

Utility Management & Government Affairs Technical Program  
PennTec Conference June 18 – 21, 2023

**DON'T FLUSH YOUR SAVINGS:  
COST EFFECTIVE ENERGY CONSERVATION FOR YOUR PLANT**

Ben Pressman, PE  
Heather Cowley

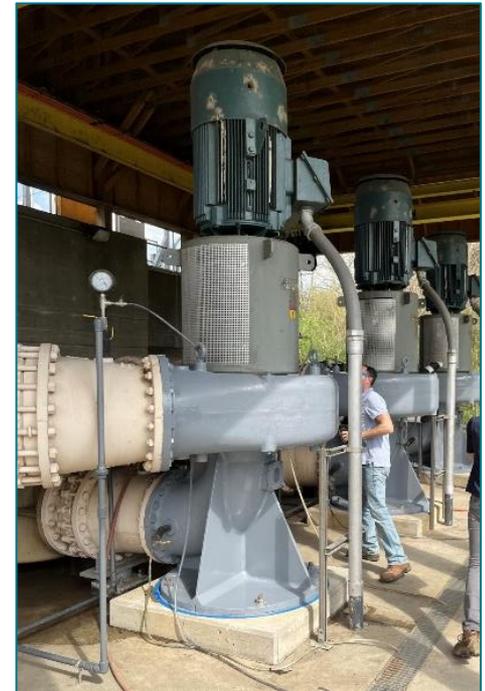


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## Cost Effective Energy Conservation for Your Plant

# Costs and Impacts of Wastewater Treatment

- What is the **energy cost** of wastewater treatment?
- **How** do WWTPs use energy?
- How do we balance increasingly stringent **water quality standards** with other goals?
  - Costs
  - Air quality
  - Solid waste disposal
  - Energy conservation



## What is the energy cost of wastewater treatment?

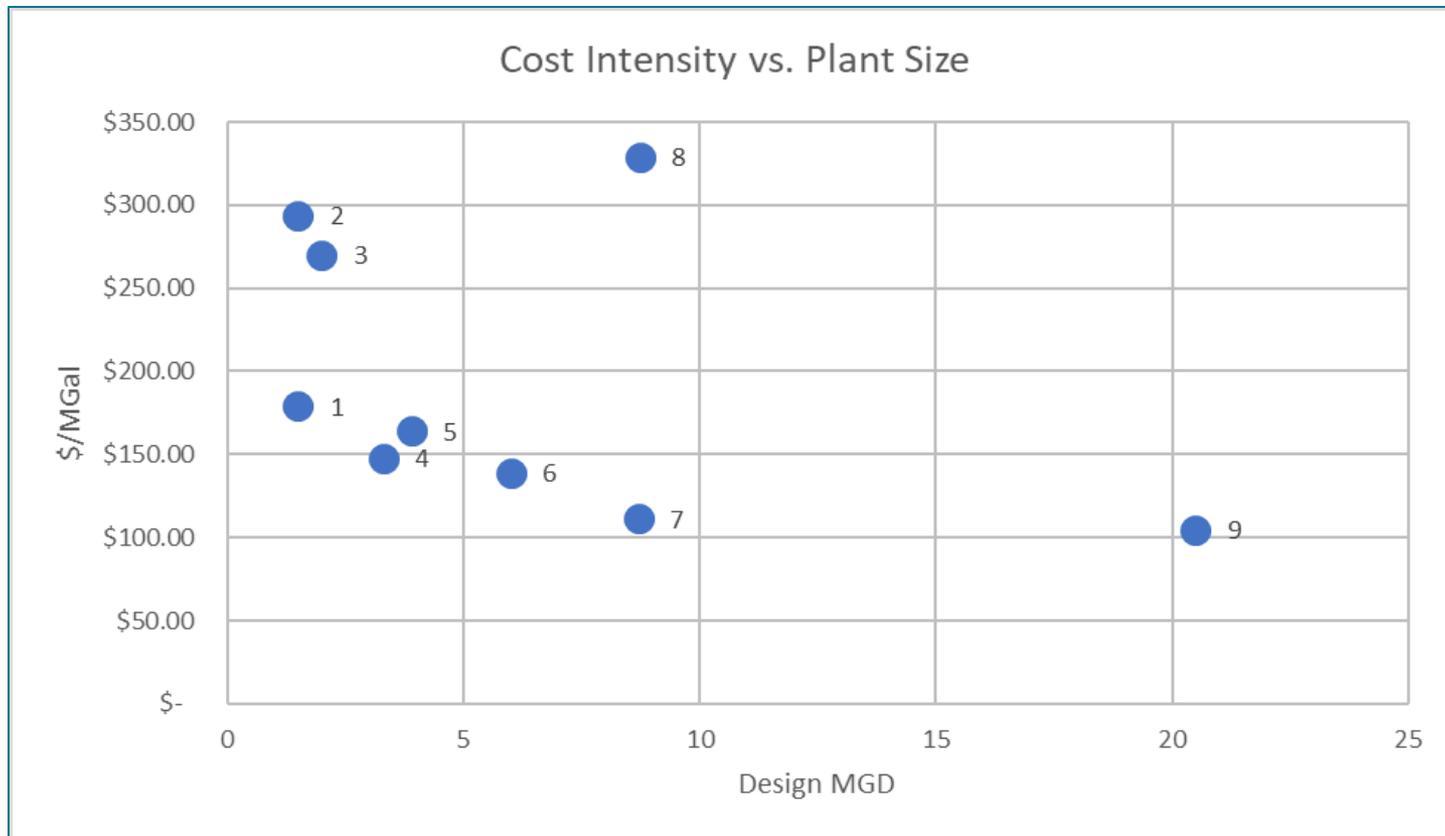
- PA DEP Partnership for Energy Efficiency in Wastewater Treatment Plants (PEW2)
  - US DOE's SWIFt program training + benchmarking, energy assessments, assistance with energy tools and peer opportunities
  - Nine WWTPs in eastern and western PA participating
  - Process analysis, operational/capital opportunities, focus on non-process loads, e.g. lights, HVAC, DHW



