Integrated Process Solutions, Inc.

Fosston, MN • Waunakee, WI

Wisconsin Wastewater Operators' Association, Inc.

Integration, Professionally

48th Annual Conference

Wisconsin Wastewater Operator's Association

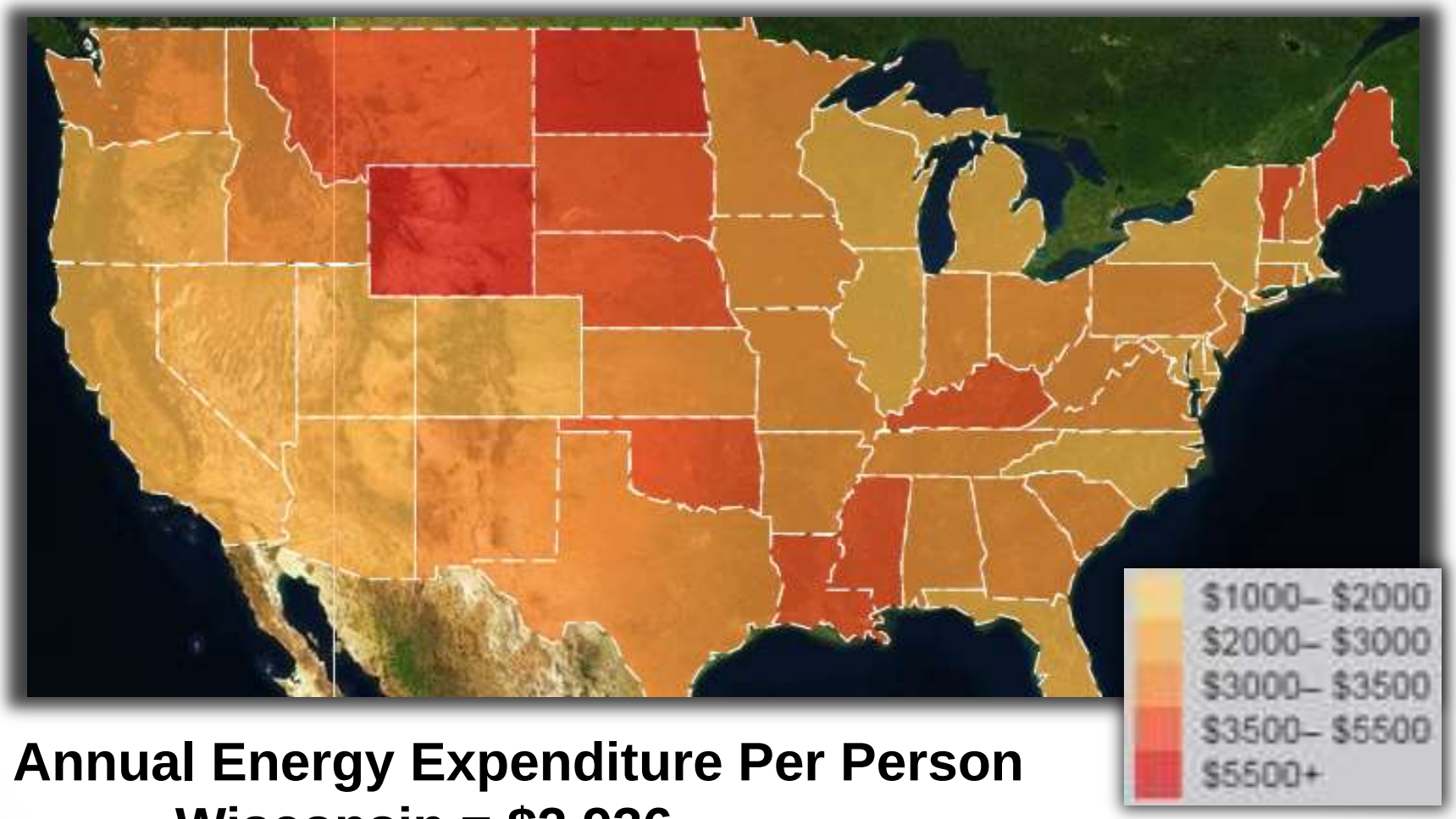
Making Energy Savings a Reality

Agenda

- Introduction
- Energy Facts
- Understanding Energy Consumption
- Utility Billing
- Implementing Energy Monitoring and Conservation
- Methods to Reduce Energy Consumption
- Grant Money Available for Energy Projects

Introduction

Where are we going?



Annual Energy Expenditure Per Person
Wisconsin = $2,936

Map courtesy of energy.gov

Where are we going?

WISCONSIN STATE JOURNAL

RATE HIKE PROPOSAL | COMPANIES SEEK TO RECOUP LOSSES

Wisconsin utility companies take aim against solar power

July 27, 2014 7:00 am • By Judy Newman | Wisconsin State Journal (51) Comments

Two Wisconsin utility companies — once among the early leaders in promoting solar power — now say the solar industry has grown so much it is hurting their business and their customers.

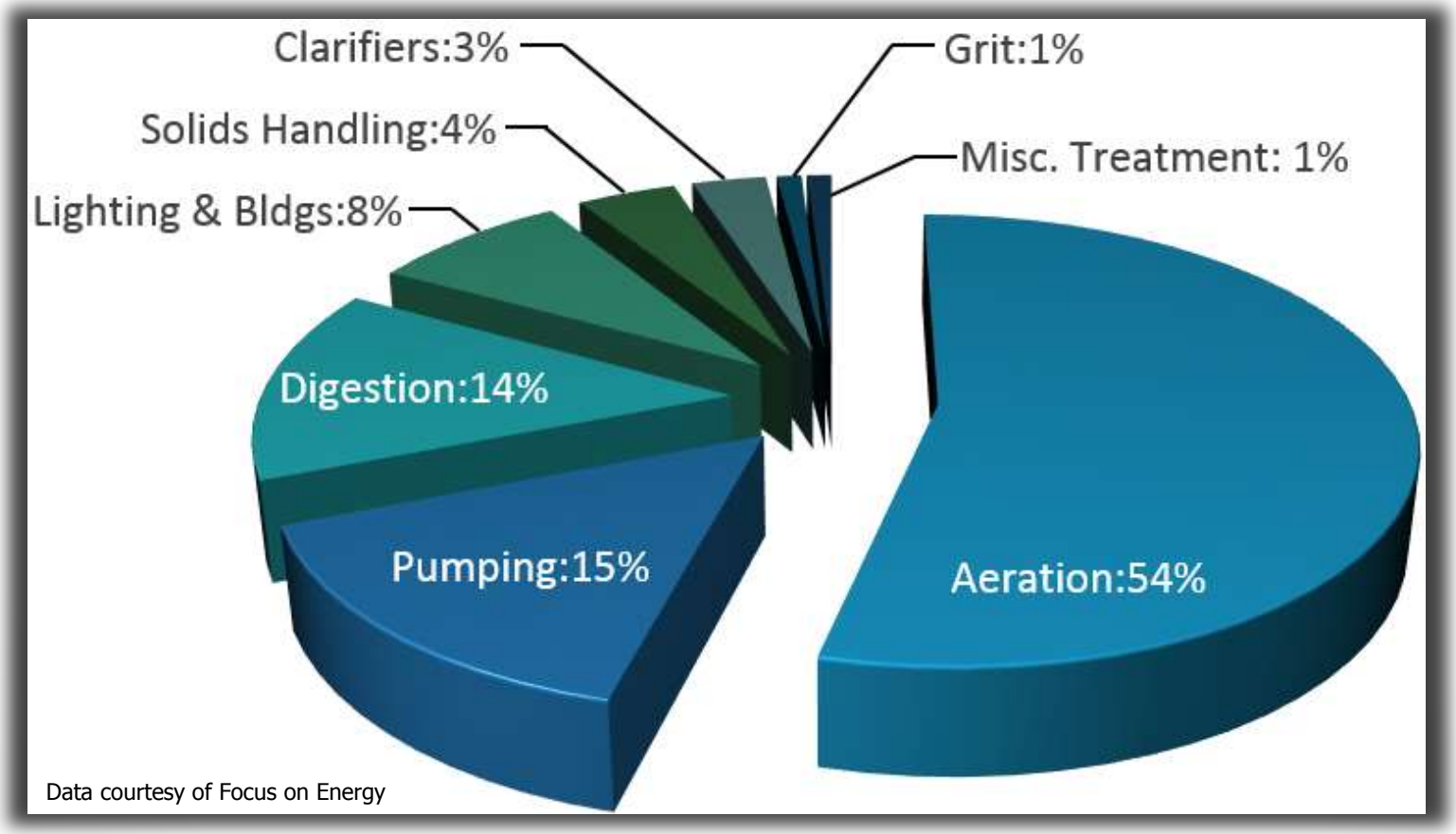
Madison Gas & Electric (MGE) and We Energies, Milwaukee, are asking state regulators for rate changes that they call a matter of fair treatment for all.

