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Preliminary Assessment of 2016 CMAR Energy Use Data

Examining Data From 408 Resource Recovery Facilities Across Wisconsin

Presentation Overview

- Why Address Energy Use Through The CMAR
- Training Initiative
- Best Practice Guide Forecasted Energy Use
- What Does The Collected Data Look Like
- Process Questions
- Facility Distribution
- What is The Data Telling Us
- Focus Assistance
- Summary – Actions – Q & A

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Why Address Energy Use Through the CMAR?

One of the primary purposes of the CMAR is to foster **communication**.

Communication of Wastewater Resource Recovery Facilities needs among **operators, governing bodies**, and the **DNR**.

This project allows the CMAR to become an educational tool that increases awareness of the importance and **value** of wastewater treatment **energy efficiency.**

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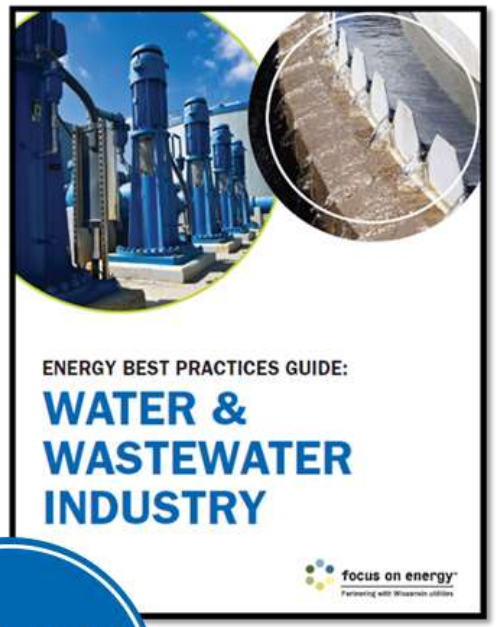
Why Address Energy Use Through the CMAR?

The Clean Water Loan Fund requires an Energy Audit, first step of energy audit is to create an energy use baseline.

In 2017 Focus on Energy provided energy efficiency incentives to over 50 Wisconsin Wastewater Treatment Facilities.



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Collaborative Process to Develop Questions?

Design Phase (2015)

CMAR Energy External Workgroup with in-person meetings to develop the new questions and data table with the charge of keeping it short, simple and easy to complete.

Jack Saltes – DNR Madison
Joe Cantwell, Focus On Energy
Jeremy Cramer, Fond du Lac WWTP
Kevin Freber, Watertown WWTP
Sharon Thieszen, Sheboygan WWTP
Gary Hanson, Short Elliot Hendricksen
Steve Ohm, DNR-Rhinelander
David Argall, DNR-Madison
Megan Levy, Office of Energy Innovation
Kevin Splain, OEI

