Laboratory and holds Ph.D. from Stanford University and an M.B.A. from the Haas School of Business at the University of California at Berkeley.

Homework #6

- Prepare summary slides for next weeks wrap-up presentation

1 on 1 calls can be setup anytime this week to help with finalizing water baselining, determining true cost ,quantifying savings from projects etc.

Treasure Hunt - Group Meeting

Meeting Goal: Review opportunities from walkthrough and identify projects to pursue further

List of all opportunities identified and separate them in two categories

1. Most promising opportunities identified
   - What additional data is needed to quantify savings
   - Cost and payback of each measure.
   - Make a slide for management presentation

2. Additional opportunities that may require large capital expenditures, or opportunities that require more analysis and should be completed later.

Thank You all for attending today's webinar.

See you all on next Tuesday – July 9th, 2024 – 10 am ET

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