Article courtesy of www.madison.com

Energy Facts

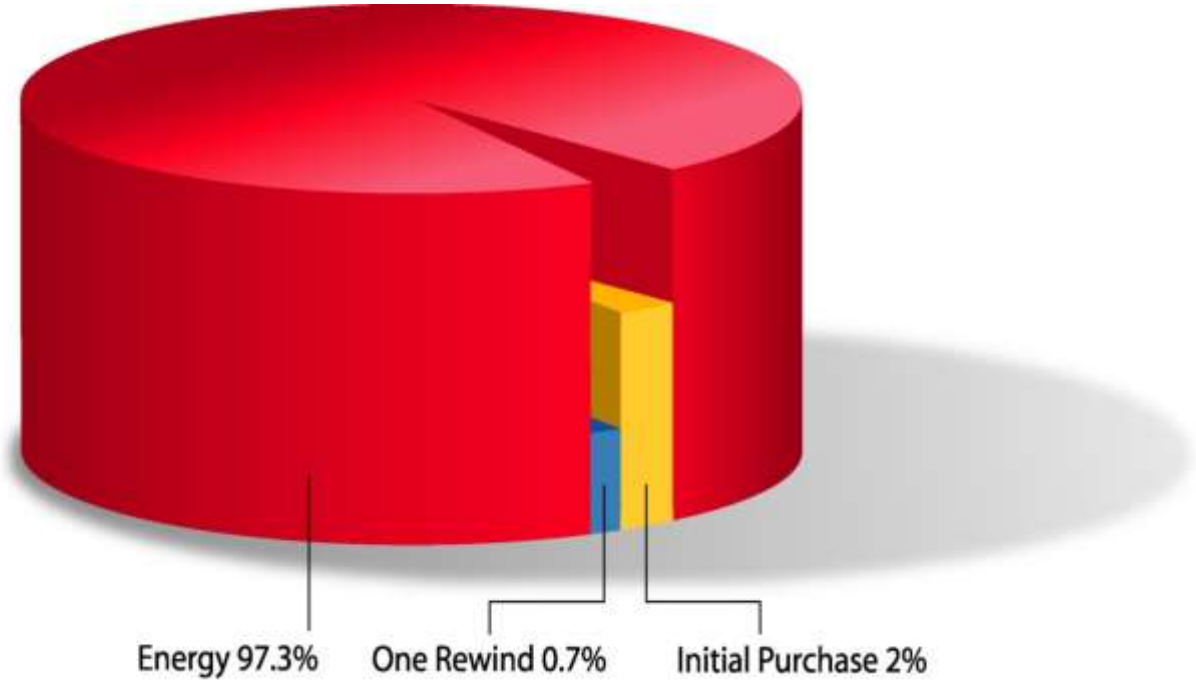
Energy Facts: Wastewater

- 650 total WWTPs in Wisconsin – ~85% are 1.0 MGD or smaller and consume 24% of total energy
- Remaining ~15% consume 76% of total energy used



Energy Facts:
Electric Motors

- Over 50% of the electric energy consumed in the United States is used by electric motors
- A heavily used motor can cost 6-10 times its purchase price to operate per year
- Motor life cycle cost is the most important overall measurement