WISCONSIN WASTEWATER OPERATORS' ASSOCIATION

OEI
Wisconsin Office of Energy Innovation

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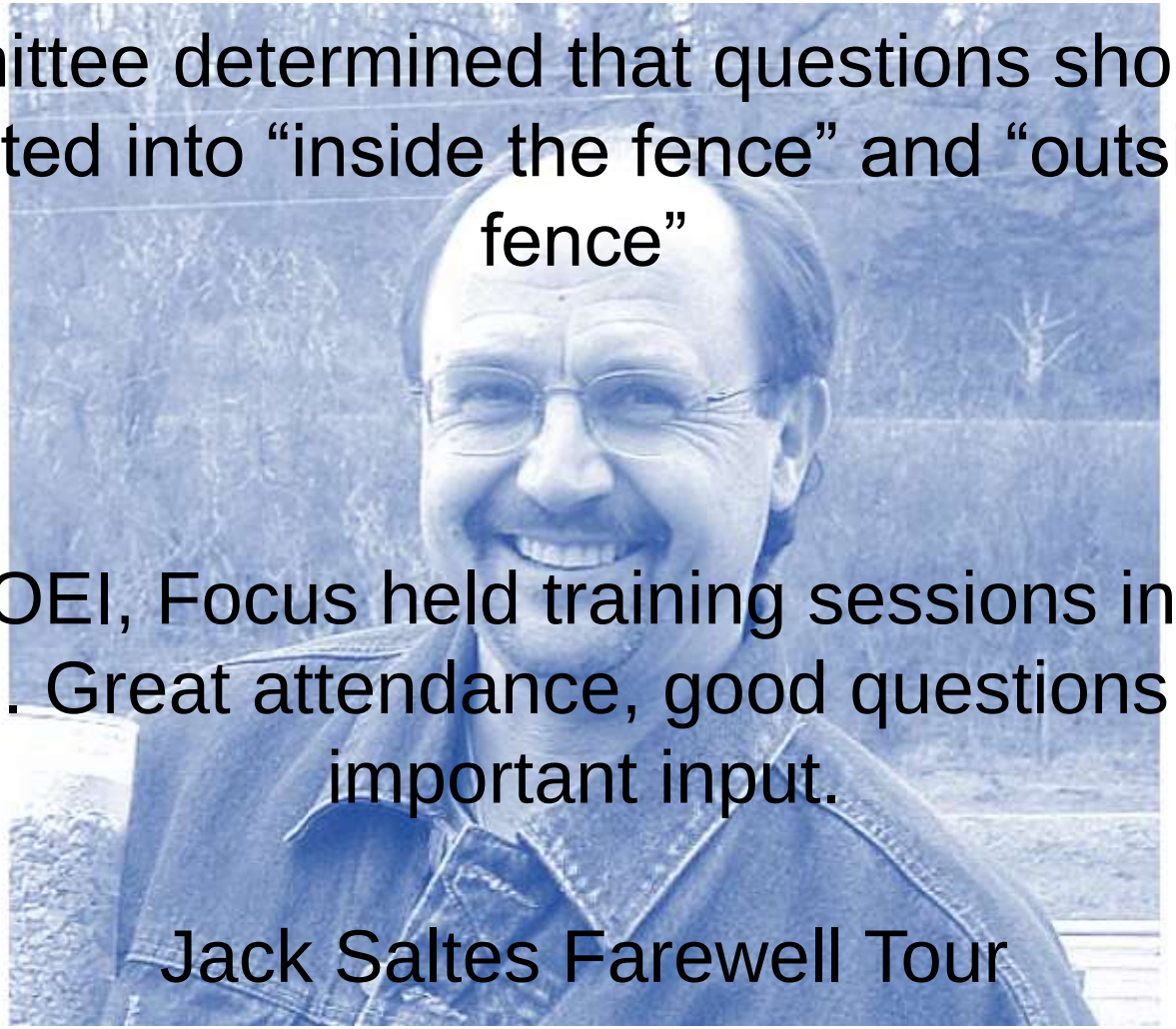
Initial Questions on Energy Use/ Training Initiative

Committee determined that questions should be separated into “inside the fence” and “outside the fence”



WDNR, OEI, Focus held training sessions in all DNR regions. Great attendance, good questions, lots of important input.

Jack Saltes Farewell Tour

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Energy Best Practice Guide: Table 4

Table 4 Best Practice Benchmarks and Top Performance Quartiles for Wisconsin Wastewater Facilities

Facility Type	Flow Range (MGD)	Average Energy Use (kWh/MG)	Top Performance Quartile (kWh/MG)	Best Practice Benchmark (kWh/MG)	Average Potential Savings
Activated Sludge**	0 -1	5,440	< 3,280	3,060	44%
	1 - 5	2,503	< 1,510	1,650	34%
	> 5	2,288	< 1,350	1,760	23%
Aerated Lagoon	< 1	7,288	< 4,000	3,540	51%
Oxidation Ditch	< 1.2	6,895	< 4,000	4,320	37%

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What the Data Looks Like and What it Tells Us

Flow Range (MGD)	Number of Facilities	Median Flow (MGD)	Best Quad (kWh/MG)	Median (kWh/MG)	Lowest Quad (kWh/MG)	Savings Median to Best	Median Savings Electric Cost Median to Best	Savings Worst to Best	Minimum (kWh/MG)	Maximum (kWh/MG)
0 - 0.05	89	0.030	4,124	7,236	10,995	43.00%	$ 2,770	62.49%	1,702	26,926
0.05 - 0.125	91	0.073	3,269	5,468	6,663	40.22%	$ 5,748	50.94%	1,306	26,312
0.125 - 0.25	73	0.184	3,111	4,109	5,664	24.28%	$ 6,607	45.07%	1,324	19,720
0.25 - 0.5	56	0.355	2,826	4,033	4,765	29.94%	$ 15,115	40.70%	1,460	14,243
0.5 - 1	34	0.659	2,421	2,806	3,263	13.70%	$ 10,027	25.81%	1,625	9,772
1 - 5	48	1.625	1,803	2,184	2,987	17.46%	$ 27,266	39.65%	1,452	5,661
>5	17	12.860	1,253	2,062	2,641	39.21%	$ 256,682	52.55%	690	3,687
0-100	408	0.162	2,601	4,023	6,192	35.33%	$ 9,081	57.99%	690	26,926

