2013 EPA Tribal Conference

Sustainable Water Infrastructure & Energy Management Systems

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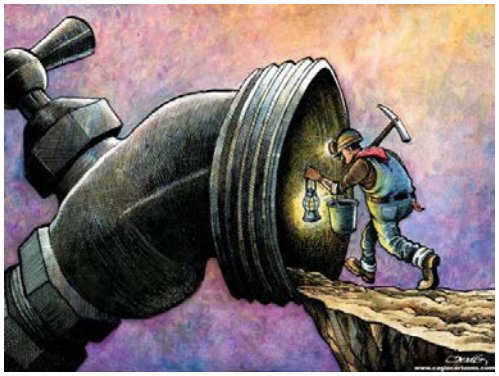
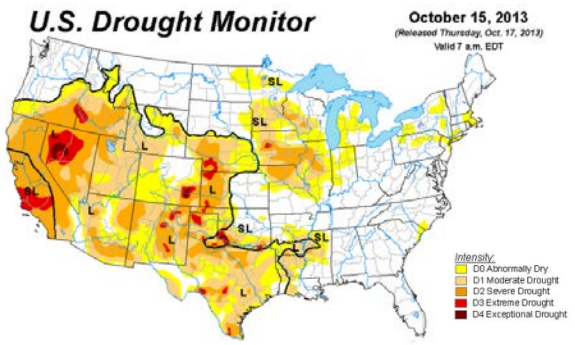
Today's Presentation

- Water Infrastructure Challenges
- EPA Region 9's Sustainable Water Infrastructure Program
- Energy & Water Audits
- Energy Management Systems
- Example Projects & Sources of Funding

Water Infrastructure Challenges

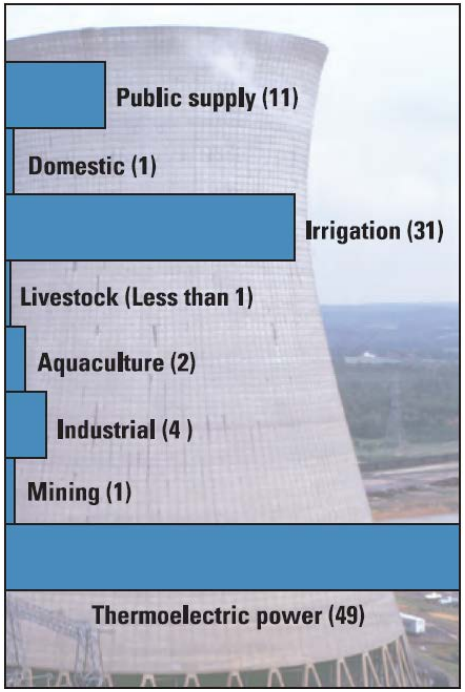
- **Water Scarcity**
  - Shortages increasingly common
- **Climate Change**
  - Changing precipitation patterns, shrinking snow packs, increasing run-off...
- **Increasing Population**
  - More people, greater system demand
- **Aging Infrastructure**
  - Upgrades to cost $.3 to $1 trillion over next 20 years
- **Energy Uncertainty**
  - Increasing Cost/Decreasing Availability
- **Water/Energy Nexus**