Energy facts courtesy of Commonwealth Edison and Baldor Electric Company

Understanding Energy Consumption

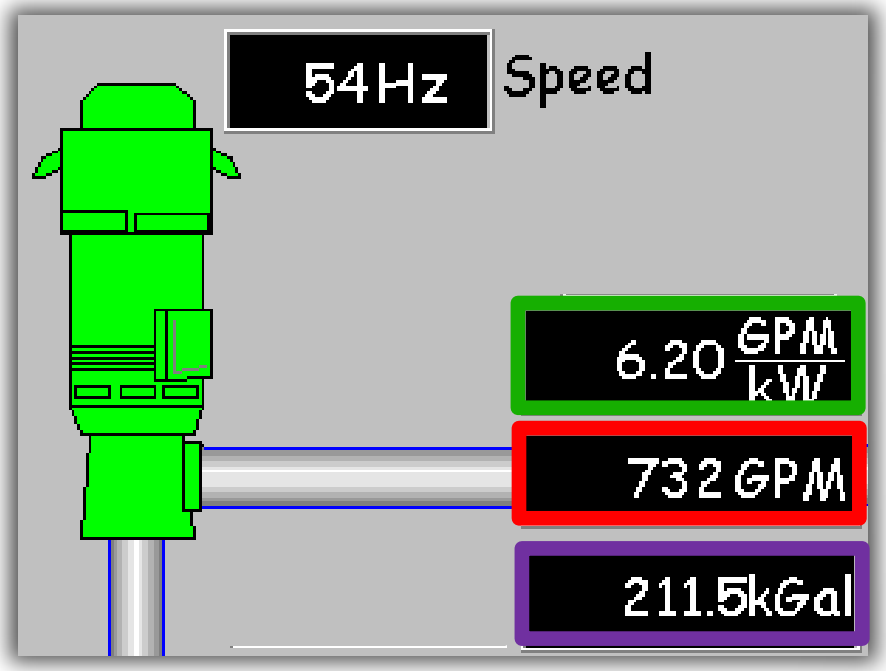
Utility Billing Components

- Typically three major components

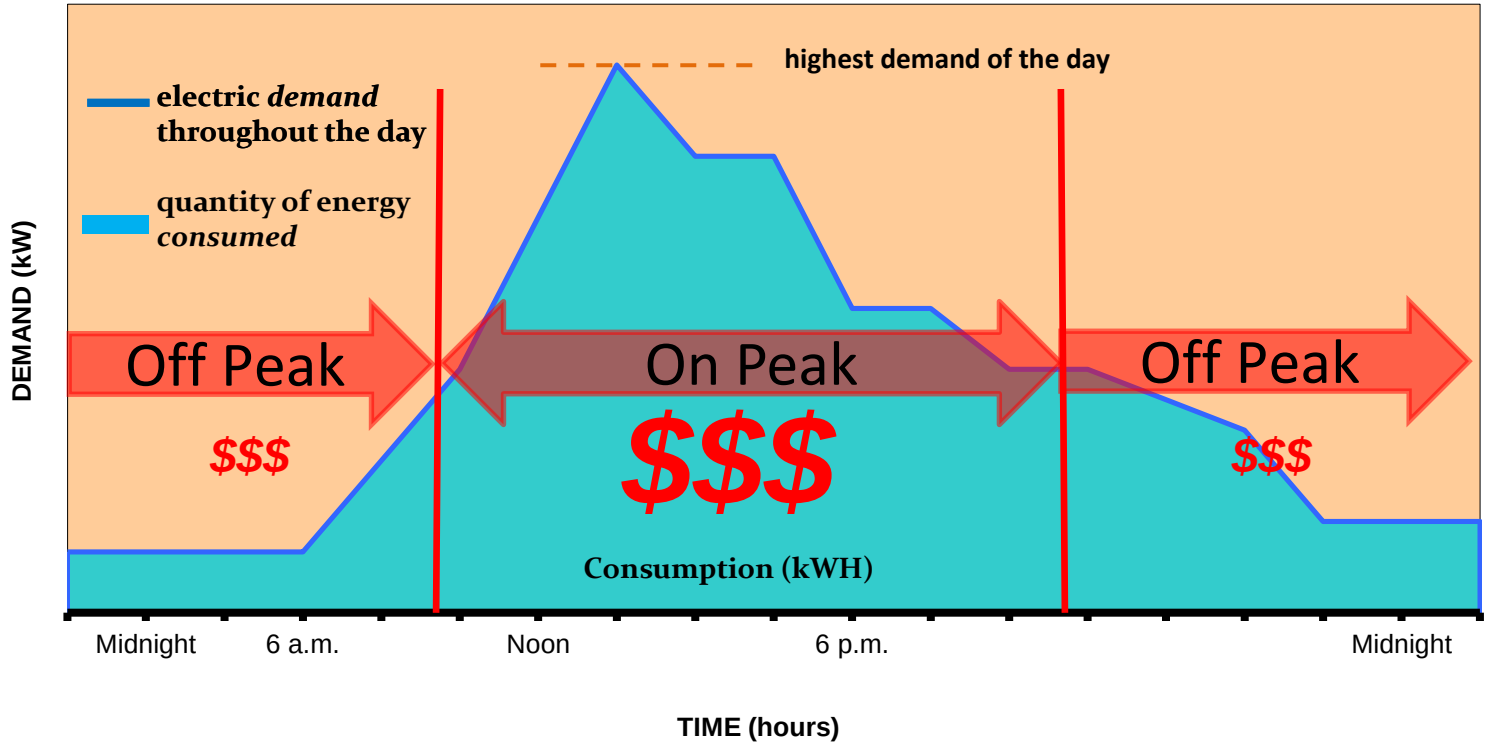
Consumption - KWH
Usage over time

Demand - kW
Maximum usage at any point in time

Power Factor
Efficiency of energy consumption

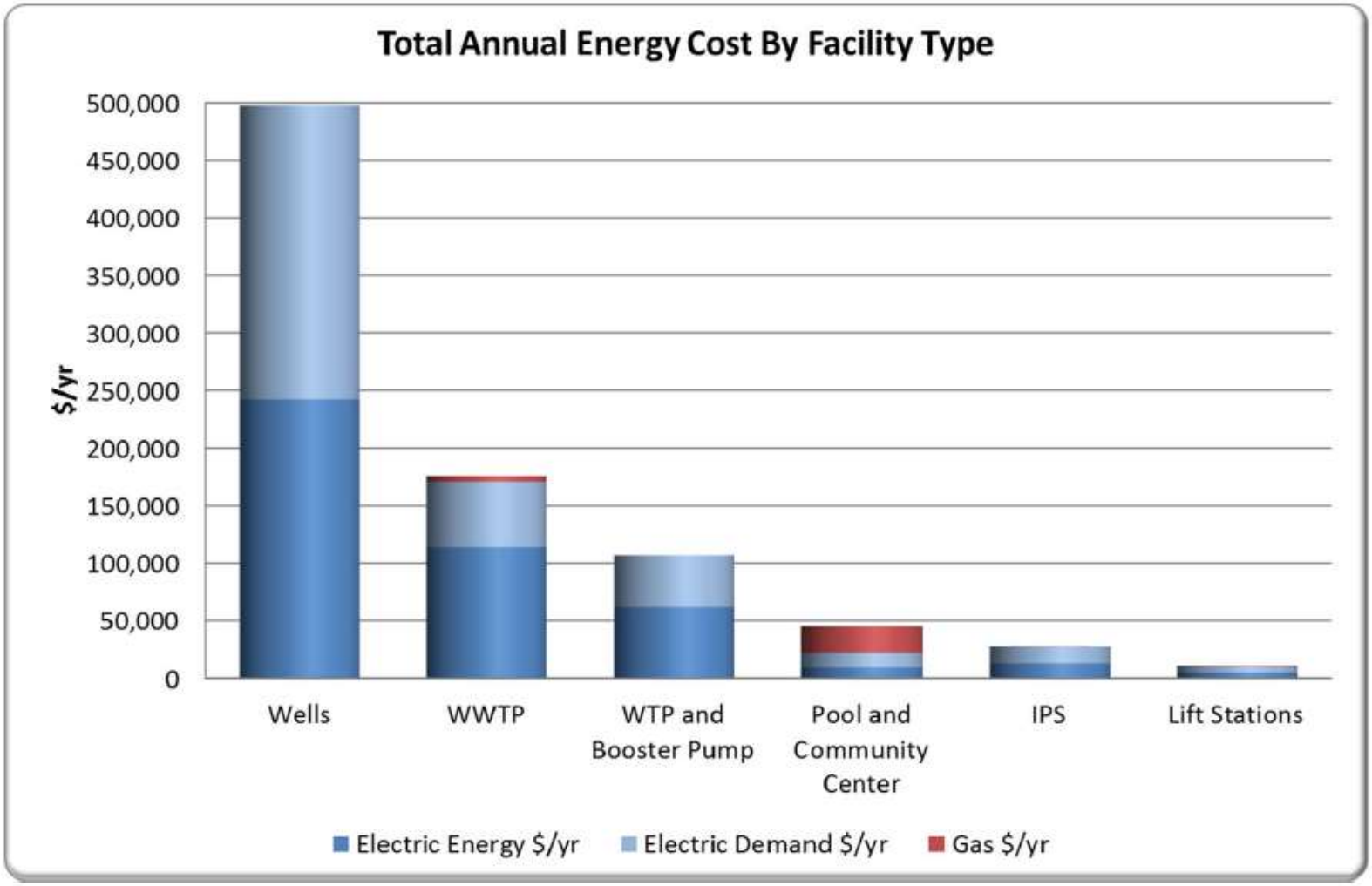


Utility Billing Components



- Energy consumption (kWH) ➔ kGAL
- Customer demand (kW) ➔ GPM Peak
- Monthly maximum demand (kW) ➔ GPM Peak Annual

Municipal Energy Profile



Energy facts courtesy of Eaton Electrical

Understanding Utility Billing – Example 1

- Every utility is different

WWTP

KWH

Power Factor

Demand

INVOICE FOR ELECTRIC SERVICE

Acct Number: 24-27500
NAME: Waste Water Trmt Plant
ADDRESS:

Invoice Date: Dec 14, 12
net invoice is payable on or before the 4th day of next month

ENERGY TO BE BILLED (KWH)

Dates of Readings Present	Dates of Readings Previous	Meter Readings Present	Meter Readings Previous	Difference		Meter Constant		K.W.H.
Nov 30, 12	Oct 31, 12	4356	4191	165	x	900	=	148,500
					x	-1%	=	(1,485)
				TOTAL METERED ENERGY				**147,015**

METERED REACTIVE (RKVAH):

Meter Readings Present	Meter Readings Previous	Difference		Meter Constant		RKVAH
219	207	12	x	900	=	10,800
			x	-1%	=	(108)
		TOTAL METER REACTIVE				**10,692**

POWER FACTOR COMPUTATION:

Total Metered Reactive (RKVAH) 10,692 = 0.0727 Tangent
Total Metered Energy (K.W.H.) 147,015
Power Factor for Above Tangent 99.7 Per Cent

MAXIMUM LOAD TO BE BILLED:

	Reading		Meter Constant		
Maxium Load As Metered:	0.31	x	900	=	279.0 K.W.

