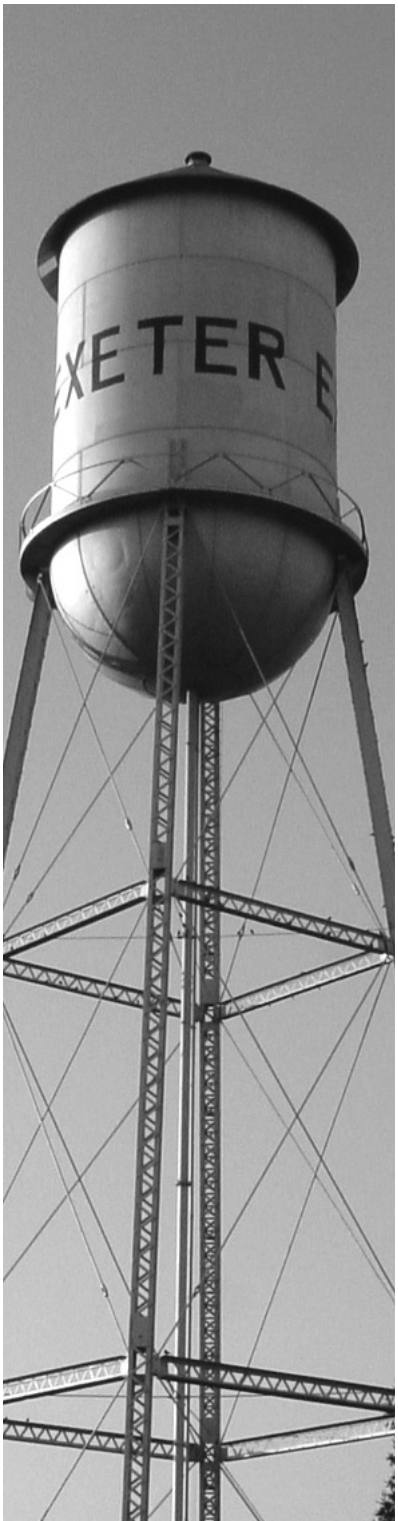
Sustainable Infrastructure for Small System Public Services:
A Planning and Resource Guide
Supplement



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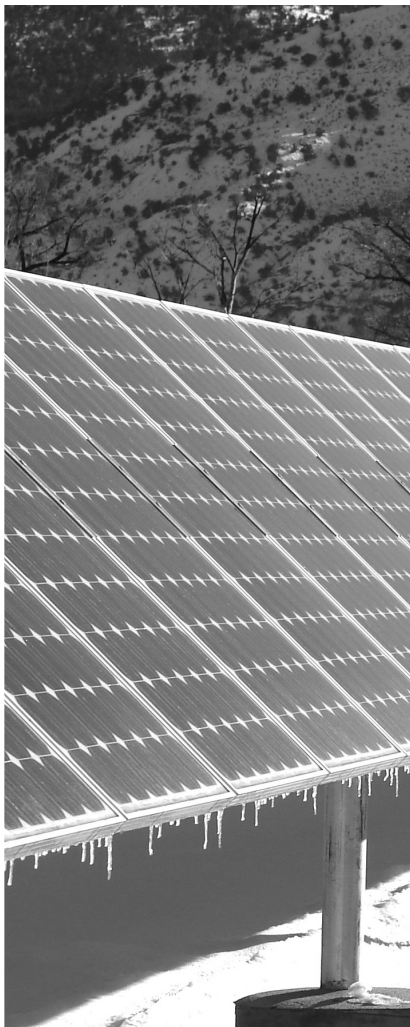

Sustainable Infrastructure for Small System Public Services: A Planning and Resource Guide Supplement

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Using this supplement

This planning and resource guide is intended as the supplement to RCAC's *Sustainable Infrastructure for Small System Public Services: A Planning Guide* published in 2009. Since the original guide was published much has happened in the area of sustainable alternatives for utilities. This supplement attempts to update the information, resources and activities.

As you go through the supplement, in each chapter, updated articles, activities, etc. and the corresponding page numbers in the original guide are noted. This is where the article, activity or resource should be inserted.

For the complete articles mentioned in the Appendices, please visit the RCAC website at *www.rcac.org*, under Resources.

Acknowledgements

As mentioned in the original guide, it is through the efforts of many people that the original planning and resource guide and now this supplement, continues RCAC's mission to best serve the needs of rural communities as they achieve their goals and visions. Our intention is to continue to actively incorporate tenets of sustainability into our community work.

Front cover photos: Kay Mulligan, RCAC and City of Rifle, Colorado

1 Water Conservation

The Water Energy Nexus (page 1-11)

Nexus* — *noun, plural nex-us-es, nex-us. *1. a means of connection; tie; link. 2. a connected series or group. 3. the core or center, or a matter or situation.*

Energy can represent the largest variable and controllable cost of providing water or wastewater services to the public. Water and wastewater utilities can be among the largest individual energy users in a community. Water leakage in small utilities can vary from 10-to-60 percent. The cost of the water leakage contains energy savings that could be applied to improving the infrastructure. Water conservation is energy efficiency that can offer energy cost savings options to save even more money.

Water, energy, land use planning and transportation are inextricably linked in a community. They all use energy and they all impact water. This water energy nexus is where the double benefit opportunities and double threat risks arise. It makes sense to further the sustainable community development process initially through your local water utility. Utilities who address their managerial self-sufficiency, financial self-sufficiency and technical self-sufficiency can systematically integrate water conservation, energy efficiency and renewable energy. Due to their structure and services, it is logical for the local water, wastewater and/or solid waste utilities to initially be an easy entry point, eventually, for the greater community to begin to look at their energy and water footprints.

Begin by first looking at the utility distribution system as a network. The picture will soon possibly include the interconnection of a local school, church, community center, trailer park or post office, with this asset network. Many of the activities within these facilities cannot take place without the presence of water and its embedded power. This relationship can be made explicit with the question, "What things will we not be able to do if the water system is without water or power for an extended period of time?" The public will be very interested in your success in saving energy and water and protecting some activities they see as crucial. They may be interested in learning more about how they might save money.

Ways that my utility or community might increase communications on water conservation:

- ☐ Speakers bureau for local animal clubs (Moose, Elks), associations, etc.
- ☐ Utility water bill inserts
- ☐ Local fairs booth
- ☐ Farmer's markets
- ☐ Watershed associations
- ☐ Local school programs, like water activity days
- ☐ Homeowner associations
- ☐ Offer free home water audits
- ☐ Local publications
- ☐ Local public websites
- ☐ Local public radio
- ☐ Physical representation of saving, like a giant thermometer
- ☐ Name water use categories (super savers, savers, standard, wasters, abusers)
- ☐ Other _____

Water Conservation at the Home Owner's Level (page 1-16)

Thus far, Chapter 1 has covered how utilities can proactively work to conserve water. However, home owners also can adopt and implement water conservation practices and measures to help preserve the availability of fresh drinking water sources. The remainder of this chapter will address how home owners can contribute to water conservation.

