EPA Region 4
Energy Assessment Tool

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Overview

- **WHY? Energy is typically the largest controllable cost of providing water/wastewater services– 18% to 30% of total O&M costs**
- **Treatment plant staff rarely see energy bills**
- **Hard to manage what you do not measure (or do not see the measurements – electric bills)**
- **Could you manage your process without flow, BOD, or TSS data???**

Why Manage Energy – Not On My Permit

- **We work for the public – they pay for your plant and our salaries.**
- **Rate payers want to know that their utilities are doing all that they can to control costs and we owe them that.**
- **Tracking & managing energy can help reduce costs and improve plant performance.**

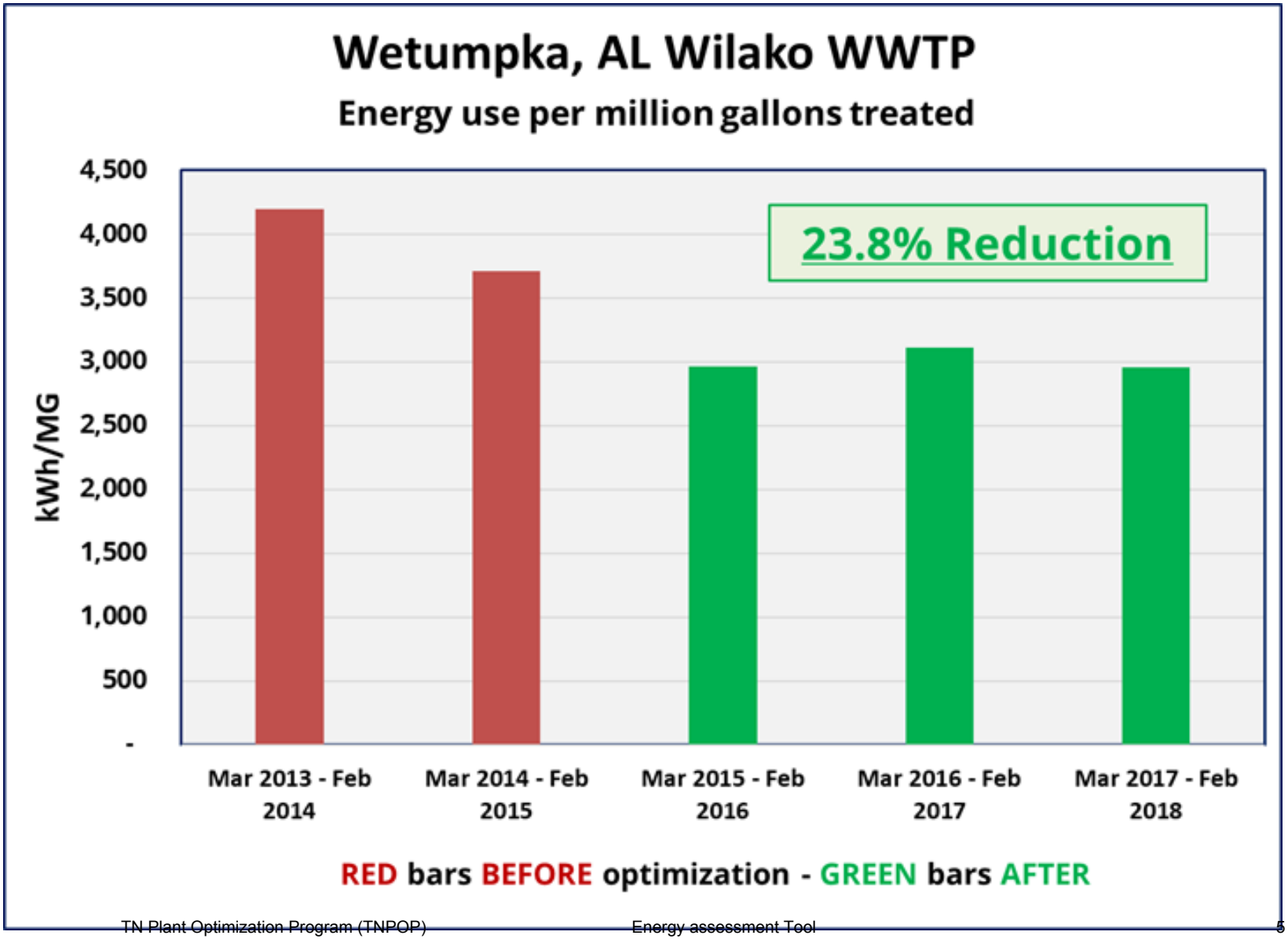
Also gives us a tool to show the results to management and the public.

