Yurok Tribe

Human Capacity Building in Energy Efficiency and Renewable Energy System Maintenance for the Yurok Tribe

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Final Report

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The Yurok Tribe themselves played key roles in carrying out the project. In performing our project tasks as consultant to the Tribe, we were assisted by:

- Dustin Jolley, Tribal Engineer
- Georgiana Myers, Energy Specialist
- Stephen Kullmann, Energy Technician
- Dewey Myers, Maintenance Department

We would also like to acknowledge the participants in the Yurok Energy Advisory Group, who are named individually in the report.

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Executive Summary

From July 2005 to July 2007, the Schatz Energy Research Center (SERC) assisted the Yurok Tribe in the implementation of a program designed to build the Tribe's own capacity to improve energy efficiency and maintain and repair renewable energy systems in Tribal homes on the Yurok Reservation. Funding for this effort was provided by the U.S. Department of Energy's Tribal Program under First Steps grant award #DE-FG36-05GO15166.

The program's centerpiece was a house-by-house needs assessment, in which Tribal staff visited and conducted energy audits at over fifty homes. The visits included assessment of household energy efficiency and condition of existing renewable energy systems. Staff also provided energy education to residents, evaluated potential sites for new household renewable energy systems, and performed minor repairs as needed on renewable energy systems.

The two Yurok Tribe staff members who performed the needs assessment were hired using funds from the DOE grant. These staff members, along with several interested Tribe members, were trained in the fundamentals of energy efficiency and renewable energy by SERC staff during a two-week intensive course, which included hands-on activities and site visits. SERC also provided quarterly training sessions and presentations on energy topics to permanent Yurok staff from various departments as well as the Tribal Council.

SERC convened two meetings of an ad hoc energy advisory group, one near the beginning and one at the end of the project period. Members of the advisory group included representatives of local utility companies, agencies providing weatherization services, non-profits serving local Tribes, an energy authority created by local governments, and other local Tribes with current DOE energy planning grants. These meetings allowed Yurok Tribe staff to network with local players in the energy field and begin to develop a strategy for the newly created Yurok Tribe Energy Program.

Outcomes from the field work and interactions with the advisory group helped SERC and the Tribe to identify energy-related needs in the community. Chief among these needs are:

- Reliable power for Tribal homes in off-grid areas and areas where the grid is unreliable, especially for elders with special health care needs.
- Improved energy efficiency. This would reduce disproportionately high household energy costs and allow off-grid homes to better live within the limitations of their distributed energy generation systems.
- A means of providing scheduled preventive maintenance and unscheduled repairs to household renewable energy systems.

The project also included an energy education and outreach campaign for the Tribal community at large. As part of this campaign, SERC developed a set of eight informational brochures on energy topics with content and design specifically targeted at the Yurok Tribe. These brochures were distributed to community members during the energy audits of Tribal households and have been made available in brochure racks at the two Tribal offices in Klamath and Weitchpec. SERC and Tribal staff also participated in two community

events, distributing literature on energy efficiency and utility programs, answering community members' energy-related questions, and distributing free energy-saving compact fluorescent light (CFL) bulbs donated by the local utilities. Program staff also visited three schools on the Reservation where they conducted energy education activities with the students and gave them literature and CFLs to take home to their families.

Simultaneously with this project, SERC also assisted the Tribe with a utility feasibility study under a separate DOE grant. SERC and Tribal staff also completed proposals to the Bureau of Indian Affairs and DOE, seeking additional funding to perform detailed feasibility studies on development of the Reservation's biomass, wind, and hydroelectric energy resources.

Recommendations

In the area of weatherization and home energy efficiency, our chief recommendation to the Tribe for existing homes is to partner with the two weatherization agencies serving the Yurok Reservation, the Redwood Community Action Agency and the Del Norte Senior Center, to make maximum use of these agencies' expertise and resources. In many cases, homes are in need of remedial repairs before effective weatherization can take place. The Tribe should work to coordinate with these agencies and increase the number of Tribal members served under the Weatherization Assistance Program (WAP). To improve the energy efficiency of new construction, our separate Utility Feasibility Study Final Report recommends adoption of a Tribal energy code.

Our recommendation for renewable energy development is that the Tribe focus its efforts on providing systems for off-grid homes not currently equipped with renewable energy systems, and on providing scheduled maintenance for systems already in place. Battery maintenance and vegetation management to keep photovoltaic modules from being shaded are key unmet maintenance needs.

The Tribe should also continue its energy education and outreach efforts and build on the work done under this project. The outreach efforts were well received by the community, but it will take a sustained effort to permanently effect people's energy habits. Chief goals are to get people to think more critically about their energy use habits, utilize more energy efficient products (such as compact fluorescent lamps), and better maintain their renewable energy systems. The Tribe can support these changes with a continued community outreach effort.

Energy program support is available from the local utilities, weatherization agencies, the Redwood Coast Energy Authority, the DOE Tribal Program, and possibly from charitable service organizations. The Tribe should continue to cultivate relationships with all these entities.

Perhaps most important is that implementation of all these recommendations depends on the Tribe identifying and supporting an "energy champion" from within the Tribal organization. This has been a key element of other successful Tribal energy programs, and it is critical to the success of the Yurok Tribe's energy program as well.

Project Overview

The Schatz Energy Research Center (SERC) assisted the Yurok Tribe in applying for the DOE Tribal Program's First Steps grant that funded this work. The Tribe then contracted with SERC to perform the following scope of work:

- Task 1: Conduct Staff Energy Training
- Task 2: Conduct Energy Efficiency and Renewable Energy Workshops
- Task 3: Perform Energy Efficiency and Renewable Energy Needs Assessment
- Task 4: Identify Energy Program and Funding Resources
- Task 5: Develop Energy Program Strategy
- Task 6: Conduct Community Energy Education Campaign
- Task 7: Monitor and Document Project Accomplishments

Staff energy training consisted of a set of four quarterly activities aimed at Tribal staff and/or the Tribal Council, designed to raise staff and council awareness of the new energy program and solicit input on energy program design from these stakeholders. The trainings also served to inform staff and council about specific activities the project team carried out and to increase staff's understanding of energy efficiency and renewable energy technologies.

Early in the project, SERC and Tribal staff collaborated to develop job descriptions for the energy specialist and energy technician positions funded by the project grant. SERC staff also helped with publicizing the job announcements and sat on the interview panels. Once these positions were filled, SERC proceeded with planning for the week-long workshops in energy efficiency and renewable energy. The workshops took place in late May and early June 2006 at the Klamath and Weitchpec Tribal offices.

Field work began shortly after completion of the trainings. The field work consisted of visiting homes and small Tribal facilities to assess the need for weatherization, the potential for making use of renewable energy, and the condition of existing renewable energy systems. Initially SERC staff accompanied and assisted the energy specialist and energy technician in the field. These two Yurok staff members quickly learned the skills they needed and continued the audit work on their own. They eventually audited 61 residences and facilities across the Reservation. Since the data for three homes were lost, there are 58 sites included in the audit database.

Meanwhile, SERC staff became aware of concerns on the Tribe's part about excessive energy costs at the Tribe's two main office facilities in Weitchpec and Klamath. SERC staff performed energy audits at these two facilities. Audit reports were provided to the Tribal Council, and SERC staff made a presentation to Council summarizing their findings. (These two large facility audits are not included in the 58 homes and other facilities in the audit database described above.)

Project staff worked to identify sources of funding and support for the Yurok Tribe energy program and to develop a long-term strategy for operating the program. In both of

these tasks, the ad hoc Yurok Energy Advisory Group was of invaluable help. This group was facilitated by Tribe and SERC staff and consisted of representatives from local utility companies, weatherization agencies, and other service providers. Representatives of other local Tribes (Smith River Rancheria, Hoopa Valley Tribe, and Big Lagoon Rancheria) also participated. This group met twice over the course of the project.

The project's education and outreach component included development of materials and participation in several events. SERC staff developed a set of eight brochures on energy topics designed with the Tribe's population in mind. Project staff also provided articles on energy topics for publication in the Tribe's newsletter. SERC and Tribe staff tabled at two community events on the Reservation to hand out literature and free compact fluorescent lights and discuss energy topics with interested Tribe members. Staff also visited three schools, where they used games and presentations to teach children about energy. The students were also given efficient lights and brochures to take home to their families.

Project documentation consisted of quarterly reports to the Tribe and to DOE, a final report and presentation to the Tribal Council (with the final report also submitted to DOE), and presentations at two annual DOE meetings in Colorado. Other documentation generated in the course of the project, such as data collection forms, project data, and educational materials, are included as appendices to this report.

Objectives

The long-term goals of the program were to increase the energy self-sufficiency of the Yurok Tribe and to create energy-related employment and economic development opportunities for Tribal members. More specifically, the project sought to develop sustainable programs operated by Tribal staff that will provide energy efficiency services and renewable energy system maintenance services to Tribal members on the Reservation.

Project objectives were:

- conduct Tribal staff energy awareness training,
- hold workshops in energy auditing and renewable energy system maintenance,
- perform needs assessment for building energy efficiency and renewable energy system maintenance,
- identify available energy programs and funding sources,
- hold multi-agency collaborative workshops to develop strategies for meeting identified energy needs on the Reservation, and
- conduct a Reservation-wide community energy education campaign.

The project team conducted all of the activities required to meet these objectives. All of the quantitative objectives set in the original proposal were met, with one exception. The project team set out to perform 100 energy assessments. In the end, only 61 assessments of homes and small Tribal facilities plus two energy audits of large Tribal facilities were performed. Of these, data for three homes were inadvertently lost, leaving 58 small sites in the project database.

There were several factors that contributed to our inability to complete the target number of audits in the allotted time. One is that the audits turned out to be more difficult and time consuming than was anticipated. Scheduling audits was difficult due to a lack of phone service in many remote parts of the Reservation. Access to some homes was also difficult. In many cases residents who had scheduled audits failed to be at home at the appointed time. The energy specialist was a Tribe member and upper Reservation resident, but she was unfamiliar with the homes and residents on the lower Reservation. The team's lack of personal connections in this area made it more difficult to recruit residents interested in having their homes audited. The summer season had appeared to be the ideal time to conduct our field season due to better weather and easier road travel. However, we learned that during summer many residents travel outside the area or are away from their homes for extended periods to participate in Tribal events such as dance ceremonies that can last for days.

We were successful in redirecting our resources from the residential energy audits to other constructive efforts. The decision to perform detailed energy audits at the Klamath and Weitchpec Tribal offices is one example. Tribal staff and Council had pointed out to SERC engineers that these facilities suffered from chronically high energy costs, so we decided to audit them although this was not part of the original project scope. The Tribe was glad to receive the information we provided on these facilities and have indicated they plan to implement some of the less costly recommendations.

Description of Activities Performed

Activities are described below, grouped according to the seven defined tasks in the project scope of work.

Conduct Staff Energy Training

Training of Tribe staff across different departments was identified as a key means to achieving the central objective of building the Yurok Tribe's human capacity to meet its energy needs. Several departments' functions are related to Tribal energy needs or opportunities. For example, the Yurok Indian Housing Authority builds and maintains housing across the Reservation. The Planning and Community Development Department conducts community development projects. The social services department administers the Low Income Home Energy Assistance Program (LIHEAP) for the Tribe. And Tribal departments and programs such as fisheries, forestry, and environmental are interested in the potential impacts of developing energy resources such as hydropower or biomass on the Reservation. It is thus in the Tribe's interest to provide energy training and information that reaches out to all these departments.

SERC provided four quarterly training events for Tribe staff and the Tribal Council over the project period. These events included:

- A presentation to Tribal staff on the energy program.
- An interactive session with Tribal staff representing multiple departments to solicit their input on the Tribe's energy-related needs.
- A presentation to the Tribal Council on the energy audits performed on the Klamath and Weitchpec Tribal offices and our findings and recommendations for reducing energy costs and making increased use of renewable energy at these sites.
- A final presentation to the Tribal Council on project outcomes and recommendations for an ongoing Yurok Energy Program (scheduled for August 2, 2007, after completion of this report).

On February 6, 2006 SERC presented the first staff training, in the form of a presentation to interested Tribal staff from all departments. The main purpose of the presentation was to raise staff's awareness that a Yurok energy program was under development. SERC staff discussed the Tribe's DOE grants and their goals and activities. We also reviewed the Tribe's past energy development activities and discussed reasons Yurok staff should care about energy issues. The remainder of the presentation was an introduction to energy efficiency and renewable energy technologies. Participant turnout was strong and represented several different departments.

On May 3, 2006 SERC conducted the second Tribal staff training/meeting. SERC gave a brief presentation that described the DOE-funded Tribal energy projects that are currently underway. The majority of the meeting involved a round table discussion. Discussion topics included: issues related to the field data collection effort, unmet Tribal energy needs, energy needs that can/should be met by the Tribe, and opportunities for collaboration with other local Tribes and other local energy service agencies. The

meeting included an interactive exercise where staff prioritized the Tribe's unmet energy needs. The top five unmet needs identified were: Tribal energy self-sufficiency, access to energy to maintain health and safety for elders and children, energy education for Tribal members, energy efficiency improvements for Tribal homes and businesses, and cleaner energy sources. A tally of the Tribal staff's energy program priorities is given in Appendix 11.

On December 13, 2006, SERC conducted the third training, in the form of an oral and slideshow presentation to the Yurok Tribal Council to present the findings of the energy audits that were done for the Tribe's main offices in Klamath and Weitchpec (see the section below on the energy needs assessment). The reports were well received. As far as we are aware, the Tribe has not to date implemented SERC's recommendations for these facilities. However, the Tribe did ask SERC for a summary of the no-cost/low-cost measures identified, suggesting they are considering implementation of these measures.

The final staff/council training event will be a presentation to the Tribal Council by SERC staff summarizing the work completed as part of this Human Capacity Building project and the separate Utility Feasibility Study. SERC staff plan to engage the Tribal Council in a discussion of next steps to take in developing the Tribal energy program. This event has been scheduled for August 2, 2007 following delivery of this final report to the Tribe. On the same day, SERC will also meet with staff from the Tribe's planning department to discuss the future of the Tribe's energy program.

Figure 1. Yurok Tribe staff and stakeholders participate in an energy meeting

Conduct Energy Efficiency and Renewable Energy Workshops

Another important training element of the project was to provide in-depth training to the dedicated Tribal staff who would help implement this project, as well as Tribal community members interested in learning about energy efficiency and renewable energy

as life skills or as a potential way to make a living. Past work with the Tribe had shown SERC staff there are a large number of Tribe members who have a high aptitude for and interest in these topics, in some cases despite little formal education.

In late May/early June 2006, SERC conducted a two-week training in energy efficiency and renewable energy system maintenance and repair. There were seven participants in the energy efficiency training and ten participants in the renewable energy training, including the Tribe's Energy Specialist and Energy Technician. All participants were awarded certificates upon completion of the trainings. The energy efficiency training took place at the Tribe's office in Klamath, CA, and the renewable energy training took place at the Tribe's Weitchpec office. Both trainings featured classroom presentations, classroom exercises, hands-on activities, and field visits. The workshops served to provide technical training for the Energy Specialist and Energy Technician, as well as offer career development and human capacity building opportunities for other Tribe members. Lists of training activities and course materials for both trainings are provided as an appendix. Completed student evaluation forms are also provided as an appendix. SERC provided a complete set of all training materials to the Tribe on a compact disk, including PowerPoint presentations, activity worksheets, and course handouts.

Energy Efficiency Training

The energy efficiency training covered the following topics:

- Energy basics, use, and cost
- Heat loss and building shell measures, windows and doors
- Space heating and cooling, water heating
- Moisture problems, indoor air quality, and ventilation
- Lighting and appliances
- Energy economics
- Energy audit techniques, NEAT software and forms
- Health and safety issues
- Energy education and outreach
- Site visits with hands-on energy audit exercises

Seven participants completed the five-day energy efficiency training. Each participant was given a copy of *Residential Energy* by John Krigger to use as a course textbook and to take home. After reviewing course objectives and learning about the background of the Tribal energy program, trainees explored the basics of energy technology, learning terminology, scientific principles of heat transfer, and important sources and uses of energy. Trainees learned to measure and calculate electric power and energy use with utility meters and handheld multimeters. Participants learned to evaluate a building's energy intensity (energy use per square foot, adjusted for local climate) and interpret utility bills.

In the next segment, trainees learned how buildings lose or gain heat and which measures are most effective for controlling or taking advantage of this heat transfer. The students learned to do basic heat transfer calculations and to understand R value, U value, heat gain coefficient, and other characteristics of building materials. In an on-site

demonstration at a Tribal home, students learned to use a blower door to measure building shell air leakage.

Looking at specific building components, the class learned about thermal performance of walls, roofs, foundations, windows and doors. Using samples of different insulation materials in a simulated wall cavity, they used a portable heater and a handheld infrared thermometer to measure differences in heat transfer. They performed a similar heat transfer experiment using ice, single and double glass window panes, and the IR thermometer.

Turning to heating and cooling equipment, the students compared different HVAC technologies and their energy use. They learned to read nameplate data and calculate energy use, efficiency, and operating costs. They compared water heating technologies and learned to insulate hot water tanks and pipes.

Because of the cool, humid climate of coastal northern California, special attention was given to indoor mold and moisture problems and how these are related to household energy use. Students learned the causes of moisture problems and strategies for controlling mold, moisture, and other indoor air quality problems.

The next segment was dedicated to lighting energy. Students compared incandescent, fluorescent, high intensity discharge and LED lighting technologies. They used light meters to measure light intensity at work surfaces and compared these values with recommended lighting levels. The course taught students to identify lighting types in the field and calculate the cost-effectiveness of replacing inefficient lights. This was followed by an overview of household appliances and their energy use. The students learned to interpret EnergyGuide labels on appliances and to evaluate the energy savings attained through choosing Energy Star products. Phantom loads were identified as an important component of electric costs, and strategies for reducing these phantom loads were reviewed.

Students learned techniques for performing professional residential energy audits, including client relations and the use of forms for tracking data and performing calculations. A special segment addressed health and safety issues, including household hazards such as carbon monoxide, lead containing paint, asbestos, and high voltage electricity. Trainees also learned how to protect their own safety while performing audits.

A segment on economics focused on estimating the implementation costs and expected savings associated with energy efficiency measures. Using these values, students were able to calculate payback times for the measures. They also looked at the NEAT (National Energy Audit) software and the forms used to collect data for use in NEAT.

Guest speakers from a local utility and a community action agency's weatherization program spoke with the students about their work and career opportunities in the energy field. One training segment was dedicated to the special energy issues associated with mobile and modular homes, which make up a large portion of housing stock on the Reservation. A large portion of the final day of energy efficiency training was dedicated to site visits and practice audits in Tribal homes. At the end students discussed how they could use their training to save energy in their own homes and completed course evaluations.