## Cost Effective Energy Conservation for Your Plant

# What is the energy cost of wastewater treatment?

- Comparison of WWTP energy cost per gallon treated



## Cost Effective Energy Conservation for Your Plant

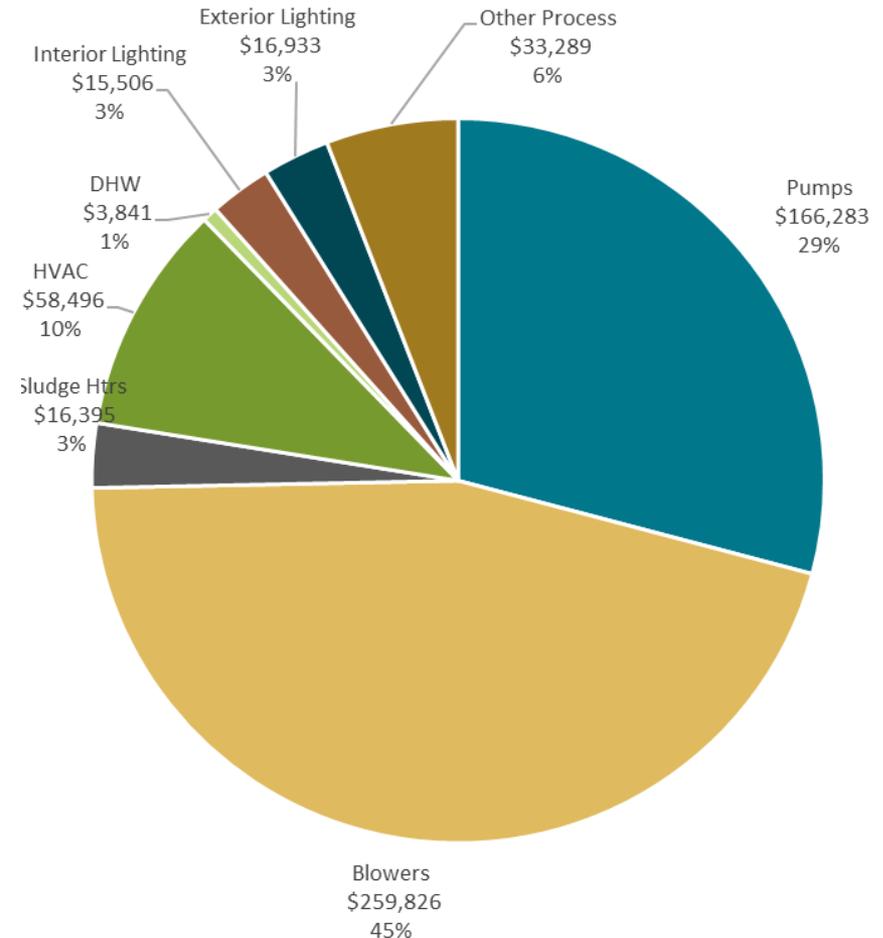
# What is the energy cost of wastewater treatment?

