Better Plants
U.S. DEPARTMENT OF ENERGY

VIRTUAL WASTEWATER INPLT SESSION 1

U.S. DEPARTMENT OF ENERGY

Recording

This meeting is being recorded (both audio and video)

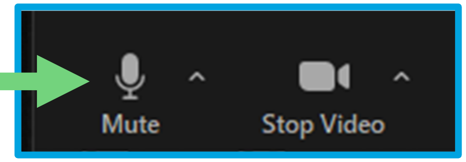
If you do not consent to being recorded, please let the meeting moderator know ASAP and we will facilitate your participation in another way or adjust our procedure.

Using Zoom!

Mute yourself!

Have a question?
Use the chat feature.

Controls accessed at the bottom



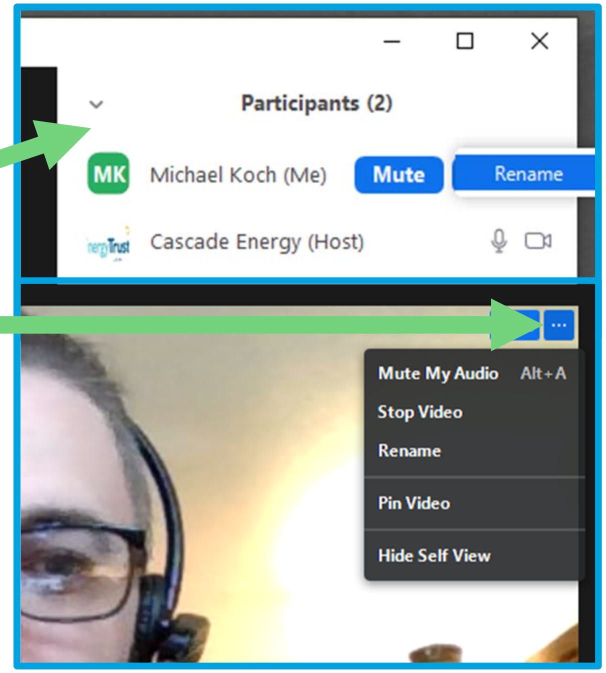
Rename yourself

"Name (Company)"

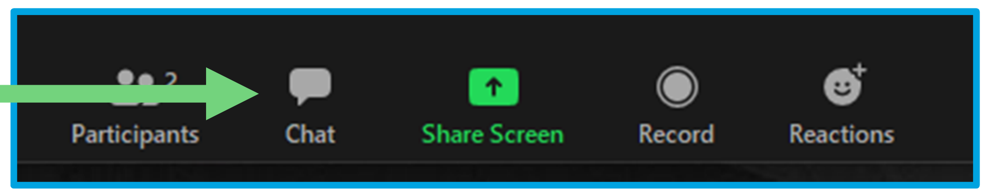
Right click on your picture or 3 dots

OR

Controls accessed at the right after clicking 'Participants' at bottom.



Access Chat at the bottom



Chat Practice!!

Using the chat function in Zoom answer the following questions:

What is your plant's average daily flows?

What is your plants average daily electrical consumption?

Today's Trainers

Richard Jackson-Gistelli
SEM Coach

CascadeEnergy®

Eric Wahlberg
(aka Eric Clapton)

WasteWater Technology TRAINERS

Thank You to Our Sponsor!

Better Plants
U.S. DEPARTMENT OF ENERGY

Thank You to Our Participants!

- Over 100 participants
- 8 countries
- Municipalities
- Engineers
- Energy Managers
- Utilities
- Directors
- Commissioners
- And oh yes…..

- ***Our Heroes…..*****The Operators, Assistant Operators, Lab Technicians, Lab Analysts, Electricians**, call them what you will, who work tirelessly and continuously keeping our waters safe and people healthy!!!

Introductions

Are you kidding…..? ☺

Instead of Introductions….

- We do want to get to know you but I estimated this would take approximately 3 hours. So, instead……

- 1. Please email Richard & Eric with the answers to the following 2 questions:

  - ***What is one thing you are doing at your plant right now that you consider is saving energy over the alternatives available?***

  - ***What is one thing you are doing at your plant right now that you consider is a wasting energy?***

- Poll Questions:

- Which best describes your job description:
- Operator
  - Lab Analyst
  - Engineer
  - Manager/Supervisor
  - Student
  - Consultant
  - Other

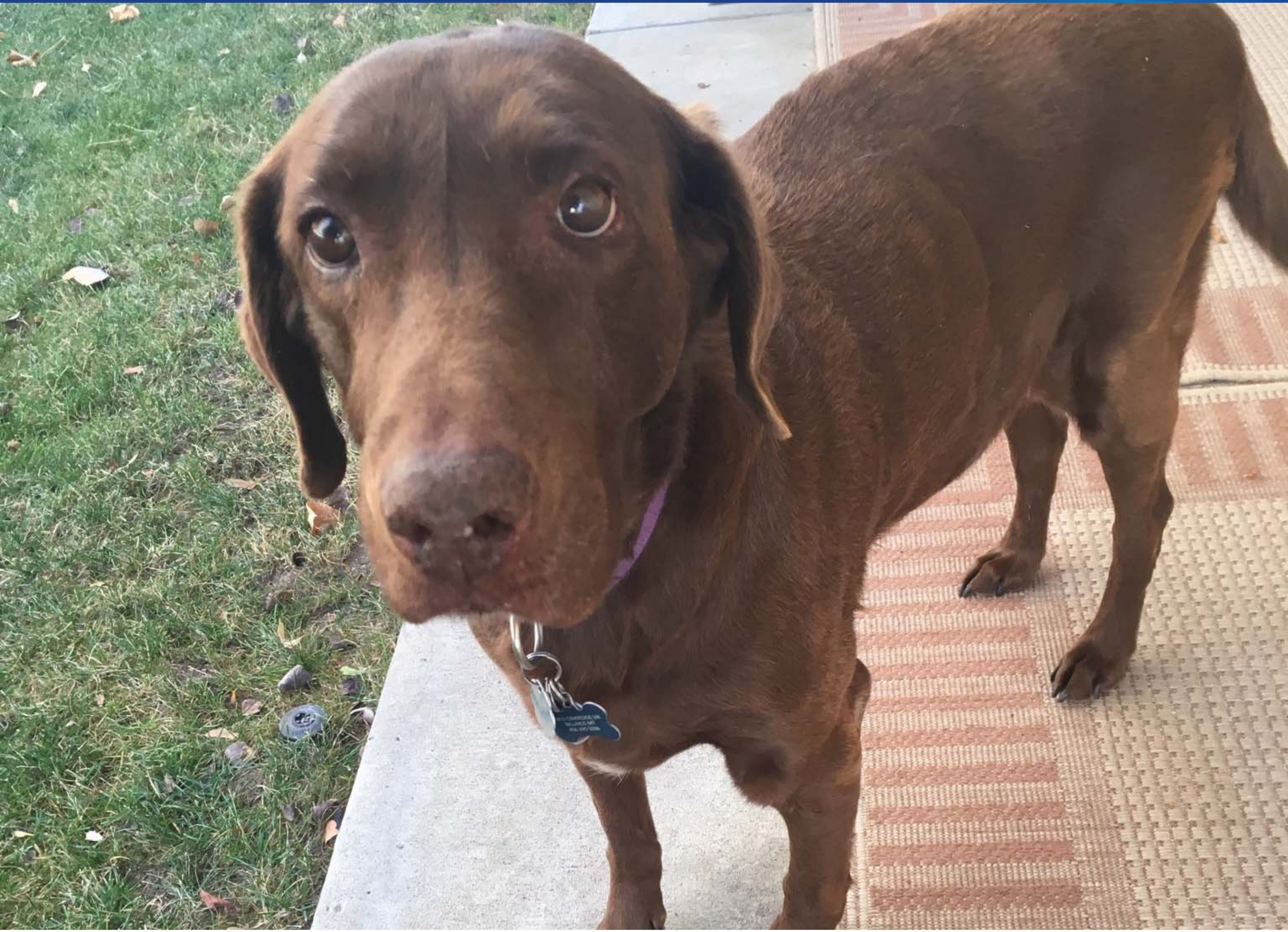
Day 1: Introduction to Wastewater Energy Optimization


EXIT
OUT

Slide 12

A94 How often do we get to see a dog from underneath? Changing our point of view shows us many new things.
Author, 3/15/2019

A95 Whether it is good or bad.
Author, 3/20/2019

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Training Schedule Overview

Sessions 1 & 2

- Wastewater Energy Basics
- Intro to Wastewater Tools
- Process Energy Conservation
- Pumping Systems
- W3 Systems
- Follow the BOD

Sessions 3, 4, & 5

- More Energy Basics
- Headworks
- Primary Clarifiers
- Aeration Energy
- Sludge Quality & SRT

