Water and Energy Efficiency in Clean Water Agencies

Alliance to Save Energy

July 20, 2011

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ALLIANCE TO SAVE ENERGY

Creating an Energy-Efficient World

What is the Alliance to Save Energy?

ALLIANCE TO SAVE ENERGY
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- ***The Alliance to Save Energy promotes energy efficiency worldwide to achieve a healthier economy, a cleaner environment and greater energy security.***
  - Non-profit organization headquartered in U.S.; operations world-wide
  - Led by **Senator Jeanne Shaheen (D-NH)** and **Peter Darbee, Chairman of the Board, CEO and President, PG&E Corporation**
  - Includes 13 Members of Congress – Bi-Cameral; Bi-Partisan
  - Also includes environmental, consumer, and trade association heads, state and local policy makers, corporate executives

Working with and Across All Sectors of the Economy

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- 176 companies, organizations, and institutions in Associates Program
- Associates Program membership represents all economic sectors
- Initiatives underway in research, policy advocacy, education, technology deployment, market transformation and communications

The Energy/Water Link

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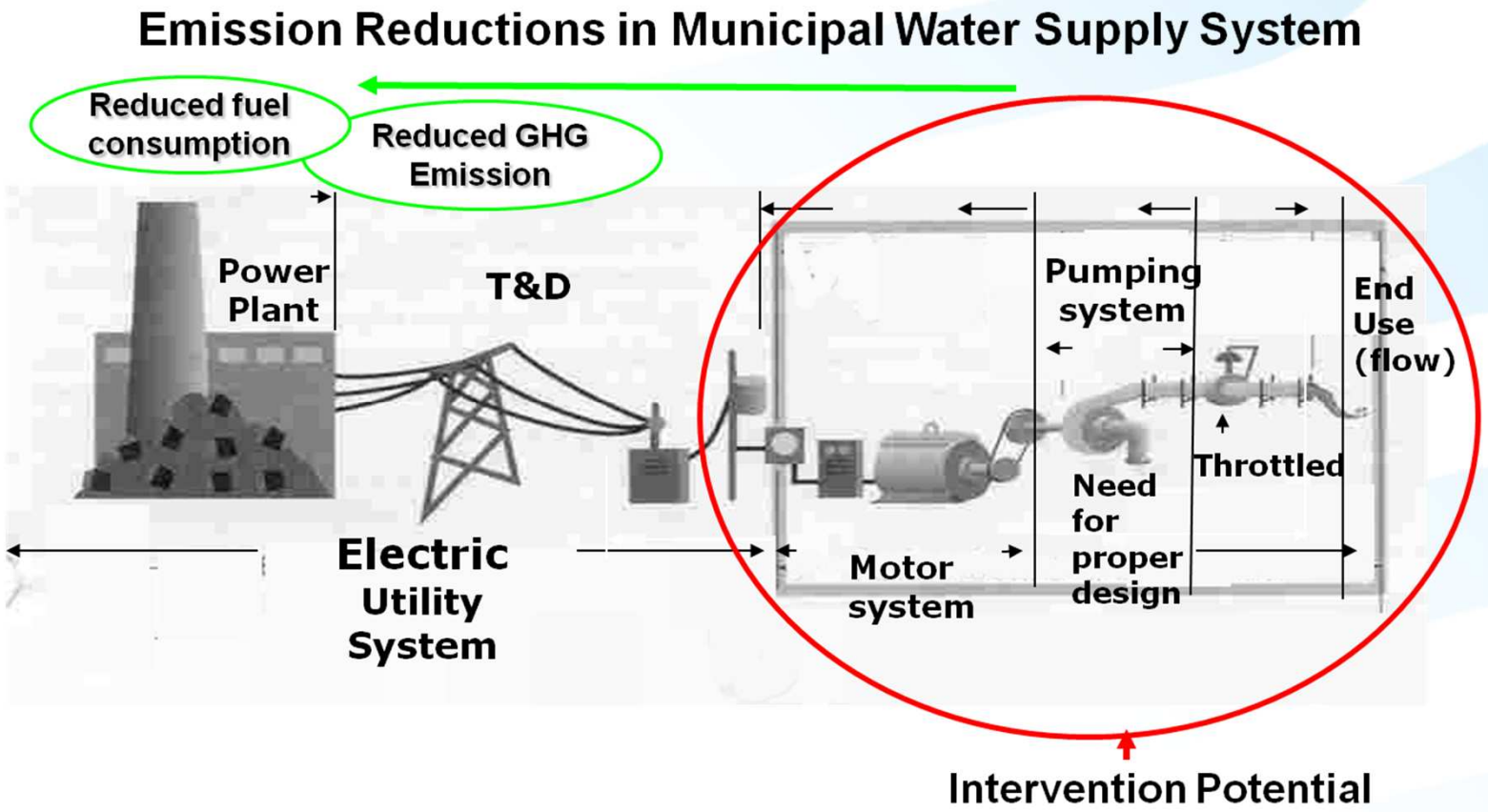

