Realistic Energy and Cost Saving Opportunities!

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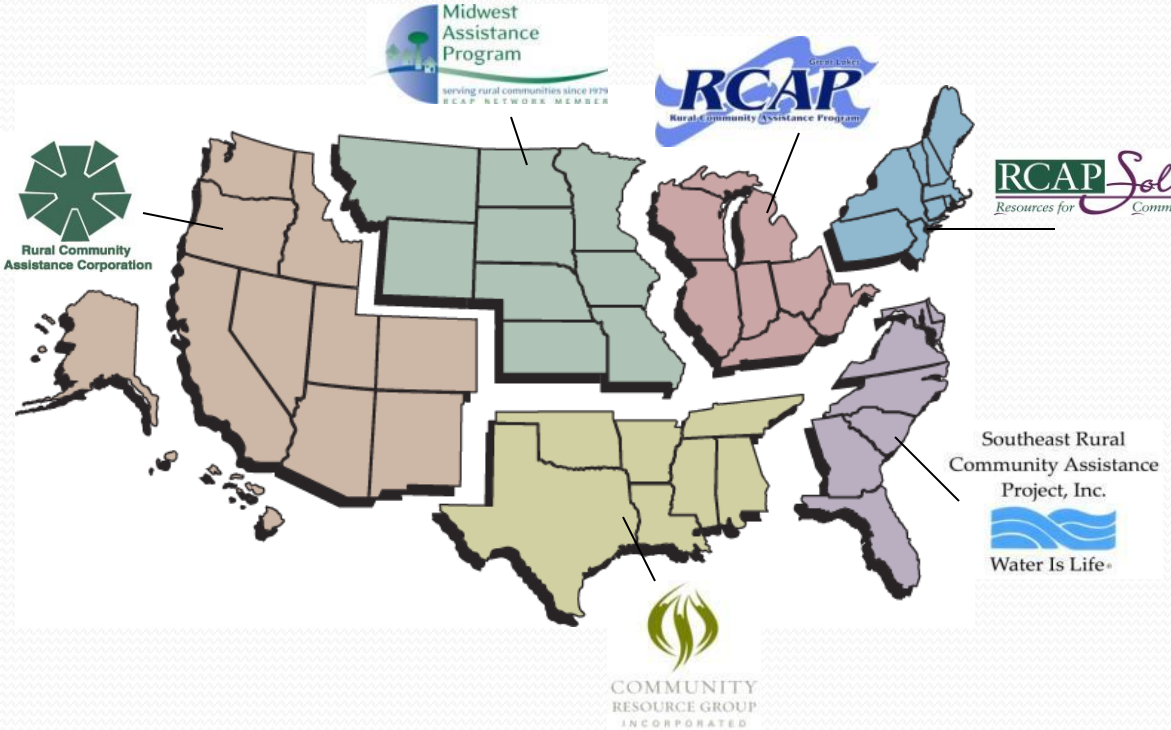
The RCAP Network



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800-321-7227 *www.rcap.org*

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"Improving the quality of life in rural communities"