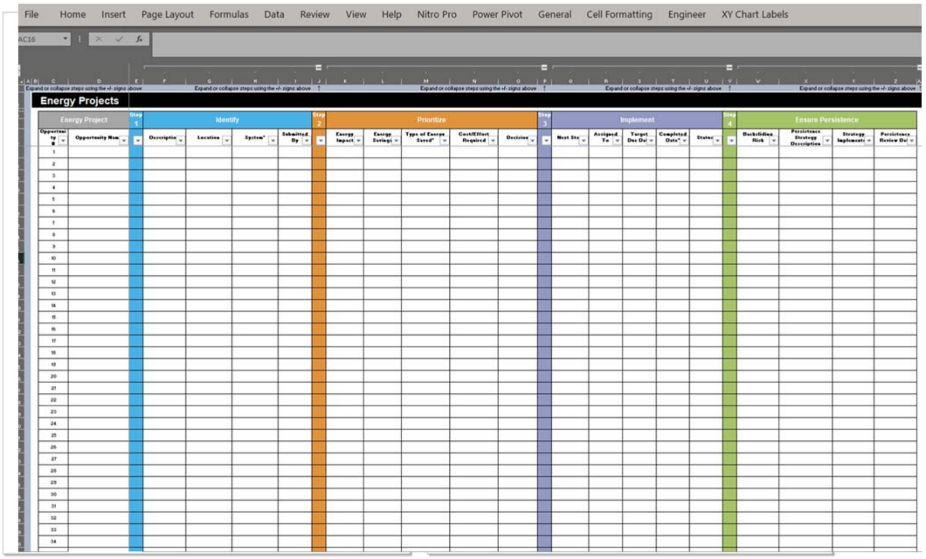
Sessions 6, 7, & 8

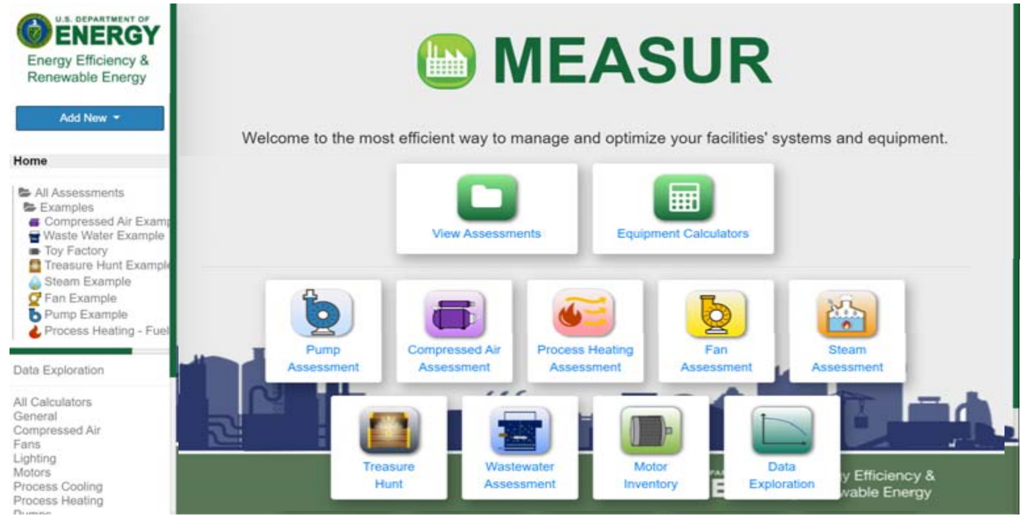
- Even More Energy Basics
- RAS Flow Optimization
- Thickening, Digestion, and Dewatering
- Ancillary Systems
- Fans and Odor Control
- Disinfection

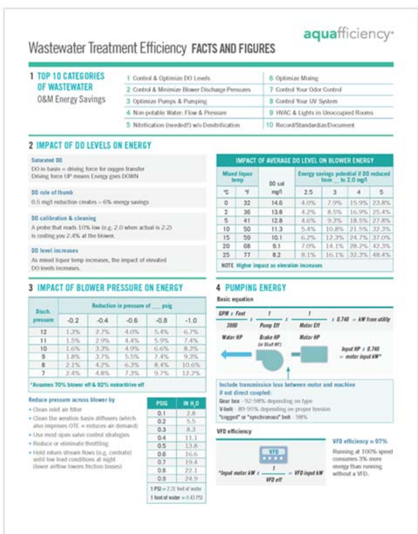
Today's Agenda

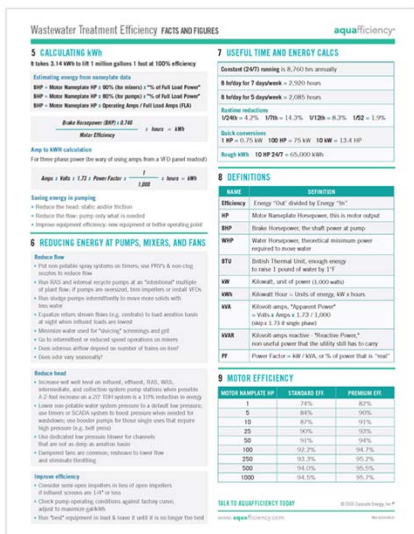
	Welcome and Introductions
	Plant Process Energy Conservation
	Plant Energy Basics
	Break
	WW Efficiency – The Cheat Sheet
	W3 Systems & The DIY W3 Walkthrough
	Wrap-up
	Done

Supporting Materials









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OPPORTUNITY REGISTER & THE TREASURE HUNT

RJG1

Introduction to the Opportunity Register

File Home Insert Page Layout Formulas Data Review View Help Nitro Pro Power Pivot General Cell Formatting Engineer XY Chart Labels

AC16

Expand or collapse steps using the +/- signs above

Energy Projects

Energy Project		Step 1	Identify				Step 2	Prioritize					Step 3	Implement					Step 4	Ensure Persistence			
Opportunity #	Opportunity Nam		Descriptio	Location	System	Submitted By		Energy Impact	Energy Savings	Type of Energy Saved	Cost/Effort Required	Decision		Next Ste	Assigned To	Target Due Da	Completed Date	Status		Backsliding Risk	Persistence Strategy Description	Strategy Implemente	Persistence Review Da
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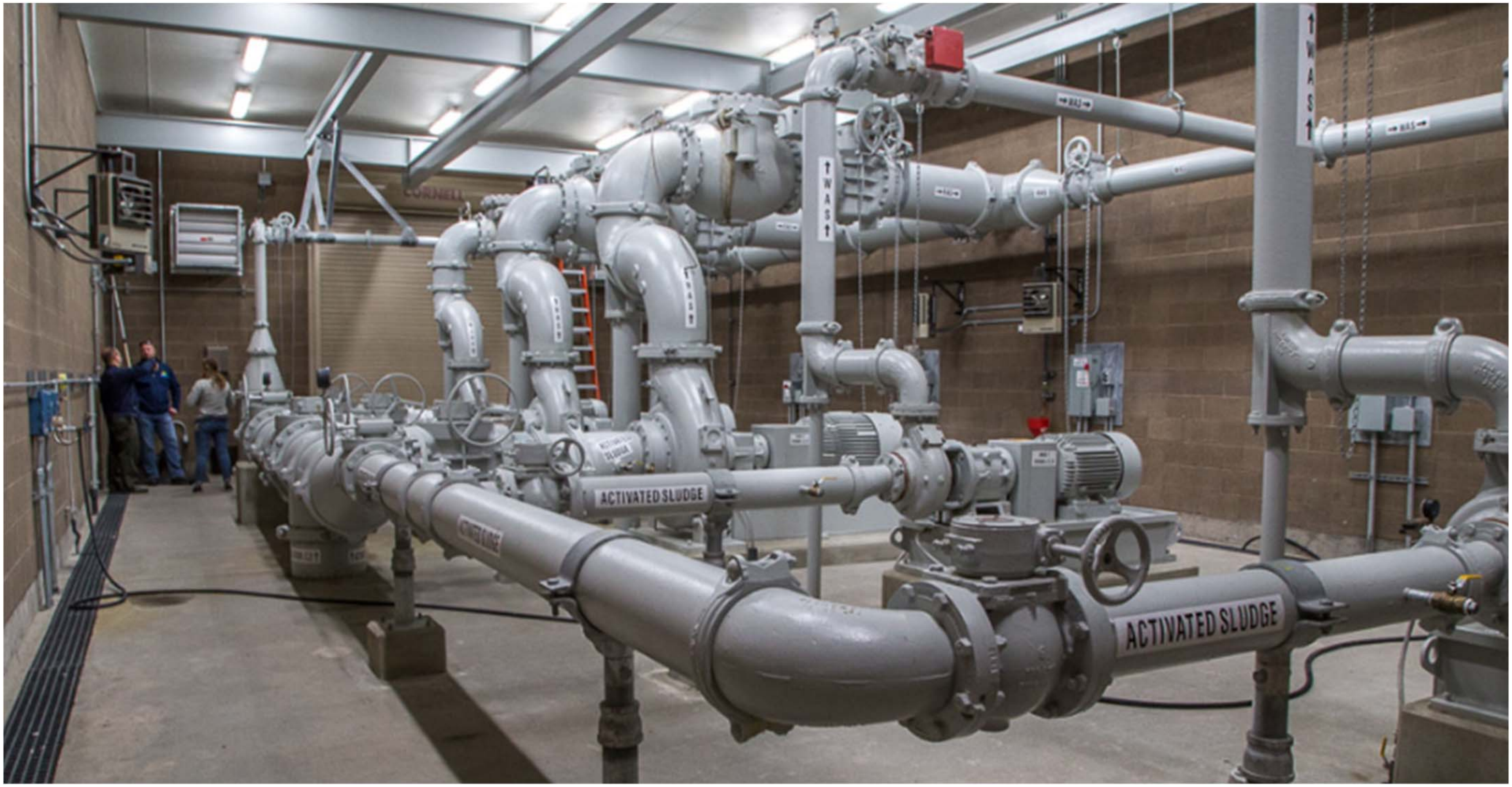
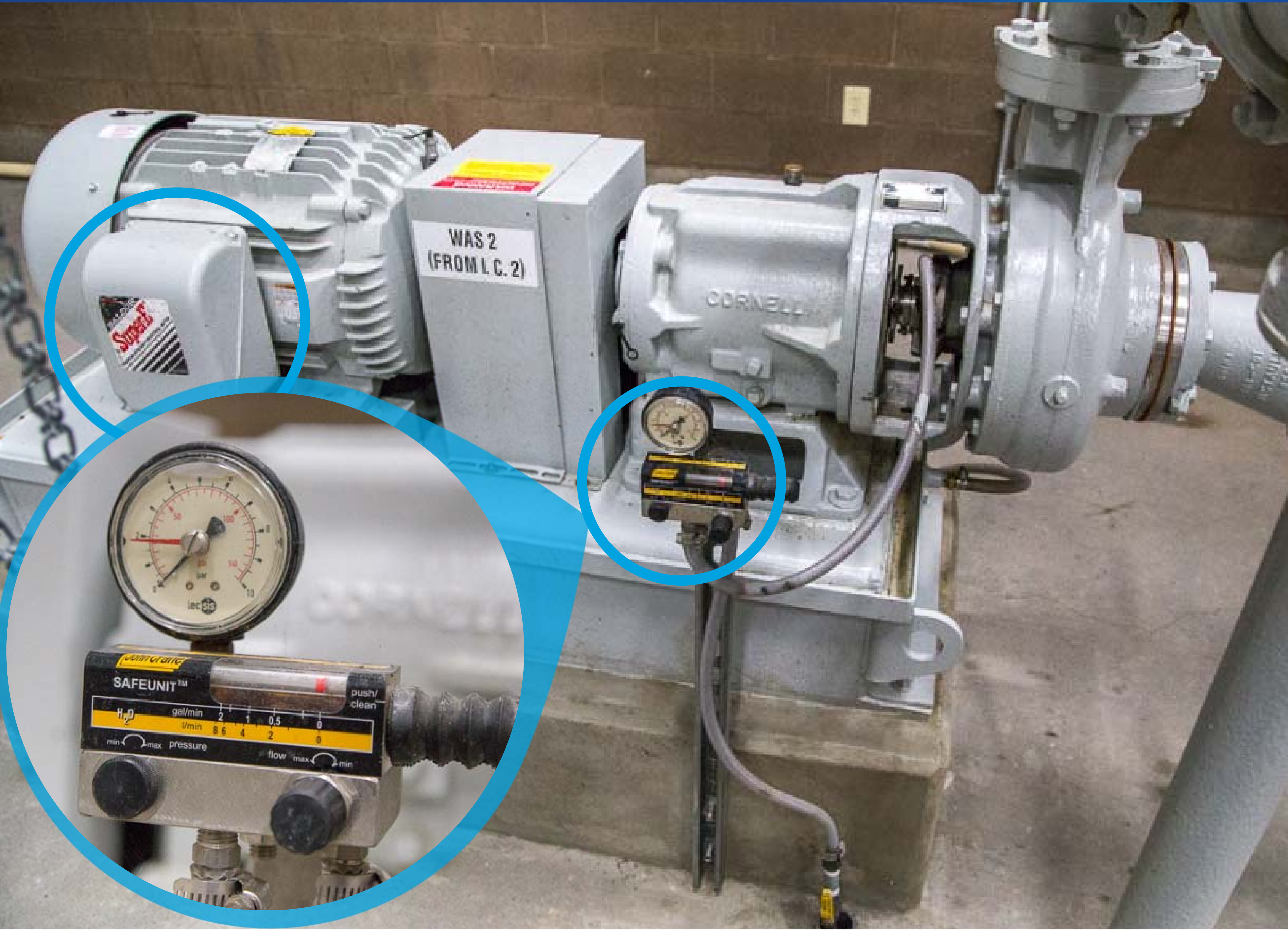
Slide 19

