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 utility companies take aim against solar power

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

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

Data courtesy of Focus on Energy
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

Total Annual Energy Cost By Facility Type

- Wells
- WWTP
- WTP and Booster Pump
- Pool and Community Center
- IPS
- Lift Stations

Energy facts courtesy of Eaton Electrical
Understanding Utility Billing – Example 1

- Every utility is different

**Example 1**

**Acct Number:** 24-27500
**Name:** Waste Water Trmt Plant
**Address:**

**INVOICE FOR ELECTRIC SERVICE**

- **Energy to be billed (KWH):**
  - Present: 4356
  - Previous: 4191
  - Difference: 165
  - Constant: 900
  - Total energy: 148,500
  - Power factor: -1%
  - Total metered energy: 147,015

- **Metered reactive (RKVAH):**
  - Present: 219
  - Previous: 207
  - Difference: 12
  - Constant: 900
  - RKVAH: 10,800
  - Power factor for above tangent: 99.7

- **Power factor computation:**
  - Total metered reactive (RKVAH) / Total metered energy (K.W.H.) = 0.0727 Tangent
  - Power factor: 99.7%

- **Maximum load to be billed:**
  - Maximum load as metered: 0.31 x 900 = 279.0 K.W.
  - Power factor adjustment
  - Billing maximum load = 279.0 / 279.8 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**

**Yearly Demand**

On Peak Demand: $0.354
Off Peak Demand: $0

**Monthly Demand**

On Peak kWH: $0.116
Off Peak kWH: $0.051

**Off-Peak and Off-Peak KWH (Time of Day Metering)**
Utility Billing Comparison

### Example 1

<table>
<thead>
<tr>
<th>WWTP</th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>kWh:</td>
<td>$9,307</td>
<td></td>
</tr>
<tr>
<td>Demand &amp; P.F.:</td>
<td>$1,210</td>
<td>Total:</td>
</tr>
<tr>
<td>Total:</td>
<td>$10,517</td>
<td></td>
</tr>
</tbody>
</table>

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

### Example 2

<table>
<thead>
<tr>
<th>Pump House</th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>kWh:</td>
<td>$1,700</td>
<td></td>
</tr>
<tr>
<td>Demand:</td>
<td>$1,571</td>
<td>Total:</td>
</tr>
<tr>
<td>Total:</td>
<td>$3,271</td>
<td></td>
</tr>
</tbody>
</table>

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
Evaluate 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

<table>
<thead>
<tr>
<th>DATE</th>
<th>Total kWh</th>
<th>On Peak kWh</th>
<th>Off Peak kWh</th>
<th>On Peak Demand kW</th>
<th>Off Peak Demand kW</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>1824</td>
<td>0</td>
<td>1824</td>
<td>0</td>
<td>85</td>
</tr>
<tr>
<td>2</td>
<td>1891</td>
<td>957</td>
<td>934</td>
<td>90</td>
<td>86</td>
</tr>
<tr>
<td>3</td>
<td>1948</td>
<td>1005</td>
<td>943</td>
<td>107</td>
<td>85</td>
</tr>
<tr>
<td>4</td>
<td>1917</td>
<td>953</td>
<td>964</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>2089</td>
<td>1071</td>
<td>1018</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>1956</td>
<td>1032</td>
<td>924</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>1761</td>
<td>0</td>
<td>1761</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>1771</td>
<td>0</td>
<td>1771</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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
Review Equipment and Operations

- Analyze data from energy monitoring
Identify and Implement

- Calculate savings

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

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
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

![Diagram showing pump stations and flow rate]

**Site Data for 9/29/2010**

<table>
<thead>
<tr>
<th>Pump</th>
<th>Flow (kGAL)</th>
<th>Runtime (Hrs)</th>
<th>Starts (Evt.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump 1</td>
<td>99.2</td>
<td>1.7</td>
<td>17</td>
</tr>
<tr>
<td>Pump 2</td>
<td>52.2</td>
<td>2.1</td>
<td>18</td>
</tr>
</tbody>
</table>

**10 Day Historical Data**

![Table showing historical data for pump stations]
Utilize VFDs Where Practical

- Slower pumping rate reduces kW demand

<table>
<thead>
<tr>
<th></th>
<th>Full Speed</th>
<th>Reduced Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow:</td>
<td>270 kGAL (typ. Day)</td>
<td>270 kGAL (typ. Day)</td>
</tr>
<tr>
<td>Runtime:</td>
<td>1275 GPM</td>
<td>935 GPM</td>
</tr>
<tr>
<td>Power:</td>
<td>3.5 hours</td>
<td>4.8 hours</td>
</tr>
<tr>
<td>Power:</td>
<td>168 kW</td>
<td>117 kW</td>
</tr>
<tr>
<td>Demand charge:</td>
<td>$1784</td>
<td>$1242</td>
</tr>
</tbody>
</table>

**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

Funding

Below are listings of Wisconsin grant programs, federal grants/incentives and private monies available for renewable energy and fuel related projects.

Access the most current list of funding opportunities here (PDF).

Updated version of Financial Incentives For The Production of Clean Energy.

- Wisconsin Grant Programs
- Federal Grants
- Federal Tax Incentives
- Private Funding
- Resources for Energy Efficient Buildings and State Construction Projects
Wisconsin Focus on Energy

- 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
Wisconsin Focus on Energy

• 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
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