Western RCAP
Rural Community Assistance Corporation
916-447-2854
www.rcac.org

Midwest RCAP
Midwest Assistance Program
952-758-4334
www.map-inc.org

Southern RCAP
Community Resource Group
479-443-2700
www.crg.org

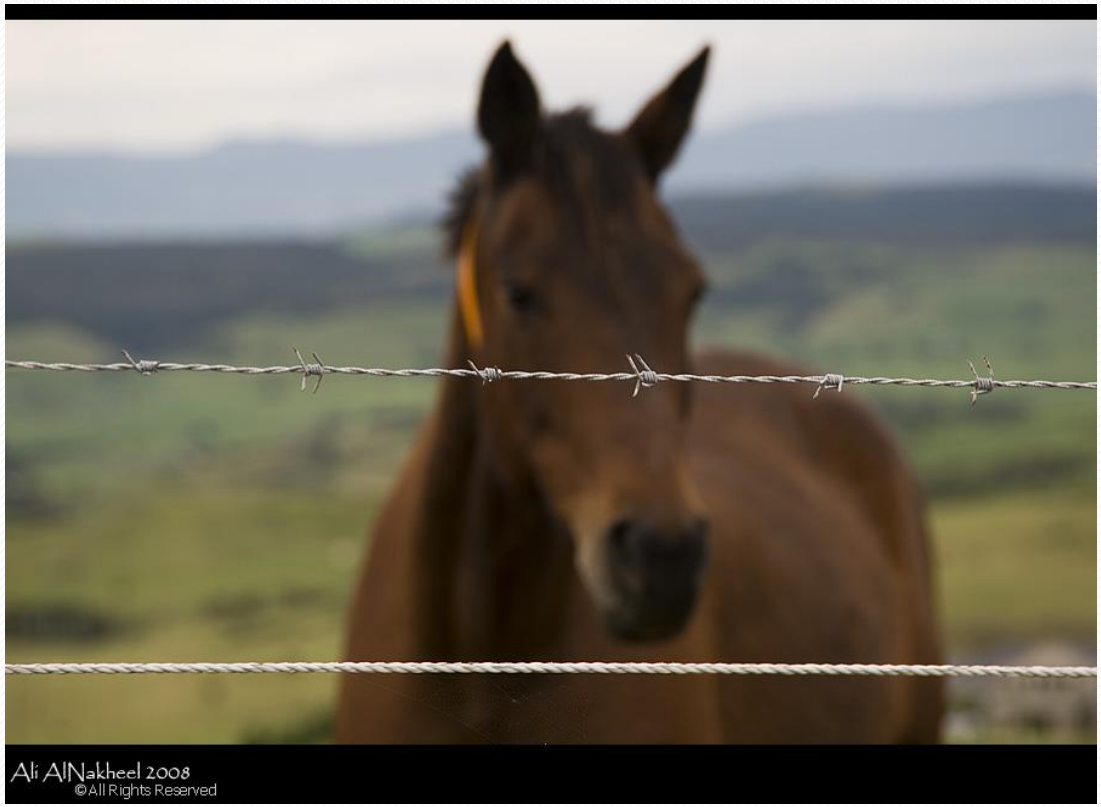
Northeast RCAP
RCAP Solutions
800-488-1969
www.rcapsolutions.org

Great Lakes RCAP
WSOS Community Action Commission
800-775-9767
www.glrcap.org

Southeast RCAP
Southeast Rural Community Assistance Project
866-928-3731
www.southeastrcap.org

Focus?

- Short-Term
- Long-Term
- Water Quality?
- Financial Goals?



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What is an Energy Audit?

- Audit:
  - (1) a formal examination of an organization's or individual's accounts or financial situation,
  - (2) a methodical examination and review

    -Merriam-Webster Dictionary

- In Terms of Water/Wastewater:
  - An analysis of the energy usage for a facility or operation and the identification of possible Energy Conservation Opportunities (ECO's)
    - ASHRAE Levels I, II, and III

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Benefits of an Audit…

- Benchmarking
  - KPI (Key Performance Indicators)
  - Identifying Trends
  - Decision Tool for Change
    - Equipment, Processes, System
- Budget Planning
- Knowledge of the System
  - Water Loss / I&I (Inflow and Infiltration)
- Error Reduction
  - Billing, Payments, Meters, Chemicals

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But, Why is it Important?

- Estimates Are Indicating That:
  - Nearly 4% of the nation's electricity is consumed with respect to water and wastewater facilities
  - Within the next 15 years, the cost of energy will increase approximately **20%**
  - An increase in utility budgeting will most likely result in increased customer billing charges

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But, Why is it Important?

- Estimates Are Indicating That:
  - Funding programs have more applications and less available money
  - Commonly, facilities have been designed for peak capacity, not to operate efficiently
  - Most likely the demographics of a community has changed (up or down)

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But, Why is it Important?

- Specific to Ohio:
  - Ohio Ranks 6th in National Energy Consumption
  - Public Water Systems scored a D+ Grade
    - Est. 9.7 Billion ('09) needed for Infrastructure (POTW)
    - Est. 12.6 Billion ('13) (+ 130%)
  - Public Wastewater Systems scored a D+ Grade
    - Est. 11.2 Billion ('09) needed for Infrastructure (POTW)
    - Est. 14.2 Billion ('13) (+ 127%)

-ASCE 2009 Ohio Infrastructure Report Card (Updated 2013)

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Need Efficiency?

Much of the burden on funding for municipal water supply systems is borne by local government. The United States Conference of Mayors in a 2007 report cites statistics obtained from the U.S. Bureau of Census that indicate that the local government share of funding spent on water supply is over 99%. Table 1 presents Census Bureau data for the fiscal years 1991-1992 through 2004-2005 which compares the local government expenditures to the state expenditures.[4]

