CBA · NAU

College of Business Administration
Northern Arizona University
Box 15066
Flagstaff AZ 86011

Identification and Implementation of Potential Energy Efficiency Programs in Indian Country

Working Paper Series 04-03—February 2004

Thomas L. Acker,
William M. Auberle,
John D. Eastwood,
David R. LaRoche,
Amanda S. Ormond,
Robert P. Slack,
and
Dean H. Smith[*]

Primary Contact:
Dean Howard Smith
College of Business Administration
Northern Arizona University
Box 15066
Flagstaff AZ 86011

[*] The authors are Associate Professor, Mechanical Engineering, Professor, Civil and Environmental Engineering, Lecturer in Economics, Program Director, Center for Sustainable Environments, Principal, The Ormond Group, Graduate Research Assistant, Mechanical Engineering, and Associate Professor, Economics and Applied Indigenous Studies respectively. This project was completed with partial funding under contract with the Western Governor's Association, for the Western Regional Air Partnership (WRAP) and is a companion to other WRAP reports on renewable energy and energy efficiency (visit http://www.wrapair.org/index.html; on the left-hand menu bar click on "WRAP Board, Committees & Forums," then click on the link to the "Air Pollution Prevention Forum.") Additional support was made available by the Sustainable Energy Solutions group at Northern Arizona University. The authors would like to acknowledge the following groups for valuable contributions of ideas, references, and resources: the Institute for Tribal Environmental Professional (ITEP), the Native American Renewable Energy Education Project (NAREEP), the Tribal Issues Working Group of the WRAP Air Pollution Prevention Forum, and the many individuals who took the time to review the draft report and provide critical feedback. Special thanks go to the Pascua Yaqui Tribe, the Confederated Salish & Kootenai Tribes of the Flathead Reservation, and the Yurok Tribe, for each hosting a visit of NAU researchers, and for sharing their experiences concerning energy and energy efficiency.

CBA · NAU
College of Business Administration
Northern Arizona University
Box 15066
Flagstaff AZ 86011

Identification and Implementation of Potential Energy Efficiency Programs in Indian Country

Thomas L. Acker, William M. Auberle, John D. Eastwood,
David R. LaRoche, Amanda S. Ormond, Robert P. Slack, and Dean H. Smith

INTRODUCTION

Tribal members spend anywhere between 1 percent and 20 percent of their incomes on basic energy services (Energy Information Administration 2000). Depending on the type and sector (e.g., commercial, residential, etc.) of an energy efficiency (EE) project, successful implementation of the project can have a significant impact due to the potentially large percentage of income expended on energy. However, for these benefits to be realized, the EE project must be successfully implemented. Because EE measures vary from simple behavioral changes to complex technological applications, a proper understanding of how to implement an energy efficiency program and how to select appropriate EE measures is crucial to achieving successful implementation. Toward this end, it is important to understand the demographics and different market segments in order to focus efforts in areas that will create the greatest yield in energy cost savings and other benefits. Furthermore, if a tribe has not previously undertaken any energy efficiency projects, it is likely that there are ample opportunities to achieve substantial savings by implementing a variety of EE measures, including "low tech" projects. The purpose of this paper is to describe how to establish a successful energy efficiency program as well as suggest potential EE measures.

With the development of the Western Regional Air Partnership (WRAP) in 1997, tribal governments were recognized as full partners in the development of strategies to address the problem of regional haze in the West.[1] The WRAP formed the Air Pollution Prevention (AP2) forum in part, "to examine barriers to use of renewable energy and energy efficient technologies, identify actions to overcome such barriers, and recommend potential renewable energy and energy efficiency programs and policies that could result in a reduction of air emissions from energy reduction and energy end-use sectors in the Grand Canyon Visibility Transport Region." The regional haze rule (RHR), promulgated by the EPA in 1999 has provisions that apply to all states and tribes in the United States. One specific provision offers western states and tribes options for complying with RHR requirements. The requirements of the RHR are among the air-quality program elements that can be implemented by tribal governments. Energy-efficiency measures are specifically recognized in Section 309 of the RHR. Under the Clean Air Act, tribes eligible to implement Section 309 (GCVTC) plans are those located in the states of Arizona, California, Colorado, Idaho, Nevada, New Mexico, Oregon, Utah, and Wyoming. These tribes *may* seek approval from the EPA to implement the RHR through Tribal Implementation Plans (TIPs). The deadlines imposed on states do not apply to tribes, but tribes *may choose*, and are encouraged, to implement programs. Thus tribes may elect to develop a regional haze program pursuant to the RHR. For any tribal lands where the tribal government elects not to take on this responsibility, the EPA must assure air-quality protection. Regional haze program requirements on some tribal lands may therefore be implemented via Federal Implementation Plans (FIPs). Economic costs and benefits—both direct and indirect—are to be identified and described.

In order to aid tribes in developing TIPs, the AP2 completed two reports: "Recommendations Of The Air Pollution Prevention Forum To Increase The Generation Of Electricity From Renewable Resources On Native American Lands", and " Reducing Energy Consumption and Improving Air Quality through Energy Efficiency in Indian Country: Recommendations to Tribal Leaders from the Western Regional Air Partnership." This paper is derived from the latter report.