Drought contingency planning

Drought is a natural hazard that differs from other hazards in that it has a slow onset, evolves over months or even years, affects a large spatial region, and occurs in virtually all climatic zones. Its characteristics vary significantly from one region to another. Its onset and end are often difficult to determine, as is its severity.

Drought originates from a deficiency of precipitation over an extended period of time, usually a season or more. This deficiency creates a water shortage for some environmental activity of the entire environmental sector. Factors such as high temperature, high winds and low relative humidity are associated factors that can aggravate its severity.

There is also a second type of drought that occurs slowly over time. Growth-induced drought is when more and more people share the same limited source of water. Growth-induced drought occurs much slower, but it never goes away.

Because droughts are a normal part of climate variability, it is important to develop a drought preparedness plan to deal with the extended period of water shortage in a timely and systematic manner. To be effective, these plans must evaluate a region's exposure and vulnerability to the hazard and incorporate these elements in a way that evolves with societal changes. Elements of this drought planning manual were adopted from The Drought Preparedness Planning: Building Institutional Capacity which developed a 10-step drought planning process (Wilhite et al., 2000). Some of the steps were modified to fit small water systems.

Drought preparedness planning will define a process to mitigate drought impacts. A locally relevant plan will include drought conditions, ways to respond or possibly avoid droughts. Drought response planning is an objectives-based focus on matching responses to actual conditions and preventing crisis. These objectives are accomplished through the development of drought triggers and indicators and by providing guidance on responses to drought conditions for the various sectors impacted by droughts:

1. Monitor and record data for the determination of drought conditions;
2. Determine intensity levels of drought; and
3. Develop methods and procedures to collect and distribute information, convene committees, promote water conservation and other means to encourage stewardship.

Drought response planning provides guidance and support to various aspects of drought activities, including but not limited to:

- Establish drought response phases based upon drought intensity levels; and
- Review the drought management plan every five years or after a drought event to evaluate performance as response effectiveness and long-term intensity trends for suitability.

Droughts are responsible for a wide range of potential impacts. These impacts can be categorized as social, environmental and economic. Each impact carries direct and indirect implications to the lives of your customers. Planning needs to account for individuals being affected by multiple impacts at the same time, for example: a customer's landscape watering needs will increase as the supply of water for irrigating is diminishing.

Potential impacts synergy or 'perfect storm' should be integrated into the planning, mitigation and response activities to help minimize them. A water system could find itself in the uncomfortable position of having to raise user rates at the same time austere conservation measures are implemented.

Drought management planning process

1. Recruit a drought planning task force
2. Provide the task force with functions
   a. Supervise and coordinate development of the plan
   b. During times of drought when the plan is activated, the task force coordinates actions, implements mitigation and response programs and makes recommendations (policy).
3. Task force drafts plan purpose and objectives

4. Conduct a Strengths-Weaknesses-Opportunities-Threats (SWOT) system drought analysis
5. Identify research needs and matching existing materials
6. Check state and Federal Government drought policy guidance
7. Task force will draft plan
    a. Seek stakeholder participant
    b. Plan for possible conflicts created by a drought event
    c. Identify drought impacts to specific customer groups/types
8. Publicize drought plan
9. Garner drought plan responses and adjust as needed
10. Finalize plan
    a. Get the plan into the hands of those who will be implementing the response activities (not just in your filing cabinet)

The drought contingency planning process identified above can and should be used to serve beyond its intended purpose. Due to its planning nature and the need to be revised and updated periodically, the 10-step process outlined has the flexibility to be modified, adjusted and implemented as a climate change adaptation measure for a specific region (county level or multi-county level; multiple utility systems all the way to the watershed level).

Most drought contingency plans identify the issues and challenges specific to the utility which are based on historical knowledge and the utilities proven response. Unfortunately, climate change has the potential to challenge historical knowledge and most definitively has the ability to deplete the existing resources.

As EPA identifies it on their Climate Ready Water Utilities website "temperature changes, and resulting changes in water quality and availability contribute to a complex puzzle of climate change challenges that have potentially significant implications for sustainability of the water sector."

EPA makes reference to the "water sector" acknowledging that when it comes to climate change related issues, individual utilities cannot go it alone. The priority of a water utility is and will always remain to be the provision of safe drinking water to its customers; however, climate change related issues force utilities to reach out to entities beyond their "traditional" operating circle; to plan and operate more vigilantly; and to develop long range planning in a comprehensive approach.

The 10-step process identified above can assist the utility as a tool to prepare and react to climate related drought at the regional level.

Temperature changes, and resulting changes in water quality and availability contribute to a complex puzzle of climate change challenges potentially have significant implications for sustainability of the water sector.

Outdoor water use

Outdoor water conservation programs need to be incorporated into the city or county land development code to provide more options. A water system's service area may fall within one or more land development planning authorities. The land development codes need to allow developers and builders the flexibility to incorporate water conserving landscape designs. This can be done the most flexibly by providing a water conservation points per acre system. It will offer more landscaping choices and reward developers for conserving water. Points are awarded to aesthetic elements like outdoor art pieces, long term water savings and sustainability.

Many existing land development codes required builders to plant grass in landscaping strips, provide a certain number of trees or shrubs as a mandate. This "one size fits all" approach ignores the fact that many people choose to work with indigenous plants.

Outdoor water use increases during spring and summer by as much as 50 percent. Landscape watering and car washing are the two main outdoor water uses responsible for creating this higher demand for water. This increase in water demand comes at a time of year when there is less water naturally available in the environment due to warmer temperatures and plant uptake.

By implementing just a few minor changes in how you use water outdoors, you will find that you can maintain your existing outdoor activities using much less water. This will save money on your water and electric bill, and protect the environment by leaving more water for local rivers, wetlands and aquifers. In the case of outdoor lawn watering, using water more efficiently will actually improve the durability of your grass, reduce the need for chemical amendments and decrease lawn mowing frequency.

Legalities to consider (page 1-21)

Programs like rainwater catchment or water reuse of greywater will have impacts on neighbors. Many small rural communities are located at the headwaters of watersheds and depend on their resources for survival, but so do other populations downstream. Watersheds are critical to economic development and environmental protection and are key to a community's long term sustainability. For that reason, due diligence needs to be done on the potential impacts of your policies and programs to your local watershed. There are significant benefits to be gained by water and wastewater providers participating in watershed based collaborations efforts. One of the major benefits is communication of current and future needs so that conflicts with your neighbors can be avoided or limited. Does your water conservation program create a benefit for more than just your customers? Are there ways for the others who benefit from your water conservation to incentivize or reward your efforts? Watershed collaborations are a forum for this type of information to be shared. It is also a great way to keep up on the most current best practices on place based issues related to water conservation.

