

# WERF 2008 Web Seminar Series

## A Roadmap to Sustainable Energy Management: Every Journey Begins With a First Step

To Hear the Audio Portion of the Seminar:

Dial: 1-888-272-7337, ***Lines Open after 1:55 p.m.***  
(International Dial: 303-928-2688)

Enter Conference ID# 2148189

For Technical Assistance:

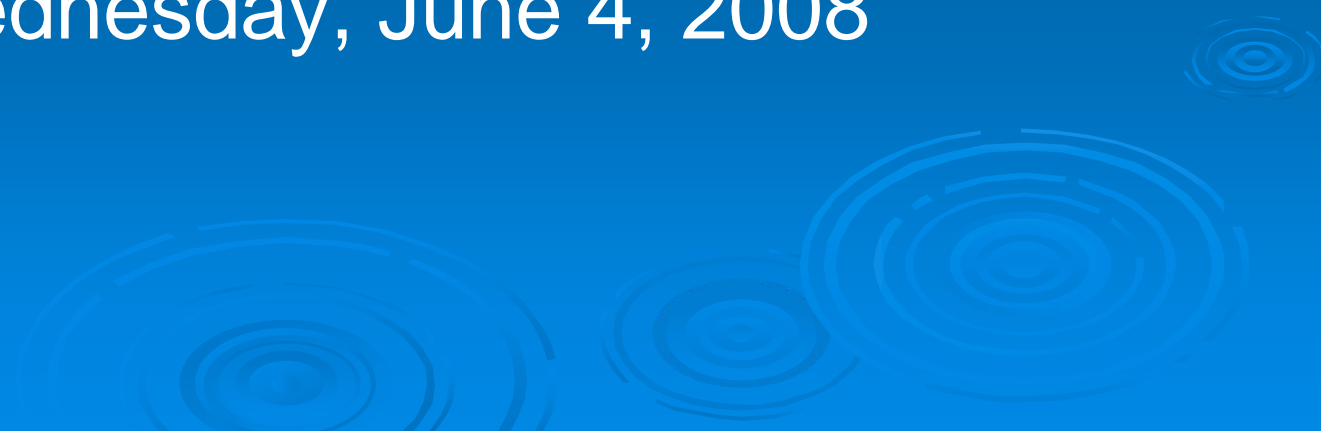
Press \*0 on your touchtone phone and Intercall support  
will assist you.



Water Environment Research Foundation  
*Collaboration. Innovation. Results.*

# A Roadmap to Sustainable Energy Management: Every Journey Begins with a First Step

Wednesday, June 4, 2008





Conference ID: 7601660

## To Submit Your Question:

Exit Fullscreen by clicking the computer icon at bottom left:

1. Click on 'Question & Answer'
2. Type your question into the 'Ask a Question' box

Speakers will address as many questions as possible

**Video (Off Air)**

No Video Available

ted ted

Video Options

**Participants (2)**

Participant Details

Event Coordinator

ted ted

**Meeting Features**

Meeting Information

**Question & Answer**

Chat

Audio Controls

Ask a Question

Ask a Question:

View Answers:

Submit Clear

# Today's Moderator



Lauren Fillmore  
*Program Director,  
Conveyance Systems*

[lfillmore@werf.org](mailto:lfillmore@werf.org)



Water Environment Research Foundation  
*Collaboration. Innovation. Results.*

# Agenda

- 2:00-2:05 Welcome & Introductions  
*Lauren Fillmore, WERF*
- 2:05-2:25 Managing to Maximize Energy Efficiency  
*Jim Horne, U.S. EPA*
- 2:25-2:35 Question & Answer Session
- 2:35-2:55 Energy Awareness in Wastewater  
Systems, *Joe Cantwell, SAIC*
- 3:15-3:25 Question & Answer Session
- 3:25-3:30 Future in Energy Management-  
Climate Change Research  
*Lauren Fillmore, WERF*
- 3:30 Wrap Up and Closing

# Jim Horne



- Jim has been at the U.S. EPA since 1980 and in the Office of Water since 1988.
- He has led efforts to help stakeholders adopt environmental management systems (EMS).
- Represented EPA on the U.S. working group that helped develop the ISO 14001 International Standard for EMS.

- Managed projects to train local governments to develop EMS, including WWTPs, public ports, solid waste operations, public works, and universities.
- Creation of a national clearinghouse of EMS information to assist public agencies adopt EMS ([www.peercenter.net](http://www.peercenter.net)).
- Creation of EMS guidance documents (EMS “toolbox”) and an *Energy Management Guidebook for Wastewater and Water Utilities*.
- Instrumental in the signing of an agreement between U.S. EPA and six national water and water associations in order to promote effective utility management .
- Jim has a Bachelors Degree from the University of Texas and a Masters Degree in Public Administration from the University of Washington.

A large, stylized water splash in shades of blue and white, centered on the slide. The splash is composed of many droplets and streams, creating a dynamic, circular shape.

# **Managing to Maximize Energy Efficiency— A Key to Sustainable Utility Operations**

## **Looking for Opportunities— Taking Action**

Jim Horne  
Office of Wastewater Management  
U.S. Environmental Protection Agency  
June 4, 2008





# Energy Use and Water Utilities

## **Water and Wastewater treatment represents about 3% of the nation's energy consumption**

- About \$4 billion is spent annually for energy costs to run drinking water and wastewater utilities
- Equivalent to approximately 56 billion kilowatt hours (kWh)
- Equates to adding approximately 45 million tons of greenhouse gas to the atmosphere

## **Energy represents the largest controllable cost of providing water or wastewater services to the public**

- 16,583 municipal treatment plants in the US
- Energy represents 25-30% of the total plant O&M
  - raw sewage pumping (12%), Aeration (25%), solid handling (30%), lighting, heating, AC and other (6%)
- As energy costs rise, operating costs rise





# Energy Reduction at Water Utilities

## Water and Energy Efficiency at Utilities =

- Reduced energy usage
- Reduced operating costs
- Reduced climate impacts / carbon footprint
- Sustainability of water infrastructure
- Save Water





# Why Focus on Management?

- Energy issues are here to stay and will only get more serious—no quick fixes!
- Individual projects are fine, but something is needed to pull it all together (a system)
- Systematic management will ensure continuing focus on energy efficiency
- The Plan-Do-Check-Act approach has worked in many different sectors
- Enables consistent, organized, and integrated management of utility operations





# Managing to Maximize Energy Efficiency

## Designed to help utilities:

- Systematically assess current energy costs and practices
- Set measurable performance improvement goals
- Monitor and measure progress over time

Uses a management system approach for energy conservation, based on the successful Plan-Do-Check- Act process [based on Environmental Management Systems (EMS)]

