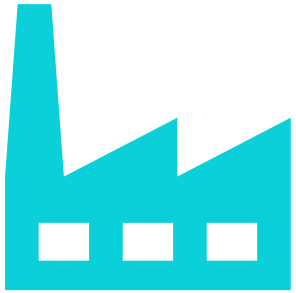
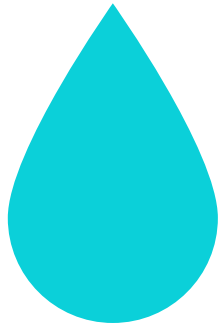
Industrial Sector

Oregon Utility Roundtable
November 1. 2023

Agenda



General Industrial Sector Updates



Water/Waste Water Opportunities

Industrial Updates and Trends

Increased project costs and labor shortage

Strong pipeline for 2024

New construction, food processing, wood products, and high tech manufacturing

Energy Project Managers

Strategic Energy Management

New UES measures for efficient pumps and VFDs

Industrial Updates and Trends

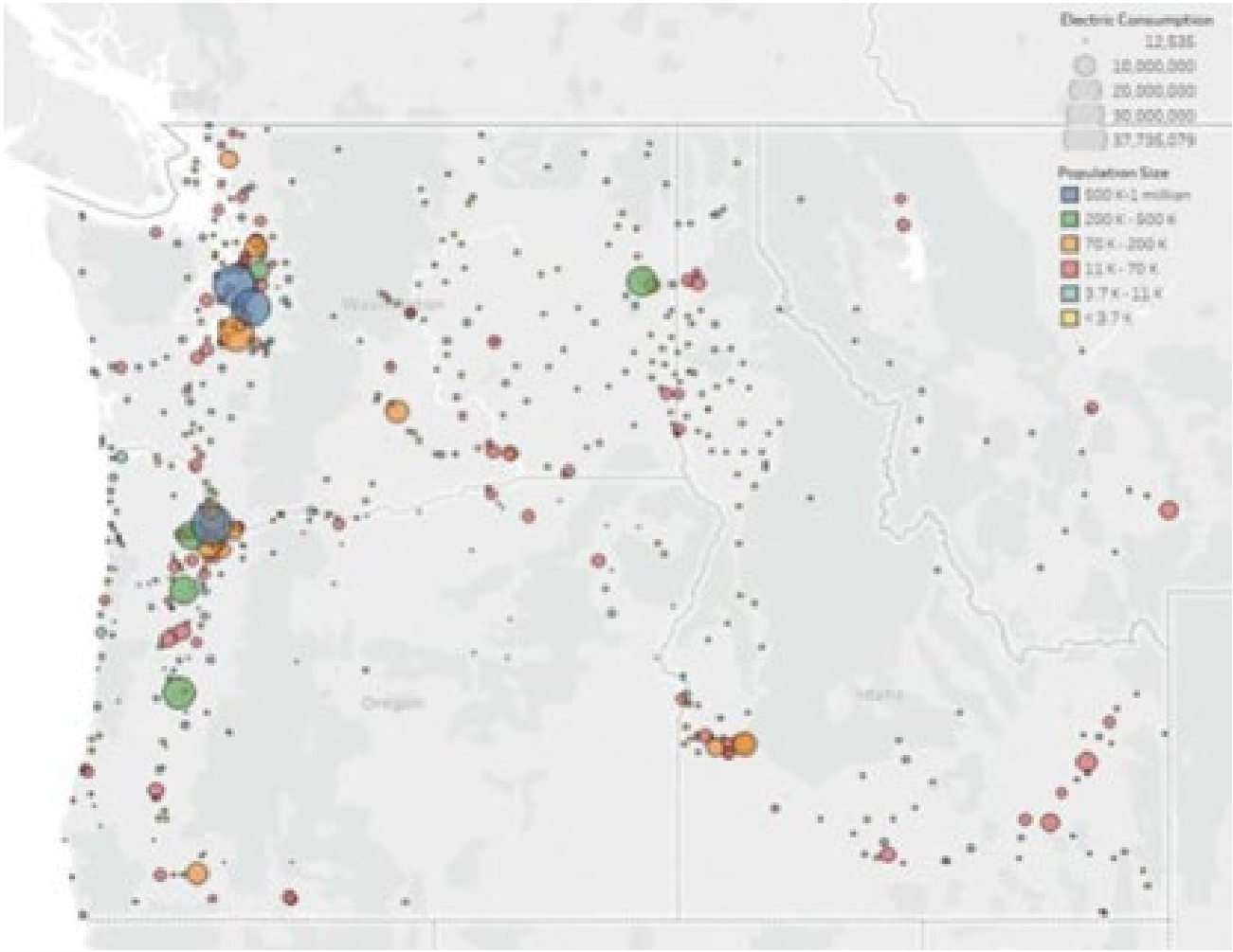
- Simplified custom projects incentive structure