Assessing the vulnerability of the local water resources is the utility's responsibility as is the development and implementation of proper conservation measures. The same responsibility reaches over to the watershed level. Spearheading the management of watersheds at the local level is a proactive approach to protecting the environment that surrounds a community and guarantees long term sustainability.

Each state has a number of watershed associations. Find your state's watershed associations online, usually bringing up maps and contact information for your states nonprofit watershed associations. Greywater legality is almost always an issue for permitted new construction and remodeling, unless you are in a visionary state such as Arizona, New Mexico or Texas (and soon, Nevada, Montana, Oregon and California). Check with your local building department to determine what is permitted.

Save Water, Save Energy (page 1-21)

Reprinted from U.S. EPA Water Sense, http://www.epa.gov/watersense/water_efficiency/benefits_of_water_efficiency.html

EPA WaterSense PARTNER

It takes a considerable amount of energy to deliver and treat the water you use everyday. American public water supply and treatment facilities consume about 56 billion kilowatt-hours (kWh) per year—enough electricity to power more than 5 million homes for an entire year. For example, letting your faucet run for 5 minutes uses about as much energy as letting a 60-watt light bulb run for 14 hours.

By reducing household water use you can not only help reduce the energy required to supply and treat public water supplies but also can help address climate change. In fact:

- If one out of every 100 American homes retrofitted with water-efficient fixtures, we could save about 100 million kWh of electricity per year—avoiding 80,000 tons of greenhouse gas emissions. That is equivalent to removing nearly 15,000 automobiles from the road for one year!
- If one percent of American homes replaced their older, inefficient toilets with WaterSense labeled models, the country would save more than 38 million kWh of electricity—enough to supply more than 43,000 households electricity for one month.

Rural Community Economic Development (page 1-21)

Economic opportunities in rural communities may be limited by lack of infrastructure, distance from markets and isolation from financial centers (capital). Coupled with limited population, revenue base and technical expertise, these competitive disadvantages result in low wages and higher cost of living (after adjusting for the cheaper cost of housing, lower return on housing) investments and higher rates of poverty among working families. Depending upon your location these problems may be exacerbated because many local economies have been historically dependent on natural resources. During the recent decade, opportunities in the mining, timber, fishing and agricultural industries have been diminished by increased international competition, mechanization, resource exhaustion and sensitivity to environmental protection. Such reductions displace workers who possess few transferable skills and live in communities where resources for acquiring new skills are scarce. Limited transportation and childcare options also reduce job opportunities. As a result, many displaced workers are forced to accept service sector jobs with sharp decreases in income.

An economic development strategy for small communities does not focus on building industrial parks or recruiting big businesses. Small, isolated communities require a different economic development approach to create the jobs, income and community self-determination necessary for long-term economic self-sufficiency. Small rural community economic development has to begin with human capital investing. Communities need to develop long-term visions for self-determination and self-sufficiency — and find the resources necessary to turn those visions into reality. Key elements for sustainable rural community economic development are investments in human capital and creation of business ventures and jobs by local entrepreneurs and community based organizations.

Multiplier effect

Imagine one dollar bill circulating through a community's economy. First, someone buys a donut at the bakery. The bakery owner uses that dollar and others to pay one of the employees. The bakery employee then buys groceries at the local supermarket, using the original dollar, which is then paid to one of the employees of the supermarket. The supermarket employee uses the dollar (and many more!) to buy gas at a local service station. The dollar is then paid to a service station employee, who buys home repair materials at the local hardware store, and so on. The value of that one dollar to the community's economy was multiplied many times as it is circulated. If a small community is too small to have businesses there is no multiplier effect. The very small communities will need to focus on creating small business opportunities. If business start-up seed money cannot be accessed from outside resources, the community should consider savings realized from conservation to aid start ups either as a revolving loan or one time donation. Eventually the benefit will be realized for everyone once a multiplier effect takes hold.

A key principle of community economic development is to keep money circulating within the local economy as long as possible. When money leaks out of the local economy, the multiplier effect ceases. How does money leak from the local economy? Possibilities include:

- Businesses located in the community, but owned by outside companies, sending significant portions of their proceeds outside the community to the home office. This can include local utilities.
- Residents shopping in other communities or purchasing from mail order/online vendors.
- Local businesses buying goods or raw materials from sources outside the community.

Some rural communities are so small and isolated as to not constitute an economy in and of themselves. Residents commute to neighboring towns to work. They also must commute to larger towns to spend their money because there are no local businesses. The money that comes in and goes out of the community will benefit only individual households.

Modern economies are complex and linked in intricate ways, making it extremely difficult, if not impossible, to eliminate all ($$) leaks. Identifying and plugging leaks to the extent possible can have profoundly positive effects.

What does all this have to do with utility systems? Utilities are businesses which impact and are impacted by the economies of the communities they serve. Utilities employ local residents, hire contractors, buy supplies, consume energy, produce waste, collect fees and engage in a host of other economic activities. Drinking water, wastewater and solid waste systems either increase or decrease the multiplier effect and prevent ($$) leakage or not. ■

Food for Thought (page 1-21)

Are your water and wastewater systems operated by local residents who spend their wages in the community, or by a contractor from outside the community who exports contract payments out of your community? Is there an opportunity to switch to local ownership and control?

Economic Development Water Conservation Questions:

1. Name at least three water features in your community?

- ☐ Lakes/ponds
- ☐ Intermittent streams
- ☐ Leaking pipes
- ☐ Golf course(s)
- ☐ Other_____
- ☐ Rivers
- ☐ Water utility
- ☐ Big trees
- ☐ Agriculture
- ☐ Other _____

2. How might conservation related to any of these water features help to bring funding into my community? Can include education. _____

_____

3. In my community water conservation jobs might include?

- ☐ Landscape/xeriscape
- ☐ Rancher
- ☐ Contractor
- ☐ Tourism
- ☐ Other _____
- ☐ Farmer
- ☐ Water utility worker
- ☐ Water operator
- ☐ Water conservation specialist

4. To increase our local economy, I think we could incorporate the following idea(s) for water conservation: _____

_____

5. Possible partners on water conservation economic development in my community include:

- ☐ Soil and conservation service
- ☐ Local water utility
- ☐ Chambers of commerce
- ☐ State conservation agency
- ☐ Other_____
- ☐ Water operator
- ☐ U.S. Department of Agriculture
- ☐ Council of governments
- ☐ Other _____
- ☐ Other _____

Additional or Updated Resources (page 1-22)

California Department of Water Resources, water use efficiency publications
http://www.water.ca.gov/wateruseefficiency/publications/

Florida, instructions for completing a water district water audit, 17 pages
http://www.sjrwmd.com/rules/pdfs/40C205902.pdf

Landscape conservation
http://www.californiagreensolutions.com/

Massachusetts water audit forms and worksheets
http://www.mass.gov/dep/water/approvals/wmgforms.htm

Additional or Updated References (page 1-24)

Water Efficiency Magazine, *http://www.waterefficiency.net/* the journal for water resource management. The website has an archive of past issues dating back to 2006.