RJG1 Add new photo
Richard Jackson-Gistelli, 4/7/2022

Treasure Hunts




TASKMASTER
ACTIVATED SLUDGE


WAS 2
(FROM L C. 2)
CORNELL
SAFEUNIT™
push/
clean
H_2O
gal/min
2
1
0.5
0
l/min
8
6
4
2
0
min
max
pressure
flow
max
min

- How many years have you worked in the industry?
  - <2
  - 2 -5
  - 5-10
  - 10-20
  - 20+

ERIC

In my COVID isolation…

“It's only boring until you learn something about it. Knowledge makes things interesting.”

The heroes that stand between a city or town and a cherished body of water

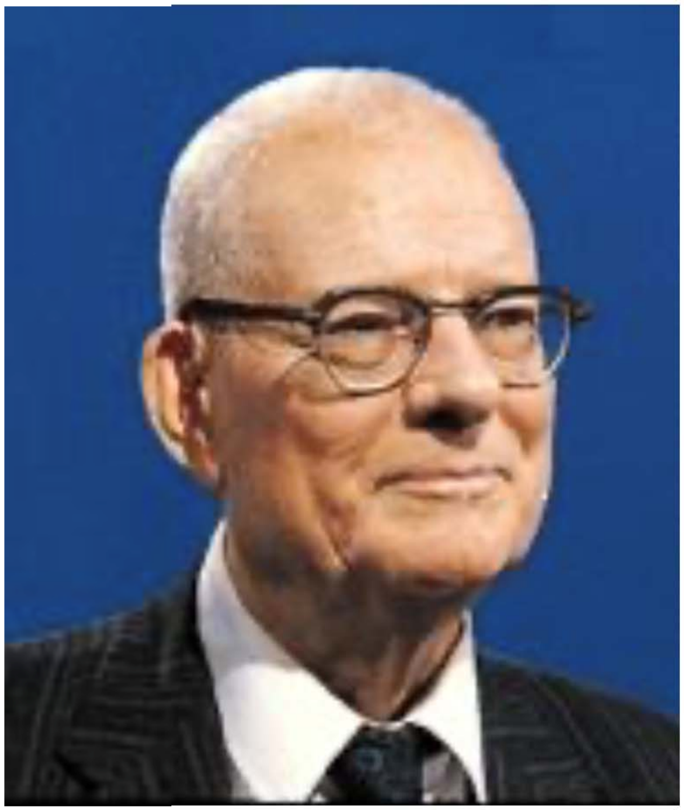
"The British and American Medical Associations jointly concluded in 2005 that of any technology, modern wastewater treatment has had the greatest positive impact on public health and life expectancy."

Nine signs of stagnation

1. We've never done it that way.
2. We’ve always done it that way.
3. We're not ready for that, yet.
4. We're doing all right without it.
5. We tried it once, and it didn't work out.
6. It costs too much.
7. That's not our responsibility.
8. It just won't work.
9. Our facility is too small (big, hot, cold, different) for that.

Institutional inertia is hard to overcome, sometimes dangerously so

W. Edwards Deming 1900—1993



"It's not enough to do your best. You must know what to do, then do your best."

Kang, Olmstead and Allbaugh, *WET*, (DEC/2010)

1. Commitment to saving energy throughout organization
2. Energy generation
3. Process energy conservation
4. Assess and refine

Four steps to energy self-sufficiency

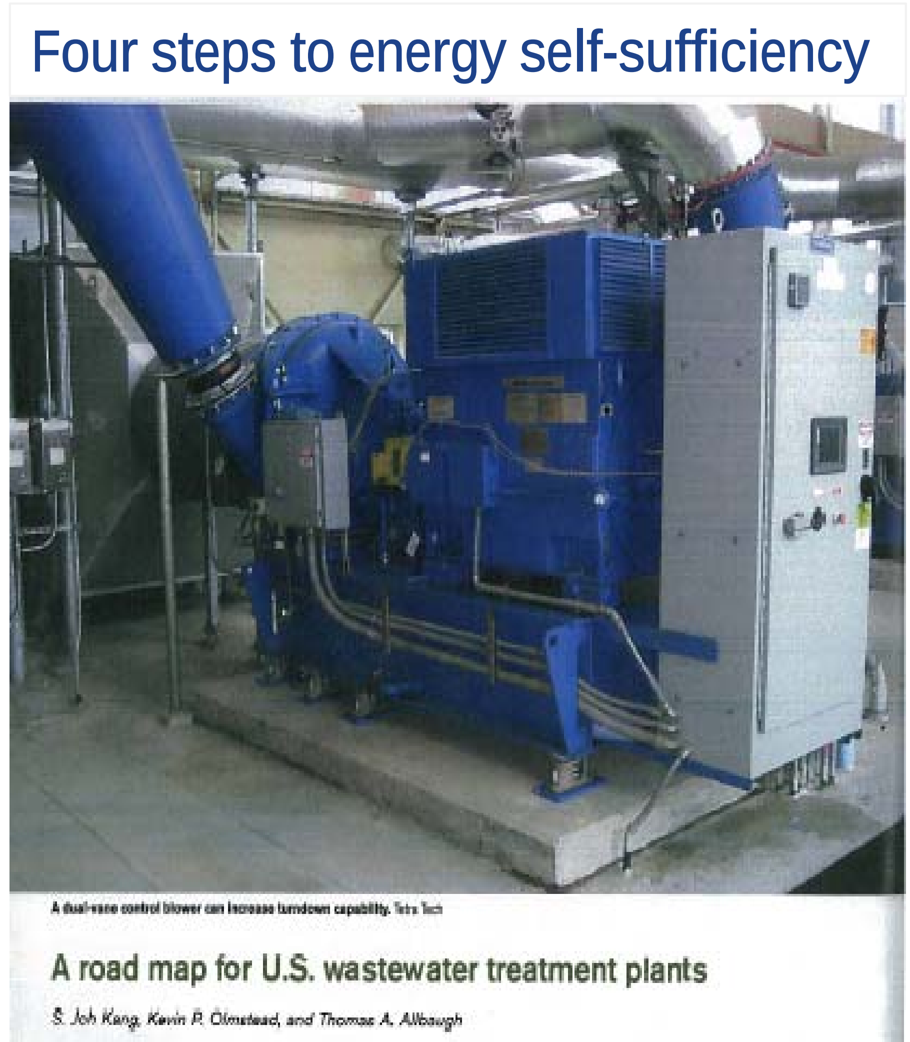
A dual-vane control blower can increase turndown capability. Tetra Tech

A road map for U.S. wastewater treatment plants

S. Joh Kang, Kevin P. Olmstead, and Thomas A. Allbaugh

Very Different Than Energy Conservation

1. Commitment to saving energy throughout organization
2. Energy generation
3. **Process energy conservation**
4. Assess and refine



Process Energy Conservation—Seven Focal Points

1. Primary Clarifiers
2. Reduce SRT
3. Denitrify
4. Increase Equipment Turndown Capability
5. Create Swing-zones
6. Side-stream Treatment
7. Combined Heat and Power Cash-back Incentives

Decarb?)