[1] For more details on the WRAP and the RHR see Acker et al. (2004a) or either of the AP2 reports listed in the reference list.

HOW TO IMPLEMENT AN ENERGY EFFICIENCY PROGRAM

With a more competitive electric power market and the advent of retail competition in half of the WRAP states, utility-operated energy-efficiency programs (called demand-side management programs) have largely disappeared. New structures for delivering energy are emerging that may create new opportunities for promoting energy efficiency. Many state utility commissions have instituted system benefit charges (SBCs) that become part of the bill paid by all electricity customers. Funds from an SBC are set aside for purposes such as energy-efficiency educational programs. Energy service companies (ESCOs) now exist that contract with customers to provide energy-related services. One typical service is identifying and implementing energy-efficiency measures for the customer. Often these services are set up with a performance contract where the ESCO receives payment out of the monthly energy savings.

Regardless of whether a tribe chooses to pursue energy efficiency using internal resources or contracting externally, it is important that the tribe has a person or office assigned with the responsibility of tribal energy issues. Acker *et al.* (2003) conducted a small sample survey of tribes in the WRAP region as part of the AP2 renewable energy project (Air Pollution Prevention Forum, 2002). Of the small sample, three-quarters of the tribes had no central energy office or personnel, yet three-quarters of the sample expressed an interest in developing renewable energy programs. (See Acker *et al.* 2003, page 350) A person in this position typically would have the title of Energy Manager.

The Energy Manager

Hiring a person or assigning to a person the duties of an energy manager is a key step in implementing EE programs. It is important that the responsibility for energy issues and EE be assumed by a single person or office within an organization, and that this person or office have support and commitment from the highest levels of the organization (Capehart et al. 1997). The task of the energy manager is to develop, implement, and maintain a plan focused on tribal energy use. This plan should include, but not be limited to the following: identify and track energy uses, recommend energy-efficiency programs and equipment, and conduct education and/or rebate programs. When implementing EE measures and programs it is generally best to begin by setting some goals, and then implement low-cost, highest-return projects first.

Designing an Energy Program

The energy manager will have the ability to create and manage efficiency and conservation plans through development of an *Action Plan*, especially if given the full support of the tribal leadership. To form a viable and dynamic Action Plan it is first important to understand the "initial community vision" as presented by the tribal leaders. Formation meetings can be held that include speakers who address the community's "hot topics," and to ensure that the end results of the Action Plan benefit the people. When an Action Plan is complete, the energy manager will continue to update and meet with the tribal leadership on the plan. As needs are identified, it is important to determine who in the community should be invited to participate in the implementation.

The Rebuild America Program

The Rebuild America Program run through the U.S. Department of Energy contains a wealth of material to assist in the process of creating and carrying-out an Action Plan (see http://www.rebuild.org/aboutus/pf.html). Borrowing from the website, the Action Plan should include, at a minimum, the following elements (see the Rebuild America Web site for more details):

1. Determine baseline data on energy consumption
    a. Be as specific as possible (on a building-to-building basis). The assessment can begin by identifying all meters that monitor electricity consumption and by tracking usage information. Typically usage information may be available from the tribal department that is responsible for paying the electricity bills (if any). As part of an initial assessment the number of electric meters should be compared to the number of meters for which the tribe is being billed. Although this task may seem unnecessary, it is common for entities to be billed for meters that have long-since been modified or removed.
    b. Tracking of utility information can be performed by putting the monthly billing information from each meter into a spreadsheet or database system or other computer software program. This will allow identification of which buildings (or other energy end-uses) are using the most energy. In

addition, collection of this monthly information will allow personnel to spot high-usage anomalies that may be indicative of problems.

c. When data are unavailable, determine a strategy for collecting detailed and accurate data. Information and software from the Rebuild America Program [are] available to tribes, free of charge, which facilitates utility tracking (http://www.rebuild.org/SolutionCenter/productservices.asp). This is a good starting point for tribes who are interested in beginning the process of understanding their usage patterns.

2. Decide which energy efficiency improvements are important
    a. Are there capital or operating and maintenance improvements that are needed in your buildings?
    b. Are there upgrades that will help your organization better meet its mission or its "political" priorities?
    c. How likely are those improvements to result in cost savings, better occupant safety, productivity, comfort, and cultural compatibility?
    d. What mix of improvements above will be the most compelling drivers and incentives for action?
    e. Perform an economic evaluation of proposed EE measures by calculating net present value using life-cycle costs (see Sec. IV and Appendix B for more information about this type of economic evaluation).

3. Understand the decision-making process:
    a. Understand the process the tribe follows to consider and approve capital improvements in buildings.
    b. Assess the availability of internal funding and technical expertise for the project(s) under consideration.
    c. Research any policy and/or statutory provisions that may affect your procurement of services, equipment, and financing.
    d. Identify and involve key persons who must approve policy, legal, operating, and financial decisions.

4. Determine your project development approach
    a. Examine what internal resources and external options are available to conduct the general improvements.
    b. Decide what mix of internal and external resources are needed to plan and implement the project(s).
    c. Determine and get approval for an initial project target, development approach, and team.
    d. Decide who must be included in regular communications as the project develops, and how communications will occur.

