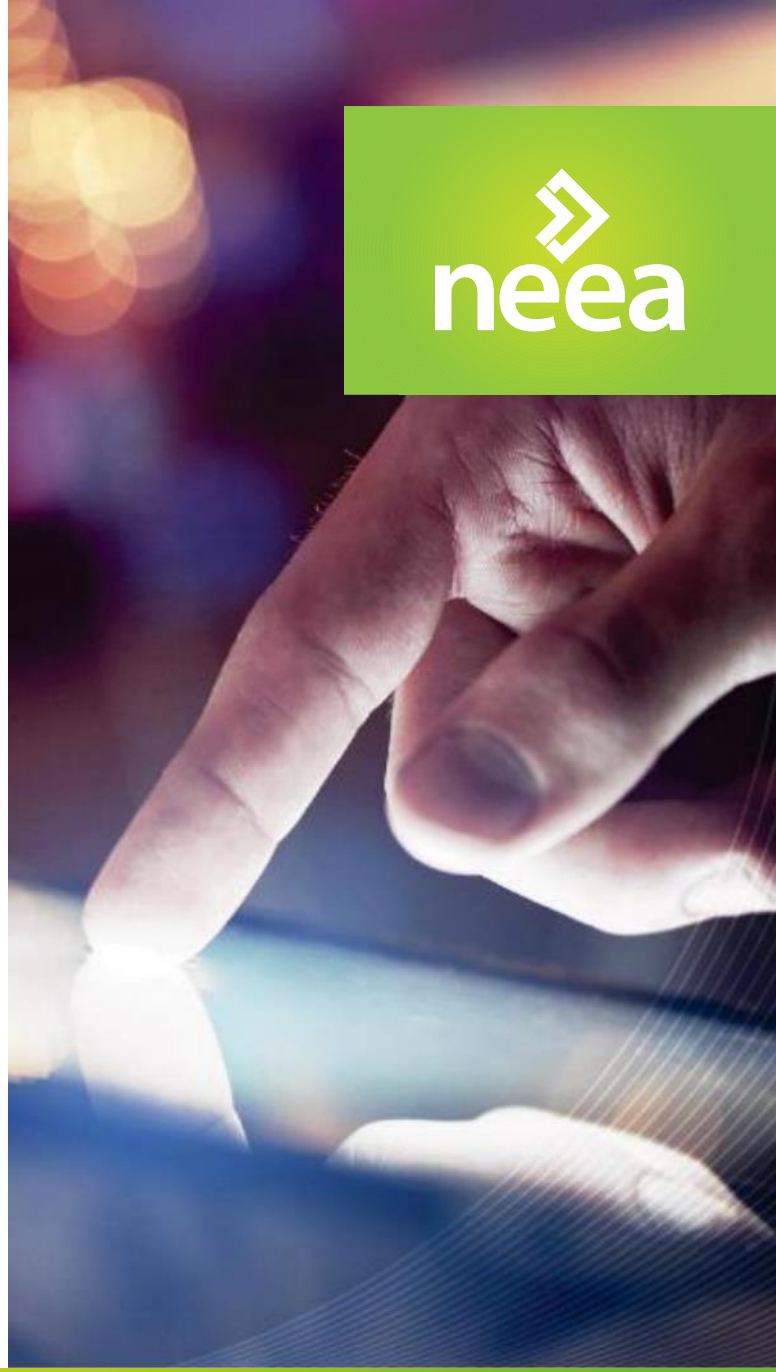
July 16, 2019

Industrial Advisory Committee (IAC)

Q3 2019 Meeting



Agenda

- Welcome, Introductions
- Agenda & Packet Review, Informational Updates
- Industrial Portfolio Update & SEM Scope for Next Cycle
- IAC Member Share Out/ Round Robin
- Water & Waste Water Market Tech Measures & Learnings from the Field/Utility Cohorts
- Air Saver Unit Update
- Waste Heat Capture System
- Public Comments
- Adjourn

Informational Updates

- Industrial Advisory Committee Conference Coordination p.12
- C+I Lighting Regional Strategic Market Plan Quarterly Update p.13

Quarterly Newsletters & Reports

- Q2 Marketing Newsletter
- Q2 Emerging Technology Report
- Q2 Market Research & Evaluation Newsletter

July 16, 2019

Industrial Portfolio Update

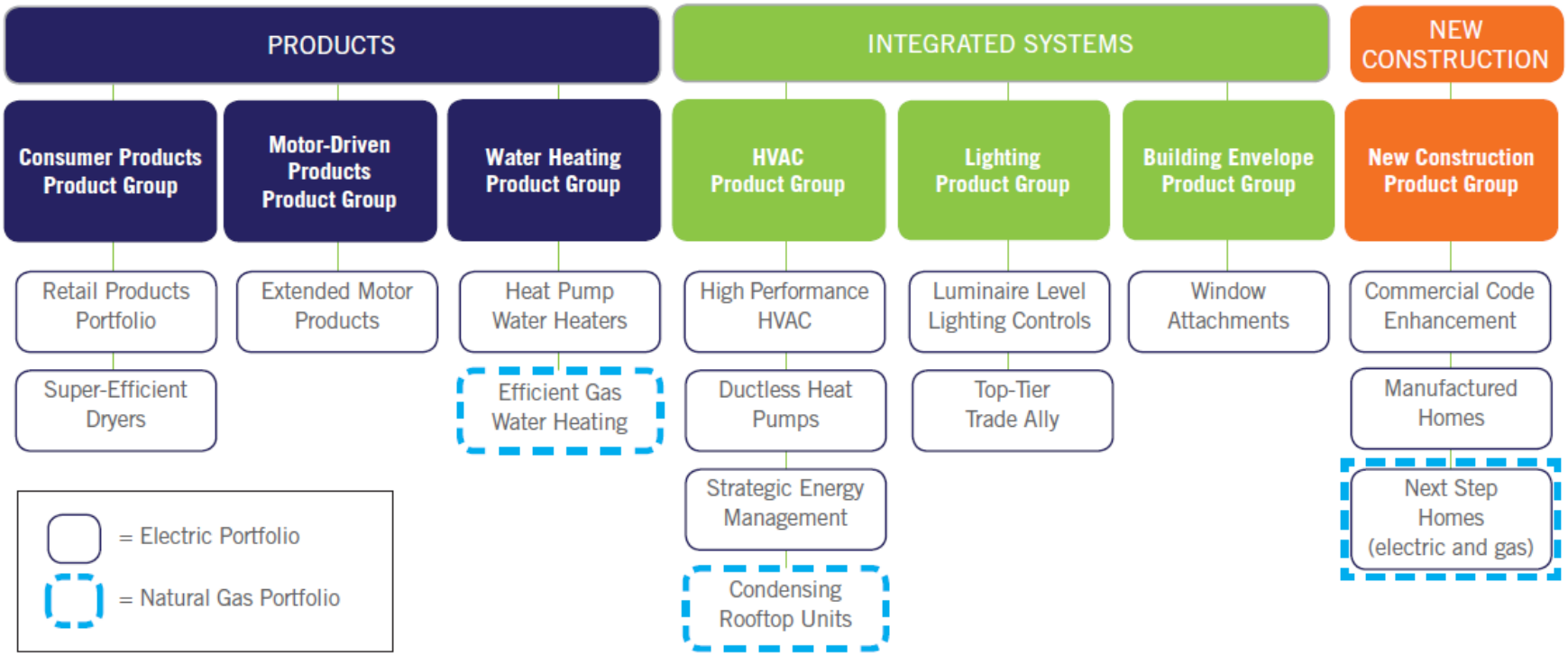
Emily Moore, Senior Manager



Updates for Cycle 6

- NEEA is implementing organizational changes to align with 2020-24 Business Plan
- New structure around ‘product groups’ (rather than sectors)
- RPAC continues to work on improvements to advisory committee roles and structure

Product Group Structure



2020 Ops Plan Timeline:
External Engagement

Program	Q3 Update
Extended Motor Products 	• Final Technical Workgroup meeting is July 22nd to review draft pumps research report • Market Characterization and Baseline study is underway and on track for completion in Q3 • 5 participation agreements are in place with NW pumps distributors
Industrial Technical Training 	• Beginning transition of program to interested utilities • On track to meet goals of 2019 training plan: 8 of 12 planned trainings are complete • 100 participants trained in Q2; 141 to-date

SEM in Cycle 6

NORTHWEST
STRATEGIC ENERGY MANAGEMENT
COLLABORATIVE

SEM Data Plan: Priorities

Summary information on what the region has learned to date through evaluation. Identify gaps in information.

SEM savings potential information, including where program activities should provide the highest value.

Best practice information for how to engage small to medium size customers in the region.

Benchmarking information, such as program cost, energy saving actions completed, target energy performance indicators.

IAC Member Share-out

Lunch !

Cascade Energy®

Energy Saving Technology in the Water and Wastewater Sector

- Layne McWilliams, PE JD
- Director of Customer Engagement, Water/Wastewater
- & Sr. SEM Coach

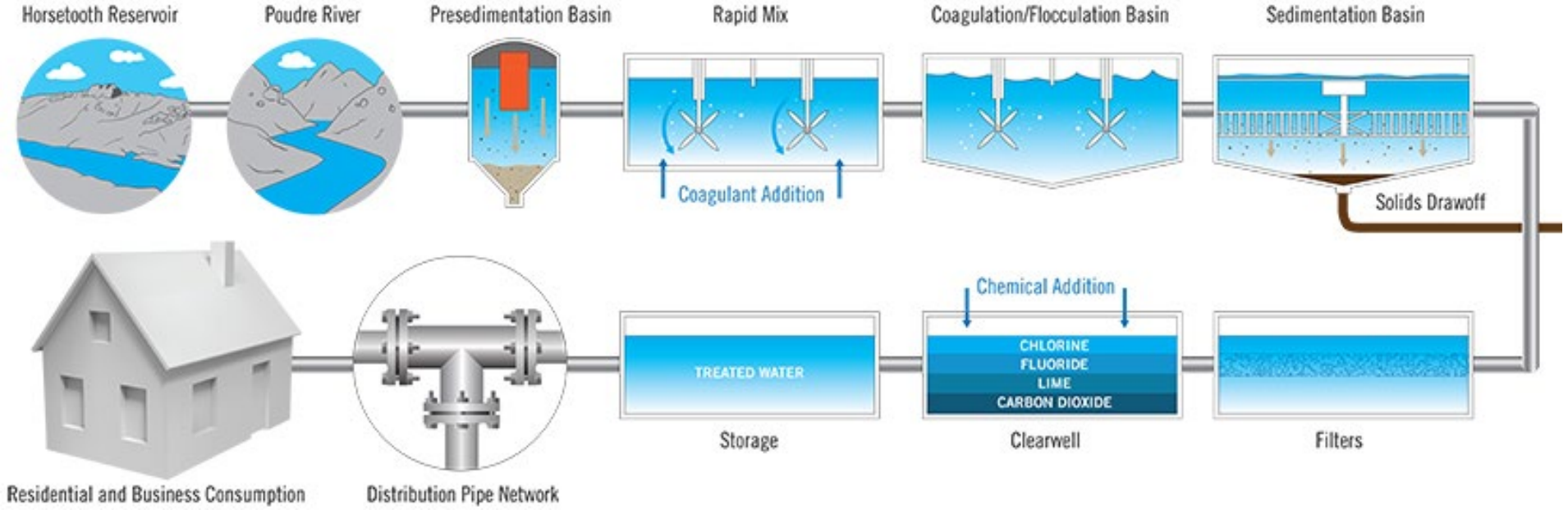
Overarching Trends in Water/Wastewater

- **OneWater: Water is water, regardless of source**
- Alternative sources are becoming mainstream
  - Direct use of rainwater
  - Reuse of reclaimed wastewater for non-potable uses (e.g. irrigation, golf courses – now a state law in Arizona)
  - Reuse of renewed water for potable
- As detection improves, more “pollutants” are found.

Overarching Trends in Water/Wastewater

- The Silver Tsunami is in full swing
- Owners are starting to ask for (and expect) energy efficient construction, resource recovery, and energy management principles in new construction
- Manufacturers recognize and are actively marketing energy efficiency
- The robots are coming – and they will be smiling!

Ft. Collins, CO (fcgov.com) Water Treatment

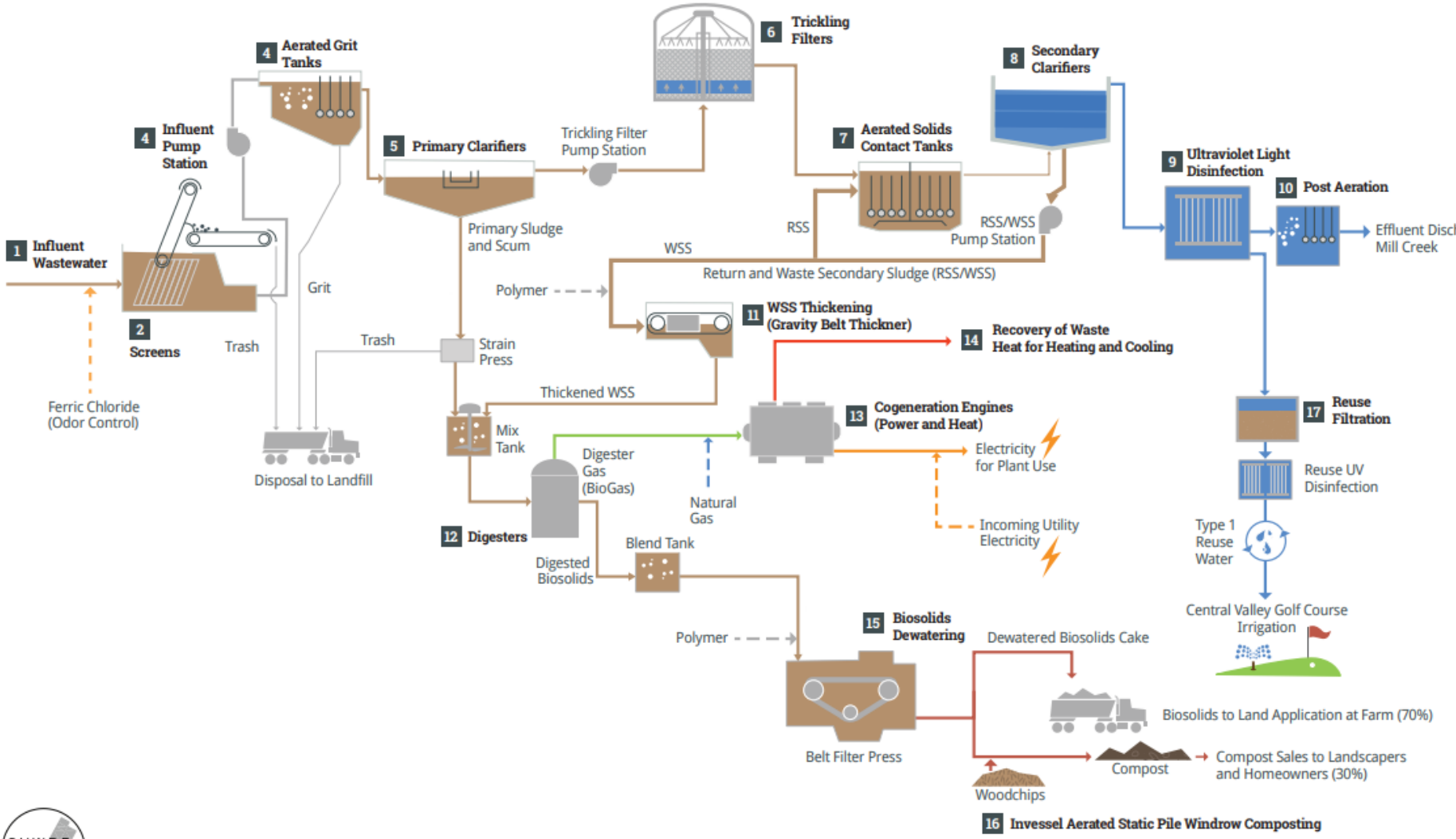


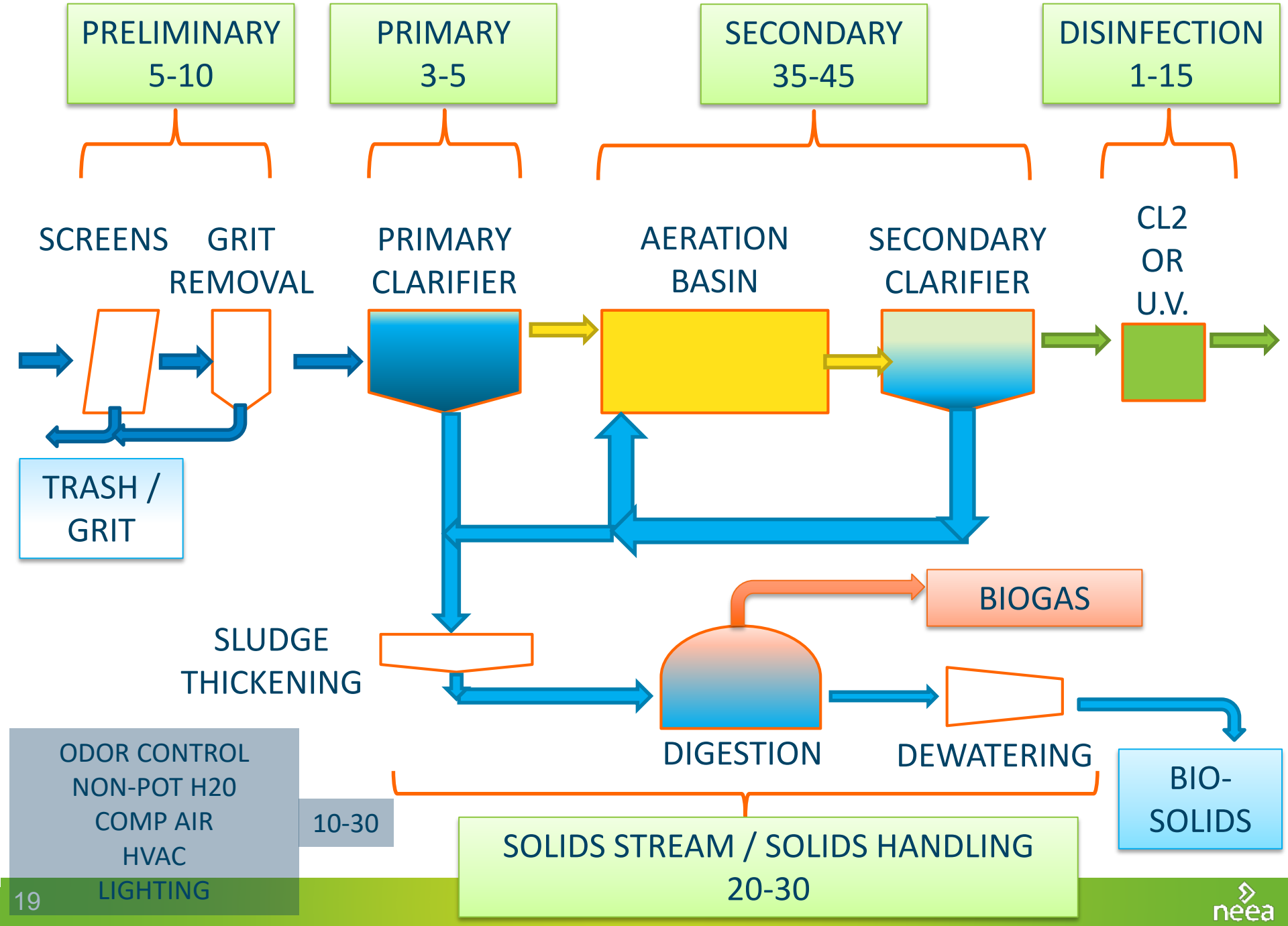
Colorado's Front Range provides awesome gravity assist.