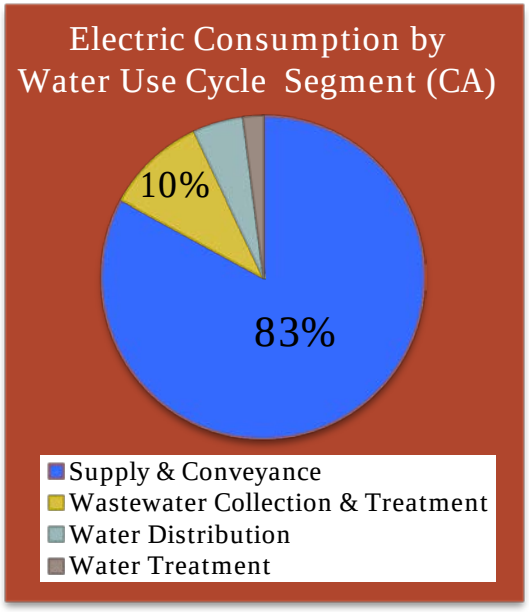
The Water-Energy Nexus

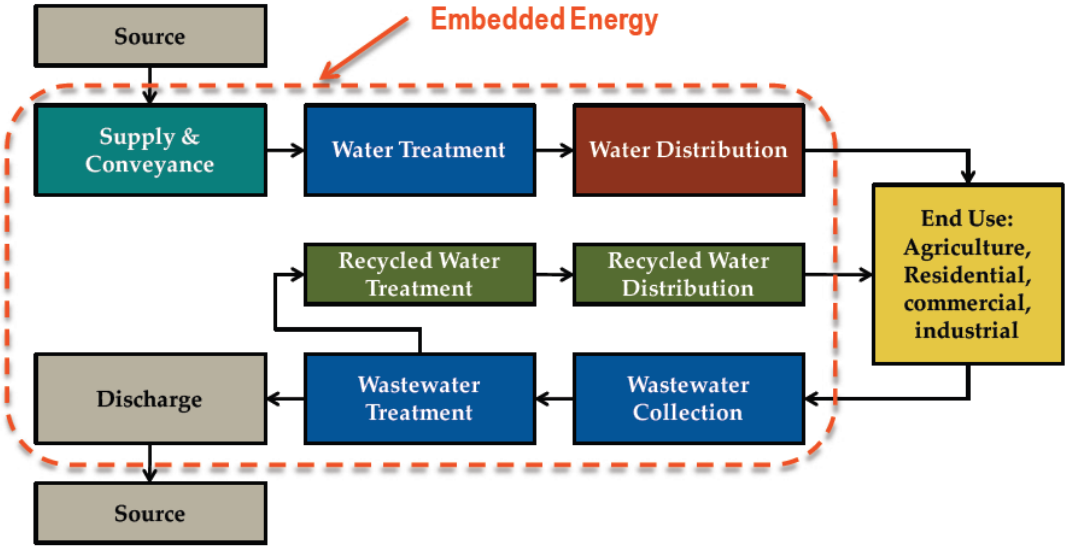
- **Water embedded in Energy**
  - Each kilowatt-hour (kWh) of thermoelectric generation requires the withdrawal of ~ 25 gallons of water, primarily for cooling purposes.
  - On average, ~ 2 gallons of water are lost to evaporation for each kWh consumed
    - In Arizona, 7.85 gallons of water are lost to evaporation per kWh consumed.



The Water-Energy Nexus

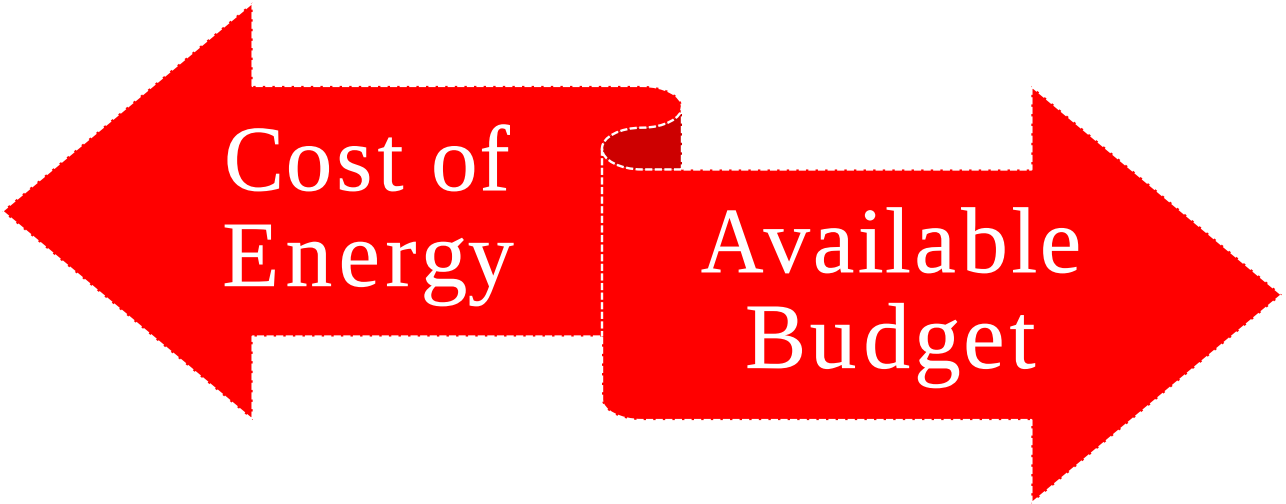
- **Energy embedded in Water**
  - Drinking water & wastewater systems account for approximately 3-4 % of national energy use
    - Often the largest energy consumers of municipal governments, accounting for 30-40 % of total energy consumed.
      - In CA, 7.7 % of total state electricity (18,282 GWh) is used by the water sector