Plant #	Annual Energy Cost	Capacity	Avg MGD 2021	% Capacity	ENERGY STAR Score	Cost Intensity [\$/Mgal]	Activated Sludge	Other Treatment Processes	UV Disinfection	Aerobic Digestion	Anaerobic Digestion
1	\$ 70,881	1.5	1.0	67%	24	\$ 179.00		•		•	
2	\$ 101,264	1.5	1.0	68%	22	\$ 293.75		•			•
3	\$ 93,764	2	1.0	50%	29	\$ 270.00		•	•		•
4	\$ 133,013	3.3	2.5	77%	39	\$ 148.00	•		•		•
5	\$ 211,484	3.9	3.5	89%	60	\$ 164.00	•		•		•
6	\$ 183,015	6	3.6	61%	49	\$ 139.00	•			•	
7	\$ 245,782	8.7	6.3	72%	36	\$ 111.30	•	•			
8	\$ 428,150	8.7	3.6	42%	19	\$ 329.00		•		•	
9	\$ 584,451	20.5	15.2	74%	63	\$ 104.71	•				•

## Cost Effective Energy Conservation for Your Plant

# How do WWTPs use energy?

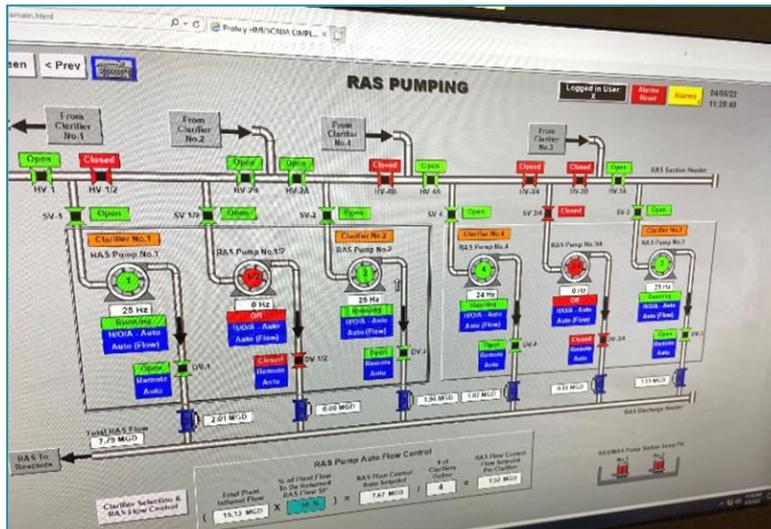
- Typical activated sludge plant
  - Blowers – 45%
    - Activated sludge treatment
    - Aerobic digestion
  - Pumps – 29%
    - Raw sewage pumps
    - RAS pumps
  - HVAC – 10%
  - Other Process – 9%
    - UV disinfection
    - Centrifuge/dewatering
  - Lighting/DHW – 7%



## Cost Effective Energy Conservation for Your Plant

# Tracking WWTP energy performance

- Benchmarking
  - Internal tracking
  - ENERGY STAR Portfolio Manager
  - DOE/DEP tools
- Equipment sub-metering
- SCADA systems