### Ensuring a Sustainable Future: An Energy Management Guidebook for Wastewater and Water Utilities

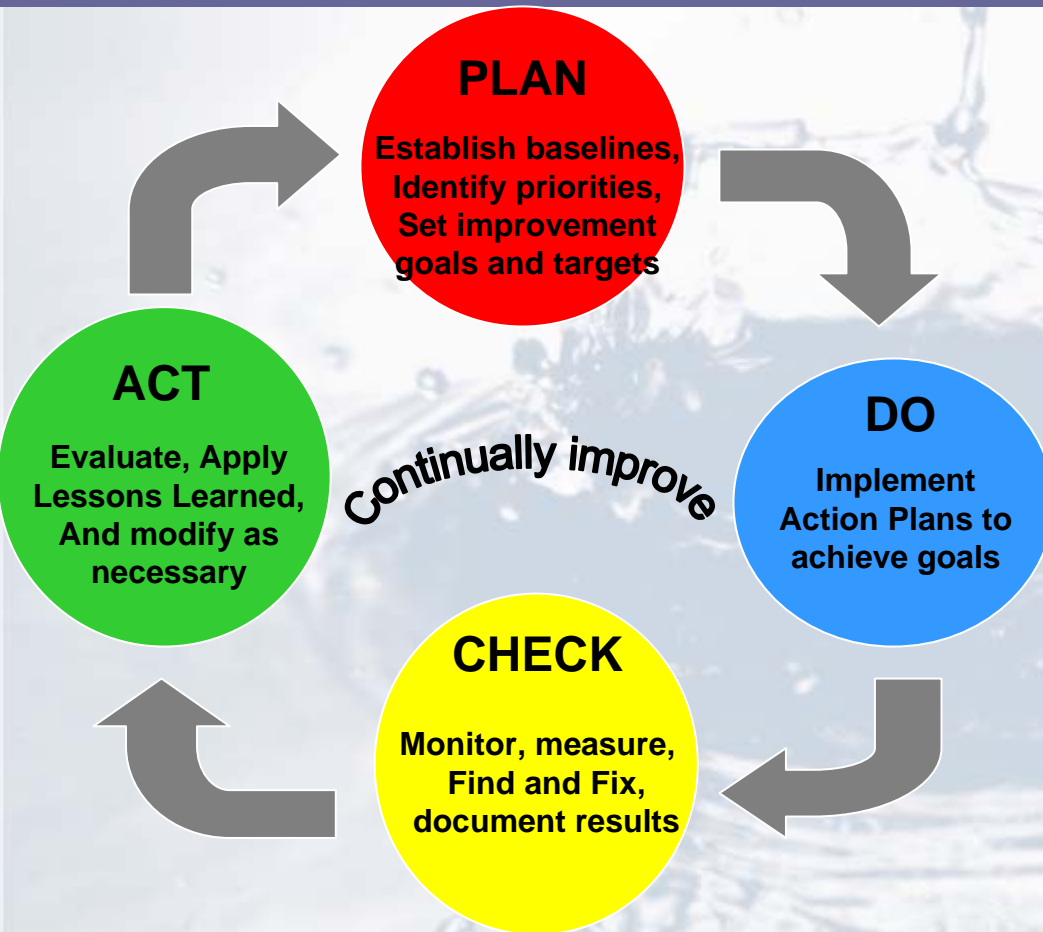


JANUARY 2008





# The Plan-Do-Check-Act Approach



- Allows utilities to systematically assess and manage energy opportunities and take action
- NOT a project—a system to manage for the long haul





# Guidebook Organized Around 4 Major Steps and Key Actions

- Establishing Your Energy Improvement Program
- Implementing Your Program
- Monitoring and Measuring Your Program
- Maintaining Your Program





# Step 1—Planning Your Program

## Key Steps Involve:

- Assessing current energy usage
- Determining scope of your program
- Setting priorities and establishing energy improvement goals and performance measures
- Securing management support





## Step 2: Implementing Your Program

### Key Steps Involve:

- Developing an action plan to meet your improvement goals (timeframes, roles and responsibilities, deadlines, etc.)
- Ensuring employees are properly trained
- Communicating your energy improvement goals and plans (internally and externally)
- Ensuring proper documentation of work instructions, manuals, and other operating controls





## Step 3: Monitoring and Measuring Your Program

### Key steps Involve:

- Determine what you need to monitor
- Review progress toward your energy goals and targets
- Take corrective action if progress is not being made





## Step 4: Maintaining Your Program

### Key Steps Involve:

- Ensure alignment of energy goals with overall utility goals
- Expand involvement of staff over time, as necessary
- Communicate success!





# Benchmarking Energy Use at Utilities

## Portfolio Manager – interactive energy management tool

- Helps utilities assess energy and water consumption:
  - Identify under-performing buildings
  - Set targets for energy improvement priorities
  - Verify efficiency improvements
  - Calculate its carbon footprint
- An important tool in establishing an energy management program



**Coming soon: Best Practices Guide** with examples of how energy-efficient technologies and practices can reduce energy use and save money.





# Where Do We Go From Here?

- EPA is sponsoring a number of workshops around the country
- 2 already conducted in New England
- 5 more planned for 2008
- Current Dates:
  - July 22 Kansas City
  - September 18 Worley, Idaho
  - October 14 Nashville, Tennessee
  - October 29 W. Lafayette, Indiana
  - November 20 Sacramento, California
  - December 4 Madison, Wisconsin





# Thank You

- More information is available at:

[www.epa.gov/waterinfrastructure/bettermanagement\\_energy.html](http://www.epa.gov/waterinfrastructure/bettermanagement_energy.html)

Jim Horne

EPA Office of Wastewater Management

202-564-0571 [horne.james@epa.gov](mailto:horne.james@epa.gov)



# Question & Answer Session

To ask our speakers a question, please follow the instructions on the next slide.



Conference ID: 7601660

## To Submit Your Question:

Exit Fullscreen by clicking the computer icon at bottom left:

1. Click on 'Question & Answer'
2. Type your question into the 'Ask a Question' box

Speakers will address as many questions as possible

The sidebar contains three main sections: 'Video (Off Air)', 'Participants (2)', and 'Meeting Features'. The 'Meeting Features' section is expanded, showing 'Meeting Information', 'Question & Answer', 'Chat', and 'Audio Controls'. A red circle with the number '1' is placed over the 'Question & Answer' link.

The dialog box has a title bar 'Ask a Question' and two main text areas: 'Ask a Question:' and 'View Answers:'. A red circle with the number '2' is placed over the 'Ask a Question:' text area. At the bottom, there are 'Submit' and 'Clear' buttons.

# Joe Cantwell, P.E.

- Mr. Cantwell is the leader of the Water/Wastewater Cluster for Wisconsin's Focus on Energy Industrial Program at Science Applications International Corporation (SAIC). The program promotes energy efficiency and renewable energy.
- Joseph is a licensed professional engineer in Wisconsin and Colorado, with more than 30 years experience in water/wastewater engineering.
- His experience includes facility planning, design, construction management, operation and maintenance manual development, start up assistance, and user charge system development.
- As leader for the Water/Wastewater Cluster, he has surveyed numerous facilities to identify, assess, and present energy efficiency modifications which facilities could use to reduce their energy consumption.
- He is the primary author for the Water/Wastewater Best Practices Manual.

# Energy Awareness in Wastewater Systems

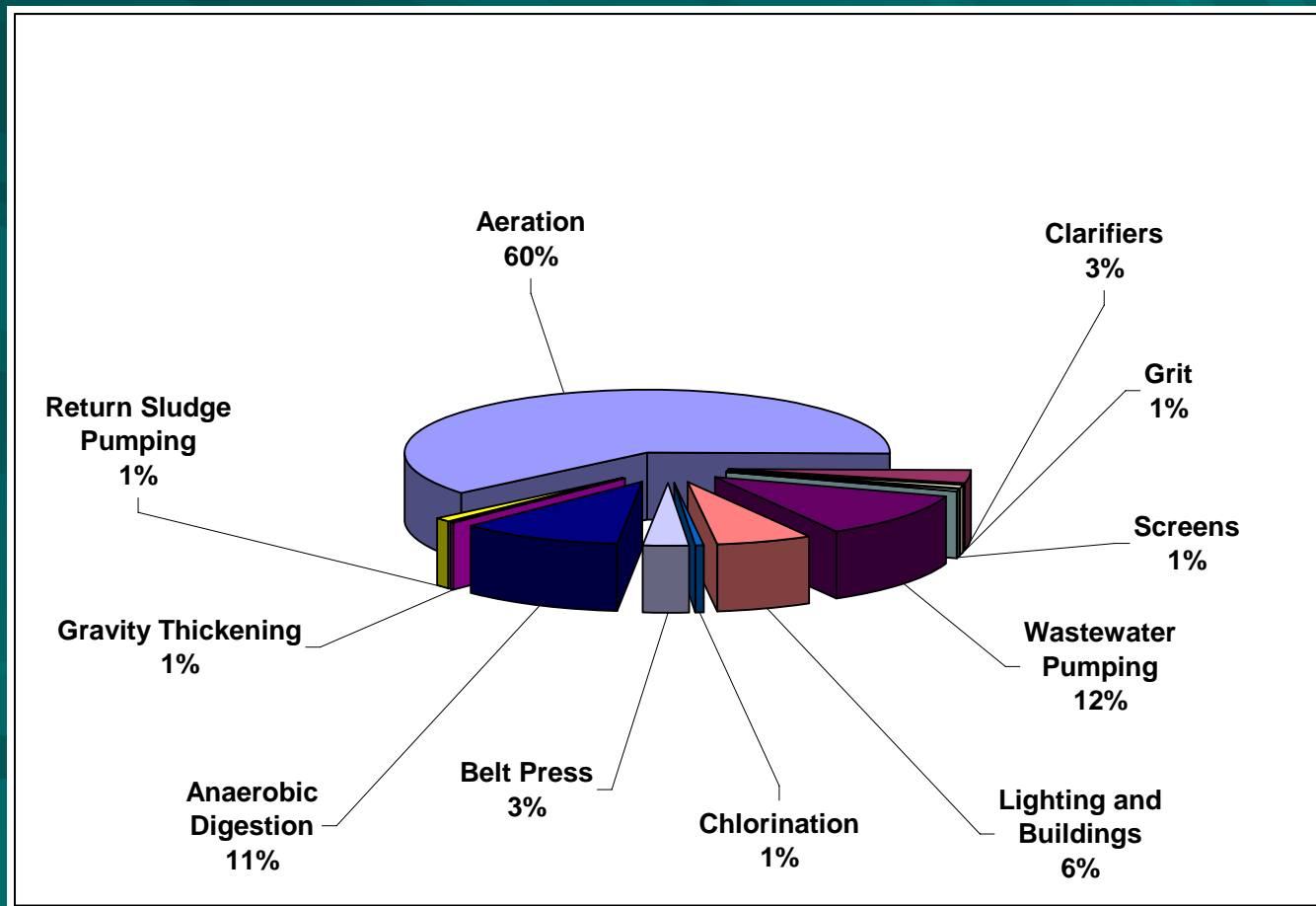
WERF

*June 4, 2008*

Joseph Cantwell, P.E.