Most water systems, however, involve pumping. Typically 65 – 80% of energy use in water treatment is pumping. (EPRI 1994 says 67% of total is high service pumping).

Groundwater source may be ~98% pumping energy.

CVWRF Process Schematic

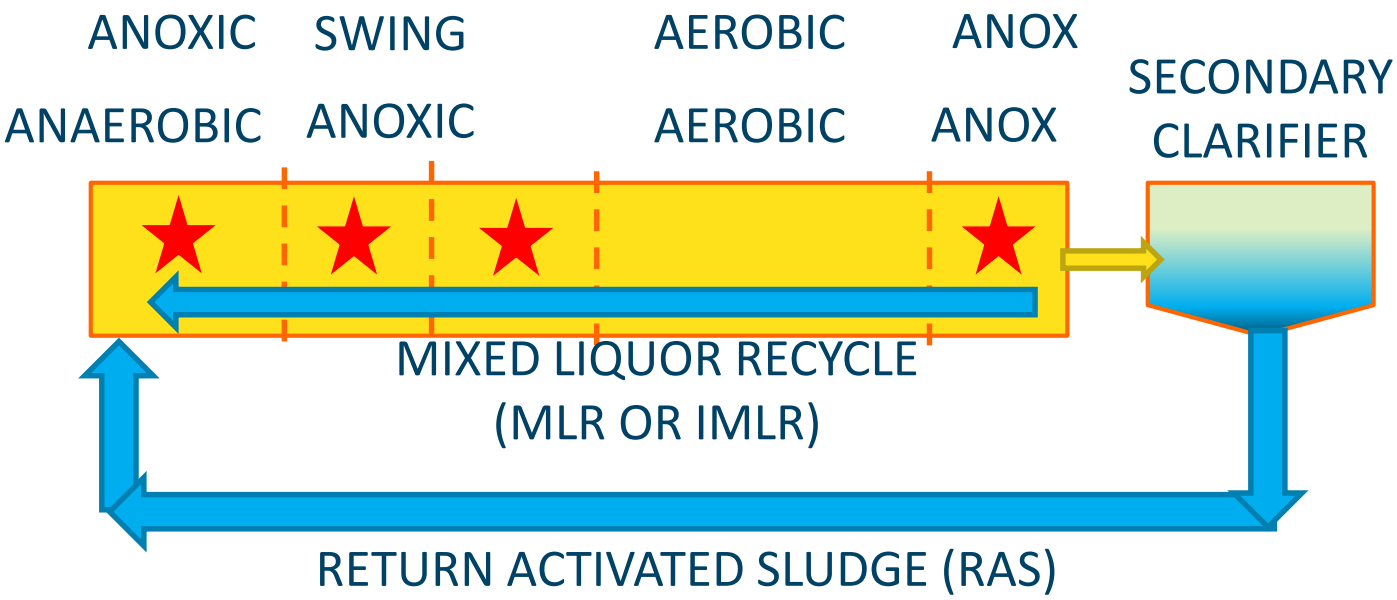



PRELIMINARY
5-10
PRIMARY
3-5
SECONDARY
35-45
DISINFECTION
1-15
SCREENS
GRIT
REMOVAL
PRIMARY
CLARIFIER
AERATION
BASIN
SECONDARY
CLARIFIER
CL2
OR
U.V.
TRASH /
GRIT
BIOGAS
SLUDGE
THICKENING
DIGESTION
DEWATERING
BIO-
SOLIDS
ODOR CONTROL
NON-POT H20
COMP AIR
HVAC
LIGHTING
10-30
SOLIDS STREAM / SOLIDS HANDLING
20-30

Process Equipment to Watch

- **MIXING**
- "Big Bubble" Mixing (PHI)
- Xylem "Smart" Mixers
- Linear Motion Mixing
- Landia GasMix System
- Mixer/mixing retrofits:
  - Adding VFD's to small mixers
  - Decoupling mixing from aeration

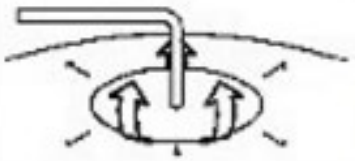
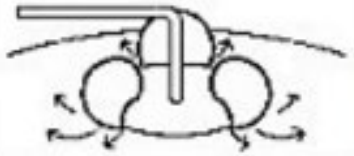
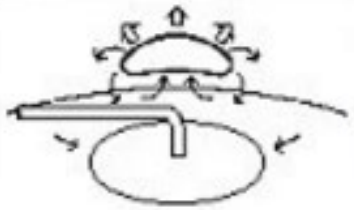
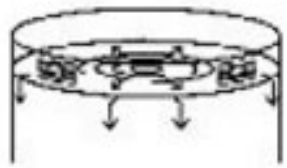
AERATION BASIN – NOW MULTI ZONE



NON-AEROBIC ZONES REQUIRE MIXERS

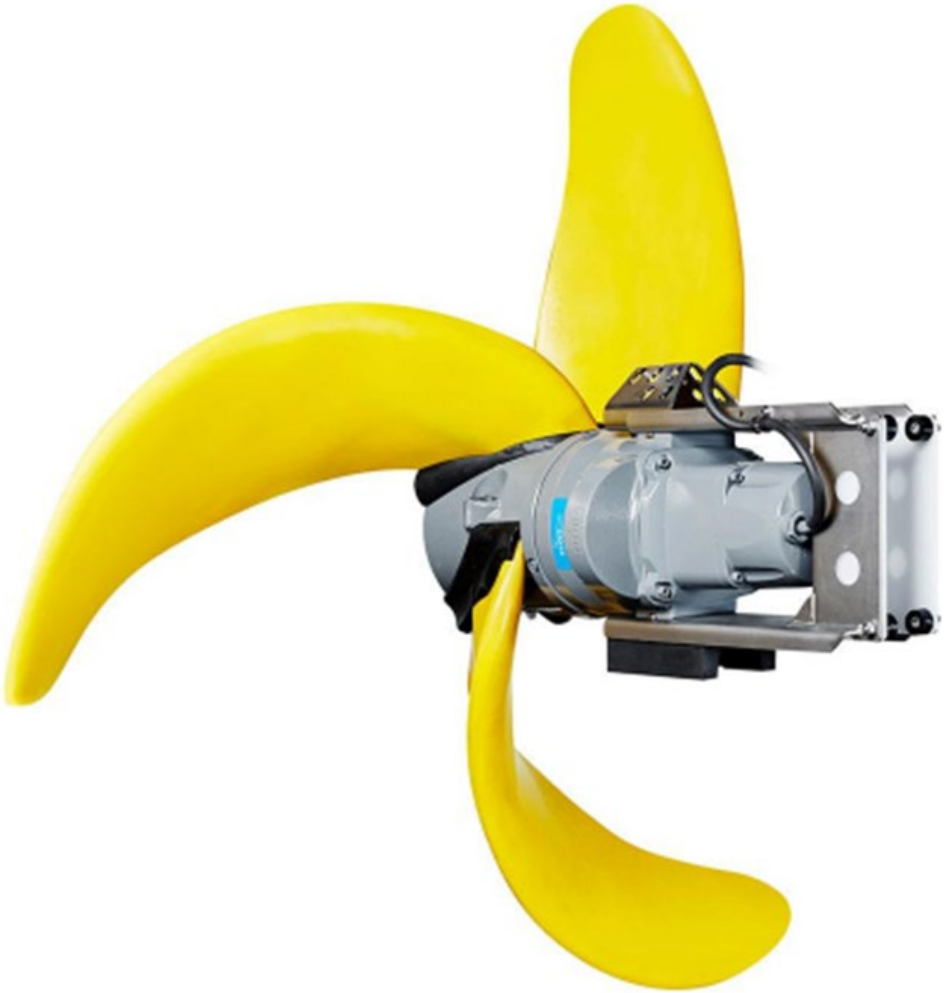
Pulsair Compressed Air Mixing – "BIG BUBBLE"

Pulsair Compressed Air Mixing

	**The Pulse** Compressed air is pulsed between the tank and accumulator plate, creating a shock that energize the fluid at the molecular level.
	**The Sweep** The air forms around the accumulator plate, which pushes liquids outward, mixing the heavier fluids and solids and cleaning the tank bottom.
	**The Vacuum** The bubble begins to ascend, pulling liquids and sediments back to the accumulator plate.
	**The Rise** Floating to the surface, the bubble generates currents that push and pull liquids and sediment up from the bottom and toward the top.
	**The Wake** The bubble releases through the surface, creating ripples and currents that move toward the side of the tank. The ripple reflect off the tank wall, creating mixing on the surface. The currents move down the side wall to the bottom, where the cycle is repeated.

http://wastewater.pulsair.com/video/

Pumps & Mixers with Integral VFDs



FLYGT

4320 low speed mixer

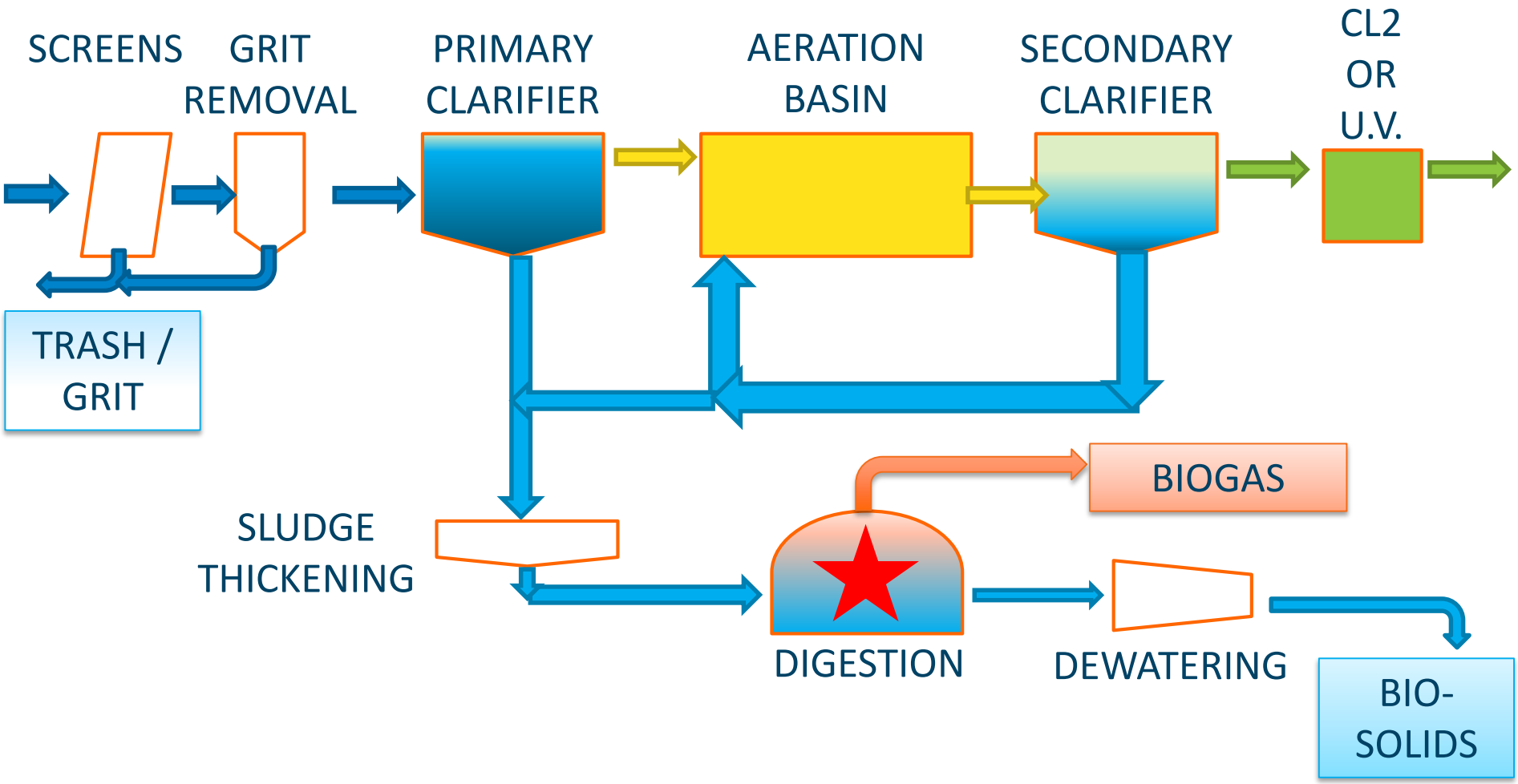
FEATURES

- Integrated variable speed drive coupled with a high efficiency mixer – eliminates the need for an external VFD
- Motor efficiency comparable to the Super Premium IE4 levels, with fully adjustable speed
- Superior hydraulic efficiency combined with superior motor efficiency and adjustable speed, to provide only the thrust your process requires, delivers unparalleled energy efficiency
- Drastically reduces carbon footprint – energy savings may provide payback in as little as a couple years
- Easily adjust speed without removing mixer – equipped with user friendly remote speed controls that can be mounted tank side or in a control room for easy accessibility
- Three propeller sizes each in two or three-blade versions: 1.4, 2.0 and 2.5 m (55, 79 and 98 inches) for a range of mixing applications
- Rated motor power options of 2, 4 and 8 kW
- Propeller options and speed range deliver a broad range thrust for virtually any submersible mixing application

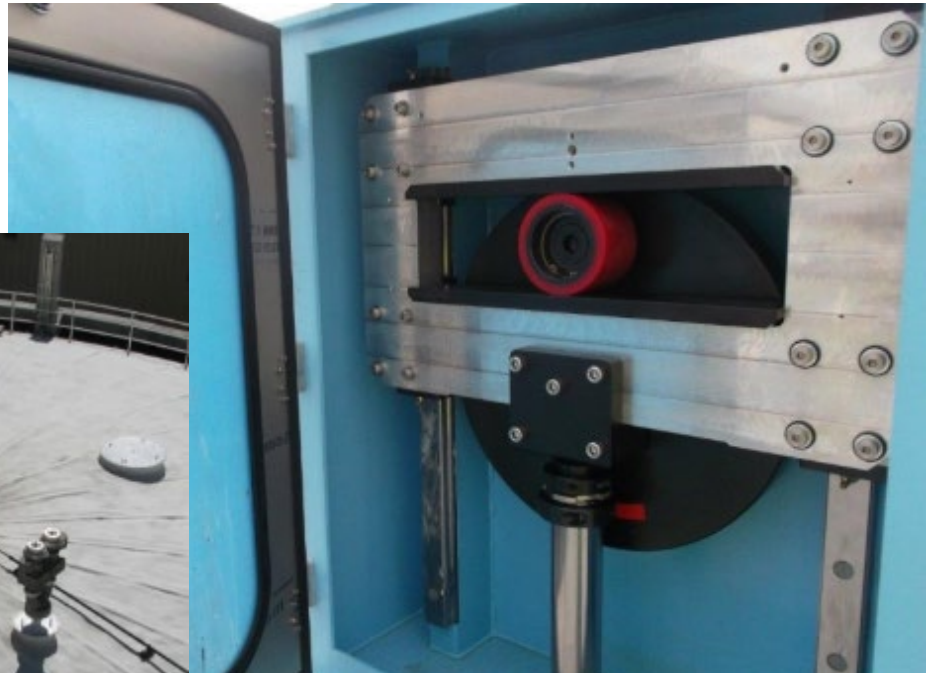
Hyperboloid mixers: Not new, but still not many in PNW

invent®
environmental technologies

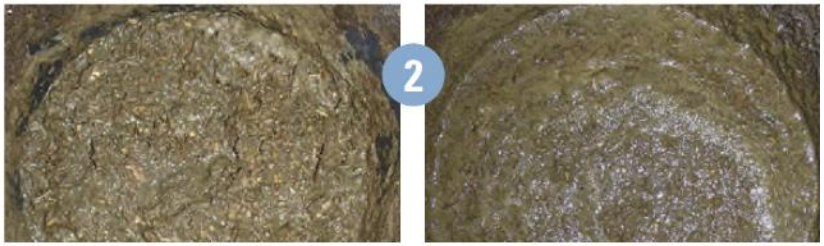
DIGESTER MIXING IS CRITICAL



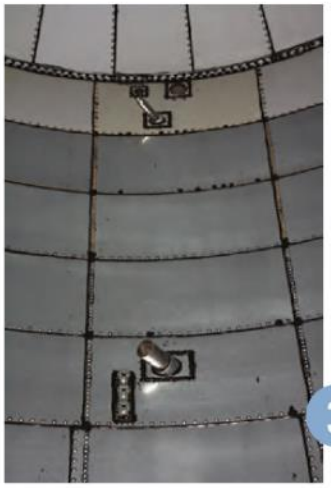
Linear Motion Mixers



Landia GasMix System



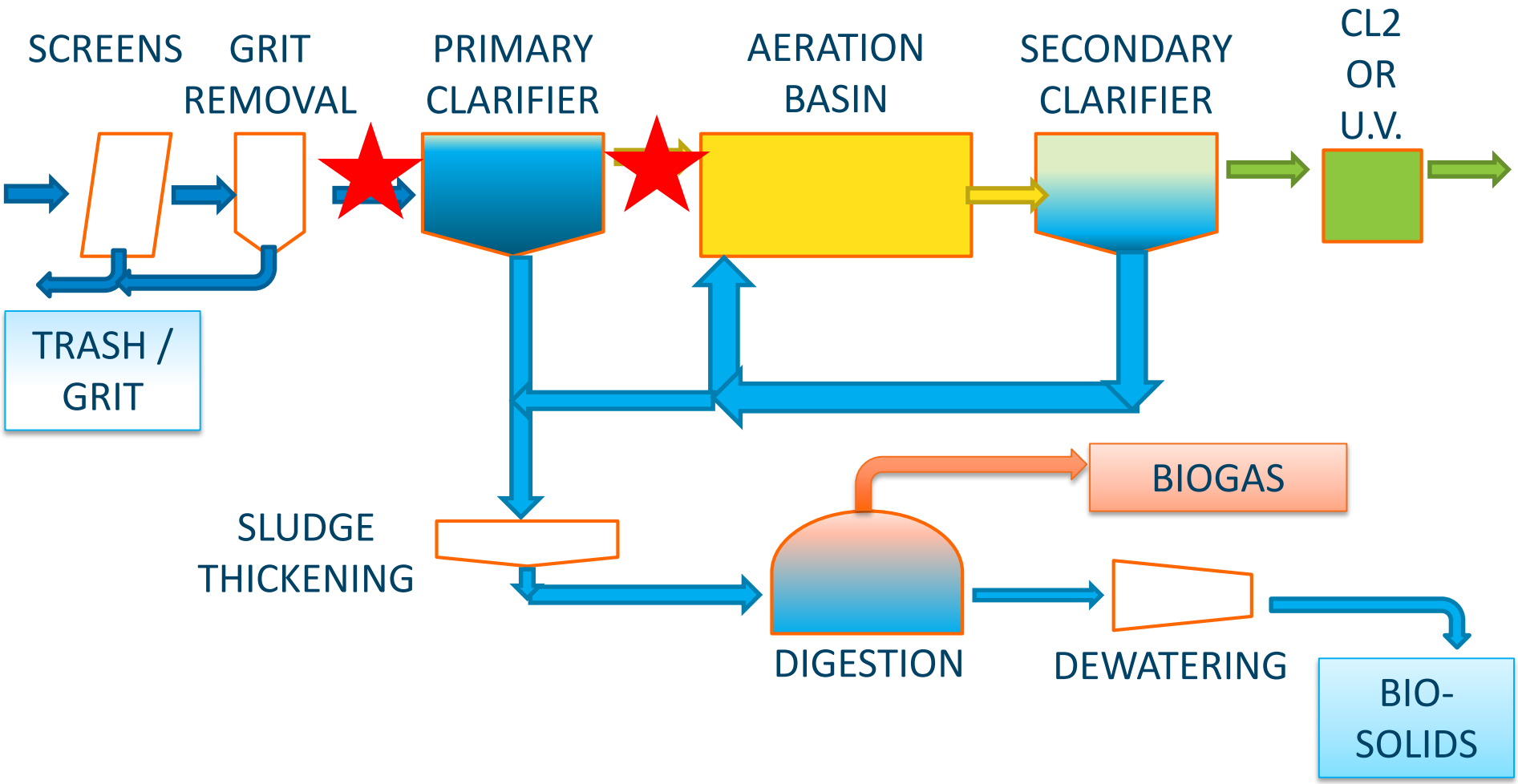
1. The GasMix system keeps moving parts on the outside of the digester.
2. Slurry feedstock before and after treatment with the GasMix system.
3. Nozzles at strategic locations around the digester provide the mixing action.
4. A GasMix system with insulated tank and piping.