Four steps to energy self-sufficiency

A dual-vane control blower can increase turndown capability. Tetra Tech

A road map for U.S. wastewater treatment plants

S. Joh Kang, Kevin P. Olmstead, and Thomas A. Allbaugh

Primary Clarifiers—On the Agenda

1. Add if not existing
2. Maintain and document maximum performance
3. Chemically enhanced primary treatment (CEPT)

Reduce SRT—On the Agenda

1. Why SRT control is so important
2. Setting SRT_{TARGET}
   a. Meet effluent ammonia requirement or goal
   b. Maximize sludge quality
   c. Minimum that meets a. and b.

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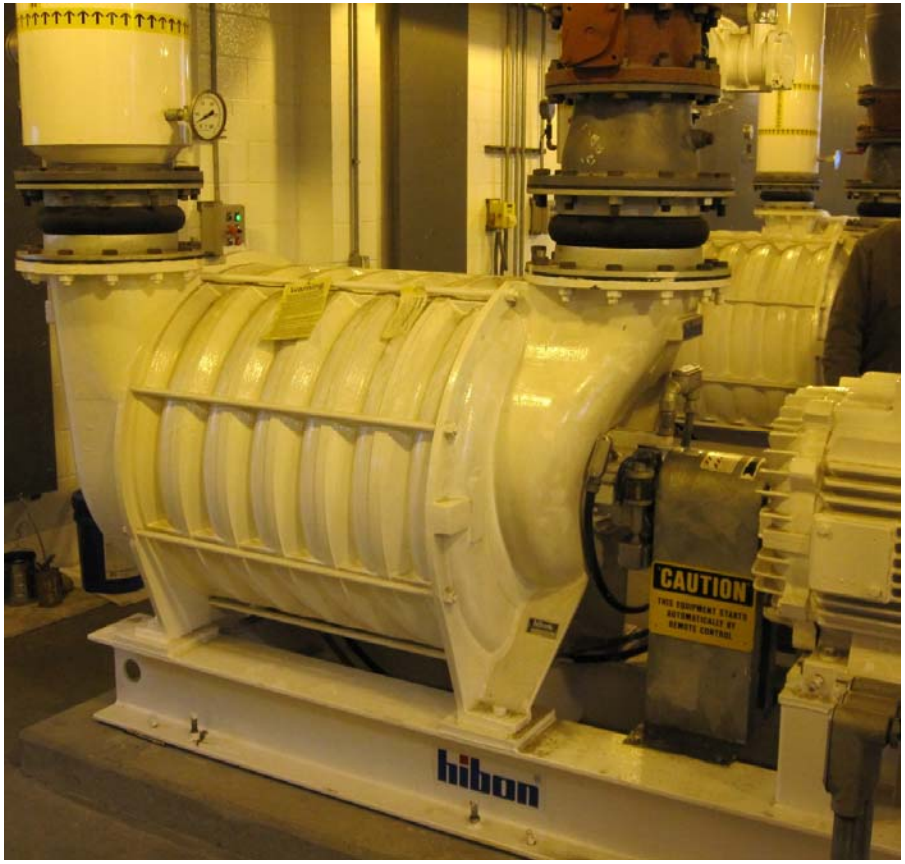
Equipment Turndown—On the Agenda

1. What's the right
   DO setpoint
   in aeration basins?
2. What's the right
   RAS flow rate?



Next Session: Can’t Generate Energy Without Anaerobic Digestion

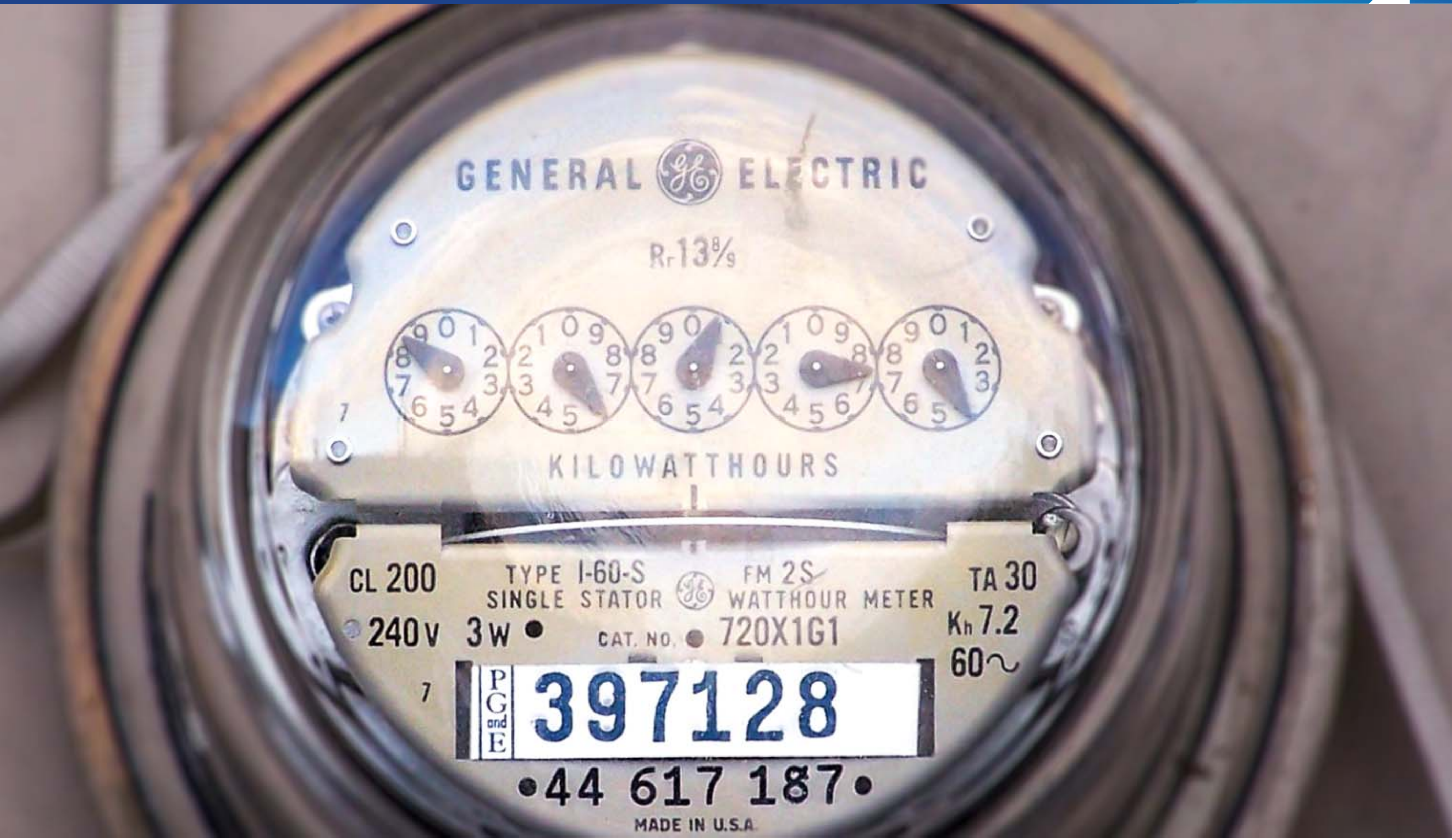
1. Commitment to saving energy throughout organization
2. **Energy generation**
3. Process energy conservation
4. Assess and refine

BREAK

- Why is water efficiency important to you?
  - Cost Savings
  - Reducing risk and improve resilience
  - Corporate Image
  - Effluent Quality improvement
  - Decarbonization
  - Others

WASTEWATER PLANT ENERGY BASICS AND KPIs

Plant Energy 101



Reading Your Electricity Bill

ACME ELECTRIC

February 2019

Account ID	0004 1234-56789 8
Billing Dates	12/31/2018- 1/31/2019 32 days of service

Invoice Number	**123456789**
Current Charges	**$29,760.80**
Due By	**2/15/2019**

METER # ABC123456, Schedule 81 Secondary

Service Description	
Basic Charge	560.00
System Usage Charge	593.85
Off-Peak Usage of 195446.000 kWh x $0.0335	6,547.44
On-Peak Usage of 295347.000 kWh x $0.0504	14,885.49
Demand Charge of 932.000 kW x $1.9500	1,817.40
Transmission Charge of 932.000 kW x $0.910	848.12
Distribution Facility Capacity Charge of 1017.00 kW x $2.0600	2,095.00
	$27,347.32
Taxes and Adjustments	
City Tax (1.5%)	410.21
Public Purpose Charge (3%)	820.42
108 Regulatory Adjustments	29.47
115 Energy Efficiency Funding	1,153.38
	$2,413.48

Period Ending	Avg Daily Temp	Avg kWh per day	Avg Cost per day
1/31/2019	71.5	15338	930.03
1/31/2018	73.1	15021	889.25

kWh use

kW demand

Units of Measure

POWER

(demand)