# Electricity Requirement for Typical Activated Sludge Facilities

(WEF)



# Energy Baseline

Find out where you're at  
(baseline)...

...so you can figure out where  
you want to go  
(benchmark).

# Assessment Approach

- Obtain and Review Energy Bills
- Explore Major Energy Uses
- Address Facility Operations
- Assess Level of Interest of Facility
- Meet with Operations Personnel
- Address Cooperation to Implement



# Data to Gather

- Energy Bills
- Size of Treatment Units
- Design Memorandum
- Influent Information
- Effluent Limits
- Site Input
- Equipment Size and Operational Data
- Maintenance Prone Equipment

# Basic Assessments

- Plot energy consumption and demand
- Percent loading – components and systems
- Variability of process equipment
- Variation in loading hourly/daily/weekly
- Distribution of energy consumption
- Obtain Amp, Watt or DO readings
- Meet and review operations with site personnel

# Obtain & Understand Your Electric Bill

- Energy charges
- Demand charges
- Fixed charges
- Power Factor chrgs

**A SAMPLE CG-20 TIME-OF-USE ELECTRIC BILL**

Wisconsin Public Service Corporation  
Member of AWP Resources Corporation

ACCOUNT NUMBER: 000000    BILL DATE: 03/23/2004    BILLING PERIOD: 03/23/2004    AMOUNT DUE: \$1,368.80

WISCONSIN PUBLIC SERVICE CORP  
PO BOX 18054  
GREEN BAY WI 54307-9004

CUSTOMER: CG-20 000000  
GREEN BAY WI 00000-0000

Conservation Information: 01/28/2004 to 02/27/2004 was 11% warmer than last year.

KWH USED	SMPS	CONSUMPT	HTS DES DAYS	EMVOTS	DEE DAY
21882	22	846.0	1347	29.1	29.1
26682	28	874.2	1317	19.4	19.4
26682	29	874.9	1348	18.7	18.7

Statement of Your Account

Beginning Amount	.00
Energy Charges/Credits	885.78
Monthly Charges	60.00
System Demand Charges	343.22
Customer Demand Charges	79.80
<b>Total Amount Due 03/23/2004</b>	<b>\$ 1,368.80</b>

**Detailed Explanation**

DESCRIPTION	AMOUNT
<b>COML AND IND ELEC</b>	
CG-20	
Reading 03/23/2004	24197
Reading 01/29/2004	-23851
	346
Water Credits	x .80 = 60960
KWH Used	87,680
<b>Energy Charges/Credits</b>	
On Peak	9,410 KWH at \$ 0.4682
Off Peak	18,270 KWH at \$ 0.2347
<b>Total Energy Charges/Credits</b>	<b>885.78</b>
<b>Monthly Charges</b>	
Customer Charge	48.00
Non-Tax Cust Chg	12.00
<b>Total Monthly Charges</b>	<b>60.00</b>
<b>System Demand</b>	
Peak	03/28/2004 17:45
63 KW x \$5.446	= 343.22
<b>343.22</b>	
<b>Base</b>	
63 KW x \$ 5.06	
<b>Total System Demand</b>	<b>343.22</b>
<b>Customer Demand</b>	
12 Month Maximum Demand	79.80
12/29/2003 17:50	79.80
<b>Total Customer Demand</b>	<b>79.80</b>
<b>Total Electric Charges</b>	<b>1,368.80</b>
<b>STATEMENT SUMMARY FOR ACCOUNT 00000</b>	
Previous Balance 01/26/2004	\$1,282.32
Payments 02/13/2004	\$1,142.00 CR
Beginning Amount	\$ 136.32
Electric Service	\$1,368.80
<b>Total Amount Due 03/23/2004</b>	<b>\$1,368.80</b>

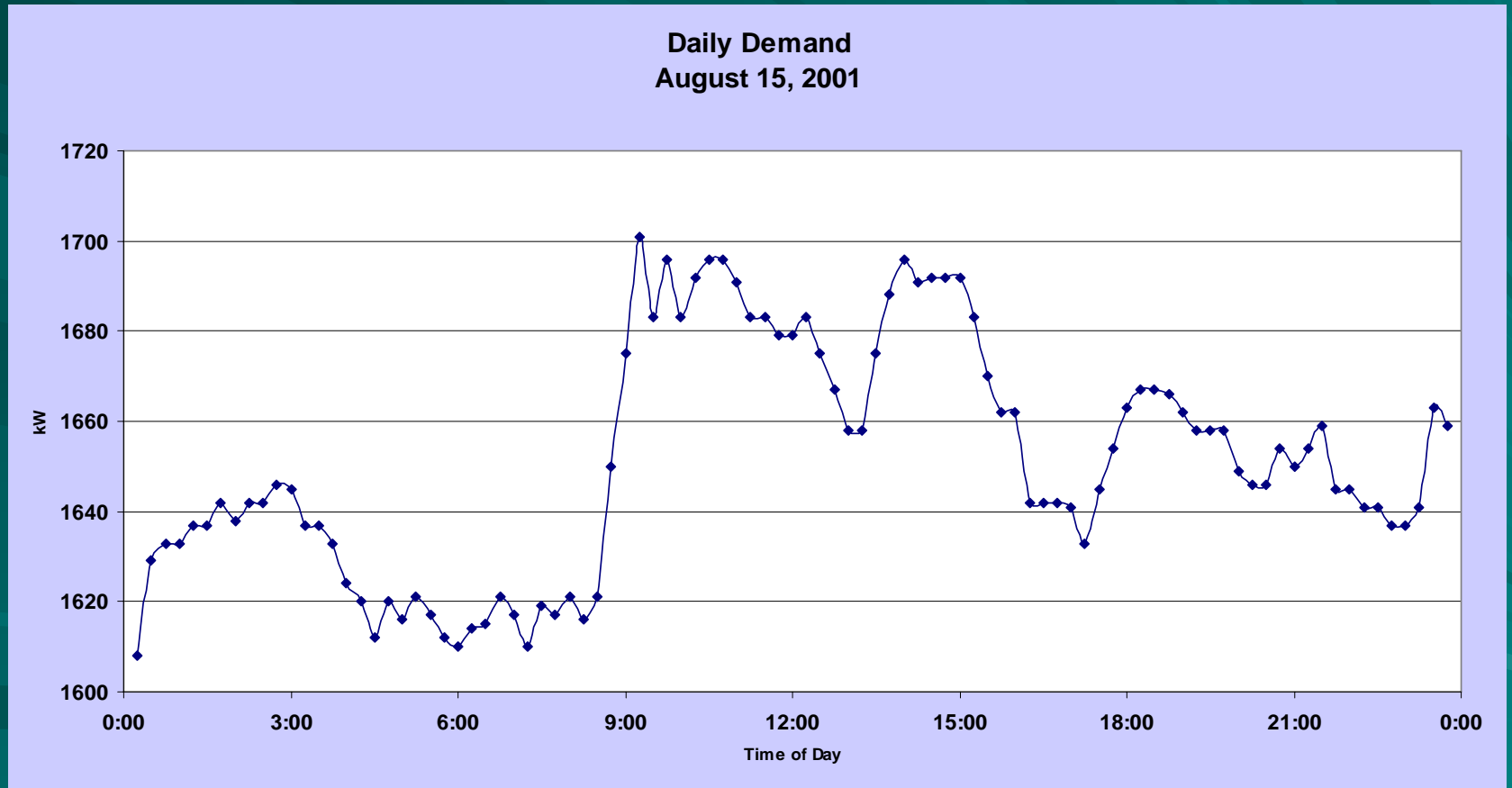
The prior 12 months of electric and/or gas consumption data is available for your account(s) upon request. Contact Wisconsin Public Service Corporation at the phone number provided on top of this bill.