The Water-Energy-$ Nexus

Energy represents the **largest controllable cost** of providing water and wastewater services to the public, and is generally on the order of 30-60% of a city's energy bill



The Water-Energy-$ Nexus…cont'd

- **Why efficiency?**

  - **Yearly, 283 billion gallons of water are lost in CA urban water distribution systems**

    - **Accounts for over 2.5 billion kWh of wasted energy**

Assuming (conservatively) electricity costs $0.10 per kWh,

CA could recover **$255 million/yr** in energy lost from leaks


Saving Water saves Energy*Saving Energy saves Water
WaterSense
Meets EPA Criteria
Energy
Saving Water & Energy boosts the triple bottom line

Sustainable Infrastructure Program

We provide technical & financial resources to help communities increase:

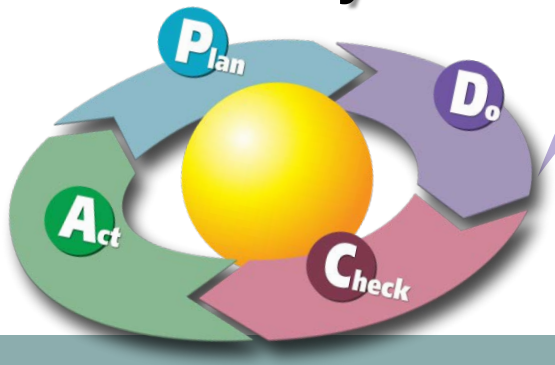
- Water Efficiency
- Energy Efficiency
- Water Recycling
- Low Impact Development
- Renewable Energy Generation

Complete an water and/or energy AUDIT

Prioritize audit recommendations

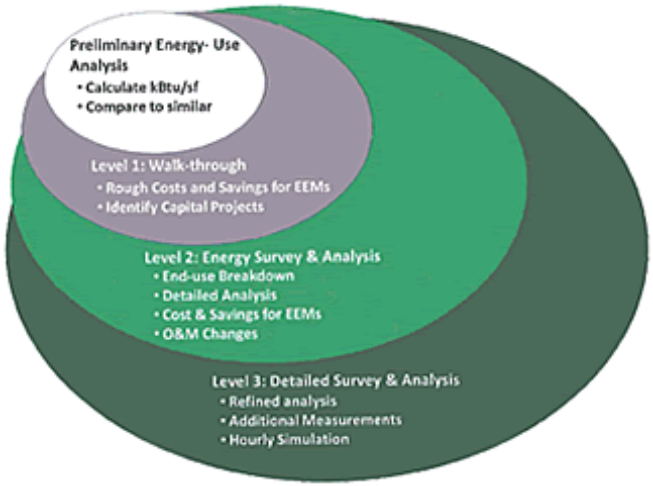
Identify funding to IMPLEMENT projects

We offer a systematic EMS approach (and a short cut):



The short cut: start with an audit

- **What is an audit?**
  - Different types
    - Benchmarking
    - Walk-Through Audits
    - Detailed Process Audits



- **What does it do?**
  - Benchmarking
    - Preliminary energy/water use analysis (e.g. Portfolio Manager)
  - Walk-through -> Detailed Process Audits
    - Identify capital and operational opportunities for savings, and determine payback period

Energy Audits

- Identify capital and operational improvements
  - Capital improvements generally require more $
    - E.g. Upgrade motors & blowers, install variable frequency drives & more efficient aeration, etc.
  - Operational improvements can be achieved inexpensively
    - E.g. load shedding, suspending unnecessary equipment, implementing an EMS, etc.
- Identify renewable energy opportunities
- Can also assess designs of future projects

Wailuku Kahului WWTP Energy Efficient Blowers

1-MW solar array at the Hayward, CA WWTP

Water Audits

- Identify “Non-Revenue” water
  - Real losses, i.e. leaks
  - Apparent losses, i.e. unbilled/unmetered consumption
- Complete detection surveys to identify leaks and determine corrosion rates (to target pipe replacement)
- Optimize pressure zones (direct relationship between increasing pressure and water loss)
- Recommend metering systems
  - i.a., determine appropriate rate structures

Example Energy Audits Results

- 15 energy audits conducted at randomly selected (large & small) facilities
- Using only recommendations with a 7.5 year payback or less, the 15 energy audits identified a total of:

  - 6,900 MWh/yr of potential energy reductions
  - 1,700 MWh/yr of energy demand reduction
  - $1.4M/yr potential cost savings
  - 4.6 yr payback period (16% ROI)
  - 6.9 million pounds/yr of reduced greenhouse gas emissions