Process Equipment to Watch

- **Unloading Aeration Basins**
- Primary Filtration
- Sidestream or Shortcut Denitrification
- Simultaneous Nitrification/Denitrification

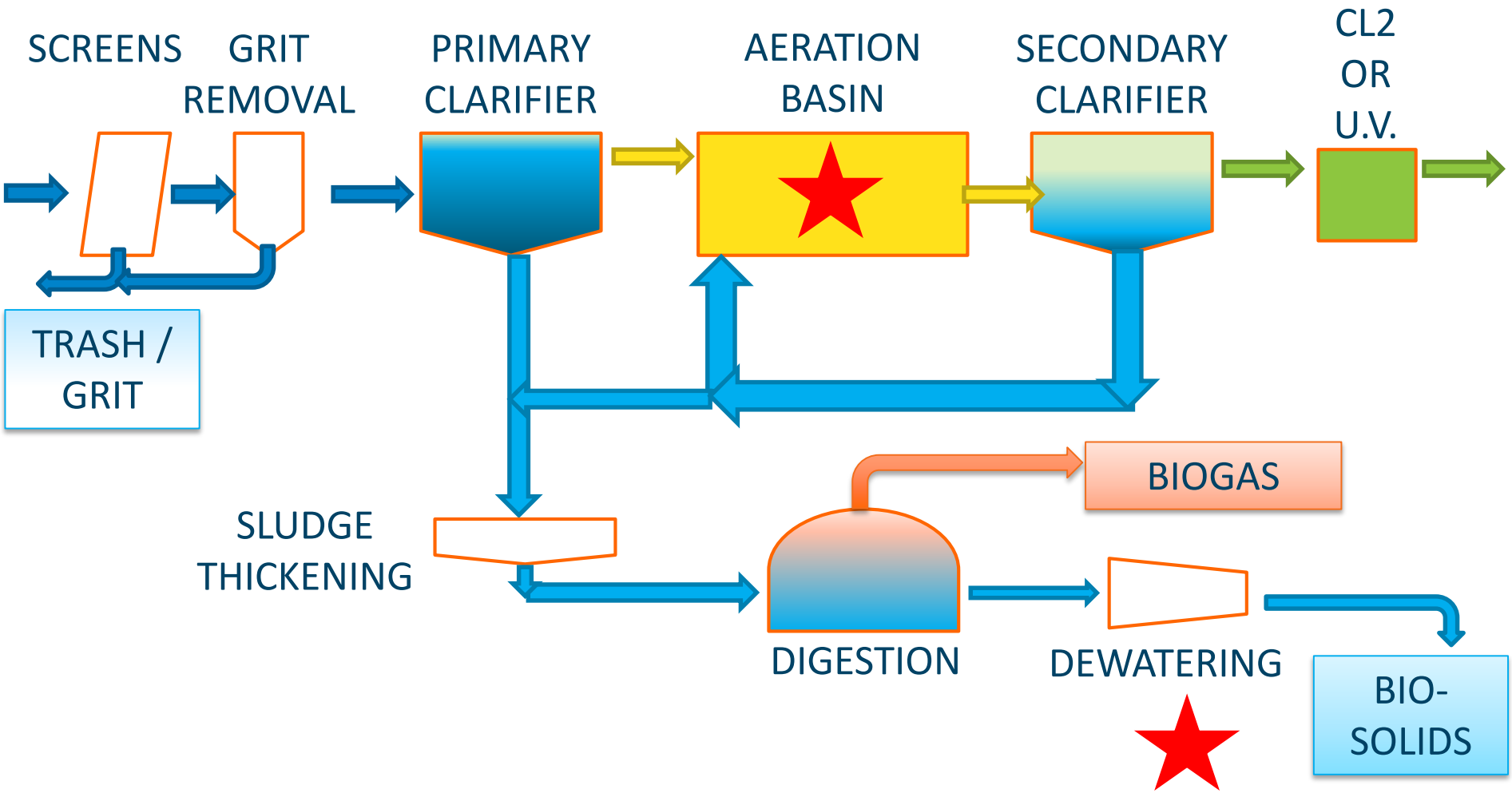
PRIMARY FILTRATION



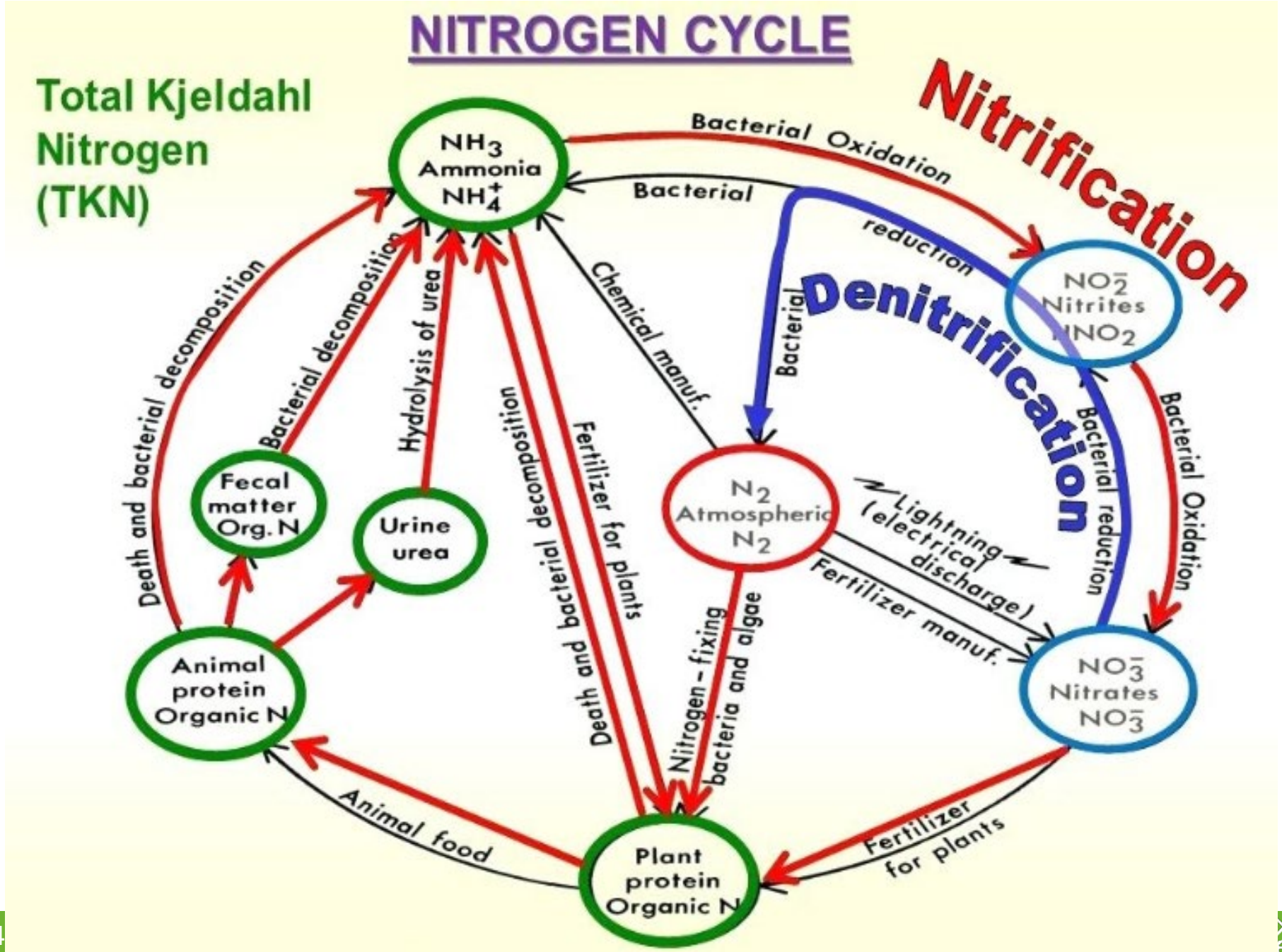
Primary Filtration

- Upstream, downstream, or in place of primary clarifiers
- Move more carbon to digester BEFORE expensive secondary process
- Better gas recovery
- The Dalles, OR

LOWER-ENERGY NITROGEN REMOVAL



Michigan DEQ Operator Training https://slideplayer.com/slide/4213746/



Process Equipment to Watch

- **Instrumentation & Controls**
- Phosphorous instruments to minimize chem addition
- Ammonia Based Aeration Control
- Specific Energy Pump Station Optimization
- AquaSite Optimization Umbrella
- HACH WIMS

Nitrogen & phosphate control system Liquiline Control CDC81

With Liquiline Control you safely comply with your phosphorus limit value while optimizing your precipitant consumption.

IQ SensorNet P700 IQ Orthophosphate Analyzer

IQ SensorNet P700 IQ Orthophosphate Analyzer

Smart Pump Controls

Flygt MultiSmart™

Lowering Your Costs, Saving Your Time

MultiSmart not only makes life simpler and gives you peace of mind, it saves you money. Nuisance call-outs are dramatically reduced thanks to built-in features like pump reversal that prevent clogging as well as alarms to prompt preventative maintenance. Pump energy efficiency is optimized by monitoring pump voltage and amperage to calculate real power consumption. By knowing the energy used by each pump it decreases pump station electrical consumption by leveraging the use of the most efficient pump. Control panel costs are reduced due to built-in functionality in the Flygt

Smart Pump Controls

Monthly Summary Report

Kempner Water Supply Corp.

Historical Summary

	Volume (MG)	Energy (kWh)	DPO Mode Enabled	Energy Reduction*
Month (Since 2018/12/01)	138	201,534	50%	$3,049
Past 12 Months (Since 2018/01/01)	2,273	3,377,110	51%	$42,972
All Time (Since 2011/03/27)	13,431	21,105,480	53%	$249,579

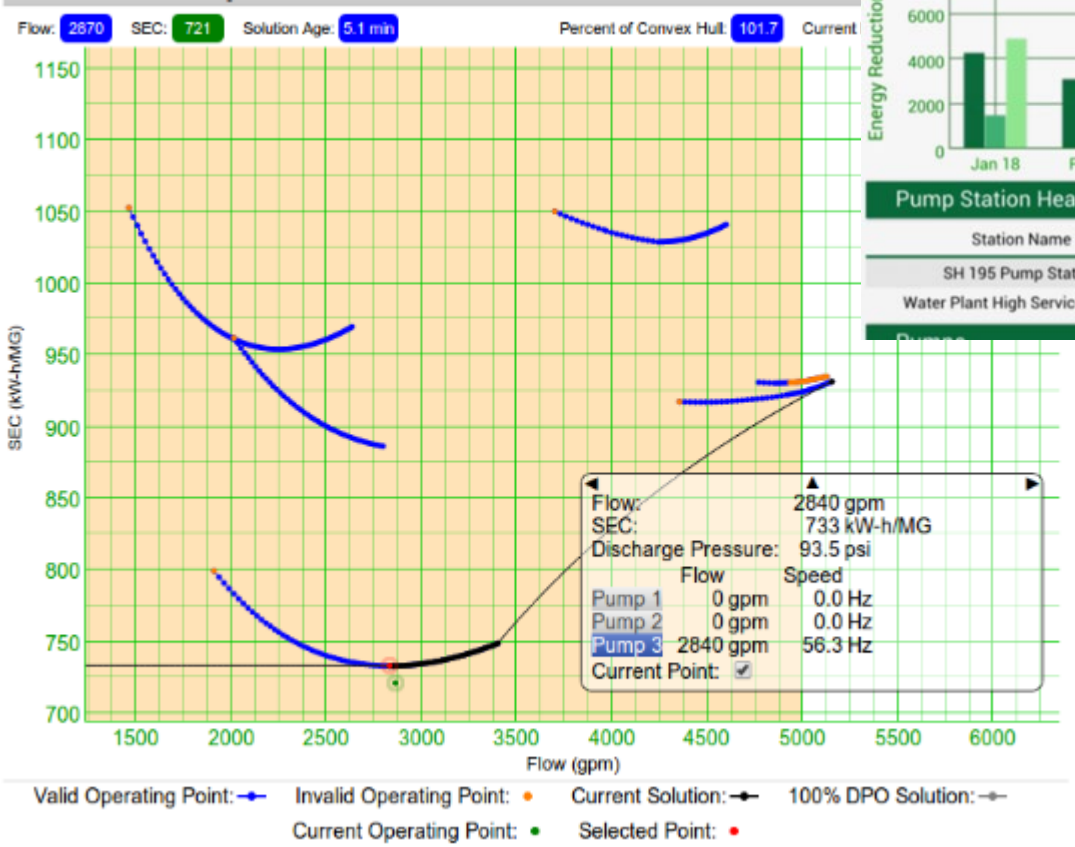
*Calculated assuming a constant energy cost of $0.10

Energy Reduction - Year in Review

Pump Station Health Data

Station Name	Pump Station Capacity	Recommended Repair	Repair NPV	Payback Period
SH 195 Pump Station	80%	Hwy195Pump4	$46,579	4 years, 4 month
Water Plant High Service Pumps	94%	-	-	-

Current SEC Map



SPECIFIC ENERGY

Plant and System Optimization

AQUASIGHT

Features

Pumping Performance	Phosphorus Removal	DO Control	Nitrification Intelligence	Blower Performance
Disinfection Optimization	Solids Handling Intelligence	Chemical Measurements Monitoring	No HW/SW Installation Required	Aquasight Virtual Advisor™

Digital Resource Recovery Platform

APOLLO™

- ☑ Real-Time Data Treatment
- ☑ Performance and Cost KPIs
- ☑ Live Unit Process Dashboards
- ☑ Real-Time Advisors
- ☑ Digital Asset Intelligence
- ☑ Influent Forecasting
- ☑ Effluent Analysis
- ☑ SAMI™ 24x7 Autonomous Monitoring
- ☑ SOP Knowledge Retention

O&M Savings

19%	13%	9%
Identified	No-Cost	Realized

Pollutant Removal

94%	82%	94%	✓
CBOD	TP	TSS	Permits

GLWA Facility

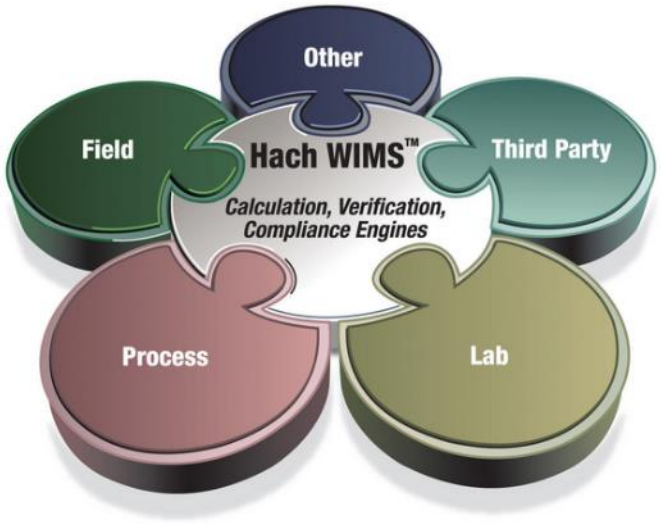
GLWA is a regional water & wastewater utility serving 3.9M residents based in SE Michigan. The WRRF is one of the largest facilities in the US and treats an average of 650 MGD with wet weather primary and secondary treatment capacities of 1700 and 930 MGD respectively. Facility includes both liquids and solids processing

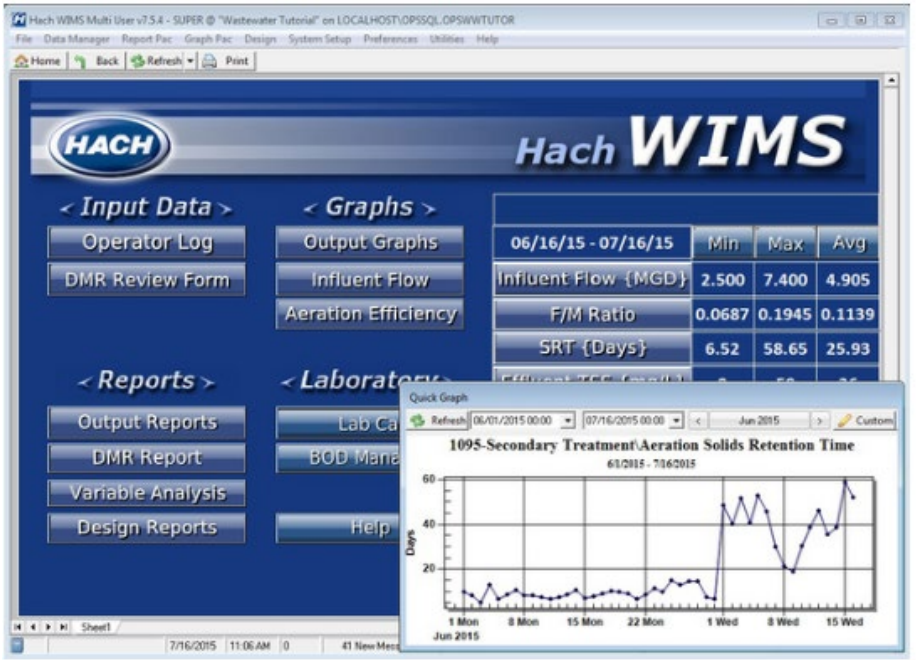
MI Energy
Michigan Agency for Energy
Michigan Energy Office