Power Factor Adjustment

Billing Maximum Load = K.W. 279.0 = 279.8 K.V.A. x .99 = 277.0 K.V.A.
% Power Factor 99.7

MAXIMUM LOAD CHANGE:

277.0 KVA Billing Maximum @4.37 per KVA 1,210.67

Understanding Utility Billing – Example 2

- Every utility is different

Pump House

ELECTRIC: COMM & IND TIME-OF-USE (CG-4B)
WELL 4

Meter	Read Dates	Days	Readings	Constant				KWH
E291557	05/27/11 - 06/29/11	33	0 - 33037	1.000				33037
Customer Charge (3 Phase)				33 DAYS	at $	1.69960	$	56.09
State Low-Income Asst Fee				33 DAYS	at $	0.21212	$	7.00
Distribution Service								
Customer Maximum Demand				132.9 KW/DAY	at $	0.08219	$	360.46
Electricity Service								
Maximum On-Peak Demand				103.7 KW/DAY	at $	0.35394	$	1,211.22
On-Peak Energy Charge				351 KWH	at $	0.11635	$	40.84
Off-Peak Energy Charge				32686 KWH	at $	0.05077	$	1,659.47
						Subtotal		.....

Yearly Demand

Monthly Demand

Off-Peak and Off-Peak KWH (Time of Day Metering)

On Peak kWH: $0.116

Off Peak kWH: $0.051

On Peak Demand: $0.354

Off Peak Demand: $0

Utility Billing Comparison

- Example 1

WWTP

kWH:	$9,307
Demand & P.F.:	$1,210
Total:	$10,517

kWH = 88% (No TOD)
Demand & P.F. = 12%

- Example 2

Pump House

kWH:	$1,700
Demand:	$1,571
Total:	$3,271

kWH = 52% (On/Off Peak)
Demand = 48% (No P.F)

Implementing Energy Monitoring and Conservation

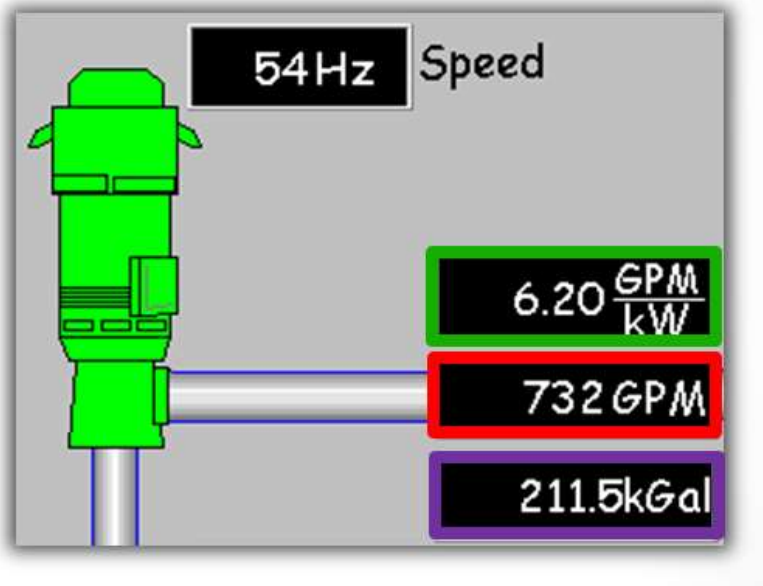
How Do We Get There?

The Path to Energy Savings

1. Educate
2. Monitor and Record
3. Review Equipment and Operations
4. Identify and Implement

Educate

- Choose an energy leader
- Educate staff on energy basics
- Become energy focused



The Path to Energy Savings

- Educate
- Monitor and Record
- Review Equipment and Ops
- Identify and Implement

Monitor and Record

- Implement energy monitoring
  - Building/structure
  - Per process
  - Large equipment
- Develop Baseline

“You can’t manage what you can’t measure.”

The Path to Energy Savings

- Educate
- Monitor and Record
- Review Equipment and Ops
- Identify and Implement

Monitor and Record

- Use utility billing, spreadsheets, or reporting tools to review past data and track future data

MONTHLY ENERGY USAGE REPORT
April 2012

Main Switchboard - Overall WWTP

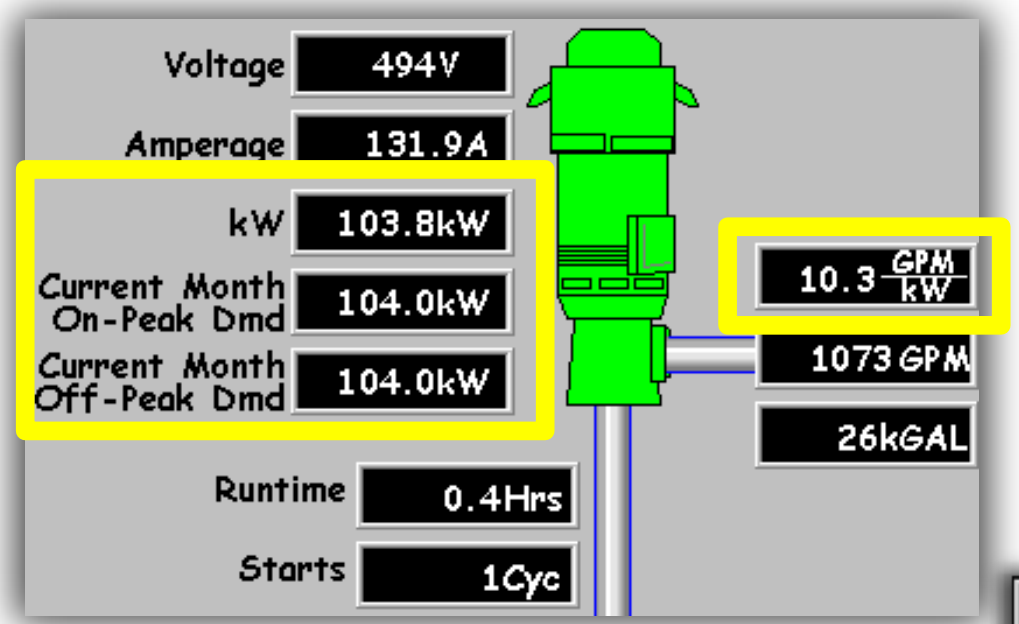
DATE	Total kWH	On Peak kWH	Off Peak kWH	On Peak Demand kW	Off Peak Demand kW
1	1824	0	1824	0	85
2	1891	957	934	90	86
3	1948	1005	943	107	85
4	1917	953	964		
5	2089	1071	1018		
6	1956	1032	924		
7	1761	0	1761		
8	1771	0	1771		