Figure 2. Training participants use a blower to measure house tightness

Renewable Energy Training

The renewable energy training covered the following topics:

- Electricity basics and safety
- Micro-hydro systems (system basics, resource assessment, system design and sizing, system operation and maintenance)
- Solar resource assessment, site selection, collector slope and orientation
- Solar hot water systems (system basics, system design and sizing, system operation and maintenance)
- Solar electric systems (system basics, system design and sizing, system operation and maintenance, system installation)

Nine participants completed the four day renewable energy training. All participants received copies of *"Stand-Alone Photovoltaic Systems – A Handbook of Recommended Design Practices"* and *"Maintenance and Operation of Stand-Alone Photovoltaic Systems,"* both published by Sandia National Laboratories. Additional handouts included selected articles from Home Power magazine.

The renewable energy training began with an introduction to electrical systems and electrical system safety. Students learned about the basic concepts of current, voltage, and resistance, as well as the difference between power and energy. They learned how to wire components in series and parallel, and how the voltage and current in these two wiring configurations will vary. Hands-on activities included instruction in the use of a digital multimeter and measurement of current, voltage, and resistance. Students also learned how to determine residential electrical loads.

The micro-hydro segment covered the basics of what a micro-hydro system is, including the major components and how they work. A Pelton Wheel was demonstrated and a

laboratory exercise was conducted to measure the static and dynamic head of a hydraulic system. A class design exercise included sizing and selection of a micro-hydro generator, head loss calculations and pipe sizing, and selection of system components, including controller, diversion load, and battery bank. The micro-hydro segment also included a fieldtrip to a local creek (Aiken's Creek). The class surveyed the stream's elevation profile to determine its static head and measured stream flow using the bucket and stop watch method. This information was then used to assess the stream's energy production potential.

Assessing the solar resource is a necessary task for the design of either a solar electric or a solar hot water system. In the solar resource segment, students learned how the solar resource is measured and obtained data on the amount of solar energy available on the Yurok Reservation. Students worked with a pyranometer and examined the effect of slope and orientation on the intensity of incident solar radiation. Students also learned how to assess a site for adequate solar access using a Solar Pathfinder tool.

The solar hot water system segment discussed types of solar hot water systems, how they work, and what their major components are, as well as system sizing, installation, and maintenance. Students got to examine various system components and were able to work with a differential controller to see how it controls pump operation based on fluid temperatures at various locations in a system. Students also participated in setting up a demonstration system that consisted of a solar hot water collector, solar electric powered pump, and storage tank. Students operated the system and monitored the temperature of the water entering and leaving the solar collector.

The solar electric system segment was allotted the most time in the training. Topics included system components and how they work, photovoltaic module performance, system sizing and design, component selection, system installation, and system maintenance. Students generated current-voltage curves for solar electric modules and learned how these curves change with varying environmental conditions. Students also learned how to work with basic electrician's tools, such as wire cutters, strippers, and crimpers. Students then employed these newly learned skills to assemble and operate a small solar electric system, including two solar electric modules, charge controller, inverter, battery, disconnects, and overcurrent protection. Students designed a stand-alone PV system for an example residence using the Sandi National Laboratories design methodology (as presented in *Stand-Alone Photovoltaic Systems – A Handbook of Recommended Design Practices*, Sandia National Laboratories).

The renewable energy training culminated with a site visit to an off-grid home on the Reservation that featured a hybrid solar electric and micro-hydro system. Students examined the system's components and monitored its operation. This included a hike from the turbine to the intake of the micro-hydro system to see how the system was laid out.

Figure 3. Trainees learn about solar hot water

Assist Tribe in Performing Energy Efficiency and Renewable Energy Needs Assessment

The central activity in the project was a series of energy audits conducted in homes on the reservation. The primary purpose of the field energy audits was to collect data to complete an energy needs assessment. Secondary goals were to look for immediate ways energy could be saved; make initial assessments on renewable energy potential and assess existing renewable energy systems; look for energy-related safety concerns; distribute compact fluorescent light bulbs and water heater insulating blankets where needed; make referrals to assistance agencies, and educate residents about saving energy and using energy related equipment safely.

Summary of Previous Energy Needs Assessments

As part of our efforts for this project SERC also reviewed two previous needs assessment studies that were conducted for the Tribe within the last 10 years. One of these was conducted by Humboldt Water Resources (HWR) in approximately 1998 and the other by Winzler & Kelly Consulting Engineers (W&K) in 2004. Each of these studies included a subset of the households assessed as part of this project.

As part of an EPA-funded Tribal water quality project, HWR conducted a service needs assessment of 148 Yurok Tribe households in approximately 1998. The great majority of the households surveyed (88%) are located on the Reservation. Approximately half of the survey participants live in the downriver (Klamath/Requa area) and half in the upriver (between Weitchpec and Wautec) areas. 24 of the individuals surveyed by HWR were also surveyed by SERC in 2006-2007. The HWR survey was broad in scope and covered water supply, wastewater, solid waste, communication, and transportation needs in addition to energy. Key energy findings were: 1) Those who didn't have grid electricity

were about evenly divided between those who did and did not want it. 2) Most people were not using solar power, but of those who were not, most wanted to have it. 3) Propane was by far the leading energy source for off-grid refrigerators, but electricity was greatly preferred for off-grid lighting.

W&K conducted an energy needs assessment of 75 off-grid Tribal households on the upriver section of the Reservation between October 2004 and January 2005. This survey was done in the context of a feasibility study on creating a self-supporting Tribal electric utility, and thus the emphasis was on estimating the expected electric loads in off-grid houses should they become connected to the utility grid. Fourteen of the homes surveyed by W&K were also surveyed by SERC in 2006-2007. In a report dated April 2005, W&K summarized the survey results. The report notes that:

- All but one of the respondents used propane to cook. Availability of grid electricity was not expected to change this preference much, since many people prefer to cook with propane, and there would not likely be any energy cost savings associated with switching to electric cooking.
- 77% of respondents used propane to power their refrigerator. This would be likely to change significantly with the arrival of grid power, as very few grid-connected households elsewhere use propane-powered refrigerators by choice.
- 55% of households used generator power to operate their clothes washer. This use of generator power would likely be displaced by grid power.
- Over 90% of households heated their water with propane. These households will likely continue to use propane for water heating if they are provided with grid power.
- Space heating was mostly done with woodstoves (80% of homes). Wood will probably continue to be the space heating fuel of choice, as it is available free or at low cost to many Tribal households.
- The authors of the study speculated that electricity consumption by small appliances and consumer electronics will increase significantly with grid availability.
- Total home fuel costs were reported to average $132.67 monthly. The authors anticipated this figure will be driven upward by lifestyle changes once grid power is available. However, they also noted that generator fuel costs, which are much higher on a per-kilowatt-hour basis than grid electricity, will go down for newly grid-connected households.

The W&K report does not consider the fact that, despite higher life cycle energy costs, electric appliances such as water heaters, stoves and clothes dryers are often installed instead of propane appliances for the following reasons:

- Electric appliances generally have lower purchase price and thus may be more attractive, particularly for low income households.
- Owners of renter-occupied housing often choose electric appliances due to lower purchase price, lower maintenance requirements, and the fact that the owner does not have to pay the energy costs.
- Electric appliances are sometimes preferred in special cases such as housing for elders due to reduced risk of fire or carbon monoxide poisoning.
- Electric appliances may be preferred by residents who wish to avoid the hassle of procuring propane or the intrusion of having it delivered.

Preparation for Field Audits

In order to perform this field work and assist with the other project tasks, two staff positions within the Tribe's planning department were funded using the DOE grant. The positions consisted of a full-time Energy Specialist funded for one year and a part-time Energy Technician funded for approximately half a year. The Schatz Energy Research Center (SERC) assisted the Tribe in the development of job descriptions and job announcements for the positions. SERC also assisted the Tribe in composing the interview questions used in hiring for these positions. SERC contacted local college and university career centers and used other means to publicize the positions. SERC staff also participated in the hiring panels that interviewed the applicants, though final decisions about hiring were up to the Tribe.

Georgiana Myers, a Yurok Tribe member, resident of the Yurok Reservation, and previously on Yurok Tribe staff in the enrollment department, was hired to fill the Energy Specialist position. Stephen Kullmann, a graduate student in International Development Technology at Humboldt State University, was hired to fill the Energy Technician position. In preparation for the upcoming field work, Georgiana and Stephen participated in the week-long energy efficiency and renewable energy trainings described above. Following the trainings, SERC staff worked with these two Yurok staff to plan and prepare for the field audits. This included the development of a list of required tools, securing/scheduling a vehicle for use in the field, developing data collection forms, developing an energy audit checklist, obtaining tools, creating file folders for data forms, obtaining a list of existing households with renewable energy systems, and beginning to schedule energy audits. Yurok staff also contacted local businesses and solicited donations of energy saving equipment, including compact fluorescent lamps, weather stripping, and water heater blankets. These items were then freely distributed to residents who participated in the audit program.

SERC staff created a set of energy audit forms to be used in the household energy assessments. The initial goal was to complete the necessary paperwork for a standard National Energy Audit Tool (NEAT) or Mobile Home Energy Audit (MHEA) assessment. In addition, data collection forms for the assessment of renewable energy systems were also developed. These forms were largely based on inspection worksheets found in *Maintenance and Operation of Stand-Alone Photovoltaic Systems* from Sandia National Laboratories. The initial set of data collection forms proved to be cumbersome and overly time-consuming to complete. It became clear that filling out the audit forms and completing the other tasks expected of the auditors would require spending several hours at each home. Given the long distances to and between the audit sites, this would have limited the team to completing just one or two audits per day.

So, after the first few audits, SERC staff and the field team consulted together and developed simpler, more streamlined versions of some of the forms. These revisions made the forms easier and more practical for the field team to use on the job, while still yielding important data about the homes. For a complete list of the forms used in the field, see the Products Developed section below. The forms themselves are included as an appendix.

Conducting the Field Audits

The energy audits were conducted by the Yurok Energy Specialist and Technician, joined occasionally in the field by the SERC engineers and/or the Yurok Tribal Engineer. Audits were completed in all areas of the Reservation and on both on and off-grid homes. The audit process was conducted as follows. The Energy Specialist would attempt to schedule as many audits as possible in close proximity before going into the field. Once at the homes, the auditors would introduce themselves, explain the purpose of the program, and ask the residents if they had any specific energy concerns. The auditors would then proceed to collect information, through direct observation, measurement, and questions. Field data forms were completed as fully as possible. If there was a renewable energy system, evaluations were made on its condition and simple maintenance tasks, such as adding water to the batteries or cleaning PV panels, were completed as needed. If there was no renewable energy system, an evaluation of the available solar resource was made using a Solar Pathfinder tool. If a creek was located near the home, it was evaluated for its micro-hydroelectric potential. When utility bills were available, the auditors examined them to determine if the resident might qualify for money saving programs such as California Alternate Rates for Energy (CARE), Medical Baseline Allowance, or other special rate schedules (such as residents with electric heating as the primary heat source). On-grid residents were also asked to sign a utility bill release form that would allow the Tribe to access that customer's past electric utility bill data for evaluation. Educational pamphlets about saving energy and using equipment safely (see the Community Energy Education Campaign section of this report) were distributed, along with free compact fluorescent lamps.

Once in the field, flexibility was key, as some residents were not home as scheduled or changed their mind about participating. There was great variety in the condition of the houses that were visited. The spectrum ranged from the very new with modern electrical service and appliances to those running on little or no electricity and jury-rigged systems. Some of the more remote houses were very difficult to get to on rough roads, and sometimes it was necessary to visit multiple times to find someone at home. Some people were naturally suspicious about having Tribal employees look around their houses, and care was taken to ask permission before going anywhere in private homes or property. On occasion, access to areas such as attics or crawl spaces was deemed unsafe or inaccessible and information had to be estimated or left uncollected. Some people appeared bothered by the audit and wanted it over as quickly as possible, while others welcomed the opportunity for a visit and kept the auditors chatting. Because of these and other variables, the amount of time required to complete an audit ranged anywhere from under an hour to a half day with travel time.

Figure 4. Energy Specialist Georgiana Myers interviews an elder about energy use

SERC staff provided ongoing support to the Tribe's field team (Georgiana and Stephen) as they performed house-by-house energy efficiency audits and renewable energy system assessments across the Reservation. SERC staff accompanied Georgiana and Stephen in the field on several occasions, providing technical assistance in auditing and assessing the homes. Assistance was particularly important for homes with renewable energy systems, as many of these systems required troubleshooting and minor repairs.

In addition to the residential energy audits, SERC and Tribe staff performed day-long energy efficiency audits of the Tribe's two main office buildings in Klamath and Weitchpec. SERC staff also organized an inspection visit to the site of a recently installed micro-hydroelectric project on the Yurok Reservation. The system serves the home of a Yurok elder who requires reliable, constant power for her medical oxygen generator. Yurok project staff participated in the visit, accompanied by Don Harris, owner of Harris Hydroelectric, the manufacturer of the turbine used in the system.

Figure 5. Energy Technician Stephen Kullmann evaluates shading on a solar-equipped rooftop overlooking the Klamath River

Field Audit Results

The team completed 58 of our initial goal of 100 audits. (Three additional audits were completed, but the data from these audits were accidentally lost in the field.) The reduction in the total number of audits completed was mainly due to the excessive time required to reach remote sites on the Reservation and the difficulty of successfully scheduling audits and/or finding people at home in locations where there was no telephone service. A map showing locations of the audits is included as an appendix.

The data for the audits were entered into an Excel database, which was provided separately to the Tribe. A tabulation of the data is included as an appendix to this report. See Table 1 for a brief summary of statistics about the homes audited.

Table 1. Summary Statistics for Energy Audits Completed

Total audits:	58
Total occupants:	155
Elders:	25
Children:	30
Disabled:	6
Renewable energy:	11
Utility power:	34
PG&E:	19
PP&L:	15
Off-grid:	24
Site built:	42
Modular/mobile:	16

Notes: 74% of the audits were performed in the upriver area. This summary table does not include the audits of the main Tribal offices in Klamath and Weitchpec.

Findings of interest from the energy efficiency assessments included:

- According to recommendations made to residents, 81% of those evaluated needed lighting repairs or upgrades, 50% needed better air sealing measures, 48% were in needed of additional insulation, and 38% needed water heater repair or replacement.
- Regarding recommendations for safety related issues, 76% of those evaluated needed installation or replacement of carbon monoxide detectors, 69% needed installation or replacement of smoke detectors, and 25% needed wiring upgrades.
- 67% of the homes use wood as their primary heating fuel. Wood use should not be discouraged, since it is the most affordable fuel on the Reservation. The air quality concerns that make wood stoves a concern in urban areas are not a major issue on the Yurok Reservation during the heating season.
- 78% of homes have no cooling system (14% have conventional air conditioning and 8% use evaporative coolers).
- 30% have windows that are loose or very loose fitting and 44% of homes have single pane windows, indicating a substantial need for higher performance windows.
- 20% needed water heater blankets (the team was able to supply and install blankets to several of these homes).
- only 18% of refrigerators are more than ten years old, meaning replacement is probably not yet cost-effective for most refrigerators.
- 65% of homes use incandescent bulbs as their primary light source, meaning there is ample opportunity to increase use of tube fluorescent and compact fluorescent lighting.
- There were 15 program referrals made as a result of the energy audits. This included referrals to the CARE, Balanced Payment Plan, Medical Baseline, Energy Partners, FERA, REACH, LIHEAP, and local weatherization assistance programs.

- Many of the off-grid homes were assessed for their readiness to be connected to the electric utility grid in the event that the electric grid is extended to their location. Of the homes assessed, many will need electrical system upgrades before they can be connected to the grid. Most off-grid homes do not have an existing weatherhead or meter socket. In addition, only half the homes assessed had a main breaker panel, and 66% were deemed to need moderate or serious work before they could be connected to the electric utility grid.

Important findings from the renewable energy assessments include:

- 88% of sites that do not presently have renewable energy systems have good potential for renewable energy. Solar is the most widely available resource, with some homes also having micro-hydro power potential.
- Most renewable energy system owners report that they are happy with their system. However, over half reported having some problems with their system during the past year, and 73% have had to replace a major component of their system since it was installed.
- It was common to find batteries in a low state of charge condition. The average solar electric system size was 670 watts, which is a relatively small system. It is likely that this small system size leads to batteries routinely being undercharged, which in turn lessens battery life. It is recommended that any newly installed systems be sized in the 1-2 kW range. These are typical system sizes for meeting the electrical demands of an off-grid home.
- Less than 10% of the off-grid renewable energy system users report that they equalize their batteries regularly.
- More than 30% of the systems assessed were in need of repairs. Some minor repairs were made on-site during the visits or as part of follow-up visits.
- 30% of the solar electric systems needed tree trimming to reduce array shading.
- None of the homes visited included a working solar hot water system.

Data on solar availability at home sites were collected at 35 residential and community properties using the Solar Pathfinder site analysis tool. At some locations, multiple sites were evaluated. In total, 58 Pathfinder measurements were taken at the 35 locations. Many of these sites have excellent solar potential. Energy program staff acquired Solar Pathfinder Assistant software for processing the data. Solar exposure at each site was estimated as a percentage of what the exposure would be if there were no shading at the site at any time of year from horizon to horizon. Values ranged from a minimum of 15% of this theoretical maximum to a maximum of 97%, with an average solar exposure of 78%. Using regional solar energy availability data built into the Pathfinder Assistant software, we were able to estimate average daily energy availability at these locations, based on an array oriented due south and tilted at latitude (40.8° above horizontal). The values ranged from 0.66 kWh per square meter per day to 4.36 kWh per square meter per day, with an average value of 3.48 kWh per square meter per day. The Pathfinder analyses also helped owners of existing solar systems to identify vegetation in need of pruning or other obstacles that could be relocated to reduce shading. In some cases, energy program staff were able to assist the resident in removing these shading sources. A summary of the Solar Pathfinder data is provided as an appendix.

Another task undertaken by the field team was making referrals or providing residents with assistance in signing up for needed energy-related services. For example, the team discovered that several homes on the Reservation that were equipped with electric heat for primary space heating were not taking advantage of a special utility rate option that would provide them with a larger baseline allotment, reducing their winter heating bills. The team advised the utility of this situation, and the identified households were shifted to the preferred rate option.

Through PG&E we acquired electric billing histories for all of the PG&E customers who consented to sign data release forms during our residential audits. These data, combined with data on off-grid electric use in Yurok households collected during an earlier project, gave us some sense of typical on- and off-grid electric use in Yurok Tribe homes. The off-grid homes were each equipped with a small solar electric system (720 DC watts in most cases) and a backup generator. During the months of June and July, the months for which the most complete data are available for these two data sets, average electric use per house in the grid-connected homes was 356 kWh per month. By comparison, electric use in the off-grid homes at the same time of year averaged just 95 kWh per month. Thus grid-connected households on the Reservation can be expected to consume several times as much electric power as similar off-grid homes. This fact has two important implications for the Tribe. First, off-grid household power systems do not need to be sized and designed to meet national average (i.e. 15-25 kWh per day) household electric consumption patterns in order to be considered adequate. Second, the Tribe needs to anticipate that off-grid households that become connected to the grid (or to village scale mini-grids where individual households do not need to maintain their own power systems) are likely to greatly increase their electric consumption.