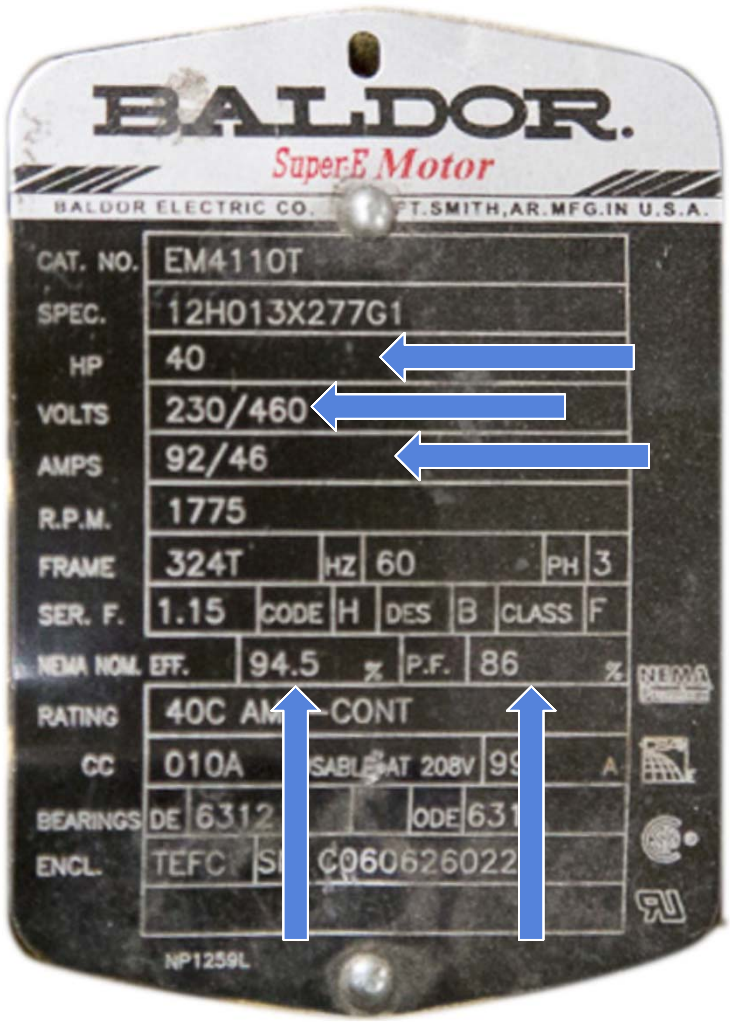
kW

ENERGY

(consumption)

kWh

Motor Nameplates



Just in case…..

Is the same as X in digital equations….,
and refers to multiplication….

5 * 10 = 50 50 x 10 = 50

Estimating Power

Estimating Power from Motor HP and Load Factor		
HP	=	Motor HP from the nameplate (Motor horsepower)
Load Factor	=	Estimated capacity/loading (0-100%)
Motor Efficiency	=	Motor efficiency rating from the nameplate

Estimating Power

Estimating from Motor HP and Load Factor

$$\textbf{Power (kW)} = \frac{0.746 * HP * \text{Load Factor}}{\text{Motor Efficiency }\%}$$

However, a simpler equation can be used for an estimate

$$\textbf{Power (kW)} = HP * 0.75$$

Estimating Energy Cost

1

POWER

(kW)

2

HOURS

of operation

3

RATE

per kWh
(kilowatt-hour)

kWh = kW*Operating Hours

Cost ($) = kWh*$/kWh

Electricity Example

Power (kW)

= <u>0.746 * HP * Load Factor</u>
Motor Efficiency %

= (0.746 * **40** * **.80**)/**.945%** = **25 kW**

Energy (kWh)

= kW * Annual Operating Hours

= **25** kW * **7,303** = **184,480 kWh**

Annual Energy Cost ($)

= kWh * $/kWh

= **184,480** kWh * **$0.05** = **$9,224**

Sample Rates (cents/kWh) Across the US

Area	Industrial June 2016	All Sectors June 2016
New England	11.84	15.95
Middle Atlantic	7.18	12.92
East North Central	6.92	9.98
West North Central	7.77	10.47
South Atlantic	6.65	10.04
East South Central	6.06	9.19
West South Central	5.23	8.18
Mountain	6.79	9.90
Pacific Contiguous	10.12	13.59
Alaska & Hawaii	19.44	21.97
U.S. Total	**7.03**	**10.53**

July 2019

US Ind. Avg. 7.18

MA & RI Ind. 14.41

Idaho 6.69

Home Work: Reading Your Electricity Bill

ACME ELECTRIC

February 2019

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Period Ending	Avg Daily Temp	Avg kWh per day	Avg Cost per day
1/31/2019	71.5	15338	930.03
1/31/2018	73.1	15021	889.25

Homework Pre-Review:

ACTIVITY SHEET – ENERGY BASICS EXERCISE DAY 1

a. How many kilowatt-hours of electricity did this facility use during this billing cycle? (January 2019)

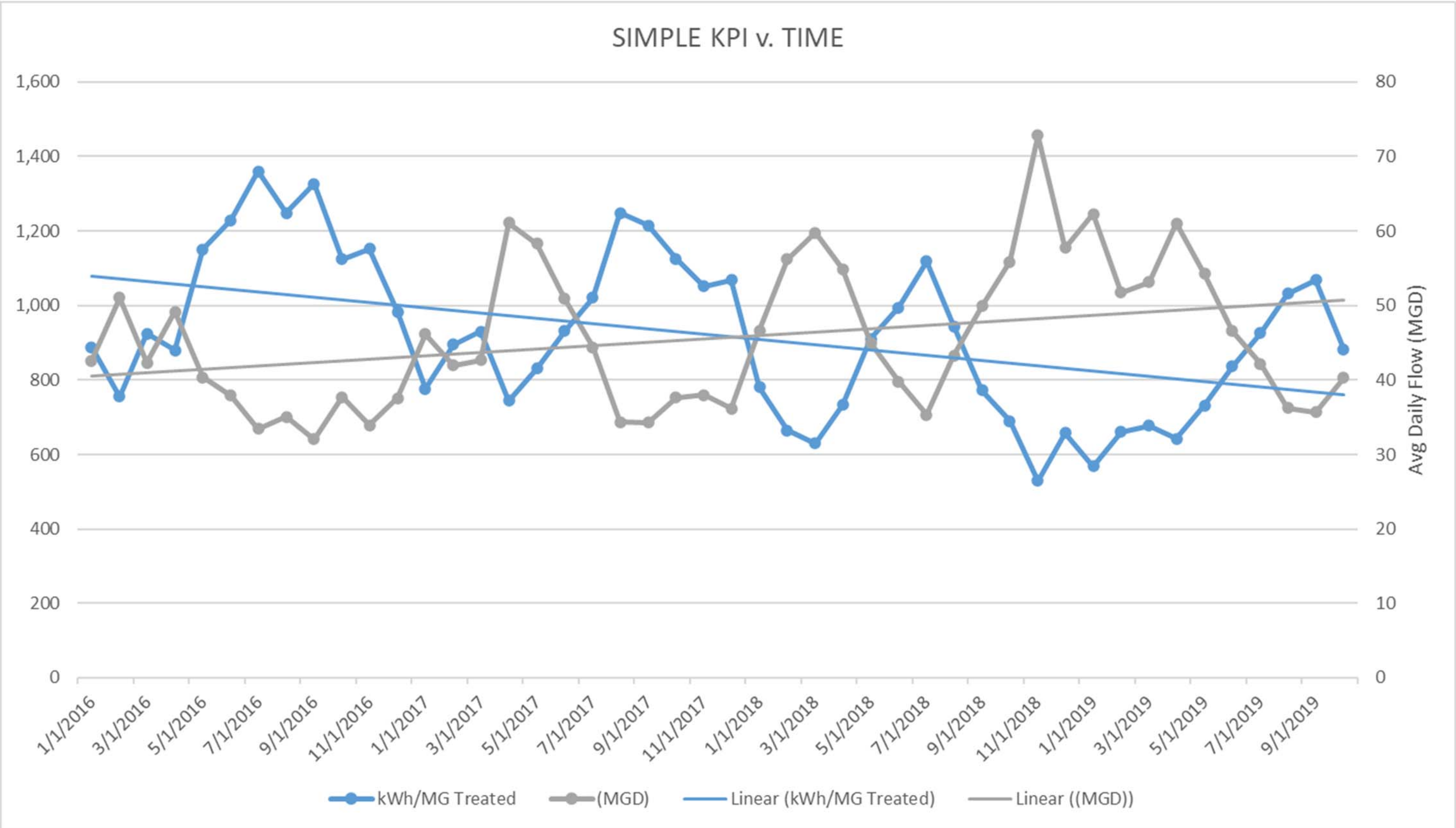
b. How much cheaper is their off-peak rate than their on-peak rate?

c. The plant runs two of its four 150 hp blowers all the time in the winter. How many kW of power do the two blowers draw?

d. How many kWh do the two blowers consume on average every day?

e. From the info above, what is the average whole-plant benchmark in kilowatt-hours per million gallons treated?

