U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

The Energy-Water Nexus: State and Local Roles in Efficiency & Water and Wastewater Treatment Plants

September 11th, 2013

DOE's State and Local Technical Assistance Program

DOE's Technical Assistance Program

Priority Areas

- Strategic Energy Planning
- **Program & Policy Design and Implementation**
- Financing Strategies
- Data Management and EM&V
- **EE & RE Technologies**

Resources

- General Education (e.g., fact sheets, 101s)
- Case Studies
- Tools for Decision-Making
- Protocols (e.g., how-to guides, model documents)

Peer Exchange & Trainings

- **Webinars**
- Conferences & in-person trainings
- Better Buildings Project Teams

One-on-One

- Level of effort will vary
- In-depth efforts will be focused on:
  - *High impact efforts*
  - *Opportunities for replicability*
  - *Filling gaps in the technical assistance marketplace*

Priority Area: EE & RE Technologies

- **Trainings & Peer Exchange**
  - ➢ Upcoming TAP Webinars:
    - States Applications for Combined Heat and Power Technologies, 9/25
    - Tapping New Markets for Efficiency: State Initiatives for Multifamily Housing, 10/17

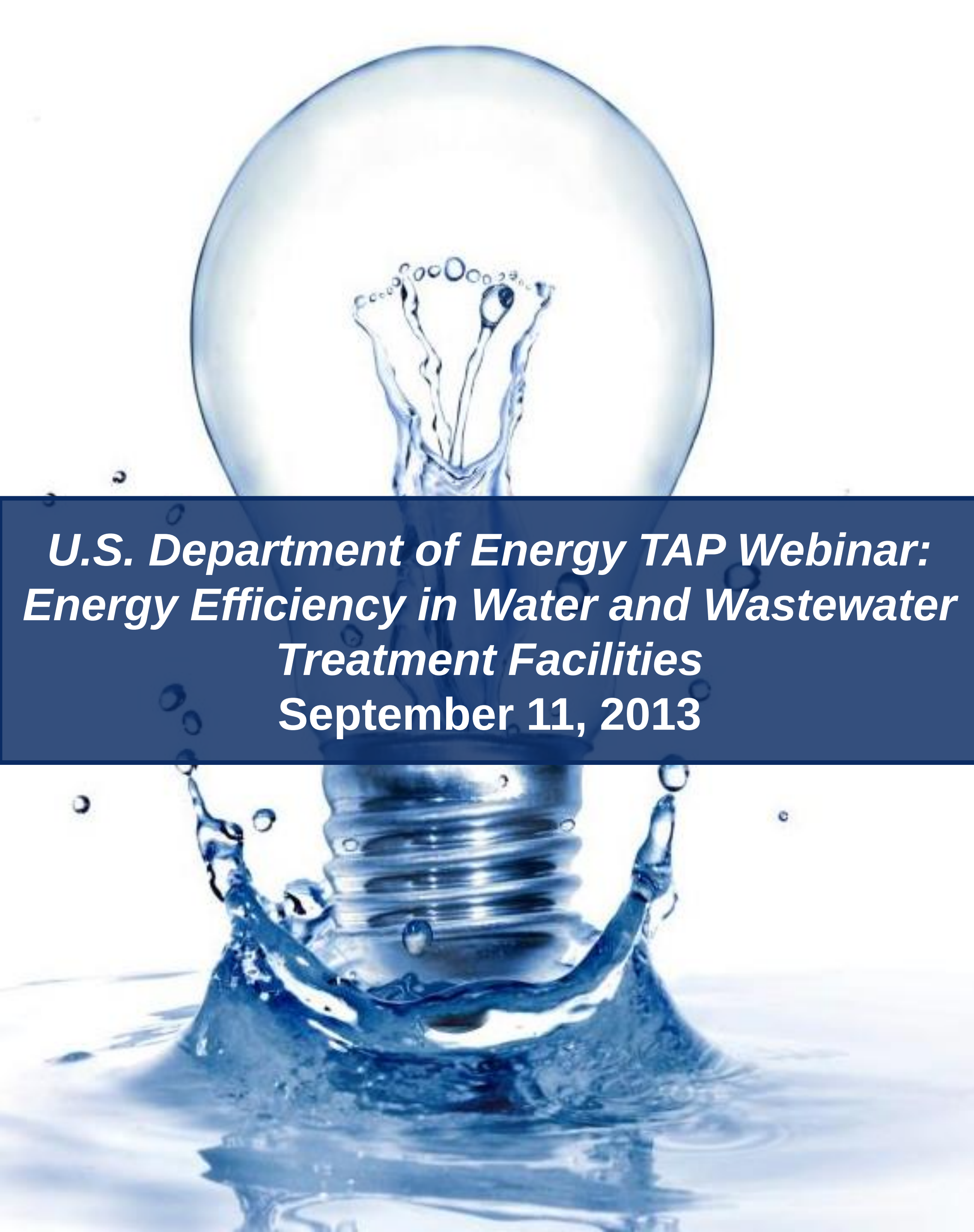
    www.eere.energy.gov/wip/solutioncenter/wip_events.html
- **Resources**
  - ➢ Advanced Manufacturing Office's Energy Resource Center
    www.eere.energy.gov/manufacturing/tech_assistance/ecenter.html
  - ➢ Water Environment Foundation's Matrices of Best Practices in Energy Roadmap
    www.wef.org/energywater.aspx
  - ➢ EPA's Sustainable Water Infrastructure Program
    water.epa.gov/infrastructure/sustain/index.cfm
  - ➢ EPA's State and Local Guide to Energy Efficiency in Water and Wastewater Facilities
    www.epa.gov/statelocalclimate/documents/pdf/wastewater-guide.pdf
  - ➢ Updated Solution Center resource portal for technology deployment live later this year

How to Tap into These and Other TAP Offerings

- Visit the ***Solution Center***
  www.eere.energy.gov/wip/solutioncenter/

- Submit an ***application*** for assistance
  www.eere.energy.gov/wip/solutioncenter/technical_assistance.html

- Sign up for ***TAP Alerts***, the TAP mailing list, for updates on our latest and greatest
  TechnicalAssistanceProgram@ee.doe.gov



U.S. Department of Energy TAP Webinar: Energy Efficiency in Water and Wastewater Treatment Facilities
September 11, 2013

Energy Conservation and Generation Technologies at Water & Wastewater Facilities

Barry Liner, Ph.D., P.E.
Director, Water Science & Engineering Center

Water Environment Federation
the water quality people

Energy Use in Water Sector

- Drinking water and wastewater consume:
  - 3% - 4% of domestic electricity[1]
  - 7% of worldwide electricity[1]
  - 19% of California electricity[2]
    - (Includes end use)
- Water resources can be 50% of a municipality's electricity use

1. Electric Power Research Institute (Burton 1996)
2. Energy Down the Drain: The Hidden Costs of California's Water Supply

Drinking Water Energy Use

- 1,000 – 2,500 kWh/MG
  - Roughly 80% is pumping

New regulations are increasing the use of the following, energy intensive treatment processes:

- UV Disinfection 70-100 kWh/MG
- Ozone 170 kWh/MG
- Membranes
  - Nano and RO 1,800 kWh/MG
  - Ultrafiltration 1,000 kwh/MG
  - Microfiltration 100 kwh/MG

AwwaRF 91201.Energy Index Development for Benchmarking Water and Wastewater Utilities

Wastewater Facility Energy Use

- 1,000-4,000 kWh/MG
- Wastewater contains between 2-10 times amount of energy needed to treat it

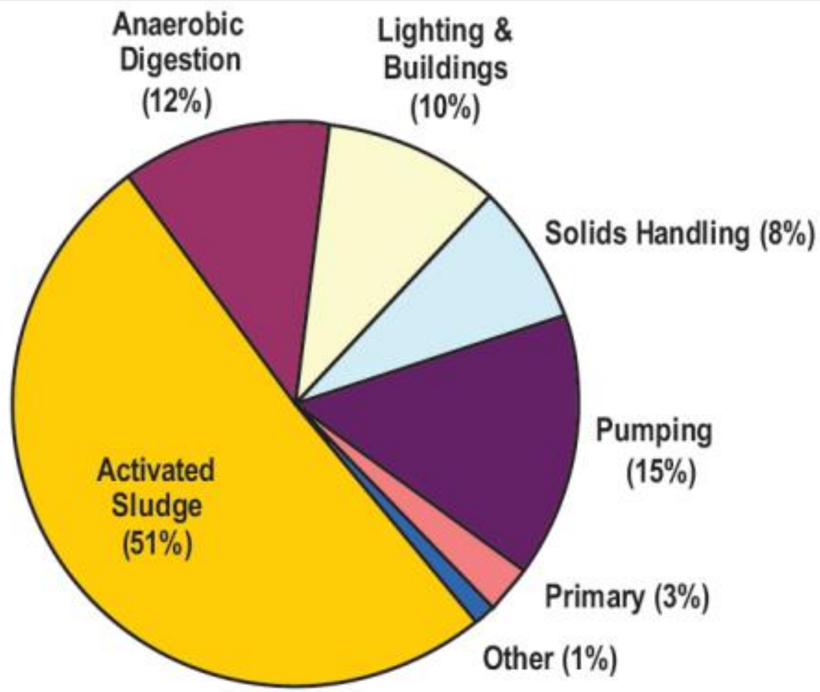
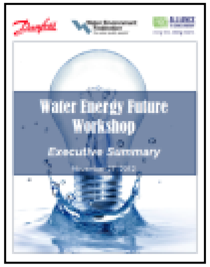


FIGURE 5.2 Typical energy use for an activated sludge secondary facility (SAIC, 2006; WEF, 2009).