Flow Range (MGD)	Number of Facilities	Median Electricity Consumed (kWh)	Best Quad (kWh/BOD)	Median (kWh/BOD)	Lowest Quad (kWh/BOD)	Electric @ $0.10/kwh $/MG	Total kwh	Total Influent Flow (MG)	Average kWh/MG	Median (kWh/MG)
0 - 0.05	89	64,400	3,195	4,494	7,096	$ 6,440	7,009,492	903	7,758	7,236
0.05 - 0.125	91	142,920	2,201	3,082	4,434	$ 14,292	15,134,696	2,586	5,853	5,468
0.125 - 0.25	73	272,140	2,215	2,935	3,942	$ 27,214	21,931,982	4,851	4,521	4,109
0.25 - 0.5	56	504,800	1,674	2,014	2,951	$ 50,480	29,170,920	7,209	4,047	4,033
0.5 - 1	34	731,681	1,209	1,601	2,213	$ 73,168	26,580,786	8,535	3,114	2,806
1 - 5	48	1,561,368	889	1,101	1,573	$ 156,137	82,593,499	35,248	2,343	2,184
>5	17	6,546,865	790	1,232	1,296	$ 654,687	279,907,393	143,790	1,947	2,062
0-100	408	257,020	1,606	2,501	4,140	$ 25,702	462,328,768	203,122	2,276	4,023

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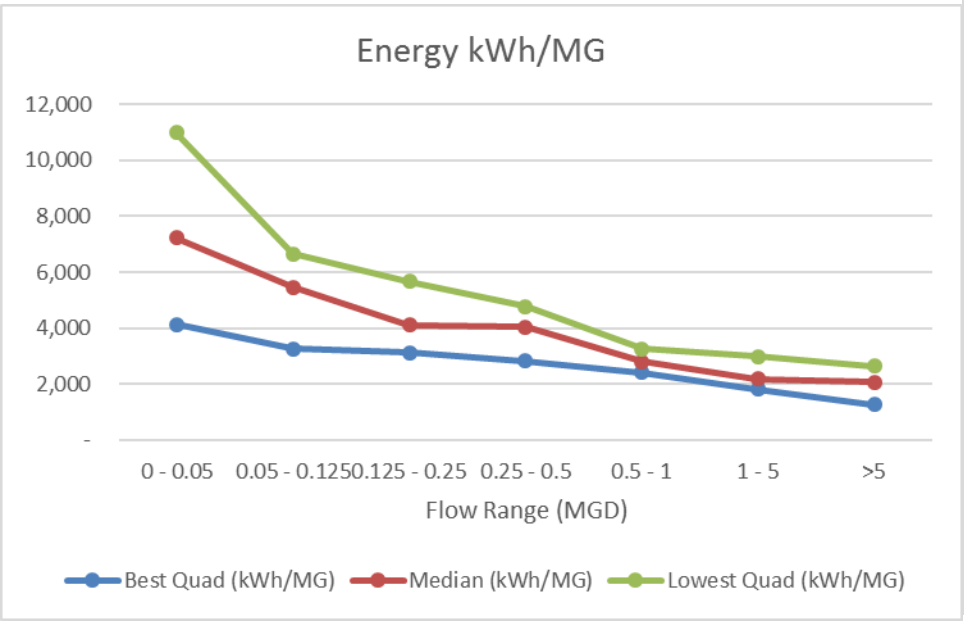
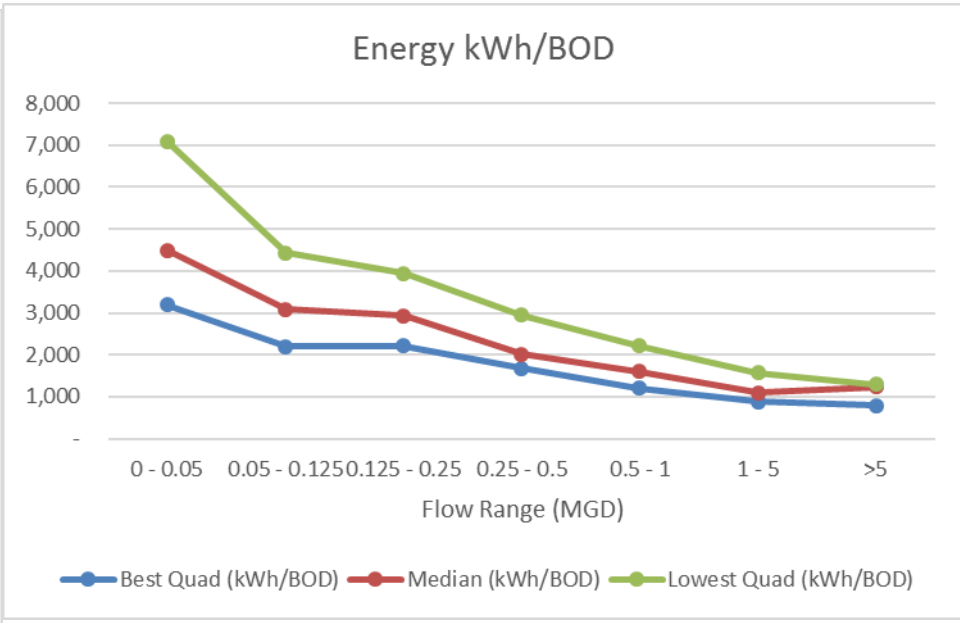
What the Data Looks Like and What it Tells Us