5. Develop an education program for all facets of energy use on the reservation with a particular emphasis on energy efficiency.

Another federal program that is specifically aimed at the rehabilitation of existing buildings is the Housing and Community Development Act of 1992. This program is designed to offer home ownership, property rehabilitation, and new construction opportunities for eligible tribes, Indian Housing Authorities and Native Americans seeking to own a home on their native lands. The Program is designed for fee simple land within the operating area of an Indian Housing Authority or Tribe, Tribal Trust land, or on individually allotted land on reservations. (http://www.hud.gov/offices/pih/ih/homeownership/184/index.cfm)

Once an EE program has been established within a tribe, or by a group of collaborating tribes, the next step to identify good candidate EE measures. The material to follow addresses the factors affecting which EE measures and policies might be most beneficial, as well as suggesting numerous measures and policies.

TRIBAL CHARACTERISTICS AFFECTING ENERGY EFFICIENCY

Some of the primary characteristics of a tribe that will influence the type of EE measures and programs that might be employed are as follows:

- Heating climate vs. cooling climate
- Rural vs. urban
- Large vs. small energy consumer
- Level of economic activity
- Political infrastructure related to energy and electricity (i.e., was there a tribal utility authority or similar organization that handles energy/electricity issues for the tribe?)
- Electrification of areas not previously served by electricity

Each of these characteristics is discussed in more detail below.

Energy use is greatly affected by climatic conditions. There are two basic climatic categories in energy – cooling climates and heating climates. A cooling climate is dominated by warm weather and the need for cooling indoor space, although a cooling climate may also have heating needs. Conversely, a heating climate is dominated by cold weather, which requires heating. Climatic conditions therefore dictate which energy-efficiency measures should be used. For example, installing shading structures on homes in a hot climate may be beneficial by limiting heat gain, but in a heating climate may limit beneficial heat gained during the winter months.

The urbanization of an area may also affect which measures are available and appropriate. In the WRAP region, tribes are located in highly urbanized areas as well as in remote rural areas. The availability of energy services, equipment, and supplies is generally more limited in a rural area. Tribes may need to consider whether an energy-efficiency measure can be supported with local resources, or if resources are needed that are not available in the local area, which would cost more. If a rural tribe is considering installing energy efficient equipment that will require maintenance that cannot be performed by tribal employees (e.g. an advanced cooling system on a commercial building), the cost and availability of service technicians needs to be factored into the decision about the equipment. At the same time, this lack of a technician provides an opportunity for a new local job.

The resources available to a tribe, and its magnitude of energy consumption, will also affect energy-efficiency choices. If the tribal facilities (residential, commercial, etc.) consume a relatively small amount energy (e.g., if there are not many energy consumers or the facilities require little energy for operation, etc.) then the tribe may benefit mostly from low-cost measures that are easy to implement. The tribe with a small energy use may not have the resources, the staff, or the need to consider the more complicated or costly programs. In this case it may be beneficial for a group of tribes to collaborate in establishing and energy program, or in hiring an energy manager. If the tribe has a large energy use, or substantial resources available within a sizable tribal government, staff members may already be available to dedicate to energy projects, or it may be possible to hire a dedicated energy manager.

The potential for energy efficiency is typically tied to the level of the tribe's economic activity because economically prosperous tribes generally use a greater amount of electricity and other energy sources than tribes with smaller amounts of economic activity. Similarly, tribes who have diverse business activities may have a wider range of energy-efficiency measures to choose from. If a tribe has commercial, industrial, and residential buildings as well as agriculture, the tribe will have more EE applications to consider than a tribe with only commercial buildings. Determining which is the the highest energy-use sector would be a logical first step in choosing the most effective EE measures.

Tribal structure also has an effect on the type and diversity of EE measures that could be implemented. If the tribe has an energy authority, then efficiency efforts can be led by that organization (which already has the responsibility for providing energy services). Having or establishing an energy authority can be the most effective method to improving energy usage because its mission is dedicated to energy issues. Such an authority would have information on energy use throughout the tribe and could implement efficiency measures in various sectors. A tribal energy manager could likewise collaborate with various departments within an energy authority or within the tribal government to implement appropriate energy-efficiency projects.

Another factor affecting choice of energy measures is previous energy activities. If a tribe has never undertaken any EE programs, it may have a greater variety of programs to choose from than a more experienced tribe. For those tribes with little experience it may be logical to start with projects that are easy to implement and that have a known demonstrated benefit, to gain experience and confidence. Tribes that have already implemented a variety of EE projects may be comfortable in trying complicated or highly technical projects that have a longer-term payback.

ENERGY SECTORS: ORGANIZATION OF ENERGY USES AND MEASURES

Energy end-uses are typically grouped by market sector: transportation, residential, commercial, and industrial. Data on energy use is typically reported in these broad categories. Within each of these sectors are subgroups that further define the energy-use market. For instance, it may be useful for tribes to subdivide the commercial sector into typical commercial applications (retail stores, office buildings, etc.), tribal and governmental buildings, and gaming and recreation. Depending on the tribe, an appropriate subcategory of the industrial sector to consider could be agriculture. Within each end-use sector, EE measures are frequently grouped by the type of measure, such as lighting, heating, cooling, or building envelope (insulation and windows), etc.