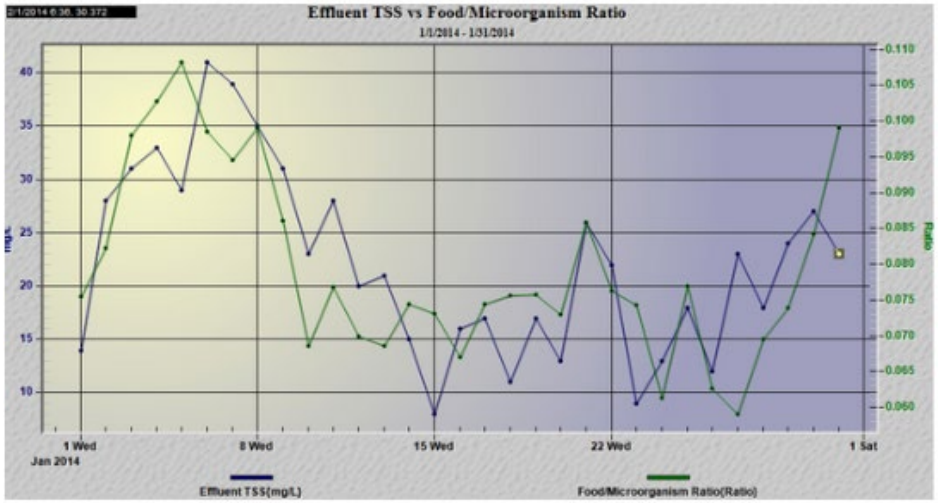
www.michigan.gov

Better Lab / Plant Data Integration

Hach WIMS™ - Water Information Management Solution







Plant KPI Trend Report

Month	Influent Flow MGD	Influent BOD mg/L	Influent TSS mg/L	Primary Eff BOD Load lbs/Day	MLSS mg/L	Food/Microorganism Ratio Ratio	Solids Retention Time Days
Jan 2008	3.05	285	208	5,116	3,684	0.0793	52.01
Feb 2008	3.06	275	204	4,922	3,623	0.0770	54.22
Mar 2008	3.02	285	206	5,099	3,669	0.0793	51.07
Apr 2008	3.04	285	206	5,073	3,661	0.0791	51.18
May 2008	3.10	285	206	5,181	3,678	0.0802	51.64
Jun 2008	2.99	285	206	5,007	3,665	0.0779	52.43
Jul 2008	3.04	285	206	5,099	3,669	0.0793	51.07
Aug 2008	3.03	288	206	5,056	3,673	0.0786	51.21

Thank you!

- **Layne McWilliams, PE JD**
- **Director of Customer Engagement, Water/Wastewater**
- **& Sr. SEM Coach**
- **971-244-8581**
- **layne.mcwilliams@cascadeenergy.com**

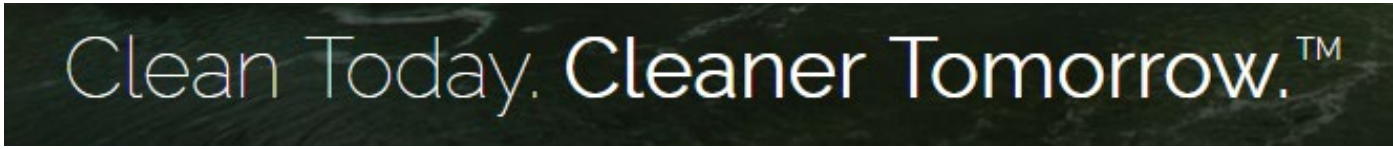
Energy Efficiency as a Group Effort Cohorts Work!

Randy Thorn, P.E.
Principal Engineer
Idaho Power

Our Clean-Energy Goal

As Idaho Power continues serving customers and communities with **reliable**, **affordable** energy, we look to do so with a new and exciting goal:

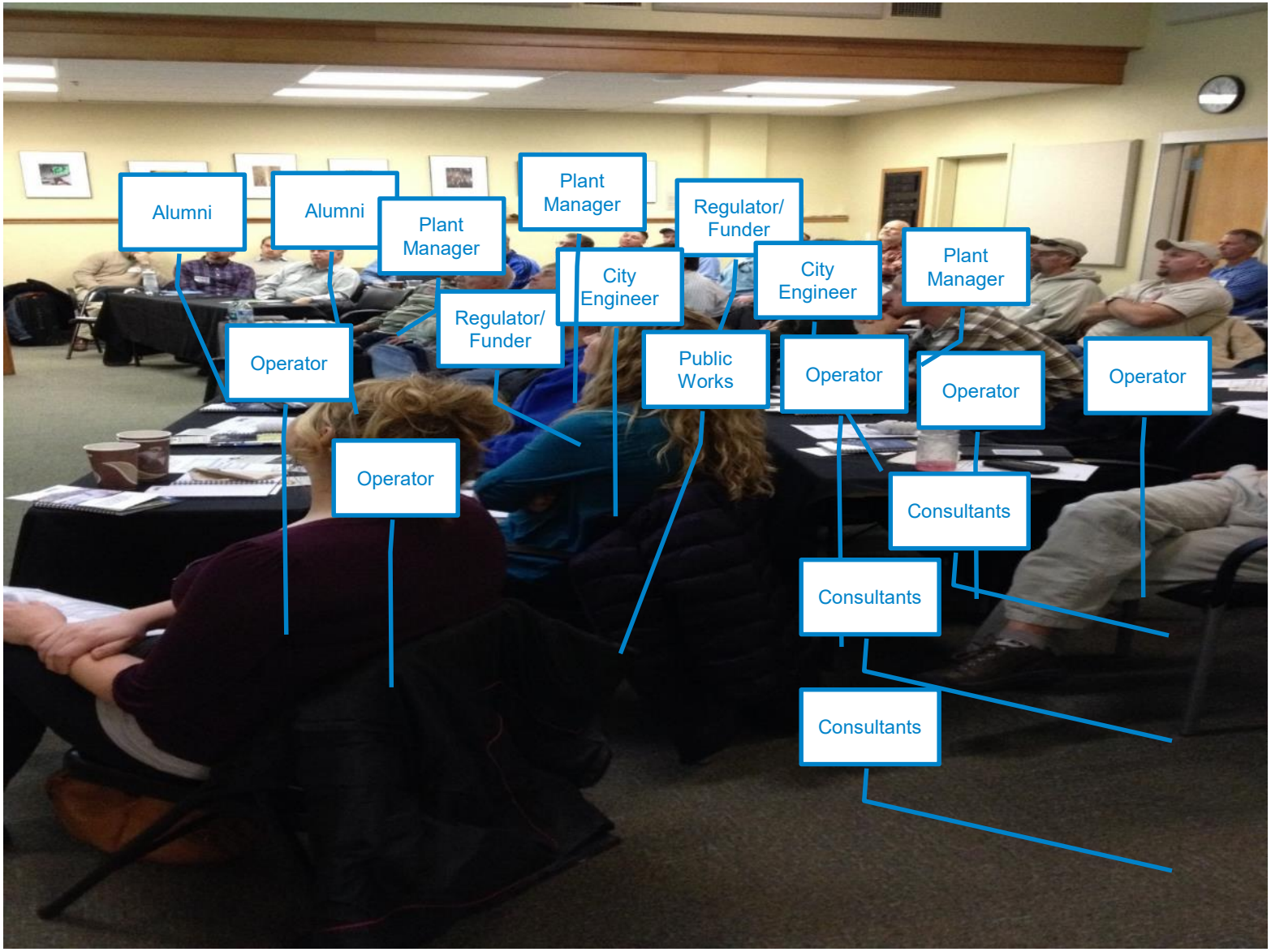
Providing 100% clean energy by 2045



Cohorts

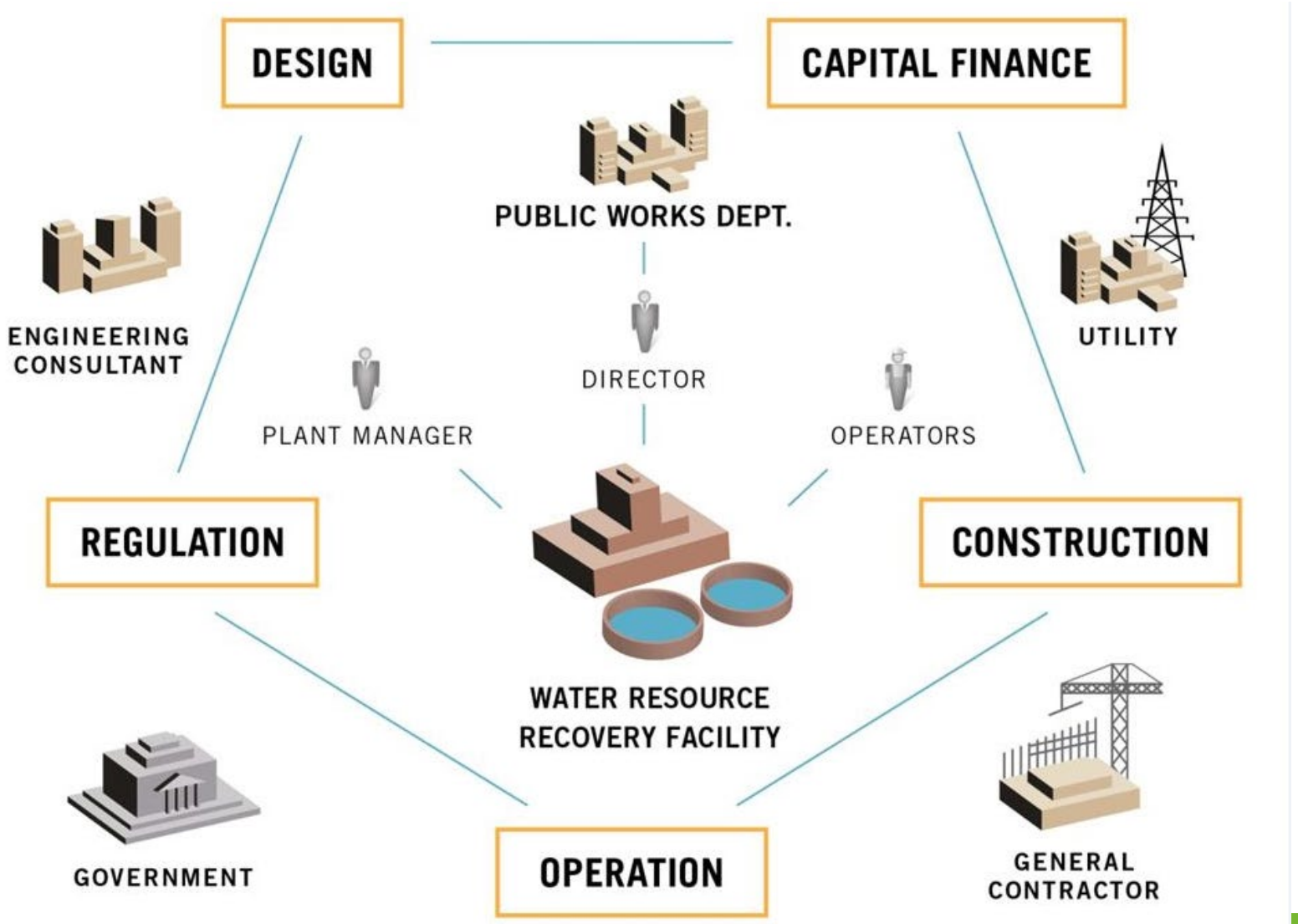
- Refrigeration Operator Coaching for Energy Efficiency
- Wastewater
  - Finished Year 5 continuation with 7 cities. Reengaging with a couple participants that didn't perform for various reasons.
  - Multiple capital projects
- Schools
  - School Cohort almost complete
  - Evaluating how to move forward with participants
  - 6 districts with 24 facilities
- Water Supply
  - In year 2 for Eastern ID (2 cities)
  - In year 4 with original cohort. Continuing with 11 cities.
  - Multiple capital projects

Idaho Power Wastewater Cohort


Alumni
Alumni
Plant Manager
Plant Manager
Regulator/ Funder
City Engineer
City Engineer
Plant Manager
Regulator/ Funder
Operator
Public Works
Operator
Operator
Operator
Operator
Consultants
Consultants
Consultants


PAIRS
Paired Teams
Ketchum
Nampa
Blackfoot
Jerome
Kuna
Hailey
Caldwell
Boise West
Meridian
Boise Lander
EXIT

Idaho Power Wastewater Cohort



Idaho Power Wastewater Cohort

Boise Lander Water Renewal Facility

Idaho Power Wastewater Cohort

"Between January 1, and November 1, 2014, we've cut our energy use by 559,129 kWh, and we'll be close to 700,000 kWh by the end of the year." -

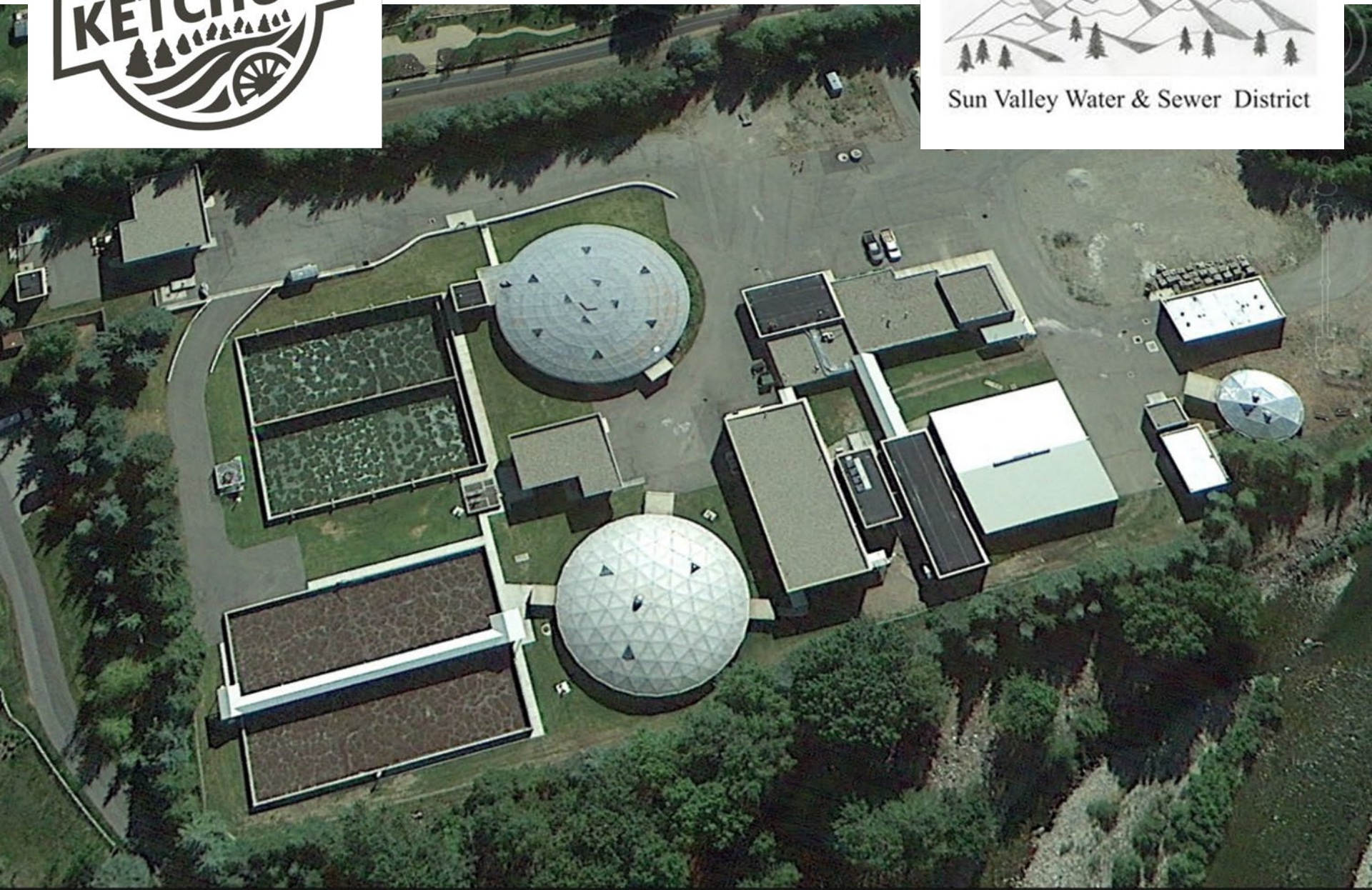
Royce Davis, Plant Manager, City of Boise-Lander

55

KETCHUM

SVWSD

Sun Valley Water & Sewer District



ELIMINATING ENERGY WASTE FROM WASTEWATER

IDAHO POWER®
An IDACORP Company

Wastewater Energy Efficiency Cohort Success Story and Energy-saving Tips

" The level of treatment wasn't affected, but we reduced our energy consumption for that process by about 15 percent."