In addition to the residential energy audits, SERC and Tribe staff performed energy efficiency audits of the Tribe's main office buildings in Klamath and Weitchpec. Numerous opportunities to save energy were identified, and preliminary estimates were made of the potential for generating solar electric power on both buildings using rooftop arrays. SERC staff prepared detailed reports on both audits and made a presentation to the Tribal Council in December 2006. Executive summaries from the two audit reports are included as appendices to this report. The energy efficiency measures identified at the Weitchpec office have potential to save $1,000 to $1,500 per year for a modest investment. A solar electric system at this facility would yield about $2,500 per year in electric cost savings but would cost nearly $100,000 (before rebates) to purchase and install. At the Klamath office, many of the savings opportunities identified are associated with the building envelope and heating and cooling equipment. Further analysis is required to quantify savings potential for these measures. The solar electric system proposed for this facility would achieve approximately $2,400 in annual electric cost savings. Installation cost would be approximately $198,000 (before rebates).

Assist Tribe in Identifying Energy Program and Funding Resources

The Yurok Tribe does not at this time have sufficient discretionary funds available to support a significant energy program. Funding or support from an external source will be necessary to operate the program in the near term.

Simultaneously with this project, SERC assisted the Yurok Tribe with a DOE-funded Utility Feasibility Study. Under that grant, SERC helped the Tribe to identify numerous potential sources of federal and private grant funding. See the Utility Feasibility Study final report for details. In order to avoid needless duplication of effort, the project team working on this Human Capacity Building project instead focused on identifying institutional and in-kind forms of support available locally.

The Tribe has had some success in soliciting support for its energy program from outside sources. The community action agencies providing weatherization services in the area (Redwood Community Action Agency and Del Norte Senior Center) provided significant support in implementing the project through participation in the energy advisory group meetings, telephone consultations, and assistance with the intensive energy training workshops. Local joint powers agency the Redwood Coast Energy Authority donated several dozen compact fluorescent lamps and water heater insulation blankets. Both of the utility companies that serve the Yurok Reservation have provided support for the Yurok Tribe Energy Program:

- PG&E donated several cases of compact fluorescent lamps (CFLs) for distribution to residents
- PP&L donated $500 cash, which was used to buy more CFLs and other energy saving materials for free distribution to households.
- Both utilities offered to provide the energy program staff with electric billing histories for customers willing to sign release forms provided by the utility.
- Representatives of both utilities participated in the meetings of the Tribal energy program's advisory group.

The Yurok Tribe currently makes use of the Low Income Home Energy Assistance Program (LIHEAP), using the funding to purchase firewood and/or provide utility bill payment assistance for eligible residents. In fiscal year 2006, the Tribe received $63,202 in LIHEAP assistance. Administrative rules for LIHEAP state that tribes may divert up to 15% of these funds for weatherization programs (or up to 25% under certain circumstances if a waiver is granted by the Department of Health and Human Services, which administers LIHEAP). See Section D (Policy Decisions) of the LIHEAP Tribal Manual at www.sustainable.doe.gov/Tribes/policy.doc for details.

One possibility for the Tribe to efficiently administer such a LIHEAP-funded weatherization program would be to use the allowable portion of LIHEAP funds to contract with one or both of the existing local low-income weatherization programs, operated by the Redwood Community Action Agency and the Del Norte Senior Center, to provide these weatherization services. While these agencies are already able to provide some weatherization services on the Reservation, the Tribe makes up a small portion of the population the community action agencies serve. Having a dedicated source of

funding for Yurok household weatherization would increase the level of service the agencies are able to provide to the Yurok community. Note that weatherization-related activities such as conservation education can also be supported with the LIHEAP weatherization funds, per the LIHEAP manual.

The REACH program is another possible source of funding administered by LIHEAP. REACH funds are only available to states or Tribes that receive LIHEAP funds. Unlike LIHEAP funds, which are awarded to all eligible Tribes based on Tribal population, the REACH program is competitive and gives out a very limited number of awards. In recent years, seven to fourteen Tribes per year received REACH grants, with most of the grants in the amount of $150,000. The application deadline for 2007 was June 1. Note that this program is undergoing significant changes this year. The program's focus is being shifted to "energy-related health and safety issues and "home energy vulnerability." The announcement for this year's funding notes that the size and number of grant awards is being reduced. Maximum grants for Tribes will be $50,000 (plus an additional $10,000 available for energy efficiency education). No more than four Tribes will be awarded grants. However, the announcement also states that preference will be given to Tribes that have not received REACH funding in the past three years. For more information on the LIHEAP and REACH programs, see www.sustainable.doe.gov.

Assist Tribe in Developing Energy Program Strategy

This Human Capacity Building project is one of two concurrent DOE-funded energy program development projects in which SERC has been assisting the Yurok Tribe. As part of the other project, a Tribal Utility Feasibility Study, SERC analyzed various opportunities, including the development of renewable energy resources on the Reservation, the creation of programs to install and maintain off-grid renewable energy systems for Tribal residences, and the development of a Tribal energy code. Meanwhile in this Human Capacity Building project, SERC worked to train Tribal staff and assist them in two key energy program tasks: the execution of an energy needs assessment study and the delivery of a community energy education program.

Rather than simply conduct energy training and needs assessment in a vacuum, the project team wanted to fit these efforts into a larger context and begin building a permanent Tribal energy program that would meet the Tribe's needs for years to come. An important means for achieving this was to look outside the Tribe for local expertise in energy technology, energy program management, and insights to the experiences other local Tribes with DOE energy planning grants were having with their energy program implementation. The creation of an energy advisory group was one key to this process.

On May 5, 2006, SERC assisted Tribal staff in hosting the first of two planned meetings of the Tribe's energy advisory group. This group is made up of representatives from other local Indian Tribes, local utilities, weatherization providers, and other organizations that provide energy services and related services in the region.

Participants and invitees included:

Meeting host:

- Yurok Tribe, represented by staff members Dustin Jolley, Georgiana Myers, Peggy O'Neill

Meeting facilitator:

- Schatz Energy Research Center, represented by Jim Zoellick and Richard Engel

Attendees:

- PG&E: Robert Cherry
- Redwood Coast Energy Authority: David Boyd
- Smith River Rancheria (recent DOE grant awardee): Dorothy Perry and Russ Crabtree
- Hoopa Valley Tribe (recent DOE grant awardee): Curtis Miller
- State of CA Community Services and Development: Jaime Hostler
- Northern California Indian Development Council: Anna House
- Strategic Energy Innovations: Morgan King
- Pacific Power: Becky Eberle (participating by phone)

Invited, unable to attend:

- Redwood Community Action Agency: Val Martinez
- Del Norte Senior Center: Eileen Silvy
- Sustainable Nations: PennElys Goodshield

Discussion topics included: issues related to the field data collection effort, unmet Tribal energy needs, energy needs that can/should be met by local Tribes, potential funding sources and available energy services, and opportunities for collaboration with other local Tribes and other local energy service agencies. A lot of good information was gathered and further opportunities for collaboration were discussed. Participants agreed to attend a follow-up meeting to assess progress and discuss further steps.

Figure 6. SERC's Jim Zoellick facilitates a Yurok Energy Advisory Group meeting

The second and final energy advisory group meeting took place on July 17, 2007. Participants at this meeting included:

- Dustin Jolley, Yurok Tribe Engineer
- Richard Engel and Jim Zoellick, SERC staff and meeting facilitators
- Val Martinez, Redwood Community Action Agency
- Eileen Silvey, Del Norte Senior Center
- Steve Baldy, Big Lagoon Rancheria
- Robert Cherry, Pacific Gas and Electric
- Becky Eberle, Pacific Power (participating by phone)
- Tallchief A. Comet, Humboldt State University
- Eric Johnson, United Indian Health Services

At this meeting, SERC staff gave a presentation of the project team's accomplishments over the life of the project. SERC staff also presented the service providers at the meeting (mainly utility and weatherization agency representatives) with a set of questions to explore how they might help the Yurok Tribe to further develop its energy program. Steve Baldy from Big Lagoon Rancheria, a neighbor of the Yurok Reservation, described some of the energy related work his Rancheria hopes to do, and the group discussed some resources he might pursue and how some of the lessons learned in the Yurok project

could apply to his much smaller organization. SERC also made a short presentation about funding for Tribal energy projects.

Val Martinez of Redwood Community Action Agency brought valuable participation to this meeting. She has worked in weatherization for decades and has recently been working under contract to the State of California to identify ways to increase weatherization services to Native Americans. She also is active in the weatherization professionals' organization Energy OutWest. Through her work with that group, she has found that out of some twelve Tribes that established their own weatherization programs using Tribe staffing and funding, only three were still running the last time she checked. She notes that contracting out the work to an established weatherization agency seems to be more successful in the long run.

The energy advisory group has been of value to this project, not only in terms of advice and information that came directly out of the meetings, but also personal contacts that we established and were able to call upon at various times over the course of the project. Some of the broad conclusions that came out of the advisory group meetings include:

- There are several local agencies and companies that stand ready to assist the Yurok Tribe with energy program development.
- This support may take the form of technical assistance or in-kind material donations. Any of these forms of support could potentially be counted as matching contributions when the Tribe pursues grant funding.
- There appears to be a consensus that the Tribe would benefit more from taking advantage of weatherization services offered by existing agencies (RCAA and Del Norte Senior Center) than by creating its own weatherization program.
- However, if the Tribe wishes to significantly increase the level of weatherization services currently being received by its members, the Tribe will need to identify a source of funds to support this.
- The utility companies generally find it simpler to make a cash or equipment donation directly to the Tribe to assist with a program such as distributing compact fluorescent lights, rather than setting up a special incentive or outreach program with this relatively small and isolated population.

Conduct Community Energy Education Campaign

Any successful energy program must include an education and outreach element. Simply providing weatherization services or renewable energy system maintenance without educating and empowering the people served will yield only short-term benefits. Energy education can produce benefits over many years by producing behavior changes such as more attention to the care of energy equipment or motivation to save energy and thus save money. An effective education campaign should include in-person contact with adults and children, as well as written materials that reach their audience through multiple channels. All of these elements were included in this energy education effort.

The project included an energy education and outreach campaign for the Tribal community at large. As part of this campaign, SERC developed a set of eight

informational brochures on energy topics with content and design specifically targeted at the Yurok Tribe. For a list of all the brochure topics, see Products Developed below.

SERC staff authored and desktop-published a set of eight tri-fold brochures on energy topics for distribution to Yurok households. In addition to being distributed during the home visits, these brochures have also been put on display in literature racks in the lobbies of the Tribe's main offices at Weitchpec and Klamath. Copies of these energy education brochures are included in Appendix 10 of this report.

Figure 7. Yurok energy brochures

Project staff also wrote articles on energy topics for each issue of the Tribe's newsletter during the project. Those articles are also included in the appendix. SERC staff provided editorial support to Tribal staff in preparing these articles on the Tribal Energy Program for publication in the Tribal newsletter. The Yurok Energy Team also prepared energy education advertisements for the Tribal newsletter.

The project team participated in two community events where we provided energy outreach and education to Tribe members. The first of these was Klamath Cleanup Day on April 21, 2007. Staff set up a table in the community room at the Tribe's Klamath office building. Participants in the river cleanup event were invited to a lunch at the community room. Staff interacted with participants throughout the lunch event, discussing energy topics, demonstrating energy saving technologies, distributing free energy-saving compact fluorescent lamps (CFLs), and handing out energy brochures. The second community event was the Spring Fling event put on by the Social Services Department. The energy team attended the June 9, 2007 Spring Fling event in Weitchpec where we distributed CFL's and energy brochures, discussed energy topics, and answered general questions about energy and energy services.

Figure 8. Tribal Engineer Dustin Jolley tabling at the Klamath Cleanup Day

SERC and the Tribe also included schoolchildren in their energy education efforts with three visits to schools on the Reservation:

- March 9, 2007: Weitchpec School in Weitchpec. 13 students in grades K-3.
- May 16, 2007: Margaret Keating School in Klamath. 24 students in grades 4-5.
- May 23, 2007: Jack Norton School in Wautec. 24 students in grades 4-8.

During these visits, the energy team played energy learning games with the students, explained why clean energy resources and saving energy are important, and provided packets for the students to take home to their families that included a letter introducing the Tribal energy program and its goals, energy brochures, and a free CFL. When weather permitted, a solar oven was set up to bake cinnamon rolls. Students participated with great enthusiasm in the energy learning activities at all the schools.

The Weitchpec School visit was timed to coincide with a visit by a representative from PG&E, the local electric utility, and their local solar contractor. PG&E had just announced that Weitchpec School was being awarded a free solar electric system under the utility's Solar Schools program.

Figure 9. SERC's Richard Engel teaches Weitchpec School children about solar energy and energy efficiency

Prepare Project Documentation

SERC filed quarterly progress reports with the Yurok Tribe throughout the life of this project. The Tribe in turn incorporated SERC's reports along with financial management reporting in their own quarterly reports to DOE.

Members of the Yurok Energy Team attended the Department of Energy Tribal Energy Program Reviews in October of 2005 and October of 2006. This was extremely helpful to the Energy team. We were able to meet representatives of other Tribes and learn about their energy program efforts. Individuals whom we connected with at the meeting have since followed up with the Tribe and with SERC, asking for information that will be used to strengthen other Tribes' energy programs.

Products Developed

Numerous products were developed and published in the course of the project. These products or summaries of these products are included as appendices to this report or have been provided separately to the Tribe, as appropriate. The products include:

- Brochures on energy topics for distribution to Tribe members. Eight brochures were produced. Selection of topics, information included, and graphics used in the brochures were all oriented specifically toward the Yurok audience. The brochures are included as an appendix. Means of distribution of the brochures included handing them out during home energy assessment visits, placing them on display in the lobbies of the two main Tribal offices, sending them to families as part of packets given out to students during school visits, and making them available when tabling at Tribal events. Brochure topics included:
    - Heating Your Home with Wood
    - Portable Generator Safety
    - Fast Facts About Insulating Your Home
    - Energy-Efficient Lighting for Your Home
    - Is Your Home Wasting Electricity…When You're Not Even There? (phantom loads)
    - Solar Electric System Maintenance: Tips for Getting the Most Out of Your Solar Electric System
    - Fast Facts About Weatherizing Your Home
    - Home Energy Checklist for Action
- Training materials used in the quarterly staff trainings and the two-week intensive training in energy efficiency and renewable energy. These materials included lesson plans, Powerpoint slide shows, worksheets, and training evaluation forms.
- Field energy assessment forms. The final set of forms used included:
    - An energy audit checklist that outlines the tasks to be completed at each site and forms to be filled out and allows the auditor to keep track of which of these tasks have been done
    - Forms for collecting the energy use information used in the NEAT/MHEA audits
    - An electric load inventory form, for use at off-grid homes with limited electric power capacity or at on-grid homes where the resident is concerned about high electric bills
    - An electrical inspection form to determine readiness of off-grid homes to be connected to utility power
    - A renewable energy site assessment form to note opportunities to use solar or microhydro power where these are not already in use
    - A renewable energy system assessment form to record the condition of existing systems and backup generators
    - A recommendations form to leave with the client that notes important opportunities for saving energy
    - A release form that grid-connected utility customers could sign, granting permission for SERC and the Tribe to obtain their electric billing histories from their utility company (separate forms for PG&E and PP&L)

- Database of homes audited. Information collected in the energy audits was transferred to a Microsoft Excel table, allowing for analysis and summarization of the data. The database includes over 300 data fields for each home visited, although not all fields are pertinent to each home.
- Solar site analysis charts for each site surveyed. At each site where a solar resource survey was conducted, one or more photos were taken of the Solar Pathfinder's shading pattern. These photographs were analyzed using the Solar Pathfinder Assistant software to quantify the available solar resource. A one-page report was generated for each photo using the Assistant software. A one-page summary table of all of the sites was also produced.
- Articles published in the Yurok Tribe's official newspaper, Yurok Today. The appendix to this report includes four articles written by project staff. Other short articles or announcements on energy topics that were published in the newspaper during the project period are also included to provide context.
- Presentation and reports to Yurok Tribal Council on the Tribal facility energy audits. Project staff delivered written reports on the audits of the Klamath and Weitchpec Tribal offices and made a presentation to the Council on the energy saving opportunities identified at these locations.
- DOE presentation. The project team made combined presentations on the Human Capacity Building and Tribal Utility Feasibility Study projects at the DOE's program review meetings in October 2005 and October 2006. The first of these presentations was made by Yurok Tribe project staff. At the second meeting, the presentation was made jointly by SERC staff and Tribal staff.
- Advisory group minutes. Project staff took notes and made audio recordings of the advisory group meetings. These were used to produce minutes on the meetings, which were distributed to the participants.
- School visit materials. Project staff developed materials specifically for the school visits, including a letter to the students' parents introducing the Yurok energy program, and an informative label for the energy saving CFLs that were sent to the parents.
- Quarterly and final reports. In addition to meeting DOE's reporting requirements, these reports serve as a lasting document for the Tribe of project accomplishments and can serve the Yurok and other Tribes in future energy program development.

Conclusions and Recommendations

Our conclusions and recommendations are provided according to the major work areas within this project.

Weatherization and Energy Efficiency

Our field work and the data we collected confirmed that there is a significant unmet need for residential weatherization and energy efficiency services on the Reservation. Some of the specific key needs include greater levels of insulation and building envelope air sealing, measures to improve thermal performance of windows, more efficient lighting, and measures to increase appliance efficiency. In many cases, the greatest energy savings would be achieved by replacing equipment such as water heaters or windows. However, given low household incomes and limited Tribal funding, this may not be practical in many cases. Significant energy savings can still be achieved through much less expensive measures, such as installing insulating blankets on older water heaters and applying clear insulating film to single-pane windows during the heating season.

Creating a permanent Tribal weatherization program from scratch would be a costly and time-consuming process. The experience of other Tribes and communities has shown that a more cost-effective approach is to enlist the help of an existing agency that provides weatherization services under the federally funded Weatherization Assistance Program (WAP). For the Yurok Tribe, this means coordinating with the Del Norte Senior Center (Del Norte County) and Redwood Community Action Agency (Humboldt County). These agencies already provide some level of services on the Reservation, but their services are typically arranged one-on-one with individual households. The Tribe may be able to arrange for a more coordinated Reservation-wide effort. Eileen Silvey of Del Norte Senior Center and Val Martinez of RCAA both indicated they are willing to work with the Tribe on this, but they will require some source of additional funding to do so on a large scale. Some of the Tribe's LIHEAP funds could potentially be diverted for this purpose, but these funds would not be adequate to fund a large weatherization program. In addition, the current LIHEAP funds are already being fully utilized, generally for firewood purchase and utility bill payment assistance. Diverting a portion of these funds would likely be a difficult decision because it would mean there would be fewer resources for current LIHEAP clients.

Another issue that needs to be resolved in working with the weatherization agencies is that they have found many homes on the Reservation are in need of remedial repairs, such as replacing damaged siding or fixing leaky roofs, before it makes sense to install insulation or replace windows. The homeowners, the Yurok Indian Housing Authority, or some Tribal department needs to make a commitment to address these problems before homes with such deficiencies can be weatherized. The weatherization agencies are interested in coordinating with the Tribe on this issue to make sure that remedial repairs are completed prior to the performance of weatherization work.