Next to residential, perhaps commercial buildings are the most common on tribal lands, including retail stores, office buildings, hospitals, warehouses, schools and government buildings. Because of the great diversity of uses for these buildings, their equipment and their building envelopes (the materials from which the building is constructed) can vary widely. For example, the amount of energy consumed and the equipment necessary to operate a grocery store will be substantially different than that of an office building, and will thus require different efficiency measures. Regardless of the specific purpose of a particular building, however, all commercial buildings will likely have energy expenditures associated with heating and cooling equipment, lighting fixtures, and the building envelope. Thus grouping buildings by sector, and EE measure by end-use (such as heating, cooling, etc.) may assist in choosing the most effective EE projects.

A subgroup of commercial buildings common on tribal lands is the tribal or other government buildings. In many cases government buildings represent a substantial portion of the total commercial building stock. Government buildings will have opportunities for efficiency in the heating and cooling equipment, air distribution system, boilers and chillers, windows, and lighting.

Another subset of commercial buildings that may be present on tribal lands is recreational and gaming facilities. These buildings will have the same type of efficiency opportunities as government buildings but magnified due to the high energy use common in most gaming facilities. For example there may be substantial "plug loads" from gaming machines as well as significant air handling loads that could be improved. Increasing the energy efficiency of these facilities holds the opportunity of increasing their profitability.

Residential buildings include single-family homes, apartment buildings, and any type of group housing facility. Tribes and tribal members expend substantial resources on housing, so investment in energy-efficiency measures for residences will have a positive impact on tribal members by lowering their energy costs. Residential opportunities include heating and cooling equipment, building envelopes (e.g. insulation, windows), air duct systems, and shading and landscaping. Residential programs typically start with education. Educational programs that inform residents about how energy is consumed in the household, how that relates to energy costs, and the related opportunities for energy savings through simple actions (such as simple behavioral changes like turning off the lights or equipment changes such as using compact fluorescent light bulbs instead of incandescent light bulbs), can be very beneficial.

In some parts of the WRAP region agriculture is an important energy end-use. For example, large amounts of electricity may be used for water pumping if irrigation is necessary. Substantial efficiency gains can be made in the motors that pump water, as well as in the irrigation systems themselves.[2]

Water and wastewater treatment facilities, fabrication plants, manufacturing facilities, lumber mills, and mining operations are examples of industrial applications. Energy-efficiency measures for the industrial sector include many of the measures applicable for commercial buildings but also some specific to large energy consuming boilers, motors, pumps, and fans.

FINANCIAL RESOURCES

The key to any project is to identify an available and reliable funding source. Although most energy-efficiency measures will result in cost savings over time, it can be difficult to come up with the initial money to pay for the project. Several methods can be used to identify or establish a funding source.

Revolving Fund for Energy Efficiency Project

There are energy-efficiency measures, identified throughout this report, that have a known payback. For example, replacing older fluorescent lighting with new energy-efficiency lighting typically has a payback period of

[2] See Acker et al. (2004b) for a case study concerning energy efficient irrigation on the Flathead Reservation in Montana.

2 to 3 years. This means that the entire cost of the retrofit will be recovered in reduced energy bills after 2 to 3 years, and the project will continue to offer savings for the lifetime of the equipment.

A revolving fund can be created that allows dollars saved from the implementation of energy measures to be earmarked for other energy-saving projects. This can be accomplished using a direct accounting method that monitors the utility bills on a year-to-year basis and allocates any savings to a separate energy-efficiency fund to be used for future projects. The advantage of this direct accounting method is that the tribe will spend no more on energy efficiency than it saves, after its initial investment. A disadvantage of the direct accounting method is the time and effort required to verify savings. Because utility bills normally fluctuate each year depending on the severity of the winter or summer, however, utility bills that would have been lower as a result of an energy-saving measure may not actually be lower if there has been a colder winter or hotter summer than the previous year. This would result in funds not being available for projects. Numerous publications provide methods of verifying energy savings; for example, see Hunn (1997), Turner (1997), and Bersbach (2001).

Alternatively, instead of using verified savings for EE projects, estimates of electricity savings could be allocated to the energy-efficiency fund. Because actual savings may vary from estimated savings, a tribe could choose to earmark a percentage of the estimated savings for the energy-efficiency fund. For example, consider an energy efficiency retrofit that results in savings of $5,000 per year after a 3-year payback. Each year after the initial payback period the tribe could allocate all $5,000 or a percentage of the $5,000 to the energy-efficiency fund for new projects. As more projects are implemented the savings amount would grow and so would the energy-efficiency fund. One benefit of this estimating method is that energy management planners would have a predictable amount of funds for future energy-efficiency projects.

One key to establishing a revolving fund using project savings is to identify and implement the energy-saving projects with the greatest savings and shortest payback first. A lighting retrofit is an example of a project with a short payback.[3] This will allow funds to build up for use later in the more expensive projects with a longer payback period. As mentioned above, lighting retrofits in buildings are one of the most cost-effective changes. In addition to providing substantial energy savings, it is a relatively simple retrofit that can be performed without highly trained staff.