~ Mick Mummert, Wastewater Superintendent — City of Ketchum, Idaho

Real Savings, Real Dollars

- Replaced two 125 HP centrifugal blowers with two high efficiency high speed turbo blowers with VFD's controlled by a PLC.
- Saved 438,479 kWh
- Incentive $52,617 (~20%)
- Operational savings $22K per year

City of Jerome

- New anaerobic digesters
- Intermediate clarifiers
- New aeration basin with fine bubble diffusers and DO control system
- New blower building
- LED lighting and efficient HVAC

5,193,000 kwh savings

$931,470 incentive

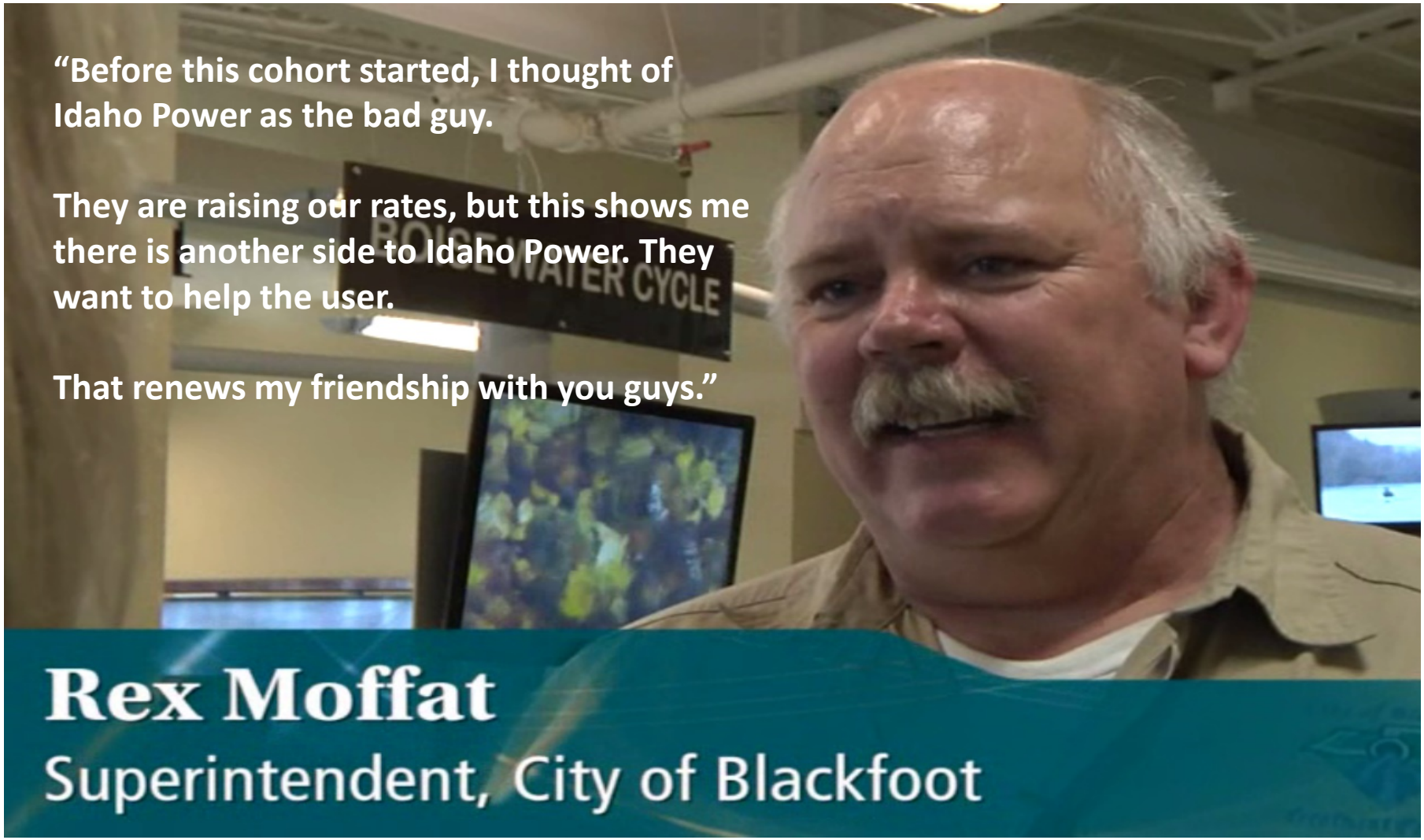
Fruitland WWTP

Idaho Power
July 30 at 6:54 AM ·

Thanks to energy efficiency measures at its new wastewater treatment plant, the City of Fruitland has reduced its energy expenses and earned an Idaho Power energy efficiency incentive check for $206,836! We are proud to partner with our communities to save energy and money!

Video Link

https://www.youtube.com/watch?v=ES46PET3B70


“Before this cohort started, I thought of Idaho Power as the bad guy.
They are raising our rates, but this shows me there is another side to Idaho Power. They want to help the user.
That renews my friendship with you guys.”
Rex Moffat
Superintendent, City of Blackfoot

Program Results

Huge increase in capital projects

Strong industry relationships

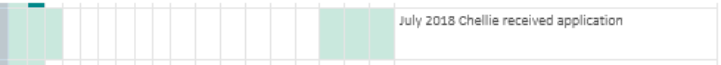
Program Results

Customer	Project Name	Design Company	Audit/ Analysis Company	Project Type	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Note
American Falls	Aeration Blower Replacement IP#2055		Cascade Energy	CE																			None. Paid.
Avimor	Avimor Foul Air Blower Replacement	T-O Engineers	T-O Engineers	CE																			4/23/19: Zahra will ask Carl about project-Nampa office may be designing upgrade.
Bellevue	Lift Station pumps		Cascade Energy	SCE																			5/6/19 Chellie to ask for bid pump curve. Pre-approval submitted through SCE.
	WWTP upgrades			CE																			5/3/18-emailed Frank about potential project
Blackfoot	Intermediate Pumping Station VFD upgrade	J-U-B	Cascade Energy	SCE																			2/7/19-received invoice from Rex
	Phase 2: UV and Aeration upgrades	J-U-B	Cascade Energy	CE																			Need pre-app
	Water - groundwater to surface water	In-House		CE																			11/30/18 Wendy emailed Princton scoping audit app.
Boise	Dixie Drain	Brown & Caldwell	Brown & Caldwell	CE																			5/16/19 Wendy emailed Chellie review of Detailed Audit
	Lander - STEP project	Brown & Caldwell		CE																			2/25/19: delayed for a few years per Josh
	Lander Phase 2 Filtration			CE																			2/7/19-at 30% design
	Lander Street - upgrade phase 1	Jacobs	Jacobs	CE																			2/7/19-met with Jay - at 90% design. Melanie to set up mtg w/Jay and Royce
	Lander-aeration blowers	HDR		CE																			5/21/19 Royce said Brad Bjerke is working on blower project
	Lander-VFDs on W3 pumps		Cascade Energy	SCE																			None. Boise decided to wait for their new W3 station.
	West Boise WRF Air Compressor Upgrade & Aeration Mixer VFDs CEA#639	In-House	Cascade Energy	SCE																			5/20/19 Will go out to bid for compressors and will install VFDs on mixers for Basins 1 & 2 Zones 2 &3 in next few months.
	West Boise WRF Post Air Blowers CEA#639	In-House	Cascade Energy	CE																			pre-app received
	West Boise/Joplin baffles	In-House		CE																			12/28/18 Baffles installed. 11/29/18 Tony will look into baffles and aeration optimization and savings
	West EBNR - MLR pumps			SCE																			5/20/19 Wendy waiting on info from Boise
	West/Joplin Admin and Ops buildings																						11/2/18: Wendy will ask Austin who is designing. PER will be started in 2018
	West/Joplin UV Channels 1&2	In-House		CE																			5/20/19-UV Channel 3 is not sufficient to meet new dose. Channels 1 and 2 run regularly. Might be in 2021 budget for replacement.

1 - Added to Register
2 - On Radar (No Submittals)
3 - Pre-App Paperwork Submitted
4 - Scoping Audit App Submitted
5 - Detailed Scoping Audit App Submitted
6 - Scoping Audit Authorized
7 - Detailed Audit Authorized
8 - Draft Scoping Audit Received or Not Needed
9 - Draft Detailed Audit Received or Not Needed
10 - Analysis Complete/Audit Finalized
11 - Pre-Approval App Submitted
12 - Pre-Approval Issued
13 - Project Installed
14 - Payment App Submitted
15 - M&V Started
16 - M&V Complete
17 - Check Issued
18 - Project Close Date

Within the Last Month
1-3 Months Ago
3-6 Months Ago
Over 6 Months Ago

Program Results

Caldwell	Digester -IP#1627	Keller	Cascade Energy	CE		July 2018 Chellie received application
	WWTP	Keller		CE		July 2018 Chellie received application
Chubbuck	Brookstone Potable to PI upgrade	In-House	Cascade Energy	CE		3/19/2019-Chubbuck plans to provide info by mid-April. 1/23/19 starting preliminary design
	Highline booster station	Keller	Keller	CE		5/1/19: Coulter working w/Chellie on Detailed Audit app. 11/6/18: Colter is preparing energy calcs. Out for bid now. Construction start Dec 2018. Operation in summer 2019
	Well 4 rehabilitation	In-House	In-House	CE		Mike Wise doesn't think there was energy savings. Did not bypass aeration tower. NO NEXT STEP.
	Well 6 and booster station	Keller	Keller	CE		5/1/19: Coulter working w/Chellie on Detailed Audit app. 11/6/18 Colter is working on energy calcs. In construction and may be in operation Dec 2019.
	Well 7, tank, and booster station					2023 timeline
City of Council	Council WWTP upgrades	Great West Engineering	Cascade Energy	CE		2/28/19 Need pre-approval app
CS Beef	WWTP	HDR	Cascade Energy	CE		2019-01-17 - tom.simenc: Contacted customer multiple times. Still waiting on costs.
Darigold Boise	Equalization-VFDs on 3 hp	HDR	Cascade Energy	SCE		1/28/19 Shane will let us know when they decide if they are using existing pumps or new pumps
	WWTP Process Controls-VFDs for blowers and jet recirculation	In-House		CE		1/28/19 Shane said they don't want to move forward with scoping until they have new control system this summer.
Dickinson Frozen Foods	aeration blower VFDs			CE		4/4 Wendy picked up loggers. Need cost documentation
	WWTP effluent chiller	In-House		CE		2/20/19 Todd said they are not planning to install chiller at this time
Dietrich	New well (#2)- iron bacteria issue					Not cost effective to use this well due to iron bacteria issue and Well #1 is operating efficiently. NO NEXT STEP
	Well pump (#1) investigation/retrofit					Well #1 is operating efficiently. NO NEXT STEP
Dry Creek Ranch	Water system pumps w/VFDs	SPF	Cascade Energy	SCE		None. Payment application submitted to IPC
	WWTP CEA#699	T-O Engineers	Cascade Energy	CE		4/1/19 scoping audit revised and resubmitted to Chellie
Eagle	Eaglefield Well 5 and Legacy Well upgrades	In-House		CE		2/28/19 sent Ken comments on JUB proposal.
	Lexington Well-#IND2246	In-House	Cascade Energy	CE		None. Paid.
	Well 6 and booster station	SPF		CE		2/11/19 Chellie emailed Jason scoping audit application

Program Results

Eagle Sewer	Aeration upgrade	Jacobs	Jacobs	CE	None. Paid.
Emmett	Aeration upgrade			CE	completed scoping audit Jan 2017. Not sure if they will move forward with project
	Wastewater system scoping-#CEA553	Keller	Keller	CE	
	water system scoping #CEA552	Keller	Keller	CE	projects?
Fruitland	Water Treatment Plant-Compressed Air System Upgrade		Cascade Energy	SCE	None. Paid.
	WWTP Upgrades	T-O Engineers	Cascade Energy	CE	None. Paid.
Glanbia Gooding	WW Brine Upgrades	T-O Engineers		CE	11/14/18 Wendy emailed Carl scoping audit application. Might be able to go streamlined.
Glenn's Ferry	Lagoon Aeration Upgrade			CE	12/20/18-Harv with Medora is providing a GridBee quote to city.
Gooding	North and South Well Pumps VFDs-#IND2095	Keller	Cascade Energy	SCE	Pre-approved
	WWTP upgrades	Keller		CE	8/29/18: Chellie emailed Oksana to set up mtg. Oksana said project is too early in design to discuss.
Hailey	WWTP Solids Upgrade project	HDR	Cascade Energy	CE	3/13/19 Steve is still working to optimize digester blowers.
Halfway	Wastewater system scoping				schedule meeting when in the area
	Water system scoping				11/7/18-Chellie will check with Dan about irrigation
Hazelton	Booster Pump Station Upgrade	Riedesel	Cascade Energy	CE	None.
	Water Distribution System Replacement				6/27/19-Shawn will send detailed breakdown of costs. Project may not be cost effective.
Hidden Springs	Aeration Blower Replacement	T-O Engineers		CE	4/23/19 Wendy talked to Zahra. She is not working on ww projects anymore. She emailed Wendy curve for proposed blower. Wendy to review.
Horseshoe Bend	WWTP aeration blower upgrades	Civil Dynamics		CE	12/6/18: Facility Plan is being reviewed by DEQ. Sent Mike scoping audit and incentive info.
INL	Lift Stations upgrades				4/1/19 follow up with INL
Jerome	10th Street Well and Booster Station upgrades			CE	11/16/18 Wendy emailed Brian scoping audit application
	WWTP Expansion	Keller	Keller	CE	4/24/19 Sent to Chellie

Program Results

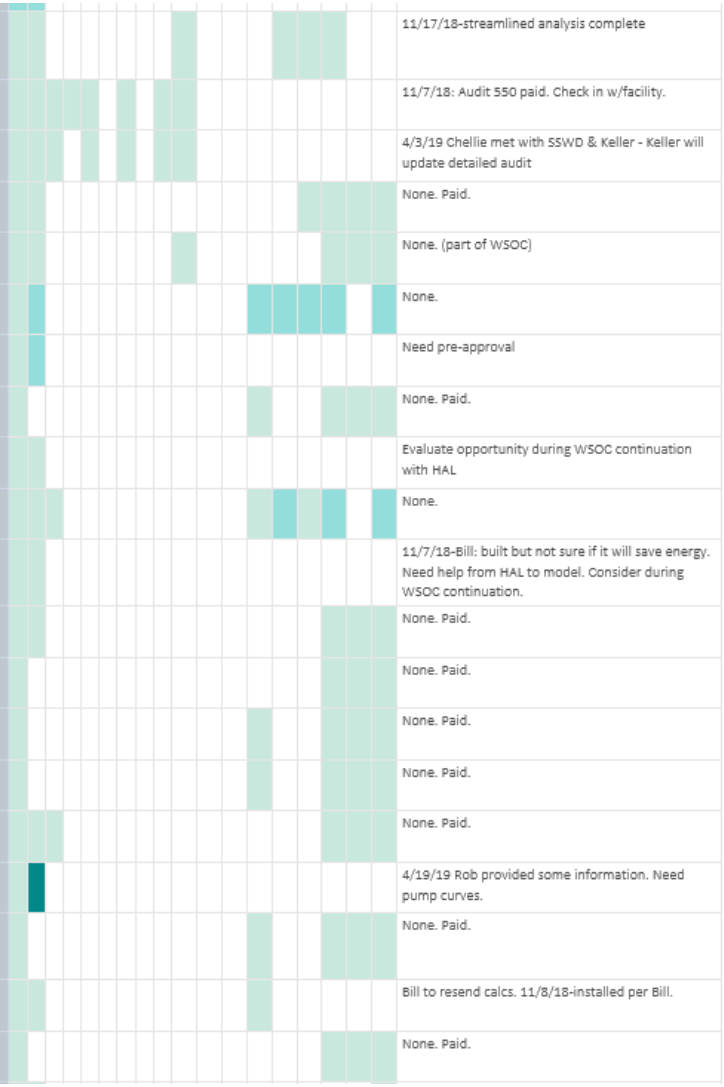
Jerome Cheese	WW blower - IND 1900		In-House	CE	11/7/18-Chellie will review operating info and costs
	WW VFDs	In-House	In-House	CE	11/7/18 Chellie will send over information to Wendy to consider processing through SCE.
Ketchum	Headworks-IND2069	HDR	HDR	CE	Construction started spring 2018. 11/7/18-Chellie asked Mick for paperwork
	KSW abandonment-#IND2124		Cascade Energy	CE	Scoping Report sent to Chellie 6.14.18
	Well Refurbishment@Big Wood Well	J-U-B	Cascade Energy	CE	None. Paid through WSOC.
	WWTP digester blower replacement	In-House		CE	2/15/19 Chellie & Quentin said may be eligible for incentive
	WWTP effluent pump replacement				4/19/2018 Dave Genetti mentioned this project to Jerry. Mick said they are getting a pump quote for budgeting purposes. If they do the replacement Mick will contact Idaho Power. Potential streamlined project.
Kuna North WWTP	MBR Air Scour Blower Upgrades	In-House	Cascade Energy	CE	need Pre-App. 2/8/19 Tom doesn't think he will be able to do this project this budget year. Oct is next budget year.
Lamb Weston Twin Falls	Centrifuge VFDs		Cascade Energy	CE	None. No savings (replacing VFDs, running 40 hp at full speed).
McCain Foods	WWTP expansion and upgrade	T-O Engineers	McClure	CE	3/4 through design. 11/9/18 Chellie waiting on McClure response. M&V timeline?
McCall	Raw water pump	SPF	SPF	CE	11/2/18: SPF to submit detailed audit-application
Meridian	Lower zone new well #32		Cascade Energy	SCE	NO NEXT ACTION. 1/2/19 estimated operation is 12 hours per year.
	UV-#1722	Jacobs	In-House	CE	1/9/19 System is optimized. Stacey will get new data and M&V.
	Well #30		Cascade Energy	SCE	None. Paid.
	Well No. 29		Cascade Energy	SCE	None. Paid.
	WWTP Liquid Stream Upgrade-#1724	Brown & Caldwell	Cascade Energy	CE	Need pre-app. 9/21/18-Commissioning fall 2019.
Micron	water system upgrade	SPF	SPF	CE	4/1/19 Detailed Audit complete
Middleton	Middleton WWTP Blower & UV Upgrades		Cascade Energy	CE	4/29/19 Send scoping audit report to Chellie
Mountain Home	3rd St Booster motor upgrades				Ask about at 6/10/19 mtg.
	Well 16			SCE	11/5/18 Review when receive new cohort data

Program Results

Nampa	Aeration Control Upgrades	Brown & Caldwell	Cascade Energy	CE	1/31/19-still optimizing. Shannon said operating for P removal will start after solids project is complete. No optimized run time yet.
	Group B: #4 water pump station VFD	Brown & Caldwell	Cascade Energy	SCE	4/8/19 Shannon provided trend data. Still need costs
	Phase 2 Reuse Upgrades - Blowers	Brown & Caldwell		CE	11/27/18 W talked to Shelby. In preliminary design - construction 2021, built by 2026
	Project Group C: new anaerobic digester			CE	1/25/18-starting final design. Start construction in one year.
	WWTP Influent Pump Upgrades	Brown & Caldwell	Cascade Energy	CE	None. Paid.
New Meadows	New well & booster station	Mountain Waterworks		CE	1/30/19 Sent Ed audit information
North Lakes Sewer District	blower upgrade			CE	3/26/19 Wendy emailed Bill Eddy-need scoping audit or pre-approval application
Notus	Aeration upgrades	Mountain Waterworks		CE	11/7/18-Chellie will check with IP irrigation group - Notus wanted help with irrigation pump
Ontario	WW Aerators - Scoping / Possible RCX			CE	11/7/18-They considered grid bees. Jacobs runs this plant. Chellie will ask Stacey about this project.
Payette	Water Well VFDs		Cascade Energy	SCE	None. minimal to no savings potential.
	WWTP upgrades				Check in later in 2019
Pocatello	Upgrade compressors			P	9/7/18 need prescriptive application
	Well 35 upgrade VFD, pump, motor	In-House			11/28/18-Harold will send Chellie info
	Wells 2 & 18 upgrades	In-House		SCE	4/16/19 Chellie said to process through SCE 11/28/18 Harold will send Chellie additional info
	WPCF Upgrade	HDR	Cascade Energy	CE	5/13/19-William at HDR has all data and is working through calcs (might be errors because see plant energy decrease but no blower energy decrease)
	WWTP Digester 3 lance mixer upgrade	In-House		CE	9/7/18 discussed at treasure hunt
	WWTP Eliminate heat transfer pumps	In-House		CE	9/7/18 discussed at treasure hunt
Richfield	Wastewater System Scoping	In-House	Cascade Energy	CE	need pre-app
	Water System Scoping	In-House	Cascade Energy	CE	None. No cost effective capital project.
Shoshone	Aeration DO control			CE	3/13/19 contact operators to dicuss jet aeration system and 6 mg/L DO
	Water System Upgrade	Riedesel		CE	3/13/2019 Rex would like to discuss project (facility