PROJECT TYPE	MEASURE LIFE (YEARS)	SECTOR	PAYMENT RATE ($/KWH)
NONRESIDENTIAL LIGHTING	ALL	AGRICULTURAL, COMMERCIAL, INDUSTRIAL	$0.13
NEW OR RETROFIT CONSTRUCTION, MAJOR RENOVATION (EXCLUDING NONRESIDENTIAL LIGHTING)	1	ALL	$0.025
	2-3	AGRICULTURAL, COMMERCIAL, INDUSTRIAL, RESIDENTIAL	$0.06
	4-19	AGRICULTURAL, COMMERCIAL, INDUSTRIAL, RESIDENTIAL, UTILITY DISTRIBUTION	$0.33
		WHOLE BUILDING NEW CONSTRUCTION COMMERCIAL, INDUSTRIAL	$0.35
	20+	AGRICULTURAL, COMMERCIAL, INDUSTRIAL, RESIDENTIAL, UTILITY DISTRIBUTION	$0.38
NEW CONSTRUCTION	45+	RESIDENTIAL	$0.45

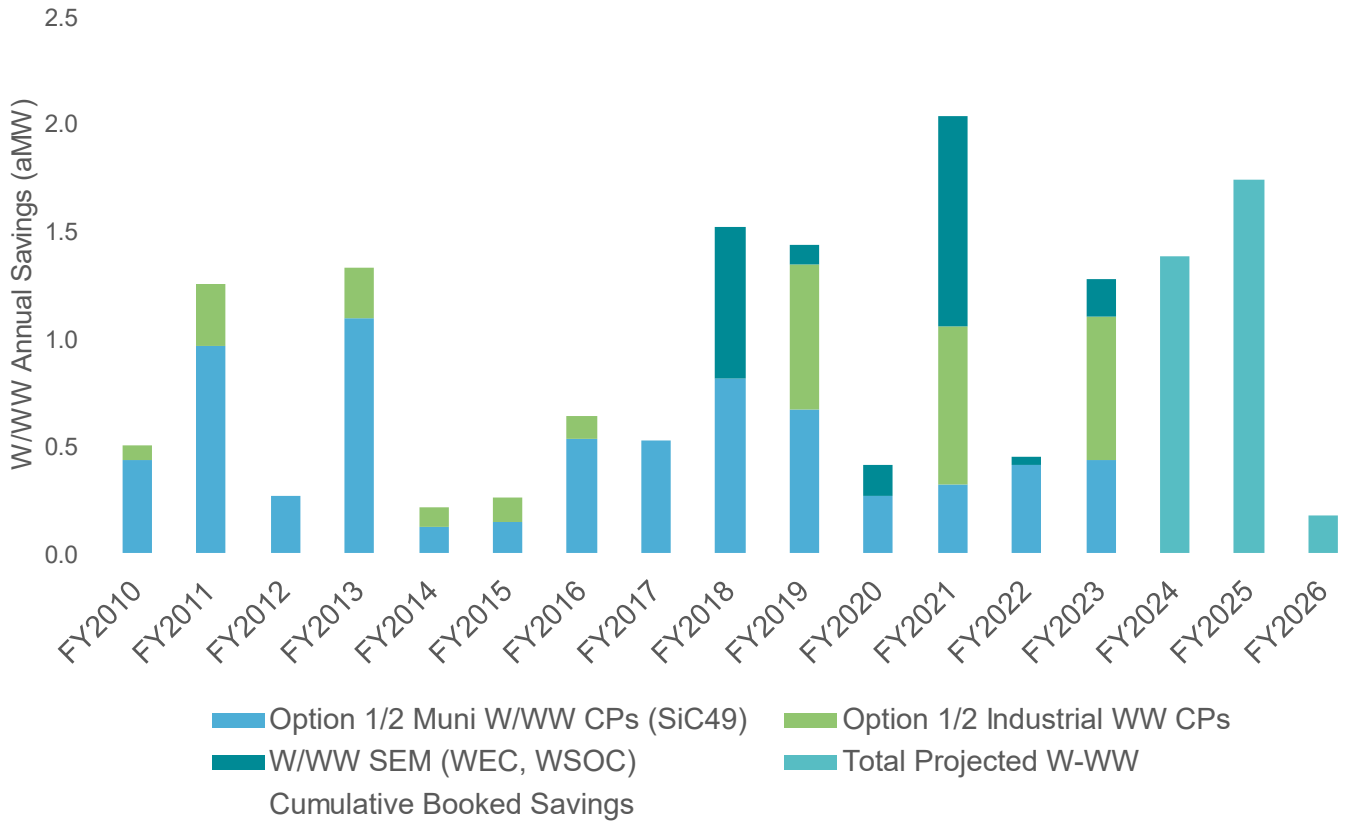
Waste Water Opportunities

Overview

- Water and wastewater plants in the PNW consume over 2 billion kWh per year.
- W/WW plants can be found in almost *every* utility territory.
- That there is still a lot of energy efficiency to do!!!



Historical Savings

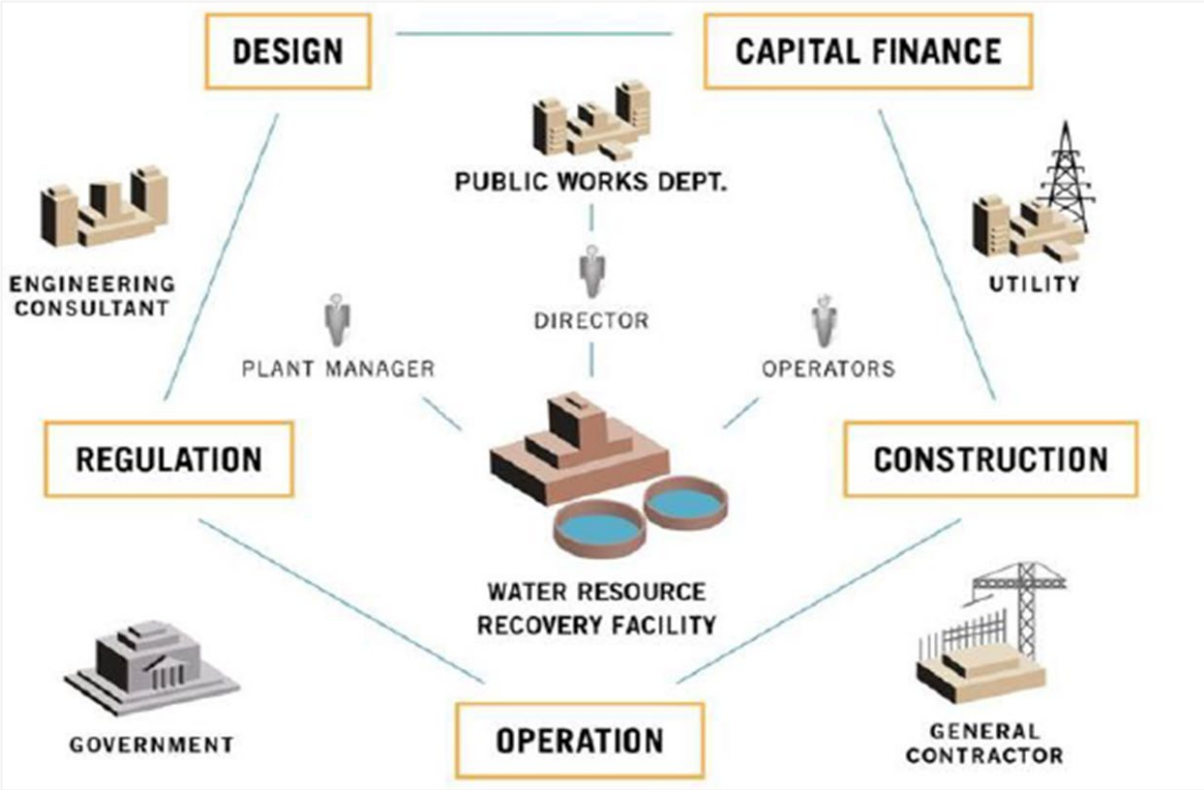


New Custom Refnos

- 14 new reference numbers with 20 year measure life
- Increases BPA's willingness to pay from $0.25/kWh to $0.38/kWh
- Improves B/C Ratio – important in new rate period!