The screenshot shows the MyPortfolio Energy STAR Portfolio Manager interface for a Wastewater Treatment facility. The facility name is redacted. The interface includes a 'Summary' tab, a 'Meter Summary' section, and an 'Energy Use by Calendar Month' chart. The chart shows 'Site Energy (kBtu)' on the y-axis and months from July 2018 to January 2023 on the x-axis. The chart displays two data series: 'Electric - Grid' (blue line) and 'Natural Gas' (red line). The 'Electric - Grid' series shows a peak of approximately 1,100 kBtu in January 2021, while the 'Natural Gas' series remains consistently low, around 100 kBtu. The interface also includes a 'Meters - Used to Compute Metrics (3)' table and a 'Your Property is:' section.

**Facility:** Wastewater Treatment  
Year Built: 1947

**ENERGY STAR Score (1-100)**  
Current Score: 58  
Baseline Score: 66

**Meter Summary**  
3 Energy Meters Total  
3 - Used to Compute Metrics  
Current Energy Date: Feb 28, 2023

**Energy Use by Calendar Month (Not Weather Normalized)**  
Site Energy (kBtu)  
Electric - Grid  
Natural Gas  
(Chart current as of 04/27/2023 01:37 PM EDT)

**Meters - Used to Compute Metrics (3)**

Name	Meter ID	Energy Type	Most Recent Bill Date	In Use? (Inactive Date)
Electric Grid Meter #22020109	116210394	Electric - Grid	03/06/2023	Yes
Electric Grid Meter #22020131	116210395	Electric - Grid	03/06/2023	Yes
Natural Gas	135348909	Natural Gas	03/06/2023	Yes

**Your Property is:**  
 A Single Building  
 Part of a Building  
 A Campus of Multiple Buildings

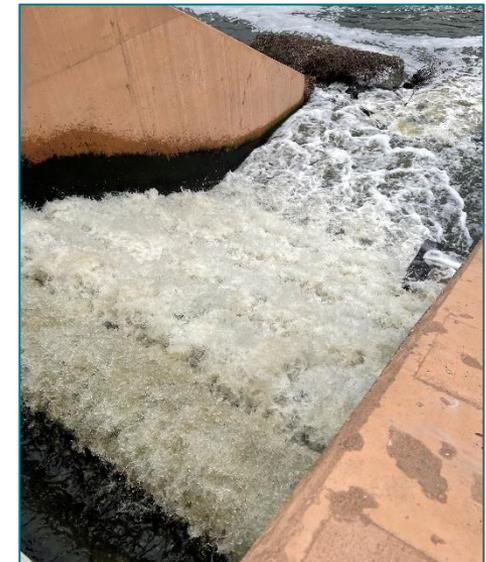
**You Are Tracking:**  
 Total energy consumption for your property  
 Partial energy consumption for your property

## Cost Effective Energy Conservation for Your Plant

# How can WWTPs improve energy performance?

- Energy conservation
  - SCADA systems
  - Variable frequency drives (VFDs)
  - Digestion and dewatering
  - Natural aeration
  - Automatic lighting controls
  - HVAC temperature and setback controls
- Energy efficiency
  - Right-sized motors
  - LED lighting
  - High efficiency HVAC systems
- Renewable energy
  - On-site (e.g. solar, microturbine)
  - Grid-purchased (e.g. wind)

	Centrifuge	Screw Press	Belt Filter Press
Operator Attention	Med	Low	High
Maintenance	High	Low	Med
Power Draw	High	Low	Low
Odor	Med	Low	High
Noise	High	Low	Low
Polymer Use	Med	High	Low
Solids Capture	High	Med	Low
Footprint	Small	Large	Med
Capital Cost	High	Med	Low
Feed Sensitivity	Low	High	Med
Est. Energy Use (kWh/yr)	87,282	34,913	23,275
Est. Energy Cost (\$/yr)	\$5,785	\$2,314	\$1,543
Avoided Energy Cost (\$/yr)	-	\$3,471	\$4,242