An alternative way of getting weatherization and prerequisite home repairs done is to enlist the help of a charitable non-profit community service group. An example of such a group is the Sierra Service Project, a church-affiliated organization that worked on the Reservation during summer 2006 providing minor home repairs.

Renewable Energy Systems

Our assessments found that most of the households where renewable energy is not yet being used have significant renewable energy potential – mostly in the form of solar energy and to a lesser extent with micro-hydro power. We were surprised to learn how little solar hot water is being used on the Reservation, since this is a proven technology that is usually one of the more cost-effective ways to use renewable energy.

We recommend the Tribe pursue opportunities to increase household-scale use of on-site renewable energy. (See the Utility Feasibility Study for detailed recommendations on the development of a program to provide renewable energy systems to off-grid households.) The focus should be on homes that do not have access to grid electricity, as these are the households that will benefit most from renewable power. There are an estimated 15 to 25 homes on the Reservation that do not have renewable energy systems *and* are not grid-connected. These households currently rely entirely on generators for their electricity, or they do not have electric power at all. Where the resource is available, we recommend the development of micro-hydroelectric systems or hybrid solar electric and micro-hydroelectric systems because micro-hydro power will typically be more cost effective. If a micro-hydro resource is not available, solar electric systems can be a suitable choice. Renewable energy systems for grid-connected homes may be desirable in the long term but should be given lower priority for now.

The Tribe does not currently have a designated source of funds to continue installing off-grid power systems at the Tribe's expense. However, the Tribe does have access to wholesale pricing for renewable energy equipment through its dealer license with AEE Solar based in Redway, CA. The dealer license (customer #22047) was established by the Tribal Engineer in 2006. This could be used to make bulk equipment purchases and resell the equipment to Tribe members at prices well below retail (typical cost savings between wholesale and retail prices will amount to about 30%). The Tribe should survey its membership to determine level of interest and willingness to pay for participation in a bulk purchase program.

For homes that already have renewable power systems, the main need identified is for regular and proper maintenance. We recommend the Tribe establish a renewable energy system maintenance program and fund it through user fees, supplemented by funds from other sources according to need and availability. The Utility Feasibility Study final report includes an analysis of maintenance program costs, as well as a proposed fee schedule. A list of recommended maintenance tasks is also provided.

A lack of adequate battery charging is probably the most serious maintenance issue facing off-grid solar electric systems. Systems are particularly susceptible in the wintertime when the solar resource is at a minimum and household electrical loads are at

their peak. Many of the solar electric systems that were assessed during the energy audits exhibited low battery states of charge. Techniques to help maintain battery states of charge include: providing an adequately sized solar electric array, managing household electrical loads in order to remain within a prescribed energy budget, and running a backup generator as needed.

Providing an automatic generator start feature can also help maintain battery charge. With this feature the generator will automatically turn on when the battery voltage (and state of charge) drops below a predetermined level. Alternatively, residents can be relied upon to manually run their generators when needed, but this requires training to educate the resident about proper battery care. Unfortunately, even with proper training there are still numerous disincentives to providing adequate battery charging. These include the cost of generator fuel, the noise of the generator, and the inconvenience of running a generator. Typically residents will prefer to run their generators as little as possible. We did find that most households with battery storage are trying to take care of their batteries by maintaining the electrolyte levels. However, very few households perform equalization charges regularly. Equalization is critical to extending battery life.

Minor repairs (such as to wiring), component replacement as needed, tree trimming around solar arrays, and waterway maintenance for micro-hydro systems are some other maintenance needs that were identified in the field. Some of these tasks can be (and are) performed by the householders themselves, but in the case of elderly or disabled residents, this may not be possible.

Community Education and Outreach

The educational materials and activities that were developed for schools and the community as part of this program were well-received. The Tribe should continue to reach out to the community to build expertise and human capacity in the energy field among the Yurok people. At a minimum, the Tribe should continue printing and distributing the energy brochures developed under this program. The Tribe's designated energy champion should continue to write and publish relevant articles on energy topics for the Yurok newsletter.

The Tribe should also continue efforts to make compact fluorescent lamps readily available to the Tribal community. These lamps offer substantial energy savings, and they were well received when we distributed them during the public outreach events. The Tribe might be able to obtain more lamps from the local utility companies, or they could purchase lamps in bulk, thereby reducing their purchase cost. The lamps could then be offered to Tribal members at community events and through displays at the Tribal offices.

Students in Jack Norton, Weitchpec, and Margaret Keating Schools were eager to learn about energy and asked us when we could return to explore the topic with them some more. We encourage the Tribe to find ways to keep cultivating these young minds so they have the skills and enthusiasm to help the Tribe achieve energy sustainability when they reach adulthood. The Weitchpec School is scheduled to receive the installation of a new

solar electric system through PG&E's Solar Schools program, and this will offer another prime energy education opportunity. In addition, there are numerous energy education resources available for teachers (see Appendix 12 for a brief listing of resources).

We also were impressed with the level of interest and aptitude we found among the adult participants in our two weeks of intensive training in energy efficiency and renewable energy. We suggest the Tribe offer such trainings again and encourage all community members to participate. If this is not feasible, an alternative would be for the Tribe to publicize energy trainings offered by other groups such as PG&E and the Redwood Coast Energy Authority. Many of these trainings are low-cost or free, and occasionally they are offered in nearby locations such as Eureka, California. One example of this type of opportunity is that Tribal maintenance staff are currently enrolled in a Building Operator Certification course in Eureka, where they are reportedly doing well and learning valuable skills. Tribe members or entry-level staff who participate in such trainings could pick up skills that might qualify them to become professional staff for the Tribe's energy program as it develops and expands.

Staff Education and Capacity Building

The staff training component of the project turned out to be a two-way learning opportunity. While SERC staff were raising awareness of energy issues among Tribal staff, the Tribal staff in turn taught us a lot about how the Tribal organization works and what has already been achieved. If the Tribe implements our recommendation (from the Utility Feasibility Study) to incorporate energy services into the Public Utility District, staff education could include training new or existing personnel to carry out the job roles described in the Utility Feasibility Study. Other Tribal departments or agencies that would benefit from more energy training include the Yurok Indian Housing Authority and the Social Services department.

As discussed above, the Housing Authority can support energy services by coordinating with weatherization agencies to perform home repairs that need to take place prior to weatherization. Social Services can also help deliver energy services by identifying households needing weatherization services and assisting them with intake paperwork, income qualification, etc. Both of these Tribal organizations may need or desire some staff training in order to perform these roles well. The Department of Energy's Tribal Program office occasionally announces training opportunities that could be of value to Tribal personnel. Some of these trainings are free or low cost, though out-of-state travel may be required.

In addition, we recommend that the Yurok Indian Housing Authority and the Social Services Department set up a joint meeting with the Redwood Community Action Agency and the Del Norte Senior Center to discuss their weatherization assistance programs. These Tribal departments should fully understand what services are offered and what eligibility criteria must be met. In addition, the local weatherization assistance providers are interested in coordinating with the Tribal departments to better serve the Tribal community.

Continuing Funding and Programmatic Support

Through this project and our work on the Tribe's Utility Feasibility Study, we have identified numerous ways the Yurok Tribe may be able to acquire funding or in-kind resources to achieve its energy goals. This report provides information on programmatic and in-kind forms of support available to the Tribe. Programmatic support opportunities include the LIHEAP and REACH programs. In-kind support includes donations of energy efficiency products from utilities and other local agencies. See the Utility Feasibility Study final report for information on grants, loans, and other forms of cash funding the Tribe may be able to acquire. For programmatic support, we recommend the Tribe continue to cultivate its relationships with the local utility companies (Pacific Power and PG&E), the local weatherization providers (Del Norte Senior Center and Redwood Community Action Agency), the Redwood Coast Energy Authority, service organizations such as the Sierra Service Project, and the Department of Energy's Tribal Program.

We understand that implementation of our recommendations will require a commitment of human resources the Tribe may not be able to spare at this time. We at SERC are eager to help the Tribe continue developing its energy program. We are willing at any time to negotiate a new contract to continue providing energy support services to the Tribe and would be honored to continue this fruitful working relationship.

Lessons Learned

Energy Assessments

We consider the energy audits to have been a success in qualitative terms, though we fell short of our quantitative goal to assess 100 homes. Scheduling audits was difficult given the remoteness of most of the homes and the lack of telephone service in many parts of the Reservation. Even when audits were scheduled, residents were sometimes not home at the appointed time or changed their minds and decided not to participate. A future weatherization or renewable energy maintenance program will need to take this into account. Service personnel may need to deliberately "overbook" themselves in order to maintain a full work schedule and ask clients to be flexible about appointment times.

Our initial plan for information collection was overly ambitious and not sufficiently focused. We set out to collect enough information to complete the NEAT audit form, providing our field team with many pages of forms to complete at each home. It soon became clear that this was not working well, as some of the forms were left blank or only partially completed. We reassessed our data needs and decided that we should attempt only to answer a small number of key questions. We developed our focused questions (e.g. Are batteries on renewable energy systems being adequately maintained? Would attics benefit from additional insulation?) and redesigned the data forms to address these questions. As a result, our forms came back from the field more completely and carefully filled out.

Another impetus to simplify the data forms was feedback we heard that many Yurok Reservation residents feel "surveyed to death." Many residents questioned the purpose of this program and what type of result and benefit they would see from it. We learned that two surveys had been conducted on the Reservation in recent years that had asked questions similar to some we were asking. Survey participants found it difficult to connect the previous studies with any tangible results. In the future we recommend working with Tribal staff (and perhaps informally interviewing a few residents) to learn what surveys have been conducted recently and seeking out those surveys and their results before launching a full-blown field survey. Anticipating residents' concerns and questions about the survey and being prepared with honest and direct responses is important.

Information gleaned from field assessments should be made available not only to the Tribal government and sponsoring agencies, but also to the Tribal population at large. Published data should be presented in a context that protects individual participants' confidentiality but allows Tribe members to see that the aggregate information. Most importantly, the Tribe should make it clear to its members that the funding they've secured for energy development projects, like the electrical grid extension project, is made possible by the Tribe's ability to demonstrate need. The necessary information for a needs assessment comes from the survey data they've collected from Tribal households. Perhaps this will demonstrate to Tribal members the value of surveys and assure them that they are not wasting their time opening up their homes to the auditors.

It is also important to check incoming data frequently during the survey period to make sure data are being collected and recorded in a complete and consistent manner. Different field staff members may place greater emphasis on different parts of the survey, resulting in significant data gaps. Work with field staff to make sure they understand which data are most critical and strive for completeness.

Training and Education

The staff training events went well overall, but we would have liked to have seen more participation, both in terms of number of attendees and variety of Tribal departments represented. For future staff training events, the Tribe may wish to make participation obligatory for key staff or require that each department send at least one or two representatives. We recognize that many staff are overworked and do not have extra time for optional training events. The Tribe should try to keep the training events as short as possible while still achieving the training objectives. Training sessions should also be publicized well ahead of time to allow interested participants to set aside time on their schedules.

One of the more enlightening training activities for the energy program team was the "green dots" exercise used during the second staff training. Several of the participating staff were also Tribe members. We provided a list of potential energy priorities for the Tribe and asked staff to rank these priorities according to their own sense of which were the most and least important. Each priority was posted on a separate sheet of paper and posted on a bulletin board. Staff were given sets of green dot stickers to indicate their priorities. The highest identified priorities were:

- Tribal Energy Self Sufficiency
- Energy education for Tribal members (energy consumers)
- Energy efficiency improvements for Tribal homes & businesses

The lowest identified priorities were:

- Assistance with paying energy bills
- Power generation on Reservation to sell to utilities as revenue source for the Tribe
- Assistance with getting new renewable energy systems for Tribal homes & businesses

A complete listing of priorities and their rankings is provided as an appendix.

Schools outreach went well but could be broadened. During this project we only reached the three primary schools on the Reservation. Future schools outreach could include the older students enrolled in the charter school on the Reservation, as well as after-school or vacation activities for students of all ages who live on the Reservation.

The two weeks of intensive training for the temporary energy program staff and community members was also a success. The student evaluations show that the trainees enjoyed the courses and planned to implement what they learned to help themselves and their families save energy and use renewable energy. Some trainees expressed a desire for additional training that would help them qualify for specific jobs in the energy field. To respond to this need, the Tribe may wish to explore ways to make future trainings more

vocationally oriented. In addition, the Tribe's TERO office could add an energy section to their job skills bank. Tribe members with energy related skills could then be selected to participate in energy development projects on the Reservation.

Staffing, Continuity, and the Need for an Energy Champion

In staffing the energy program, it is critical to identify candidates with the expertise they will need in the field, or at least a willingness to learn these skills. Attitude is also a must: the Tribe should seek employees who are personally dedicated to the program's goals and objectives. The persons who do the hiring need to clearly understand the hiring process and enter it with a clear, shared understanding of what the minimum qualifications for the position(s) should be and the relative importance of filling a position with a Tribe member vs. identifying the person most qualified to carry out the responsibilities assigned. Of course the ideal candidate would meet both these criteria, but at times the hiring team may have to make a difficult choice between these potentially conflicting priorities.

We made the following point in our previous report to the Tribe on the Utility Feasibility Study, but we feel it is important and bears repeating. The Tribe is currently undergoing a transition with the conclusion of its two contracts with SERC and the departure of Tribal Engineer Dustin Jolley, who has provided enthusiastic support for development of the Tribal energy program. With these changes comes the threat of a loss of continuity in the Tribe's energy activities. This would repeat a pattern that has happened before, as evidenced by the numerous studies and surveys that have been conducted by various consultants and agencies over the years, unfortunately with little to show for them in terms of implemented projects. This problem is not unique to the Yurok Tribe, as most local governments tend to make energy planning a low priority except when faced with a crisis.

We recommend the Tribe designate a willing staff member to act as energy champion. This person could be the Tribal engineer or someone in another permanent staff position. A technical background in energy is helpful, but it is at least as important that the energy champion bring to the task enthusiasm and willingness to learn. This person should have access to all the Tribe's energy documentation, which should be organized and kept in a single secure location. The Tribe should provide this person with adequate work time and other resources to implement at least some of the preceding recommendations. If the Tribe pursues a working relationship with RCAA or Del Norte Senior Center to implement more weatherization work, the energy champion should act as liaison with these agencies.

Bibliography

Note: for a more extensive bibliography on the Yurok Tribe's energy activities and related background information, see the Tribal Utility Feasibility Study Final Report *(June 2007).*

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Yurok Tribe Strategic Energy Plan. Facilitated by the Council of Energy Resource Tribes. December 17-19, 2003.

Appendices

1. Activity lists, course materials, and schedules for intensive energy efficiency and renewable energy training courses
2. Student evaluations from intensive energy trainings
3. Data collection forms used in the field
4. Executive summaries from audit reports on Klamath and Weitchpec offices (full reports were provided to the Tribe separately)
5. Map of audit locations
6. Tabulation of data from field energy assessments
7. Summary data on Solar Pathfinder reports
8. Presentations, agendas and associated materials from staff and Tribal Council trainings
9. Articles about the Yurok energy program from the Yurok newspaper and SERC newsletter
10. Yurok energy brochures
11. Tally of Tribal staff energy program priorities
12. Energy education resources for teachers

Appendix 1: Activity lists, course materials, and schedules for intensive energy efficiency and renewable energy training courses

Energy Auditor Training Schedule

Hour	Monday 5/22	Tuesday 5/23	Wednesday 5/24	Thursday 5/25	Friday 5/26
9:00-10:25	Intros, Energy and electricity basics	Windows and doors	Lighting	Field trip: walk through site-built home	Energy professionals talk about their work and local energy programs
10:25-10:35	BREAK	BREAK	BREAK	BREAK	BREAK
10:35-12:00	Buildings and energy use, energy costs, metering, billing	Space heating and space cooling	Appliances	Energy economics: savings, cost and payback	Mobile and manufactured homes
12:00-12:30	LUNCH (BYO)	LUNCH (BYO)	LUNCH (BYO)	LUNCH (BYO)	LUNCH (Provided)
12:30-1:55	Heat loss and building shell measures (Part I)	Water heating	Energy audit techniques	NEAT software and forms	Field trip: walk through mobile home
1:55-2:05	BREAK	BREAK	BREAK	BREAK	BREAK
2:05-3:30	Heat loss and building shell measures (Part II)	Moisture problems, indoor air quality and ventilation	Safety and health issues	Energy education and outreach, working with clients	Review/discussion, careers in energy, presentation of certificates

Energy Efficiency Training Syllabus
5-day training for energy specialist and energy technician candidates, Yurok Tribe

Segment 01, Intro and Energy Basics, Day 1, 9:00-10:25
Props
light bulb w/ socket, blow dryer, hot plate, mug and styro cup of hot water, heat transfer materials: steel, wood, plastic; graduated beaker; oatmeal flakes, bucket
Handouts
sign in sheet
class schedule matrix

Sign in
Personal introductions
Training goals and overview
    Week 1: residential energy auditing
    Week 2: design, installation, repair and maintenance of renewable energy systems
Week 1's Overall training objectives
Trainees will:

- learn about the Yurok energy program and its goals
- learn and understand basic information about energy and energy consumption
- learn why saving energy in homes is important
- learn about the different components that make up a house and how they affect overall household energy use
- learn what measures can be taken to reduce household energy use/energy costs
- learn skills necessary to improve the energy efficiency of a single family site-built house or manufactured/mobile home
- learn how to collect and organize information needed to prepare an energy audit report
- learn how to perform energy audits safely and how to identify basic health and safety hazards in a home
- learn how to inspect weatherization work done by others
- learn basic information about energy economics
- learn how to educate and motivate others to save energy
- learn about local utility and community action agency programs available to help residents meet their energy needs affordably
- learn about jobs in the energy field and how to qualify for them
- become motivated to pursue employment in the energy field or use energy skills in current job

Upon completion of Week 1, trainees will receive a certificate of completion and get to keep the "Residential Energy" book. Book is provided free w/ course, but trainees need to make a good faith effort to be present all day every day to get to keep the book.