Program Results

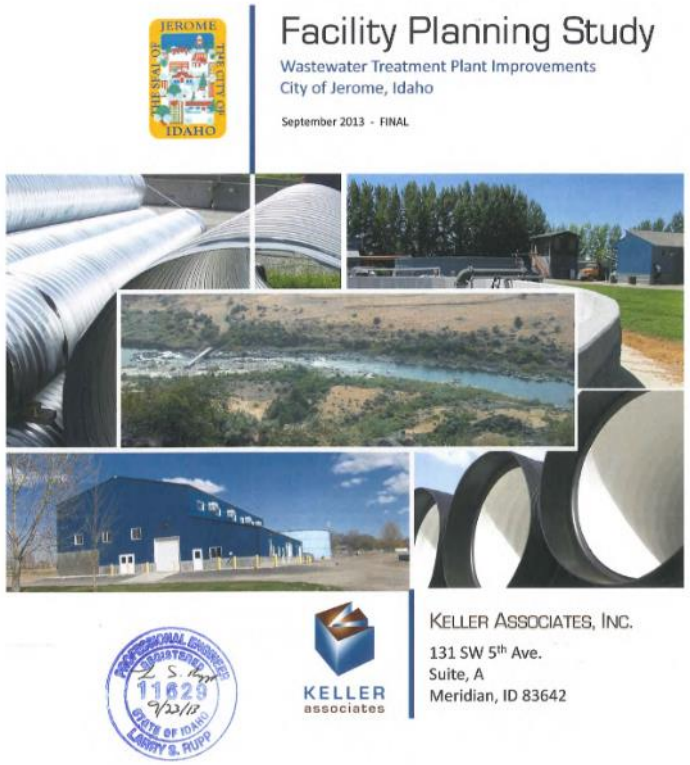
Smith Road Subdivision in Chubbuck	VFDs	Keller	Cascade Energy	SCE	11/17/18-streamlined analysis complete
Star Sewer & Water District	Water system scoping	Keller	Keller	CE	11/7/18: Audit 550 paid. Check in w/facility.
	WWTP upgrades	Keller	Keller	CE	4/3/19 Chellie met with SSWD & Keller - Keller will update detailed audit
Suez	Aquadvanced Energy (AAE/Derceto)	In-House	In-House	CE	None. Paid.
	Briar Hill Rehab	In-House	In-House	CE	None. (part of WSOC)
	Columbia WTP compressor replacement #1	In-House	Cascade Energy	P	None.
	Columbia WTP compressor replacement #2	In-House	Cascade Energy	P	Need pre-approval
	Floating Feather			CE	None. Paid.
	Flushing expansion		Cascade Energy	CE	Evaluate opportunity during WSOC continuation with HAL
	Frontier Well #2	In-House	Cascade Energy	SCE	None.
	Garfield Booster	In-House	In-House		11/7/18-Bill: built but not sure if it will save energy. Need help from HAL to model. Consider during WSOC continuation.
	Hidden Valley 1	In-House	In-House	CE	None. Paid.
	Install Pineridge PRV and Holcomb PRV control changes			CE	None. Paid.
	Lower Danmore Booster Rebuilds			CE	None. Paid.
	Pleasant Valley			CE	None. Paid.
	Quail Ridge booster station	In-House	In-House	CE	None. Paid.
	Raptor-pump replacement	In-House	Cascade Energy	SCE	4/19/19 Rob provided some information. Need pump curves.
	Replacement of Bluffs Booster with Spring Mountain PRV			CE	None. Paid.
	Roger Heights PRV to butterfly valve	In-House	In-House	CE	Bill to resend calcs. 11/8/18-installed per Bill.
	South County Split			CE	None. Paid.

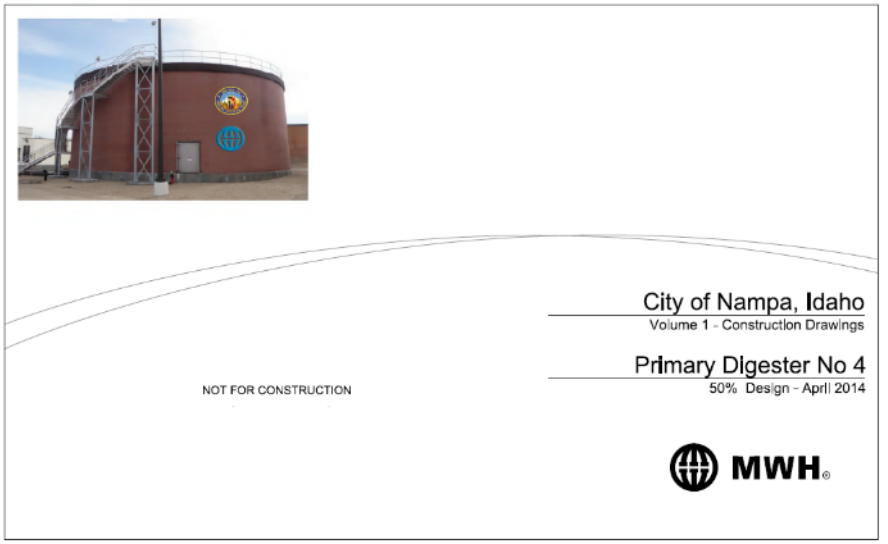


Program Results

	Sunset Tank, Hulls Gulch booster (no VFDs)			CE		May result in system savings, but likely not cost effective for incentive. NO NEXT STEPS.
	Upper Danmore	In-House	In-House	SCE		ordering VFD
TASCO (Amalglamated Sugar)	WWTP upgrade	T-O Engineers		CE		1/28/19 TASCO told Greg they are not ready to meet yet - too early
Twin Falls	Arsenic / Harrison pump station			CE		Have annual savings number based on well capacity. Will they decide to install treatment?
	Grandview					Rehab PI station; not clear where the energy savings is coming from; is this different than standard construction? Layne to check if we have data
	Hankins-serve from system					
	Parks gw to surface water			CE		11/28/18 Lee is working with JUB to finish master plan by end of 2019
	Perrine Point PI station			CE		2/21/19 Wendy asked for update on timing from Lee. 11/30/18 Wendy emailed Lee pre-app link, spreadsheet, and scoping audit link
	Riverhawk PI - switch North Point Ranch Ph1 to surface water			CE		2/21/19 Wendy asked for update on timing from Lee. 11/30/18-Wendy emailed Lee pre-app link, spreadsheet, and scoping audit link
	Soccer Field VFDs		Cascade Energy	SCE		2/21/19 Lee said he will get back to this project in March
	South Hills PI Station			CE		None. Paid.
	Wills Booster Station		McClure	CE		None. Paid.
	WWTP upgrade			CE		None. Paid.
Vale	Scoping					
Wendell	Municipality Booster Pump		Cascade Energy	SCE		Paid?

Consultant Engagement



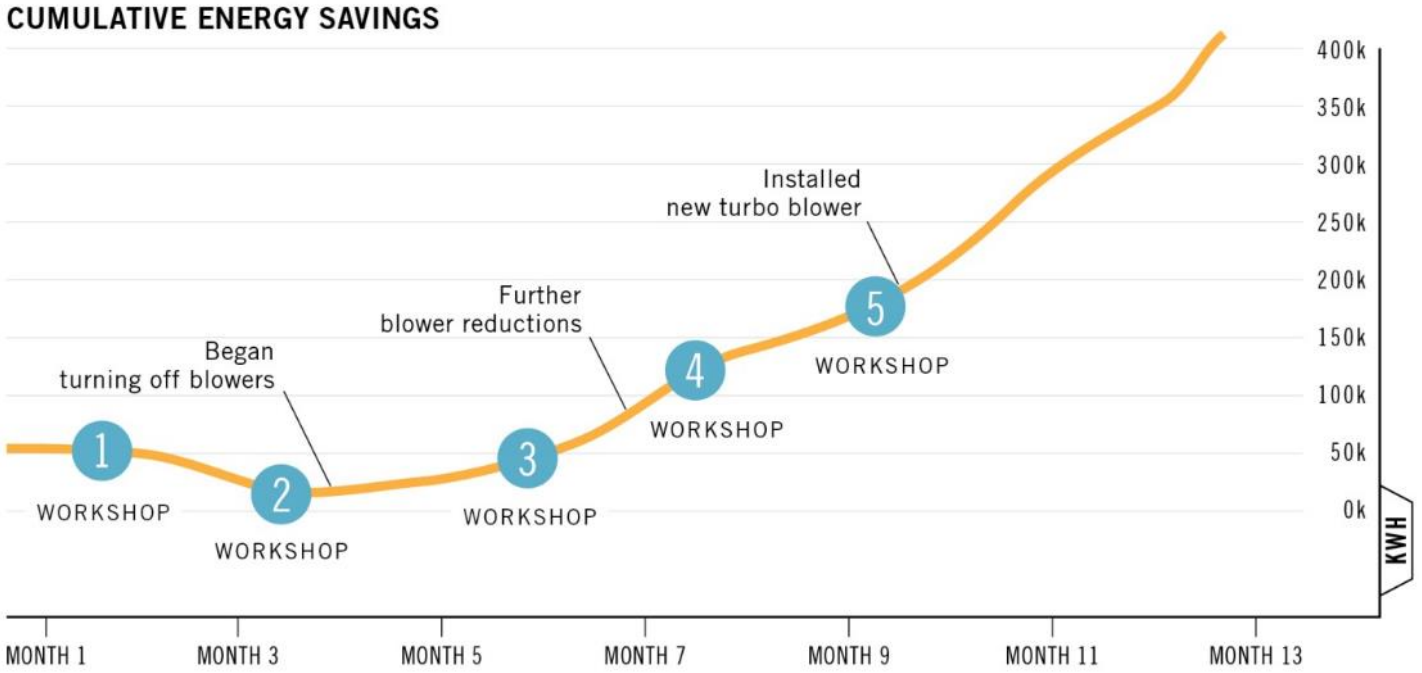


11 Active LARGE construction projects

New Consultants introduced to the efficiency programs: 13!

Surprises

- One-on-one recruiting is not effective
- Hold a recruiting workshop
- Screen on customer readiness
- Extent of organizational improvement



Why the water cohort?

- Delivering water uses significant energy
- Municipality, not competitive
- Ripe with Opportunity
- Water Data availability (models, pump curves, flow info)
- Electrical data- MV90, AMI

Nationally, the energy used by municipal water and wastewater treatment plants account for, on average, 35% of a municipalities energy budget.

Hazelton Pumphouse Retrofit Incentive

- 10 hp pump w/VFD operates instead of a 20 hp & 50 hp
- $27,000 estimated incentive
- $7,700 estimated electrical cost savings per year

Water Cohort Success

- **“A lot of our parks have been running on city well water and we saw a great opportunity for savings by switching over and using our canal water rights.”**

- **“You do have to put the effort into it but once you get going on it and get your head wrapped around it, we found that it’s just as easy to operate efficiently as it is to not.”**

- **“It’s not that they’re bad wells it’s just that we discovered through the cohort that several were terribly inefficient compared to the others.”**

- **“The cohort will make your system better because you’ll understand your system better. It forces you to ask, ‘is this system as efficient as it could possibly be?’ And the answer is, ‘probably not.’”**

Custom Projects

- And some not-so-traditional . . .

- **Leak detection & repair**
- **Piping improvements**
- **Water network optimization**
- **Sourcing projects (surface water vs. wells)**

Custom Projects

- Motors
- Variable Frequency Drives
- Control Upgrades
- Process Upgrades
- Pumps
- Compressed Air
- Lighting

Technical Training

"We have definitely applied a lot of the cost savings opportunities to our system. I can say that we are learning a lot more about different power saving opportunities that we did not know existed in our system."

-Ryan Baumann, City of Twin Falls

idahopower.com/training
(208) 388-5099
training@idahopower.com

IDAHO POWER

COMMERCIAL AND INDUSTRIAL ENERGY EFFICIENCY PROGRAM

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Wastewater Energy Coaching (WEC)

WEC: 2 Performance Years

May 1, 2017 – April 30, 2018

May 1, 2018 – April 30, 2019

PUD: Jim Conlan Sr. Energy Management Engr
Allison Grinczel Energy Management Engr

Snohomish County WEC Cohort Customers

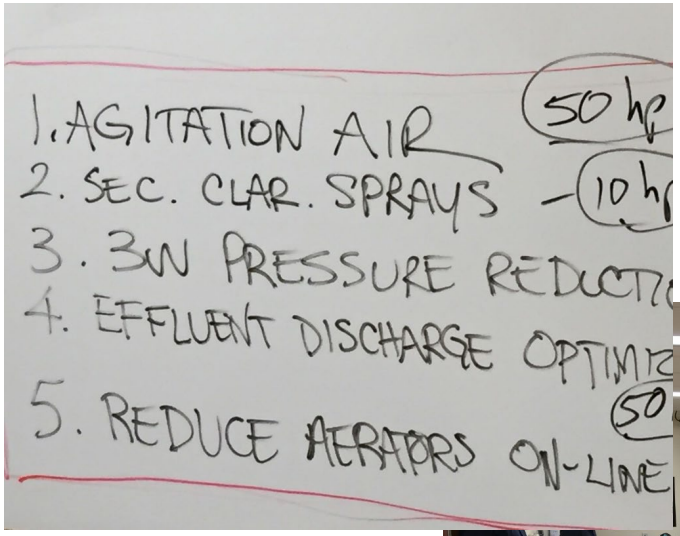
1. City of Everett WPCF
2. City of Edmonds WWTP
3. City of Lynnwood WWTP
4. Mukilteo Water & Wastewater District
5. City of Marysville WWTP
6. Lake Stevens Sewer District
7. King County Wastewater Treatment-Brightwater

Workshops

- **5 Cohort Workshops**
- **Site Energy Scan**
- **Treasure Hunt**

Treasure Hunt

- **Numerous Action Items Identified at every Plant**
- **Plenty of Low Cost / No Cost Opportunities**
- **Some Future Capital Projects**



Team Work

- **Executive Sponsorship**
- **Energy Champion**
- **Regular Energy Team Meetings**

KEYS TO WEC COHORT SUCCESS

1. Very Good Customer relationships for a long time
2. Evaluate-Qualify-Select customers that are committed
3. Partner with ESI, proven strategy for SEM, great coaching to deliver the program, Industry knowledge
4. Cohort customers trust each other, PUD & ESI
5. Willingness to share success, failure, and Lessons learned

WEC Summary- Highlights

- **Start Engagement in (WEC) Wastewater Energy Coaching Dec. 2016**
- **Establish Baseline kWh/Year/Model at each Plant**
- **Performance Yr1: May 1, 2017 - April 30, 2018**
  Yr2: May 1, 2018 – April 30, 2019
- **Model kWh Savings Yr1: *5,279,976 kWh***
- **Estimated kWh Savings Yr2: *6,153,908 kWh***
- **Average Estimated Site Savings per Year: *8.3%***
- **Now WEC 2-year renewal for Performance Yrs 3, 4**

PUD

City of Everett

Water Pollution Control Facility Energy Savings

SNOHOMISH COUNTY PUD PARTNERSHIP

PUD Starts Engagement in Wastewater Energy Coaching (WEC) in December 2016

Performance Year 1: May 1, 2017 – April 30, 2018

5 Workshops Plus on-site Energy Scan & Treasure Hunt

- Baseline kWh/Year at Plant: ..... 14,336,379 kWh/Year
- Year 1 kWh Savings: ..... 2,759,005 kWh
  Enough energy savings to run the Wall Street Building for 1.5 years
  Enough energy savings to power 237 average homes in Snohomish County for 1 year
- Avoided Electrical Costs: $220,720/Year
- PUD Incentive Check: $60,000

snopud.com

Break!

Progress Update – Air Saver Unit

Justin Ramsay, PE
Energy 350

Overview

- Technology Introduction
- Study of Methodology
- Review of Findings
- Identified Barriers
- Next Steps

Our Ask:

- **<u>Our Ask of You</u>:**
- Would utilities be interested in getting Unit Energy Savings “UES” by the regional technical forum for Air Saver units as applied in the field? Or would you rather handle this technology as a custom project solution? If the path is UES would it be beneficial for NEEA to build a specification, test procedure and qualified products list with recommended incentives? Do you think it should become part of a NEEA initiative or just end as a UES?

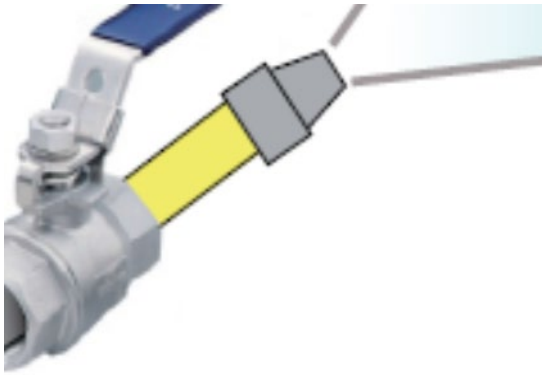
- **We will circle back at the end of the presentation**

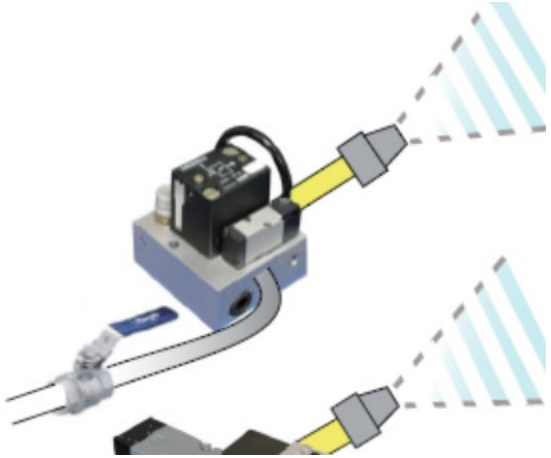
Technology Introduction

- Air Saver Unit (ASU) by Parker Pneumatic
- The intent of operation of the ASU is to reduce compressed air consumption in open blowing applications by rapidly pulsing the source air.
- The ASU is offered in both electronically controlled and pneumatically controller options.
  - Note that for this study, we've had no application where the electronic option was used.
- Installation is simple and the end user should need to make no changes to their process to accommodate the ASU.