Change our Mind(set)

- *WEF believes that wastewater treatment plants are* ***NOT waste*** *disposal facilities, but rather water* ***resource recovery*** *facilities that produce* ***clean water****,* ***recover nutrients*** *(such as phosphorus and nitrogen), and have the potential to reduce the nation's dependence upon fossil fuel through the production and use of* ***renewable energy****.*

Key Barriers

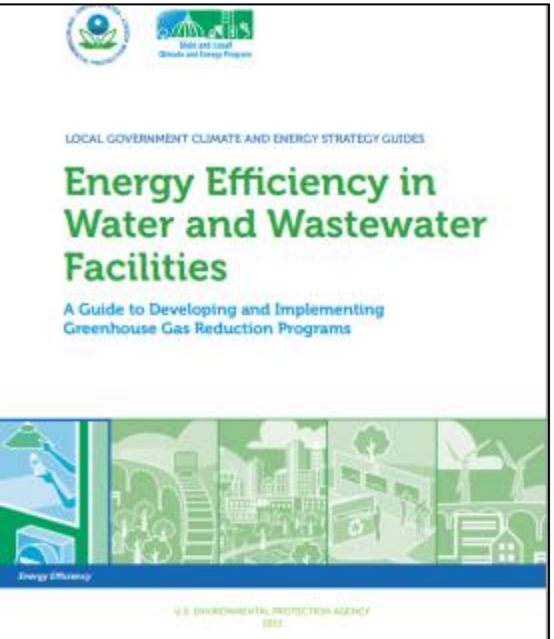


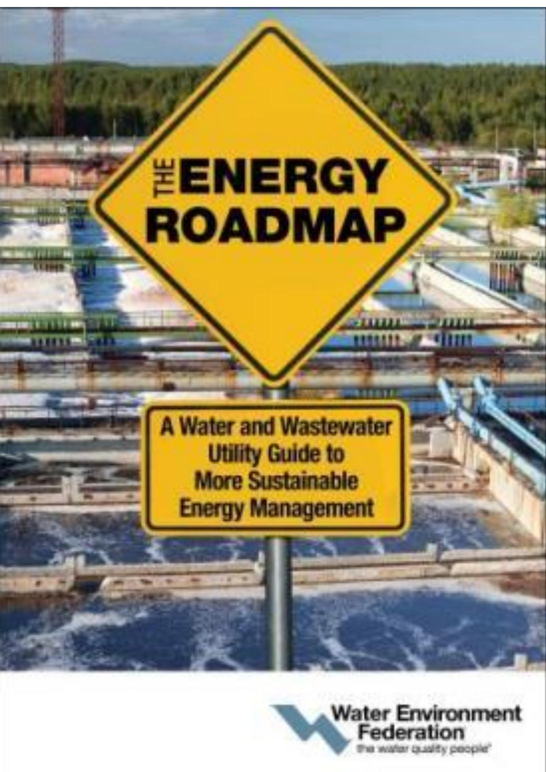
Barriers

- Little guidance from Federal to State for energy efficiency
- Regulations are not streamlined and often mandate other priorities
- Energy from biosolids not universally considered renewable
- Selling excess electricity back to the grid is sometimes hindered by tariffs and interconnection policies
- Standardization is needed for the state definition of energy service companies – WRRFs and their energy streams (biogas/biosolids) should be included

Potential Solutions

- Provide guidance for improving energy efficiency and implementing energy generation at water treatment facilities
- Encourage policy and integrated planning that supports a permit process incentivizing energy efficiency and energy generation in the water sector
- Offer grants, tax credits, state revolving funds, public/private partnerships, or other options to help with financing the energy transition
- Work to harmonize ESCO legislation in all 50 states





Free Resources

- WEF Matrices of Best Practices in Energy Roadmap
  - http://www.wef.org/energywater.aspx
- WEF e-learning course
  - *Drivers Ed for the Energy Roadmap*
- The U.S. Environmental Protection Agency (EPA) Energy Efficiency in Water and Wastewater Facilities
  - http://www.epa.gov/statelocalclimate/documents/pdf/wastewater-guide.pdf

TABLE 1.1 Strategic management—utility progression characteristics.

	Enable	Integrate	Optimize
Strategic direction	SET GOALS • Energy goals and key performance indicators are established for both conservation (see *Demand-Side Management*) and production (see *Energy Generation*).	GATHER SUPPORT • Utility incorporates energy goals and key performance indicators to strategic plan. • Governing board establishes energy /sustainability committee.	PRIORITIZE AND IMPLEMENT • Energy management program initiatives are prioritized using tools such as ○ Strategic business planning and effective utility management and ○ Environmental management systems. • Energy generation is an integral part of a utility's suite of services. • Utility implements ISO 50001 Standard. • Utility uses triple bottom line approach for sustainability project decision making.
Financial viability	IDENTIFY FUNDING OPTIONS • Financial strategy developed to support energy audit and to fund resulting projects.	BUDGET FOR SUCCESS • Life cycle analysis used for decision-making on energy projects. • Energy use is considered on all capital project design and in operating budget decisions and standard operating practices.	INVEST IN THE FUTURE • Utility's energy initiatives generate sufficient revenue to invest in other utility priorities and reduce upward pressure on rates. • Energy arbitrage opportunities are leveraged.
Collaborative partnerships	EVALUATE OPPORTUNITIES • Opportunities for collaboration on energy projects (e.g., energy services company, joint venture, public– public/private partnership) are analyzed. • Diverse markets for energy products are identified.	ESTABLISH CONNECTIONS • Contracts with partners are in place and implemented to facilitate data exchange and planning with water, energy, and gas utilities. • Utility planning efforts are integrated with other agencies regarding multiple resources (e.g., water, stormwater, etc.).	LEVERAGE RESOURCES • Utility uses partnerships to maximize energy sales revenues and/or reduce demand (e.g., selling power or biogas to adjacent facility, working with a feedstock provider for co-digestion).
Toward carbon neutrality	PLAN CARBON FOOTPRINT ANALYSIS • Approach to carbon footprint analysis/GHG inventory is established.	INVENTORY GHG* EMISSIONS • Carbon footprint/GHG inventory is developed.	RECOVER RESOURCES • Additional resources are recovered or realized (e.g., carbon credits) as utility moves toward carbon neutrality. • Comprehensive carbon footprint/GHG inventory is maintained, including fugitive emissions and embodied energy of significant inputs (e.g., chemicals).

*GHG = greenhouse gas.

Table 1.2 Organizational culture—utility progression characteristics.

	Enable	Integrate	Optimize
Energy vision	DEVELOP VISION • Leadership group develops energy vision. • Governing body adopts energy vision as policy. • Leadership group communicates energy vision to workforce.	COMMUNICATE INTERNALLY • Leadership group links energy vision to staff performance plans. • Leadership group incorporates energy goals/key performance indicators to strategic plan.	COMMUNICATE EXTERNALLY • Utility shares energy vision with external stakeholders and the industry. • Plans are in place to embrace external market changes.
Energy team	FORM TEAM • Utility establishes cross-functional energy team. • Leadership group establishes clear charge and authority for energy team with defined roles for members.	TAKE ACTION AND TRACK • Energy team drives implementation of recommendations. • Energy team systematically reports on progress and future actions.	EMPOWER TEAM • Energy team provided significant budget authority to implement improvements. • Energy team interfaces directly with governing body to get direction from and report on energy program status.
Staff development and alignment	SET TRAINING PLAN • Employee performance plans include energy program-related activities to support energy vision. • Training needs for utility leadership and staff are identified.	TRAIN AND SUPPORT STAFF • Staff are trained in demand-side management and energy generation. • Staff maintains knowledge of emerging technologies through information-sharing events.	EMPOWER STAFF • Leadership group establishes incentives for energy-conservation results. • Leadership group empowers staff to make changes for energy savings.

Table 1.3 Communication and outreach—utility progression characteristics.

	Enable	Integrate	Optimize
Customers and community	• Customer outreach and education strategy is tailored to project needs and customer expectations. • Community groups are identified for outreach to gain program support.	• Proactive customer outreach program (e.g., bill inserts, tours, fact sheets, Web site) that focuses on environmental benefits and cost-effectiveness is established.	• Utility engages customers in helping to achieve energy program goals (e.g., local grease collection).
Regulatory and legislative	• Key regulators are identified and effective working relationships are established (e.g., regulations pertaining to air and solids). • Legislative strategy is developed to enhance opportunities and minimize hurdles for energy program.	• Key regulators are educated on holistic energy/water relationship. • Utility advocates for unified regulations that address cross-media issues. • Regional collaboration with other agencies occurs (e.g., for funding or policy changes).	• Utility works with industry associations to influence regulators/legislature to create incentives to encourage efficient energy use and increase renewable energy production. • Utility influences funding agencies to prioritize energy projects in the water sector. • Regulators and utility work together to resolve cross-media issues.
Media outreach	• Media outlets are identified and strategies are developed.	• Media kit is developed (e.g., video, sound-bites, pictures, and press releases).	• Dedicated utility staff work on messaging with media.
Environmental advocacy groups	• Outreach strategy is developed to support energy projects. • Appropriate partnerships are identified.	• Utility shares energy program activities (e.g., tours, fact sheets, etc.).	• Joint programs and outreach that support the goals of both organizations are implemented.
Water sector	• Key energy staff network at local/regional industry events and information-sharing groups.	• Successes, failures, and lessons learned are shared at industry events.	• Energy staff lead industry initiatives to support sector advancements in sustainability.

TABLE 1.4 Demand-side management—utility progression characteristics.

	Enable	Integrate	Optimize
Electricity costs and billing	GET ORGANIZED • Historical electric bills are analyzed (2-plus years of data are preferred).	UNDERSTAND THE DETAILS • Rate structure and billing details are understood ○ Demand charges ○ Energy charges, unit costs, and time of use ○ Billing period	IMPLEMENT CHANGES • Modifications are made to billing and/or operations to reduce costs ○ New rate structure is selected and ○ Loads are shifted to reduce on-peak demand charges or unit costs.
Power measurement and control	GET THE BIG PICTURE • Baseline energy use and benchmarks are determined. • Energy submetering needs are identified. • SCADA[a] systems and power monitoring capabilities are identified.	DETERMINE USE BY KEY PROCESS • Energy use by each significant unit process area is determined. • Energy use is benchmarked against similar size/type plants to identify target areas for energy reductions. • Electricity use and process data are analyzed together. • Load management (shedding/switching) is in place.	MONITOR FOR REAL-TIME CONTROL • Electricity use by significant load center is monitored in real time. • Real-time control is in place (e.g., SCADA) to measure equipment energy use and efficiency with a user-friendly display (i.e., "energy dashboard"). • Excess power generation is wheeled to other assets or entity.
Energy management	INITIATE AUDIT • Energy team performs energy audit. • Goals are set for reducing energy use and costs.	IMPLEMENT RECOMMENDATIONS • Cost-effective recommendations from audit are implemented. • Energy team tracks actual vs planned results.	PLAN FOR THE FUTURE • Energy savings are incorporated to the design of all future capital projects and new operating strategies.
Source control	UNDERSTAND INFLUENT • Loads (industrial, water use, I&I[b]) are understood and evaluated for energy treatment requirements and energy production potential.	MANAGE LOADING • Methods are in place to manage influent loading to reduce energy use (e.g., industrial surcharge optimization, I&I reduction program, etc.). • Methods to reduce flows are investigated.	ENHANCE ENVIRONMENT • Sources are managed to reduce energy use and maximize energy production potential (e.g., appropriate incentives for trucking high-strength waste).