About the Yurok-SERC partnership
    The two DOE grants: creation of a Tribal energy program through
        Human capacity building
        Development of a Tribal "utility"
    Current training is part of the human capacity building
Why save energy? And why a Yurok Energy Program?
    Rising energy costs

Global and local energy challenges – fossil fuels running out, climate change, dams for producing electricity destroying fisheries, air pollution, other impacts of energy production
High household energy costs for Tribe
Desire to make Tribe more self-sufficient in meeting their energy needs
Need for economic development and employment opportunities

Program funding and time limitations:

- Weatherization vs. energy auditing
- This is an introductory course – will cover many topics, but not in great depth

Being an energy auditor: part scientist, part detective, part handyman, part counselor…even part artist

Energy basics

Need to understand energy basics to be a good auditor and understand what you see in the field
What is energy? ability to do work – heat as a form of work
Basic science of energy

forms of energy: chemical, thermal, radiant, mechanical, electrical, etc.
Energy and power: quantities and rates
Units of energy and power: BTUs, BTU/hr, Watts, kilowatts, therms, gallons of propane
systems: boundaries, inputs and outputs, buildings as systems
heat transfer: heat moves from warm to cold; conductive, convective, radiant transfer
ACTIVITY: experience 3 forms of heat x-fer w/ light bulb, blow dryer, mug and styro cup of hot water
insulators and conductors: show samples of steel, wood, other matls. Water and air
radiant energy reflected, absorbed, or transmitted when striking an object (mirror, flat black surface, glass)
conservation of energy: energy neither created nor destroyed
energy efficiency: 100*(useful energy out/total energy in)
energy conversions and efficiency losses (diagram: motor w/elec in, work & heat out)
ACTIVITY: passing oatmeal, discuss diagram of energy generation/T&D system

Energy sources

renewable and non-renewable energy
coal, oil, natural gas, hydroelectric, biomass, geothermal, solar, wind, waves
relative contributions of different sources, nationally and locally (see Energy Element and NEED)
energy sources used by the Yurok, their costs and impacts

Energy consumption

use pie graphs to illustrate:
end uses: lighting, heating/cooling, plug loads, transportation, process energy
sectors: residential, commercial, industrial, agricultural, institutional
end use within residential sector
potential savings (Energy element, Krigger pg. 14)

Electricity: volts, amps, watts, kWh, AC & DC, frequency; watts = volts X amps
ACTIVITY: demonstrate Kill-A-Watt, how it displays/logs volts, amps, watts, kWh
(Jim will cover electrical basics more thoroughly in RE section)

Segment 02, Buildings, energy use and energy costs, Day 1, 10:35-12:00

Props

Utility meter and loads

Handouts
Meter reading exercise
PG&E and PP&L rate schedules
sample PG&E bill

Why do energy audits?
What accounts for energy use in buildings? Look briefly at each end use and its contribution to cost (Krigger pg. 12)
- space heating/cooling
- lighting
- water heating
- plug loads/appliances
- motor loads

Causes of inefficiency (Krigger pg. 15)
Setting priorities (Krigger pg. 16-17)
Units for energy use and energy costs
Energy intensity (kWh/ft2/yr or BTU/ft2/yr) – Krigger pg. 43
Energy cost intensity ($/ft2/yr)
Utility rates – rate schedule handouts (PG&E, PP&L)
Understanding utility bills – show sample bill
- billing period
- rates (incl. wood & propane)
- Min. charges and taxes
- Tiered rates & baselines
- residential, commercial/industrial and agricultural rates
- time of use rates
- discounts for low income customers

Looking @ bills to estimate baseline consumption
Energy cost to operate appliances (elec. and gas)
How to read utility meters
- ACTIVITY: examine utility elec. meter, perform NEED meter reading exercise.

Climates: Yurok Res. is a heating dominated climate, despite hot summers upriver. Annually, more energy expended on heating than cooling, even for houses that have A/C
Heating and cooling degree days (show some data for N. Coast locations)
BTU/ft2/yr/HDD or CDD (Krigger pg. 43 again)
Energy efficiency codes: Title 24 and HUD Mobile Home Code (see pg 23 Krigger MH)

Segment 03, Heat loss and building shell measures (part 1), Day 1, 12:30-1:55
Props
wall section w/ different insulation types, electric heater, IR thermometer
Dave Grow insulation demo kit
insulation samples

Handouts
RMI Insulation Comparison table
“Native Power” excerpt

Human comfort and heat (human comfort zone graphic)

Energy gained/lost as heat through and between bldg. surfaces – can be good or bad, but the more we can control it, the better
Building envelope or shell/thermal boundary (Krigger pg 56 – thermal boundary decisions)
Revisit convection/conduction/radiation: heat transfer in/out of buildings involves all three
Generally, heat transfer in/out of shell is either transmitted (conducted) through solid surfaces or carried by air leaks
Heat transfer through solid surfaces is stopped by insulation (and radiant barrier)
Heat transfer via air leaks is stopped with air barriers: caulk, weather strip
Not worthwhile controlling heat transfer anywhere but at thermal boundary
Contributions to heat gain/loss in building under heating and cooling conditions (use drawings)
To maintain constant temp, heat losses/gains must be balanced: compare w/ leaky bucket, must add water @ same rate it drains out to keep bucket @ constant level
Detecting heat loss

Conductive: high tech w/ IR thermography, midtech w/ IR thermometer, low tech w/frost/snow
Air leakage: blower door
Weak spots/rules of thumb (Krigger pg. 49)

Heat conductivity: U in BTU/ft2/hr/deg F. Low U is usually good, = low heat loss/gain (exception: passive solar gain where desired) (Note that thermal conductivity is *not* the same as electrical conductivity) (Krigger pg. 53: table w/ thermal conductivities of different materials)
Inverse of conductivity: R. High R is generally good.
Insulation designed to have high R value, tends to be thick but low density. Air is good insulator, but must be kept from convective circulation
Thermal mass – heat retention, reduces temp. swings day/night – high density materials
Comfortable building uses insulation AND thermal mass – insulation wrapped around thermal mass, strategic openings for solar gain to reach thermal mass where/when beneficial
Look at R/U values of specific materials – metals, wood, air, glass, etc. Demo materials
Insulation types and methods of installing

- batts & blankets (fiberglass)
- loose fill (cellulose, fiberglass, polystyrene beads)
- rigid boards (foam, polystyrene)
- spray-in (wet-spray cellulose)
- radiant barrier

Title 24 (site built) and HUD (mobile) requirements for attic, wall and floor insulation
evaluating insulation:

R per inch
settling, shifting around
look into switch/outlet plates to evaluate

vapor barrier on the warm side (indoor side in our heating-dominated climate) so any condensation doesn't get trapped within the insulating layer
Calculating heat flow: $Q\ (BTU/hr)=UA\Delta T$

Complicated to use for calculating energy use over whole year because outdoor temperature changes, but can be useful for other purposes, like to estimating peak heating cooling load for sizing equipment, and for comparing value of different envelope measures (pg 62-64 Krigger)

In addition to insulation, heat gain of a surface is also determined by color. Remember dark colors absorb radiation, light colors reflect (trailer roofs photo)

Segment 04, Heat loss and building shell measures (part 2),Day 1, 2:05-3:30

Props

blower door
weatherstrip and caulk samples

Handouts

Common Household Air Leaks
Weatherize Your Home – Caulk and Weatherstrip

Air sealing: air leaks account for ~1/3 of home heat losses
Caulk is used for air sealing at fixed gaps (around penetrations, where building surfaces meet)
Weatherstrip is for air sealing at moving joints (door and window openings)
Demo caulking and weatherstrip materials
Prescriptive vs. guided methods
Prescriptive: Follow list of where to caulk – list standard places for site-built and mobile homes
Guided: Uses a blower door. Introduce concept of blower door.
Blows air in or out of house to create pressure difference between indoors and outdoors. A "tight" house with few leaks will need high air flow to maintain this pressure difference. A "loose" or leaky house needs higher air flow (show graphic)
Typical procedure is to depressurize house to 50 Pa (about 1/5" of water column) and measure air flow in CFM. Under these conditions, <1250 CFM is "tight," >3000 CFM "leaky."
Can adjust for size of house by converting to $ACH_{50} = 60*CFM_{50}/(\text{house volume})$
ACH_{50} range: 5.6 = tight, 20 = loose
$ACH_N=ACH_{50}/20$
ACH_N should be 0.35 or greater to avoid indoor air quality problems
Can use hand or smoke to find specific locations of leaks
Close rooms or seal off ventilation/heating ducts one by one to figure out where leakiest areas are
"Ideal" tightness for our climate ranges 1,000 to 3,000 CFM_{50} depending on factors, including:

- no. of occupants (houses with more occupants should be looser),
- no. of stories (taller houses should be tighter because of stack effect),
- wind exposure (more exposed houses should be tighter)

Segment 05, evaluating windows and doors, Day 2, 9:00-10:25

Props

double and single pane window glass; IR thermometer; plastic bags of ice; safety glasses; stopwatch; graph paper

Handouts

Efficient Windows Collaborative: Arcata window choices

Windows are typically important in building heat loss, due to relatively large area and low R/high U.
Doors typically not so important – less area, better insulated.
Doors: hollow core, solid core, and frame-and-panel. Hollow core may be insulated.
Windows available in single, double, and even triple pane.
Other features: low-e coatings, argon fill
Four performance factors (animated slides):

- U (no. of layers and what's between layers),
- Visible transmittance (glass and glass coatings that affect transparency), and
- solar heat gain coefficient (low-e coatings)
- air leakage

ACTIVITY: double & single pane windows experiment
Frame types: wood, metal, vinyl.
Metal frames are not good insulators unless they are made with thermal breaks (find cross-section photo)
Measures for existing windows

- weather strip moving joints (Hoopa H.S. window photo)
- caulk fixed joints
- repair windows so they close properly
- treatments (covers): strategy to stop heat before it reaches glass
- curtains, thermal blankets, blinds, storm windows, temporary shrink-on interior film, exterior heat-reflecting film, awnings

Window replacement: not usually cost-effective to replace for cost savings alone, but replacing windows has multiple benefits – noise reduction, moisture control, draft control, aesthetics

Segment 06, Space heating and space cooling, Day 2, 10:35-12:00

Props
none
Handouts
none

Space heating issues
In addition to heat loss/gain through building shell, there are challenges in distributing heat within a building (show pix of Tribal home w/ high ceiling, stratification problems)
Space heating technologies

- central forced air
    - usually uses natural gas or propane furnace, sometimes electric furnace
    - fastest way to heat a house, especially a large house – heat distributed as fast as air can move
    - greatest potential for efficiency problems is with torn or unfastened ducts
    - ducts need to be insulated if pass through unconditioned space
    - potential for indoor air quality problems, need to change filters, keep ducts clean
- floor/wall gas furnace
    - simpler technology, may or may not use blower. No air distribution ducts – just supply air and combustion exhaust
- wood heat
    - can be cheapest way to heat or most expensive – depends if you collect your own wood or pay someone for it
    - many older wood stoves are very inefficient
    - can impact outdoor air quality, a concern in urban areas. Newer stoves have catalytic converter
- electric baseboards
    - very cheap technology to install, but very expensive to operate. Common in rental housing where builder/owner not concerned about utility bills. Efficient at point of use, but fuel very expensive per BTU

- portable electric heaters
    - very expensive way to heat a whole house
    - sometimes makes sense for just heating one room in a big house, instead of operating whole house heating system
- kerosene heaters
    - Must be vented to outdoors. Portable kerosene heaters and other unvented heaters are prohibited for use inside homes in California (California Health and Safety Code section 19881). (source: www.city.palo-alto.ca.us/fire/community/portableheaters.html)
- through-the-wall propane/gas heaters
    - can be an efficient way to heat individual rooms or a small cottage, but not recommended for heating a large house
- hydronic
    - circulates hot water, usually in pipes in floor or baseboards along walls
- heat pump
    - basically an air conditioner running backwards – more on this later. Most efficient way to heat a space using electricity.
- passive solar
    - Concentrate glass on south side, minimize glazing on west and north sides
    - Use thermal mass to absorb sun's energy, reduce temperature swing extremes
    - Use overhangs to bring sun indoors on winter days, block it on hot summer days
    - Use light-colored roof surfaces

Efficiency

remember eff=100*(energy out/energy in)

Gas and propane furnaces/heaters rated by BTUH in and out, can calculate eff.

Electric heaters are 100% eff. at turning elec. into heat, BUT the generation and transmission of the electricity is NOT so efficient…that's why electricity costs a lot more per BTU than gas or propane (about double)

Compare cost per million BTU of heat.

- Natural gas: $14/MMBTU (based on $1.40/therm, 100,000 BTU/therm)
- Electricity: $38/MMBTU (based on $.13/kWh, 3413 BTU/kWh)
- Propane: $22/MMBTU (based on $2/gal, 92,000 BTU/gal)
- Firewood: $7.20/MMBTU (based on $180/cord, 25 MMBTU/cord)

Keep in mind: this doesn't tell the whole story, because some of the energy is lost up the flue, in ducts, etc.

Maintenance

- replace or clean filters at least twice a year in systems that use them
- systems that circulate water may have scale buildup over time, which can restrict pipes and reduce performance
- have professional tuneup at least once every five years

Space cooling technologies

- fans – low energy use, but only effective up to a point. Useful for cooling small areas.
    - attic fans – vent hot air out of attic, reducing attic temperature and conductive/radiative heat transfer to living space
    - whole house fans – used in evening after hot day, with windows opened, draws cooler evening air into house, pushes warmer air up into attic where it passes to outdoors via attic venting
- vapor compression A/C –

    - explain refrigeration cycle – Krigger pg. 31
    - some have reversible heat pump feature that allows them to both heat and cool
- evaporative cooling – AKA swamp coolers –
    - "used to lower the temperature of air by using latent heat of evaporation, changing water to vapor. In this process, the energy in the air does not change. Warm dry air is changed to cool moist air. Heat in the air is used to evaporate water." (Wikipedia)
    - works best in deserts, places with low summer humidity
- passive cooling
    - shade, awnings, landscaping, deciduous trees
    - siting, orientation, shape of house, location of doors and windows can all help w/ cooling

Segment 07, Water heating, Day 2, 12:30-1:55

Props

water heater blanket
pipe insulation

Handouts

none

Water heating technologies

- Tank water heaters
    - electric
    - propane/natural gas

  thermostat controlled, maintain water @ desired temp 24/7. Causes standby losses.
- Tankless/demand heaters

  no standby losses, can save 20-30%
- Solar water heaters (Jim will discuss next week)

efficiency measures

- insulate tank: procedure – do not cover top of gas/propane heaters. Not recommended to use blanket if existing water heater is new/high efficiency model. Don't need to insulate if indoors in heated space (kitchen or bath). Water heater *must* be strapped to secure wall framing at top and bottom, partly to hold insulation in place but more importantly for earthquake safety – reduces chance of tipping, or of water or gas lines shearing.
- insulate pipes, install heat traps (check valves)
- turn down temperature. 120F recommended. Dishwashers need 130F, but many have built-in temp booster, so 120F inlet temp OK.
- install hot water saving devices – low-flow showerheads
- replace w/ efficient unit

maintenance

- flush tank periodically
- replace anode rod to extend life
- hard water = scale, but water softeners corrosive and add salts to water (health issue)

Segment 08, Moisture problems, indoor air quality, and ventilation, Day 2, 2:05-3:30

Props

none

Handouts
none
What do moisture, indoor air quality and ventilation have to do with energy efficiency?

- Starting about 30 years ago during the 1970s "energy crisis", people started trying to really seal buildings up to reduce air leaks and save energy. This was effective but created a new problem. Along with keeping air inside the house, sealing also trapped moisture and pollutants inside. This has led to allergy and respiratory problems and damage to home interiors.
- Since then, research has led to new standards & techniques for making sure homes are adequately ventilated without wasting excessive heating/cooling energy

Why is moisture a problem?

moisture provides ideal environment for mold and other pathogens
mold can cause indoor air quality problems, allergic reactions, and aesthetic and even structural damage to house
mold thrives on moisture, also needs some food. "Food" for mold can include drywall, cellulose insulation, plywood, even glues and paints

What level of moisture is ideal in a home? <60% summer (for comfort), <40% winter (to avoid condensation)
What level of ventilation is ideal in a home? Rule of thumb: about 0.35 air changes per hour. May be higher if many occupants or if people smoke indoors
Sources of moisture in buildings (Krigger pg 220 and 268)
Identifying moisture problems
Controlling moisture problems
Indoor air quality from combustion by-products

Segment 09, Lighting, Day 3, 9:00-10:25

Props
Lights w/ base: inc., CFL, LED, T8 & T12 fluorescents
light meter
Power meter
Mag/electronic ballast comparison w/ flicker checker
ballast
occupancy sensor
timer switch

Handouts
none

Terminology: lumens (emitted light) and footcandles (received light)
Lighting technologies

incandescent, halogen, fluorescent, CFL, HID, LED
non-electric lighting: propane, kerosene
efficacy: lumens per watt

lifespans of different lights
efficacy of different lights
efficiency comparison – use Evan Mills article
other qualities: color rendering, color temperature
footcandles and recommended lighting levels: demonstrate light meter

electronic and magnetic ballasts for fluorescent lights
lighting controls: timers, dimmers, occupancy sensors, daylight sensors
daylighting: the most energy efficient way to light. Important to avoid glare and UV degradation of interior finishes, upholstery, artwork, etc.
halogen torchieres – worst kind of household lighting, inefficient and fire hazard
recessed ceiling lights – must not come in contact w/ attic insulation unless they are specifically rated as OK for this.

Segment 10, Appliances, Day 3, 10:35-12:00

Props
"solar clothes dryer"
loads and watt meter for Watts Up

Handouts
Electrical load calculation form

AKA "plug loads" – commonly 120V AC, can also be 220 V AC or low voltage DC (12V, 24V)

- Kitchen appliances
- Washer/dryer
- Home electronics (entertainment)
- Power tools
- Telecom eqpmt.
- Home office
- Pumps (well, sump, etc.)

Demo power meter, play Watts Up
Appendix A18 in Krigger: power use of typical appliances
Energy Star – program to help people choose energy saving products. Label. 2 billion E-Star products sold since program began in 1992, saves $12 billion a year. (About 2% of the $700 billion spent yearly on all energy in U.S. – means many power plants that didn't need to be built)
Energy Guide labels

- List types of appliances that are labeled (ACEEE appendix 2)
- Explain scale – some appliances show energy consumption (left end of scale is best) while others show efficiency (right end of scale is best)

Phantom loads

- Give statistic on energy wasted nationally by phantom loads
- Feel adapter, warm to touch – this is wasted energy
- Unplug loads when not in use
- Use power strip, switch off

refrigerators

- tend to be single biggest electric consumer in house because runs day and night
- thermostat controls compressor, so comes on/off as fridge is heated by surroundings
- show how energy use has climbed and fallen over time – older not always worse
- ideal temperatures: 34-37F in fridge, 0-10F in freezer
- look for "energy saver" or "economy mode" switch – controls anti-sweat heaters on outside
- check door seals – dollar bill trick
- keep coils clean
- keep full – thermal mass is good

- avoid running separate freezer in house if possible
- don't keep old fridge running in garage – OK to just plug in periodically when guests in town

cooking appliances

- heat-generating electric appliances tend to use lots of power
- microwaves are efficient for reheating food, boiling water

Diswashers

- can save hot water compared to hand washing.
- Use air dry mode

Laundry

- ♣ Wash in cold water, or at least rinse in cold
- ♣ Consider front load washer – uses less water, leaves clothes dryer for faster dring time
- ♣ Do full loads
- ♣ Line dry clothes ("solar clothes dryer")

well pumps

entertainment: TV, satellite receivers, video games, stereos

- typically not a huge part of electric bill, but often significant phantom loads

hot tubs

- get insulated cover
- very expensive to heat w/ electricity, gas/propane or wood more economical

home office: computers, printers, copiers, etc.

- typical desktop computer plus CRT monitor uses ~150W
- screen savers *don't* save power – need to enable sleep mode, can reduce power to a couple watts on newer computers
- laptop computers use only 20% or 25% as much energy as desktop models
- ink jet printers use much less power than laser printers
- some other office machines such as copiers have a sleep mode too.