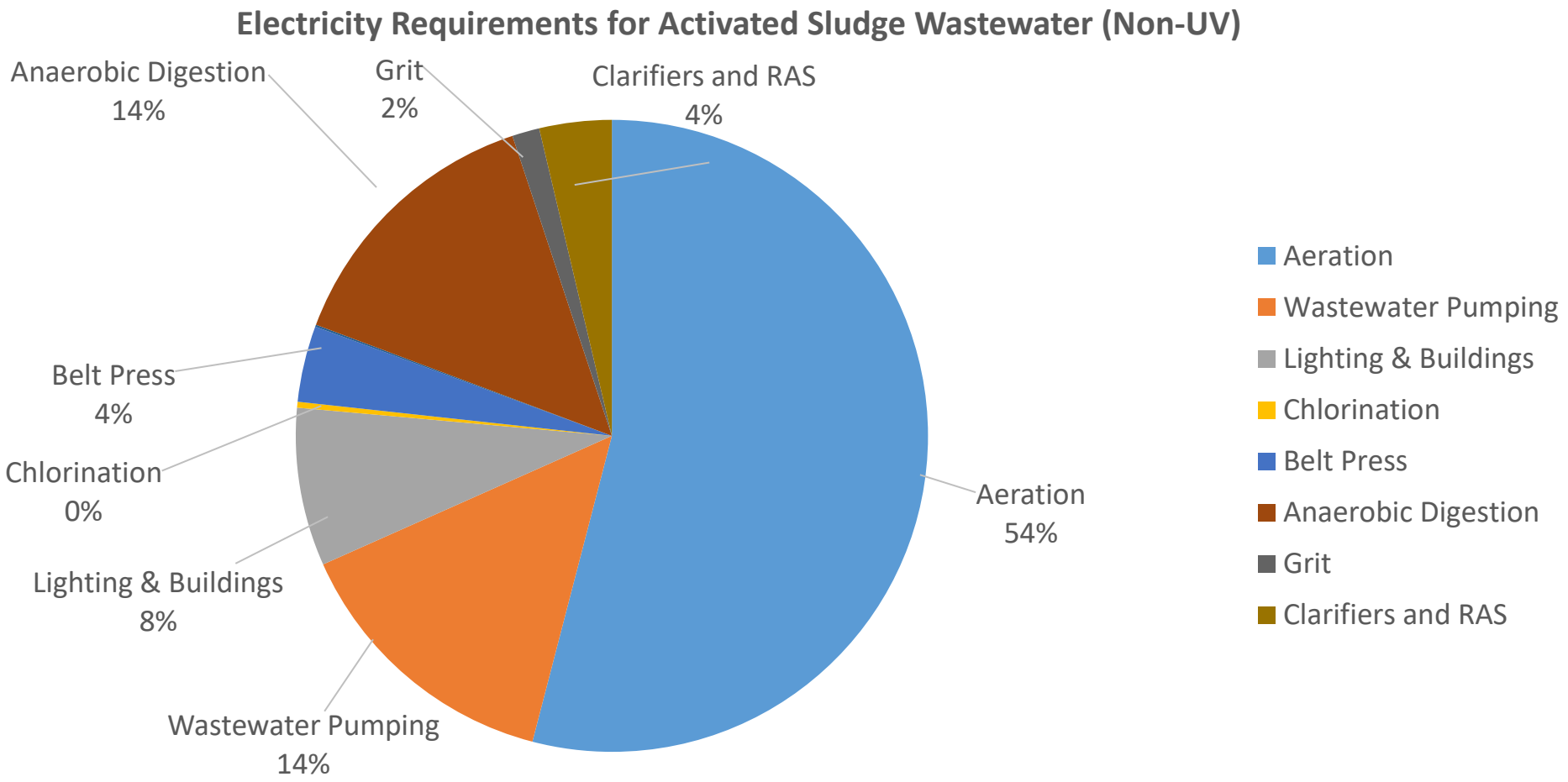
Custom Measure RefNo	Resource Opportunity Type	Sector	End Use	Category	Technology/Activity/Practice	Measure Life	Avoided Cost per kWh	10/1/2023
IPLWS83116	R	Industrial	Process Loads	Wastewater System Improvements	Piping and Valves	20	0.75	0.38
IPLWS93116	L	Industrial	Process Loads	Wastewater System Improvements	Piping and Valves	20	0.75	0.38
IPLPL83177	R	Industrial	Process Loads	Process Loads System Improvements	Piping and Valves	20	0.75	0.38
IPLPL93177	L	Industrial	Process Loads	Process Loads System Improvements	Piping and Valves	20	0.75	0.38
IPLWS83178	R	Industrial	Process Loads	Wastewater System Improvements	Efficient Fans (VFD)	20	0.75	0.38
IPLWS93178	L	Industrial	Process Loads	Wastewater System Improvements	Efficient Fans (VFD)	20	0.75	0.38
IPLWS83179	R	Industrial	Process Loads	Wastewater System Improvements	Efficient Pumps (VFD)	20	0.75	0.38
IPLWS93179	L	Industrial	Process Loads	Wastewater System Improvements	Efficient Pumps (VFD)	20	0.75	0.38
IPLWS83180	R	Industrial	Process Loads	Wastewater System Improvements	Efficient Pumps (non-VFD)	20	0.75	0.38
IPLWS93180	L	Industrial	Process Loads	Wastewater System Improvements	Efficient Pumps (non-VFD)	20	0.75	0.38
IPLWS83181	R	Industrial	Process Loads	Wastewater System Improvements	Efficient Blowers	20	0.75	0.38
IPLWS93181	L	Industrial	Process Loads	Wastewater System Improvements	Efficient Blowers	20	0.75	0.38