Years	Combined State and Local Government ($ thousands)	Local Government ($ thousands)	State Government ($ thousands)	Percent Local Government (%)
1991-1992	24,833,879	24,624,754	209,125	99.16
1992-1993	24,621,177	24,433,437	187,740	99.24
1993-1994	26,617,293	26,440,863	176,430	99.34
1994-1995	28,040,858	27,863,125	177,733	99.37
1995-1996	28,949,742	28,765,816	183,926	99.36
1996-1997	31,136,275	30,972,565	163,710	99.47
1997-1998	32,068,862	31,897,029	171,833	99.46
1998-1999	34,088,571	33,924,151	164,420	99.52
1999-2000	35,789,427	35,435,003	354,424	99.01
2000-2001	36,756,851	36,410,259	346,592	99.06
2001-2002	40,555,413	40,169,307	386,106	99.05
2002-2003	43,260,324	42,907,605	352,719	99.18
2003-2004	44,806,244	44,275,003	531,241	98.81
2004-2005	45,956,386	45,636,724	319,662	99.30

Table 1. Local and State Water Supply Expenditures

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Opportunities to Save Energy…

- Wastewater:
  - Aeration
  - Pumping
  - Variable Speed Drives
  - Automatic Controls
  - Solids Management
  - Operations
  - Processes
  - Etc.

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First Step - Benchmarking

- Helps you assess your baseline energy consumption and costs.
- Can be used to determine if On/Off-Peak Metering would benefit.
- Benchmarking tools are not equivalent to a comprehensive energy audit.
  - Does provide summary of energy usage.

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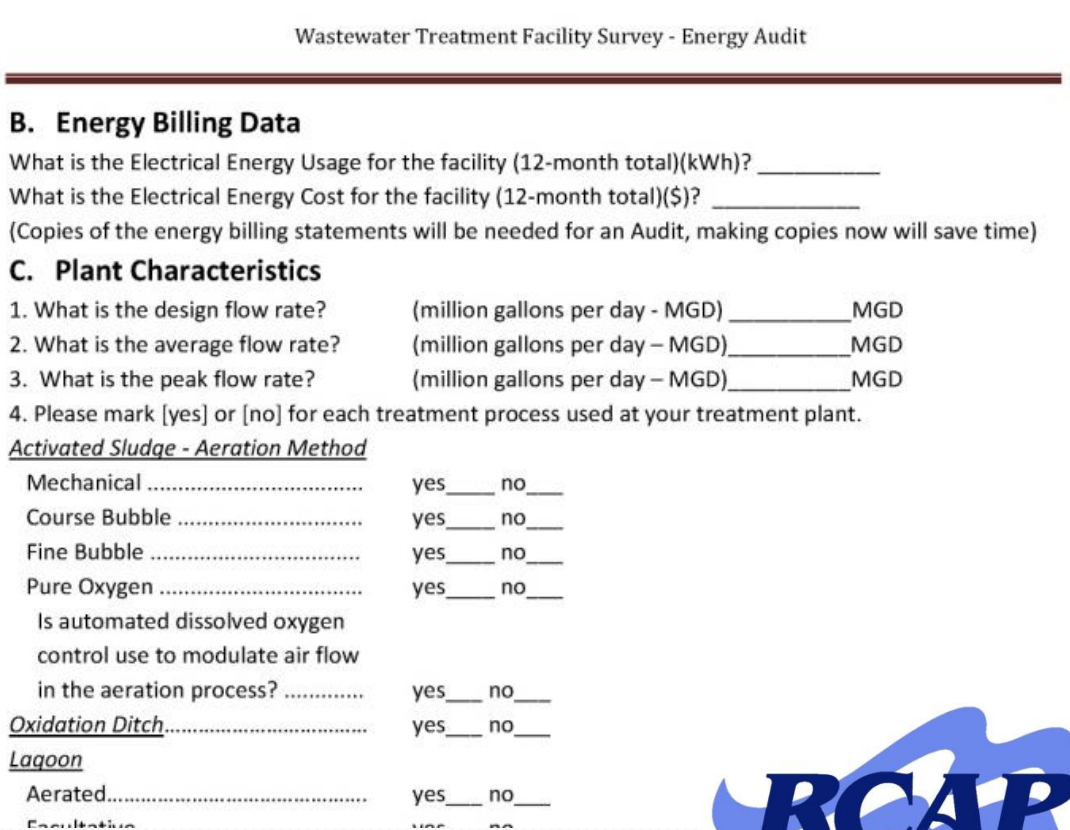
Key Performance Indicators:

- With 'Broad' Facility Data (Facility Survey):
  - Service Population
  - MG/Yr
  - Cost ($)/kWh
  - kWh/MG
  - Cost ($)/MG



Wastewater Treatment Facility Survey - Energy Audit

B. Energy Billing Data

What is the Electrical Energy Usage for the facility (12-month total)(kWh)? _____

What is the Electrical Energy Cost for the facility (12-month total)($)? _____

(Copies of the energy billing statements will be needed for an Audit, making copies now will save time)

C. Plant Characteristics

1. What is the design flow rate? (million gallons per day - MGD) _____MGD
2. What is the average flow rate? (million gallons per day – MGD)_____MGD
3. What is the peak flow rate? (million gallons per day – MGD)_____MGD
4. Please mark [yes] or [no] for each treatment process used at your treatment plant.