ACCOUNT NUMBER: 000000    NAME: CUSTOMER

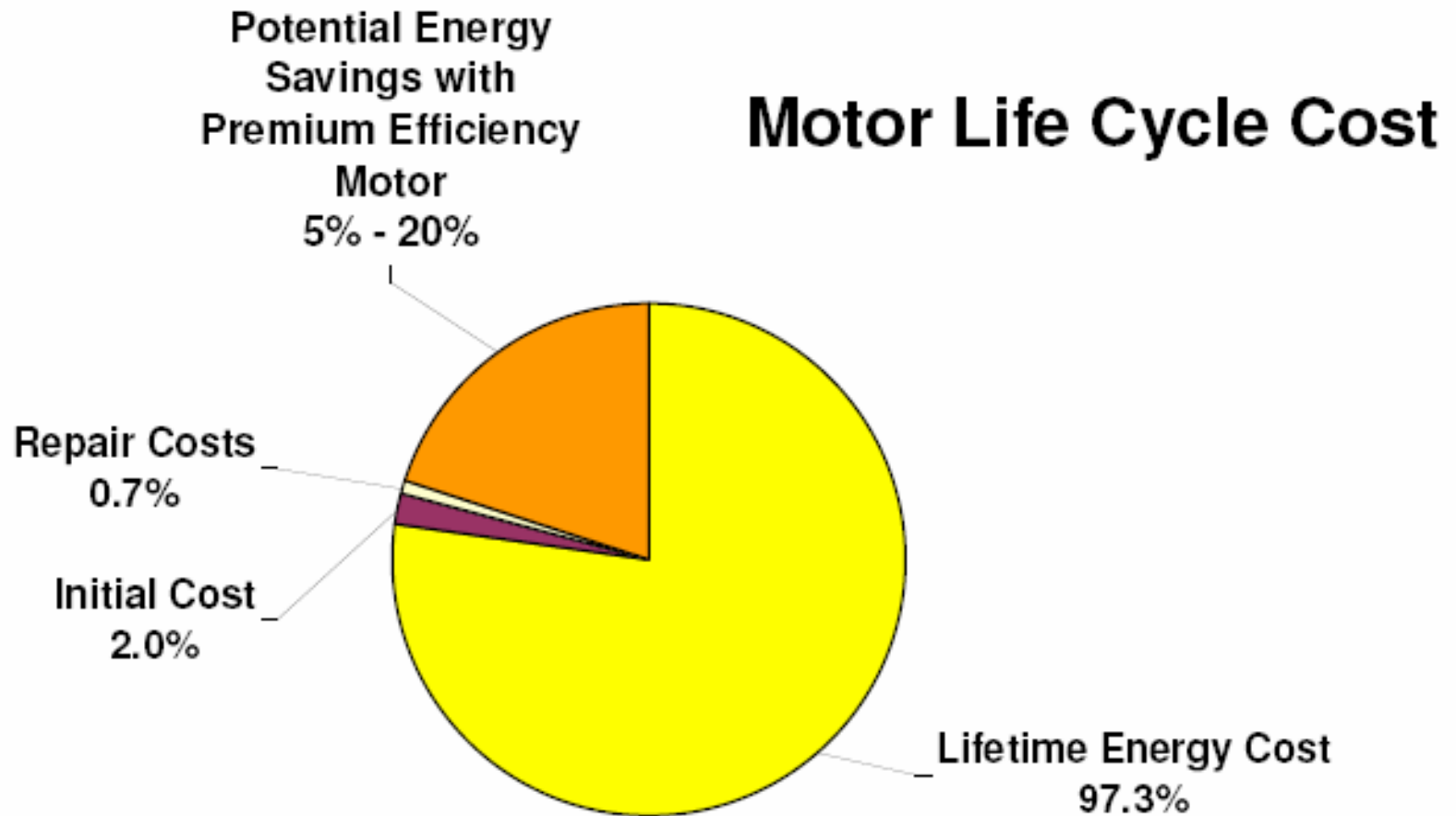
Public Service  
AWP Resources Company  
www.wisconsinpublicservice.com

Know what your bill means and how to adjust your use to optimize savings and operations

# Understand Electric Demand

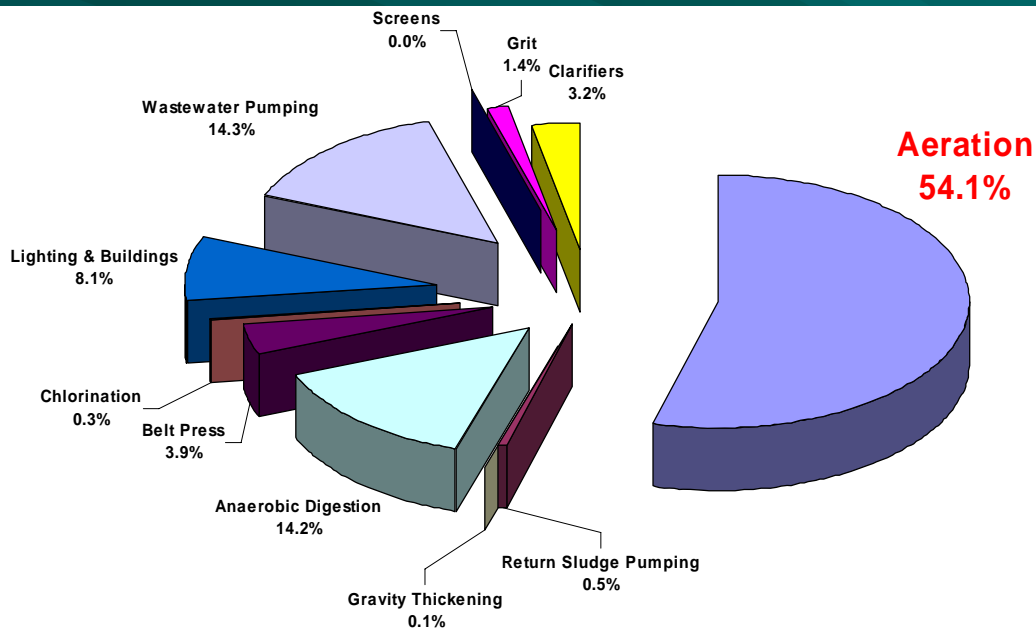


# Motor Energy Costs – Very High Percent



# Energy Intensive Processes - Aeration

## Aeration



### Electricity Requirements for Activated Sludge Wastewater

Derived from data from the Water Environment Energy Conservation Task Force *Energy Conservation in Wastewater Treatment*

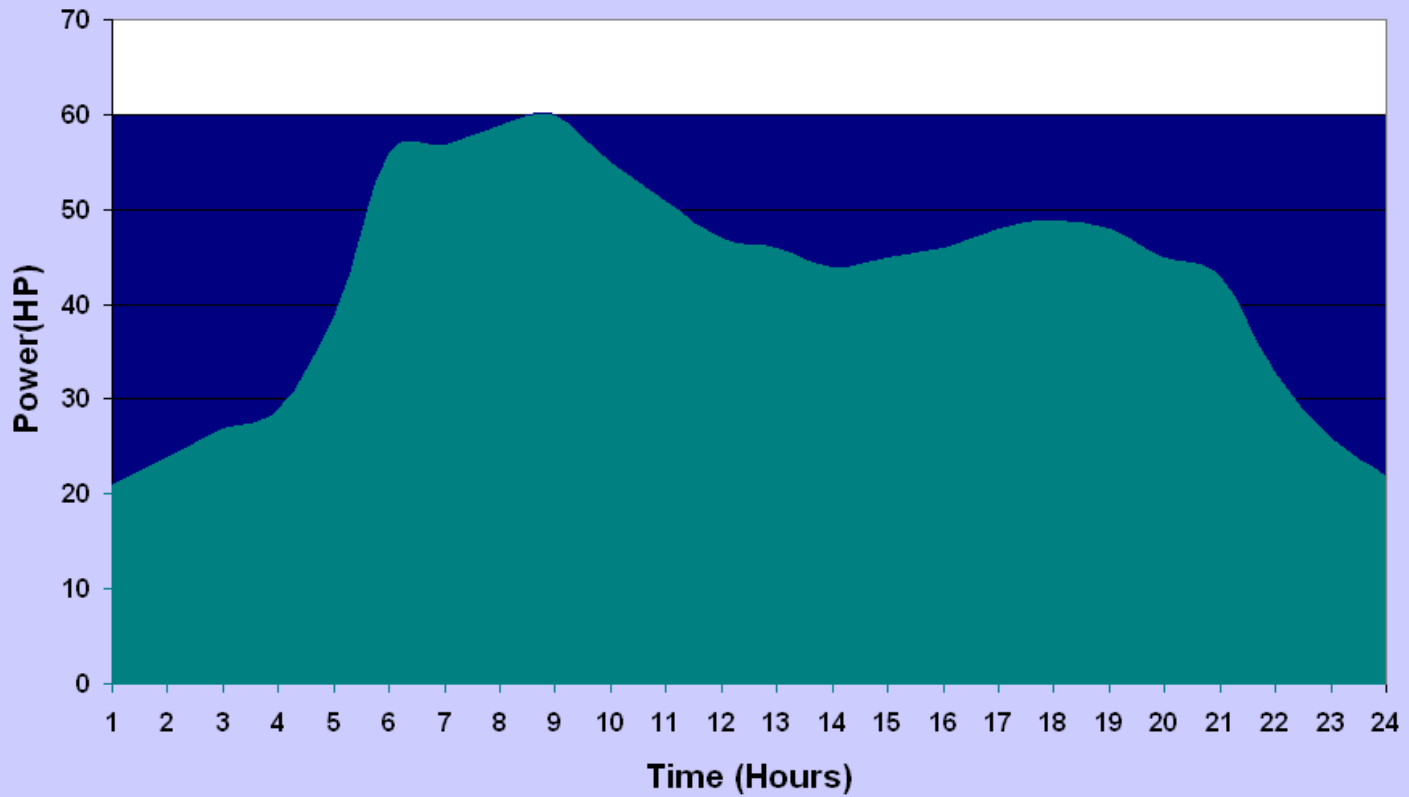
- Organic treatment
  - BOD
  - Ammonia
- Mixing
- Number of diffusers
- Airflow rate relative to blower size
- Variable airflow rate to meet demand