Energy Conservation Opportunities	Payback Period (yrs.)	Costs (Implementation)	Annual Savings ($)	Annual Energy Cost Savings	MWh/ Year Savings
Electric Rate Modifications (2): modifying rate schedules to be most efficient during peak and non-peak hours	avg = 0.12 0.1 to 0.14	$500	$3,600 - $10,000	13 - 48%	N/A
Electrical Demand Management (5) : monitoring total energy use/demand with installation of electrical metering, maximizing off-peak operations	avg = 0.2 0 to 1	$0 - $75,000	$1,000 - $115,800	0.7 - 7.3%	N/A
Operational Improvements (11): Noncapital improvements to optimize treatment	avg = 1.7 0.7 to 5	$0 - $220,000	$100 - $35,700	0.1 - 26.5%	1 - 284
Pump Modification (6): adjusting effluent pumping, inline flow meters in collection/distribution systems, and pump controls	avg = 4.1 0 to 10.7	$0 - $35,600	$250 - $7,000	0.5 - 7.2%	2 - 26
Motor Efficiency Upgrades (4): replacing inefficient motors with high efficiency motors	avg = 4.9 0.7 to 8.2	$3,100 - $175,000	$2,800 - $44,300	1.3 - 7.6%	9.6 - 136.4
Component System Upgrades (5): Capital and operational improvements on UV, process water, scrubber, and compressed air systems	avg = 5.1 4 to 6.3	$130,000 - $500,000	$20,500 - $98,000	2.2 - 28.3%	105.7 - 441.5
Efficient Lighting Fixtures (5): implementation of more efficient lighting; includes reduced use and sensors	avg = 6.6 2.6 to 11.2	$7,000 - $154,000	$2,650 - $24,700	0.5 - 2.9%	9.1 - 122.1
Variable Frequency Drive Installation (3)	avg = 7.2 2.4 to 12	$15,700 - 126,500	$1,620 - $51,600	0.4 - 4.2%	15.4 - 482
Aeration Control/Improvements (4): smaller blower installation, operation changes, better control with meter installation	avg = 8.3 4.7 to 13.3	$5,000 - $244,000	$760 - $24,400	1.6 - 26.9%	6 - 200

Example Energy Audits…cont'd

- Recommendations identified an average:

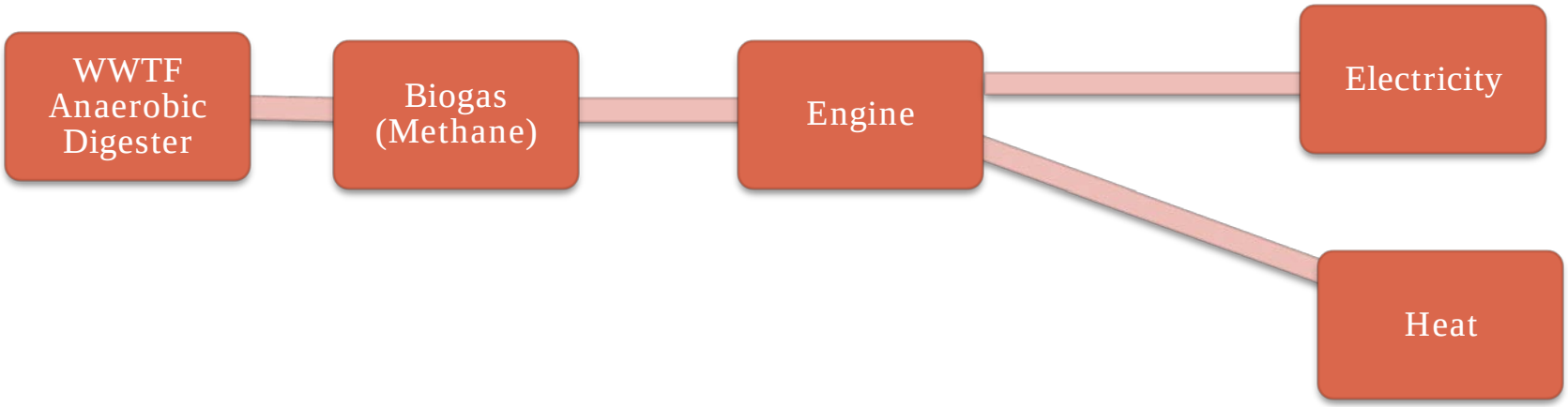
  26% savings in energy costs

- Recommendations with <1 yr payback period identified a total annual savings of $190K/yr (>100% ROI)
  - Included non-capital OPERATIONAL improvements such as rate modifications, time-of-use, depowering equipment, and shutting down unnecessary processes
    - Identifiable with low cost self-assessments or walk-through audits