Simple KPIs


SIMPLE KPI v. TIME
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40
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20
10
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Avg Daily Flow (MGD)
1/1/2016
3/1/2016
5/1/2016
7/1/2016
9/1/2016
11/1/2016
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5/1/2017
7/1/2017
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3/1/2019
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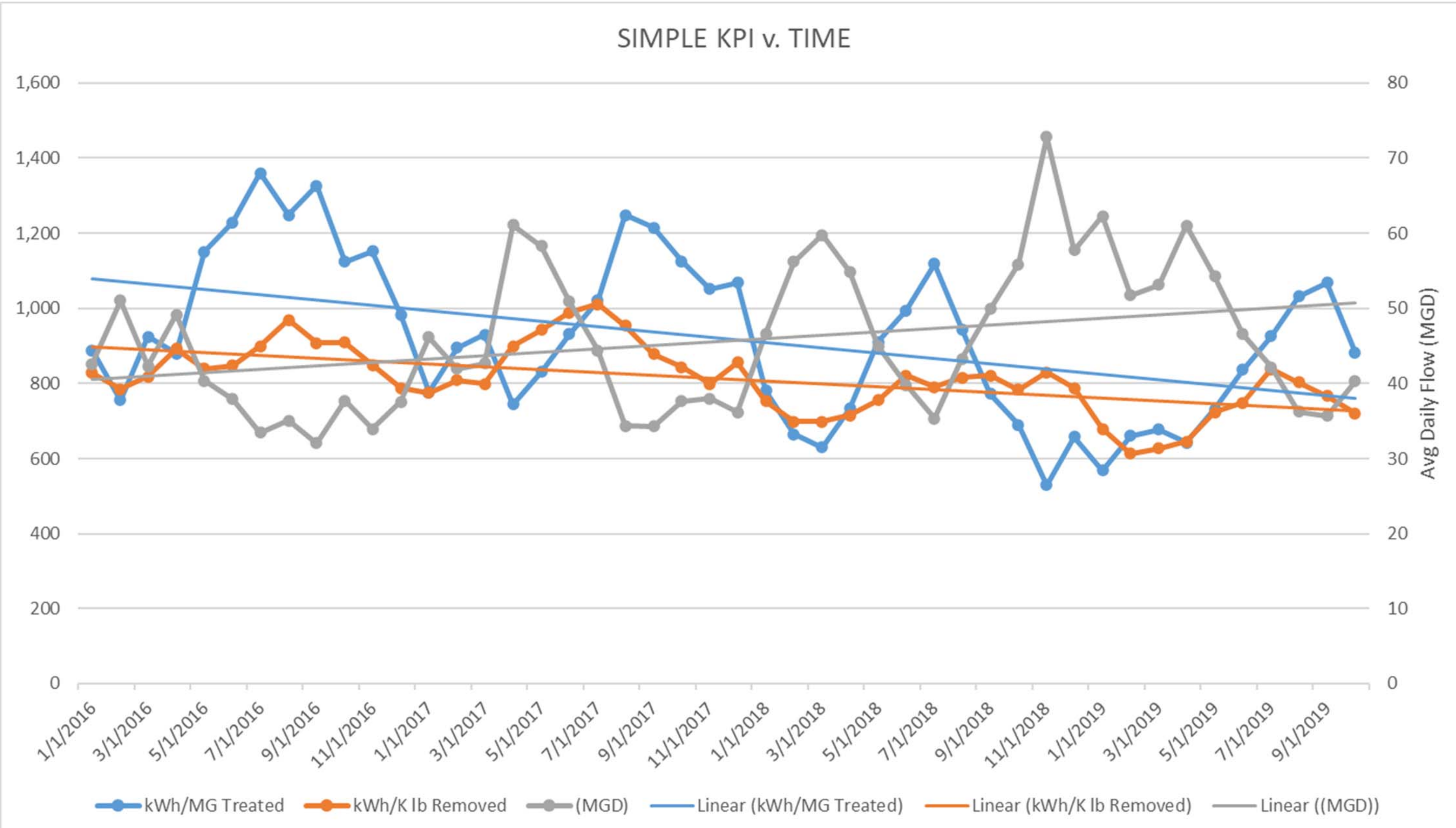
7/1/2019
9/1/2019
kWh/MG Treated
(MGD)
Linear (kWh/MG Treated)
Linear ((MGD))

Simple KPIs


SIMPLE KPI v. TIME
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Avg Daily Flow (MGD)
1/1/2016
3/1/2016
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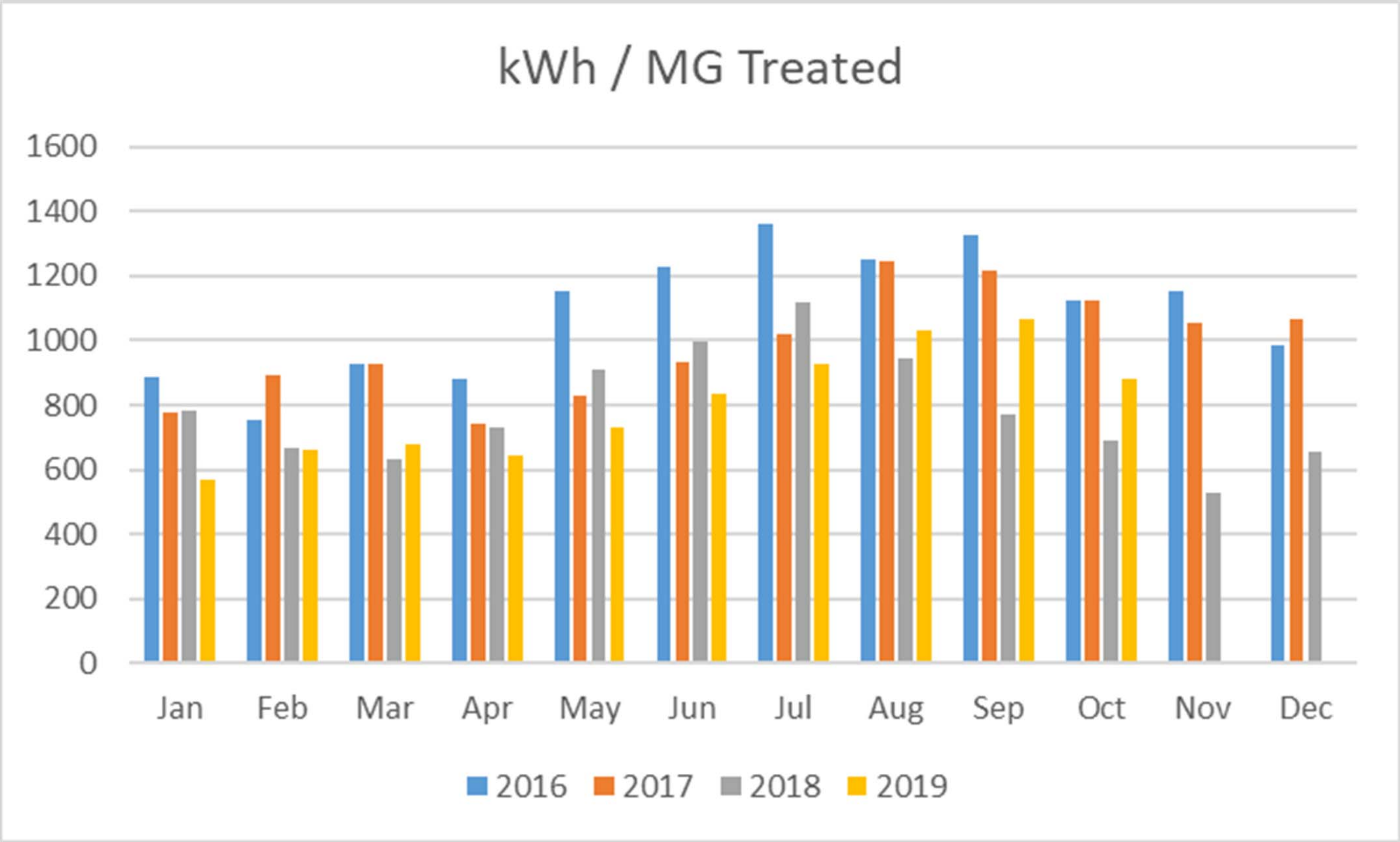
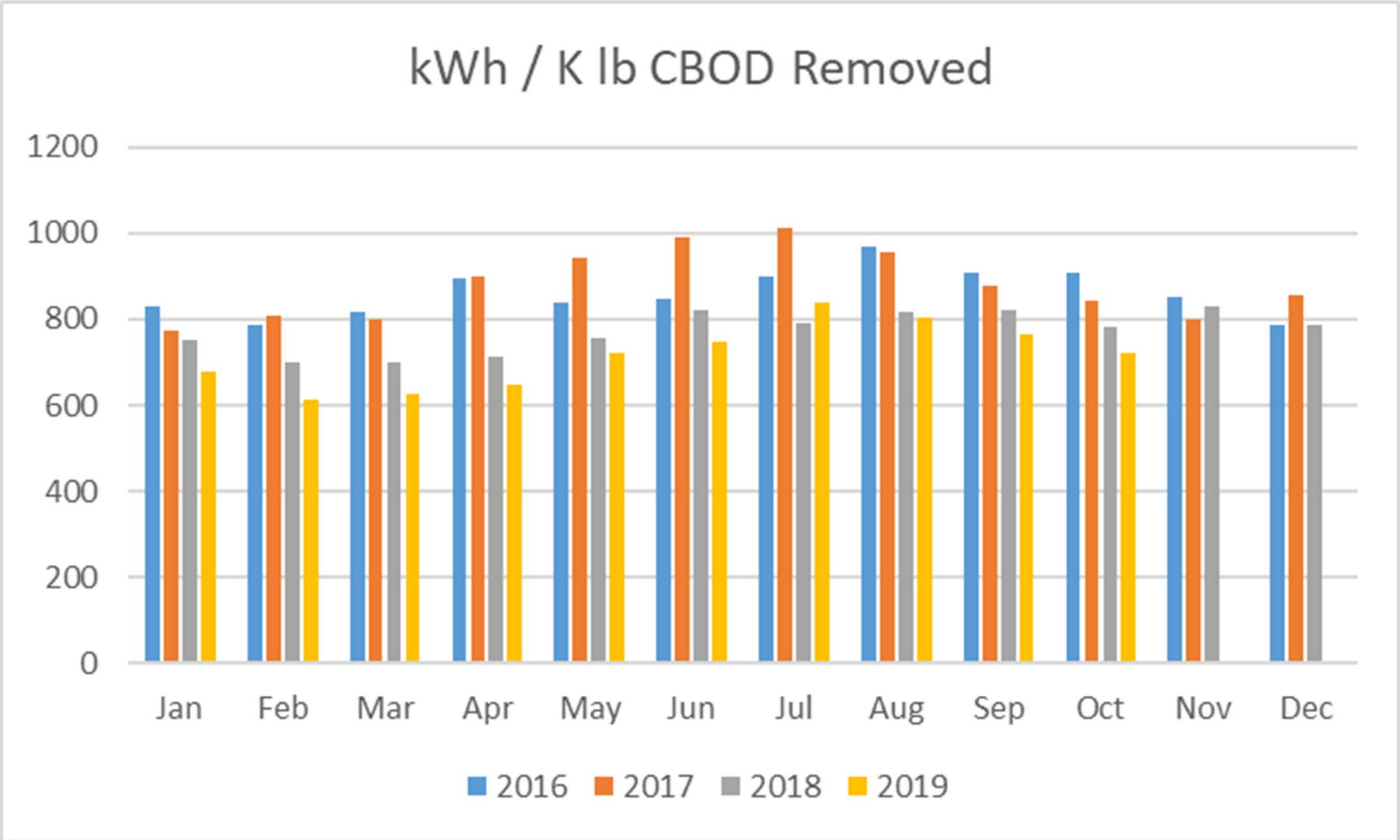
kWh/MG Treated
kWh/K lb Removed
(MGD)
Linear (kWh/MG Treated)
Linear (kWh/K lb Removed)
Linear ((MGD))