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Process Questions Asked

7.2 Energy Related Processes and Equipment

7.2.1 Indicate equipment and practices utilized at your treatment facility (Check all that apply):

- ☐ Aerobic Digestion
- ☐ Anaerobic Digestion
- ☐ Biological Phosphorus Removal
- ☐ Coarse Bubble Diffusers
- ☐ Dissolved O2 Monitoring and Aeration Control
- ☐ Effluent Pumping
- ☐ Fine Bubble Diffusers
- ☐ Mechanical Sludge Processing
- ☐ Nitrification
- ☐ SCADA System
- ☐ UV Disinfection
- ☐ Variable Speed Drives
- ☐ Other:

7.2.2 Comments:

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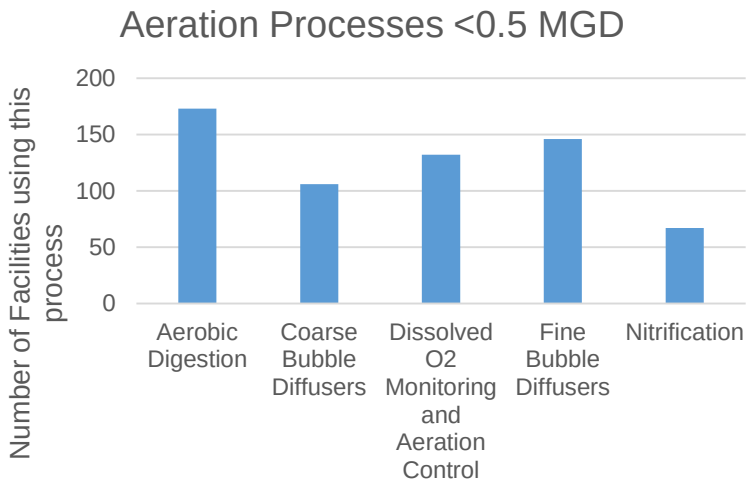
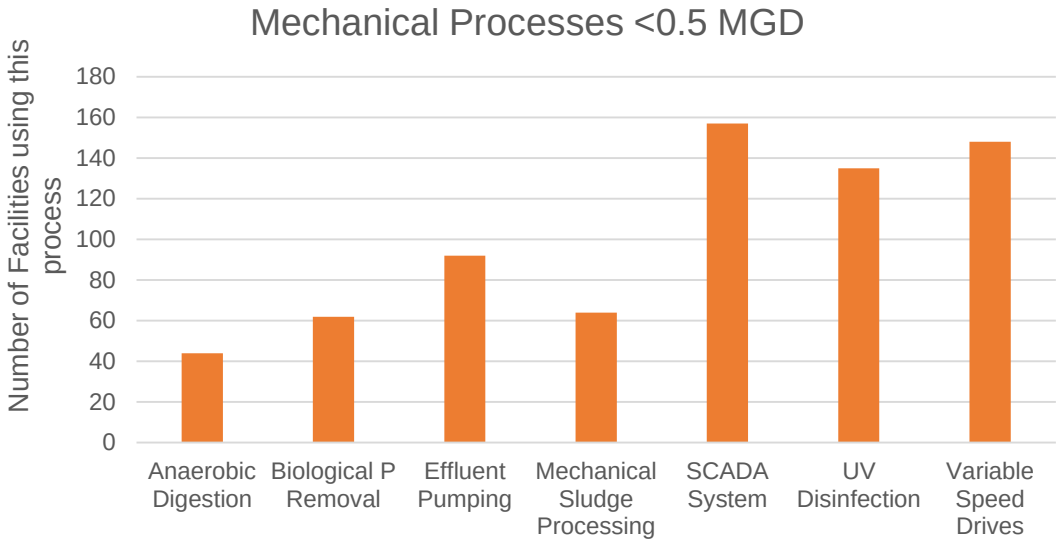
<0.5 MGD 309 Facilities Across the State