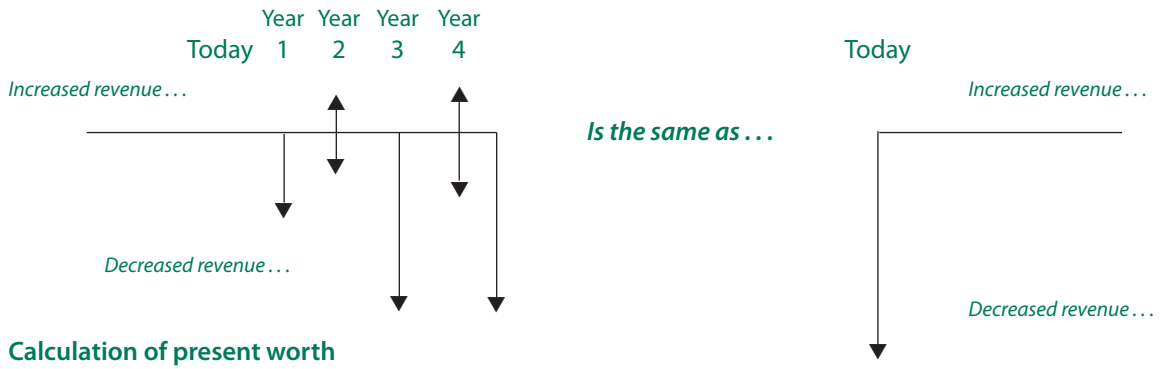
2 Energy Efficiency

Figuring Costs and Revenues as a Present Worth (page 2-35)

This calculation allows you to place all costs (and revenues) on a common basis.

$$\frac{(\text{Annual Cost})\ (1+i)^n-1}{i(1+i)^n}$$

Present Worth



Calculation of present worth

- Equations

P= present worth, i= interest rate and n= period in years

▶ Convert future cost to a present worth cost

$$P = (\text{future cost})\ (1+i)^{-n}$$

▶ Convert annual cost to present worth cost

$$P = (\text{annual cost})\ \frac{(1+i)^n - 1}{i(1+i)^n}$$

Ways that our utility or community might increase communications on energy efficiency:

- ☐ Request that electric utility identify relevant rebates and incentives
- ☐ Identify the cost savings through water conservation
- ☐ Energy efficiency tidbits in water bill inserts
- ☐ Publish energy efficiency program savings
- ☐ Break energy expenditures out as a separate budget item
- ☐ Calculate and publish energy cost per 1,000 gallons trends over time
- ☐ Signage on facilities that are in public view; 'this smart meter saves 10 percent'
- ☐ Other _____ ■

Energy Audits (page 2-35)

An energy audit is an assessment done of the local water and wastewater utility operations as they relate to energy used. The audit is basically to help a small utility reduce utility energy costs, to improve reliability and performance. The utility assets are evaluated through looking at energy consumption and ways to become increasingly efficient. Deciding if you need to perform an energy audit can be as simple as looking at the amount of money you spend on electricity each year. If this amount is significant in relation to your other expenses then an audit is in order.

For a small water utility the audit process might only include the well or pump house, all associated buildings, and distribution lines, storage tank, etc. Often, the infrastructure in small communities is basic and includes submersible pumps, wall heaters, incandescent lights, chlorinator pumps, and that may be all. Sometimes the physical configuration of infrastructure, like distribution lines and storage tanks, does not have a direct energy use like a pump, but causes energy inefficiency in the pump house. Electrical operations are often confined to just a pump house or vault. This relationship between energy used and water is the water-energy nexus and can take place anywhere in the system with an energy consumption manifestation in the pump house.

Active-mixing technology in a distribution system tank eliminates the need to deep-cycle water to maintain fully mixed conditions, which in turn eliminates extra energy load. For example, consider a single 2-million gallon tank that usually has 10 percent of its volume deep-cycled daily to promote mixing. With active mixing and assuming system pumps operate at a total dynamic head of 150 feet, a pump mechanical efficiency of 80 percent, and a motor efficiency of 90 percent, it's estimated up to 48,000 kilowatt hours per year in pumping energy and associated carbon emissions could be eliminated. [1]

There are many variations on the deliverables produced during an energy audit. These can vary significantly in quality, cost and content. Particularly for small community systems the energy audits are less defined than for much larger systems. Check with your electricity provider to see what options and costs ranges are available. You will want to match the sophistication of your audit to the complexity of your energy use patterns. Two excellent examples of energy audits were performed on by WSOS Community Action Commission for the small communities of Salineville and Cadiz. A brief overview is in the Appendix, page A-23. Please visit the RCAC website, *www.rcac.org* (under Resources), to view the complete energy audit reports by WSOS.

Most energy audits begin with your electric utility bill records for at least one year. The actual audit looks at the energy usage and the process. The report should include recommendations for:

- facility improvements
- reduced costs of operation
- energy use benchmarking
- potential funding options, rebates, incentives
- possible renewable energy options

Increasing energy efficiency is one of the most effective ways to reduce costs and improve environmental performance.

These best practices, energy audits specific to small communities, are only now becoming available. Planning monies have not been available for small community public utilities to take advantage of state or federal dollars and the local electric utility rebates and incentives for energy audits are usually based on paying for everything up front and receiving the rebate much later. With 85 percent of America's water and wastewater utilities being small systems this is now considered low hanging fruit, ripe for energy efficiency measures. Although access to rebates and incentives are changing for small community utilities, very few to zero small community water and wastewater systems have been able to take advantage of these rebates. Please ask your electric services provider what programs, rebates and incentives they might have for small utility energy audits.

With energy audit information the process can be expanded into an Energy Management Plan. This includes asset management, capital improvement plans, and alignment with the state intended use plans. EPA will be showcasing a series of pilot Energy Management Plans for small communities and hopes to have that information available in the near future.

[1] Reprinted with permission: ***Opflow,*** "Sustainable Operations: Mix it up and go green," Volume 36, No. 1, January 2010

Asset Management Planning and Energy Efficiency (page 2-47)

The Asset Management (AM) Plan is a process of accounting for ALL the utility assets and assessment of their physical condition. There are myriads of templates to complete an AM Plan but most of them include as the first step the physical inventory and catalog of the utility's assets and its existing conditions. As part of the conditions' assessment, criticality level is assessed; how severely will the system be impacted/impaired if that particular asset fails? The other assessment on the condition of the asset is on the level of redundancy; can the system afford to have spare parts sitting around? Can that particular asset be eliminated without hindering the system's operations?

The age and condition of each component is noted, normally on a database or spreadsheet. The expected useful life span of each component is researched. The age of each component is subtracted from the expected life span to give the remaining life expectancy. The cost of the components is now researched. The information gathered between the useful life and the age of the asset will determine how much time the decision makers have to either repair or replace the asset and what kind of financial impact it can have.