WHY R4-EAT?

- Needed something easy to use to track energy usage and show changes over time.
- EAT is on your computer system – not the Web
- Uses common metrics – kWh, kWh/MG, cost/MG, kWh/lb BOD Removed, flow – mgd
- Only requires basic entry data – Date, Monthly DMR data (flow and BOD) and Monthly kWh Usage and Cost (Power Bill) – and kW Demand if available

EAT Produces Charts & Graphs to Display Results Over Time – Also Before & After

Charts & Graphs Show The Story

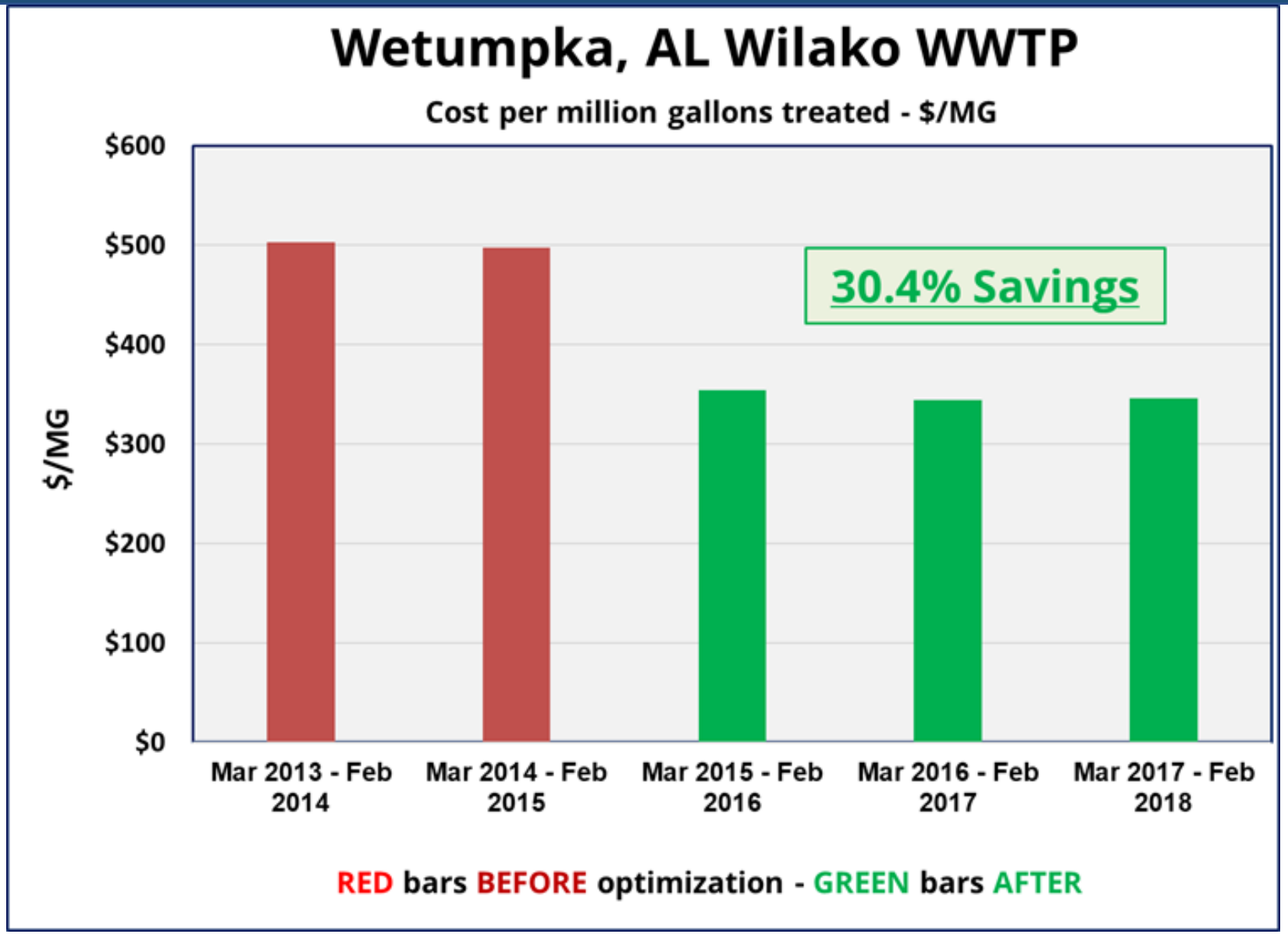


Numbers Can Be Confusing to Some

Wetumpka, AL Wilako WWTP – Same Information as Before

	Mar 2013 - Feb 2014	Mar 2014 - Feb 2015	Mar 2015 - Feb 2016	Mar 2016 - Feb 2017	Mar 2017 - Feb 2018	% Change	Cumulative Savings since Optimization
Average Daily Flow (MGD)	1.60	1.77	2.04	1.89	1.90	15.6%	N/A
Total Flow Treated (MG)	583	592	747	691	693	N/A	
Monthly Average Energy Used (kWh equiv)	203,869	202,560	184,441	179,239	170,713	-12.4%	N/A
Total Energy Used (kWh equiv)	2,446,425	2,430,722	2,213,295	2,150,864	2,048,560	N/A	
Energy per volume treated (kWh/MG)	**4,194**	**3,714**	**2,964**	**3,114**	**2,957**	**23.8% Reduction per Volume**	**N/A**