The Challenges
Water Supply & Wastewater Treatment are Infrastructure-Intensive

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- Energy and water efficiency can defer and in some cases eliminate the need for additional infrastructure investment
- Efficiency stretches limited water and energy resources…
  - expanding water access more quickly & inexpensively
  - postponing expensive new construction by maximizing the capacity of existing infrastructure

  Example: in Mexico the water currently lost to leaks would cover growth in demand for 6 years, leading to postponed infrastructure development
- Investment decisions in water & wastewater that neglect efficiency have a domino effect, increasing other investments:
  - new power plants
  - extraction & transport of fuel
  - environmental costs (e.g., air emissions)
  - declining reserves of water and hydrocarbons

Wastewater Treatment and Energy Use

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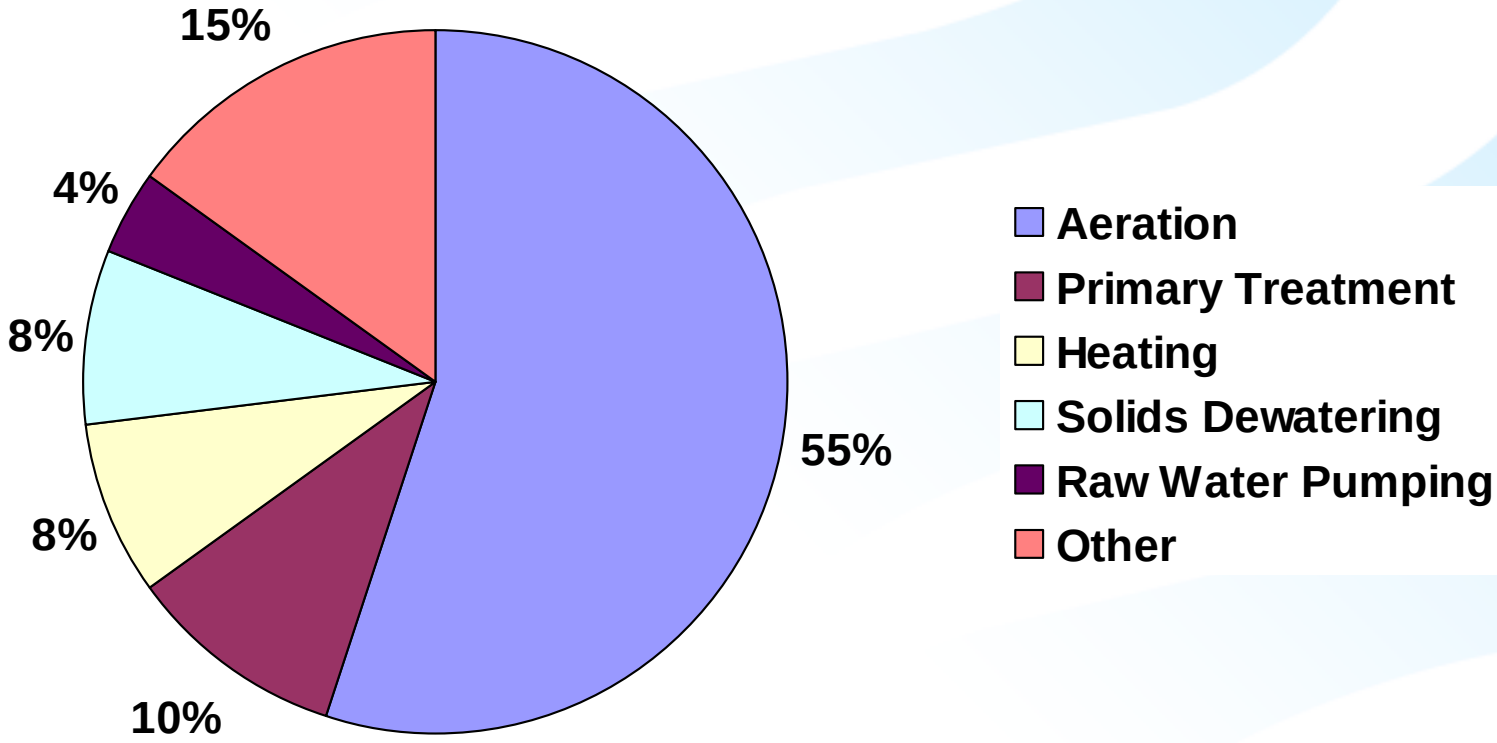