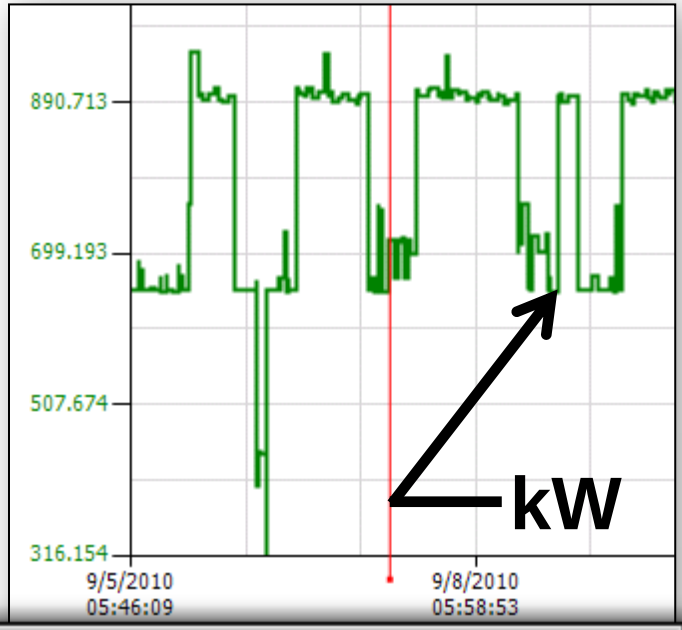
The Path to Energy Savings

- Educate
- Monitor and Record
- Review Equipment and Ops
- Identify and Implement

Monitor and Record

- Use your SCADA System as a tool





The Path to Energy Savings

- Educate
- Monitor and Record
- Review Equipment and Ops
- Identify and Implement

Review Equipment and Operations

- Identify Aged/Inefficient Equipment or Old Technology
  - Grant money and low interest loans available
- Re-visit Current Operations

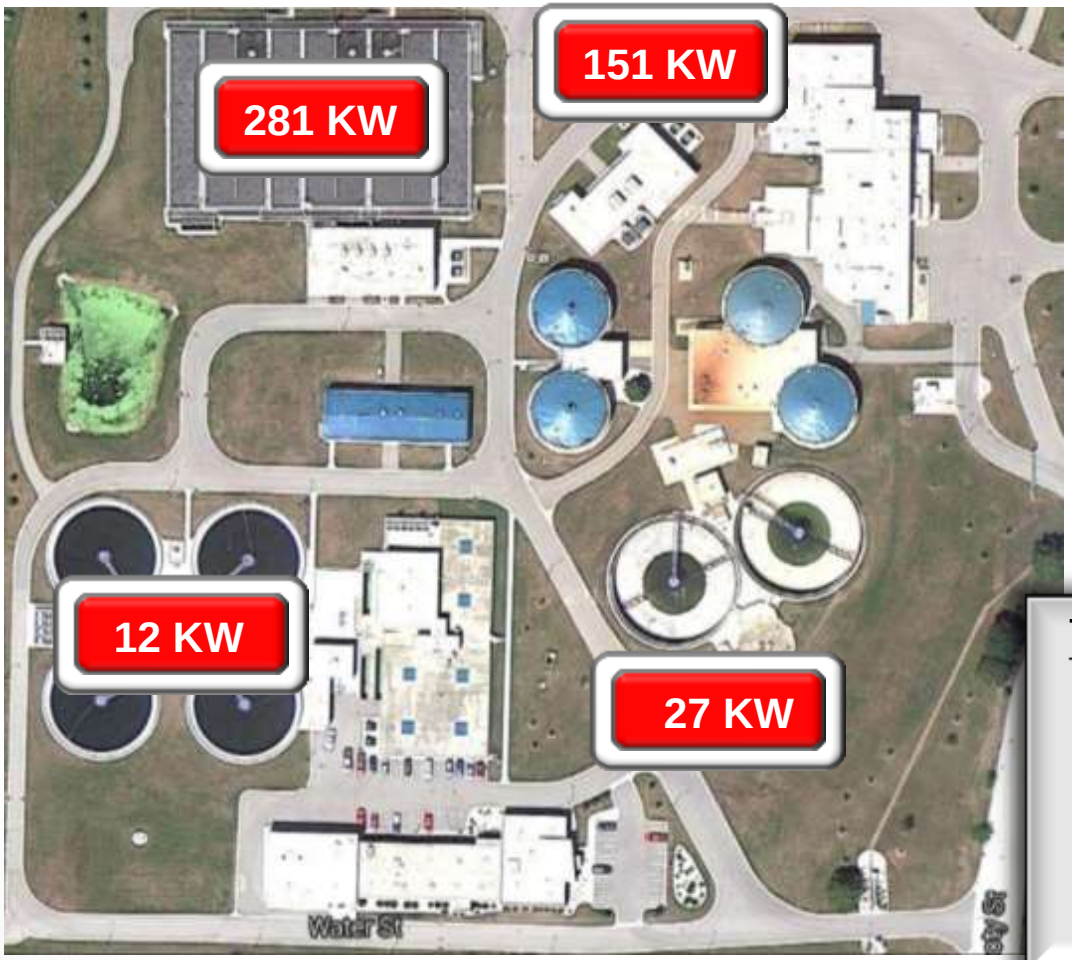
  “We’ve just always run it that way”
- Identify possibilities for Off-Peak operation
  - Thickening
  - Wasting
  - Flushing
  - Intermittent mixing
  - Transfer pumping
  - Filter backwashing

The Path to Energy Savings

- Educate
- Monitor and Record
- Review Equipment and Ops
- Identify and Implement

Review Equipment and Operations

- Analyze data from energy monitoring

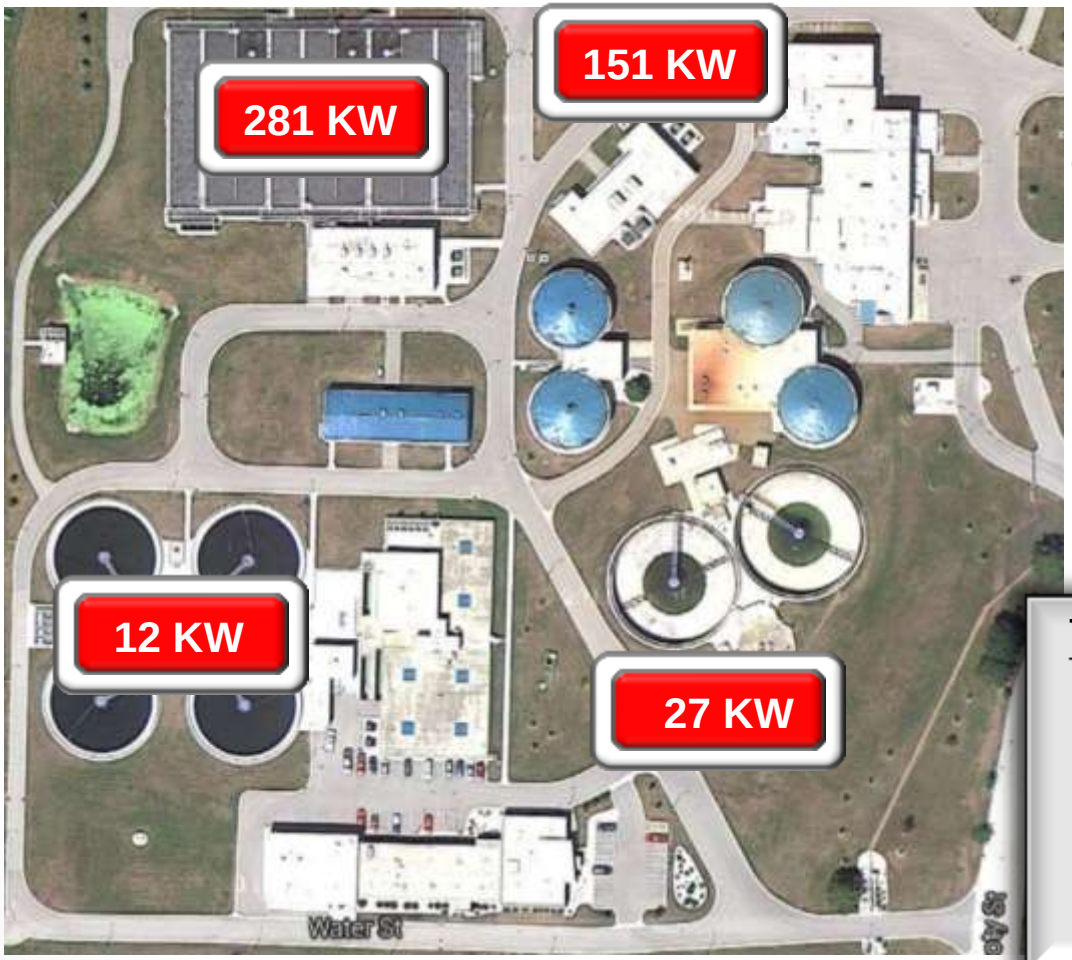


The Path to Energy Savings

- Educate
- Monitor and Record
- Review Equipment and Ops
- Identify and Implement

