Energy Audits

Key to understanding how energy is being used and where cost effective improvements can be made

FUSS & O'NEILL
Disciplines to Deliver

Types of Energy Audits

- Ø **Preliminary Audit**
- Ø **Single purpose or Targeted Audits**
- Ø **General Audit**
- Ø **Investment Grade Audit**

Preliminary Audit

- Tour and visual inspection of the facility
- Brief review of energy consumption data
- Comparison to industry averages
- Preliminary cost and savings estimates
- Generally only identifies gross inefficiencies and waste
- Not usually adequate for final decisions
- Helpful in prioritizing detailed audits

General Audit

- Ø 12 to 36 month of utility bill analysis develop detailed load profiles
- Ø Metering on some systems may be performed
- Ø In-depth interviews with operating personnel
- Ø Identifies all energy conservation measures (ECO)
- Ø Detailed financial analysis is performed for each ECO
- Ø Sufficient detail to justify project implementation.

Investment-Grade Audit

- In some organizations, both energy and non-energy investments are prioritized using a single financial criteria - Return on Investment (ROI)
- Dynamic model of energy use of the existing facility and all ECOs identified
- Detailed baseline are established and end use metering is utilized as required
- A comprehensive financial analysis is provided for each ECO

Ensuring High Quality Audits

- Pre-Site Visit Data Collection
  - *Collect data, request utility billing information, inform your Account Executive and keep Management informed*
- Site Visit by your Consultant
  - *Arrange for key decision makers to be present, make sure you share concerns about plant and they are understood by consultant, begin exploring/planning how to fund projects and assign a single point of contact for the consultant to work through*
- Follow-Through
  - *Be involved with all phases, keep management informed about ECO cost, savings and funding options*
- Develop an Implementation Plan

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- Collect Plant Data
  - *Flows, Utility bills, Operating hours, design summary, drawing and specifications*
- Calculate energy consumed per million gallons of wastewater treated and compare this to similar facilities with your colleagues.
- Inspect energy consuming equipment and systems, develop a list of potential energy conservation measures

Energy Audit

- Perform a preliminary cost benefit analysis
  - *Capital and operating costs*
  - *Energy and Demand savings*
  - *Effect on plant process, finished water quality and effluent quality*
  - *Paybacks*
  - *Availability of financing and funding after rebates if any.*
- Assemble the team, discuss the opportunities and develop an implementation plan that makes sense and meets your facilities unique needs
- Implement - If Technical Expertise is Not Available, Hire a Consultant

Audit Questions

- Does the process or equipment need to be Continuous ?
- Can the process or systems achieve the same result at a lower flow or capacity?
- Can it be run for fewer hours?
- Can the operation be shifted to off-peak hours?
- Are VFDs an option for variable flows or partial loading conditions?
- How would enhanced controls and end use metering impact energy usage?
- Do alternative technologies offer efficiency opportunities?
- Would energy training help change behaviors?
- Do not overlook the value of load shifting opportunities
  - *Expertise Required, but potential Large Savings*

Potential WWTF ECMS

Technology	Baseline (If you have)	Potential ECM (You may want to consider)
Aeration	Coarse-Bubble Diffuser	Fine-Bubble Diffuser
	Inlet/Discharge Vane or No Control	VFD Control
	Multi-stage centrifugal blowers	Singe-stage centrifugal blower with VFD Control
	Mechanical Aeration - Constant Speed Motor	VFD Control Based on O2 Content
Pumps	Throttle, Bypass or No Control	VFD Control
	Pneumatic	Electrical-Driven
Motors	Standard Efficiency Motors	High Efficient Motors
Air Compressor	Rotary Screw with load/unload control	VFD Control

Potential WWTF ECMS

Technology	Baseline (If you have)	Potential ECM (You may want to consider)
Dissolved Oxygen System	Manual Control	Automatic Control
Hydraulic-Driven System	Water or hydraulic-oil driven systems	Electrical-Driven System
Sludge Dewatering	Centrifuge	Screw Press
Sludge Thickening	Centrifuge Thickening System	Gravity Belt Thickening
UV Disinfection	Medium-Pressure UV System	Low-Pressure UV System

Aeration through Fine Bubble Diffusers

Replacement of Mechanical aerators or Coarse Bubble Systems with Fine Bubble Diffusers and High Efficiency Blowers May Allow a Large Performance – Based Energy Savings Opportunity.