Wastewater Ecosystem



- There are layers of players
- Projects require longer lead times
- Projects typically require public funding
- Regulation = risk-averse

Wastewater Energy Use Profile



Derived from data from Focus On Energy WWOA 49th Annual Conference, October 7, 2015 presentation by Joseph Cantwell, PE

Wastewater Resources

Energy Smart Industrial

MUNICIPAL WATER LEAK ABATEMENT

EVERY DROP COUNTS

How Much Are Water Leaks Costing You?

Water distribution systems are complex. Over time small cracks can lead to costly line ruptures, bleeding dry already over-taxed budgets.

The Bonneville Power Administration's Energy Smart Industrial (ESI) program can help offset the costs of detecting and repairing leaks before they become emergencies.

Wasted Water is Wasted Energy

Many utilities participating in the ESI program offer incentives to help defray leak detection and repair expenses while reducing the cost of your energy use.

What Type of Leaks are Eligible?

- Only hidden leaks discovered through a leak-detection survey qualify for incentives.
- Large water-main ruptures that require emergency repairs do not qualify for incentives. Existing major, visible leaks also do not qualify because they are considered "required" maintenance.

How Does the Leak Abatement Process Work?

Each electric utility and water treatment facility participating in the program is assigned an Energy Smart Industrial Partner (ESIP). Your ESIP serves as the main point of contact who can provide both technical and reporting assistance. They can also help collect:

- A description of each leak, with a photo of the damaged piping
- Electric use and flow data from the pump station serving the distribution piping where the leaks were identified
- A copy of leak-survey results and the associated invoice for the service
- Labor costs for hours spent on each repair, and the hourly labor rate
- Invoices for material costs (If materials are taken from a larger inventory, an invoice representing the unit cost for the individual parts is needed.)
- Invoices for permitting fees

Once the project is completed, reviewed and approved, the serving utility delivers the incentive check.

PROACTIVE LEAK DETECTION

Leak detection not only reduces the need for costly emergency repairs; but also:

Reduces disruptions to customer service

Curtails water purchase and operating costs

Lowers the potential for physical damage from sinkholes, erosion, and flooding

Contributes to overall energy-savings goals

Not all leaks are this obvious. ESI can help you find the leaks you can't see – yet.

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.

Thank you!