# Energy Savings from DO Management

Actual	Setpoint	Savings	
DO	DO	Fraction	%
2	2	-	-
3	2	1/8	12.5
4	2	2/8	25
5	2	3/8	37.5
6	2	4/8	50
7	2	5/8	67.5
8	2	6/8	75

# Aeration

## Energy Utilization



# Recent Trends in Aeration

- Away from mechanical systems
- Toward fine-bubble, full-floor systems
- General movement away from porous-media
- Movement toward fine-bubble flexible membrane diffuser systems
- Movement toward higher density fine-bubble layouts for increased energy efficiency

# Aeration

## EXAMPLE – AERATION CONTROL PARAMETER

1. Aeration Tank Volume:  $50 \text{ ft} \times 250 \text{ ft} \times 18 \text{ ft} = 225,000 \text{ ft}^3$
2. Floor Area:  $50 \text{ ft} \times 250 \text{ ft} \times 0.125 \text{ cfm/ft}^2 = 1,563 \text{ cfm (Mixing)}$
3. Code (air rate capability)@  $20 \text{ cfm/1000 ft}^3 = 4,500 \text{ cfm (Mixing)}$
4. Organic Loading:  $(3.5 \text{ MGD}) \text{ BOD} = 4,500 \text{ lb/day} \ \& \ \text{NH}_3 = 625 \text{ lb/day}$   
 $(4,500 \text{ lb/day} \times 1.1 \text{ lbO}_2/\text{BOD} \times \text{ft}^3/0.0172 \text{ lbO}_2/\text{ft}^3\text{air} \times \text{day}/1440 \text{ min})/0.20_{\text{eff}} = 1,000 \text{ cfm}$   
 $(625 \text{ lb/day} \times 4.6 \text{ lbO}_2/\text{lbNH}_3 \times \text{ft}^3/0.0172 \text{ lbO}_2/\text{ft}^3\text{air} \times \text{day}/1440 \text{ min})/0.20_{\text{eff}} = 580 \text{ cfm}$

$$1,000 \text{ cfm} + 580 \text{ cfm} = 1,580 \text{ cfm}$$

# Aeration

## EXAMPLE – AERATION CONTROL PARAMETER

**Organic Loading Controlled @ 1,580 cfm:**

$$1,580\text{cfm @}8.5\text{ psi} = 75\text{ hp} \times (0.746\text{ kWh/hp}/0.90_{\text{eff}}) \times 8,760\text{ hr/yr} \times \$0.07/\text{kWh} = \$38,120/\text{yr}$$

**Mixing (use 20 cfm/1000 ft<sup>3</sup>)**

$$4,500\text{cfm @}8.5\text{ psi} = 200\text{hp} \times (0.746\text{ kWh/hp}/0.90_{\text{eff}}) \times 8,760\text{ hr/yr} \times \$0.07/\text{kWh} = \$101,650/\text{yr}$$

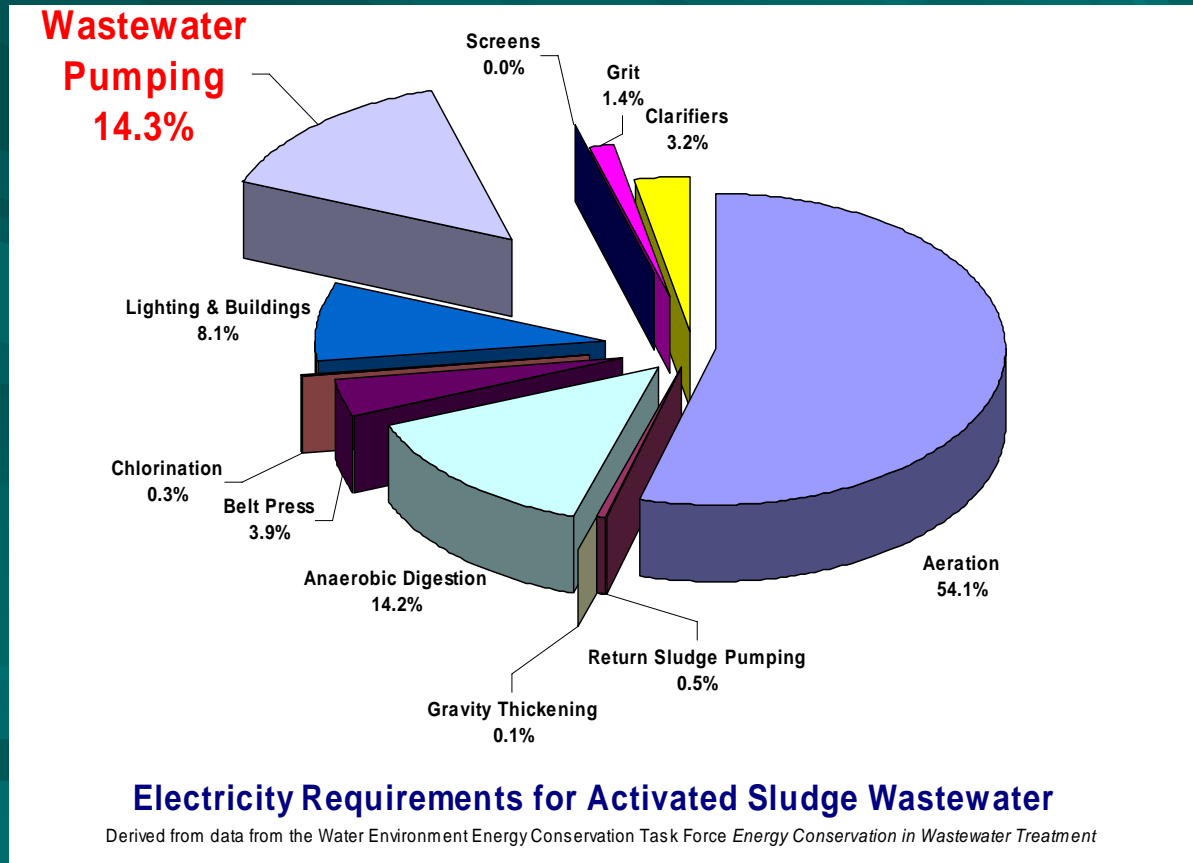
**SAVINGS = \$63,530/yr**

# Aeration

## LESSON

For the highest energy value choose the option that maximizes the lbs O<sub>2</sub> transferred/hp-hr

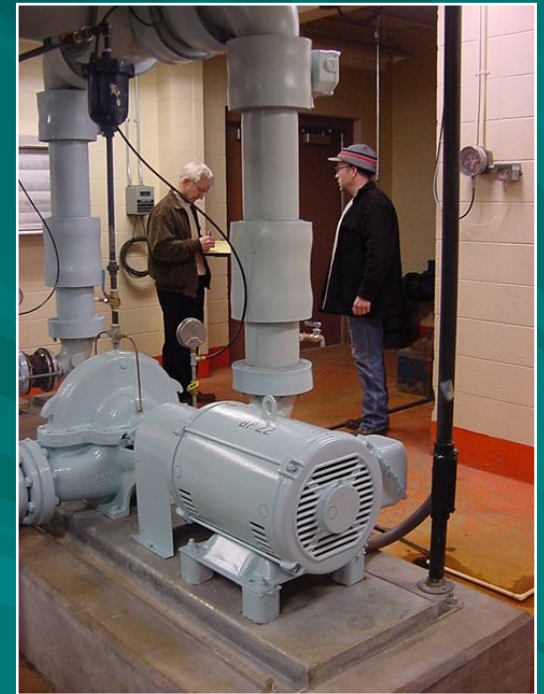
# Energy Intensive Processes - Pumping



# Pumping

## Pumping Assessment

- Pump performance curve
- Drive (if applicable)
- Motor specifications
- Design information
- Amp draw (field-measured)
- Existing flow conditions
- Discussion with operations personnel
- System components
  - Static
  - Dynamic – conveyance configuration



# Pumping

Evaluation of 1,690 pumps at 20 process plants:

- Average pumping efficiency is below 40%
- Over 10% of pumps run below 10% efficiency
- Major factors affecting pump efficiency:
  - Throttled valves
  - Pump over-sizing
- Seal leakage causes highest downtime and cost



# Pumping

## Pump System Efficiency

	Range of Efficiency	Low	Ave	High
Motor	85-95	.85	.9	.95
Drive	20-98	.20	.6	.98
Pump	30-85	.30	.6	.85
Efficiency of System		.05	.32	.80

**5 to 80%**

# Pumping

## Saving Energy thru Pump Best Practices

- **M**otor
- **D**rive
- **P**ump
- Valve throttling
- Poor selection
- Changing application
- Incomplete assessment



# Pumping

Energy saving opportunities in pump systems  
ARE available.