Activated Sludge - Aeration Method

Mechanical	yes____ no___
Course Bubble	yes____ no___
Fine Bubble	yes____ no___
Pure Oxygen	yes____ no___
Is automated dissolved oxygen control use to modulate air flow in the aeration process?	yes___ no___
Oxidation Ditch.....	yes___ no___
Lagoon	
Aerated.....	yes___ no___
Facultative	yes___ no___

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Benchmarking Tools

- USEPA's Energy Star Portfolio Manager
  - All Facility Types
- USEPA's Energy Audit Tool
  - Water and Wastewater Systems
- US Dept. of Energy Equipment Evaluation Tools
  - PSAT – Pump System Assessment Tool
  - MotorMaster +
- Simple Excel Spreadsheet
- RCAP's Free Assessment (Small & Medium)
- Or Other Program?

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Equipment Data:

- <u>Pump Assessment</u>
  - Avg. Pump Efficiency is Below 40%
  - Over 10% of Pumps Below 10% Efficiency
    - SAIC Wisconsin Focus on Energy
      - Evaluation of 1,690 Pumps at 20 Process Plants
  - Due to:
    - Throttling of Valves
    - Over-Sizing of Pumps
    - 'We've Always Done It That Way' Mentality

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Equipment Data:

- Pumps
  - Potential Pump Combinations
    - 2 Smaller to meet Peak flow, can take off-line for Average
  - Minimize Losses
    - Friction
    - Head
  - Efficiency!

  - Pump Slow…Pump Long!

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Is it Really Worth the Extra Cost?

- 100 hp TEFC motor costs ~ $4,543
  - It costs $12,707 **per year** to operate
    - **280%** of purchase cost!
      - @ 2,920 hours/yr, 75% load, $.07/kWh

Efficiency	Demand	Use/Year	Cost/Year	15-Yr Cost
90%	62 kW	181,536 kWh	$12,707	$190,605
95%	58 kW	171,959 kWh	$12,037	$180,555

  - Premium Efficient Saves!
    - 5%, $670/yr, $10,050/15-yrs

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Variable Frequency Drives?

- VFD's are used for:
  - Controlling Speed
  - Starting and Acceleration Controls
  - Reducing Operating Costs
- VFD's will only save (energy) costs when used with a varying load. If the load does not vary, or only varies slightly, there may be no energy savings. The wider the variation, the more likely for savings.

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Equipment Data…

- Lighting (numbers and locations)
  - Interior Ceiling (T-12, T-8, T-5, LED)
  - Interior Other (Incandescent, CFL, LED)
  - Exterior (Hi-Intensity, Hi-Pressure, Low-Pressure)
  - Sensors (Motion, Optical, Timed)
    - Rated Watts, Time-of-Use, Bulbs/Fixture, Ballast Type

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Equipment Data…

- Others:
  - HVAC
  - Building Envelope
  - Windows
  - Lab/Office Equipment
  - Water Conservation
  - Phantom Energy
  - Dehumidifiers
  - Water Heaters

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Show Me The Money!!!

- Energy Efficiency Can Make a Difference!

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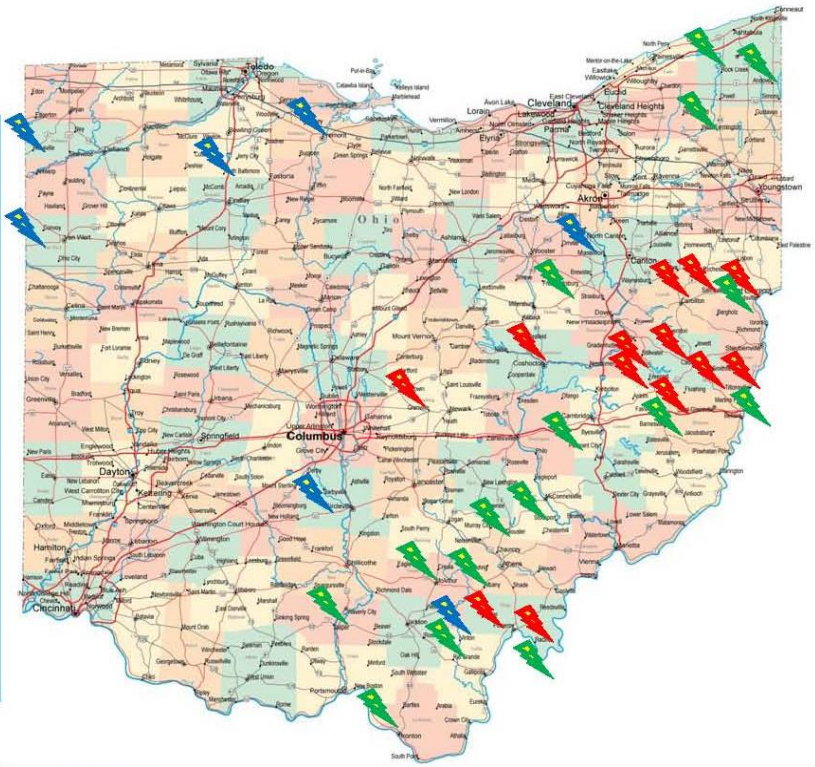
Ohio RCAP Audit Performance:

RCAP Energy Audits – State of Ohio

RCDI (USDA) Communities:

Alexandria, OH WWTP
Belmont Co., OH WTP
Belmont Co., OH WWTP
Buckeye Water WTP
Cadiz, OH WTP
Cadiz, OH WWTP
Carrollton, OH WTP
Coshocton, OH WWTP
Dillonvale, OH WTP
HCWSD Piedmont, OH WTP
HCWSD Tippecanoe, OH WWTP
Rutland, OH WWTP
Salineville, OH WWTP
~~Syracuse-Racine, OH WWTP~~
Tiltonsville, OH WTP
~~Wellsville, OH WWTP~~
(13 Communities, 16 Audits)



ARC Communities:

Albany, OH (Le-Ax) WTP
~~Andover, OH~~
Bethesda, OH WWTP
~~Coal Grove, OH~~
Holmesville, OH WWTP
~~McArthur, OH~~
Piketon, OH WTP
Piketon, OH WWTP
Pleasant City, OH
Racine, OH WTP
Rio Grande, OH WWTP
Rock Creek, OH
Stockport, OH WWTP
Tiltonsville, OH WWTP
Trimble, OH (SCVWD) WTP
Wellsville, OH WWTP
West Farmington, OH
(16 Communities, 15 Audits)

Other Communities:

Hicksville, OH WWTP
Vinton, OH WWTP
Canal Fulton, OH WWTP
North Baltimore, OH WWTP
Earnhart Hills WTP
Sandusky Co. Chamber
Convoy, OH WWTP
Earnhart Hills WWTP (3)
(7 Communities, 10 Audits)

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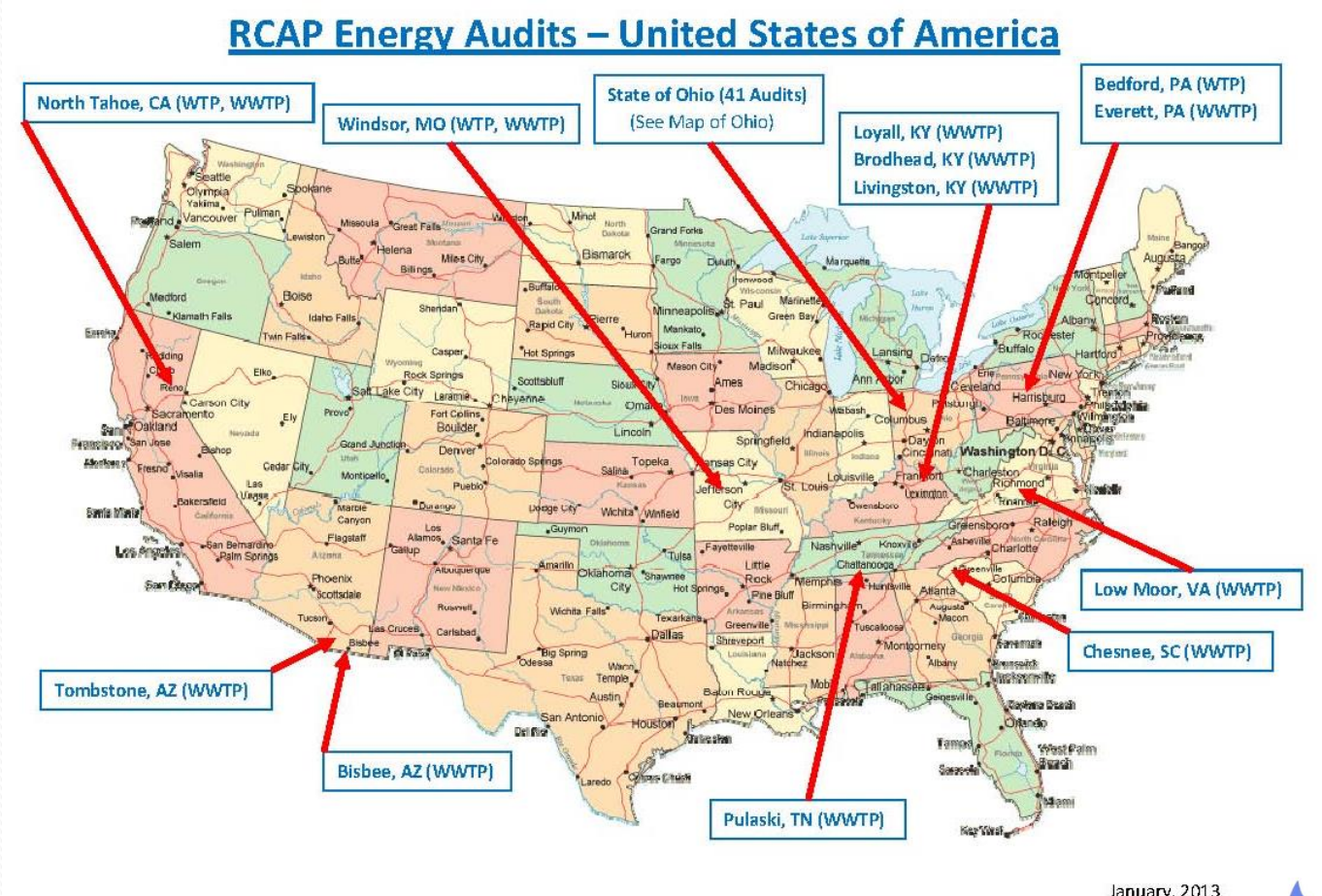
RCAP Audit Performance:



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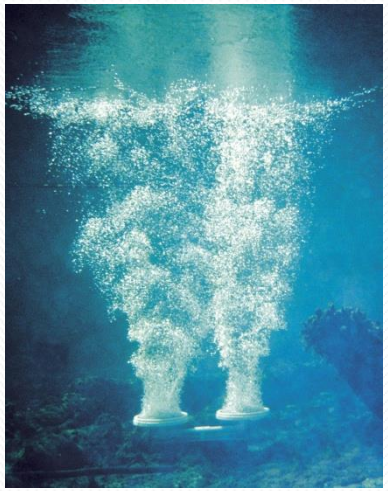
Case Studies…#1



- Wasteville WWTP
  - Population 1,397
  - Facility Constructed 1979
  - Flow (MGD): 0.25 Design, 0.081 Actual
  - Annual Energy Use = 416,800 kWh / yr
  - Annual Energy Cost = $ 23,745 / yr
  - Average Energy Cost = $ 0.057 / kWh
  - Energy Use = 14,098 kWh / MG
  - Treatment Cost = $ 803.15 / MG

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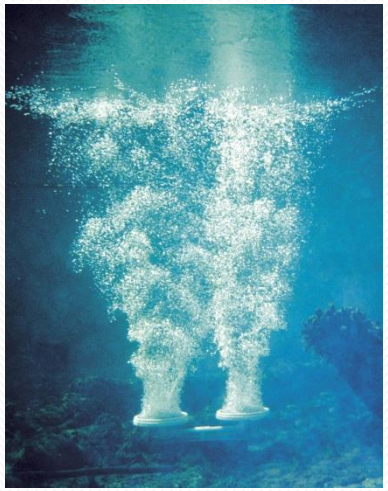
Case Studies…#1



- Wasteville WWTP
  - Focused Analysis – Aeration System
    - 50-hp Blower Motor, 24 hrs / 7 days
    - Deteriorated Diffuser System
  - Main Opportunity
    - Repair/Replace Diffusion from Coarse to Fine
      - Over 35% increase in Oxygen Transfer
    - Decrease Blower Size
      - From 50-hp to 15-hp
    - Maintain Treatment Quality

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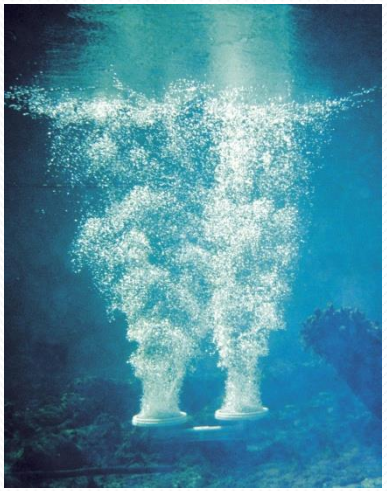
Case Studies…#1