Example Energy Audits…cont'd

- Highlighting: WWTF "X"

- Energy Audit recommended a co-gen/CHP facility
  - Producing heat and electricity by combusting biogas would:
    - Save $650K/yr
    - Reduce energy consumption by 4,000 MW/yr
    - Be paid back in 5.7 years



Key Takeaways

- All water and wastewater utilities would benefit from some level of energy and/or water auditing, especially with new construction
  - Small/mid-sized utilities are ideal candidates for inexpensive walk-through audits
- Operational changes = shortest payback periods
- Quality of auditors is key: they must have experience in the water industry

Audit Resources

- Visit our website
  - Energy Audit Information
    www.epa.gov/region9/waterinfrastructure/audit.html
  - Water Audit Information
    www.epa.gov/region9/waterinfrastructure/water-conserv.html

- Look for funding
  - Database for State Incentives for Renewable & Efficiency
    www.dsireusa.org
  - EPA Region 9 Water Infrastructure funding website
    www.epa.gov/region9/waterinfrastructure/funding.html

- E-mail us
  - ely.charlotte@epa.gov or byous.eric@epa.gov

Audit Resources… cont'd

- Schedule a free audit:
  - Region 9 Resources
    - DOE Industrial Assessment Centers (US DOE)
      - Only if your energy bill is greater than $100,000/year
  - California resources
    - Energy Partnership Program (CEC)
      - Contact Shahid Chaudhry: 916-654-4858/ Shahid.Chaudhry@energy.ca.gov
    - California Wastewater Process Optimization Program (CalPOP)
      - www.calwastewater.com/index.html
    - Your local Utility
      - E.g. PG&E provides two types of free energy audits: the on-site energy audit and the more comprehensive integrated energy audit

Let us know if you're interested in getting an energy or water audit and/or participating in free group energy management webinars and we can discuss your options

Audit Resources… cont'd

"Walk through" audit & self-assessment resources

- USEPA's Water Energy Use Assessment Tool:

water.epa.gov/infrastructure/sustain/energy_use.cfm

- NYSERDA self audit forms:

www.epa.gov/region9/waterinfrastructure/audit.html

- Portfolio Manager:

www.energystar.gov/portfoliomanager

- EPRI audit guide:

www.cee1.org/ind/mot-sys/ww/epri-audit.pdf

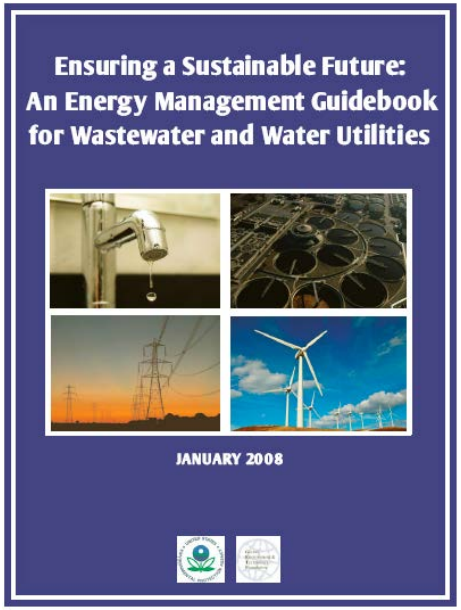
How do I organize all of this information and implement energy improvements on an ongoing basis??

A journey of a thousand miles begins with one step.