Segment 11, Energy audit techniques, Day 3, 12:30-1:55

Props

none

Handouts

Short form checklist energy audit

Remember: an energy auditor is part scientist, part detective, part handyman, part counselor…even part artist

First big decision: what are the goals of energy audit? Provide resident w/ info they can use right away to save energy? Collect info for utility/Tribe for planning energy programs? Need to go in prepared w/ plan and materials appropriate to the audit goals

Developing an audit strategy: quick walk-through vs. in-depth – minimum 15 minutes, maximum several hours.

Being considerate to the resident: respecting privacy, staying out of their way

Listing equipment/appliances in home

Determining wattages of equipment: nameplates, lists of typical items

Determining hours of use: interviewing resident – tendency to overstate.

Calculate cost of operating an appliance

Example: 1500 watt toaster, operated for 10 minutes a day. Electricity costs 13 cents/kWh

(1.5 kW)(10/60 hr/day)(30 days/mo)($.13/kWh)=$0.98/month
Calculate savings for a retrofit
Example: 100 watt light bulb. replace with 27 watt CFL. $0.13/kWh, on 6 hrs/day
(100-27Watts)(1kW/1000W)(6hrs/day)(30days/mo)($.13/kWh)=$1.71/mo
Do not change any settings unless resident says it's OK. Only change settings if you can be sure there will be no harmful side effects, and make sure resident knows you are leaving device with different setting and you have their permission.
Detective work:

- Look at circuit breaker panels – can learn a lot (see photo)
- Turn appliances on/off while partner watches electric meter
  (3.6 x Kh factor)/(number of seconds per meter disc rotation) = kW (Note: Kh factor is number of watt-hours consumed in one full rotation of the meter disc)
  dimensional analysis:
  (3600 sec/hr)(1 kW/1000W)(Whr/rotation)(rotations/sec) = kW
  Example: Kh=7.2, rotation takes 45 seconds
  (3600)(1/1000)(7.2)(1/45)=0.576 kW = 576 Watts
  Turn off every elec load until meter stops completely, then turn on one thing or circuit at a time
- Ask for bills – 1 or 2 years is ideal, but even a single bill can be helpful
- If working in a tract home neighborhood, info on similar houses can be helpful

Advanced technologies – using dataloggers w/ current sensors, light sensors, temperature sensors

Segment 12, Safety and health issues, Day 3, 2:05-3:30

Props
none
Handouts
none

Health and safety are important in two different ways in conducting energy audits:

- ♣ As an auditor, you need to look out for your own personal health and safety while conducting field work. If not, your auditing career may be cut short!
- ♣ Your primary job is to find ways to save energy. But an important additional benefit that energy auditors can provide to clients is to help them improve safety and eliminate health hazards in their homes. Many of these health hazards are directly related to energy use in the home, such as a furnace that is emitting carbon monoxide into enclosed living space, or an electric appliance that is improperly wired.

Health and safety issues for auditor:

- ♣ Lifting
  - o Use your leg muscles, not your back muscles, for lifting heavy items
  - o Keep your back straight while lifting
  - o Know your limits – ask for help when you need it!
- ♣ Ladder safety
  - o inspect ladder to be sure it's in good condition
  - o use the right type of ladder – step or extension
  - o place so all legs are on firm, level ground
  - o watch when setting up that ladder does not contact any wiring or electrical devices
  - o pay attention to labels that limit how high you should stand on ladder
  - o don't try to reach too far when on ladder – if necessary, get down and reposition ladder
- ♣ Driving

- Drive safely and legally
- Use seat belts
- Make sure you have plenty of gas to get to and from your job sites
- If you notice any vehicle problems, notify your supervisor

♣ Exposure to toxic materials
- dress appropriately on the job – long pants, no tank tops, wear or bring long sleeve shirts for attic/crawl space inspections.
- use eye protection, hair covering, work gloves, dust mask or facial respirator when appropriate

♣ Animals
- try to find out before opening gate or approaching house if there are dogs
- pay attention to "beware of dog" signs
- avoid contact with any small rodents – mice, rats, bats – or their feces
- don't disturb or remove any bee/wasp/hornet nests

♣ People – harassment etc.
- remember that participation in energy audits is strictly voluntary
- be considerate, ask permission before entering house
- don't argue with clients – your job is to help them
- if you feel in any way harassed or threatened by a client or anyone you meet on a job site, end the visit as quickly as possible and notify your supervisor of the problem

Health and safety issues for resident

♣ Moisture and mold

♣ Indoor air quality
- Carbon monoxide (CO)
  - acutely toxic: kills more than 500 people a year in the U.S.
  - released by
    - unvented gas space heaters
    - kerosene space heaters
    - backdrafting vented space heaters
    - gas ranges (stove/oven)
    - leaky wood stoves
    - automobiles idling in attached garages or near the home
    - cigarette smoke
  - often caused by misalignment of appliance burners, dirt or debris in burner, inadequate combustion air
  - more serious if house inadequately ventilated
  - can be detected with wall-mounted sensor or portable sensor

♣ Asbestos
- Found in and on many older homes, siding, pipe insulation, etc.
- Airborne particles linked with lung cancer
- Best left in place if not "friable" (crumbling)

♣ Lead-based paint
- was commonly used as paint ingredient until banned in 1978
- still found on/in ~38 million homes in US, about 25% of homes in US
- effects:
  - developmental problems in kids under 6;
  - birth defects for pregnant women;

        - adults have increase blood pressure and cause fertility problems, nerve disorders, muscle and joint pain, irritability, and memory or concentration problems
    - In older homes, best to assume paint contains lead – avoid disturbing the paint in any weatherization work.
- ♣ Fire and electrical safety
    - watch for attic insulation in contact with uninsulated wiring or heat-generating surfaces (combustion appliance flues, recessed lights)
    - GFCI outlets
    - aluminum wiring
    - look for lighting and appliances being used or located in unsafe ways:
        - halogen torchiere lights, especially near curtains
        - electric appliances or wiring in wet locations

Segment 13, Field trip: site-built home, Day 4, 9:00-10:25

Props

Blower Door

Handouts

Residential Electric Load Calculation Sheet

Home Energy Survey form

Segment 14, Energy economics, Day 4, 10:35-12:00

Props

none

Handouts

none

Savings, cost and payback

Energy audit will generate a list of energy efficiency measures.

This list raises questions:

- How much will it cost to do these measures?
- How much energy will be saved, and what are the savings worth ($)?
- How should we prioritize the projects (decide which are worth doing first)?

Cost information is available from various sources. You need to consider both materials and labor (unless project will be installed by a do-it-yourselfer).

- Product catalogs
- Energy retrofit and construction cost guides
- NEAT software (to be discussed later)
- Local retailers and building tradespeople (electricians, plumbers, etc.)

Savings can be calculated as discussed previously

Cost and savings can be related using payback. How does this work?

Three Potential Upgrades

Suppose you have identified three different energy saving opportunities for a resident:

- A: One upgrade would save $200 a year and costs $400 to implement
- B: Another upgrade would save $200 a year and costs $600 to implement
- C: third upgrade would save $400 per year and costs $600 to implement

How Do We Compare These Opportunities? They offer different combinations of savings (the part we like!) and costs (the part we don't like!). If our budget is limited which opportunity should we choose?

Simple Payback Analysis is a simple but useful tool for comparing and evaluating energy saving opportunities.
The formula is easy: simple payback (in years) = cost of project ÷ yearly cost savings
Calculating Payback

- For example, in opportunity A from before, a $400 upgrade that saves $200 a year has a payback of $400 ÷ ($200 per year) = 2 years. In other words, you will have to wait 2 years until the project's energy savings repay what you've invested. After that, the savings are like free money! So, short payback times are good. Using the payback tool, we see that project A has a 2 year payback.
- For project B, the $600 project with $200 yearly savings, payback = $600 ÷ ($200 per year) = 3 years.
- For project C, the $600 project with $400 yearly savings, payback = $600 ÷ ($400 per year) = 1.5 years.

So payback analysis tells us that option C, even though it costs more initially than option A, has the shortest payback time and is thus the "best bargain."
Payback analysis can be used for any energy upgrade, as long as you know the initial cost and the yearly energy cost savings.
Labor Costs: Keep in mind when you're calculating payback that the cost of an upgrade includes not just the cost of buying the equipment, but also the labor to install it.
The labor cost is just the number of hours it takes the electrician or maintenance person to install the upgrade times his or her hourly wage: Labor cost = Number of hours X hourly wage
Example: A two-lamp, four-foot fluorescent light fixture costs $45 from the lighting supply company. It will take an electrician half an hour to install it. Her hourly wage is $30. What is the total installed cost? $45 for materials + (½ hour × $30 per hour) for labor = $60 total
Advanced Economic Analysis: Other tools for economic analysis include:

- Return on investment
- Life cycle cost analysis
- Net present value

These tools take into account additional factors, like ongoing maintenance costs and the changing value of money over time. They require more information and are a little more difficult to calculate, so we'll leave them aside for now.
Opportunities can be ranked by measure payback, cost, or savings.
(Provide data for 5 fictitious measures, calc. payback and rank. Payback ranking and cumulative cost can be used to match an available budget)
Payback can be used to choose among solutions to a problem, e.g. repairing vs. replacing equipment or choosing standard vs. high efficiency equipment.
Payback does not account for time value of money – just mention that there are other economic analysis tools for doing that.

Segment 15, National Energy Audit Tool (NEAT) software and forms, Day 4, 12:30-1:55

Props

computer w/ NEAT software loaded
overhead projector for filling out forms

Handouts

none

Forms

Spreadsheets
Reconciling audit with utility bills – can be difficult, people actually tend to overestimate hours of use
Energy auditing software
    Intro to National Energy Audit Tool (NEAT)
    Online energy auditing tools: Home Energy Saver
Making recommendations
Creating reports

Segment 16, Energy education and outreach Day 4, 2:05-3:30

Props
none
Handouts
PG&E Rebate List

Working with clients
Approaching the resident: what's in it for them?
Getting the resident's opinion: their priorities and concerns
Presenting your recommendations to the resident
Making the financial case for energy efficiency
Presenting literature to the resident
Answering questions
Getting help with questions you can't answer
Financing energy efficiency: rebates (discuss handout), programs for limited income, low interest loans, etc.
Dealing with complaints
Follow-up: who can the resident contact for more help?
Motivating the resident to take action

Segment 17, Guest speakers from utility and weatherization organization, Day 5, 9:00-10:25

Props
provided by guests
Handouts
provided by guests

Val Martinez of RCAA on WAP, LIHEAP, her experiences in field; PG&E/PacPower Reps on utility programs??

Segment 18, Mobile and manufactured homes, Day 5, 10:35-12:00

Props
none
Handouts
none

Types: trailer, mobile/manufactured home, modular home (slides)
Krigger MH: pg. 17 exploded diagram
Lightweight construction – necessary for portability and to keep costs down, but creates challenges for making house energy efficient
Siting – E-W orientation

HUD codes for MH construction first in 1976 then updated 1994. Regulate insulation, ventilation, min. framing dimensions, vapor barrier.
24-45% savings potential w/ retrofit
Mobile home's energy points of weakness (Krigger main book pg. 50)
Most important measures for cold climates:

- ♣ Air sealing/duct repair
- ♣ Furnace tuneup
- ♣ Blown roof insulation & floor insulation
- ♣ Interior storm windows

Skirting – don't install insulated skirting. Doesn't make sense to insulate a space that will deliberately be heavily ventilated with cold outside air.
Recom. Venting for skirt: 1 ft2 for every 150-300 ft2 of floor space. Depends on how much groun moisture barrier you have – more barrier = less venting
Krigger MH pg. 73 – List of most important air sealing opportunities in MHs
Pg. 75: pre-1976 homes not well insulated. Insul. Not effective if leaves large air gaps for convection.
¼" to ½" foam board commonly used in mobile homes, but can't be in living space due to toxic smoke when burned. Has to be separated by sheetrock, fiberglass, or other fire-resistant material (not wood paneling)
Cellulose insulation is great for site-built homes but not recommended for MHs – susceptible to moisture, fire retardant is corrosive to metal siding/roofing
Floors – look for underbelly damage. Should be insulated and nearly airtight seal.
Walls – typically 1-2 inches of fiberglass
Remove plates covering light sw or outlet to inspect wall cavity quickly
Don't assume wall cavities filled w/ insul – even if insulated to spec at factory, fiberglass or loose fill insulation may have settled or detached from wall during shipping and installation
Windows – thermal weak link in MHs – low R value, typically large surface area (as fraction of wall)
Roofs/ceilings – inspect for leaks and signs of damage from both above and below if possible – look for staining, damaged materials.

Segment 19, Field trip: walk through mobile home, Day 5, 12:30-1:55
Props
watt meter
IR thermometer
Handouts
Residential Electric Load Calculation Sheet
Home Energy Survey form

Segment 20, Review/Discussion, careers in energy, presentation of certificates, Day 5, 2:05-3:30
Props
none
Handouts
Careers in Energy Services
Evaluation forms

- Talk about Richard's, Jim's, Dustin's energy careers
- Local opportunities for additional training
    - short courses through HSU extended ed
    - CR classes/certificates in building restoration, construction, residential wiring

    - RCEA workshops (on hold for now)
    - PG&E workshops – some being held via video conferencing at HSU campus
    - Commercial trainers (American TrainCo, etc.)
- Jim will discuss job opportunities in renewable energy in his workshop

COURSE EVALUATIONS

Yurok Renewable Energy System Training

Yurok Renewable Energy System Training (May 30 - June 2)

Hour	Tuesday	Wednesday	Thursday	Friday
9:00 - 10:55	**Introduction** • Electricity Basics • Safety • Off-Grid Electric Systems • Determining Loads	**Solar Resource** • Available Resource • Site Selection • Slope & Orientation	**Solar Electric Systems** • Major Components • How a System Works • PV Module Performance	• Wire Sizing • Grounding • Disconnects & Overcurrent Protection • PV System Installation (*Field Activity*)
10:55 - 11:05	*BREAK*	*BREAK*	*BREAK*	*BREAK*
11:05 - 1:00	**Micro-Hydro Systems** • Major Components • How a System Works • Resource Assessment	• Site Selection Exercise (*Field Activity*) • Slope & Orientation Demo (*Field Activity*) **Solar Hot Water Systems** • Types of Systems	• System Sizing & Design	• PV System Installation (continued) • PV System Maintenance & Repair (*Field Activity*)
1:00 - 1:30	*LUNCH (BYO)*	*LUNCH (BYO)*	*LUNCH (BYO)*	*LUNCH (Indian Tacos)*
1:30 - 3:25	• Resource Assessment Exercise (*Field Activity*)	• Major Components • How a System Works • System Sizing	• PV Array & Battery Configurations • IV Curves, Wiring Configurations (*Field Activity*)	**Site Visits** • Micro-Hydro • PV • Solar Hot Water
3:25 - 3:35	*BREAK*	*BREAK*	*BREAK*	*BREAK*
3:35 - 5:30	• System Design & Sizing • Component Selection • Maintenance & Repair	• System Installation • Maintenance & Repair • SHW System Demo (*Field Activity*)	• Component Selection (inverters, controllers, back-up generators) • Batteries	Site Visits (continued)

Renewable Energy Training Activity and Materials List
4-day training for Yurok Tribe

Segment 01, Introduction, Day 1
Handouts
Class schedule/syllabus
Basic Electricity Facts

Activities
Measure the resistance of two different wire sizes
Activity 1 – Electricity Basics (calculations)
Activity 2 – Electricity Basics – Hands-On Lab
Activity 3 – Calculating Home Electrical Loads

Props/Equipment
Multimeters
DC power supplies
Resistors (≥1000 ohm, ¼-watt)
Mini DC fans
Mini PV panels
Two spools of wire, different wire gauges

Segment 02, Micro-Hydro Systems, Day 1
Handouts
Intro to Hydro Power - Part 1 (from Home Power #104)
Intro to Hydro Power - Part 2 (from Home Power #107)
Hydroelectric Information (from AEE 2006 Renewable Energy Design Guide and Catalog)
Harris Hydroelectric info sheet
Friction Head Loss Through Plastic Pipes
PVC Pipe Specs
Wind Electric Systems Simplified (from Home Power #110)

Activities
Demonstration of Pelton Wheel
Demonstration of static and dynamic head
Micro-hydro system design exercise
Video – Residential Microhydro Power with Don Harris
Micro-hydro resource assessment at a local creek

Props/Equipment
Pelton wheel mounted in clear plastic bowl
Brass twist nozzle hose attachment
Trace C-40 Diversion Load Controller
Static and dynamic head demonstration system (ladder, container, tubing, pump, pressure guage)
Micro-hydro assessment kit (5 foot measuring rods, level, 100 foot tape measure, stop watch, 5-gal bucket)

Segment 03, Solar Resource, Day 2

Handouts

Solar Radiation Data for Arcata, CA

Activities

Solar Site Analysis Calculation Exercise
Solar Site Analysis Field Activity
Solar radiation data measurement
Demonstration of effect of slope and orientation on incident solar radiation intensity

Props/Equipment

Pyranometer
Multimeter
Solar Pathfinder with tripod
Solar Site Selector with tripod
Compass, protractor with sight tube and plumb bob

Segment 04, Solar Hot Water, Day 2

Handouts

Solar Hot Water Simplified (from Home Power #107)
Solar water heating system types and solar water heater troubleshooting checklist (from Solar Hot Water Systems – Lessons Learned 1977 to Today, Tom Lane, Energy Conservation Services of North Florida Inc, 2004.

Activities

Measuring the resistance of a thermistor
Differential controller demonstration
Component show and tell
Sizing a solar water heating system
Solar water heating system demonstration

Props/Equipment

Thermistors
Butane lighter
Mulitmeter
Differential controller demonstration system
Grundfos pump, Dribble valve, tempering valve, pressure and temperature relief valve
Solar hot water collector system (collector, hose and plumbing connections, DC pump, DC power supply, solar electric panel, storage tank, thermocouple reader, collector rack)

Segment 05, Solar Electric Systems, Day 3 & 4

Handouts

Solar Electric Systems Simplified (from Home Power #104)
Stand-Alone Photovoltaic Systems – A Handbook of Recommended Design Practices, Sandia National Laboratories, July 2003
Maintenance and Operation of Stand-Alone Photovoltaic Systems, Sandia National Laboratories, December 1991

Activities

PV module show and tell
Generating PV module IV curves
Examining the effect of temperature and insolation on PV module output
Examining the effect of shading on PV module output
Examining the effect of dirt and dust on PV module output
Observe battery voltage during charging and discharging
Assess battery state-of-charge by measuring specific gravity
Designing a photovoltaic system (Sandia design procedure)
Installation of a small stand-alone PV system

Props/Equipment

PV modules (single crystalline, poly crystalline, amorphous)
Slide wire resistors
Multimeters
Surface mount thermocouple and thermocouple reader
Pyranometer
Deep cycle lead acid battery (12 volt)
Battery hydrometer
Stand-alone PV system components (inverter, charge controller, breaker box, AC outlet, terminal blocks) and mounting rack
Wiring tools (cutters, strippers, crimpers)
Wire and crimp connectors

Segment 06, Site Visits, Day 4

Activities

Site visit to see a hybrid PV-microhydro system in operation

Appendix 2: Student evaluations from intensive energy trainings

Yurok Tribe
Energy Program
(707) 482-1350 ext. 363

Energy Auditor Training
Course Evaluation

Please answer the following questions. This evaluation is anonymous, so you don't need to write your name on it. We will use your comments and ideas to help improve energy training for Yurok Tribe members.