Year over Year KPIs



Year over Year KPIs



WW Energy Efficiency Cheat Sheet

aquafficiency

Wastewater Treatment Efficiency FACTS AND FIGURES

1 TOP 10 CATEGORIES OF WASTEWATER O&M Energy Savings

1 Control & Optimize DO Levels	6 Optimize Mixing
2 Control & Minimize Blower Discharge Pressures	7 Control Your Odor Control
3 Optimize Pumps & Pumping	8 Control Your UV System
4 Non-potable Water: Flow & Pressure	9 HVAC & Lights in Unoccupied Rooms
5 Nitrification (needed?) w/o Denitrification	10 Record/Standardize/Document

2 IMPACT OF DO LEVELS ON ENERGY

Saturated DO
DO in basin = driving force for oxygen transfer
Driving force UP means Energy goes DOWN

DO rule of thumb
0.5 mg/l reduction creates ~ 6% energy savings

DO calibration & cleaning
A probe that reads 10% low (e.g. 2.0 when actual is 2.2) is costing you 2.4% at the blower.

DO level increases
As mixed liquor temp increases, the impact of elevated DO levels increases.

IMPACT OF AVERAGE DO LEVEL ON BLOWER ENERGY

Mixed liquor temp		DO sat	Energy savings potential if DO reduced from __ to 2.0 mg/l			
°C	°F	mg/l	2.5	3	4	5
0	32	14.6	4.0%	7.9%	15.9%	23.8%
2	36	13.8	4.2%	8.5%	16.9%	25.4%
5	41	12.8	4.6%	9.3%	18.5%	27.8%
10	50	11.3	5.4%	10.8%	21.5%	32.3%
15	59	10.1	6.2%	12.3%	24.7%	37.0%
20	68	9.1	7.0%	14.1%	28.2%	42.3%
25	77	8.2	8.1%	16.1%	32.3%	48.4%

NOTE Higher impact as elevation increases

3 IMPACT OF BLOWER PRESSURE ON ENERGY

Disch. pressure	Reduction in pressure of __ psig				
	-0.2	-0.4	-0.6	-0.8	-1.0
12	1.3%	2.7%	4.0%	5.4%	6.7%
11	1.5%	2.9%	4.4%	5.9%	7.4%
10	1.6%	3.3%	4.9%	6.6%	8.3%
9	1.8%	3.7%	5.5%	7.4%	9.3%
8	2.1%	4.2%	6.3%	8.4%	10.6%
7	2.4%	4.8%	7.3%	9.7%	12.2%

*Assumes 70% blower eff & 92% motor/drive eff

Reduce pressure across blower by

- Clean inlet air filter
- Clean the aeration basin diffusers (which also improves OTE = reduces air demand)
- Use most open valve control strategies
- Reduce or eliminate throttling
- Hold return stream flows (e.g. centrate) until low load conditions at night (lower airflow lowers friction losses)

PSIG	IN H_2O
0.1	2.8
0.2	5.5
0.3	8.3
0.4	11.1
0.5	13.8
0.6	16.6
0.7	19.4
0.8	22.1
0.9	24.9

1 PSI = 2.31 feet of water
1 foot of water = 0.43 PSI

4 PUMPING ENERGY

Basic equation

$$\frac{GPM \times Feet}{3960} \times \frac{1}{Pump\ Eff} \times \frac{1}{Motor\ Eff} \times 0.746 = kW\ from\ utility$$

Water HP — Brake HP (or Shaft HP) — Motor HP

Input HP x 0.746 = motor input kW*

Include transmission loss between motor and machine if not direct coupled:
Gear box - 92-98% depending on type
V-belt - 89-95% depending on proper tension
"cogged" or "synchronous" belt - 98%

VFD efficiency

$${}^{*}Input\ motor\ kW \times \frac{1}{VFD\ eff} = VFD\ input\ kW$$

VFD efficiency = 97%
Running at 100% speed consumes 3% more energy than running without a VFD.

Wastewater Treatment Efficiency FACTS AND FIGURES

aquafficiency

5 CALCULATING kWh

It takes 3.14 kWh to lift 1 million gallons 1 foot at 100% efficiency

Estimating energy from nameplate data
BHP ≈ Motor Nameplate HP x 90% (for mixers) x "% of Full Load Power"
BHP ≈ Motor Nameplate HP x 80% (for pumps) x "% of Full Load Power"
BHP ≈ Motor Nameplate HP x Operating Amps / Full Load Amps (FLA)

$$\frac{Brake\ Horsepower\ (BHP) \times 0.746}{Motor\ Efficiency} \times hours = kWh$$

Amp to kWH calculation
For three phase power (be wary of using amps from a VFD panel readout)

$$Amps \times Volts \times 1.73 \times Power\ Factor \times \frac{1}{1{,}000} \times hours = kWh$$

Saving energy in pumping

- Reduce the head: static and/or friction
- Reduce the flow: pump only what is needed
- Improve equipment efficiency: new equipment or better operating point

6 REDUCING ENERGY AT PUMPS, MIXERS, AND FANS

Reduce flow

- Put non-potable spray systems on timers; use PRV's & non-clog nozzles to reduce flow
- Run RAS and internal recycle pumps at an "intentional" multiple of plant flow; if pumps are oversized, trim impellers or install VFDs
- Run sludge pumps intermittently to move more solids with less water
- Equalize return stream flows (e.g. centrate) to load aeration basin at night when influent loads are lowest
- Minimize water used for "sluicing" screenings and grit
- Go to intermittent or reduced speed operations on mixers
- Does odorous airflow depend on number of trains on-line?
- Does odor vary seasonally?

Reduce head

- Increase wet well level on influent, effluent, RAS, WAS, intermediate, and collection system pump stations when possible A 2-foot increase on a 20' TDH system is a 10% reduction in energy
- Lower non-potable water system pressure to a default low pressure; use timers or SCADA system to boost pressure when needed for washdown; use booster pumps for those single uses that require high pressure (e.g. belt press)
- Use dedicated low pressure blower for channels that are not as deep as aeration basin
- Dampered fans are common; resheave to lower flow and eliminate throttling

Improve efficiency

- Consider semi-open impellers in lieu of open impellers if influent screens are 1/4" or less
- Check pump operating conditions against factory curve; adjust to maximize gal/kWh
- Run "best" equipment in lead & leave it until it is no longer the best

7 USEFUL TIME AND ENERGY CALCS

Constant (24/7) running is 8,760 hrs annually
8 hr/day for 7 days/week = 2,920 hours
8 hr/day for 5 days/week = 2,085 hours

Runtime reductions
1/24th = 4.2% **1/7th** = 14.3% **1/12th** = 8.3% **1/52** = 1.9%

Quick conversions
1 HP = 0.75 kW **100 HP** = 75 kW **10 kW** = 13.4 HP

Rough kWh **10 HP 24/7** = 65,000 kWh

8 DEFINITIONS

NAME	DEFINITION
Efficiency	Energy "Out" divided by Energy "In"
HP	Motor Nameplate Horsepower, this is motor output
BHP	Brake Horsepower, the shaft power at pump
WHP	Water Horsepower, theoretical minimum power required to move water
BTU	British Thermal Unit, enough energy to raise 1 pound of water by 1°F
kW	Kilowatt, unit of power (1,000 watts)
kWh	Kilowatt Hour = Units of energy, kW x hours
kVA	Kilovolt-amps, "Apparent Power" = Volts x Amps x 1.73 / 1,000 (skip x 1.73 if single phase)
kVAR	Kilovolt-amps reactive - "Reactive Power," non-useful power that the utility still has to carry
PF	Power Factor = kW / kVA, or % of power that is "real"

9 MOTOR EFFICIENCY

MOTOR NAMPLATE HP	STANDARD EFF.	PREMIUM EFF.
1	74%	82%
5	84%	90%
10	87%	91%
25	90%	93%
50	91%	94%
100	92.2%	94.7%
250	93.3%	95.2%
500	94.0%	95.5%
1000	94.5%	95.7%

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REV 2020-09-21

W3 SYSTEMS

W3 Systems

W3 Tour

W3 Tour Discussion

An actual picture…

So What's the Big Deal?