Annual Energy Savings (kWh eq)	**N/A**	**N/A**	**737,626**	**578,872**	**689,222**	**N/A**	**2,005,720**
Total Energy Cost ($)	$293,227	$301,204	$264,156	$237,643	$239,757	N/A	N/A
Average Monthly Energy Cost ($/month)	$24,436	$27,382	$22,013	$19,804	$19,980	-20.1%	
Cost per volume treated ($/MG)	**$503**	**$497**	**$354**	**$344**	**$346**	**30.4% Savings per Volume**	**N/A**
Annual Cost Savings ($)	**N/A**	**N/A**	**$109,288**	**$107,811**	**$106,714**	**N/A**	**$323,813**

Wetumpka, AL – Cost/MG Treated



What Does EAT Not Do?

- **EAT is NOT like Energy Star Portfolio Manager Energy Tracking Tool – which is primarily for buildings.**
- **Does not use source/site energy metrics – BTU/ft^2 – the treatment community does not deal with those type of measurements.**
- **Does not provide benchmarking score – we have found those scores to have little meaning with treatment systems – too many different types of treatment and environments. The most meaningful comparison is the same facility over time.**

EAT Data Entry

ENTER PLANT NAME AND BRIEF DESCRIPTION OF PROCESSES: Design flow, Anoxic zones, Biosolids Processes, Activated Sludge Process, Fine/Coarse Bubble, etc.