Now, armed with the remaining life and replacement cost, a capital replacement plan can be drafted. A capital replacement plan is then incorporated into the utility's financial plan and reserve set aside to eventually get it funded through a proper rate structure.

Asset management and asset managing are not a simple process, but as utility infrastructure across the nation ages and financial resources diminish; this tool can be a great asset to assist utilities to sustain their established level of service. The AM Plan can assist decision makers to identify and properly plan infrastructure projects and fund them adequately without creating financial burden on the utility itself or its customers.

The AM Plan can be taken to the next level; part of the planning process can incorporate the implementation of the energy efficiency. Estimating the energy efficiency savings of new upgrades at the time of system component repair or replacement can be incorporated. For example: a well pump reaches its life expectancy. A new, much more efficient pump can be used to replace it. Subtract the amount of expected energy savings off of the anticipated loan payment of the new pump. This is the real amount the new pump will affect your budget rather than the full amount. This reduction in future budgeting impacts may make energy efficient projects more attractive sooner.

For a full version of free asset management software please refer to the EPA developed materials Check-Up Program for Small Systems (CUPSS) at *http://water.epa.gov/infrastructure/drinkingwater/pws/cupss/*.

Basic Economic Development Strategies (page 2-47)

Two broad strategies for maintaining and strengthening local economies are:

1. Reducing the cost of living through efficiencies
2. Increasing real income because you are plugging holes in the local economy

Local utility services play important roles in both of these strategies.

Reduce the cost of living for residents and those who commute from the community

Decrease costs of goods and services

Affordable housing. Utility services affect the cost of housing for everyone. Infrastructure costs, the cost of connecting homes to the infrastructure, drinking water production and waste treatment all add to the cost of housing. **Anything that can be done to reduce the cost of utility services will make housing more affordable for all.**

Cooperative or community owned enterprises. In some cases, utility systems owned and operated by local government, cooperatives or community based organizations are more cost effective than for profit operations.

A good mantra for today is *Think Globally, Shop Locally.*

Reduce time and travel cost

Business district development. Does your community have a business district? Is it thriving or slowly dying due to leakage from the local economy? If the district is healthy, are efforts being made to sustain it and strengthen it? Supporting your local businesses makes shopping less costly, less time consuming and more enjoyable. **A healthy business district requires reliable and affordable utility services, while at the same time providing income and services to the utilities and their employees.** A good mantra for today is ***Think Globally, Shop Locally.***

Targeted commercial real estate development. This is another step towards reducing time and travel costs. What goods and services do residents of your community need that are not currently available locally? Is there a vacant parcel of land that can be developed to meet the needs? A key factor in any real estate development project is the availability of reliable and reasonably priced utility services. ■

Food for Thought (page 2-47)

Are your recyclable materials shipped to distant markets, whose residents are paid to process the materials and make new products from them? Could any of the new products be made by residents of your community?

1. How might sharing resources help your community to be more energy efficient?

   _____

   _____.

2. How might energy efficiency bring jobs to your community? Can include education.

   _____

   _____.

3. In my community energy efficiency jobs might include?

   ☐ Electrician ☐ Energy auditor ☐ Weatherization ☐ Educator

   ☐ Water Operator ☐ Other _____

4. To increase our local economy we think we could incorporate the following idea for energy efficiency:

   _____

   _____.

5. Possible partners on energy efficiency in my community might include:

   ☐ Local schools/community colleges/universities
   ☐ Local businesses
   ☐ Local electric utility
   ☐ Local fire department
   ☐ Water, wastewater utility
   ☐ Local plumbers
   ☐ County manager's office
   ☐ U.S. Department of Agriculture
   ☐ State energy offices
   ☐ Other _____

Additional or Updated Resources (page 2-48)

Distributed Energy Magazine the journal of energy efficiency and reliability.
http://www.distributedenergy.com/

Montana State University Montana Technical Assistance Center at the Montana Water Center. Saving Water and Energy in Small Water Systems A four section curriculum on water conservation, energy management, alternative energy sources and water accounting. This is a wonderful resource with case study videos and lots of information.
http://watercenter.montana.edu/training/default.htm

U.S. Environmental Protection Agency (USEPA). USEPA's Performance Track: *a* program to track your performance including energy consumption/efficiency that allows you to improve performance above simply complying with regulations.
http://www.epa.gov/performancetrack/index.htm

Water Conditioning and Purification Magazine. The WCP website has an archive of old magazines dating back to 1998.
http://www.wcponline.com/

3 Renewable Energy Sources

Ways that our community or utility might increase communications on renewable energy and its role as an energy source (page 3-52)

- ☐ Is there a County comprehensive plan? Does it include renewable energy?
- ☐ Case studies of similar size systems and communities
- ☐ Renewable energy tidbits in water bill inserts
- ☐ Incorporate renewable energy into existing county ordinances
- ☐ Introduce renewable energy and place project in public view if possible
- ☐ Provide signage on renewable energy projects advertising the benefits
- ☐ Local schools field trips to your facility
- ☐ Other _____

_____

Always look at the water conservation and energy efficiency options and solutions before you begin considering renewable energy!

Energy efficiency comes before implementation of renewable energy. Reduction of energy waste is more cost effective than replacing an energy source. The most effective sustainability strategy addresses energy efficiency first, then making renewable energy in the most environmentally friendly manner.

Team Activity D (page 3-55)

Renewable Energy Asset-Based Inventory

1. Define and ask people to give examples of the five renewable energy resources (see page 3-58).
2. In a group, brainstorm an inventory list of local renewable energy resources.
3. Using a separate list, brainstorm renewable energy resources that are not currently available, but that due to the geographic location and local environmental conditions could be beneficial to the area.
4. Create a map of the service area, county or geographic area being discussed. This will help the group visualize the location of the resources.
5. Provide each participant with one or two colored dots and ask them to place the dots on the list of existing resources that:
   a. Can be expanded to include other uses besides the current one.
   b. Have proven to be the right technology for the area and their intended use.
6. Using more colored dots, ask the participants to place a dot on the list of available renewable energy resources not currently existing in the area, but that may have potential based on geographic location and environmental conditions.
7. Using the lists and the map, answer the following questions:
   a. Are the current resources being used to their optimum level?
   b. Who would be the optimization partners?
   c. Where might the optimizations take place?
   d. Is there room for new, renewable energy resources to make current operations more cost effective and environmentally friendly?

Team Activity E (page 3-56)

Project Impact Analysis and Stakeholder Identification/Futures Wheel

Purpose:

- Impact analysis gets you to look at the potential impacts, both positive and negative, of a proposed project.
- It requires you to consider direct and indirect, immediate and long-term results.
- Based on the information gathered through the analysis, decisions to amplify, promote, control and/or mitigate impacts can be made.
- It allows you to define all the impacted and/or affected groups/stakeholders.

The purpose of this exercise, as adapted from the Ford Institute Leadership Program curriculum, is to identify things that will happen, will be seen or will be in place if a project is implemented.