--Chinese proverb

'The long haul': EMS

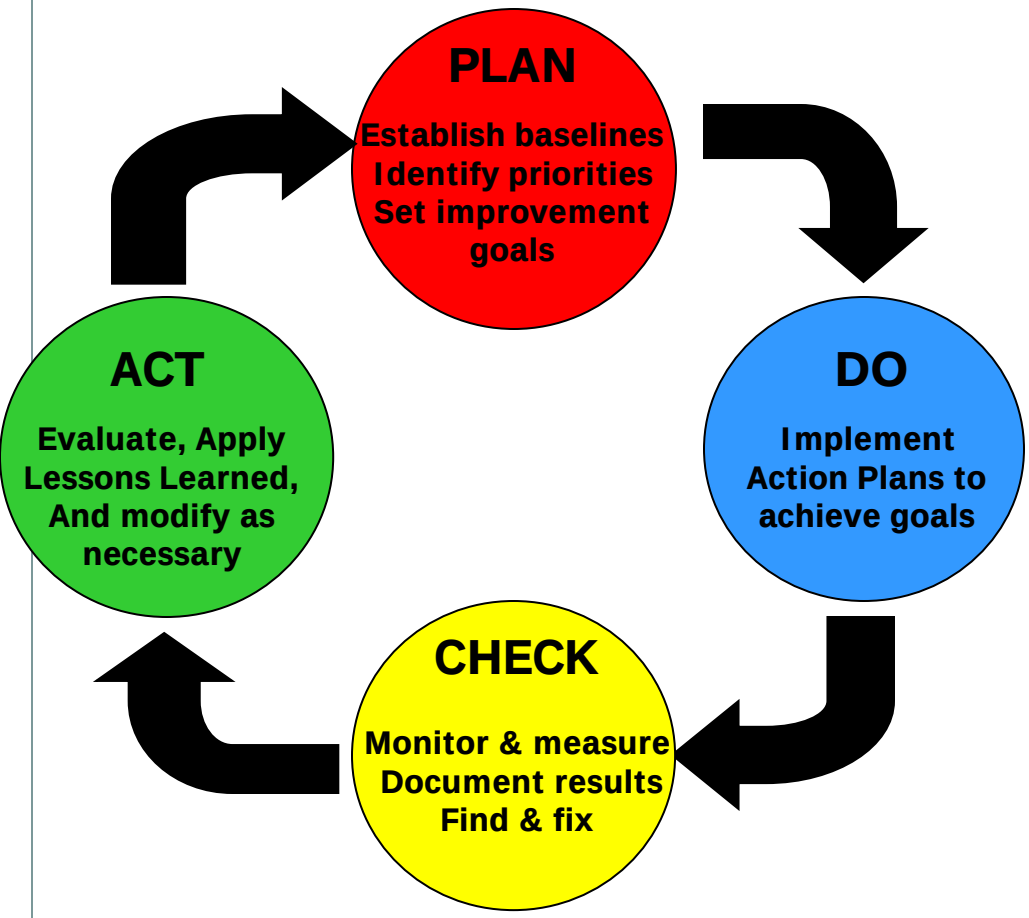
- EPA recommends an Environmental Management System (EMS) approach
  - a.k.a. Plan-Do-Check-Act
- Designed to help utilities:
  - Systematically assess current energy costs and practices
  - Set measurable performance improvement goals
  - Monitor and measure progress over time
- Process outlined in EPA's Guidebook:



water.epa.gov/infrastructure/sustain/cut_energy.cfm

NEW Rural and Small Systems Guidebook to Sustainable Utility Management

The Plan-Do-Check-Act Approach



- Allows utilities to systematically assess and manage energy; to identify opportunities; and to take action
- NOT a project—**a system** to manage energy for the long haul

Energy Management SYSTEM

- **PLAN**
  - Senior Management Buy-In*
  - Energy Team
  - Energy Policy
  - Baseline Data/Audit Completion
  - Identification of Projects
  - Ranking of Projects
  - Setting Objectives and Targets

Energy Management SYSTEM

- **DO**
  - Energy Improvement Management Plans
    - Assign action items, define timeframe
    - Performance metrics
  - Set Up Operational Controls, including Communication and Training
    - How do you know if equipment is being run properly, what if staff leaves?