Name of Facility:	
Major Unit Processes:	

MONTH OF IMPLEMENTATION: *THIS DATE IS CRITICAL*		The monitoring period begins the month *following* implementation. The baseline period is defined as the previous two years, *ending with the month of implementation*.
ENERGY DATA PROVIDER:		
PHONE/EMAIL:		

Electric Meters:

Attention: It is recommended to use 24 months of data for baseline calculations

1. Enter the Meter Number if shown and a Description: Whole Plant, Aeration, Pumping, Etc.
2. Enter the Monthly Usage: (kWh) for each meter.
3. Enter the Monthly Total Cost: The total charge for that meter, inclusive of demand charges, fees, taxes, etc.
4. If available, enter the "Actual" and "Billed" Demand in kW under the appropriate columns. (Optional)
5. If available, enter the Demand Charge as shown on the bill, under the "Demand Cost" column. (Optional)
6. If you have additional meters, click the appropriate "Show Meter" button to input additional data. Click "Hide Meter" to hide.
7. If there is significant natural gas use at the plant (e.g., for heating digesters or drying biosolids), use the gas meter table on the far right to enter the appropriate data.

Show Meter 2 | Show Meter 3 | Show Meter 4 | Show Meter 5

METER 1	
Equipment on this Meter:	

MONTH (Auto-filled)	Average Daily Flow (MGD)	MONTHLY ELECTRIC USE (kWh)	TOTAL ELECTRIC BILL (incl. demand, taxes, etc.) ($)	Actual kW Demand (if available)	Billed kW Demand (if available)	DEMAND COST (If known, else leave blank)
January-98						
February-98						
March-98						
April-98						

EFFLUENT NITROGEN DATA - mg/l

Enter Monthly Effluent Data from DMRs mg/l

If N-Data Is Reported Quarterly Enter In Month Reported

MONTH/YEAR (ex. March-2012) OLDEST *First*	TKN OR NH3 IF BOTH MEASURED USE TKN	NO_x NO_2+NO_3 (IF ONLY NITRATE IS MEASURED ENTER THOSE VALUES)	Total Nitrogen (TN)
January-98			
February-98			
March-98			
April-98			

GAS METER: *Please Enter 24 Months of Usage/Cost Data*

Enter Monthly Gas Usage as ccf or Therms:

(1 ccf = 100 cu ft = 1 Therm)

For Multiple Gas Meters - Sum and Enter Totals

Month/Year Will Be Copied From Electric Meter Table

MONTH	MONTHLY GAS USAGE CCF or Therms	MONTHLY GAS COST	kWh EQUIVALENT (Calculated)
January-98	0		0
February-98	0		0
March-98	0		0
April-98	0		0

EAT Data Entry Sheet

R4 Energy Assessment Tool for Water & Wastewater Facilities - EPA Region 4

Yellow-shaded cells indicate data entry fields

ENTER PLANT NAME AND BRIEF DESCRIPTION OF PROCESSES: Design flow, Anoxic zones, Biosolids Processes, Activated Sludge Process, Fine/Coarse Bubble, etc.

Name of Facility:	
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EAT Data Entry Sheet - Continued

Show Meter 2 | Show Meter 3 | Show Meter 4 | Show Meter 5

METER 1

Equipment on this Meter:

MONTH (Auto-filled)	Average Daily Flow (MGD)	MONTHLY ELECTRIC USE (kWh)	TOTAL ELECTRIC BILL (incl. demand, taxes, etc.) ($)	Actual kW Demand (if available)	Billed kW Demand (if available)	DEMAND COST (If known, else leave blank)
January-98						
February-98						
March-98						
April-98						
May-98						
June-98						
July-98						
August-98						
September-98						
October-98						
November-98						
December-98						
January-99						
February-99						
March-99						
April-99						
May-99						
June-99						

EFFLUENT NITROGEN DATA - mg/l

Enter Monthly Effluent Data from DMRs mg/l

If N-Data Is Reported Quarterly Enter In Month Reported

MONTH/YEAR (ex. March-2012) OLDEST *First*	TKN OR NH3 IF BOTH MEASURED USE TKN	NOx NO2+NO3 (IF ONLY NITRATE IS MEASURED ENTER THOSE VALUES)	Total Nitrogen (TN)
January-98			
February-98			
March-98			
April-98			
May-98			
June-98			
July-98			
August-98			
September-98			
October-98			
November-98			
December-98			
January-99			
February-99			
March-99			
April-99			
May-99			
June-99			