For example, if the community decided that they wanted to consider a wind farm, things to ask would include:

- *How will the project affect specific community members?*
- *Who will be impacted directly or indirectly?*
- *What kind of impacts will be experienced?*
- *When might impacts happen?*

Instructions

This process looks at first, second and third order of impacts.

Step One: Draw a wheel

1. Tape two pieces of flip chart paper together, side by side.
2. Draw a circle in the middle of the chart: write a two or three word project/program description that contains a VERB.
3. Chart five to eight immediate (First Order) impacts, both positive and negative.
   a. Connect the impacts to the chart with a SINGLE LINE.
4. Chart secondary (Second Order) impacts.
   a. Connect these impacts to the chart with DOUBLE LINES.
5. Chart other resulting impacts (Third and Fourth Order) impacts.
   a. Connect them to the chart with TRIPLE and QUADRUPLE LINES.

Step Two: Identify stakeholders

1. Brainstorm stakeholders affected by the impacts identified.
2. List each stakeholder or group of similar stakeholders on a separate sticky note.
3. List stakeholder names next to the specific impact that affects them.

Step Three: Debrief

1. Post the wheel drawings on wall and have the entire group view all wheels via a gallery walk.
2. Discuss any comments and observations.
3. What are the things that can be changed, if any?
4. What can the community live with, short- and long-term?

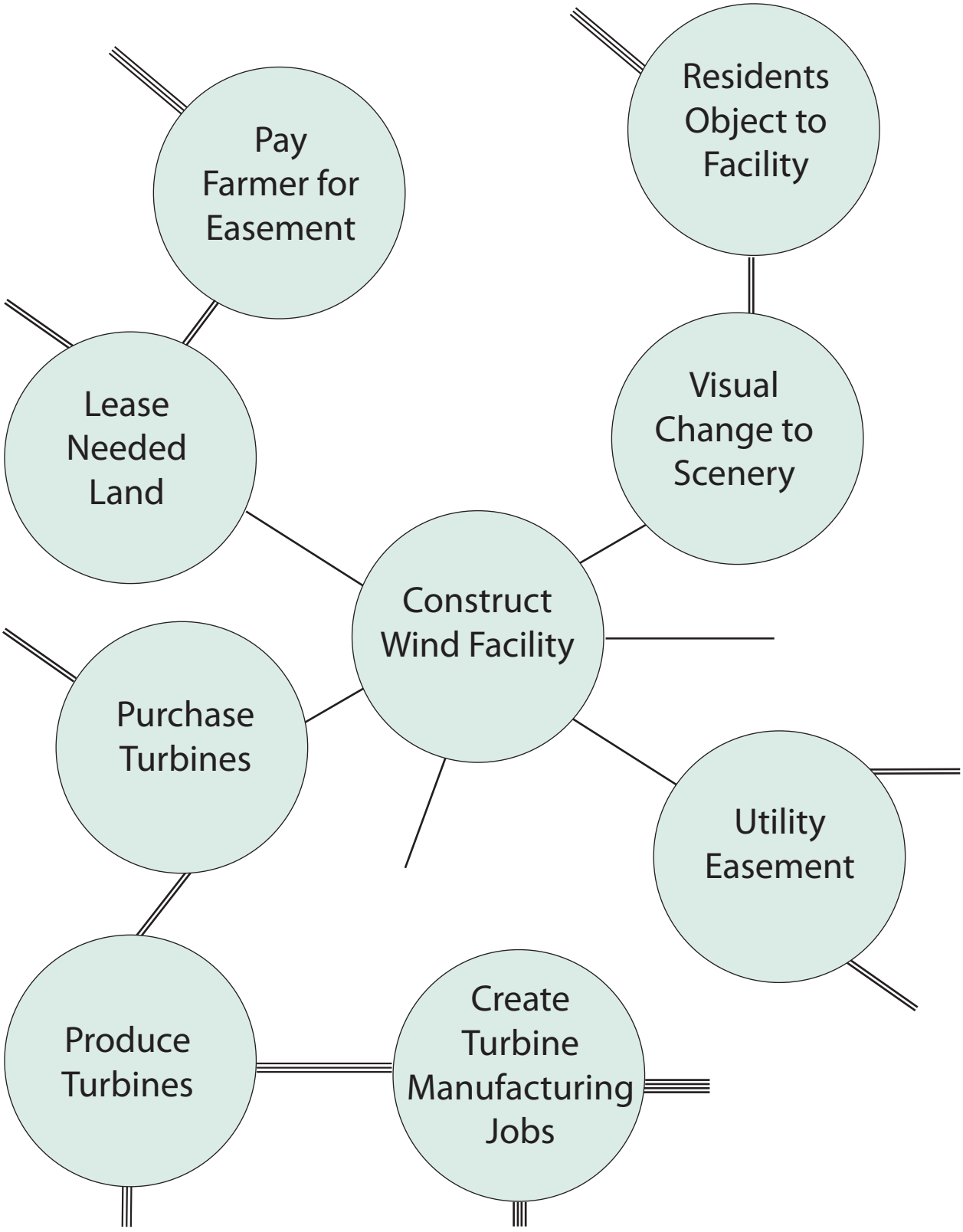
Activity Glossary:

Project/program description: a single sentence of the descriptive statement that is as specific as is practicable. It should contain a verb describing what is being done.

Impact: the good and bad things that will happen because of the project's existence.

(See Futures Wheel example on next page)

Example Futures Wheel



Renewable Energy (page 3-58)

Holistic energy planning

Many communities initially plan energy management of their water or wastewater utility in order to become increasingly efficient and save money on their energy bill. However, this is difficult to sustain. In a trend of ever increasing energy consumption, is the goal to slightly slow the increase or to achieve the direct and indirect benefits of real reduction? The local utility is at the heart of a community's energy usage protecting human health and the environment. A natural next step for these small communities might be to look into holistic energy planning; beginning to educate local schools, local community or senior centers, fire departments, clinics, churches on how integral the water infrastructure is with the health of the community. This woven fabric of overlapping infrastructure includes water, energy, transportation and land use patterns.

Holistic energy planning is a process whereby a community defines what is important for them and then determines the best mix of energy for their community based on best available resources to achieve mutually agreed upon goals. This planning process can further create local jobs, involve academic institutions, businesses, government and nonprofits, foster energy savings and spur innovation. A cautionary note: The fact that private sector businesses often times take dependable community infrastructure for granted, combined with the high cost of relocation means that holistic energy benefits will be long-term and not short-term. Job creation, for example, may be found in local businesses being able to expand or offer new services rather than the recruitment of new manufacturing facilities because of the new sewer project.

Holistic energy planning is a commitment to a sometimes frustratingly slow process of managing change in your community to achieve a consensus driven 'better world.' It is a process of aligning the community energy consumption with both the existing culture and the realities of existing funding, current usage trends, and potential energy resources.