[a]SCADA = supervisory control and data acquisition and

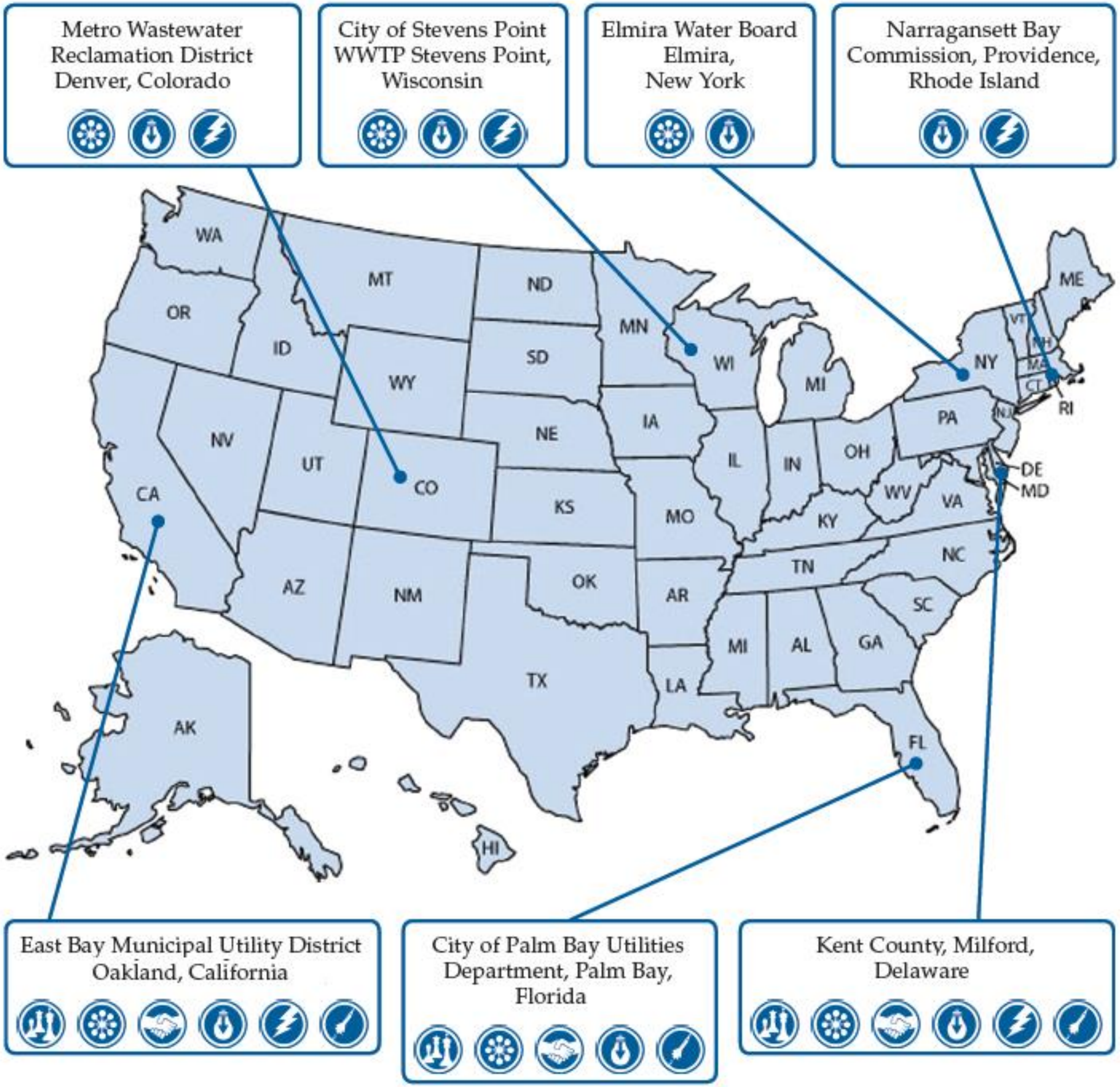
[b]I&I = infiltration and inflow.

Table 1.5 Energy generation—utility progression characteristics.

	Enable	Integrate	Optimize
Strategy	SET PRODUCTION GOAL • Measurable energy generation goal is established. • Energy generation plan is coordinated with utility strategic plan. • Energy team understands regulatory and permit limitations (e.g., air emissions) with regard to generation.	OBTAIN SUPPORT • Governing body approves capital budget for energy generation projects. • Regulatory issues have been addressed and satisfactorily resolved.	GROW PROGRAM • Infrastructure for energy generation is proactively maintained, renewed, and upgraded. • Holistic evaluation methodologies (e.g., triple bottom line) are used to evaluate energy generation opportunities.
Energy from water	EVALUATE INTEGRAL ENERGY SOURCES • Available energy resources are quantified, such as ○ Biogas, ○ Hydropower, and ○ Heat.	IMPLEMENT GENERATION SYSTEMS • Energy generation facilities are operating and producing power/heat for utility use ○ Electricity/heat and ○ Fuel (natural gas, pellets, etc.).	OPTIMIZE PRODUCTION • Energy production is optimized to maximize the value of generation (e.g., biogas storage to offset power purchases during on-peak hours).
Supplemental energy sources	IDENTIFY SUPPLEMENTAL ENERGY SOURCES • Available non-water-derived energy sources are quantified, including ○ Co-digestion, ○ Solar, and ○ Wind. • Feedstock market evaluation is performed.	IMPLEMENT GENERATION SYSTEMS • Energy generation facilities are operating and producing power/heat or fuel. • Quantity and quality of feedstock meets capacity.	MAXIMIZE PRODUCTION • On-site electricity generation from all sources approaches or exceeds on-site electricity demand. • High-strength organic waste (e.g., food; fats, oils, and grease; etc.) is integrated into feedstock supply to increase generation potential.
Renewable energy certificates (RECs)	PLAN FOR RECs • Staff gain understanding of state regulations for renewable portfolio standard and production and sales of RECs.	USE RECs • Utility produces, sells, and/or purchases RECs, as appropriate.	MAXIMIZE VALUE OF RECs • Sales and purchases of RECs are optimized to maximize value of resources, potentially using automation.

Table 1.6 Innovating for the future—utility progression characteristics.

	Enable	Integrate	Optimize
Research and development (R&D)	PREPARE FOR R&D • Staff are well versed in existing technologies. • Opportunities are identified by survey of emerging technologies.	PERFORM R&D • Utility budget includes R&D funding. • Utility actively participates in water innovation partnerships (e.g., water innovation centers, research foundations, university partnerships, etc.).	EXPAND R&D • Utility culture is open to new technologies. • Site visits to facilities using innovative technologies occur regularly. • Completed trials and research projects provide the foundation for further advancement within the industry.
Risk management	IDENTIFY AND PRIORITIZE RISKS • Risk of innovation is identified. • Strategy for risk mitigation is developed. • Planning includes measures for climate change adaptation (e.g., extreme events).	MITIGATE RISKS • Risk is reduced through collaborative research and information sharing. • Leadership group recognizes and rewards innovative approaches.	LEVERAGE INNOVATION • Organization can successfully trial and implement innovative projects and is adaptable to emerging opportunities. • Patents are obtained to protect utility and water sector.
Alternative treatment technologies	EVALUATE TECHNOLOGIES • Technologies that reduce energy use or increase generation are identified.	INITIATE TRIALS • Advanced low-energy treatment technologies and energy production technologies are demonstrated.	IMPLEMENT FULL-SCALE SOLUTION • Lower energy-consuming processes replace energy-intensive secondary treatment.
Alternative management approaches	IDENTIFY ALTERNATIVES • Decentralized treatment options are considered. • Planning is performed on a watershed basis.	IMPLEMENT ALTERNATIVES • Green infrastructure projects are implemented where appropriate. • Enhanced regionalization (e.g., biosolids processing) has been considered and implemented where appropriate.	EXPAND INTEGRATION • Alternative management approaches (e.g., decentralization, regionalization, etc.) are used, where appropriate, to maximize overall, regionwide benefit.