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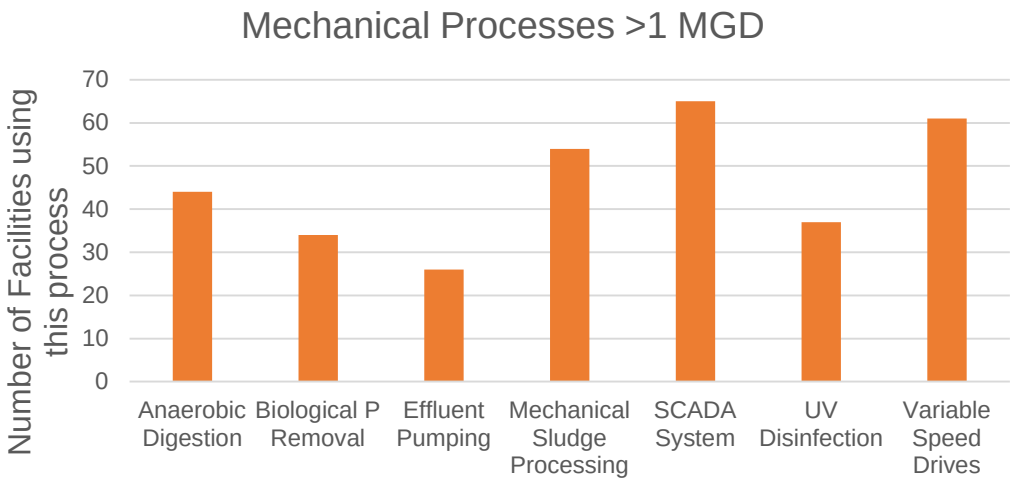
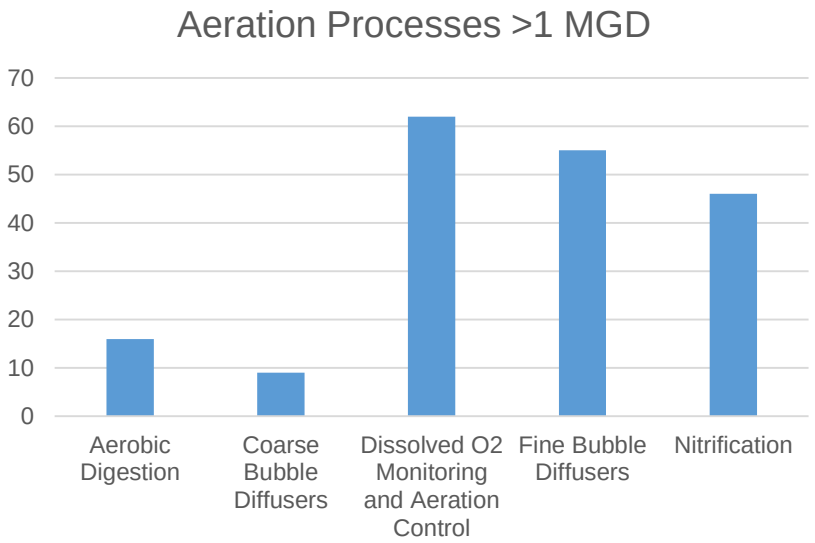
>1 MGD 65 Facilities Across the State