Check out the Hydraulic Institute's  
Pump Systems Matter web site:

[www.pumpsystemsmatter.org](http://www.pumpsystemsmatter.org)

# Solids Handling

## Energy Saving Opportunities

### Aerobic Digestion

- Flexible membrane fine-bubble diffusers
- Reduced air demand
- Higher O<sub>2</sub> volume delivered
- Longer “rest” times have been practical
- Mixing system modifications

# Solids Handling

## Energy Saving Opportunities

### Anaerobic Digestion

- Improve mixing
- Strategize operating temperature
- Thicken biosolids before feeding digester
- Direct feed high organic strength wastes
- Utilize volume of digester
- Beneficially utilize biogas

# Solids Handling

## Example of Anaerobic Digester

Assume: 4,500 ppd of TSS to be processed at 2% solids

Question: What does thickening do?

$$4,500 \text{ ppd} / 0.02 = 225,000 \text{ lb} = 27,000 \text{ gal}$$

$$4,500 \text{ ppd} / 0.04 = 112,500 \text{ lb} = 13,500 \text{ gal}$$

Therefore, 112,500 lb saved/day

$$112,500 \text{ lb/day} \times 1 \text{ Btu/}^\circ\text{F/lb} \times (98^\circ\text{F} - 50^\circ\text{F}) = 5,400,000 \text{ Btus}$$

$$5,400,000 \text{ Btus} / 100,000 \text{ Btu/therm} = \mathbf{54 \text{ therms}}$$

$$\mathbf{54 \text{ therms/day} \times 365 \text{ days/yr} \times \$1/\text{therm} = \mathbf{19,700 \text{ \$/year}}$$

# Solids Handling

## Example of Anaerobic Digester, cont'd

Improve VSS destruction:

$$4,500 \text{ ppd TSS} \times 0.60 \text{ VSS} \times 0.40(\text{destroyed}) = 1,080 \text{ lb}$$

$$4,500 \text{ ppd TSS} \times 0.60 \text{ VSS} \times 0.60(\text{destroyed}) = 1,620 \text{ lb}$$

$$\text{Additional VSS reduced} = 540 \text{ lb}$$

$$540 \text{ lb}_{\text{VSS}} \times 14 \text{ ft}^3_{\text{biogas}}/\text{lb}_{\text{VSS}} \times 650 \text{ Btu}/\text{ft}^3_{\text{biogas}} = 4,914,000 \text{ Btu}/\text{day}$$

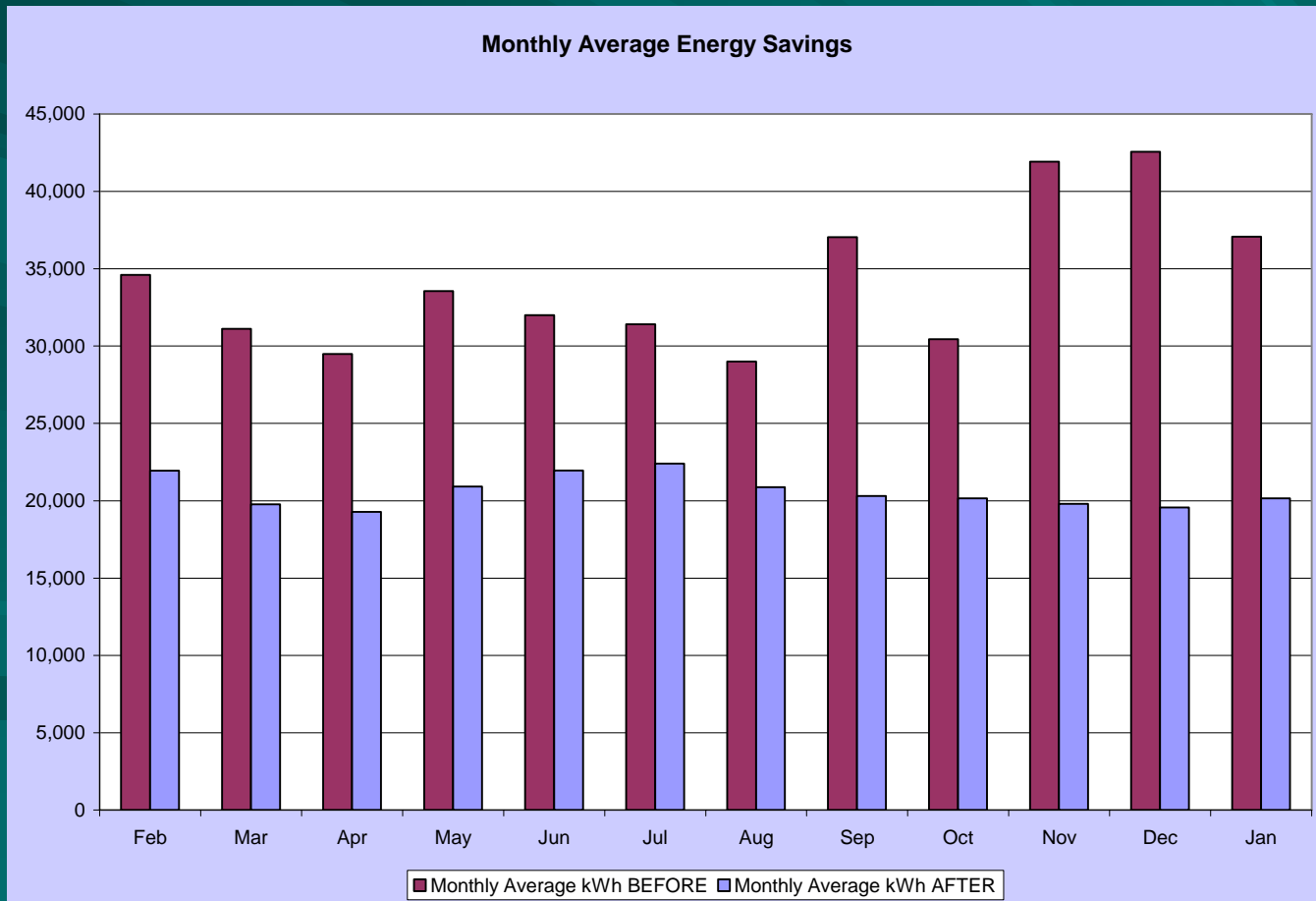
$$4,914,000 \text{ Btu}/\text{day} \times 1 \text{ therm}/100,000 \text{ Btu} = \mathbf{49 \text{ therms}/\text{day}}$$

$$49 \text{ therms}/\text{day} \times 365 \text{ days}/\text{yr} \times \$1/\text{therm} = \mathbf{17,900 \text{ \$/year}}$$

$$\mathbf{\text{TOTAL SAVINGS: } 19,700 \text{ \$/year} + 17,900 \text{ \$/year} = 37,600 \text{ \$/year}}$$