- Energy can make-up 25 to 40% of the total operating cost of a Wastewater facility

Wastewater Treatment and Energy Use

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- Aeration blowers account for majority of wastewater facility energy use
- Manual control of fixed speed aeration blowers can cause up to 50-60% excess energy use
- Significant energy savings can be realized by using variable speed control rather than fixed speed operation
- System controls of aeration blowers can improve energy efficiency further

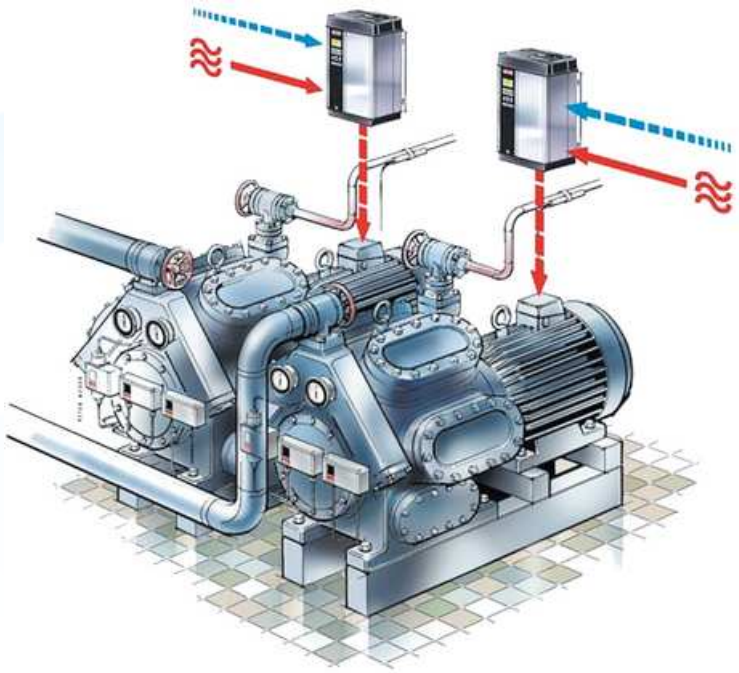


Photo courtesy of Danfoss, Inc.

What is "*WATERGY*"

Watergy is an Alliance to Save Energy program that maximizes efficiency of both energy and water

- Why is this important?
  - Each gallon in the system requires energy (~20% or > energy savings possible)
  - Water & energy efficiency frees up funding for other crucial public services
  - Mitigates risk in increasingly water-constrained environments
  - Water savings can amplify return on investment
  - Optimizing existing infrastructure forestalls the need to replace equipment
- What does a Watergy Project involve?
  - An assessment of the main end use applications
  - Assistance with design for energy efficiency
  - An energy management plan/training for plant personnel
  - Identification of financing mechanisms to enable implementation
  - Outreach/recognition of efficiency achievements

"Watergy:" The Beginnings

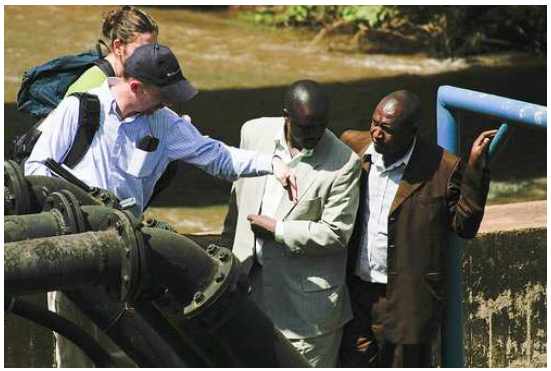
- Funded internationally by multiple donors:
  - USAID cooperative agreement 1997-2007
  - Since 2007 REEEP, APEC, IADB, Coca Cola, and local utilities
- Watergy goals:
  - Achieve energy, water and monetary savings through technical and managerial changes in water supply systems
  - Provide consumers with quality water while reducing water and energy waste
- Alliance offices in South Africa and Mexico opened to focus on Watergy
- Projects have typically involved:
  - Improving pumping system efficiency
  - Managing leaks
  - Automating system operations
  - Establishing metering and monitoring systems