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Facility Distribution Across the State

	DNR Region					
Size Range	Northeast	Northern	South Central	West Central	Southeast	Totals
0.0-0.05	17	13	28	23	2	**83**
0.05-0.125	21	15	17	32	6	**91**
0.125-0.25	21	11	13	23	5	**73**
0.25-0.5	6	8	15	18	9	**56**
0.5-1.0	10	3	10	4	7	**34**
1.0-5.0	7	6	13	10	12	**48**
>5	7	0	2	1	7	**17**
Total Surveyed	**89**	**56**	**98**	**111**	**48**	**402**
Total WPDES	**134**	**114**	**149**	**176**	**68**	**641**

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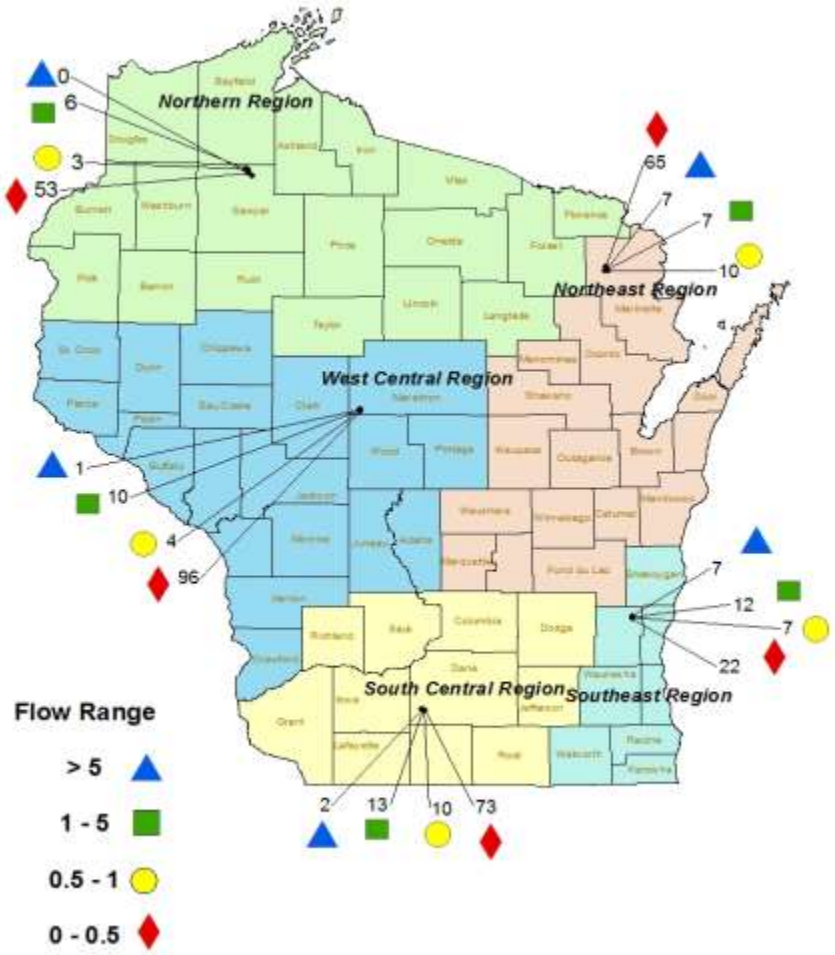
Facility Distribution Across the State



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Aerated Lagoon	< 1	7,288	< 4,000	3,540	51%
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What is the data telling us?