Case Studies

Efficiency

- Variable Frequency Drives
- Peak Shaving
- SCADA

Micro-Hydro

Energy Flow at WRRF

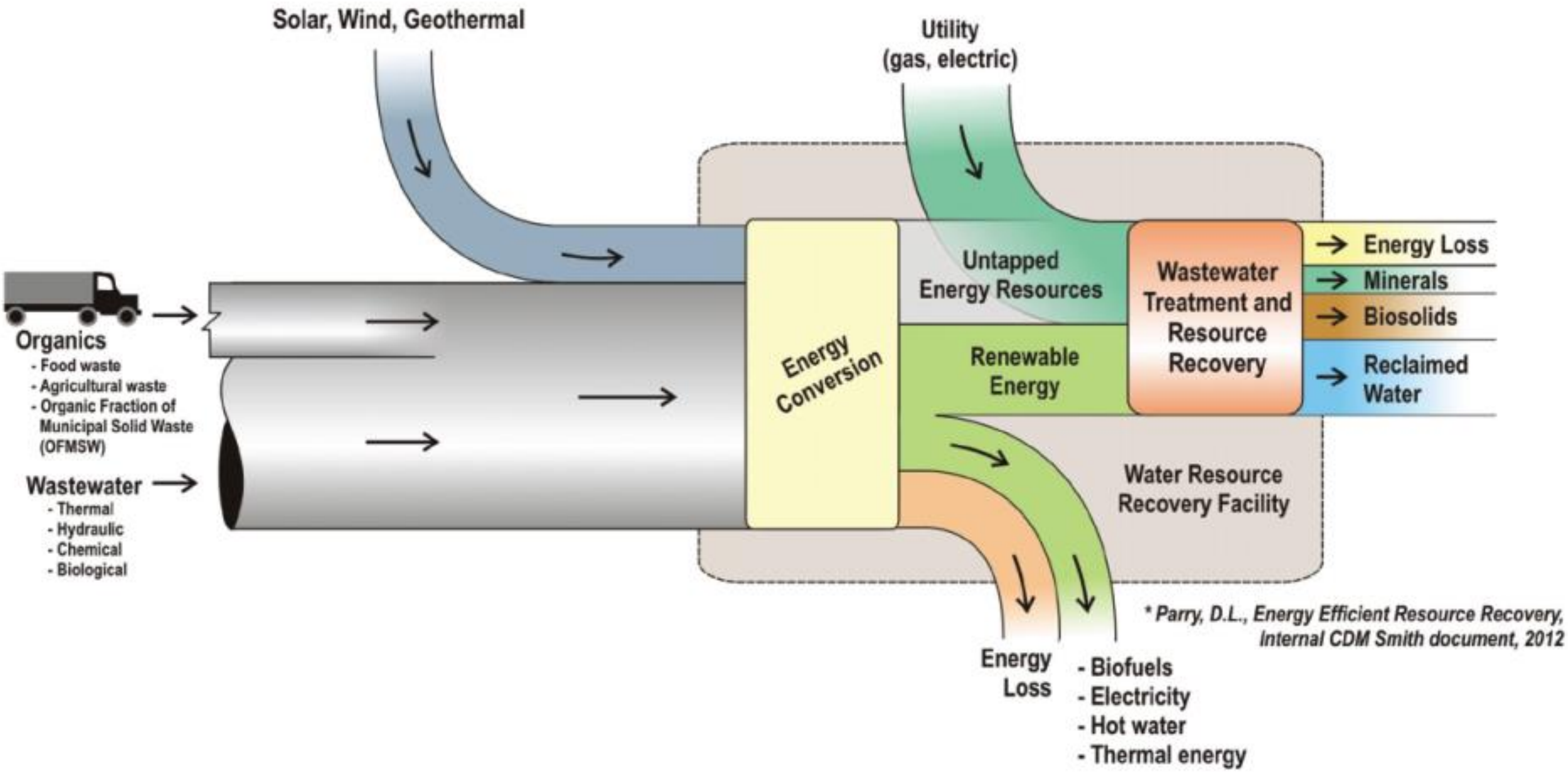


FIGURE 1.2 Schematic energy flow at a water resource recovery facility.

Anaerobic Digestion & Biogas

Stevens Point, WI

http://www.appleton.org/

- Biogas is generally 50% methane
- Combined heat & power (CHP)
- Co-digestion
  - Fats, oils, grease
  - Organic wastes
  - Whey
- Generate electricity
- Clean gas and use as fuel

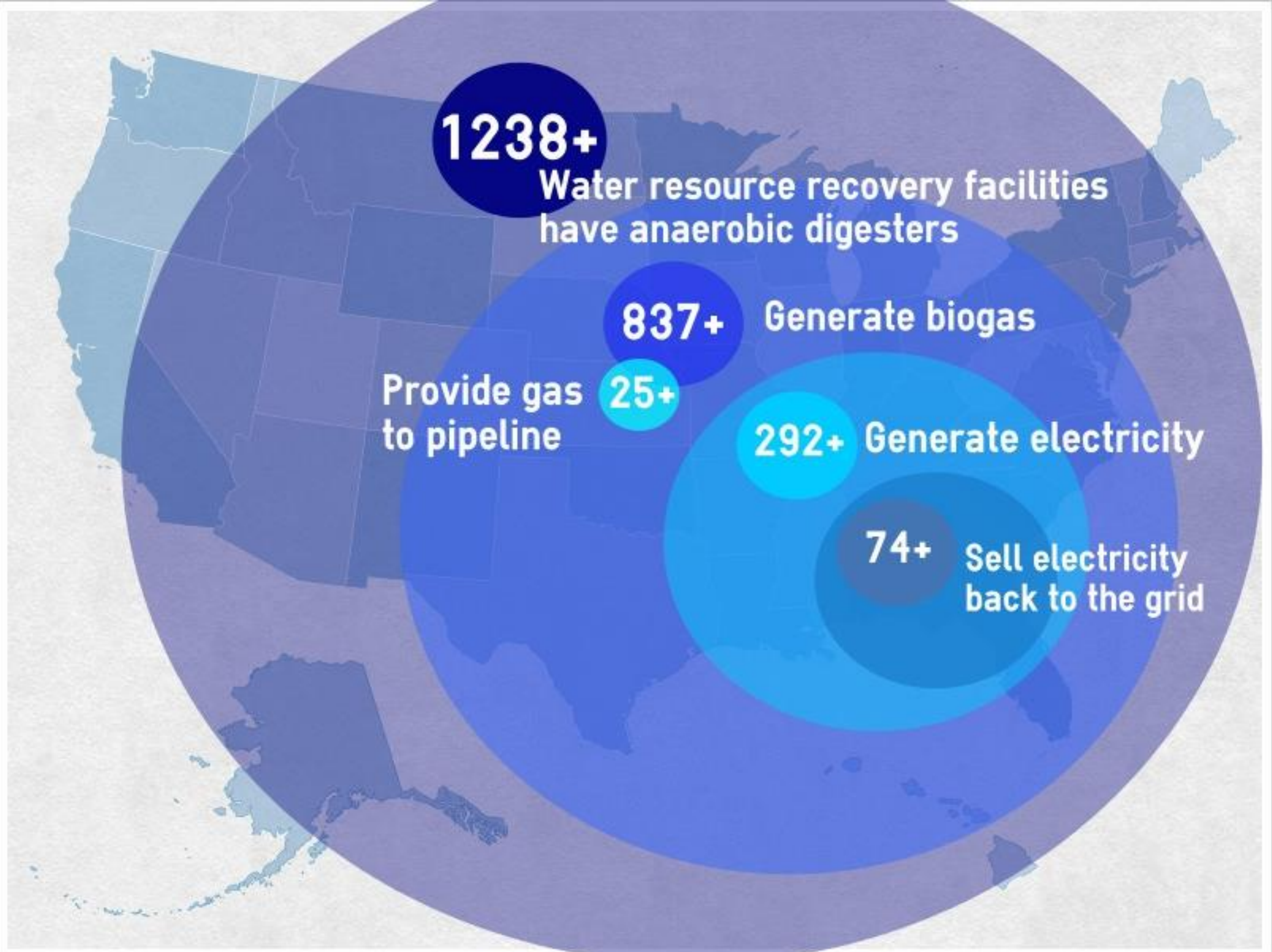
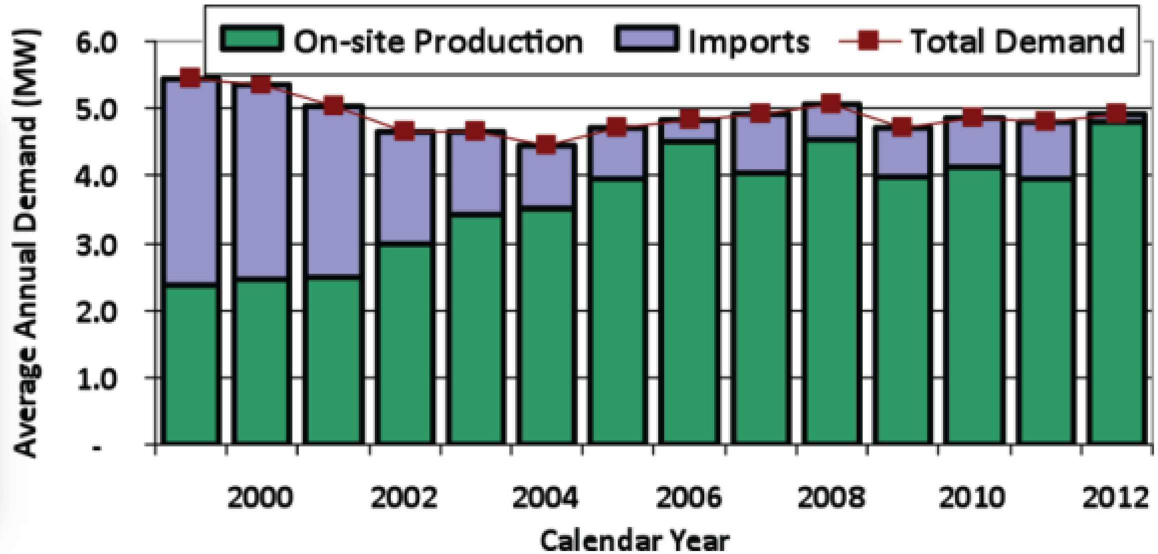

1238+
Water resource recovery facilities
have anaerobic digesters
837+
Generate biogas
Provide gas
to pipeline
25+
292+
Generate electricity
74+
Sell electricity
back to the grid

TABLE 6.1 Examples of facilities using biogas for energy generation.

Location	Average flow (ML/d)	Rate ($/kWh)	Type (year installed)	Total capacity (kW)	Capital cost ($)	Annual net savings ($/yr)	
Albert Lea, Minnesota	16 (4.3 mgd)	$0.07	Microturbines (2003)	120	$92,000	$70,000	Po for in an m 5 Al
Burlingame, California	13 (3.4 mgd)	$0.14	Internal combustion engine (2006)	200	$912,000	$116,000	
Marshalltown, Iowa	24 (6.4 mgd)	$0.07	Internal combustion engine (1972)	1000	Unknown	$70,000	
Sheboygan, Wisconsin	40 (10.5 mgd)	$0.06	Microturbines (2006, 2010)	700	$1.8 million	$125,000–250,000	Po fo pu t
Gwinnett County/Fort Wayne Hill, Georgia	113 (30 mgd)	$0.04	Internal combustion engine (2011)	2100	$5.2 million	$1 million	
Narrangansett Bay/Bucklin Point, Rhode Island	83 (22 mgd)	$0.11	Internal combustion engine (2014)	600	$4–5 million	$325,000	
Occoquan, Virginia	(32 mgd)	$0.06	Internal combustion engine (2013)	848	4.5 million	$375,000	
Hampton Roads, Virginia	204 (54 mgd)	$0.06	Internal combustion engine (2012–2013)	2200	$406,000/yr, 20-year debt	$385,000	

Net Energy Producer



Or flair for flares?