Identify and Implement

- Calculate savings



151 KW

Demand Reduction of 10%
15kW * 0.354/day * 30 days
=$160/month

27 KW

Change to Off-Peak Pumping
27kW * 8 hr/d * 30 d * $0.065/kWH
=$421/month

Total Savings
$581/month
$6,972/year

The Path to Energy Savings
- Educate
- Monitor and Record
- Review Equipment and Ops
- Identify and Implement

Identify and Implement

- Determine payback (grants/funding could shorten)
  - Power metering
    - $3,000 for metering per location => $12,000
  - Demand reduction

    $10,000 for new instrumentation, wiring, and programming

    $10,000 for engineering and contracting fees

    Total cost => $20,000
  - Off-peak pumping

    No cost – use existing control logic

Total cost = $32,000

Savings per year = $6,972

Simple payback = 4.6 years

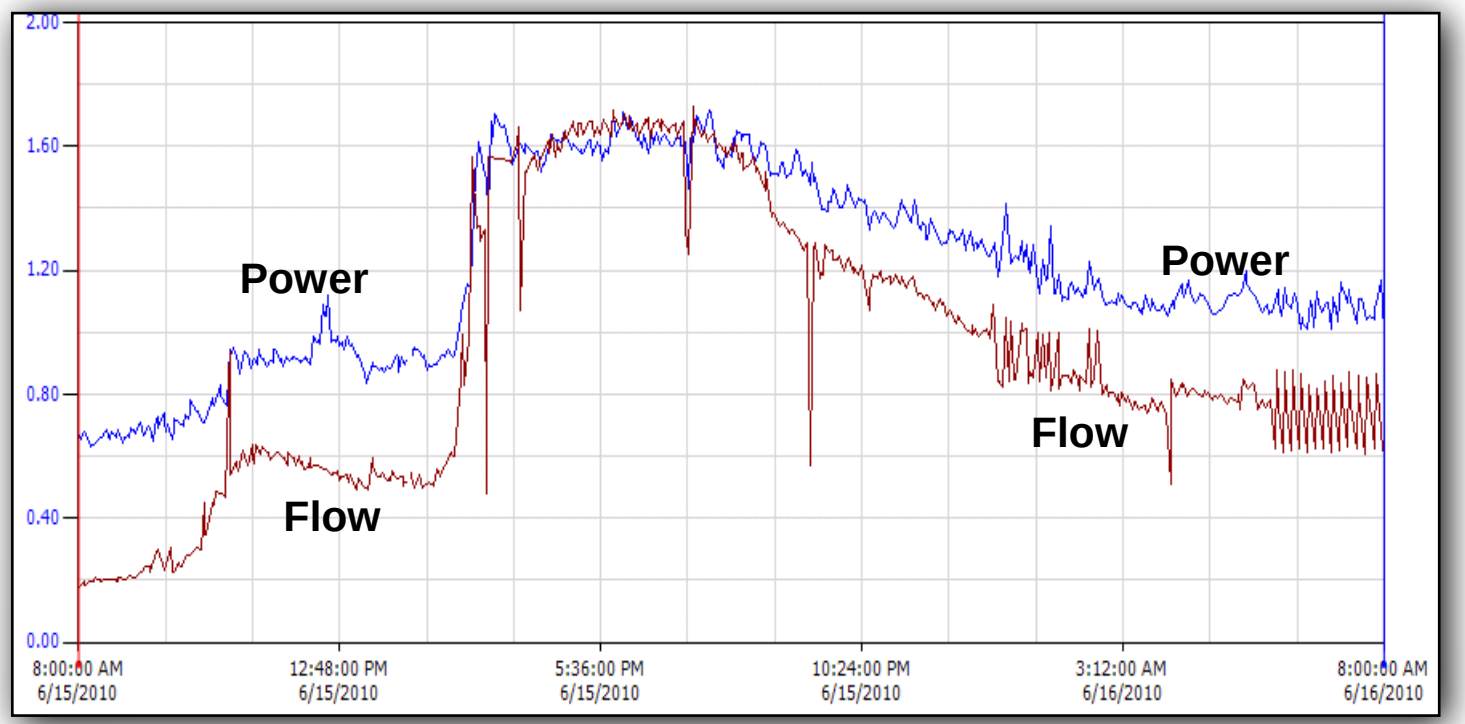
The Path to Energy Savings

- Educate
- Monitor and Record
- Review Equipment and Ops
- Identify and Implement

Methods to Reduce Energy Consumption

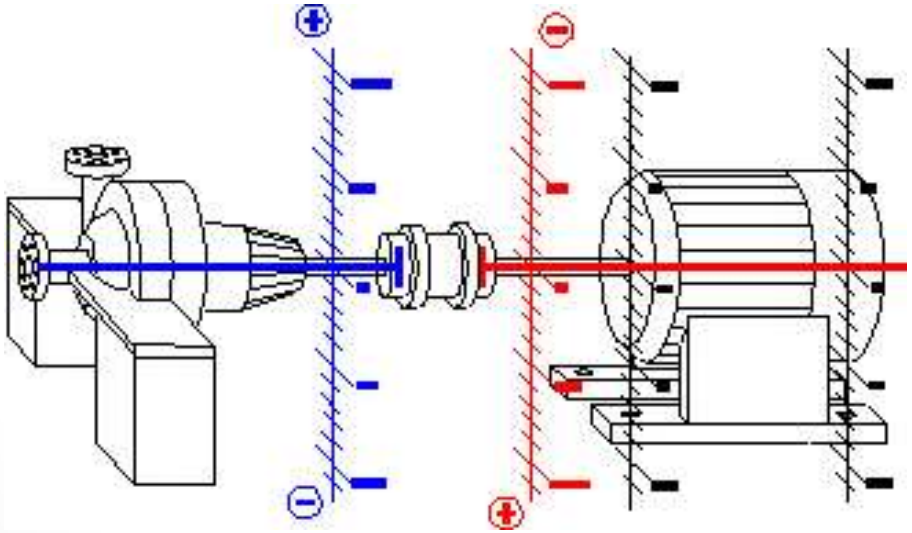
Review External Factors

- Inflow and infiltration
- Water conservation
  - Appliances, toilets, faucets, watering limitations
- Industrial/high usage customers