Flow Range	Number of Facilities	Average Energy Use (kWh/MG)	Average Flow (MGD)	Present Ave Annual Energy Use (Annual MWh/year	Best Quad (kWh/MG)	Forecast of Yearly Energy Use if all at Best Quad (mWh/yr)	Per Cent Energy Reduction(Ave to Quad) Per Flow Range
0-0.05	89	8309	0.0278	7507	4124	3781	50%
0.05-0.125	91	5841	0.0778	15103	3269	6651	44%
0.125-0.25	73	4569	0.1821	22164	3111	7072	32%
0.25-0.5	56	4123	0.3527	29726	2826	9354	31%
0.50-1.0	34	3168	0.6878	27042	2421	6378	24%
1-5	48	2461	2.012	86742	1803	23190	27%
> 5	17	1978	23.17	284409	1253	104240	37%

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What is the data telling us?

Flow Range	Number of Facilities	Present Ave Annual Energy Use (Annual MWh/year	Forecast of Yearly Energy Use if all at Best Quad (MWh/yr)	Forecast of Potential Energy Use Reduction to Best Quad Value (MWh/year)	Per Cent of Total
0-0.05	89	7507	3726	3781	2.4%
0.05-0.125	91	15103	8453	6651	4.1%
0.125-0.25	73	22164	15092	7072	4.4%
0.25-0.5	56	29726	20372	9354	5.8%
0.50-1.0	34	27042	20664	6378	4.0%
1-5	48	86742	63551	23190	14.4%
> 5	17	284409	180169	104240	64.9%

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Top 25 Low Cost No Cost Measures to Implement

1. Meet with your electric supplier to review and discuss your current rate schedule to best fits your facilities' needs.
2. Demand Management – Contact your electric supplier to review your energy rate schedule and identify on-peak hours.
   - Review your operations during on-peak hours to identify idle operation of non-essential equipment.
   - Determine if a portion of your treatment process(es) can be adjusted to operate during off-peak hours.

   Examples Include:
   - Operate thickening or dewatering equipment during off-peak hours.
   - Shift recycling of supernatant to off-peak hours.
   - Load digesters during off-peak hours.
   - Operate mixers or aerators in aerobic digesters during off-peak hours.
   - Accept or treat hauled-in wastes during off-peak hours. Utilize storage, if applicable.
   - Shift filter backwash cycles to off-peak hours.
   - Bump diffusers to off-peak hours or not at all, if practical.
   - Test repaired equipment during off-peak hours.
   - Change lead-lag equipment operation during off-peak hours.
   - Do not mix solids holding tanks during on-peak hours.
3. Maintain pumps and blowers; inspect, lubricate, and replace seals and bearings; check belt tension and alignment and adjust for optimal operation per manufacturers recommendations.
4. Turn off aerobic digester blower periodically or operate intermittently (i.e. 2 hours on / 4 hours off; repeat).
5. Modify the dissolved oxygen (DO) level in the aeration tank(s).
6. Operate select aeration tanks as needed.
7. Change intake filters for aeration blowers regularly to provide minimum resistance for intake air.
8. Identify and repair aeration system air main leaks.
9. Identify and repair compressed air leaks.
10. Re-sheave blowers.
11. Turn off unnecessary lighting and install occupancy sensors.
12. Idle aeration basins or zones seasonally, if not needed.
13. Adjust system operations when there is a change in wastewater load.
14. Raise wet well levels to reduce static head in the pump system.
15. Lower aeration tank levels to reduce air header static pressure.
16. Shift nightly low flow periods or seasonal low flow periods to smaller HP pumps / blowers, if applicable.
17. Operate minimum number of UV lamps as possible while still meeting disinfection needs if applicable.
18. Regularly clean UV lamp sleeves to improve transfer efficiency.
19. Test and calibrate / replace DO sensors if needed.
20. Identify the best location to install DO probes in the aeration tanks.
21. Install programmable thermostats and utilize night set back / set up settings.
22. Assess the potential for organics removal prior to entering the secondary treatment system. Assess the capability for high organic dischargers to feed loadings directly to a digester.
23. Review your operations to identify if any pumps or blowers are being throttled. If throttled pumps and blowers are identified, review to determine if they can be unthrottled to operate more efficiently.
24. Idle any unnecessary equipment.
25. Review Focus on Energy's Water and Wastewater Energy Efficiency Best Practices Guide. This updated guide outlines the basic steps in building an energy management program, as well as providing detailed information on water, wastewater, building efficiency, and general best practices.