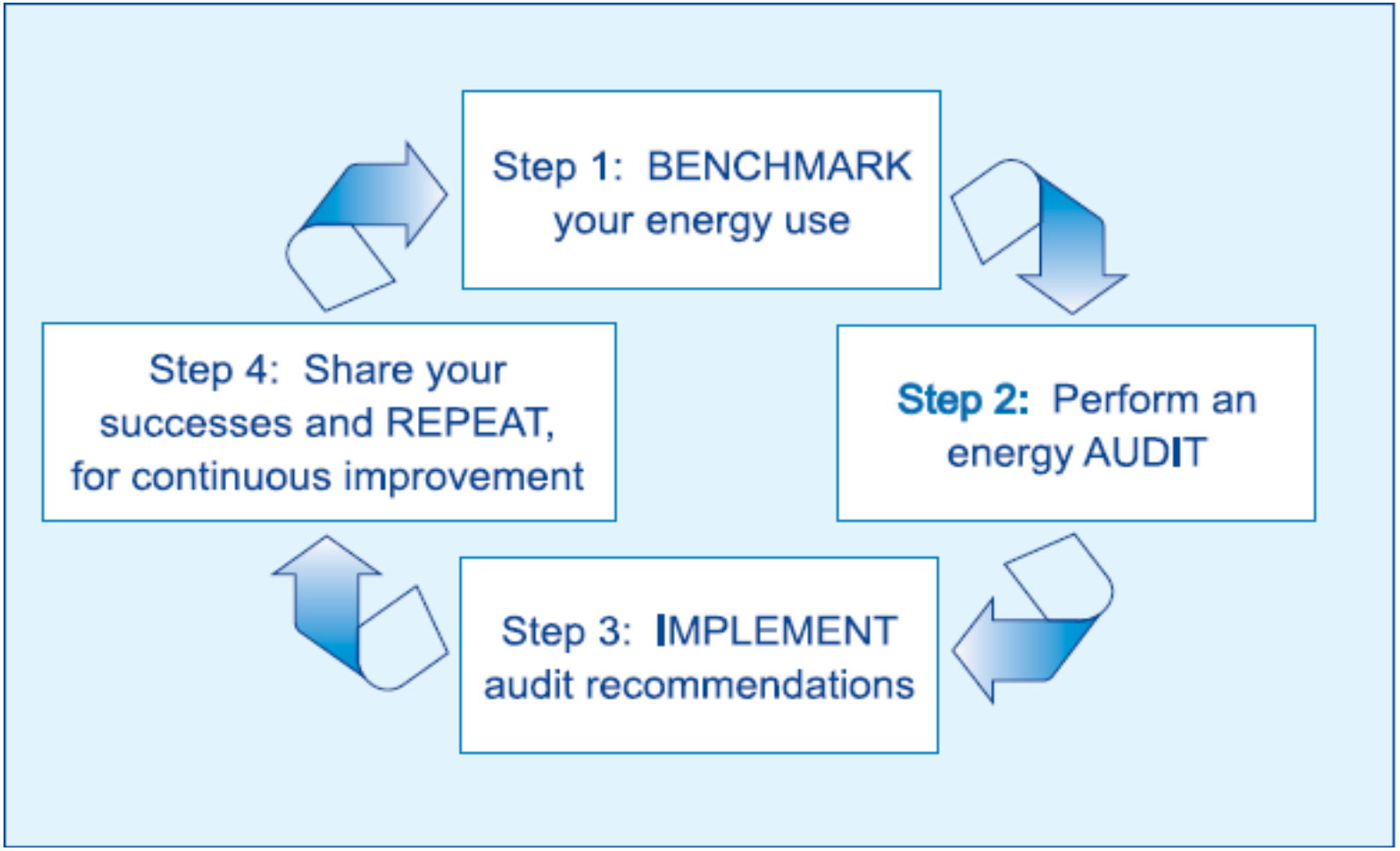
Energy Management SYSTEM

- **CHECK**
  - Monitoring and Measuring
  - Internal Review
  - Corrective Action
  - Communication & Training

Energy Management SYSTEM

- **ACT**
  - Management Review
  - Re-assessment of Energy Plans
  - Communication & Training
  - Share Successes

"Short-cut" EMS Approach



Getting Started

- Review EPA's Plan-Do-Check-Act webinars
  - Are you interested in joining next year's webinar series?
- Examine existing policies
  - Is there an existing management strategy or policy statement that could be expanded to include energy/water savings?
- Look ahead
  - Is energy use a consideration in asset management/capital improvement planning?
- Secure management buy-in
  - Is senior management aware of the opportunities? It's easy to demonstrate energy savings if you're committed to finding them

Moving forward

Example projects and funding sources for:

- Water Efficiency
- Energy Efficiency
- Water Recycling
- Low Impact Development
- Renewable Energy Generation

Water Efficiency

- Install Leak Detection Equipment
- Join WaterSense/incentivize efficient products & practices
  - **Choctaw Nation**
- Install meters
  - **White Mountain Apache Tribe** (SRF funding)
- Upgrade to Energy efficient pumps
- Improve distribution systems
  - **Hoopa Valley Tribe** (USBR funding)
- Incentivize Grey water & Rainwater
- Recycle wastewater

Water Efficiency…cont'd

- EPA SRF Tribal set-aside

www.epa.gov/region9/water/tribal/index.html

- HUD- Community Development Block Grant Program

portal.hud.gov/hudportal/HUD?src=/program_offices/comm_planning/communitydevelopment/programs