"Watergy:" A Historical Success

- Since 1997 has been implemented in more than 100 cities in 16 countries
  - Mexico, South Africa, Brazil, India, Philippines, Sri Lanka, Guyana, Kenya, Jamaica, Bahamas, Suriname, Panama, Costa Rica, Honduras, Bosnia, Ukraine
  - In many developing countries up to 1/2 of water produced is lost in leaks
  - Payback are rapid: usually from a few months to up to 3 years
  - Aggregate results: 20.8 million kWh and $5.3 million (100 cities)
  - Launched in the U.S. in 2010 (Bucks County, PA)

WATERGY AROUND THE WORLD

EE in Caribbean Water Utilities



Lake Victoria Watergy project

Watergy in South African schools

Cost-Effective Actions

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- Improve Efficiency of Pumping Systems
- Leak Detection, Repair & lowering pressure
- Automated Controls
- Energy Management
- Metering & Monitoring

Efficiency Measure Example: Pump Optimization

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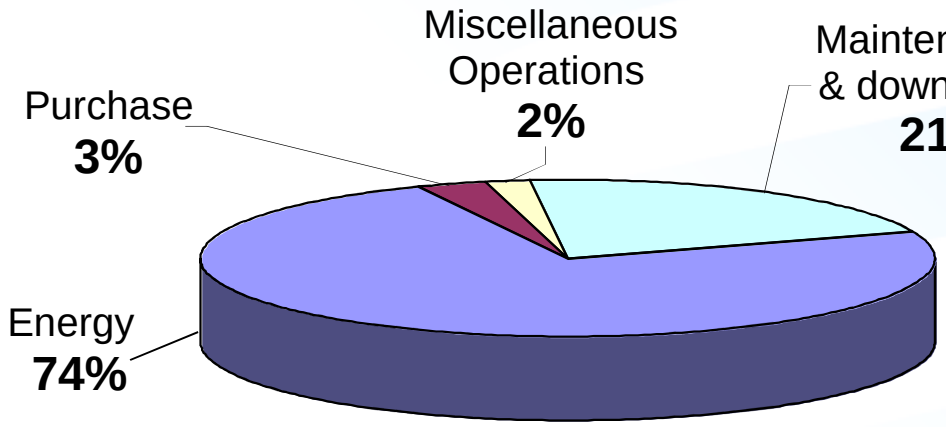
Procurement should be based on *efficiency* not *purchase price!*

- Of a pump's total cost over its lifetime:
  - 3% is for purchase
  - 74% is for energy
- A more efficient pump also has lower maintenance & downtime costs.

Typical Energy Savings in a total pumping system:

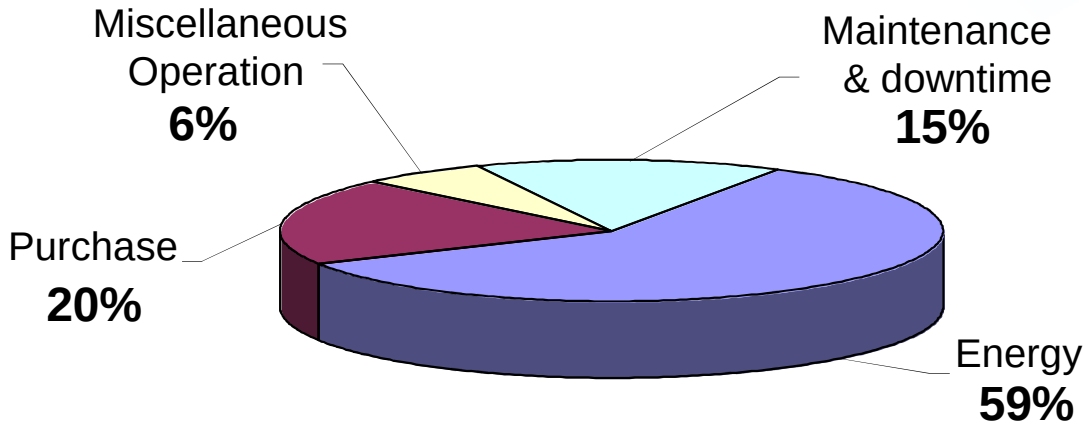
- Size – proper matching of pump size to load: 10–30%
- Speed – variable speed drives adjust as needed: 5–50%
- System Requirements – don't pump more flow and pressure than needed: 5–20%