Aeration through Fine Bubble Diffusers

- ø Higher Oxygen Transfer Efficiency
- Ø Coverage of Larger Area Increase Mixing and Oxygen Transfer
- Ø Potential Large Energy Savings

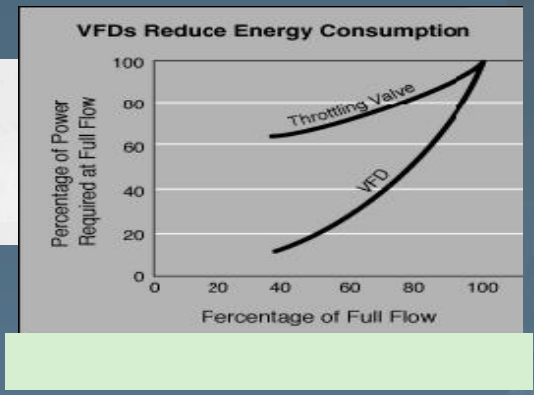
Aeration through Fine Bubble Diffusers

- **CT POTW – Concept Project – currently 3 – 40 Horsepower Surface Aerators**
- **Replacement with app 60-80 Horsepower Spencer “Power Miser”**
- **Maximize Incentives (likely 50% of installed costs)**
- **Fund project with payments from Energy Savings**
- **Energy Upgrade – to be Delivered Far in Advance of major Nutrient-removal Capital project**

Aeration through Fine Bubble Diffusers

- **ØN-P Removal Project at least 5 years out, vulnerable to SRF availability**
- **Ø ESCO Blower / Diffused Aerator Delivery possible in 2007 – 1Q2008**
- **Ø Energy Savings – immediate cost savings – ROI greater than 30 percent**

VFD Motor controller matches motor speed to load



Possible Applications

Particularly suited for pumping and aeration - large energy draws in WWT

Should be considered when flow-restricting valves or moveable air vanes are used for flow control

Existing pumps and blowers that use throttling devices can be retrofit with VFDs

Some Benefits

Offers a "soft start“ capability

More precise control of processes such as water distribution, aeration and chemical feed

25 HP at 100% 23 hrs/day vs. 2 hrs at 100%; 8 hrs at 75%;
8 hrs at 67%; 5 hrs at 50% VFD can reduce energy use by 45%

Motors and Motor System

Pumps - Fans - Compressed Air - Drives

- *Pump and blower motors account for 80 to 90% of the energy costs in wastewater treatment facilities.*
- *EE motors are up to 10% more efficient than standard motors.*
- *Lifetime energy costs to run a continuous-duty motor are 10 to 20 times higher than the original motor purchase price- think life cycle costs.*
- *EE motors should be considered for all new installations, replacement of failed motors and spares.*
- *They are frequently a cost-effective alternative to rewinding.*
- *Most times are a cost effective substitute for operating high-duty applications motors.*
- *Generally have longer insulation and bearing lives, lower heat output and less vibration*

Replace Hydraulic Drives

- Electric motors are usually an excellent replacement for water or hydraulic-oil driven equipment.
- Energy is wasted in the 3 conversion steps; electric to mechanical to hydraulic and back to mechanical before it perfroms actual work.
- Other benefits include, better control, less maintenance
- Energy saving can appraoch 20% or greater.

Energy Management

Know where and how it is used

Make the cost effective changes required to use it more efficiently

Use it when it's least expensive, if possible

Take advantage of incentives, rebates and innovative funding opportunities

Save