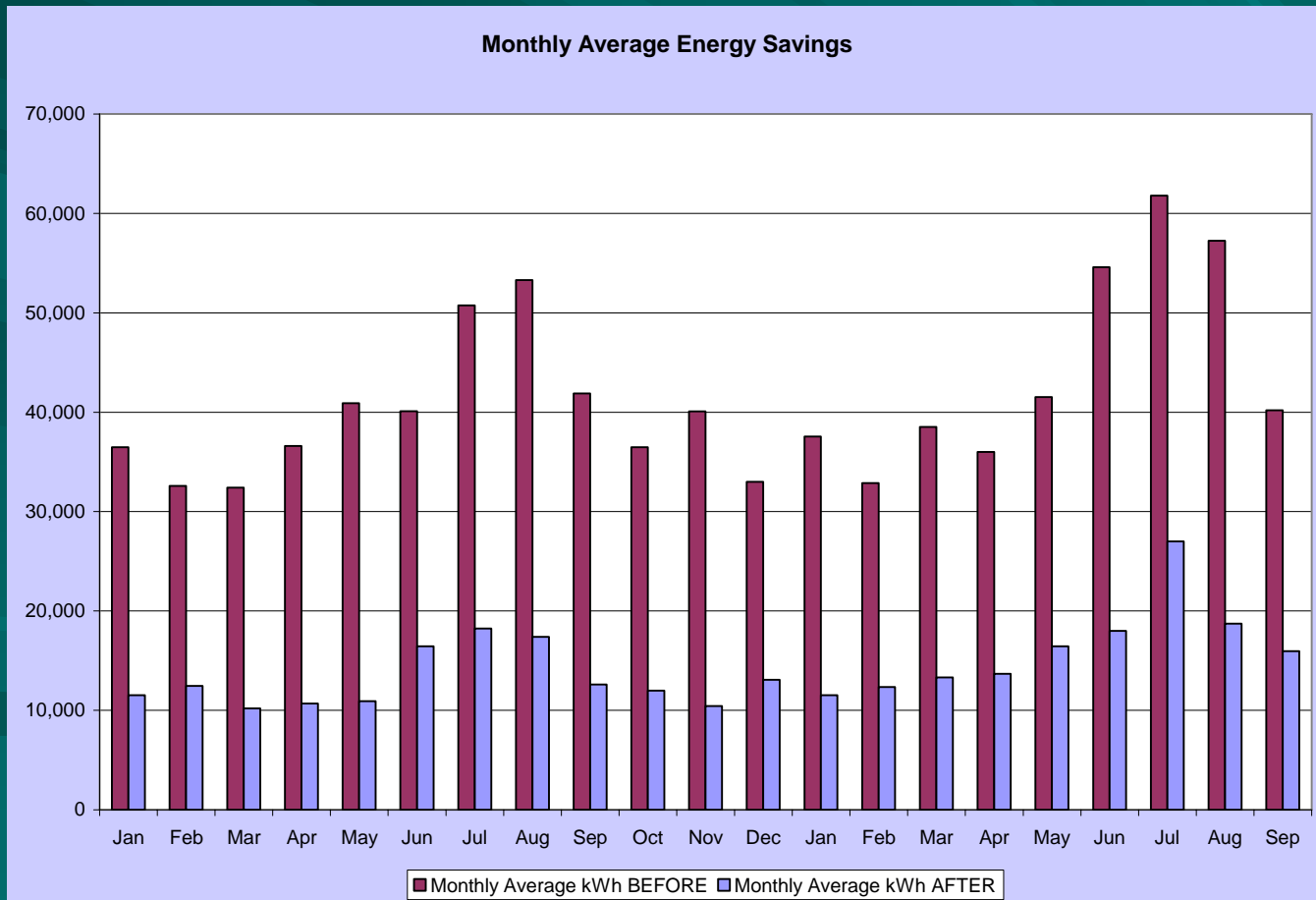
# Energy Savings Obtained Through Installed Projects

- Eagle Lake



# Energy Savings Obtained Through Installed Projects

- Northern Moraine



# Challenges to Implementation

- Not mandated, why do it?
- It works, why fix it?
- Why should it be my job to save energy?
- I don't see my utility bills.
- I don't understand my utility bills.
- I want to maintain a DO of 5-7 in case my loading suddenly increases.
- Competition with other investments.
- EE viewed as a one-time action.

# Water and Wastewater Energy Best Practice Guidebook

Provided By:



Funding for this guidebook was provided by Focus on Energy. Focus on Energy is a public-private partnership offering energy information and services to energy utility customers throughout Wisconsin. The goals of this program are to encourage energy efficiency, use of renewable energy, enhance the environment and ensure the future supply of energy for Wisconsin.

Prepared by:

**Science Applications International Corporation  
(SAIC)**

December 2006

This guidebook in whole is the property of the State of Wisconsin, Department of Administration, Division of Energy, and was funded through the FOCUS ON ENERGY Program.

**Characteristics of Wisconsin Wastewater Treatment Facilities  
Served by Focus on Energy**

# General Facility Energy Best Practices

## # TITLE

---

- 1 Facility Energy Assessments
- 2 Real Time Energy Monitoring
- 3 Energy Education for Facility Personnel
- 4 Electric Peak Reduction
- 5 Manage Electric Rate Structure
- 6 Idle or Turn Off Equipment
- 7 Install High Efficiency Motors
- 8 Variable Speed Technologies
- 9 Optimize Pump System Efficiency
- 10 Comprehensive Planning Before Design
- 11 Design Flexibility for Today and Tomorrow
- 12 Renewable Energy Options

# Wastewater Treatment Energy Best Practices

#	TITLE
---	-------

- 
- |    |  |
|----|--|
| 1  | Variable Frequency Drive Applications  |
| 2  | Reduce Fresh Water Consumption         |
| 3  | Optimize Flow with Controls            |
| 4  | Operational Flexibility                |
| 5  | Staging of Treatment Capacity          |
| 6  | Manage for Seasonal/Tourist Peaks      |
| 7  | Flexible Sequencing of Tank Use        |
| 8  | Recover Excess Heat from Wastewater    |
| 9  | Cover Basins for Heat Retention        |
| 10 | Optimize Aeration System               |
| 11 | Fine-Bubble Aeration                   |
| 12 | Aerobic Digestion Options              |
| 13 | Biosolids Processing Options           |
| 14 | Biosolids Mixing Options: Aerobic      |
| 15 | Variable Blower Air Flow Rate: Aerobic |
| 16 | Dissolved Oxygen Control: Aerobic      |
| 17 | Biosolids Mixing Options: Anaerobic    |
| 18 | Ultraviolet (UV) Disinfection Options  |
| 19 | Final Effluent Recycling               |

# What We Learned with Focus

- Energy Awareness – Management
- Knowledge of energy use is critical
- Energy efficiency w/o impact to effluent limits
- Significant savings available
- Designers need to become aware of value
- Savings are long-term
- Publicize the need for energy efficiency
- Need to develop more EE training



# Energy Awareness Leader

## What Should I Do?...

- Perform a facilities assessment
- Identify your baseline
- Identify and assess your EE opportunities
- Develop your benchmark
- Identify an internal energy advocate
- Secure management commitment
- Develop a continuous EE program

# What is YOUR next step ?

What can YOU achieve?

**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 <sup>10</sup>
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 <sup>11</sup>	3,540	51%
Oxidation Ditch	< 1.2	6,895	< 4,000 <sup>12</sup>	4,320	37%

**IF YOU HAVE QUESTIONS,  
PLEASE CONTACT:**

**Joseph Cantwell, P.E.**

**SAIC**

**1845 Derrin Lane**

**Brookfield, WI 53045**

**Tel: (262) 786-8221**

**Fax: (262) 786-5925**

**cantwellj@saic.com**



# Question & Answer Session

To ask our speakers a question, please follow the instructions on the next slide.



Conference ID: 7601660

## To Submit Your Question:

Exit Fullscreen by clicking the computer icon at bottom left:

1. Click on 'Question & Answer'
2. Type your question into the 'Ask a Question' box

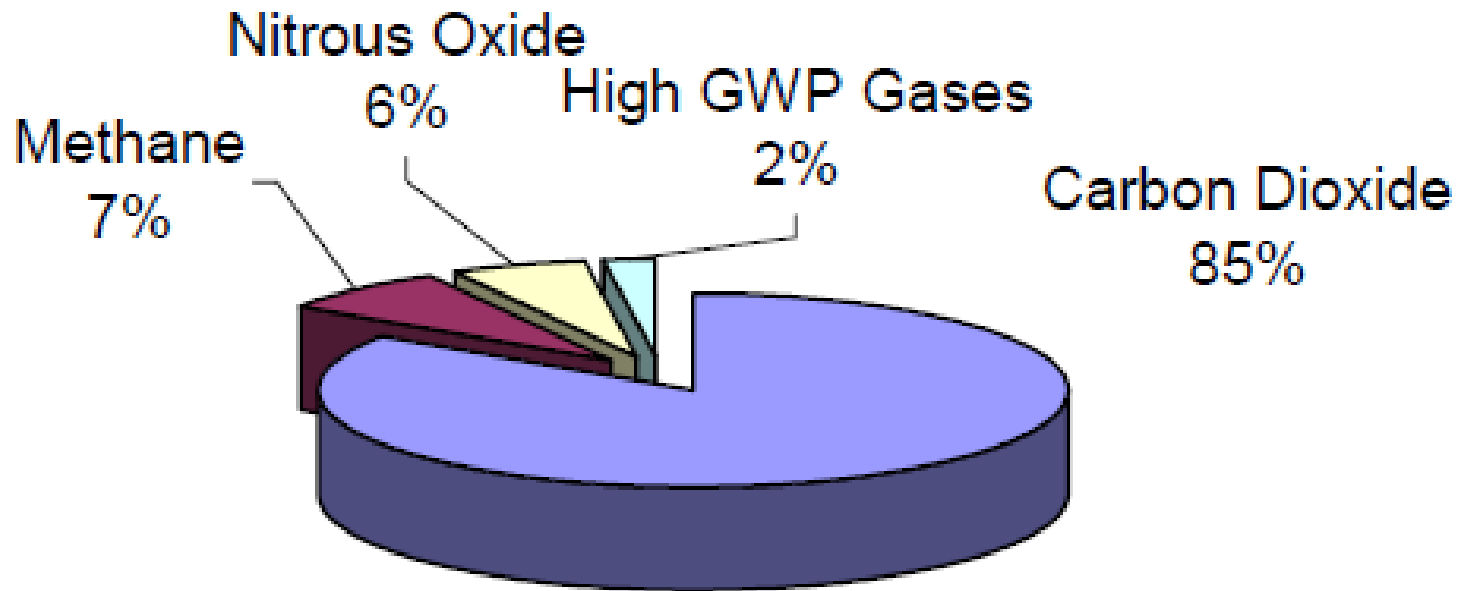
Speakers will address as many questions as possible