Maintain Equipment

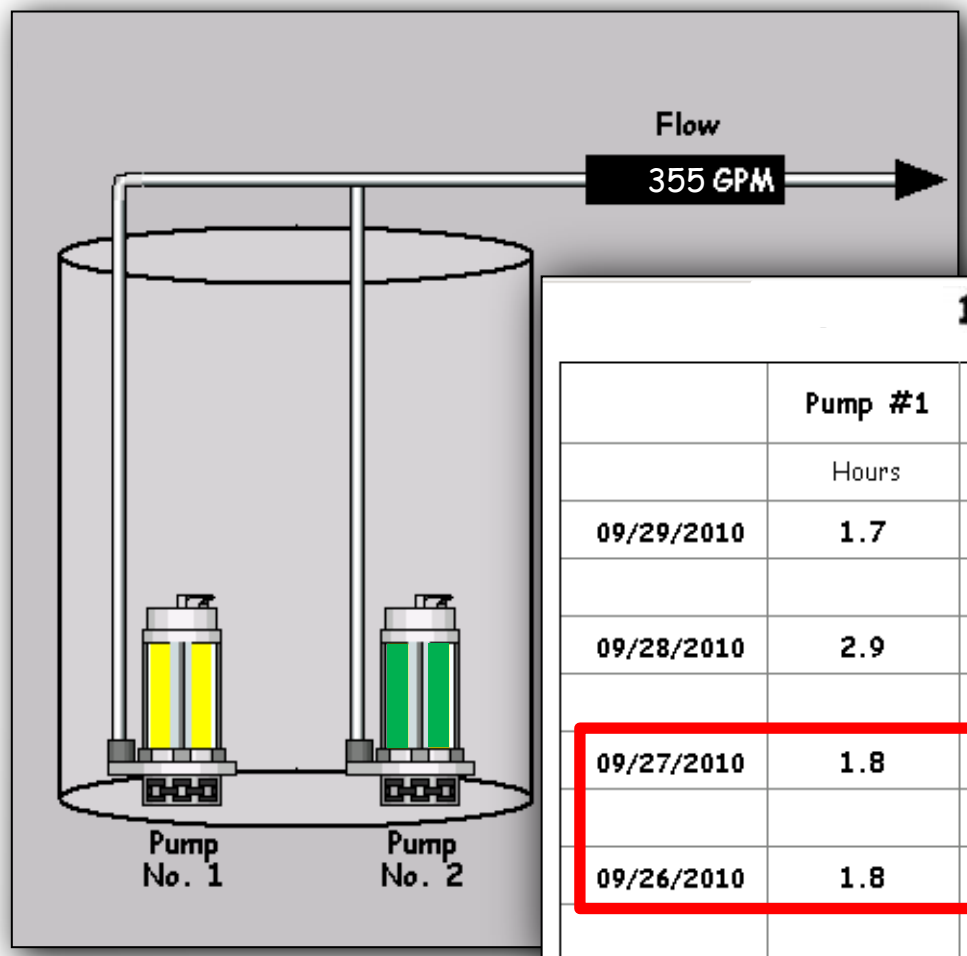
- Review Maintenance Program/Procedures
  - Equipment operating at design point
  - Equipment operating at intended efficiency
  - Excessive heat, vibration = wasted energy



Maximize Efficiency

- Monitor Pump Station Data

Site Data for 9/29/2010		
Flow	99.2	kGAL
Pump 1		
Runtime	1.7	Hrs.
Starts	17	Evts.
Pump 2		
Runtime	2.1	Hrs.
Starts	18	Evts.



10 Day Historical Data
22:46:30 09/29/2010

	Pump #1	Pump #1	Pump #2	Pump #2	Station Total
	Hours	kGAL	Hours	kGAL	kGAL
09/29/2010	1.7	46.9	2.1	52.2	99.2
09/28/2010	2.9	66.6	4.3	90.1	156.6
09/27/2010	1.8	49.9	2.2	53.3	103.1
09/26/2010	1.8	50.1	2.2	57.1	107.1

Utilize VFDs Where Practical

- Slower pumping rate reduces kW demand

Full Speed
270 kGAL (typ. Day)

Flow: 1275 GPM
Runtime: 3.5 hours
Power: 168 kW
Demand charge: $1784

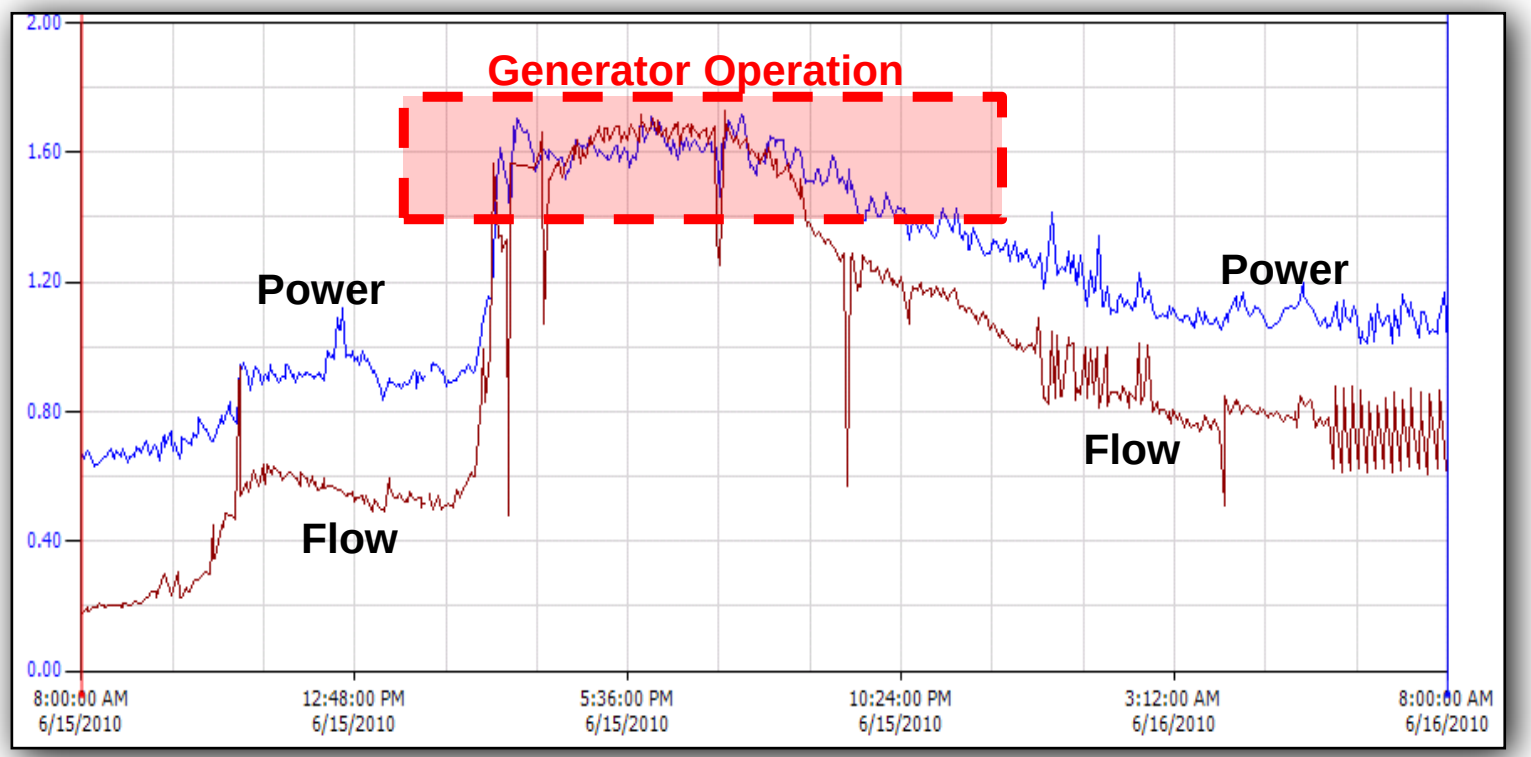
Reduced Speed
270 kGAL (typ. Day)