Traditional Renewables

Courtesy of Peter Goldberg for Narragansett Bay Commission

Kent County, Delaware

Gasification & Pyrolysis

KORE Infrastructure LLC

Fuel Cells: Orange County Sanitation District


70MPa
TOYOTA
FCHV-adv

>

BARRY LINER

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WATER'S WORTH IT™

Water Environment Federation®
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Water Energy Partnership in Arizona
(WEPA)

Connecting Water & Energy

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What's the Cost

The U.S. Environmental Protection Agency (EPA) estimates **3-4 percent of national electricity consumption**, equivalent to approximately 56 billion kilowatt hours (kWh), or $4 billion, is used in providing **drinking water and wastewater services** each year.

Future Energy Demand

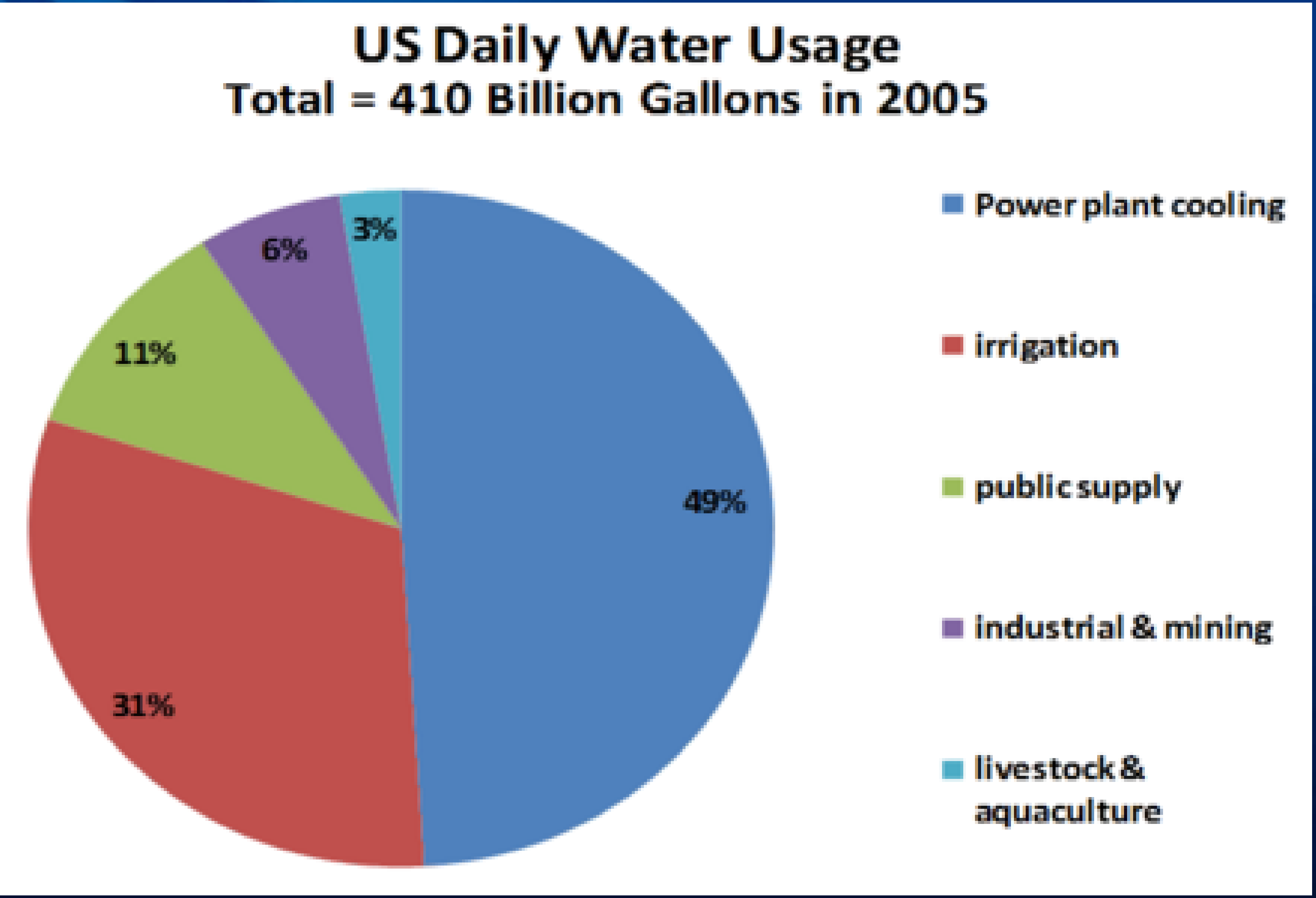
- Energy demand increase » 20% - 30% in 15 years
- Population & more stringent regulations
  - *Aging infrastructure*
  - *Increasing threats to watersheds and aquifers*
  - *Changing compliance and public health standards*
  - *"Rising cost" industry*
  - *Higher customer expectations*
  - *Emerging contaminants (pharmaceuticals)*
  - *Increasing competition for raw water sources*

Water & Energy Efficiency

Becoming water and energy efficient provides a wide range of benefits—for utilities, consumers, businesses and the community as a whole.

Using less water means moving and treating less water, reducing the strain on our water supplies, drinking water and wastewater infrastructure.

Energy Use



Source: US Geological Survey 2005

What Can the Water Supplier Do?

System owners and operators can pursue best industry practices for water efficiency, such as:

- System-wide water loss accounting
- Leak detection and repair
- **Benchmark** energy consumption

Grant History

In February 2012 the U.S. Department of Energy (DOE) issued a competitive funding opportunity announcement (FOA) to states to advance policies, programs, and market strategies that accelerate job creation and reduce energy bills while achieving energy and climate security for the nation.

The focus : *To advance Energy Efficiency in Public Facilities to assist states to develop holistic, whole-building, deep retrofit programs and strategies across as broad a segment of public facilities as possible to achieve significant energy and cost savings.*

Pumps in Water & Wastewater

- Water Distribution Pumps
  - Booster Station:
    700 – 1,200 kWh/MG
  - Well Pumps:
    1,000 – 1,800 kWh/MG
- Waste Water Treatment Plants
  - System:
    1,000 – 3,500 kWh/MG

Pumps in Water & Wastewater facilities account for (1/7) of Arizona state energy consumption

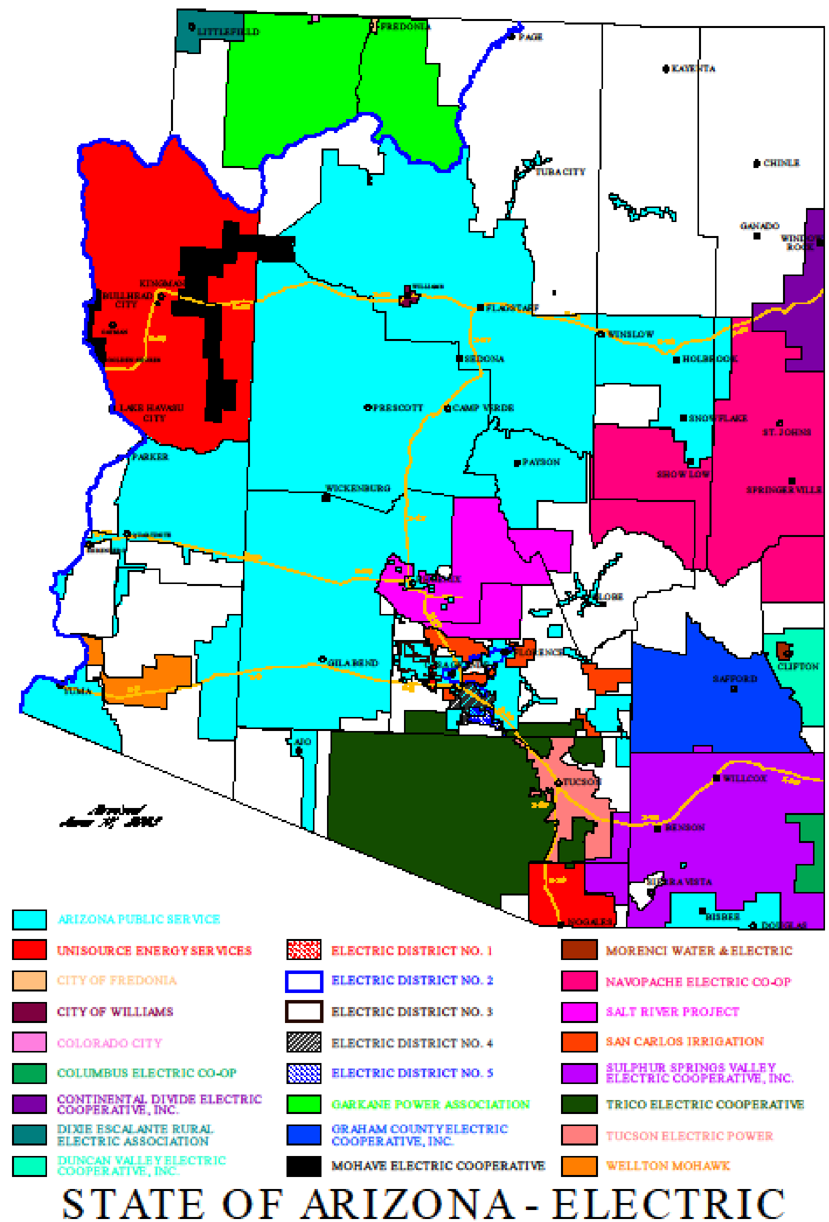
Water Energy Nexus

The EPA estimated that on average, 2 gallons of water are lost to evaporation for each kWh consumed at the point of end use This number varies state by state, depending on the energy-mix. In Arizona, for example, 7.85 gallons of water are lost to evaporation per kWh consumed.

Arizona Facts

- 6^{th} Largest State
- 15 Counties
- 30 State Parks
- 20 Native American Tribes

Arizona Utility Map



WEAP Goals

Determine where Arizona stands with respect to per capita energy consumption compared to the best plants, and how to make facility more energy efficient and save water.