Maintenance Budget

Any entity that is responsible for operating a building has a building operation and maintenance (O & M) budget. These budgets are used to make repairs, upgrade existing building systems, and maintain operation of the building. To create a revolving fund, a tribe could allocate a portion of their O & M budgets to energy-efficiency projects. Having such a revolving fund could pay for retrofits such as lighting but it could also be tapped to pay for the additional cost of energy-efficient equipment such as motors and heating and cooling system upgrades that result in saved energy.

Performance Contracting

Performance contracting is a comprehensive method of implementing energy-efficiency measures in buildings. In this method an energy service provider (commonly referred to an ESCO) is hired to handle all aspects of the retrofit, including financing. Typically a provider will evaluate energy measures, provide engineering, install the new equipment, and in some cases provide ongoing operations and maintenance service. Performance contractors use the cost savings resulting from the installation of energy-saving measures to pay for the cost of the improvements. Performance contracts typically provide for a comprehensive retrofit of buildings. This allows more expensive, longer payback measures to be blended with more cost-effective, shorter payback measures, to make the overall project financially viable. One caution when entering into a performance contract is to ensure that the energy savings are verified, and that the contractor is paid out of actual savings accrued.

An attractive feature of many performance contracts is the shared saving agreements between the provider and the building owner. Depending on the facility and the opportunity for EE upgrades, many performance contracts are written so that the building owners receive a portion of project savings. Performance contracts can also be advantageous because a third party typically completes all of the work and no tribal expertise in energy is required. Service providers can, in most cases, provide financing for the project so tribes do not have to come up with money for retrofits. This approach may be particularly attractive to smaller tribes.

Contracts can also be negotiated to provide guaranteed savings. However, performance contracts are complex documents that must be crafted carefully to ensure a benefit to the tribe, especially if a shared savings or

[3] See Acker *et al.* (2004b) for a case study concerning a lighting retrofit project on the Yurok Reservation in California.

savings guarantee is included. These types of arrangements also allow the tribe to begin implementing EE measures prior to developing its own in-house expertise.

Utility and State Rebate Programs

Rebates have been a common tool in the energy industry to encourage consumers to purchase energy-efficient products. As part of demand-side management programs, utilities offer rebates to residential and commercial business on a variety of products such as compact fluorescent light bulbs, high-SEER (SEER = seasonal energy efficiency rating) air conditioners, and efficient motors. Rebates provide cash incentives or credit on utility bills, and ultimately lower the cost of the goods being purchased. The past decade has seen a reduction in demand-side management programs offered by regulated utilities, as well as a reduction in the variety of rebates. However, in states with electricity supply problems, rebate programs may still be offered in an effort to decrease peak load.

Grant Programs

Grants are another possible source of funds for EE projects. A variety of federal, state, and private foundations offer funding. However, competition for grants can be strong and a substantial amount of time and effort is usually required to submit a grant application. Depending on the source of the funding, grants may be offered for project design, equipment, and installation. Usually a certain amount of matching funds are required for grants. It is also sometimes difficult to find funding for personnel costs that may be associated with the project.

NEW TECHNOLOGY

The U.S. economy is obsessed with and driven by technology. Advances in technology in the energy field have allowed us to continue to do more work with the same or smaller amounts of energy. New energy technologies and advances to save energy, or use energy more efficiently, are continually being made. Although it is important to keep abreast of new technology, it may be more effective for tribes to rely on products and equipment that have been widely used and offer proven performance.

The role of the energy manager is critical in the deployment of energy technology. Having a designated energy manager in the tribe, or as part of a consortium of tribes, or as part of an energy authority would allow one individual to become familiar with all tribal facilities. The energy manager could be provided with training so he/she would be capable of evaluating technology. That knowledge combined with a familiarity of tribal facilities would ensure a proper technological match.

An issue that arises with energy equipment is nameplate ratings versus actual operation. Energy-equipment products, such as motors, are tested and given an energy-efficiency rating (name plate rating). However, in actual operating conditions the equipment may not perform up to the rating. As is true with any product, it is wise to research product or system claims carefully. New energy technology offers great potential for use by tribes to conserve energy. However, energy managers should resist the temptation to invest in new, unproven technology when there are a myriad of products available with proven performance. For more information about new energy-saving products and a guide to EE technology, see the Federal Energy Management Program (FEMP) Web site at http://www.eren.doe.gov/femp/prodtech.html.

ENERGY SAVING PRODUCTS

Companies, entrepreneurs, and research laboratories are continually developing new energy-saving products. Frequently an energy manager is barraged with sales pitches to try a new energy-saving gadget. There are hundreds of legitimate energy-saving products on the market, so energy managers should be wary of products making extraordinary claims. Many energy-consuming products are provided with an EnergyStar rating by the federal EPA, which provides information about the energy use that can be useful in evaluating how well a product uses energy. For more details visit http://www.energystar.gov/default.shtml. The FEMP also has a considerable amount of information available about energy-efficient products (see http://www.eren.doe.gov/femp/procurement/).