1. What parts of the course were most valuable to you?

Explanations of power rates and How to reduce those. learning techniques to find energy hogs and phantom loads

2. What parts of the course were least valuable to you?

The non-residential or showing of technologies or items that most people won't be able to use. I.E. Some light bulbs

3. What subjects would you like to see added to the course or covered in greater depth?

More "on the Job training" going to homes finding Ways to help people. And more Solutions for off the grid people

4. Would you recommend this course to other Yurok Tribe members? Why or why not?

Heck yes. Everything I have learned I can use to help myself or family members

5. How do you plan to apply what you have learned in this course?

Tell people about compact fluorescent lights and try to share other knowledge I have gained to benefit them

6. Please share any other comments you have about the course.

Very Informative and clear for the most part.

Thank you!

Yurok Tribe
Energy Program
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Energy Auditor Training
Course Evaluation

Please answer the following questions. This evaluation is anonymous, so you don't need to write your name on it. We will use your comments and ideas to help improve energy training for Yurok Tribe members.

1. What parts of the course were most valuable to you?
   Pretty much every thing I learned alot.

2. What parts of the course were least valuable to you?
   Pretty much nothing.

3. What subjects would you like to see added to the course or covered in greater depth?
   the Blowerdoor

4. Would you recommend this course to other Yurok Tribe members? Why or why not?
   Yes it's pretty good stuff to know

5. How do you plan to apply what you have learned in this course?
   Looking at my family's house's more in depth & giving some tops on energy saving

6. Please share any other comments you have about the course.
   I Liked it
   It was [redacted] great stuff

Thank you!

Yurok Tribe
Energy Program
(707) 482-1350 ext. 363

Energy Auditor Training
Course Evaluation

Please answer the following questions. This evaluation is anonymous, so you don't need to write your name on it. We will use your comments and ideas to help improve energy training for Yurok Tribe members.

1. What parts of the course were most valuable to you?

   MATH

2. What parts of the course were least valuable to you?

   I THOUGHT ALL WERE VALUABLE

3. What subjects would you like to see added to the course or covered in greater depth?

   TO HAVE MORE PRODUCTS TO SHOW

4. Would you recommend this course to other Yurok Tribe members? Why or why not?

   YES. IT SHOWS YOU EXACT OR CLOSE FIGURE OF COST SAVINGS

5. How do you plan to apply what you have learned in this course?

   INSTALL MY OWN HOME AND SHARE MY KNOLEGE WITH OTHERS

6. Please share any other comments you have about the course.

   I WAS VERY PLEASED WITH EVERYTHING

Thank you!

Yurok Tribe
Energy Program
(707) 482-1350 ext. 363

Energy Auditor Training
Course Evaluation

Please answer the following questions. This evaluation is anonymous, so you don't need to write your name on it. We will use your comments and ideas to help improve energy training for Yurok Tribe members.

1. What parts of the course were most valuable to you?

All fairly equally valuable

2. What parts of the course were least valuable to you?

N/A

3. What subjects would you like to see added to the course or covered in greater depth?

hybrid sources of energy savings

4. Would you recommend this course to other Yurok Tribe members? Why or why not?

yes, to save money

5. How do you plan to apply what you have learned in this course?

assess family houses, help weatherize houses

6. Please share any other comments you have about the course.

very informative

Thank you!

Yurok Tribe
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Energy Auditor Training
Course Evaluation

Please answer the following questions. This evaluation is anonymous, so you don't need to write your name on it. We will use your comments and ideas to help improve energy training for Yurok Tribe members.

1. What parts of the course were most valuable to you? I say Actual Fix it yourself, improve for Savings and enlarge your resources was good.

2. What parts of the course were least valuable to you? that hard to say because we've had no electricity ever at my house beside generators but, PG&E and meter reading yet still great.

3. What subjects would you like to see added to the course or covered in greater depth?

the course has covered far more knowledge of efficiency ~~that~~ than I would normally think.

4. Would you recommend this course to other Yurok Tribe members? Why or why not?
yes. for most tribal members of river electricity is new. And conserving your money is important.

5. How do you plan to apply what you have learned in this course? Begin Sealing of leaks and re-evaluate energy efficiency within the generater.

6. Please share any other comments you have about the course.

this course is awesome and your a great teacher!

Thank you!

Yurok Tribe
Energy Program
(707) 482-1350 ext. 363

Renewable Energy Training
Course Evaluation

Please answer the following questions. This evaluation is anonymous, so you don't need to write your name on it. We will use your comments and ideas to help improve energy training for Yurok Tribe members.

1. What parts of the course were most valuable to you?

   Learning about the actual installation of a PV system. Also, the procedures for sizing solar/hydro systems

2. What parts of the course were least valuable to you?

   The theory of power within a hydro system. (Only because I've heard it before)

3. What subjects would you like to see added to the course or covered in greater depth?

   None

4. Would you recommend this course to other Yurok Tribe members? Why or why not?

   Yes, very informative.

5. How do you plan to apply what you have learned in this course?

   By installing a PV system.

6. Please share any other comments you have about the course.

   The course was well planned and the hands-on demos were effective learning tools. Much effort was put forth by Jim.

Thank you!

Yurok Tribe
Energy Program
(707) 482-1350 ext. 363

Renewable Energy Training
Course Evaluation

Please answer the following questions. This evaluation is anonymous, so you don't need to write your name on it. We will use your comments and ideas to help improve energy training for Yurok Tribe members.

1. What parts of the course were most valuable to you? Talking & listening micro-hydro sytems learning about what to do & not to do with solar
2. What parts of the course were least valuable to you? Some of the earths Rotation around the sun on its tilted axis
3. What subjects would you like to see added to the course or covered in greater depth? Wiring that was kind of confusing
4. Would you recommend this course to other Yurok Tribe members? Why or why not? OF Course very m for national & a great way to Become Self Sufficient
5. How do you plan to apply what you have learned in this course? Share knowledge. And try to work on my Current home
6. Please share any other comments you have about the course. Skate or Die, live long and prospo Peace love and Chicken grease

Thank you!

Yurok Tribe
Energy Program
(707) 482-1350 ext. 363

Renewable Energy Training
Course Evaluation

Please answer the following questions. This evaluation is anonymous, so you don't need to write your name on it. We will use your comments and ideas to help improve energy training for Yurok Tribe members.

1. What parts of the course were most valuable to you?

   EVERYTHING OF COURSE WAS IMPORTANT

2. What parts of the course were least valuable to you?

   THE VIDEO

3. What subjects would you like to see added to the course or covered in greater depth?

   MORE OUT IN THE FIELD TO LOOK AT SYSTEMS ACTUALLY BEING USED

4. Would you recommend this course to other Yurok Tribe members? Why or why not?

   YES, IF ANYONE WHO MOVED WHERE THERE WAS NO TYPE OF POWER WOULD BE ABLE TO HOOK UP SOME TYPE OF ENERGY

5. How do you plan to apply what you have learned in this course?

   KEEP ON LEARNING SO I WILL BE ABLE TO HOOK UP MY OWN SOLAR OR HYDRO POWER

6. Please share any other comments you have about the course.

   I ENJOYED THE WEEK WORKING WITH JIM AND EVERYONE IN THIS TRAINING

Thank you!

Yurok Tribe
Energy Program
(707) 482-1350 ext. 363

Renewable Energy Training
Course Evaluation

Please answer the following questions. This evaluation is anonymous, so you don't need to write your name on it. We will use your comments and ideas to help improve energy training for Yurok Tribe members.

1. What parts of the course were most valuable to you? every thing between Solar and Hydro

2. What parts of the course were least valuable to you? none

3. What subjects would you like to see added to the course or covered in greater depth? ?

4. Would you recommend this course to other Yurok Tribe members? Why or why not? yes because we all could use either ~~xxx~~ Energy Resources

5. How do you plan to apply what you have learned in this course? Solar panels at home

6. Please share any other comments you have about the course. Great Course, Great teachers.

Thank you!

Appendix 3: Data collection forms used in the field

Energy Audit Checklist
Client Name: _____ Date:_____ Time:_____

___ 1. Auditors introduce themselves to residents, explain purpose of visit, request permission to perform audit (if not previously arranged)

___ 2. Ask resident about her/his energy related concerns/questions

___ 3. Take at least one representative photo of outside of house. (Also photograph any special or noteworthy conditions you notice in the course of the audit for possible inclusion in project reports)

___ 4. Perform NEAT/MHEA audit and fill in appropriate forms, asking resident for equipment hours of use and other info as needed:
- Client Info.pdf
- NEAT Essentials.doc *OR* MHEA Essentials.doc
- NEAT and MHEA supplemental form.doc

___ 5. If resident is concerned about high electric costs or has trouble living within capacity of off-grid power system, perform load inventory using Elec Loads Table.xls, discuss findings and savings opportunities w/ client

___ 6. If resident is off-grid but anticipates being connected to the grid in the future, conduct a wiring survey using Electrical Inspection Form.doc

___ 7. Conduct renewable energy assessment using RE Site Assessment.doc

___ 8. If resident is using a renewable energy system and/or a generator to meet their electric needs, perform an assessment using Renewable Energy System Assessment.doc.

___ 9. Complete Home Energy Survey and Recommendations (Survey and Recs Form.doc, original and carbon copy), discuss, leave original with resident, keep carbon copy

___ 10. Give resident appropriate program outreach literature and energy saving products, explain their use

___ 11. Present resident with info on special programs (CARE, medical baseline, etc.) as appropriate, help resident complete forms for any he/she wishes to apply for or provide info on how to apply on their own

___ 12. Ask resident to sign utility bill release form (PG&E or PP&L as appropriate)

___ 13. Complete visit, leaving card or other contact info with client in case they wish to follow up

___ 14. Make notes in notebook about any required follow-up tasks

___ 15. Input NEAT/MHEA data to computer later at the office, upload and organize photos in project file

___ 16. Review and complete follow-up tasks

Client Information Form

CLIENT INFORMATION

Client ID | **Alt. Client ID**
Client Name
Address
Unit No.
City | **State** | **Zip**
County | **Other Geo. Ident.**

Occupants

Number of: Occupants
Elderly
Disabled
Native American
Children

Primary Language: English Spanish Other; Other European Language; Other Asian Language

Dwelling

Dwelling Type: Site Built, Mobile Home, Shelter, Other, Duplex, Triplex, Fourplex, Multifamily (>4)

Ownership: Owned, Rented

Primary Heating Fuel: Natural Gas, Electricity, Propane, Oil, Wood, Coal, Kerosene, Other, None

☐ High Energy Use
☐ High Energy Burden

Secondary Heating Fuel: Natural Gas, Electricity, Propane, Oil, Wood, Coal, Kerosene, Other, None

Year Built

☐ Previously Weatherized
Year

Comment

Energy Index

Floor Area (sq ft)
Heating Degree Days (base 65 F)

	Annual Cost ($)	Estim. % for heating
Primary Heating Fuel		
Secondary Heating Fuel		

Client Contact Types: Applicant / Person of Record; Other Contact for Applicant; Landlord / Owner; Superintendent; Maintenance Staff; Non-Applicant / Person of Record

CLIENT CONTACT INFORMATION

Contact Name	Home Ph	Work Ph	Cell Ph	Contact Type	Primary Applicant	Comment

NEAT Essentials

Client Name _____

Stories: 1 / 2 / 3 or more

Floor Area (ft2) _____

Comment: Year built or manufactured (approximate) _____

Walls (treat all outside walls as 1 wall)

Exterior type: wood / stucco / metal or vinyl / brick or stone / other / none

Existing insulation type: blown cellulose / blown fiberglass / fiberglass batts / other

Existing R value _____

Windows (describe most common type)

Number of windows on entire house _____

Frame type: wood or vinyl / metal / improved metal

Glazing type: single / double

Leakiness: very tight / tight / medium / loose / very loose

Doors (describe most common type)

Number of doors on entire house _____

Door type: wood hollow core / wood solid core / steel insulated / sliding glass

Attic

Type: Finished/Unfinished

Area (ft2) _____

Existing insulation type: none / blown cellulose / blown fiberglass / fiberglass batts / other

Existing insulation (inches) _____

Foundation

Foundation type: conditioned / non-conditioned / uninsulated slab / insulated slab

Area (ft2)

Ceiling (of basement/crawl space) R value _____

Heating system (primary)

Eqpmt type: grav furn / forced air furn / elec resistance / heat pump / space htr: vented / unvented

Fuel: wood / electricity / propane / kerosene / other _____

Uninsulated supply duct length (ft) _____

Input units: gals/hr / kBTU/hr / Watts

Input rating _____

Output capacity (kBTU/hr) _____

Condition: good / fair / poor (but working)

NEAT Essentials (cont'd)

Cooling system (primary)

AC unit type: central / window / heat pump / evaporative

Size (kBTU/hr) _____

SEER _____

Water heater

Fuel: electricity / propane / other _____

Storage capacity (gallons) _____

Rated input _____

Input units: kBTU / kW

Label R value _____

No. of showerheads _____

Average showerhead flow rate (GPM) _____

Comments: Need blanket? yes / no

Refrigerator

Size (ft3) _____

Label kWh/yr _____

Age: <5 yr / 5-10 yr / 10-15 yr / >15 yr

Door seal condition: good / some wear / gaps visible

Lighting

Comments: main indoor lighting type: Inc. / CFL / tube fluor. / kerosene / propane

main outdoor lighting type: Inc. / CFL / HID

Health and Safety

___ smoke detector needed

___ CO monitor needed

___ Wiring problems: attic / walls / crawlspace or basement

___ Water leaks: attic / walls / crawlspace or basement

___ Moisture problems: attic / walls / crawlspace or basement

___ Vapor barrier needed in crawl space

___ Lead based paint likely

___ Asbestos siding likely

___ Exhaust fan needed: bathroom / kitchen

Comments:

MHEA Essentials

Client Name _____

Length _____ ft Width _____ ft Height _____ ft

Wind Shielding: well shielded / normal shielding / exposed

Home Leakiness: tight / medium / loose Outdoor water heater closet: ☐

Walls (treat all outside walls as 1 wall)

Wall stud size: 2x2 / 2x3 / 2x4 / 2x6

Orientation of long wall: North / South / East / West

Insulation type thickness: batt/blanket (in) _____ / loose fill _____ (in) / foam core (in) _____

Windows

Total number of windows facing: N _____ S _____ E _____ W _____

Frame type (most common): jalousie / awning / slider / fixed / door window / sliding glass door

Glazing type (most common): single / double

Leakiness: very tight / tight / medium / loose / very loose

Doors

Total number of doors facing: N _____ S _____ E _____ W _____

Door type: wood solid core / wood hollow core / standard manufactured home door

Ceiling

Roof type: flat / bowstring / pitched

Roof color: white or reflective / normal or weathered

Insulation type thickness: batt/blanket (in) _____ loose fill (in) _____ foam core (in) _____

Existing insulation (inches) _____

Floor

Skirt? Y / N Condition of belly: good / average / poor

Loose insulation thickness (in) _____ Batt/blanket thickness (in) _____

Addition

Note: complete separate form for addition if mobile home has substantial site-built addition (>200 ft^2)

Heating system (primary)

Eqpmt type: furnace / heat pump / space heater / none

Fuel: wood / electricity / propane / kerosene / other _____

Output capacity (kBTU/hr) _____

Efficiency _____ Efficiency units: steady state / AFUE / COP / HSPF

Duct location: floor / ceiling / none

Duct insulation location: above duct / below duct / around duct or ductboard / none

MHEA Essentials (cont'd)

Cooling system (primary)

AC unit type: evaporative cooler / central AC / room AC / heat pump / none

Capacity (kBTU/hr) _____

Efficiency _____ Efficiency units: COP / EER / SEER

Water heater

Fuel: electricity / propane / other _____

Storage capacity (gallons) _____

Rated input _____

Input units: kBTU / kW

Label R value _____

No. of showerheads _____

Average showerhead flow rate (GPM) _____

Comments: Need blanket? yes / no

Refrigerator

Size (ft3) _____

Label kWh/yr _____

Age: <5 yr / 5-10 yr / 10-15 yr / >15 yr

Door seal condition: good / some wear / gaps visible

Lighting

Comments: main indoor lighting type: Inc. / CFL / tube fluor. / kerosene / propane

main outdoor lighting type: Inc. / CFL / HID

Health and Safety

___ smoke detector needed

___ CO monitor needed

___ Wiring problems: attic / walls / crawlspace or basement

___ Water leaks: attic / walls / crawlspace or basement

___ Moisture problems: attic / walls / crawlspace or basement

___ Vapor barrier needed in crawl space

___ Exhaust fan needed: bathroom / kitchen

Comments:

Yurok Tribe Energy Program

Supplemental Form for NEAT and MHEA Software Data Collection

Client Information

Client Name _____ Audit Date _____

GPS Coordinates

Latitude:_____°N Longitude:_____°W Elevation:_____ft.

Utility Company (circle 1): PG&E / PP&L / Other _____/ None

Electric account #: _____ Electric meter #: _____

Ducts and Infiltration

Whole House and Duct Leakage Comments (based on visual inspection)

_____

Blower Door Test (Optional)

Existing Whole House Leakage _____CFM @ _____Pa

Blower Door Test Comments (Major Identified Leakage Locations)

_____

_____

Water System

☐ Pumped well: rated pump output _____ HP rated efficiency _____%

nominal current _____ A nominal voltage _____V

☐ Gravity feed: check site for microhydro potential

☐ Water treatment equipment: rated power consumption _____ W

Utility and Fuels Information

Electric: Is House Connected to Utility Electric Service? (yes/no) _____

Typical Electric Bill Summer: $_____/mo. Winter $_____/mo.