## Cost Effective Energy Conservation for Your Plant

# How can WWTPs improve energy performance?

Plant #	Key ECMs	Total Project Cost	Total Savings	Payback, yrs	% of Total Energy Cost	Process % of Total Savings	HVAC % of Total Savings	Other % of Total Savings
8	<b>Blower control</b> , LEDs, UH control	\$12,300	\$73,700	0.2	16%	86%	8%	5%
3	Upgrade UV disinfection, Screw press dewatering, Aerobic digestion, LEDs, Heat pumps	\$31,500	\$18,100	1.7	20%	96%	1%	3%
2	RBC control, sludge heater fuel switching, LEDs, heat pumps	\$83,800	\$34,900	2.4	30%	68%	21%	11%
9	<b>Blower control</b> , Automatic lighting control, Heat pumps	\$229,200	\$72,600	3.2	13%	76%	16%	8%
7	<b>Blower control</b> , Prioritize trickling filters, LEDs, Heat pumps	\$310,200	\$77,800	4.0	30%	93%	3%	4%
5	<b>Blower control</b> , Upgrade UV disinfection, LEDs, UH control	\$191,800	\$23,700	8.1	12%	70%	6%	24%
6	<b>Replace blowers, Blower control</b> , LEDs, UH control	\$344,600	\$39,400	8.8	20%	94%	1%	5%
1	Fine bubble diffusers, Fix air leaks, <b>Replace blowers</b> , LEDs, UH control	\$265,000	\$19,100	13.8	28%	86%	9%	5%
4	Post-SBR equal. tank, <b>Blower control</b> , LEDs, radiant heat	\$776,400	\$30,800	25.2	23%	88%	8%	4%
Average		\$249,400	\$43,300	5.8	21%	84%	8%	8%

## Cost Effective Energy Conservation for Your Plant

# Case Study: Energy vs. Compliance

- WWTP #7
  - 8.7 MGD capacity, currently averaging 6.3 MGD (72%)
  - ENERGY STAR score: 36
  - Water treatment
    - Trickling filters vs. activated sludge – 50% difference in energy use
  - Solids handling
    - Incineration
    - Digestion
    - Dewatering
    - Disposal



## PA DEP Partnerships and Resources

### Biggest take-aways for EPO:

- Goal is clean water – many paths, same outcome
  - Design firms leave out energy – plants need total energy cost analysis: capital vs. operating
  - Simplest tool for plants: Portfolio Manager
- 
- PA Partnership for Energy Efficiency (PEW2)<sup>2</sup>
    - Repeat program 2024-27
    - Looking for 25 facilities: Training, Energy Star Benchmarking, Assessment, Energy Emergency Planning & Security
  - Other initiatives for WWTP energy conservation
  - Trends in compliance updates (e.g. PFAS)
  - Coordination between energy team and compliance teams

## Cost Effective Energy Conservation for Your Plant

# Review of the presentation's highlights



Track energy performance



Have a plan to continuously improve energy performance



Strive to balance energy and compliance



Use automated controls to maximize efficiency



Optimize control of largest energy users



Don't forget about lights & HVAC!



Coordinate with DEP



Take advantage of DEP Energy programs

## Cost Effective Energy Conservation for Your Plant

# Additional Resources

- ENERGY STAR Portfolio Manager  
[energystar.gov/buildings/benchmark](https://energystar.gov/buildings/benchmark)
- DOE/DEP tools  
[dep.pa.gov/Business/Energy/pages/default.aspx](https://dep.pa.gov/Business/Energy/pages/default.aspx)
- Third-party consultants  
[ssmgroup.com](https://ssmgroup.com)

QUESTIONS, COMMENTS AND FEEDBACK



**Thanks for joining us!**

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**BEN PRESSMAN, PE**

Project Mechanical Engineer  
Energy Services  
Direct: 610-609-8357

[Ben.Pressman@ssmgroup.com](mailto:Ben.Pressman@ssmgroup.com)

**HEATHER COWLEY**

Regional Energy Specialist  
PA Department of Environmental Services  
Direct: 484-250-5816

[HCowley@pa.gov](mailto:HCowley@pa.gov)

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