Wetumpka, AL Data Sheet Filled Out

MONTH (Auto-filled)	Average Daily Flow (MGD)	MONTHLY ELECTRIC USE (kWh)	TOTAL ELECTRIC BILL (incl. demand, taxes, etc.) ($)	Actual kW Demand (if available) Meter X 240 Mult.	Billed kW Demand (if available)	DEMAND COST (If known, else leave blank)	MONTH/YEAR (ex. March-2012) OLDEST *First*	TKN OR NH3 IF BOTH MEASURED USE TKN	NOx NO2+NO3 (IF ONLY NITRATE IS MEASURED ENTER THOSE VALUES)	Total Nitrogen (TN)
March-13	1.75	183,106	$21,815.92	484.56			March-13	0.00		2.58
April-13	1.59	179,520	$21,068.78	478.32			April-13	0.00		0.95
May-13	1.34	198,214	$22,905.24	495.60			May-13	0.00		2.28
June-13	1.55	216,721	$24,725.90	472.32			June-13	0.00		2.89
July-13	1.71	209,520	$25,460.92	591.36			July-13	3.05		11.68
August-13	1.64	230,880	$27,203.95	574.56			August-13	0.00		17.00
September-13	1.59	187,350	$26,249.48	472.32			September-13	0.00		18.90
October-13	1.32	177,604	$21,630.81	472.32			October-13	0.00		17.70
November-13	1.42	190,557	$23,167.45	538.80			November-13	0.00		18.40
December-13	1.81	211,456	$24,752.98	511.68			December-13	0.00		8.43
January-14	1.70	233,988	$27,501.61	560.40			January-14	0.69		4.96
February-14	1.79	227,509	$26,743.91	560.40			February-14	0.63		1.07
March-14	1.87	204,232	$24,601.86	560.40			March-14	0.00		0.58
April-14	2.16	219,604	$25,748.22	507.84			April-14	0.00		1.09
May-14	1.84	223,200	$25,366.82	429.60			May-14	0.00		5.57
June-14	1.66	231,360	$26,398.89	469.20			June-14	0.00		2.89
July-14	1.59	242,389	$32,820.97	958.32			July-14	0.00		16.70
August-14	1.67	231,849	$31,226.45	901.68			August-14	0.00		13.70
September-14	1.59	228,966	$28,938.97	400.32			September-14	0.86		17.06
October-14	1.43	207,600	$26,980.87	387.84			October-14	0.93		19.43
November-14	1.45	186,731	$25,066.74	450.72			November-14	0.79		11.39
December-14	1.69	205,204	$26,760.86	458.64			December-14	0.00		2.93
January-15	2.19	258,468	$31,178.46	462.00			January-15	0.00		1.77
February-15	2.05	233,508	$28,935.41	514.08			February-15	0.71		4.37
March-15	2.08	182,160	$24,319.85	514.08			March-15	0.74		0.86
April-15	2.18	177,134	$23,015.83	408.00			April-15	0.66		0.83
May-15	1.96	178,080	$23,117.82	414.48			May-15	0.00		0.26
June-15	1.82	189,131	$24,093.75	427.20			June-15	0.00		0.20
July-15	1.88	187,920	$23,521.45	509.28			July-15	0.00		12.37
August-15	2.02	194,153	$21,840.86	476.16			August-15	0.00		0.54
September-15	1.59	201,345	$22,277.63	460.08			September-15	0.00		4.85

EAT – Basic Metric is kWh/MG

- **The basic EAT metric is kWh/MG – the amount of energy required to treat 1 MG of flow. Commonly used in energy efficiency area.**
- **Flow can vary for several reasons making kWh/MG change significantly unrelated to efficiency**
  - **Rainy Weather I/I**
  - **Dry Weather Low Flows**
  - **Seasonal Groundwater Table**
- **Organic load generally varies less and can be a better indicator of real change in process efficiency.**