Other good sources of information for energy products are state energy offices, which may be aware of both reputable and non-reputable products and product vendors. These offices have expertise in deploying energy conservation and efficiency programs and can offer technical advice. The National Association of State Energy Officials Web site gives a list of state energy office contacts (www.naseo.org/members/states.htm).

The federal government plays a large part in the development and deployment of new energy technologies. The national laboratories are tasked with researching and testing new energy products and systems, and federal agencies are used to deploy and test those products. One source of information to keep up-to-date on emerging

technologies is the Department of Energy's Office of Building Technology, State and Community Programs. This office provides information about efficient products and where to get them. The Emerging Technology Web site provides a review of products and sources for purchasing efficient products (http://www.eren.doe.gov/buildings/emergingtech/printable/index.html).

Energy Demonstrations

The Federal Energy Management Program (FEMP), an arm of the Department of Energy, is tasked with controlling energy usage in federal facilities. In addition to other functions, the FEMP operates the New Technology Demonstration Program. The demonstration program introduces and deploys new energy-efficient technologies in the federal sector. This program can assist tribes because they post information on demonstration projects and technology assessments; many technologies used for federal facilities are directly transferable to tribal facilities. For information on technology demonstrations go to www.eren.doe.gov/femp/prodtech/tech_d.html. For technology assessments go to Federal Technology Alerts (www.eren.doe.gov/femp/prodtech/fed_techalert.html).

Additional Sources of Technology Information

The American Council for an Energy Efficient Economy (ACEEE) produces a variety of reports that analyze energy efficiency and conservation technologies. The ACEEE is nationally recognized for its advocacy and research. It partners with various organizations to monitor emerging technologies in the building and industrial sectors. For a list of publications and their costs visit www.aceee.org.

The most comprehensive Web site for energy-efficiency information belongs to the Energy Efficiency and Renewable Energy Network (EREN). In addition to information on all of Department of Energy's energy-efficiency and renewable energy programs, the site provides links to 600 other energy sites. An extraordinary amount of information can be accessed using the search engine available on this site (www.eren.doe.gov).

ENERGY EFFICIENCY RESOURCES

Energy Efficiency Measures

Table 1 provides a list of specific energy-efficiency measures, divided into sectors to provide easy reference. This table is provided to give the reader a quick reference guide to the types of energy-efficiency measures available to tribes. Many excellent publications for evaluating EE measures can be purchased, including the *Energy Management Handbook* by Turner (1997), the *Energy Efficiency Manual* by Wulfinghoff (1999), *Fundamentals of Building Energy Dynamics* by Hunn (1996), and *Introduction to Energy Management* by Capehart et al. (1997). The Rebuild America Program Website (http://www.rebuild.org/index.asp) also contains suggestions of numerous good EE measures. For the energy manager who is choosing and implementing EE measures, these resources are valuable tools.

Table 1 – Energy efficiency measures categorized by sector, and rated for cost, maintenance, ease of implementation and energy savings potential.

Sector	Measure	Cost	Maintenance	Ease of Implementation	Energy saving potential
Residential					
	Lighting retrofit with compact fluorescent (CFL) bulbs	Low	Low	Easy	Low to Mod
	New Construction CFL Fixtures (Indoors & Outdoors)	Low	Low	Moderate	Low to Mod
	Heating and Cooling – New and Replacement Evaporative Cooling	Moderate	Moderate	Easy	High
	Heating and Cooling-Duct Testing and Sealing	Moderate	Low	Difficult	High
	Heating and Cooling Service and repair	Moderate	Moderate	Moderate	Moderate
	Purchase energy star equipment (clothes washers, etc.)	Low to Mod	Low	Easy	Moderate
	Purchase efficient equipment (high SEER CAC, heat pumps and AC window units)	Moderate	Low	Easy	Moderate
	Retire old refrigerators	Moderate	Low	Easy	Moderate
	Weatherization-style program	Low to High	Low	Difficult	High
	Shading and Landscaping	Low to Mod	Moderate	Moderate	Low
Commercial (including Government, Gaming, and Recreation)					
	Purchasing high efficiency gas boilers space heat	Moderate	Moderate	Easy	Moderate
	Gas boiler fuel switching	High	Moderate	Moderate	Low
	Install LED exit signs	Low	Low	Easy	Low
	Install LED traffic signals	Low	Low	Easy	Low
	Fluorescent lighting	Moderate	Low	Easy	High
	Heating and cooling, low cost measures	Low	Moderate	Moderate	Moderate
	Heating and cooling, high cost measures	High	Moderate	Moderate	Moderate
	Ground-source heat pump	High	Moderate	Difficult	High
	Gas air conditioning	High	High	Moderate	Moderate
	Building commissioning and retro-commissioning	Moderate	High	Difficult	High

Table 1 – Energy efficiency measures categorized by sector, and rated for cost, maintenance, ease of implementation and energy savings potential.