Life Cycle Cost -Efficient vs. Inefficient pump



Life Cycle Costing: Inefficient Pump

- Purchase Price: $28,000
- 1st Yr Energy Cost: $69,000
- Total in Year One: **$97,000**



Life Cycle Costing: Energy Efficient Pump

- Purchase Price: $56,000
- 1st Yr Energy Cost: $19,600
- Total in Year One: **$75,600**

Case Study: Bucks County Water & Sewer Authority (BCWSA)

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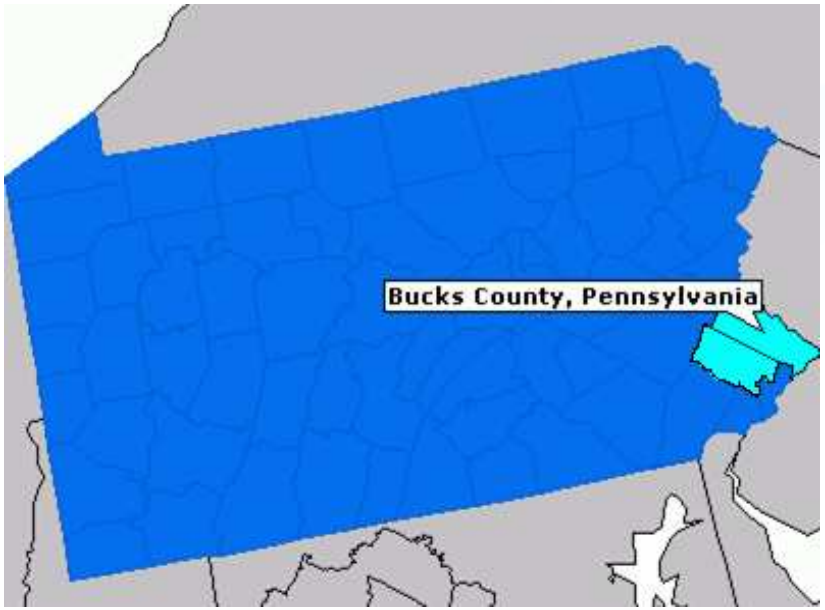

Systems designed based on historical growth, not rational design

Created in 1962

$65 million in Annual Revenue

78,000 Retail Water and Sewer Customers

385,000 Wholesale and Retail Population Served in Bucks & Montgomery Counties PA

One of 27 PA water systems serving over 100,000 people

Nearly 1,000 of these large systems across the US

BCW&SA has grown by 300% over the last 15 Years through Acquisitions

BCW&SA: A Typical Eastern US Water System

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- Some Pumping/Storage
- High Quality Raw Water – Conventional pre-treatment is sufficient
- Distribution system based on history, not rational design
- Energy is one of the top three expenses:
  - Total energy costs: $1.7 M in 2009
  - Total energy use: ~20 million kWh in 2009
- Scope of Bucks County Watergy project:
  - 4 wastewater treatment plants (treat more than 2 MGD)
  - 3 pumping stations (average total flow ~25 MGD)
    - Account for 69% of total energy consumption

Watergy Approach: Best Practices

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- Cross-functional assessment team:
  - Includes management, operations & energy experts
- Uses a systems approach instead of focusing on discrete components
- Technology neutral, product agnostic
- Strong knowledge of energy management:
  - Principles of ISO 50001
  - ASME System Assessment Standard for pumping systems

Proposed Solutions

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- Pump control replacements
- Blower improvements
- Other mechanical and metering improvements
- Operator training and incorporating energy management into SOPs, O&M manuals
- Financing packages from government, utility, and private parties

Assessment Results

- Electric Energy Savings → 4.1 million kWh
- Energy Cost Savings → $361,000/yr
- Simple Payback → 2.2 years (~ 45% ROI)
- Integrated energy management plan

Future Watergy Activities

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- Projects
  - Exploring with additional utilities & state agencies
- Advocacy
  - Policy development
- Outreach/Training
  - Tools & materials to raise awareness
  - Energy management training

ISO International Organization for Standardization

Concluding Remarks

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- Water and energy are not cheap or plentiful
- Addressing water and energy efficiency yields multiple benefits
- Opportunities in the U.S. are strong to:
  - Increase market penetration of energy efficient technologies
  - Foster a culture of continuous energy & water efficiency

THANK YOU!

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www.ase.org

www.watergy.org