New EAT Metric – kWh/Lb BOD Removed

- Flow impacts energy use in WWTPs but organic load – BOD – has more impact
- Bulk of WWTP energy use is aeration and biosolids processing.
- Measuring energy efficiency related to BOD removal is more focused on treatment process – not pumping flow.
- Newer Versions of EAT have capability to track both kWh/MG and kWh/Lb BOD Removed
- Lb BOD Removed can be calculated from DMR easily

EAT – Nutrient Tracking

- **EAT Nutrient Tracking is being added for facilities that report nutrient data.**
- **Nutrient Tracking can show effectiveness of using anoxic zones for N removal and biological/chemical processes for P removal.**

Wetumpka, AL - Nitrogen Discharge

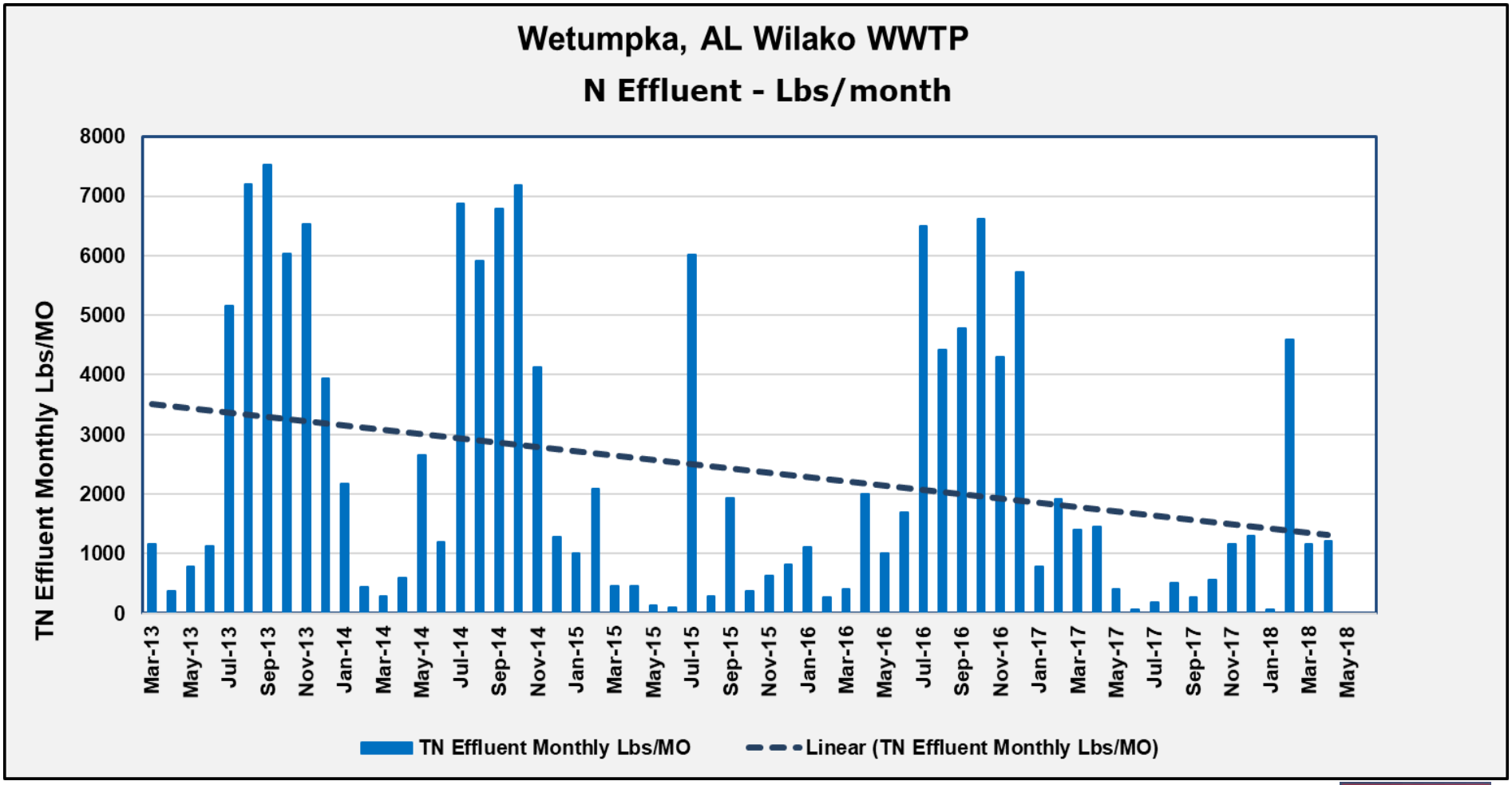

Chart Produced by EAT With N Tracking

Target Your Energy Management Effort

- **Equipment Inventory Worksheet – Tool that identifies the largest energy using equipment in your plant.**
  - **Fill in equipment info – hp, run time –hrs/year, load factor – full load, 50% load, etc., and kWh cost.**
  - **For each piece of equipment the Tool will calculate total kWh used/year, total cost/year, overall plant total kWh usage, and % of total for each entry.**
  - **Helps identify where the most energy goes in the plant.**

Equipment Inventory Worksheet

MOTOR DRIVEN EQUIPMENT LIST - ONLY LIST YOUR LARGER HP MOTORS
PLANTS 5 mgd DESIGN OR LARGER - OVER 40 HP --- UNDER 5 mgd DESIGN - OVER 20 HP

Energy Cost $/kWh	$X.XXX

Enter the average cost of electricity for your facility. This is the sum of all electrical costs (service fees, demand charges, taxes, etc.) divided by the kWh consumed during the same period

YELLOW Colored cells are data YOU fill in

BLUE Colored cells are calculated Values

24/7/365 = 8760 hrs