Non-potable water reclaimed from the plant isn't free. You are paying your utilities for it.

Pumping Power Equation: (From Cheat Sheet)

- GPM x FEET of HEAD / 3960 = Water HP
- Divided by pump, motor, and drive efficiency

Example:

- 500 GPM @ 100 PSI average (85 ON – 115 OFF)
- 100 PSI = **231 feet**
- 500 GPM x 231' TDH / 3960 = **29.2 water hp**
- 29.2 / 70% pump eff / 94% motor eff = **44.3 hp**

So What's the Big Deal?

Pumping energy:

- 29.2 / 70% pump eff / 94% motor eff = **44.3 hp**
- 44.3 hp x 0.75 kW/hp = **33 kW**
- 33 kW x 8760 hr/year = **290,000 kWh**

What's that cost you?

- 33 kW x $4.50 x 12 months = **$1,800 in demand (kW)**
- 290,000 kWh x $0.07 = **$20,000 in energy (kWh)**
- The free water costs **~$22,000 per year!**

W3 systems

aquafficiency

Site Savings Guide

WALKING YOUR SYSTEM FOR ENERGY SAVINGS

NON-POTABLE WATER

Sometimes energy savings opportunities are staring right at us – we just don't recognize them! Take this guide with you on a tour of your non-potable / reclaim water system to help you see opportunities. And remember - **W3 isn't free!**

How much energy is consumed?

Average Flow Rate:	gpm
Average Discharge Pressure:	psi
Motor size:	hp
VFD used?	
Number of pumps:	
Number operating typically:	
What is the typical pressure drop across filter if used?	

1 Pump Line-up & System Checks

Goal is to operate at the lowest possible pressure at the pump that gets the job done in the field.

Can you lower the pressure seasonally or for part of each day?

Lower flows at use points preserve pressure in the system and save energy at the pumps.

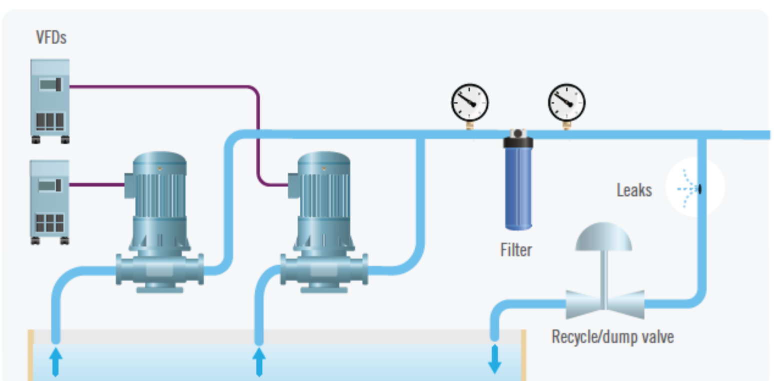
Find and fix all the leaks out there!

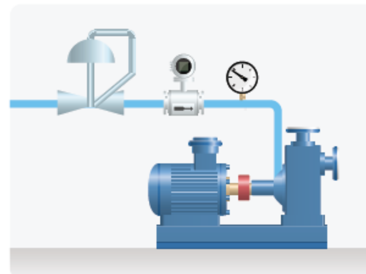
Do you use a dump valve? Right size your pumps or add a VFD.

Is the most efficient pump used at each flow rate?

Do additional pumps increase the flow, or do they stall each other?

Dirty filters waste pressure. Clean them regularly. Add parallel or larger filters to avoid pressure drops.



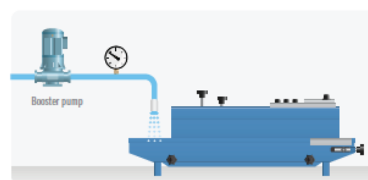


2 Seal Water

Adjust to minimum flow required.

Add solenoid so seal water only runs when pump operates.

Check PRV for proper operation. Replace/rebuild as needed.



3 Solids Handling / Headworks Sprays

Headworks and solids handling equipment often drive system pressure. Booster pumps can be used to boost only the water needed by the equipment.

Make sure spray cycle triggers and runtimes are correct; reduce to minimum needed for reliable operation.

Avoid large "trough flushing" flows with non-pot; use grit classifier overflow water or other gravity source.

Select and install appropriate nozzles and orient them to maximize effectiveness.

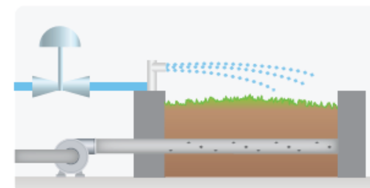
4 Bio Filter / Yard Irrigation

Adjust to minimum flow required.

Add moisture sensor in biofilter media; wet only as needed.

Ensure sprinkler / spray is adjusted to water the target and avoid waste.

Add timer to reduce run time.

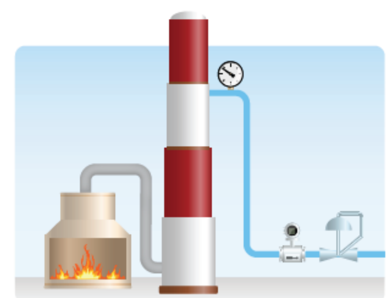


5 Pollution Control

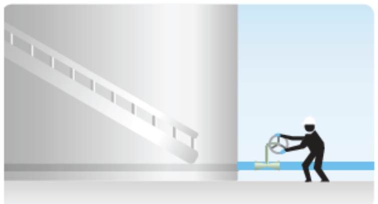
Emission monitoring instruments and scrubbers can require high-volumes and high pressure. A small booster pump can eliminate having to run full system at high pressure.

Reduce discharge pressure & flow to meet need.

Add controls so that water shuts off if incinerator or source of emissions is shut off.



W3 systems



6 Tank Fill

A portable, low-head, high-flow pump can be used in lieu of non-pot system water to fill tanks.

Fill tanks when other uses of non-pot are low.

Utilize temporary pressure boost controls to compensate for fill; return system to lower pressure when fill is complete.

Consider equalizing tanks first through drains, then top with non-pot.

7 Hose Bibs / Washdown

Avoid "just running" hoses. If there is a constant area of concern, set up spray system or fix the problem.

All washdown hoses need nozzles and hand valves to be effective.

Add pressure boost controls to boost pressure during washdown activities and return to low pressure automatically.

If plant is not staffed at night, then no washdown will happen, and high pressure is not needed. Turn pressure up during day shift, turn down at end of day.

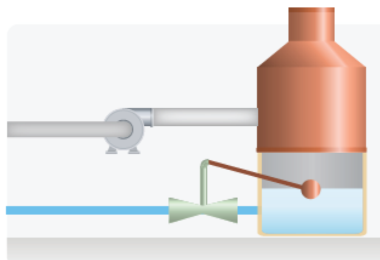
Disable/disconnect heat trace systems after winter.

8 Odor Control

Install float valve or other level control device rather than constant overflow for odor scrubber make up water.

No reason for high pressure water here; upsize pipe if the top-off time is not fast enough or reduce depth between high and low level setpoints.

While you're here: are the scrubber pumps throttled? Consider resizing or adding VFD.
Is the scrubber fan dampered?
Resheave to reduce flow and open damper.

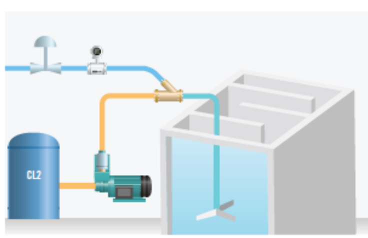


9 Carry Water

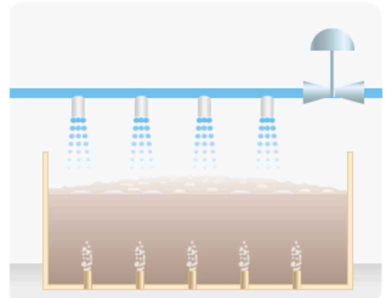
Carry water can be low, low pressure. Consider a separate, low-head pump.

Monitor flowrate and adjust to match the CL2 solution concentration used.

Would discharge manifold eliminate need for flash mixer?



NON-POTABLE WATER WALKING YOUR SYSTEM FOR ENERGY SAVINGS



10 Foam Suppression

(at channels, tanks, etc.)

Foam suppression can be effective with very little water if the right nozzles are used.

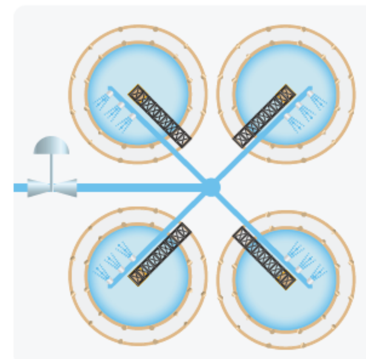
Consider running foam suppression on solenoids or auto cycle valves, half of the system at a time (e.g. north side of channel, then south side).

Blank off nozzles that aren't doing any useful work. Lower flow = lower energy!

11 Clarifier Scum Sprays

Clarifier sprays can run a few minutes every hour and do the job. Add solenoid valves and stagger the cycles so only one clarifier spray bar runs at a time.

Put spray bar control valves where operators can easily reach and adjust.
Reduce flows to minimum needed.



What did you find?

1 write down what you find

2 take a photo with your phone

3 send to your coach

FACILITY ____________________

YOUR NAME ____________________

SAVINGS OPPORTUNITIES: ____________________

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Closing

SEE YOU NEXT WEEK!