- Wasteville WWTP
  - Energy Conservation Opportunities
    - Annual Energy Use = 162,223 kWh / yr
      - A 254,567 kWh Savings (61%)
    - Annual Energy Cost = $ 8,985 / yr
      - A $14,760 /yr Savings (62%)
    - Energy Use = 5,487 kWh / MG
    - Treatment Cost = $ 303 / MG
    - Cost of Opportunities = $29,970
      - 2.03 year Simple Payback

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Case Study…#2

- 

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Case Study…#2

- Analysis
  - Village Population 1,110
  - Facility Constructed 1938 (upgrade 1987)
  - Production (MGD): 0.200 Design, 0.248 Actual
  - Annual Energy Use = 391,036 kWh / yr
  - Annual Energy Cost = $26,548 / yr
  - Average Energy Cost = $0.068 / kWh
  - Energy Use = 4,320 kWh / MG (295%)
  - Treatment Cost = $293.75 / MG (277%)

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Case Study…#2

- Initial Assessment:
  - Small
  - Moderately Aged (over 25 yrs)
  - Low Energy Cost for Region
  - High Energy Use
  - High Production

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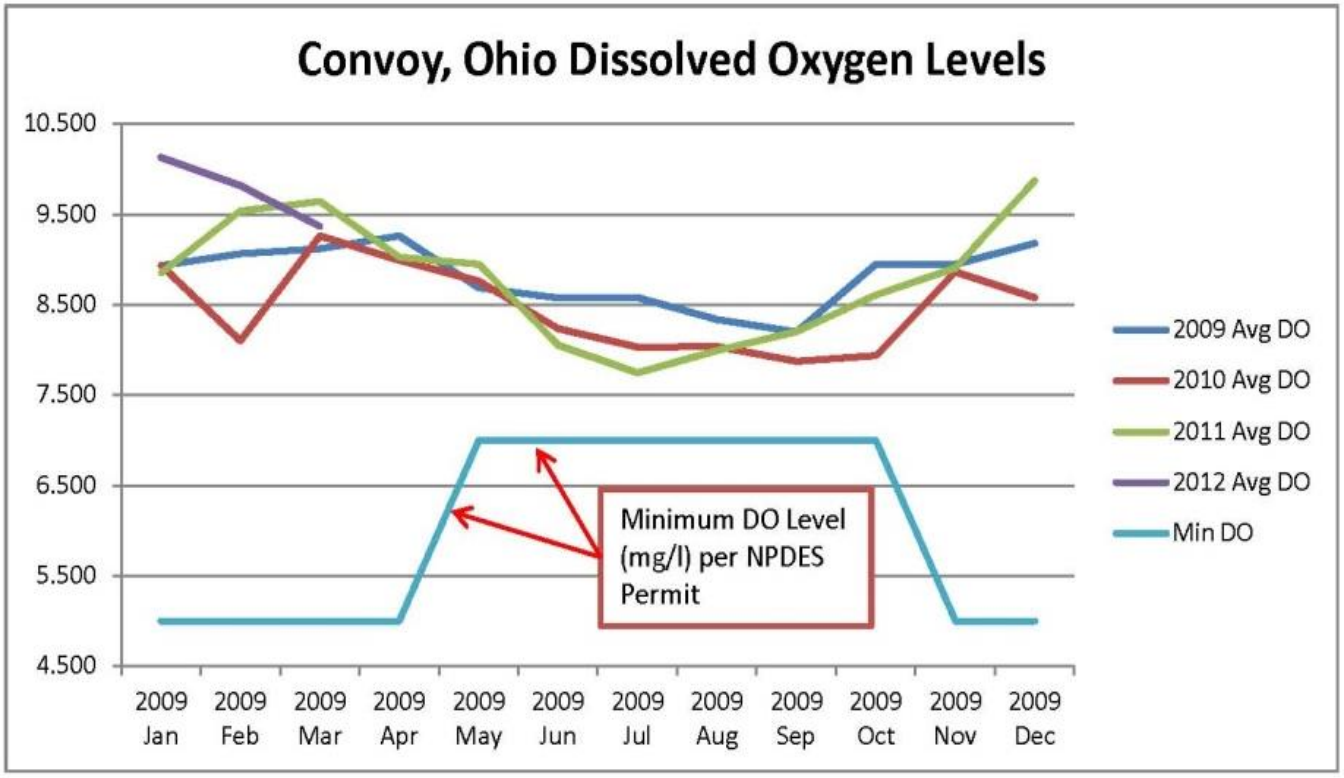
Case Study…#2

- Aeration Levels



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Case Study…#2

- Water Use?
  - Water Production: 0.150 MGD
    - 500 Connections
      - 150 gpd per connection = 0.075 MGD
    - 0.040-0.075 MGD Reduction Potential