100% Load Factor means that the equipment is loaded (running) at full power. If you feel the equipment is not running at full power make a best guess as to what percent it is loaded.

Is a Throttling Valve, Pressure Diversion Device or other method used to reduce flow or pressure on pumps?

	Equipment Name	Motor Nameplate HP	kW	Load Factor	Run Hours per yr	kWh/Year	Cost/yr	% of total kWh	Age of Motor - yrs	VFD on motor - Y/N	Throttling Valve or Similar - Y/N
	Motors & Blowers										
1			0.0			0	#VALUE!	#DIV/0!			
2			0.0			0	#VALUE!	#DIV/0!			
3			0.0			0	#VALUE!	#DIV/0!			
4			0.0			0	#VALUE!	#DIV/0!			
5			0.0			0	#VALUE!	#DIV/0!			
6			0.0			0	#VALUE!	#DIV/0!			
7			0.0			0	#VALUE!	#DIV/0!			
8			0.0			0	#VALUE!	#DIV/0!			
9			0.0			0	#VALUE!	#DIV/0!			
10			0.0			0	#VALUE!	#DIV/0!			
11			0.0			0	#VALUE!	#DIV/0!			
12			0.0			0	#VALUE!	#DIV/0!			
13			0.0			0	#VALUE!	#DIV/0!			
14			0.0			0	#VALUE!	#DIV/0!			
15			0.0			0	#VALUE!	#DIV/0!			
16			0.0			0	#VALUE!	#DIV/0!			
17			0.0			0	#VALUE!	#DIV/0!			
18			0.0			0	#VALUE!	#DIV/0!			
19			0.0			0	#VALUE!	#DIV/0!			
20			0.0			0	#VALUE!	#DIV/0!			
	Electrical equip. (e.g., UV) (kW may be filled in if known)										
1						0	#VALUE!	#DIV/0!			
2						0	#VALUE!	#DIV/0!			
	Total	0.0	0.0			0	#VALUE!				

Total HP Total kW

Bottom Line

- **Energy Management at WWTPs should be part of Plant Management – not an afterthought**
- **Energy Management Related Benefits**
  - **Opportunity to reduce energy use**
  - **Save money**
  - **Reduce nutrient discharge**
  - **Reduce chemical usage**
  - **Often NO or LOW cost to implement**

Why would you NOT want this??

KEY STEP – TRACK ENERGY USE

QUESTIONS??

For More Information Contact:

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