Sector	Measure	Cost	Maintenance	Ease of Implementation	Energy saving potential
Commercial (including Government, Gaming, and Recreation) – continued					
	Building load controls	Moderate	High	Moderate	High
	Building envelop enhancements	Moderate	Low	Moderate	Moderate
	Building training programs	Moderate	High	Difficult	High
	Efficient transformers	High	Low	Low	Low
	Cooling tower variable speed drives	Moderate	Moderate	Moderate	Moderate
	Water heating heat-pump unit	High	Moderate	Moderate	Moderate
Industrial					
	Fan systems measures	Moderate	Moderate	Moderate	Moderate
	Air compressor system measures	Moderate	Moderate	Moderate	Moderate
	Combined Heat and Power	High	High	Difficult	High
	Motor downsizing	Low	Low	Easy	Moderate
	Premium motors	Moderate	Moderate	Easy	Moderate
Policy					
	Tribal procurement policy	Low	Low	Moderate	High
	Green energy purchasing	Moderate	Low	Moderate	Low
	Energy education	Moderate	High	Moderate	High
	Rebate purchasing incentives	Moderate	Moderate	Moderate	Moderate
	Tribal mandates	Low	Low	Moderate	Moderate
	Tribal energy policy	Low	Low	Moderate	High
	Public benefits fund	Mod to High	Moderate	Difficult	Moderate
	Support federal mandates	Low	Moderate	Easy	Low
	Designate energy person	Mod to High	--	Moderate	High
	IECC or other building codes	Low	Moderate	Moderate	Moderate

Tribal Energy Authority

There are many significant benefits to establishing a tribal energy (utility) authority. It is an excellent center within a tribe in which to develop expertise about energy and energy efficiency, it is a central entity that can represent the energy needs of the tribe and negotiate lower energy rates on behalf of the tribe, it provides jobs for tribal members, and it can enhance tribal sovereignty and energy independence. Regardless of whether a tribe (or a collaborating group of tribes) forms an energy authority, establishing an energy manager position is crucial. Such a person can improve the tribe's overall energy situation, reduce the amount paid for energy, and implement EE programs. Whether assigning the duties of an energy manager to an existing staff member within the tribe or within an energy authority, or establishing a new position of energy manager, establishing such a position is a critical step in reaping the potential benefits of EE.

ENERGY EDUCATION PROGRAMS

Education can make the difference between an effective, successful, comprehensive energy management program and a fragmented program with little support. As described previously, there are numerous reasons to conduct energy-efficiency programs, not the least of which is to save money. Educating tribal members, leaders, facility managers, staff members, and contractors about the benefits of monitoring and conserving energy will build support for an energy program. Although many may think of energy efficiency and conservation programs as simply installing new or better technology, education is also a very effective method for conserving energy because it encourages people to change their behavior.

Train Tribal Staff and Employees

A trained staff is necessary to design, implement, and maintain energy-efficiency programs. Staff members can be contractors who are hired because of their knowledge, or tribal staff who have been provided with enough training to become knowledgeable about energy issues. The latter method builds capacity within the tribe; trained tribal members will set an example for others, with everyone helping to reduce reliance on outside resources. Tribal employees who are educated about turning off the lights and computer equipment will contribute to lower electricity bills because lighting is a substantial cost of operating a building. Employees can also be encouraged to find ways to conserve energy so they are able to contribute to the economic health of the tribe.

Educate Residents

Energy is consumed in all sectors of the economy, so education is important for the people who work in all sectors. Tribal energy personnel can work within each sector to provide an understanding of energy usage and the options for using energy more effectively, and therefore using less. Residential consumers use energy to heat and cool their homes, store and prepare food, wash clothes and dishes, light their residences, and run electrical equipment and home appliances. As mentioned previously, Tribal members typically spend between 1 percent and 20 percent of their incomes on basic energy services (Energy Information Administration 2000). These electricity customers would benefit from education programs about the cost and amount of energy consumed by the equipment in their homes. Residents can also be educated on the economic and environmental benefits of turning off lights, only running clothes dryer when they are full, and using more effective space conditioning (heating and cooling). In addition, residents can be informed about energy-efficient equipment (such as EnergyStar-rated products) so that they can make informed decisions when purchasing energy-consuming equipment. A primary benefit of conserving energy for residents is that spending less on utility bills will free financial resources for other needs.

Attend or Host Technical Training

Outreach efforts can also be undertaken to educate the commercial, agricultural, and industrial sectors about energy-saving opportunities. Education can be as simple as providing information on available training or sharing information on what has been learned from tribal projects. Or, if there is substantial opportunity for savings, the tribe may wish to offer its own training, which can be specialized. A number of professional organizations provide energy training. For example, the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) offers a variety of basic and advanced courses. Tribal personnel and staff from the various energy sectors can attend courses specific to their work areas, or if there is enough interest, the ASHRAE will provide on-site training. Training improves the skill of those attending and many times the cost of the training will be recovered in implemented energy-saving techniques that are learned in the training.

Educate the Children

Another facet of an education program is to include curricula on energy in the primary and secondary schools. As detailed in Ratliff and Smith (2002), creating an effective education program for students can provide benefits that are long lived. Students need the tools to make informed energy decisions throughout their lives. A wide variety of educational materials can be made available for teachers; to ensure a successful program, they should be provided with training on the use of such materials, and the materials should fit into the core classes.