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2017 Energy Advisor Territory Map

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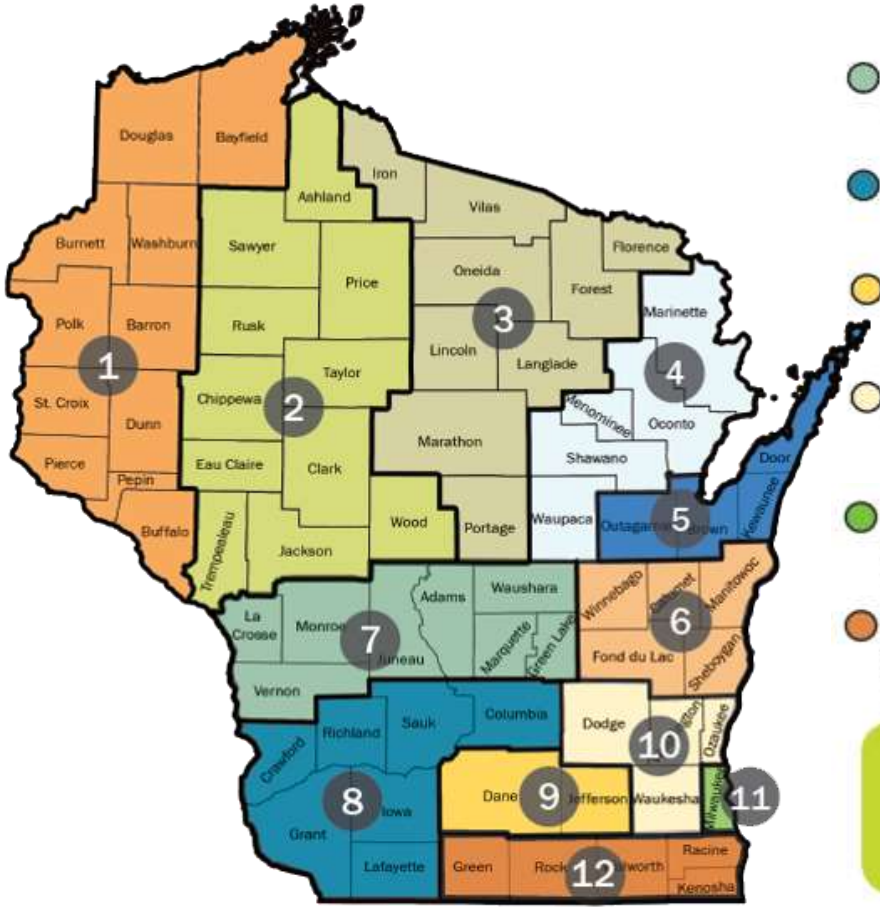

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Talk to an AgSG Rep today!
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Resources

- **Focus on Energy - 800.762.7077**
  - **https://focusonenergy.com/business/water-wastewater**
  - Energy Advisor Map, **focusonenergy.com/ea-map**
  - Ag, Schools, and Government Program
  - Large Energy User Program
- **Office of Energy Innovation**
- **Wisconsin Municipal Energy Efficiency Technical Assistance Program (MEETAP)**
- **Request Wastewater Treatment Facility Energy Tracking Tool:** Vanessa.Durant@Wisconsin.gov

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Summary

- Range of reported energy use: **690 to 26,926 kWh/MG**
- Average energy use:
  - 0.0 - 0.05 MGD: **8,309 kWh/MG**
  - 0.5 – 1.0 MGD: **3,168 kWh/MG**
  - > 5 MGD: **1,978 kWh/MG**
- Per Cent of Energy Reduction Available (From Average to 75 %'ile Data): **24 to 50 %**
- Amount of forecasted energy savings available from wastewater facilities: **256 MWh/year**
- Forecasted value of energy savings at $0.10 /kWh
  256,000,000 kWh X 0.10 $/kWh = **$25,600,000 / year**

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Take Away & Actions

- **TAKE AWAY**

  - Wastewater System energy use can be reduced

  - Focus on Energy assistance is available

  - If you have completed one energy project now look for the second, third, fourth

- **ACTIONS**

  - Continue data analysis

  - Reach out to facilities with high energy use

  - Develop and provide additional education and training materials and/or sessions

  - Encourage facilities to contact Focus on Energy for assistance

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Questions – Comments - Contacts

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