Goal #1 – Benchmarking 100 water & wastewater facilities in Arizona

Goal #2 – Determine possible savings potential

Goal #3 – Recommend & assist in implementation solutions to reduce energy costs

Water Energy Partnership in Arizona Activities

INVESTIGATION

- Facility Identification

-Benchmarking

- Education/Training

TECHNICAL ASSISTANCE

- Needs Assessment

- Funding Options

-Education/Training

IMPLEMENTATION

- Project Upgrades

- Education/Training

Coordination/Collaboration

Starting Point

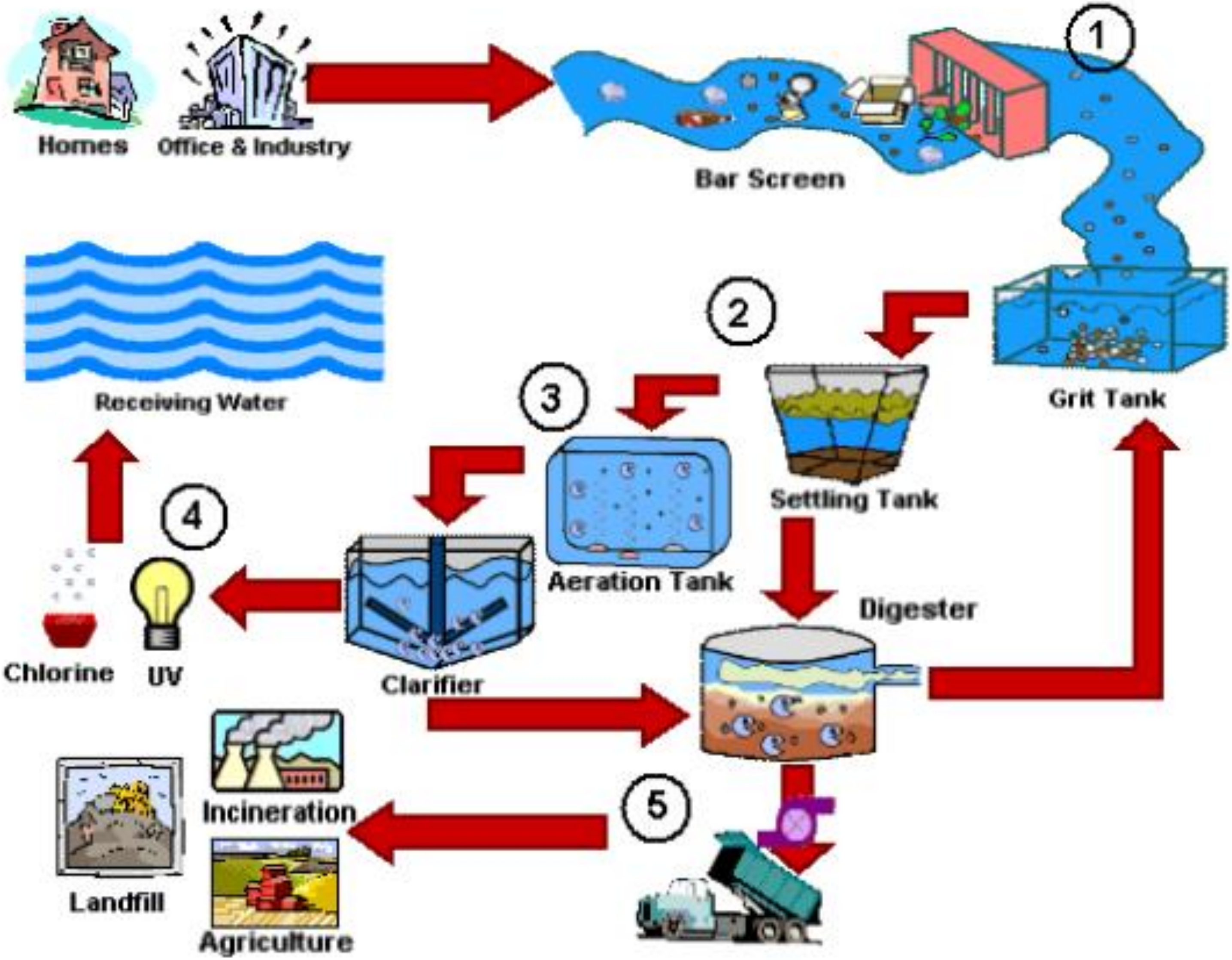
We **are not** the water experts - seek assistance!

Who are the Experts

- State Agencies
- Federal Agencies
- Utility Companies
- Design, Manufacturing & Engineering Companies
- Energy Service Companies
- Professional Organizations

Train Staff

Typical Wastewater Processing



Why Coordination and Collaboration?

Energy issues are here to stay and will only get more serious—no quick fixes!

- Individual projects and technologies are fine, but something is needed to pull it all together (**a process)**

- Systematic process will provide a **focus on energy efficiency**
  - Reduce operating costs
  - Financial savings can be reinvested back into system
  - Less pressure on resources
  - Less strain on current energy grid

Create Resource Teams

Develop teams to assist facilities as they provide information to elected officials and the general public.

Keys to Successful Communication

Grant Application Partners

State:

Arizona Department of Environmental Quality

Water Infrastructure Finance Authority

Federal:

U.S. Department of Agriculture Rural Development

Private:

Arizona Public Service

Honeywell

Lincus Energy

Rural Community Assistance Corporation

Current Partners

State: AZ Department of Environmental Quality, Water Infrastructure Finance Authority, AZ Department of Water Resources, AZ State Parks, AZ Department of Transportation

Federal: USDA Rural Development, EPA, U.S. Bureau of Reclamation

Utility: Arizona Public Service, Unisource, Salt River Project, Sulphur Springs, AZ Electric Power Cooperative, Mohave Electric Co-op

Private: Honeywell, Lincus Energy, AMERSCO, TRANE, NCS Engineering, Chelsea Group, Border Environment Cooperation Commission (BECC)

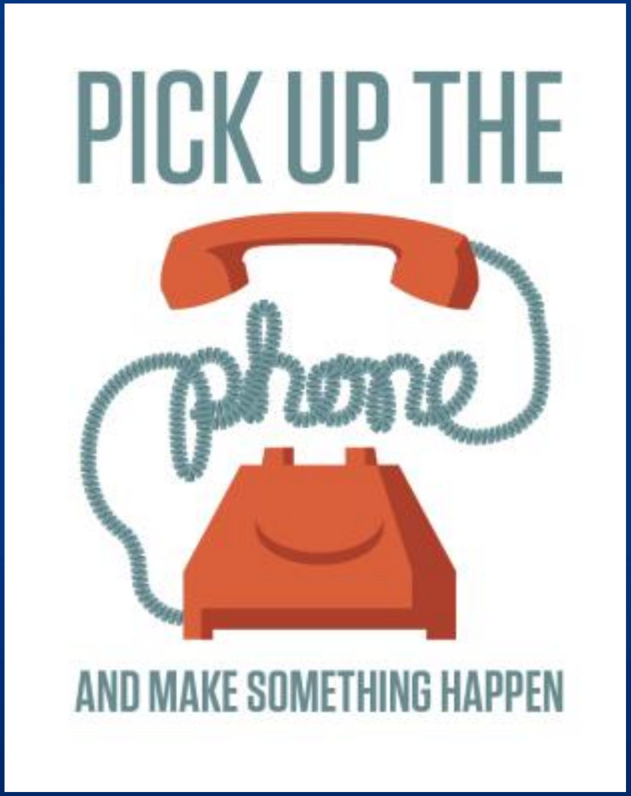
Professional Organizations: AZ Planning Association, AZ Water Association, Rural Water Association, AZ Co-op Association

Successful Partnerships

Formed around specific issues or areas of concern

- Take time
- Understanding of the partner organizations goals/mission
- On-going communication

Challenge


PICK UP THE
phone
AND MAKE SOMETHING HAPPEN


Get Out of the office

Thank You

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City of Fort Worth Village Creek Water Reclamation Facility Journey towards Net Zero Energy

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City of Fort Worth

Peter V. Cavagnaro, P.E., BCEE
Johnson Controls, Inc.