The U.S. Department of Energy, in collaboration with many western states, offers a variety of educational programs as well as other energy-efficiency programs.

TRIBAL ENERGY POLICIES

Creating a comprehensive and effective tribal energy policy or plan is a significant undertaking that requires involvement of tribal officials, staff, and members. For tribes that have no established energy plan or policy, it may be beneficial to review the process and resulting policies developed by other tribes. A good example of an energy policy has been created by the Navajo Nation can be found at the following web site: http://www.navajonationenergypolicy.com/.

Elements of a tribal energy policy that a tribe may consider adopting are:

- Create a policy that calls for establishment of a tribal energy plan.
- Support energy efficiency within all sectors of tribal energy use.
- Adopt a tribal policy that requires adherence to an energy code, such as the IECC (formerly the Model Energy Code, now the International Energy Conservation Code), for all new buildings within the reservation boundaries.
- Incorporate energy efficiency into new tribal housing projects.
- Establish a policy recommending that life cycle cost methods be used in evaluating and selecting all new energy-related projects (either new construction or renovation).

CONCLUSIONS

The strongest recommendation stemming from the Air Pollution Prevention forum of the WRAP was for tribes to develop and implement energy plans. This paper has detailed specific implementation processes for energy plans. Table 1 itemizes energy efficiency measures categorized by sector, and rated for cost, maintenance, ease of implementation and energy savings potential. In two companion papers, Acker et al. (2004 a and b), the authors have explored a discussion of the benefits of any such plan and itemized a variety of components of any said plan and three specific energy efficiency programs on three reservations. In the first case, based on Jacobs (2000) and Smith (2000), the authors show how energy efficiency programs can lead to both costs savings and secondary benefits to tribes. In the latter case it was shown that efficiency projects are relatively easy to identify and in all cases proved to be cost efficient. In a forthcoming report the research team will be developing a energy plan ‘template” for tribes to customize for their individual use.

REFERENCES

Acker, Thomas L., Auberle, William M., Duque, Earl P.N., Jeffery, William D., LaRoche, David R., Masayesva, Virgil, And Smith, Dean Howard, "Implications of the Regional Haze Rule on Renewable and Wind Energy Development on Native American Lands in the West," *Wind Energy*, 2003; 6:347-354.

Acker, Thomas L., Auberle, William M., Eastwood, John D., LaRoche, David R., Ormond Amanda, Slack, Robert P. And Smith, Dean Howard, 2004a, "Recommendations for Reducing Energy Consumption and Improving Air Quality through Energy Efficiency in Indian Country" College of Business Administration Working Paper Series, Northern Arizona University. ref. 04-04.

Acker, Thomas L., Auberle, William M., Eastwood, John D., LaRoche, David R., Ormond Amanda, Slack, Robert P. And Smith, Dean Howard, 2004b, "Economic Analysis of Energy Efficiency Measures: Tribal Case Studies with The Confederated Salish and Kootenai Tribes of the Flathead Reservation, The Pascua Yaqui Tribe, and The Yurok Tribe," College of Business Administration Working Paper Series, Northern Arizona University. ref. 04-02.

Air Pollution Prevention Forum, "Recommendations Of The Air Pollution Prevention Forum To Increase The Generation Of Electricity From Renewable Resources On Native American Lands", 2002. www.wrapair.org

Air Pollution Prevention Forum, " Reducing Energy Consumption and Improving Air Quality through Energy Efficiency in Indian Country: Recommendations to Tribal Leaders from the Western Regional Air Partnership." 2003, www.wrapair.com

Bersbach, C. 2001, "Verification of Building Energy Savings due to Energy Efficiency Retrofits," Masters Project Final Report, Mechanical Engineering Department, Northern Arizona University, May 2001.

Capehart, B.L., Turner, W.C., and Kennedy, W.J. 1997. *Guide to Energy Management, 2nd ed.* Fairmont Press Inc., Lilburn, Georgia.

Energy Information Administration. 2000. Energy Consumption and Renewable Energy Development Potential on Indian Lands. Office of Coal, Nuclear, Electric and Alternate Fuels, U.S. Department of Energy. April 2000 (www.eia.doe.gov/cneaf/solar.renewables/page/pubs.html).

Hunn, B.D. 1996. *Fundamentals of Building Energy Dynamics.* MIT Press, Cambridge, Massachusetts.

Jacobs, J. 2000. *The Nature of Economies.* Modern Library, New York.

Ratliff, Nicholas, and Smith, Dean Howard, "Renewable Energy Electricity Generation In Arizona: What, Why And Maybe How." College of Business Administration Working Paper Series, Northern Arizona University. ref. 02-35

Smith, D. H. 2000. *Modern Tribal Development: Paths to Self-Sufficiency and Cultural Integrity in Indian Country.* Altamira Press, Walnut Creek, California.

Turner, W.C. 1997. *Energy Management Handbook, 3rd ed.* Fairmont Press, Inc., Lilburn, Georgia.

Wulfinghoff, D.R. 1999. *Energy Efficiency Manual.* Energy Institute Press, Wheaton, Maryland.