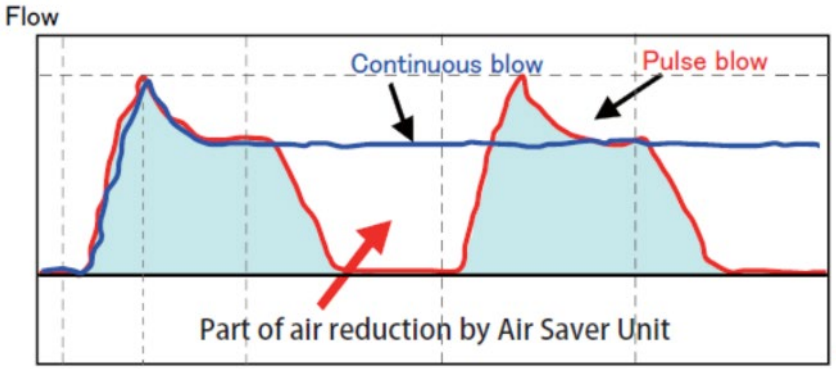
Technology Introduction

- The major advantage of the ASU is the ease of installation
- Common applications where open blowing compressed air is used:
  - Drying of product
  - Cleaning of product
  - Clearing of scraps
  - Cooling applications
  - Conveying assistance
- The pneumatically controlled ASU requires no wiring to be added, as incoming air is used to operate the mechanics of the ASU





Technology Introduction



- Theory of operation is that by pulsing rapidly enough, the process will see no change even though compressed air consumption is reduced
- The manufacturer claims a further advantage by the effect of creating the pressure wave with each pulse
- Per manufacturer's sales brochure, flow reduction can be up to 50%

Study Methodology

- Identify 10 open blowing applications
  - Currently have completed
- For the baseline, flow to the application is monitored for a two-week period in the “as found” condition
- After the baseline period, the ASU is installed and tuned by the customer, with assistance from Energy 350 as needed
- To quantify the effect of the ASU, flow to the application is monitored for another two-week period
- Collected data of the pre and post install case is reviewed to determine the flow reduction achieved
- Power reduction is taken directly from performance data for the compressed air system, when available.
  - Otherwise, a review of the compressed air equipment is used to estimate the proper kW/scfm relationship for the given equipment

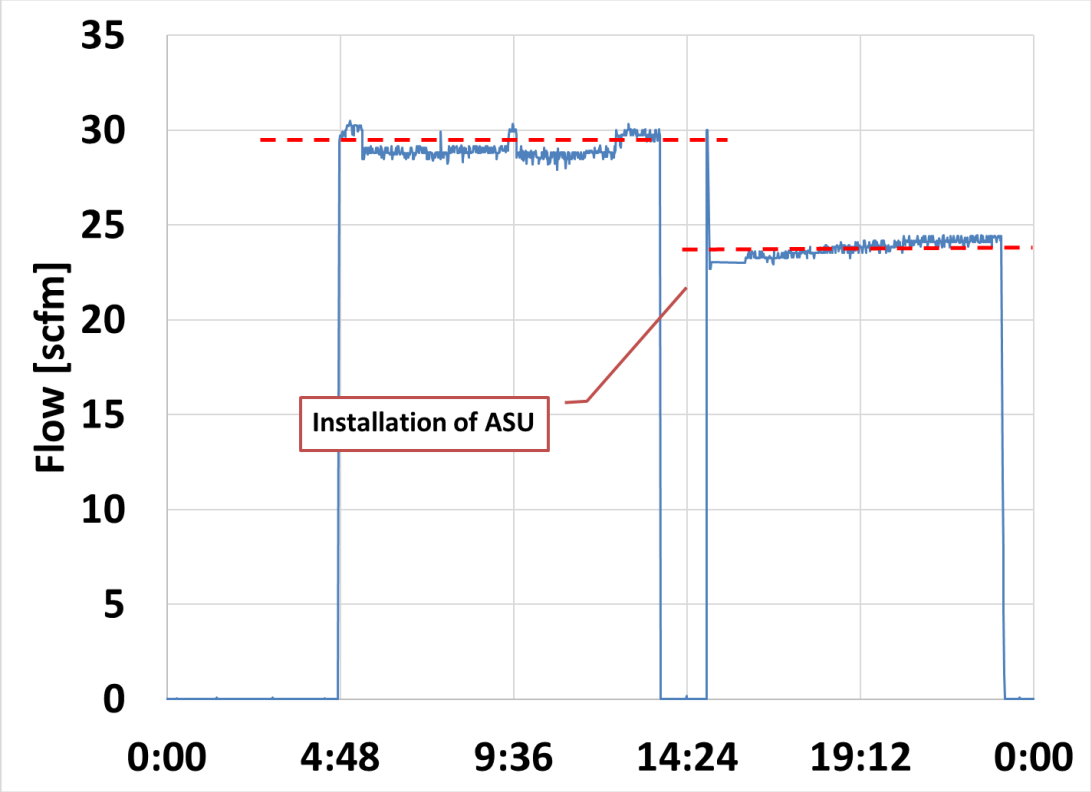
Study Methodology – Equipment

- Flow metering equipment used for this study:
  - IFM SD8501
    - » Thermal anemometer style meter
    - » Pulse output
    - » Factory mounted to flow-straightening length of 1” NPT pipe
    - » Flow range 0-132 scfm
  - CDI 5200-10S
    - » Thermal anemometer style meter
    - » 4-20 ma output
    - » Mounted to flow-straightening length of 1” NPT pipe by Energy 350
    - » Flow range 0-200 scfm
  - CDI 5200-15S
    - » Thermal anemometer style meter
    - » 4-20 ma output
    - » Mounted to flow-straightening length of 1 ½” NPT pipe by Energy 350
    - » Flow range 0-300 scfm

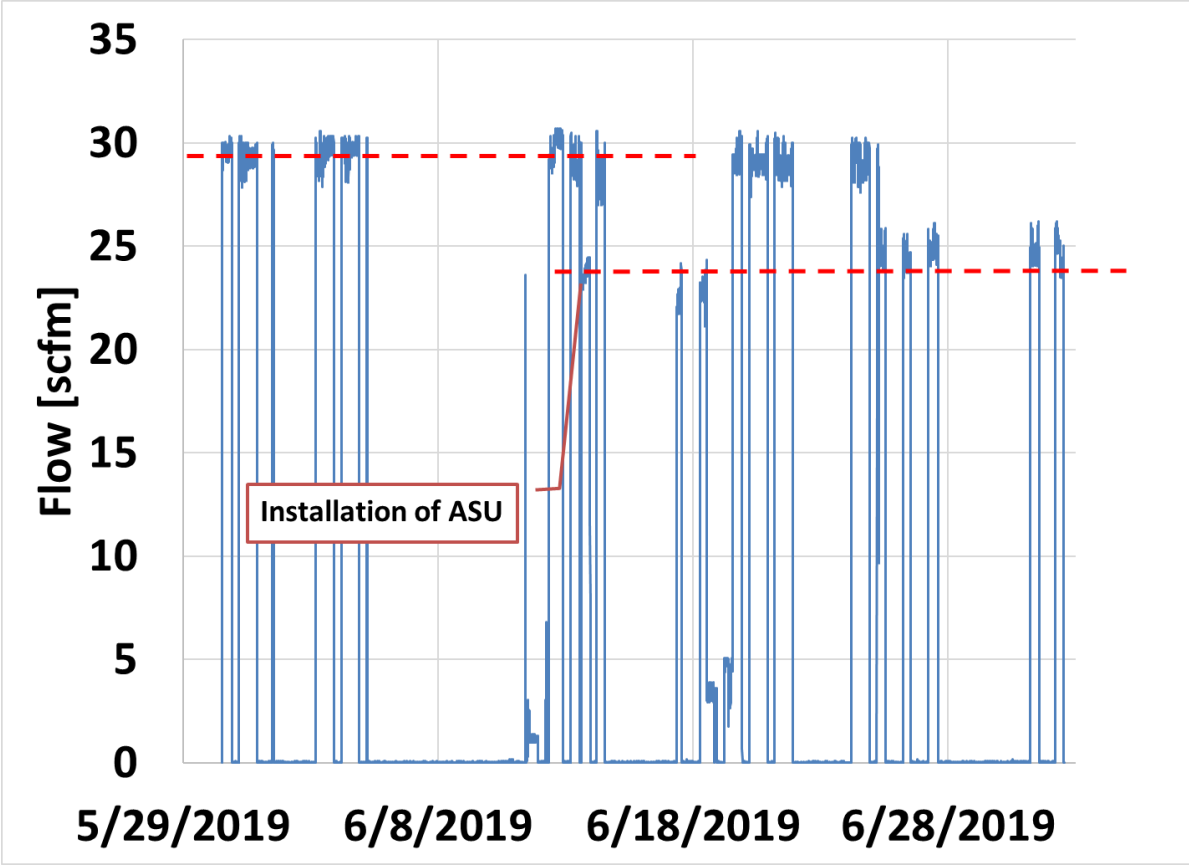
Summary of Progress and Results

- Initial metering has been installed for 11 applications
- ASU has been installed in 7 locations
- Full data (pre and post) has been collected at 6 locations
- Of the already collected datasets, only 3 are showing conclusive data
- Observed flow reduction has been from 15-40% of existing
- Energy savings has been wildly variable, but mostly due to variance in operating hours of the applications

Review of Findings



Review of Findings



Identified Barriers

- Customer interest:
  - Relative to other energy users in industrial settings, the ASU is aimed to reduce a share of an already small amount of waste.
  - There is always a bit of hesitancy with any change of process.
- Access:
  - For the purposes of the study, the flow meters require a 120V power source, which is not always readily available
    - » Some sites do not allow temporary extension cords to be left in place
  - The metering equipment is water resistant, at best, so washdown areas have to be approached cautiously
- Inconsistent Operation:
  - Some sites adjust the open blowing application often, making it difficult to compare the operation before and after the ASU installation
- Potential ASU Operation Issue:
  - Observed data and discussion with site contacts indicate the ASUs potentially failing open during operation
  - We are working to identify the cause of this issue with the customer

Next Steps

- Continue identifying and recruiting participants
  - We are continually finding interested customers and working through scoping
- Work with manufacturer to identify issue with intermittent operation
- Finalize results across all installations

Discussion

- Would utilities be interested in getting Unit Energy Savings “UES” by the regional technical forum for Air Saver units as applied in the field? Or would you rather handle this technology as a custom project solution?
- If the path is UES, would it be beneficial for NEEA to build a specification, test procedure and qualified products list with recommended incentives? Do you think it should become part of a NEEA initiative or just end as a UES?

Thoughts, Questions, Comments?

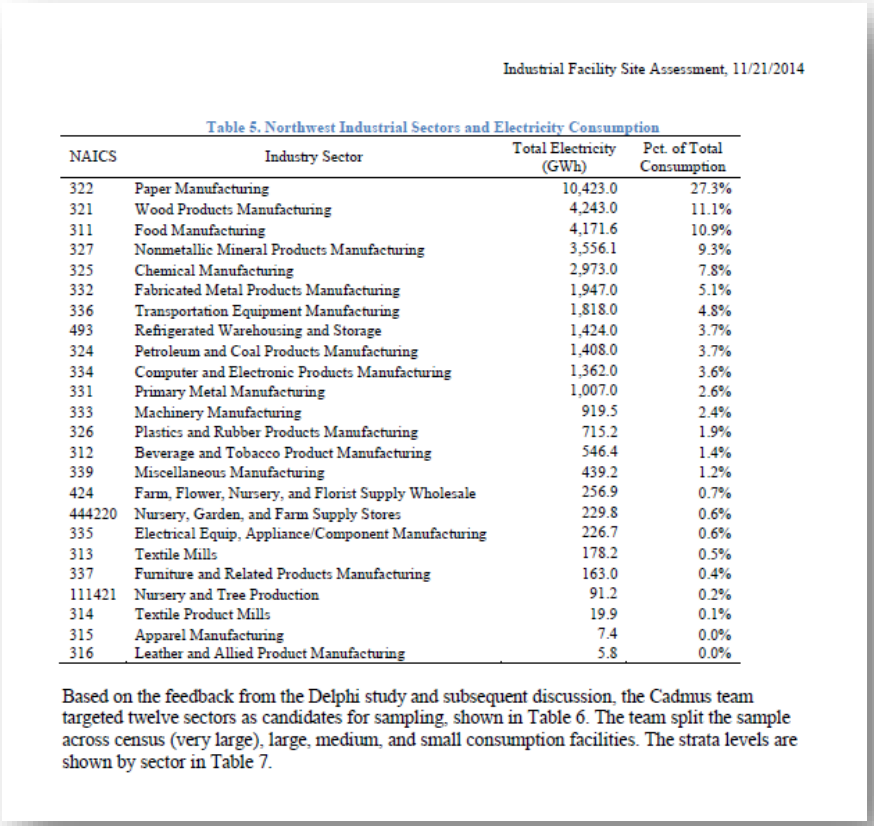
Emerging Technology:

Waste Heat Capture Systems

Eric Olson
Senior Product Manager



Background & Opportunity



Industrial Facility Site Assessment, 11/21/2014

Table 5. Northwest Industrial Sectors and Electricity Consumption

NAICS	Industry Sector	Total Electricity (GWh)	Pct. of Total Consumption
322	Paper Manufacturing	10,423.0	27.3%
321	Wood Products Manufacturing	4,243.0	11.1%
311	Food Manufacturing	4,171.6	10.9%
327	Nonmetallic Mineral Products Manufacturing	3,556.1	9.3%
325	Chemical Manufacturing	2,973.0	7.8%
332	Fabricated Metal Products Manufacturing	1,947.0	5.1%
336	Transportation Equipment Manufacturing	1,818.0	4.8%
493	Refrigerated Warehousing and Storage	1,424.0	3.7%
324	Petroleum and Coal Products Manufacturing	1,408.0	3.7%
334	Computer and Electronic Products Manufacturing	1,362.0	3.6%
331	Primary Metal Manufacturing	1,007.0	2.6%
333	Machinery Manufacturing	919.5	2.4%
326	Plastics and Rubber Products Manufacturing	715.2	1.9%
312	Beverage and Tobacco Product Manufacturing	546.4	1.4%
339	Miscellaneous Manufacturing	439.2	1.2%
424	Farm, Flower, Nursery, and Florist Supply Wholesale	256.9	0.7%
444220	Nursery, Garden, and Farm Supply Stores	229.8	0.6%
335	Electrical Equip, Appliance/Component Manufacturing	226.7	0.6%
313	Textile Mills	178.2	0.5%
337	Furniture and Related Products Manufacturing	163.0	0.4%
111421	Nursery and Tree Production	91.2	0.2%
314	Textile Product Mills	19.9	0.1%
315	Apparel Manufacturing	7.4	0.0%
316	Leather and Allied Product Manufacturing	5.8	0.0%

Based on the feedback from the Delphi study and subsequent discussion, the Cadmus team targeted twelve sectors as candidates for sampling, shown in Table 6. The team split the sample across census (very large), large, medium, and small consumption facilities. The strata levels are shown by sector in Table 7.

2014 Industrial Facilities Stock Assessment Report

- The DOE estimates that 20 to 50% of energy consumed is lost via waste heat
- 5 to 13 quadrillion BTU/year remain unrecovered
- Efficiency improvements can improve efficiency by 10 to 50%

Waste Heat Temperatures

Low: <450° F

Medium: 450-1,200 ° F

High: >1,200° F

Current technology includes:
Condensation recovery

Economizers

Recuperators

Regenerators

Regenerative and recuperative burners

Heat pumps

Passive air preheaters

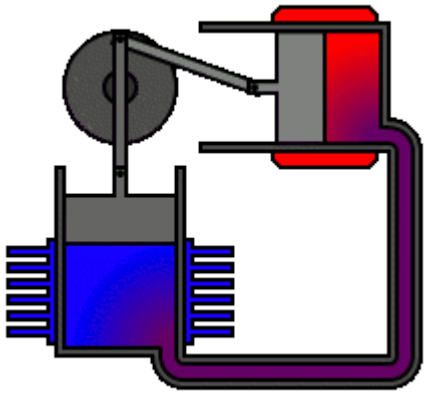
Waste heat boilers

The Stirling Engine (review)

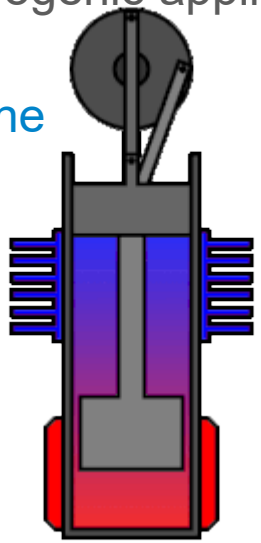
- A heat engine that uses external energy source
- Uses a working fluid (such as Helium or Argon)
- When gas is compressed, it heats up and when decompressed it cools down ⇨ mechanical work to drive a compressor
- Closed-cycle regenerative system
- Currently used in many refrigeration and cryogenic applications

Other types include

- Free-piston Stirling Engine
- Flat Stirling engine
- Fluidyne Stirling engine
- Rotary Stirling engine
- Thermoacoustic Cycle



Alpha-style Stirling Engine



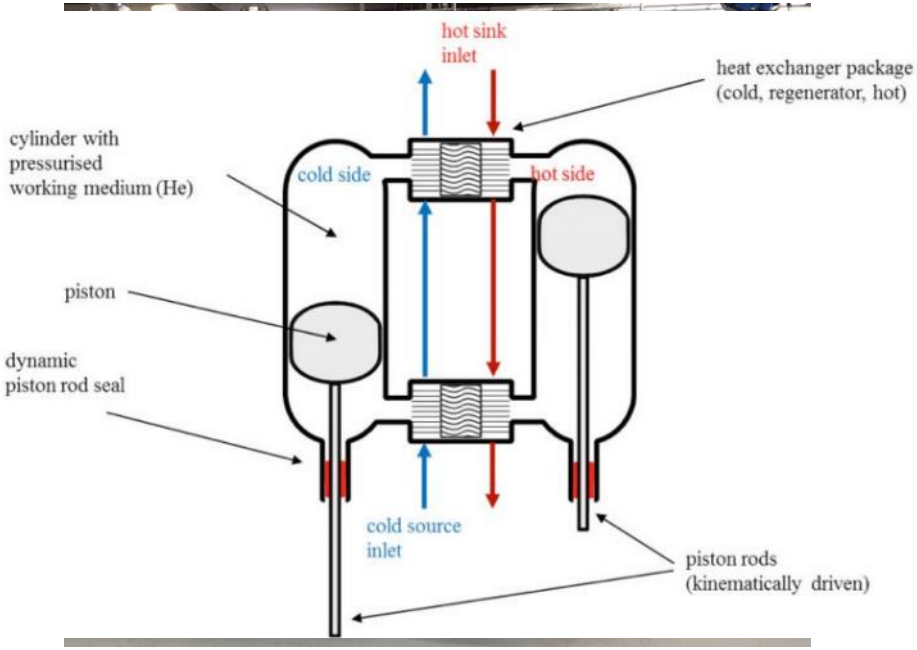
Beta-style Stirling Engine

Olvondo Technology ThermoLift

Company Overview

- Norwegian company
- 10 employees
- Main shareholders are two large players in the Norwegian Oil and Gas industries
- Technology under development since 2006
- More than 30,000 operational hours
- Multiple large installations under construction
- Currently only available in Scandinavia, expanding into EU in 2019-2020
- Expansion into U.S. requires right in-market partner for engineering and installation support
- Currently raising additional capital
- https://www.olvondotech.no