September 11, 2013

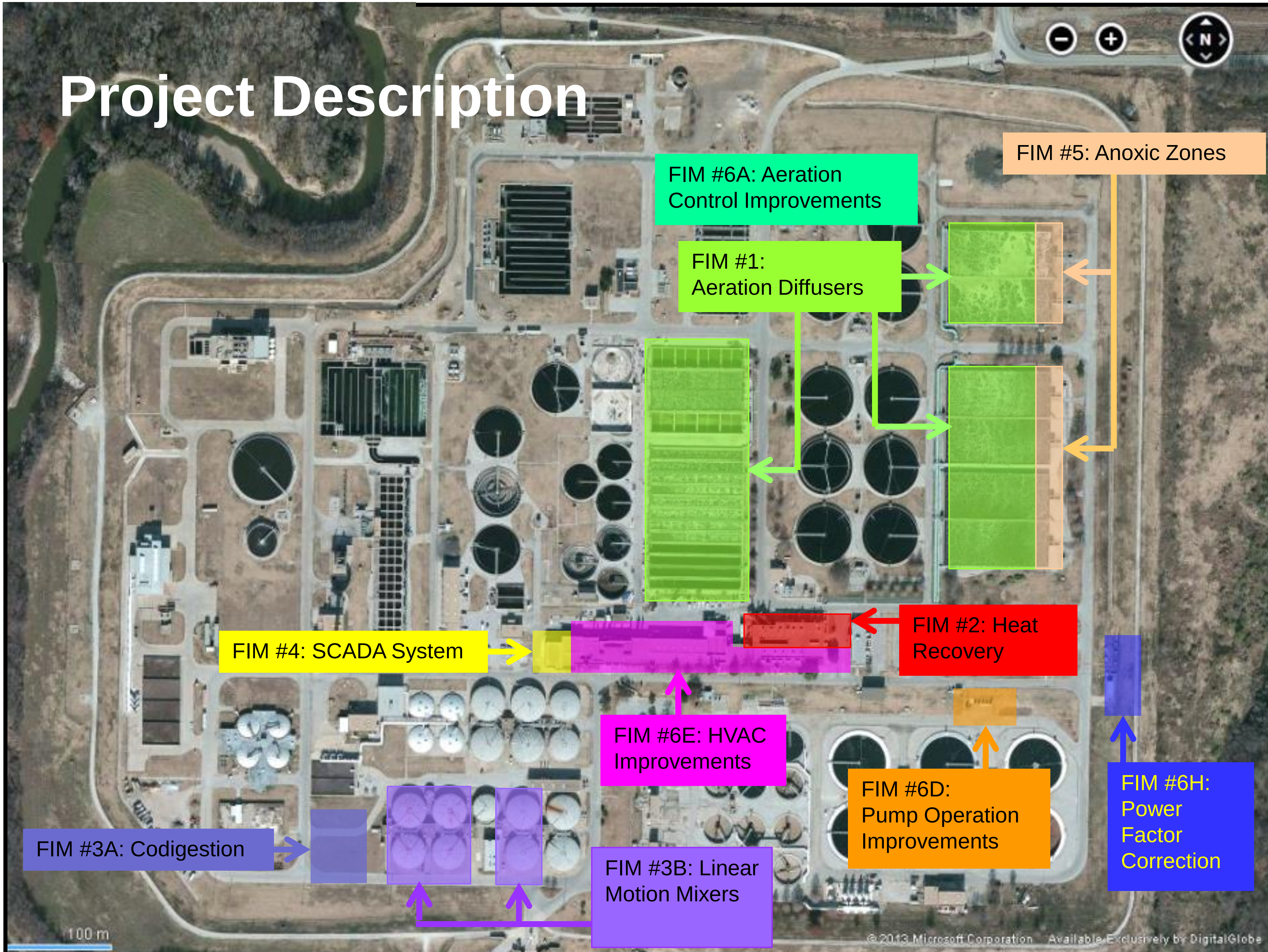
Outline

- Overview
- Project Description
- Technology
- Project Drivers
- The State Energy Conservation Office
- Performance Contracting (ESPC)
- Financing
- Savings & Payback

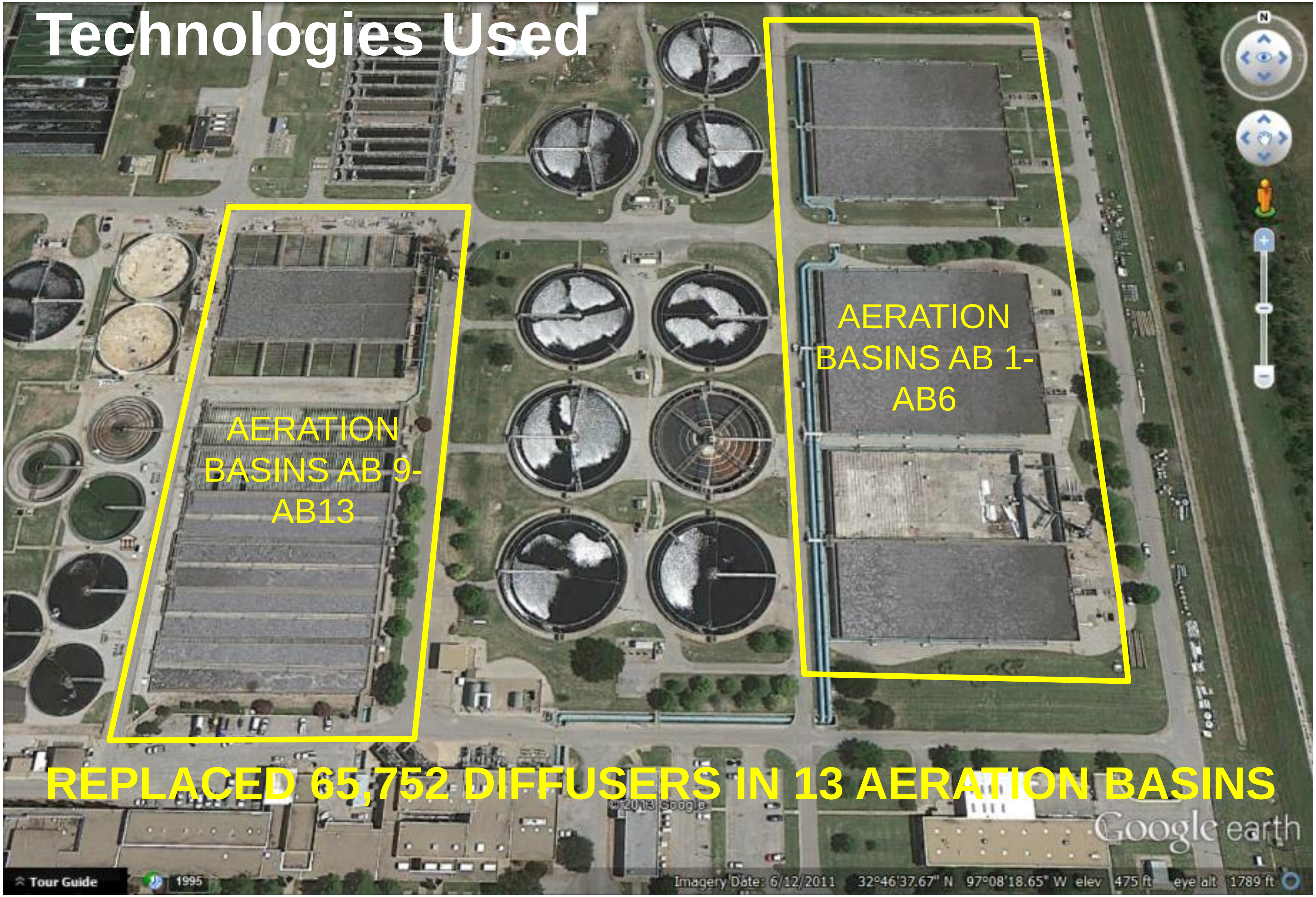
Overview

- Village Creek Water Reclamation Facility
  - Fort Worth, Texas
  - Service area 450 square miles
  - 166 MGD permitted capacity
  - Regional facility serving more than 1 million people in 22 entities
  - One of the nation’s fastest growing cities

Project Description



Technologies Used



REPLACED 65,752 DIFFUSERS IN 13 AERATION BASINS

VCWRF Co-Digestion System

Dedicated High Strength Waste Receiving Facility:

- Truck unloading pad
- 30,000 gal mix tank
- Two 8,000 gal batch tanks
- Recirculation, transfer and feed pumps (six total)
- PLC control feeds each digester once/hour
- Receiving up to 9 x 6,000 gal trucks / day

Six digesters cleaned, and new mixers installed

Photo courtesy of Freese & Nichols, Inc.

Waste Heat Recovery

Waste Heat Recovery

Heat Recovery Steam Generator (HRSG) on turbine exhaust generates steam

Duct Burner

Duct burner uses biogas to boost the temperature and produce steam that powers two steam turbines

Steam Turbine Powered Blowers

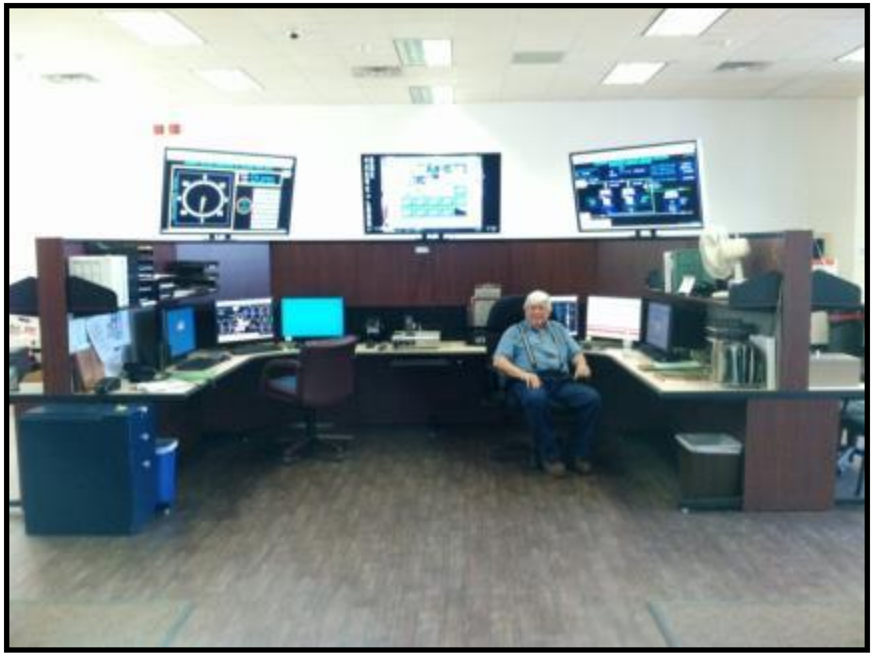
2 unused 1200 HP
31,000 cfm blowers

Rehabilitated and equipped
with steam turbine drivers

Anoxic Zones & Nitrate Rich Recycle

SCADA System Replacement

Project included the replacement of the existing Johnson Yokogawa SCADA system with a new Emerson Ovation SCADA Distributed Control System