Distributed energy

When a small public utility or a small community looks at incorporating renewable energy, they need to look closely at the mix of their electric utility needs now and in the future. The utility needs to decide if they will be providing any of their power locally. This is called distributed power, or distributed energy; where the electricity is produced near to where it is used.

Historically, our small local utilities have only been using transmission grid power, commonly produced a distance from the community, transported by interconnected large transmission lines, commonly made from coal, oil, natural gas, nuclear and hydro power. Now, many utilities are considering and purchasing small scale technologies such as capturing waste heat, biosolids and water conservation, especially incorporating energy efficiency and creating local power that is independent of the larger transmission grid. This distributed local power can be linked with the larger grid, depending upon how the system is configured.

When energy is needed at a remote site for powering low usage equipment, like SCADA, then an application of solar power can be much more cost effective to install than conventional power. When larger amounts of power are needed for large volume deep wells, some facilities have found onsite natural gas powered generators to be more cost effective than the installation of power lines. Some facilities have found that their capital investment can be quickly recovered and they begin saving money by installing onsite natural gas generators to lower their plant power demand just during peak demand periods. The utility is able to get an energy savings during the most expensive electricity rates.

Utilities can:

- Remain 100 percent transmission grid-tied electricity
- Begin to add distributed power sources
- Become 100 percent distributed energy

Distributed generation can save money, increase jobs locally, can address climate change adaptation and mitigation strategies.

Renewable energy and climate variability

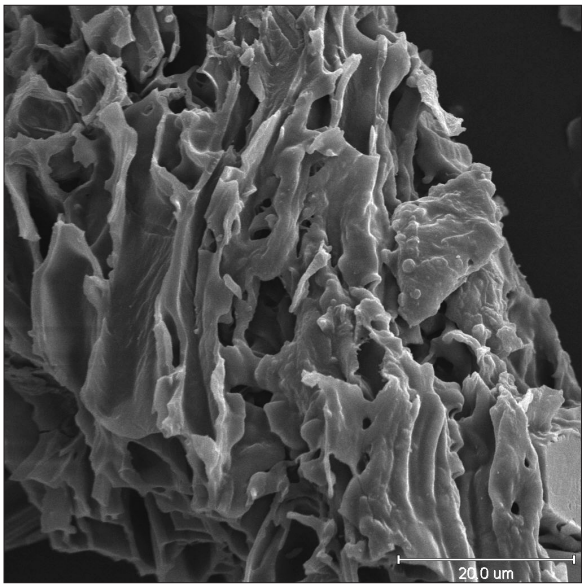
Water and wastewater utilities have begun to identify and take advantage of renewable energy resources specific to their geographic locations, creating savings opportunities. While in most cases, renewable energy infrastructure projects can be cost intensive, over the long run they can be a wise investment, if your utility is flexible and prepared for potential variabilities in weather. While the technology to operate 50 hp (horse power) pumps is not quite optimal yet, solar panels used to cool down pump houses or to run chlorine pumps are possible added value, depending upon your energy audit and profile of process use. Wastewater treatment plants have the potential to support a portion of their operations through methane generation and other alternative energy sources. Being aware of potential green house gas reduction efforts as a component of the utility operations may decrease vulnerability in addressing weather related variables that might impact your local utility.

Biomass: Energy From Plant and Animal Matter (page 3-60)

A new process for using biomass that is gaining momentum is biochar. Biochar is created by the pyrolysis (addition of low or high heat) of biomass. The pyrolysis process can be adjusted while making biochar to accommodate different feedstocks to produce different by-products. At the same time, the process also sequesters the biomass' carbon that is applied to soil to increase water holding and fertility for crop production. The carbon sequestration prevents the production of CO_2 and greenhouse gases.

Small biochar pilot projects are taking place across rural America. This technology seems especially relevant for small communities where agriculture and woodlands produced biomass is most plentiful. The limiting factor that seems to be emerging for biochar is the cost of transporting the biomass feedstock and the biochar soil amendment. Some small rural communities will be located in the most efficient biochar production sites and should be looking to the possible benefits and impacts of a biochar facility.

Biochar's axiom is the same as the old real estate axiom 'location, location, location.' Feasibility is dependent upon the location of biomass feedstock, location of input resources like water and location of the product market. Rural water and wastewater systems are stakeholders in all three location questions.



Biochar magnification photo courtesy of the Center for Sustainable Environmental Technologies at Iowa State University

Increase income generating opportunities; Increase demand for labor (page 3-71)

Business retention and expansion. As mentioned previously, local utilities are business operations. Maintaining local control of utility services is a way of retaining jobs and income in the local economy. And maintaining reliable and affordable utility services is a way of retaining and growing other businesses. Utility businesses and other businesses are mutually dependent.

New business creation. As with retention and expansion of existing businesses, new business creation requires utility services. Poorly maintained utilities or exorbitantly expensive utilities will hinder creation of new businesses.

Entrepreneurial development. Is your community's waste stream full of garbage or gold? Do the wastewater system's biosolids end up in the local landfill or in a composting operation? Many so called waste materials can be recycled as feedstock for local businesses, where they will create jobs and income for local residents, while at the same time reducing hauling and disposal costs for the utilities that manage them. Entrepreneurial opportunities are not limited to the waste stream. Does your community's water system produce water of exceptional purity and taste? If so, market it! At the very least, marketing may draw curious sightseers to town, who will of course be directed subtly to the business district.

Business recruitment. Recruitment of new businesses to a community has long been a core economic development strategy. Again, there is a direct relationship between availability and cost of utility services and the ability of a community to attract new businesses.

Import substitution. Your community's utilities may be a source of leakage for the local economy. One solution is import substitution, or replacement of imported products and services with local products and services. Where are chemical supplies purchased? Is there a local source? If the local source is more expensive, is there a win-win solution in which suppliers and buyers can help each other for the benefit of the entire community? Labor is one of the biggest costs for many businesses, including utilities. Do utility executives live in the community, or in a management company's home community? Locally owned and operated utilities can increase the multiplier effect.

Share resources. Many communities are regionalizing. Finding collaborative, cooperative ways of collectively determining their future through the increased economies of scale. Sharing resources will actually open up jobs for communities involved.

Improve labor supply

Job linkage and placement. Don't let good jobs sit idle for lack of applicants. Set up formal and informal mechanisms for getting the word out, identifying qualified candidates and getting positions filled. Vacant positions don't contribute anything to the local economy.

Technical skills training. Utilities provide a broad range of employment opportunities, from field labor to technical operations to management and executive positions. Many utilities are currently experiencing difficulty recruiting employees. A local or regional effort to recruit and train system operators could help keep jobs in the community and prepare residents to take advantage of employment opportunities. Community colleges are one possible source of technical skills training. If you cannot afford to pay industry standard operator wages, organize your systems operations to allow for new operators to work for a while building experience and then move on. This means that systems need to be set up for a short institutional memory and redundancy is needed for staff with limited experience.