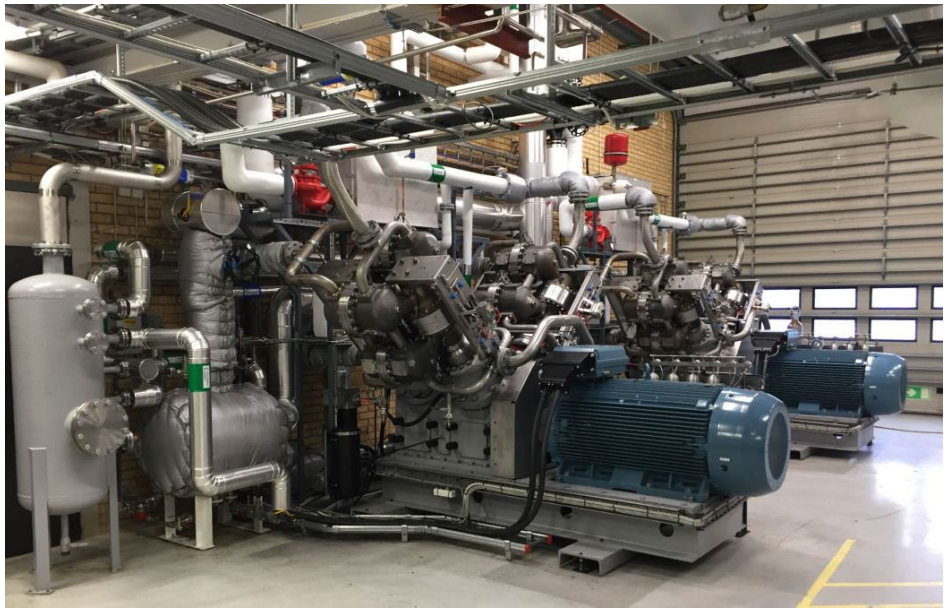
Technology Overview



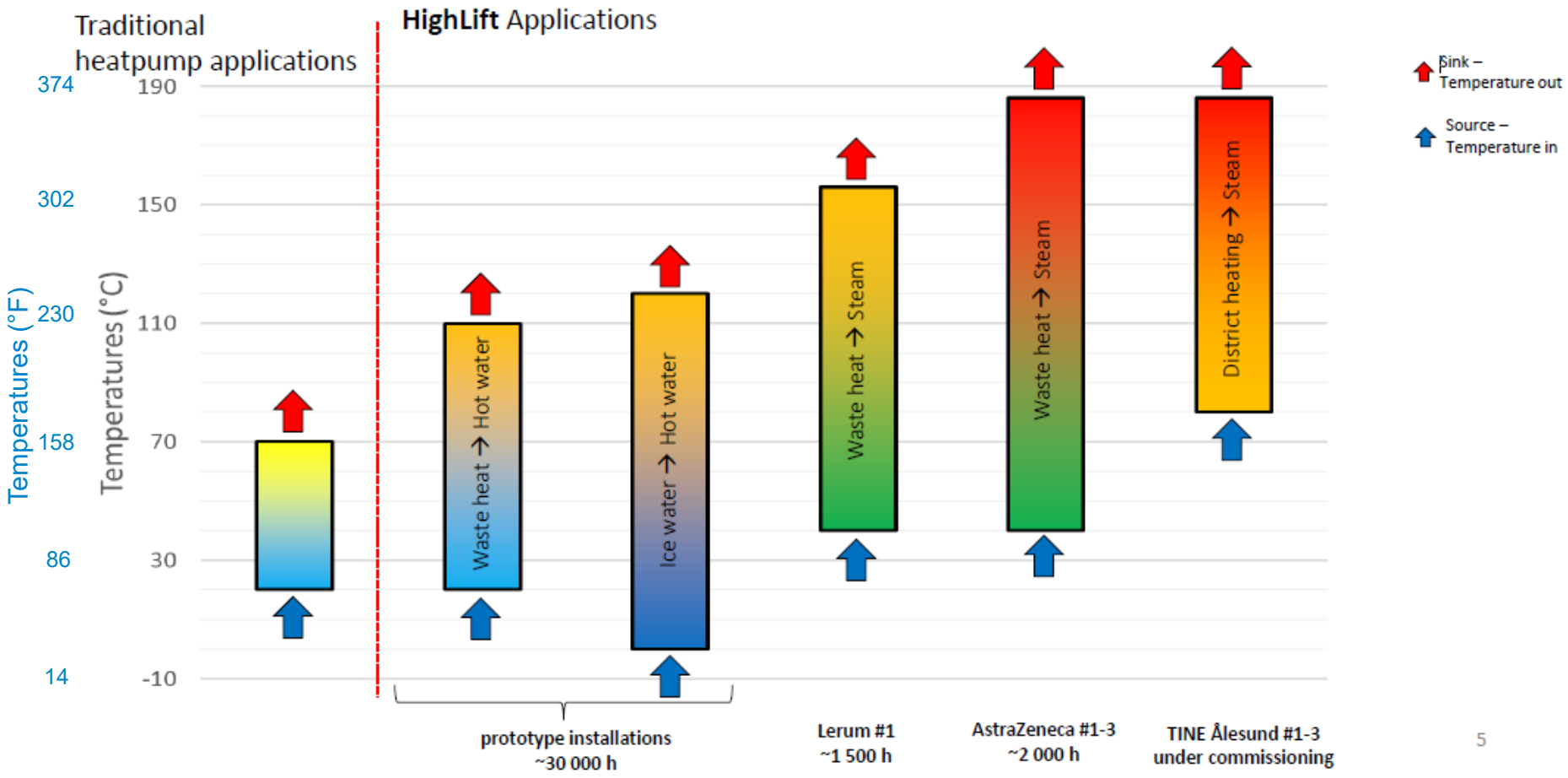
- Utilizes motor to compress gas
  - 420 HP/315 kW motor
  - High HP required for start-up and then throttled down for standard running
- Helium (4.4 lbs./2 kg.) gas used as medium
- Can utilize waste heat temperature down to 32° F and then recycle it up to process heat or steam of 212° to 392° F (1.75 million BTU/hour or 500 kW of heating) “high lifting” the temperature
  - Max. inlet temperature 212°
- Simultaneously produces up to 850,000 BTU/hour (70.8 tons) cooling
- Requires hot and cold water loops
- Claims:
  - CO_2 reduction of 165/tons year
  - Reduced energy consumption by more than 50% (COP≥2) when compared to electric boilers
- Standard unit about 10 ft x 10 ft x 10 ft
  - Steam unit 18 ft x 10 ft x 10 ft

AstraZeneca Test Site Installation

- Requires 21.1 GHw of steam production annually
- With retrofit, 95% of steam supplied by 3 HighLift units
- 9.4 GWh (45%) savings ~$310,000 (based on Norwegian energy prices)
- Secondary savings of ~$53,000
- Space heating temperature 77 - 95°F
- Steam 347 - 363°F at 116 – 145 PSI
- 25,000 hours of operational experience
- Will be adding a 4th unit based on energy savings



Olvondo Technology's HighLift technology differentiators - wider temperature range



SoundEnergy B.V. THEAC-25

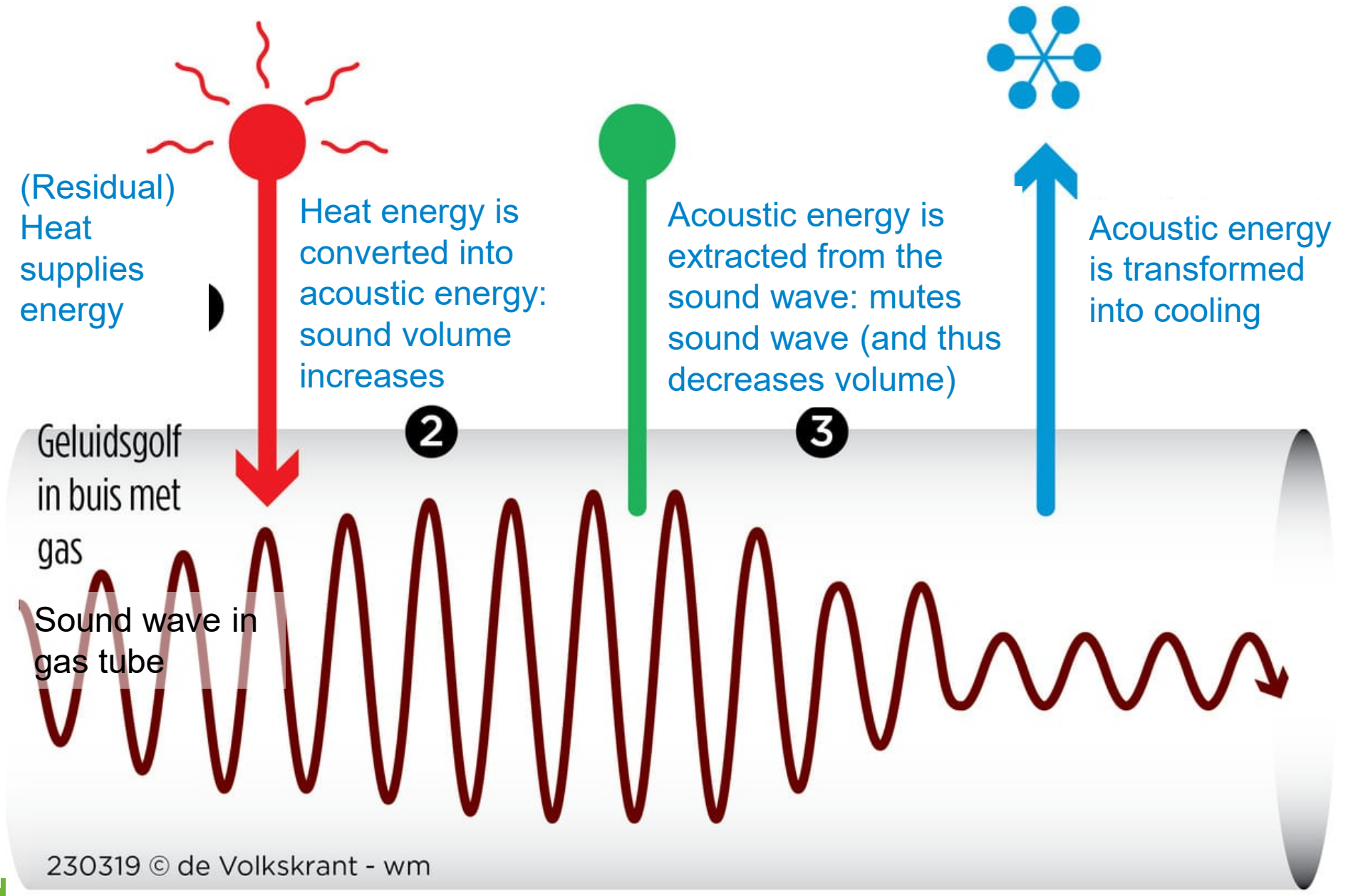
Company Overview

- Netherland based start-up
- ~11 employees
- Founders have expertise in thermoacoustics, lubricant free pistons, and architecture
- Employees with expertise in heat transfer, thermal and fluid engineering, and industrial design
- Focus of company is to address the energy requirements for air conditioning
- First units have been sold
- https://www.soundenergy.nl

SOUND ENERGY

neea

AIRCONDITIONING UIT GELUID



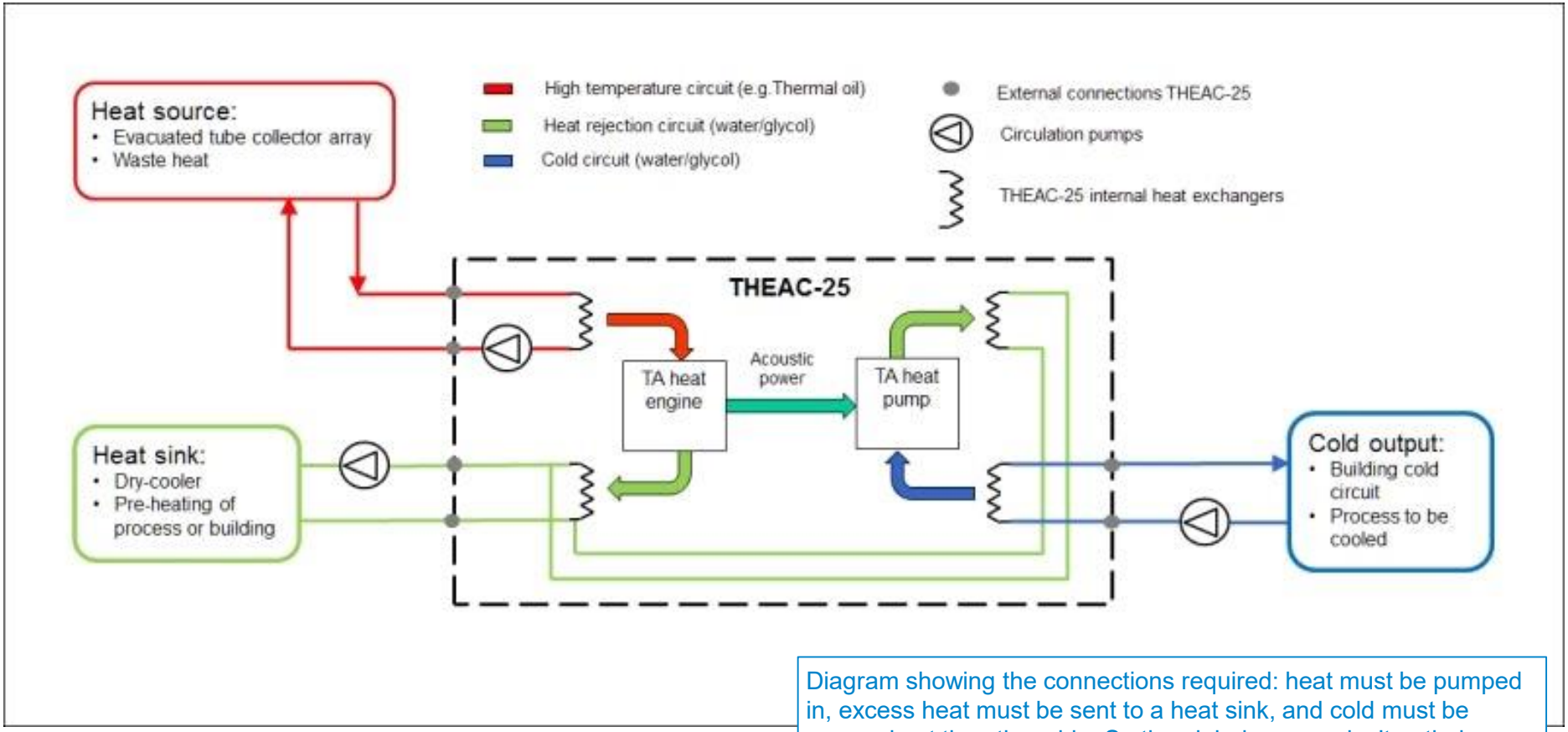


Diagram showing the connections required: heat must be pumped in, excess heat must be sent to a heat sink, and cold must be pumped out the other side. So the global process isn't entirely energy-neutral, but the cooling system itself requires no electrical input (Credit: Aster Thermoacoustics)

Technology Overview

- Thermal energy is converted into an acoustic wave
- Sound wave is sent through a pressurized loop and amplified
- Amplification creates pressure differential
- Pressure differential converted back into another heat differential

Product Details & Claims

- Scavenges waste heat at 40 – 50% efficiency
- Argon used as medium (GWP=0); no refrigerants
- 13 x 13 ft x 31”
- 2,425 lbs.
- Product life of 20-30 years
- Estimated price of $50,000 (excluding installation and prior to scale-up)

- Provides 7.1 tons (85,300 BTU/25 kW) of cooling (COP of 0.5)
- Input temperature range from 320°F to 572°F
- Cold output temperature down to -13°F
- Hot output max to 392°F
- Operating noise of 70 dBa (about the noise of a dishwasher or shower)
- No additional CO_2 emissions
- No moving parts other than small pumps and dry cooling system (~2 kW)
- Electricity savings of up to 50 MW hours/year

Applications

Home › Mocca D'or › Current
› THEAC-25 from SOUNDENERGY gives residual heat a new function in the Mocca d'Or building

THEAC-25 FROM SOUNDENERGY GIVES RESIDUAL HEAT A NEW FUNCTION IN THE MOCCA D'OR BUILDING

June 24, 2019

Mocca d'Or coffee roaster renovates and innovates in the field of sustainability! With the groundbreaking THEAC-25 system from SOUNDENERGY BV, the residual heat from coffee roasting is given a new function without waste!

Mocca d'Or will have a beautiful new modern building at the end of 2019 that will be realized in collaboration with Construction Company Aan De Stegge Twello, Loohuis Installatiegroep and SOUNDENERGY BV. With twice as much room to guarantee further growth in the coming years, which is entirely focused on modern craftsmanship, coffee experience and sustainability!

On June 26, 2019, at NPO 1, in the TV program The World of Tomorrow by AVRO-TROS, a beautiful item will be devoted to the application of THEAC-25 at Coffee Roaster Mocca d'Or in Zwolle at 8.30 pm

- Cooling of new building utilizing waste heat from coffee roasters (Netherlands)
- Condensing air into drinking water (Dubai)
- Datacenters

Additional Resources

- https://www.soundenergy.nl
- https://www.soundenergy.nl/forbes/
- https://www.soundenergy.nl/new-atlas/

Next Steps

- Please share your interest in either of these products/technology
- What additional information would you like?
- Send questions, comments, requests to:
  Eric Olson
  Senior Product Manager
  eolson@neea.org
  503-688-5435

Meeting Wrap-Up

- Any public comments?
- Any feedback on any of the following?
  - Agenda, packet, slides
  - Facilitation / Share-out
  - What worked? What was missing? What needs improvement?
  - Did you have any topics of interest for the next meeting's agenda?
  - Anything else?

Thank you!

TOGETHER We Are Transforming the Northwest

Avista
Bonneville Power Administration
Cascade Natural Gas Corporation
P.U.D. Chelan County
Clark Public Utilities
Cowlitz PUD
EnergyTrust of Oregon
Grant PUD
Idaho Power An IDACORP Company
NorthWestern Energy
NW Natural
PACIFIC POWER
PGE
PSE Puget Sound Energy
Seattle City Light
Snohomish County PUD Public Utility District No. 1
Tacoma Power Tacoma Public Utilities