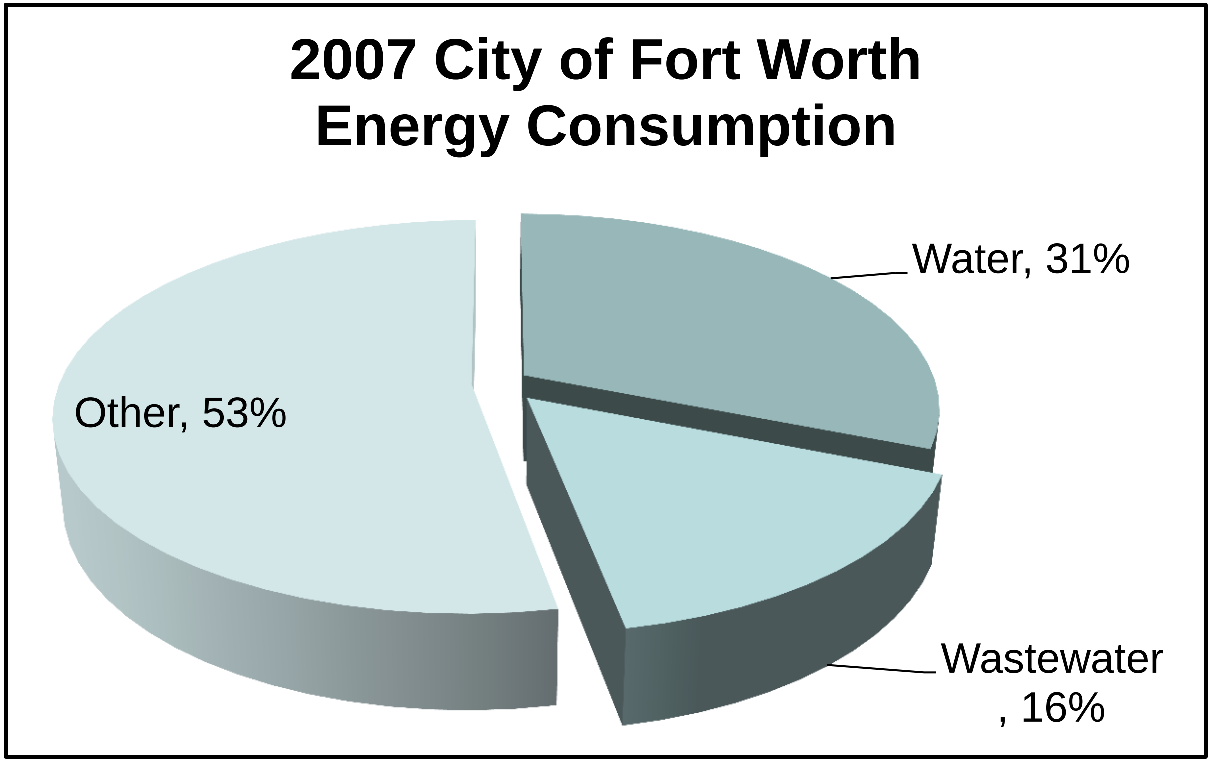


Project Drivers

- City wide effort to comply with Texas State Legislation to improve air quality by conserving electricity
  - Federal Clean Air Act
  - Texas Emission Reduction Plan
- Village Creek project is phase V of city's seven phase program to reduce annual electric consumption by 5% per year

Internal Project Drivers

The Fort Lewis Water Department has been a major consumer of electricity



Compelling Event

- Recognition that energy savings could be used as an alternative source of project funding
- An existing Energy Savings Performance Contract (ESPC) that had been used to develop and implement energy projects throughout the city

The Texas State Energy Conservation Office (SECO)

Instrumental to Fort Worth in implementing conservation efforts through

- Technical Assistance
  - SECO assisted Fort Worth with the “how to” of Conservation Projects to help start the program in 2001
- Financial Assistance
  - SECO provided $10 million in low-interest loans for phases one through three

Performance Contracting

- Alternate Procurement Mechanism

- Regulated by State Government Code 302
  - Requires guaranteed savings through
    - Cost-effective energy conservation
    - Operations and maintenance savings
  - Requires an independent third party review of projected savings

- Single point of responsibility by the Energy Services Company (ESCO)

Energy Conservation Program Financing

- Energy Savings Performance Contract
  - > $59-million contract over 7-phases (2003 - 2013)
  - Secured approximately $900K in utility rebates
- Over $10-million from SECO
- $5.2-million EECBG Department of Energy Grant
- $16-million Capital Funding
- $27-million Municipal Leases

Village Creek
Project Cost & Benefits

Project Cost	$35 million
Annual Utility Savings	$2.56 million
Annual O&M Impacts	$0.24 million
Total Annual Benefits	$2.80 million
Simple Payback	12.4 years

Village Creek Progress to Net Zero Energy

Total Electric Consumption

- 240,000 kWh per day

With 5 MW on-site generation

- Reduced to 150,000 kWh

Reclaiming Waste Heat

- Reduces to 110,000 kWh

Energy Conservation

- Reduces to 35,000 kWh

Project Contributors

And Others

Thank You

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Prezi

Barker Meadow Reservoir

Colorado Governor's Energy Office (GEO): Projected Operating Expense Assistance


TOWN OF NEDERLAND
WASTEWATER
TREATMENT FACILITY
DEDICATED TO THE FUTURE
GENERATIONS OF NEDERLAND
COMPLETED: 2013
TOWN OF
NEDERLAND
EST. 1874
BOARD OF TRUSTEES:
JOE GIERLACH
MAYOR
KEVIN MUELLER
MAYOR PRO TEM
ANNETTE CROUGHWELL
PETER FIORI
RANDY LEE
LEDGE LONG
CHRIS PERRET
TOWN ADMINISTRATOR:
ALISHA REIS
ENGINEER:
FRACHETTI ENGINEERING, INC.
CONTRACTOR:
ASLAN CONSTRUCTION, INC.


GROVE

Geothermal Ground Loop

Sequencing Batch Reactor (SBR)

High efficiency blowers

Controls:

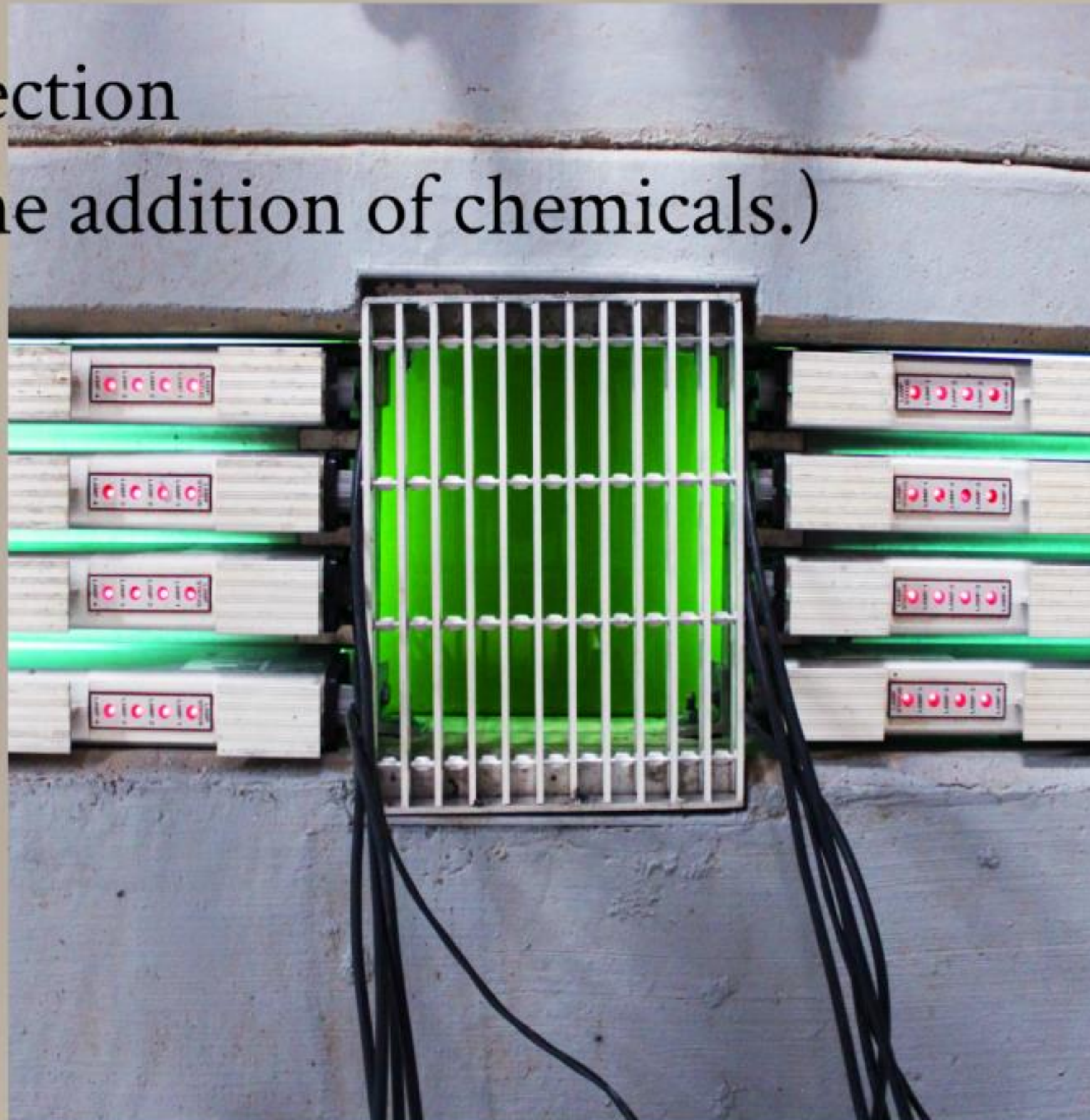
A high degree of automation makes for an efficient facility with reduced maintenance and operating costs.

Tankless water heaters:

Plant effluent (non potable water) is used for a variety of secondary uses including landscape irrigation, wash down, and operations and maintenance requirements.

All building materials selected to increase energy efficiency and decrease operations & maintenance profile.

UV Disinfection
(without the addition of chemicals.)




21931
RETURNABLE DRUM

Tertiary Filter Controls

Tertiary Filter Controls

The reduction of nutrients (phosphorus and nitrogen) through biological nutrient removal, chemical precipitation, and tertiary filtration, improves water quality for Barker Reservoir and downstream users.

Financing:

Revenues:

Total Budget: $4.7M

$500K: Grant from Colorado Department of Local Affairs (DOLA)

$2M Zero Percent interest loan from the Green Points Program through the State Revolving Fund

$2M 3% loan State Revolving Fund

$370,000K from City of Boulder

Expenses:

Total Project:	$ 4,600,000
First Engineer/Redesign Cost:	$ 500,000
VFD Blowers:	$ 61,000
Underground Air Pretreatment:	$ 70,500
Teen Center Heat Exchange:	$ 20,500
Additional Controls:	$ 20,000
Future Solar Connection:	$ 350
Tankless Water Heaters:	$ 0


Solar Connection Provided
for Future On-Site Solar Farm.
Future Heat Exchange System
Pulls heat from effluent wastewater
to heat the nearby Teen Center.

Questions?

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