Use your utility as a vocational school to help transform community members into employment candidates. If new business arrives in or near your town, do folks have the skills to perform the work? Businesses moving to rural communities often times transfer workforce in from somewhere else because they cannot find the skills that then need during the start up.

Food for Thought (page 3-77)

1. List at least three potential renewable energy resources in your community (from Team Activity D, page 3-55):

- ☐ Industrial wind
- ☐ Industrial solar
- ☐ Biomass
- ☐ Heat pumps
- ☐ Distributed wind
- ☐ Distributed solar
- ☐ Bioenergy
- ☐ Hydro and micro-hydro
- ☐ Other _____

2. How might renewable energy bring jobs to your community? Can include education.

_____

_____

_____

_____

3. In my community renewable energy jobs might include?

- ☐ Electrician
- ☐ Contractors
- ☐ Local utility positions
- ☐ Cement workers
- ☐ Renewable energy design
- ☐ Educators
- ☐ Local and county positions
- ☐ Operations and maintenance
- ☐ Other _____

4. To increase our local economy, I think we could incorporate the following idea(s) for renewable energy: _____

_____

_____

5. Possible partners related to renewable energy might include:

- ☐ Governors energy office
- ☐ Academic institutions
- ☐ Local utilities
- ☐ Council of governments
- ☐ Chambers of Commerce
- ☐ County managers
- ☐ Local renewable energy associations
- ☐ Local non-profits
- ☐ Other _____

Additional or Updated Resources (page 3-78)

American Council for an Energy Efficiency Economy: Water and Wastewater
http://www.aceee.org/topics/water-and-wastewater

Applied Solutions: supports counties and cities to identify and implement advanced technologies, policies and services through integrated systems to build resilient, healthy and stable local economies and communities.
http://www.appliedsolutions.org

AWWA resource book *The Green Utility: A practical guide to sustainability,* by Cheryl Welch
http://www.awwa.org

Energy Information Administration: an in depth description of energy efficiency and how it is measured
http://www.eia.doe.gov/emeu/efficiency/contents.html

U.S. Environmental Protection Agency (USEPA): promoting energy efficiency in the water sector
http://www.epa.gov/WaterSense/

National Renewable Energy Laboratory (NREL): renewable energy types of technology transfer via terms, energy analysis, research and product reporting for home and businesses
http://www.nrel.gov

Solar America: A guide to community solar: utility, private and non-profit project development in communities across the United States, people are seeking alternatives to conventional energy sources.
http://solaramericacommunities.energy.gov/pdfs/A_Guide_to_Community_Solar.pdf

State of Colorado, Governor's Energy Office, *Advancing Colorado's New Energy Economy*: resources on residential buildings, commercial buildings, electric and gas utilities, greening government, energy savings partners, renewable energy and the Colorado Carbon Fund
http://www.rechargecolorado.com/

Sustainable Infrastructure for Water and Wastewater
http://water.epa.gov/infrastructure/sustain/index.cfm

RCAC Green Infrastructure related publication *Green Building Guide, Design Techniques, Construction Practices and Materials for Affordable Housing*
http://www.rcac.org/assets/greenbuild/grn-bldg-guide_4-20-09.pdf

A Appendices

Partnering for Progress (Page A-88)

Onsite power for water providers is a matter of cooperation.

By Paul Hull

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More and more water districts, communities, and private companies are undertaking to use renewable power (so far, it's been mostly solar or wind) for some, or all, of their operations. Renewable power onsite and under local control brings with it an independence that some communities thought they would never see again. Communities or private purveyors of water must change their power sources to meet new state regulations and operate their businesses as their customers wish. Although switching to onsite renewable power may sound expensive and technically unfeasible, in reality, many communities (served both by public or private water purveyors) have been tasked with altering their current power sources to meet new regulations and/or customer needs. As a result, onsite power for water purveyors is no longer a fringe option, but rather a mainstream solution. And when it comes to using renewable sources for onsite power, water districts and utilities are leading the way.

The driving force behind this nationwide move to using more renewable energy, rather than energy based on fossil fuels, comes from the communities and states (equals we the people!) who want better things for their future, their children, and grandchildren. That driving force is not a sales ploy from companies who happened to have developed new technologies. It is a genuine concern for the future of our nation, especially when the frequency and cost of outages in the traditional systems of power are forecast to get worse.

The more you investigate renewable power or onsite power, the more you notice that every project is a success from more than one source, with the very essence of the community important to what is designed for equipment and operation. Could renewable onsite power help your community to conserve energy, gain power independence and stability of expenditures in its water distribution? It is worth more research, and it may cost much less than you always thought.

Energy Audits

These summaries are excerpted and reprinted with permission from Deb Martin, Ohio RCAP program at WSOS Community Action Commission, Inc. For a copy of the complete energy audits that describes each energy conservation opportunity, please visit the RCAC website at: www. rcac.org, *under Resources.*

Salineville Wastewater Treatment Facility Energy Audit

The Village of Salineville is a small, rural community located in Eastern Ohio, with a population of 1,397 people (2000 Census) and a total median household income of $27,473.

Representatives from the Ohio Rural Communities Assistance Program (Ohio RCAP) conducted a Level II Energy Audit for the Salineville Wastewater Treatment Facility ((WWTF) in 2009 to identify potential energy conservation opportunities.

Ohio RCAP's estimated that a 61% energy cost savings for Salineville was possible with an improvement cost of $29,970, and could be realized with a simple payback period of just 2.03 years. The savings of $14,760 per year not only offsets the improvement cost, but there is also a compounding effect that must be taken into consideration.

Cadiz Water Treatment Facility Energy Audit

The Village of Cadiz is a small, rural community located in Eastern Ohio, with a total population listed at 3,308 people (2000 Census), and a total median household income of $29,518. The community is served by the Village-owned Water Treatment Facility (WTF), which has a total of 1,382 connections, and 45 of the connections are not serviced by municipal wastewater.

Ohio RCAP conducted a Level II Energy Audit for the Cadiz, Ohio WTF in 2010. They conservatively estimated a 19.4% energy savings was possible with a projected improvement cost of $10,300, and that can be realized with a simple payback period of 0.75 years. The projected savings of $13,625 per year not only offsets the improvement cost, but there is also a compounding effect that must be taken into consideration. This savings will allow planning for capital improvements, emergency events, and establish a long-term asset for the Community.

What is the Next Step?

These reports outline multiple opportunities for Salineville and Cadiz to implement at their facilities. It is imperative that the facilities continue to meet all safety and permit requirements, with no exception. Quality treatment must never be sacrificed. There is no cost saving measure that is worth compromised treatment quality.

Additional Information

If you have any questions about implementing a water conservation program, performing an energy audit, renewable energy sources, or how to best use this guide, contact Rural Community Assistance Corporation (RCAC) at *www.rcac.org* or at 916/447-2854.

RCAC
www.rcac.org

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RCAP *RCAC is the Western RCAP*