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Case Study…#2

- Results:
  - Focused Analysis –
    - Water Use and Disposal
  - Main Opportunity
    - Water Meter Installation
  - Additional Opportunities
    - Equipment
    - Controls
    - Aeration

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Case Study…#2

- <u>Pending Capital Improvement Projects</u>
  - Additional Water Well
  - Additional Storage Tank
  - Water Main Replacement
  - Upgrade/Replacement of Wastewater Plant

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Case Study…#2

- <u>Energy Conservation Opportunities</u>
  - Install Water Meters
  - Educate Community on Water Use
  - Seek Inflow and Infiltration
  - Eliminate need for Water Well, Water Tower, Main Replacement, and Wastewater Plant Upgrade

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Case Study…#2

- Energy Conservation Opportunities
  - 124,000 kWh savings…31%
  - $8,300 savings…31%
  - 0.96 year payback
    - DOES NOT INCLUDE I&I REMOVAL
    - DOES NOT INCLUDE WATER CONSERVATION

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Case Studies…#3

- Askin' WWTP
  - Population 228
  - Facility Constructed 1977
  - Production (MGD): 0.40 Design, 0.39 Actual
  - Annual Energy Use = 28,064 kWh / yr
  - Annual Energy Cost = $ 10,255 / yr
  - Average Energy Cost = $ 0.37 / kWh
  - Energy Use = 1,776 kWh / MG
  - Treatment Cost = $ 649 / MG

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Case Studies…#3

- Askin' WWTP
  - Focused Analysis – Operations
    - Equipment Age
    - Throttled Aeration Valves
    - Effluent Discharge Limits
  - Main Opportunity
    - Energy Rates

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Case Studies…#3

- Askin' WWTP
  - Energy Conservation Opportunities
    - Annual Energy Use = 18,747 kWh / yr
      - A 13,219 kWh Savings (41%)
    - Annual Energy Cost = $ 6,257 / yr
      - A $4,756 /yr Savings (43%)
    - Energy Use = 1,194 kWh / MG
    - Treatment Cost = $ 398 / MG
    - Cost of Opportunities = $1,913
      - 0.4 year Simple Payback

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Case Studies…#3

- Askin' WWTP
  - Energy Conservation Opportunities
    - Call to Energy Utility Company
      - Incorrect Billing Structure
      - 60-70% Cost Savings Immediate!
      - Will Change Savings From Previous Slide…
        - 12-15% of Remainder

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RCAP Opportunities

- Large Percentage of Operational Savings
  - Versus Equipment Costs
  - Typically Low/No Cost with Operations
- Build Comparable Database for Small Systems
  - Initial Assessments
  - Recommendations for Opportunities
- Create Continuity of Process
- Improve Overall Utility Operations
- Document Performance

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RCAP Audit Results:

- Operational Opportunities
- Process Modifications
- Equipment Analysis

- Average 25% Potential Savings
  - 6% - 90% Actual Savings Range
- Average 1-year Simple Payback

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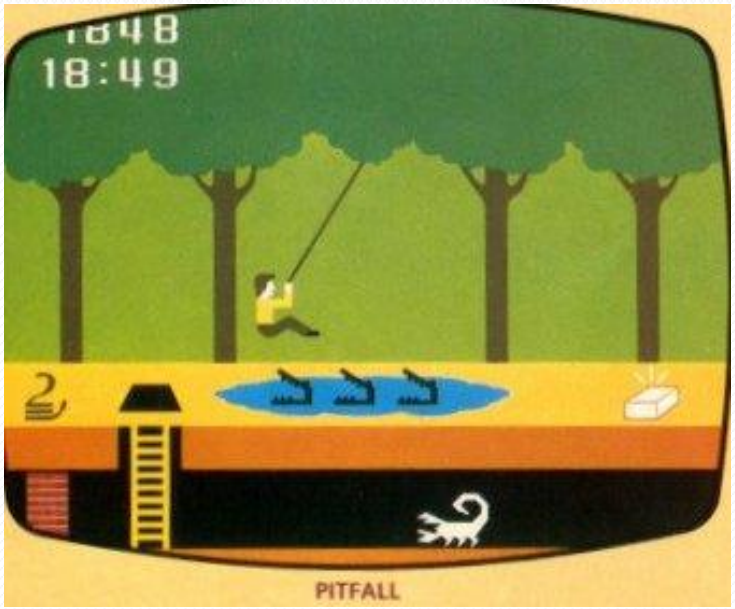
Pitfalls?

- Certified Auditors
- Knowledge of Water Systems
  - Operations and Processes

    vs.

  - Equipment and Lights
- Alternative Energy



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Questions?

- Thank you for your interest!

RCAP National Initiative

Ohio RCAP Initiative

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