The sidebar contains three main sections: 'Video (Off Air)', 'Participants (2)', and 'Meeting Features'. The 'Meeting Features' section is expanded, showing 'Meeting Information', 'Question & Answer', 'Chat', and 'Audio Controls'. A red circle with the number '1' is placed over the 'Question & Answer' link.

The dialog box has a title bar 'Ask a Question' and two main text areas: 'Ask a Question:' and 'View Answers:'. A red circle with the number '2' is placed over the 'Ask a Question:' text area. At the bottom, there are 'Submit' and 'Clear' buttons.

# Climate Change – GHG Emitted Nationwide – All Sources

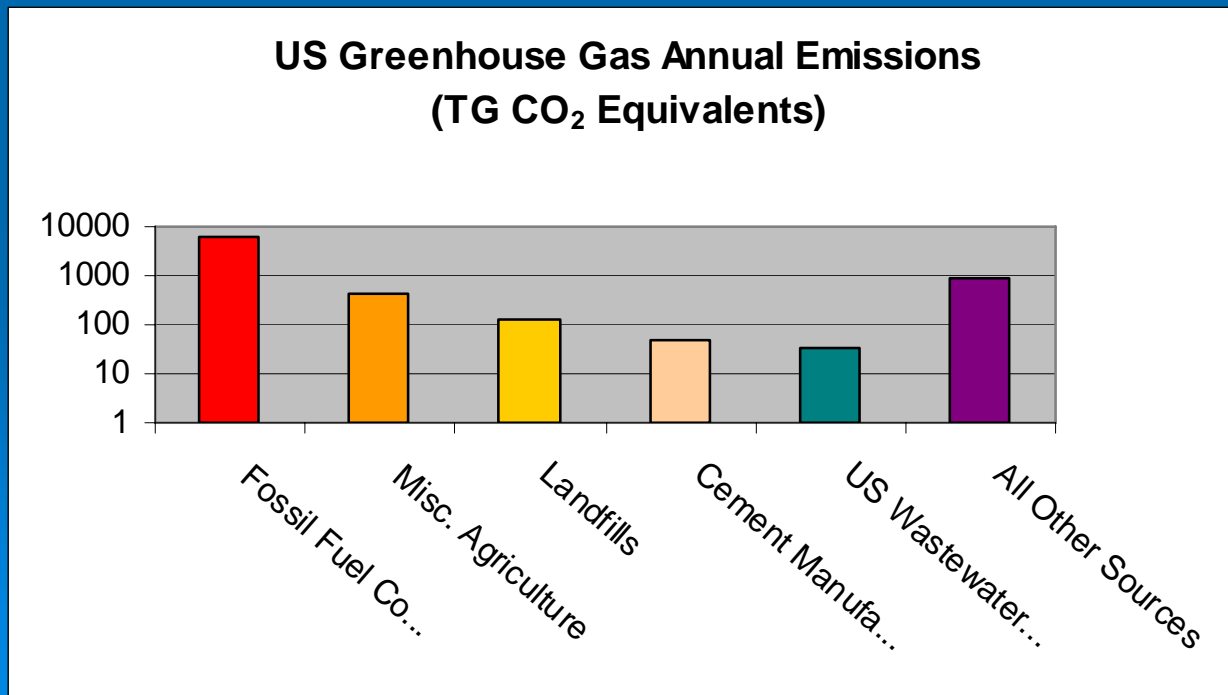
## EPA National GHG Distribution



Source: CH2M-Hill and LACSD

# Climate Change Potential

- Key greenhouse gases from wastewater treatment are methane and  $N_2O$ .
- Methane has 21 times and  $N_2O$  has 310 times the warming potential of  $CO_2$ .



# Climate Change Challenge

- Understand the likely impacts of climate change, including impacts on water quality, wastewater services and costs
- Obtain methods, processes, tools, and information for effective planning and operations of wastewater services under climate change



# Climate Change Challenge

## ➤ Mitigation

- Identify and reduce GHG emissions
- Under the Optimization Challenge:
  - Energy efficiency and management
  - Renewable energy utilization



# Climate Change Challenge

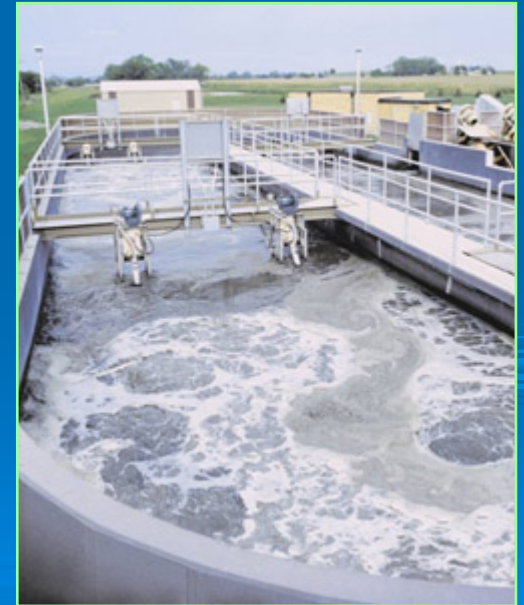
## ➤ Adaptation

- Minimize impacts due to changing hydrologic and climatic conditions
- Make decisions on capital improvements in the face of climate uncertainty
- Communicate management approaches and costs



# Climate Change Challenge

- Characterize Impacts to Wastewater Industry
  - order of magnitude cost projections under different scenarios
- Toolbox/Guidance/Clearinghouse Information on Climate Change
  - Collaboration with AwwaRF
- Develop Model for N<sub>2</sub>O Emissions from Nitrification/Denitrification processes



For additional information, please contact:

Lauren Fillmore

lfillmore@werf.org

Phone: (703) 684-2470

Fax: (703) 299-0742

635 Slaters Lane

Suite 300

Alexandria, VA 22314

www.werf.org

**WERF**  
Water Environment Research Foundation

HOME | ABOUT WERF | CONTACT US | SITE MAP | LOGIN | MY PROFILE

FUNDING | RESEARCH | NEWS | GET INVOLVED | PUBLICATIONS | EVENTS | JOIN

Search [GO]

Collaboration. Innovation. Results.

**Login to WERF.org**

email

password  GO

Need login help?

Forgot your password?

Program Areas  
Select One

Quick Links  
Select One

LOOKING FOR TOOLS?

LOOKING FOR RESEARCH?

LOOKING FOR EVENTS?

**News**

**2007 Decentralized Systems Unsolicited Research Competition for Graduate Students.**  
WERF is now seeking pre-proposals to fund up to \$100,000 (in total) for its Unsolicited Student Research Competition to Support Student Research in the Decentralized Systems Field.

**RFP Issued for Emergency Warning System Research**  
WERF is now accepting proposals for research that will develop guidance for wastewater utilities interested in implementing online emergency warning systems.

More News

**Committees**

**Subscriber Committees**  
Subscribers can participate by joining one or more committees for the latest information and to share ideas.

- Conveyance Systems
- Infrastructure Management
- Solids Treatment, Residuals & Reuse
- Stormwater

**Highlights**

**Removing Nutrients from Wastewater: The Past, Present, and Future**  
Webinar: Gain a global perspective on nitrogen and phosphorus removal and learn why it is so important to control and

# Closing & Follow-Up

- Thank you for participating!
- As you leave today's session, an online survey will follow. We appreciate your feedback.
- This presentation has been recorded. A link to the recording will be available at [www.werf.org](http://www.werf.org) later this week.
- For more information, go to [www.werf.org](http://www.werf.org)