- USDA- Rural Development

www.rurdev.usda.gov/RD_Grants.html

- USBR WaterSMART grants

www.usbr.gov/WaterSMART/grants.html

- California-specific funding
  - e.g. Infrastructure and Economic Development Bank http://ibank.ca.gov/infrastructure_loans.htm
  - See CFCC website for more: www.cfcc.ca.gov/

Renewables & Energy Efficiency

- Install Variable-Frequency Drives
- Upgrade to Energy Efficient Motors and Motor Systems
- Upgrade Heating, Cooling, Ventilation Systems
- Install energy efficient lights and lighting systems
- Manage your electric load
- Sustainably manage biosolids
- Generate energy on-site
  - Co-Gen
  - Biodiesel
  - Hydro
  - Solar
  - Wind
  - Enhance biogas production through co-digestion

The Alaska Native Tribal Health Consortium received $700,000 for Energy Efficiency Upgrades at their Sanitation Facility in Selawik, Alaska.

http://apps1.eere.energy.gov/tribalenergy/projects_detail.cfm/project_id=169

The Kashia Band of Pomo Indians of the Stewarts Point Rancheria received a $46,800 from DOE's EECBG program for a new solar array.

At the EBMUD WWTF, food waste is co-digested with biosolids. Digesting 100 tons of food waste per day, 5 days a week, provides sufficient power for an estimated 800 to 1,400 homes

RE & EE…cont'd

- Funding sources mentioned on slide 32 also relevant
- DOE's Tribal Energy & EECBG programs

http://apps1.eere.energy.gov/tribalenergy/
http://www1.eere.energy.gov/wip/eecbg.html

- Power Purchase Agreements (PPAs)

www.epa.gov/region9/waterinfrastructure/docs/water-sector-ppa-factsheet.pdf

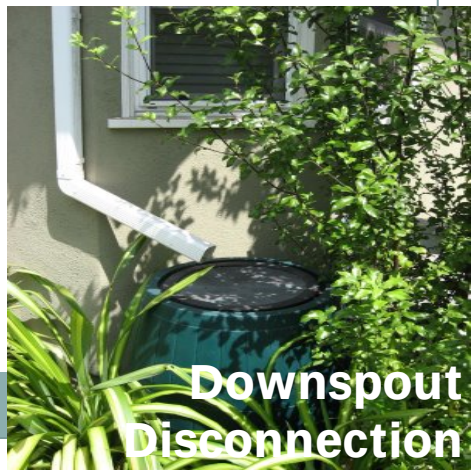
- EDA's Economic Development Assistance Program
  - FY12 solicitation for public works www.eda.gov/ffo.htm
- Dept. of Treasury's New Markets Tax Credit Program

http://cdfifund.gov/what_we_do/programs_id.asp?programID=5

Rural Community Assistance Corporation (RCAC) Loans

- Prioritizes "green projects" www.rcac.org/pages/126
- Several USDA grants (See Lisa Butler's presentation)

Green Infrastructure/LID



Green Infrastructure… cont'd

- Funding sources mentioned on slide 32 & ~33 also relevant
- EPA Brownfield grants

www.epa.gov/brownfields/grant_info/index.htm

- EPA Clean Water Act grants
  - 106/Water Pollution Control grants

    www.epa.gov/region9/water/tribal/tribal-cwa.html#One
  - 319/Non-point Source grants

    www.epa.gov/region9/water/tribal/tribal-cwa.html#Two
- Additional Funding
  - NPS Rivers, Trails, and Conservation Assistance Program
  - DOT Transportation Enhancement Activities
  - NOAA Community Based Restoration Program
  - U.S. FS National Urban and Community Forestry Program
  - More $ ideas at water.epa.gov/infrastructure/greeninfrastructure/gi_funding.cfm

Green Infrastructure… cont'd

- EPA's Municipal Handbook: Funding Options
  - Discusses stormwater fees and loan programs
- Guidance for Municipal stormwater Funding
- Stormwater Program and Budget Planning Tool
  - Developed by the Center for Watershed Protection
- EPA's Financing Alternatives Comparison Tool
  - A financial analysis tool that helps identify the most cost-effective method to fund a water project.

Additional Resources

- National Sustainable Infrastructure website:

http://water.epa.gov/infrastructure/sustain/

  - Asset Management page

    http://water.epa.gov/infrastructure/sustain/asset_management.cfm

- EPA's Pond Manual

www.epa.gov/ordntrnt/ORD/NRMRL/lrpcd/projects/ponds.htm

- EPA ORD's Water Cluster Research

www.epa.gov/nrmrl/watercluster/projects.html

- WERF's Decentralized Water Resources Collaborative

www.ndwrcdp.org/

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