Flow: 935 GPM
Runtime: 4.8 hours
Power: 117 kW
Demand charge: $1242

Monthly Savings:$542 ($6504 annually)

Expand SCADA Capabilities

- Use SCADA and standby generators to reduce demand



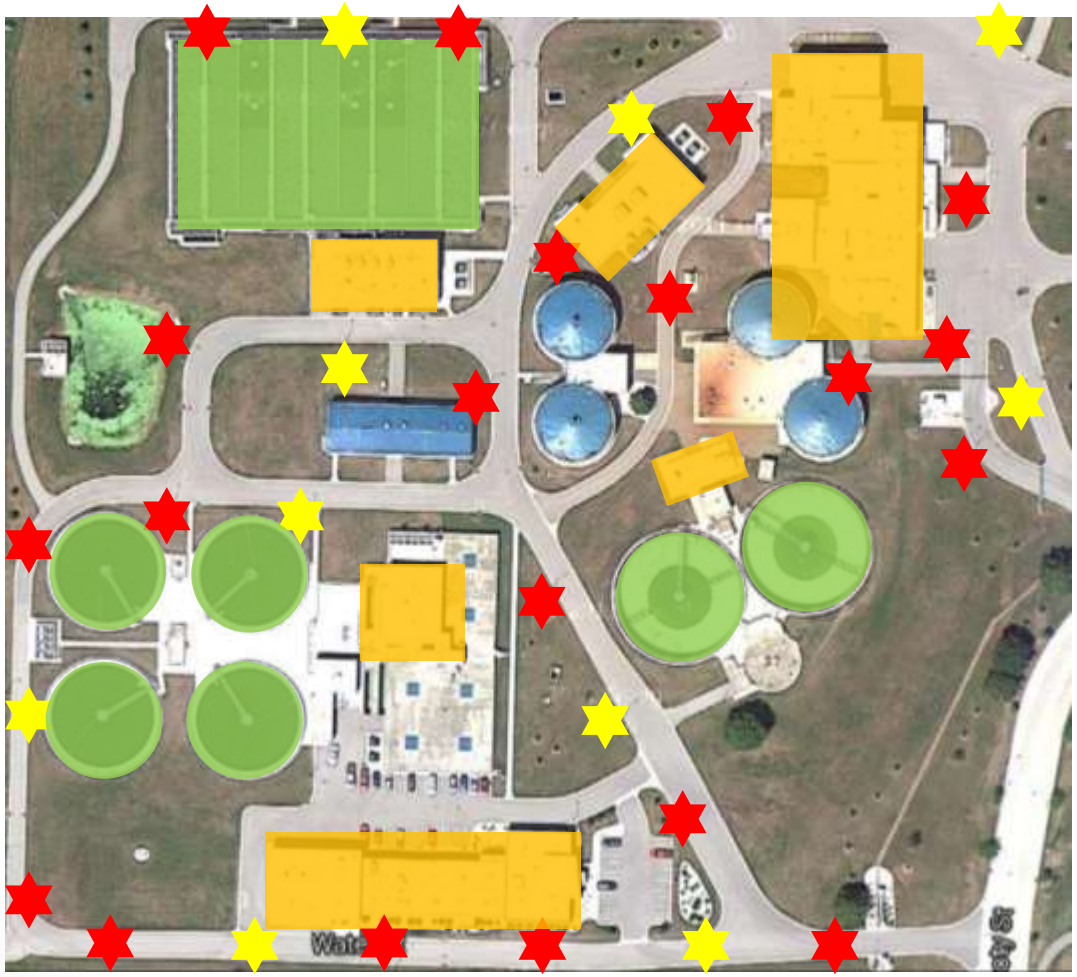
- Start at flow setpoint after time delay
- Stop at flow setpoint after time delay

Expand SCADA Capabilities

- Use SCADA as an energy management tool with LED lighting
  - Dual level switching
  - Dimming
  - Occupancy Sensors

Expand SCADA Capabilities

- Use SCADA to control facility site lighting



- Group A – Roadway 1
- Group B – Roadway 2
- Group C – Buildings
- Group D – Tanks

- Photocell
- Timeclock
- Both

Grant Money Available for Energy Projects

Federal, State, and Local Resources are Available

- Grants, incentives, and low interest loans

Wisconsin Focus on Energy

focus on energy℠
Partnering with Wisconsin utilities

- A partnership of all of Wisconsin's investor owned utilities (WPS, Excel, Alliant, WE, etc.), as well as most of the state's electric cooperatives and municipal utilities

- Unbiased information and technical assistance to participating utilities' electric and/or natural gas customers

- Provides financial incentives for energy-saving projects that would not occur otherwise

IPS

Wisconsin Focus on Energy

focus on energy℠
Partnering with Wisconsin utilities

- Assessment Incentive
  - Assists energy users in funding studies or assessments
  - FoE will pay 50% of assessment cost, up to $7,500

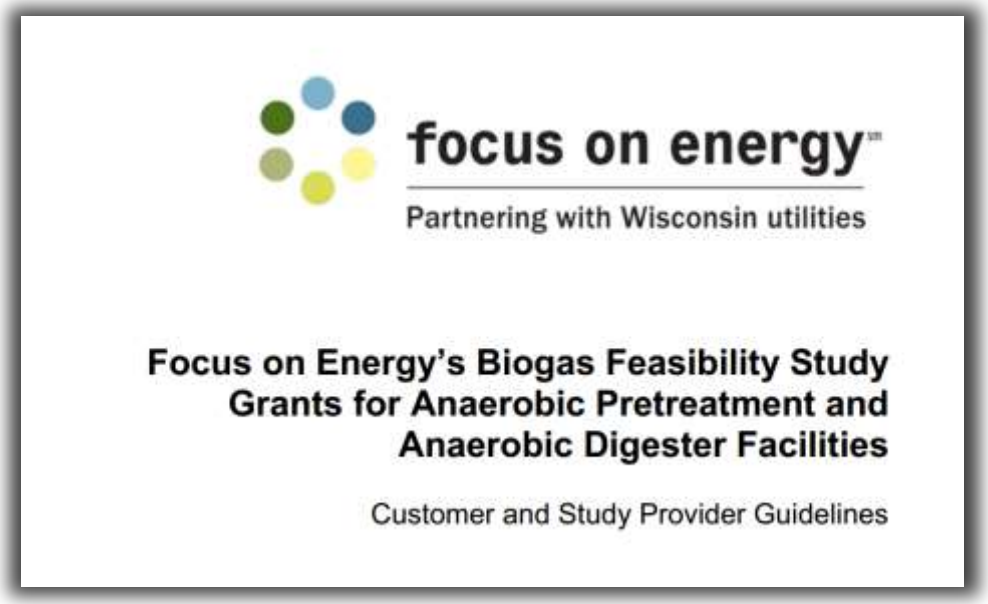
- Prescriptive Incentive
  - “Off-the-shelf” incentives
  - Lighting, HVAC, VFDs, boilers, compressors

- Custom Incentive
  - Special projects (e.g. blowers, heat recovery, digesters)
  - Maximum incentive of $200,000 per project

IPS

Wisconsin Focus on Energy

- Special Incentives
  - Vary per year



- Renewable Energy Competitive Incentive Program (RECIP)
  - Microturbines, biogas, biomass, geothermal, solar

Conclusion

Summary

- Understand how energy is consumed and become energy focused
- Implement energy monitoring
- Use SCADA as a tool for increased energy savings
- Utilize resources and funding currently available

Questions