Propane: Size of Propane Tank (Gal) _____

Typical # of Mos. to Use 1 Tank Propane: Summer_____ Winter _____

Price of Propane $_____/Gal

Kerosene: Size of Kerosene Tank (Gal) _____

Typical # of Mos. to Use 1 Tank Kerosene: Summer_____ Winter _____

Price of Kerosene $_____/Gal

Wood: Number of Cords of Firewood Purchased in Typical Year: _____

Price Paid per Cord $_____/Cord

Residential Electric Load Calculation Sheet

Resident Name: _____ **Utility Rate:** _____ **$/kWh**

Auditor Name: _____

Date: _____

Yurok Tribe Energy Program

A Item	B Quantity	C Hrs On per Day	Existing D Watts	Existing E kWh per Month (B x C x D x 0.03)	Existing F Cost per Month (E x Utility Rate)	Retrofit G Watts	Retrofit H kWh per Month (B x C x G x 0.03)	Retrofit I Cost per Month (H x Utility Rate)	J Savings (F-I)
Electric Range									
Washing Machine									
Clothes Dryer									
Dishwasher									
Refrigerator									
Separate Freezer									
Portable Electric Heater									
Television									
Satellite or Cable TV Unit									
Stereo									
Microwave Oven									
Toaster									
Coffee Maker									
Pump (Well, Sump or Septic)									
Lights (specify room _____)									
Lights (specify room _____)									
Lights (specify room _____)									
Lights (specify room _____)									
Other loads (specify _____)									
Other loads (specify _____)									
		TOTAL							

Electrical Inspection Form **Yurok Energy Program**

Resident Name _____ Inspector Name _____Date _____

Utility Hookup Requirements

Indicate equipment present:

weatherhead with wiring ☐ Yes ☐ No Comment _____

electric meter socket ☐ Yes ☐ No Comment _____

main breaker/fuse box ☐ Yes ☐ No Comment _____

Main Panel

Are individual branch circuits equipped with breakers/fuses? ☐ Yes ☐ No

Is breaker/fuse panel in an appropriate & accessible location? ☐ Yes ☐ No

Are circuits/loads adequately distributed & clearly identified on panel? ☐ Yes ☐ No

Is electrical service grounded? How? _____ ☐ Yes ☐ No

Wiring (where visible)

Wiring type: NM (Romex) / Knob and Tube / Wire in Conduit / Other _____

Are wiring and insulation in overall good condition? ☐ Yes ☐ No

Are there surface wire runs on walls, ceiling or floor (not enclosed in conduit)? ☐ Yes ☐ No

Are wall outlets, wall switches and light fixtures securely installed? ☐ Yes ☐ No

Outlets/Switches

Are outlets and switches in working order? ☐ Yes ☐ No

Do outlets appear to be overloaded with too many appliances plugged in? ☐ Yes ☐ No

Extension Cords

Are extension cords being used as a substitute for permanent wiring? ☐ Yes ☐ No

Are extension cords secured with nails or staples to wall? ☐ Yes ☐ No

Do extension cords appear to be overloaded? ☐ Yes ☐ No

Summary Evaluation – What Is Needed for Grid-Connection?

☐ Nearly ready ☐ Moderate work (e.g. new panel) ☐ Serious work (e.g. major rewiring)

Note Any Problems/Comments:

Yurok Energy Program
Site Assessment for Solar and Microhydro Resource Potential

Client Name: _____ **Date**: _____

Solar

1. Is the roof of the residence an acceptable location for a PV array? Y N
(no serious shading, o.k. structural integrity, adequate available space, acceptable slope)

2. Roof orientation (degrees SE or SW)_____

3. Assess roof or adjacent location using Solar Pathfinder™ (attach photo). Note any issues about solar access (e.g. expected future tree growth that would need to be managed).

_____

Assess other potential solar collector sites if appropriate:

4. Note location relative to residence (north, south, east, west). _____

5. Note approximate distance to residence. _____

6. Describe the conditions of the location: flat or sloped terrain, thick brush, rocky, swampy, etc. Note any issues that would make installation of a collector rack difficult.

_____

7. Assess ground location using Solar Pathfinder™ (attach photo). Note any issues about solar access (e.g. expected future tree growth that would need to be managed).

_____

Microhydro

1. Is there a creek nearby? Y N Is it on the resident's property? Y N

2. Approximate distance to residence? _____

3. Is the creek currently used for:
Potable water supply *Irrigation water* *Other:*_____ *None*

4. What sort of facilities associated with the creek currently exist?
Water storage tank *Water supply pipe* *Water diversion* *Other:*_____

5. What is the approximate flow in the creek currently?
High flow (>100 gpm) *Medium flow (10 to 100 gpm)* *Low flow (<10 gpm)*

6. How does the wintertime flow compare with the current flow?_____

7. What sort of elevation head is available between the creek and the residence in the nearby vicinity?
High head (>50 feet) *Medium head (10 to 50 feet)* *Low head (<10 feet)*

Renewable Energy System Assessment

Client Name: _____ **Date**: _____

Client Questions:

Are you happy with your system? Y / N Who maintains it? *No one / resident / other:* _____

How long ago was your system installed? _____

Are or have you experienced any problems with your system within the last year? Y / N

Explain: _____

Have you replaced any major equipment? Y / N If so, what and when? _____

_____

On a typical day how many hours do you run your generator during the …

summer? _____ spring/fall? _____ winter?_____

When did you last change the oil in your generator? _____

Do you maintain the water in your batteries? Y / N Type of water used? *Distilled / other:* _____

When did you last check the level of water in your batteries? _____

Do you give your batteries an equalization charge periodically? Y / N

When did you last equalize your batteries? _____

If you have microhydro, how many months of the year does it operate? _____

System Type: ☐ PV ☐ Microhydro ☐ Other _____

PV Modules: Manufacturer _____ Model _____

Rating: STC watts _____ (OPTIONAL: Voc _____ Isc_____)

Total # of modules in PV array _____

Batteries: Type: ☐ vented lead-acid ☐ sealed lead-acid ☐ Other _____

Manufacturer _____ Model _____

Individual battery voltage _____ Rating (amp-hours) _____

Battery dimensions (LxWxH): _____
(if no information available on model and AH rating)

Batteries in series per string_____ # Strings in parallel _____

Charge Controller: Manufacturer _____ Model _____ Rating (amps) _____

Diversion Controller: Manufacturer _____ Model _____ Rating (amps) _____

Diversion Load: Type _____ Rating (watts) _____

Inverter: Manufacturer _____Model _____Rating (watts continuous) _____

Generator: Fuel Type _____Make/Model _____Rating (watts) _____

☐ TAKE PHOTOGRAPHS OF ALL SYSTEM COMPONENTS

PV System Assessment

Shading

☐ Assess shading of array with Pathfinder (*take picture, label picture with residents name*).

Do trees or shrubs need to be trimmed? Y / N Were they trimmed during site visit? Y / N

System Condition

PV Array:

Are any PV modules broken or damaged? Y / N Do modules need to be cleaned? Y / N

Power Center:

Is there an earth ground rod and is it intact? Y / N

Is there a disconnect switch between the array and the rest of the system? Y / N

Is there a fuse(s) or circuit breaker(s) between the array and the rest of the system? Y / N

Is there a disconnect switch between the batteries and the rest of the system? Y / N

Is there a fuse(s) or circuit breaker(s) between the batteries and the rest of the system? Y / N

All wiring looks secure and in good condition? Y / N

All components are securely mounted and are protected from the elements? Y / N

Note comments or problems:

System Operational Status *(measure the following parameters while the system is operating)*

Array voltage _____ V Array current _____ A

Battery voltage _____ V Battery current _____ A Charging / Discharging?

Charge controller status *(check controller indication, if any):*

☐ Charging ☐ Fully charged/floating ☐ Low voltage disconnect ☐ No indication

If system has an amp-hour counter, how many amp-hours from full are the batteries?_____

Battery Assessment

Battery tops are clean and dry and caps are secure? Y / N

Battery connections are secure and relatively corrosion free? Y / N

Battery enclosure, racks, and tie downs are in good condition? Y / N

Battery enclosure is adequately ventilated? Y / N

Is there a temperature compensation probe installed? Y / N / don't know

Are the electrolyte levels in the batteries adequate? Y / N Added distilled water? Y / N

Draw a schematic of the battery bank and number the batteries and cells, then measure and record the voltage for each battery. Measure the specific gravity for every cell in one battery and at least one or two cells in every other battery.

BATTERY OPEN CIRCUIT VOLTAGE RECORD

(APPLY THE TEMPERATURE CORRECTION TO THE MEASURED SPECIFIC GRAVITY BEFORE RECORDING IT ON THIS SHEET.)

Battery # ___	Specific Gravity	Voltage
Cell # 1	___________	
Cell # 2	___________	
Cell # 3	___________	
Cell # 4	___________	
Cell # 5	___________	
Cell # 6	___________	

Battery # ___	Specific Gravity	Voltage
Cell # 1	___________	
Cell # 2	___________	
Cell # 3	___________	
Cell # 4	___________	
Cell # 5	___________	
Cell # 6	___________	

Battery # ___	Specific Gravity	Voltage
Cell # 1	___________	
Cell # 2	___________	
Cell # 3	___________	
Cell # 4	___________	
Cell # 5	___________	
Cell # 6	___________	

Battery # ___	Specific Gravity	Voltage
Cell # 1	___________	
Cell # 2	___________	
Cell # 3	___________	
Cell # 4	___________	
Cell # 5	___________	
Cell # 6	___________	

Battery # ___	Specific Gravity	Voltage
Cell # 1	___________	
Cell # 2	___________	
Cell # 3	___________	
Cell # 4	___________	
Cell # 5	___________	
Cell # 6	___________	

Battery # ___	Specific Gravity	Voltage
Cell # 1	___________	
Cell # 2	___________	
Cell # 3	___________	
Cell # 4	___________	
Cell # 5	___________	
Cell # 6	___________	

Battery # ___	Specific Gravity	Voltage
Cell # 1	___________	
Cell # 2	___________	
Cell # 3	___________	
Cell # 4	___________	
Cell # 5	___________	
Cell # 6	___________	

Battery # ___	Specific Gravity	Voltage
Cell # 1	___________	
Cell # 2	___________	
Cell # 3	___________	
Cell # 4	___________	
Cell # 5	___________	
Cell # 6	___________	

Microhydro System Assessment

Intake

Free of debris? Y / N (clear out as needed)

Proper alignment? Y / N (adjust as needed)

Condition of intake/headworks? _____

Penstock/Supply Line (walk the line)

Condition of penstock? _____

Adequately supported? Y / N

Operating Parameters

Is system operating? Y / N Dynamic pressure reading at turbine (if available) _____

Generator voltage_____ Generator current_____

Battery voltage _____ Battery current _____ Charging / Discharging?

Diversion load controller status? _____

Is power being dissipated? Y / N Power dissipation (watts) _____

Turbine and Generator

Type _____Make/Model _____Rating (watts) _____

# of nozzles _____ Shutoff valves? Y / N Noisy operation? Y / N
Tailrace (discharge from turbine) is clear and allows water to drain freely? Y / N

Diversion Load

Adequate? Y / N Condition? _____

System Condition

Is there an earth ground rod and is it intact? Y / N

Is there a disconnect switch between the generator and the rest of the system? Y / N

Is there a fuse or circuit breaker between the generator and the rest of the system? Y / N

Is there a disconnect switch between the batteries and the rest of the system? Y / N

Is there a fuse or circuit breaker between the batteries and the rest of the system? Y / N

All wiring looks secure and in good condition? Y / N

All components are securely mounted and are protected from the elements? Y / N

NOTE: Make sure you complete the Battery Assessment

Generator Assessment

Is the generator located immediately adjacent to the house? Y / N

Does it pose a CO hazard? Y / N Is there adequate ventilation? Y / N

Is there adequate protection from the weather? Y / N

Generator Start? *Automatic / Manual* ?

CHECK OIL

Proper oil level? Y / N Oil condition? *Clean / dirty* Need oil change? Y / N

CHECK AIR FILTER (if appropriate)

Air filter condition? Clean / dirty Need air filter change? Y / N

CHECK COOLANT (if appropriate)

Proper coolant level? Y / N Coolant condition o.k.? Y / N

Need to add or change coolant? Y / N

Battery Charging:

Is there a separate battery charger? Y / N / ? Does the inverter have a battery charger? Y / N / ?

If separate: Manufacturer _____ Model _____ Rating (amps) _____

Yurok Tribe
Energy Program
(707) 482-1350 ext. 363

Home Energy Survey and Recommendations

Client Name _____ Community _____

Auditor Name _____ Date _____

The following recommendations are provided to help you reduce your home energy costs and improve your family's comfort and safety. Please contact us at the above phone number with any questions.

Insulation

Ceiling/Roof	R- _____	Add R-_____ ☐ _____
Walls	R- _____	Add R-_____ ☐ _____
Floor	R- _____	Add R-_____ ☐ _____
Windows	U- _____	☐ Add Storm or Replace w/ Double Pane
Heating/Cooling Ducts	☐ Insulate	☐ _____
Attic Access Hatch	☐ Insulate	☐ Weatherstrip ☐ _____

Other: _____

Heating

Furnace/Heater	☐ Replace Filter ☐ Tune-Up ☐ Replace
Thermostat Control	☐ Programmable ☐ Reset to ___°F
Disconnected Ducts	☐ Reconnect Ducts ☐ _____
Leaking Ducts	☐ Reduce Duct Leakage ☐ _____

Other: _____

Air Leaks

Windows – weatherstrip	☐ _____
Windows – caulk	☐ _____
Doors – weatherstrip	☐ _____
Doors with Glass – caulk	☐ _____
Fireplace/Woodstove	☐ Reduce Leakage ☐_____

Penetrations: ☐ Electric Outlets ☐ Plumbing ☐ _____

Other: _____

Water Heater

Water Heater & Pipes	☐ Insulate ☐ Replace ☐ _____
Thermostat Control	☐ Reset to ___°F ☐ _____
Shower Heads	☐ Low Flow ☐ _____

Other: _____

Lighting

Indoor Lights	☐ Convert to _____
Outdoor Lights	☐ _____
_____	☐ _____

Appliances

Refrigerator/Freezer ☐ Set Refrig. to 34-36°F ☐ Set Freezer to 0-10°F ☐ Replace
Clothes Washer/Dryer ☐ Replace ☐ _____
Phantom Loads ☐ Use power strip ☐_____
Pumps ☐ Service/Replace ☐ Put on timer ☐ _____
Other: _____

Other Energy Uses

_____ ☐ _____
_____ ☐ _____

Health and Safety

☐ Install smoke alarm ☐ Install carbon monoxide alarm
☐ Upgrade wiring ☐ Abate moisture/mold
☐ Clean wood stovepipe ☐ Increase clearance for wood stove &/or stovepipe
☐ Generator needs to be relocated for proper ventilation
Hazardous materials: ☐ Asbestos ☐ Suspected lead paint peeling
☐ Other hazardous material or condition: _____

Financial and Energy Assistance

(We can help you apply for any of the following programs that are available in your area)

☐ CARE (20% discount on monthly energy bill) ☐ Balanced Payment Plan
☐ Energy Partners ☐ FERA
☐ Medical Baseline ☐ Third Party Notification
☐ Sierra Service Project ☐ RCAA/DNSC WAP Weatherization

Alternative Energy System

☐ Clean solar electric panels ☐ Trim trees/brush to eliminate shading of solar panels
☐ Maintain battery water level ☐ Perform battery equalization charge every two months
☐ Batteries need serious charging: reduce loads in winter, run generator to charge batteries
☐ Change oil on generator ☐ Other generator work: _____
☐ Microhydro electric system needs repair: _____
☐ Other: _____

Additional Comments

Appendix 4: Executive summaries from audit reports on Klamath and Weitchpec offices (full reports were provided to the Tribe separately)

Energy Audit of Yurok Tribal Office At Klamath, CA

Report prepared by Richard Engel, Schatz Energy Research Center

Executive Summary

On September 20, 2006 Dustin Jolley of the Yurok Tribe Planning Department and Richard Engel of the Schatz Energy Research Center visited the Yurok Tribal Office at Klamath, CA and performed a walk-through energy audit of the facility with on-site assistance from facility maintenance staff member Dewey Myers. This report presents our findings and recommendations for reducing energy use and energy costs and making use of solar electricity at the Klamath office. The purpose of this audit was to identify qualitatively areas where the Tribe may be able to realize energy cost savings. Further analysis is necessary to quantify potential costs and savings.

Our key finding is that energy use and costs are higher than expected for a building of this size, type, and recent vintage. The following is a summary list of recommendations that we expect to help address this condition, while improving user comfort and performance of the building's equipment:

- Investigate the cost and savings potential for performing a professional, comprehensive retro-commissioning of the entire building, with special attention to heating, ventilating and air conditioning (HVAC), electrical system, and building shell diagnostics.
- Consider additional training for building maintenance staff. A 56-hour course in Building Operator Certification is tentatively planned to take place in Eureka beginning spring 2007.
- Evaluate and pursue *one* of the following two strategies:
    - Investigate the feasibility and cost-effectiveness of replacing the building's decentralized heating and cooling system with an efficient, centralized HVAC system incorporating a boiler and chiller.
    - Maintain the existing HVAC system configuration, but develop a strategy for replacing existing inefficient heating and cooling equipment with high-efficiency substitutes as funding permits.
- Analyze building circuits and correctly label breakers in the electrical service panels.
- Inspect exterior doors and rehang or re-weatherstrip the doors as needed to reduce air infiltration between and beneath the doors.
- Investigate opportunities to reduce heat loss through the attic above the kitchen by installing operable louvers on passive ventilation openings in attic.
- Inspect windows throughout the building. Identify failed double-pane windows and consult with building contractor and/or manufacturer to pursue replacement under warranty where needed.
- Inspect trim around exterior doors and windows and caulk where needed.
- Where glare is a problem, use window film with low u-value, moderate solar heat gain coefficient, and the highest visible transmittance that sufficiently cuts glare.
- Consider reconfiguring thermostat control in some areas to avoid adjacent HVAC systems "fighting" each other, i.e. simultaneously heating and cooling the same

space, or trying to simultaneously satisfy contrasting climate control needs in adjacent spaces.

- Service the malfunctioning condensing unit identified in this report, which periodically ices up.
- Inspect and, if needed, repair the HVAC duct serving the Council support offices.
- Adjust the walk-in cooler temperature to a lower setting to avoid food spoilage.
- Implement a strategy to avoid backfeeding hot water into the building's cold water lines.
- Modify the plumbing associated with the dishwasher circulation pump to avoid crossfeeding scalding water into the tempered hot water line.
- Insulate all hot water pipes where accessible.
- Perform a lighting satisfaction survey and measure light levels to determine where delamping or use of additional task lighting is appropriate.
- Repair timer control circuits on outdoor lighting.
- Inspect and repair rain-damaged outdoor light fixtures.
- Consider unplugging the building's drinking water cooler/heaters and implementing alternative strategies for heating and chilling water.
- Consolidate refrigerator loads and unplug unneeded units. Make sure refrigerators with rear coils are pulled away from the wall to permit air circulation.
- Specify Energy Star office equipment and make sure automatic power saving features are enabled. Encourage use of laptop computers and LCD monitors.
- Discourage unnecessary use of electric space heaters. Help staff to acquire and use energy-saving alternatives.
- Purchase energy-saving occupancy sensor switch to power down vending machine that sells non-perishable products.
- Consider installing a rooftop solar electric and/or solar hot water system.

Energy Audit of Yurok Tribal Office At Weitchpec, CA

Report prepared by Richard Engel, Schatz Energy Research Center

Executive Summary

On September 6, 2006 Dustin Jolley and Stephen Kullmann of the Yurok Tribe Planning Department and Jim Zoellick and Richard Engel of the Schatz Energy Research Center visited the Yurok Tribal Office at Weitchpec, CA and performed an energy audit of the facility. This report presents our findings and recommendations for reducing energy use and/or energy costs and making use of solar electricity at the Weitchpec office.

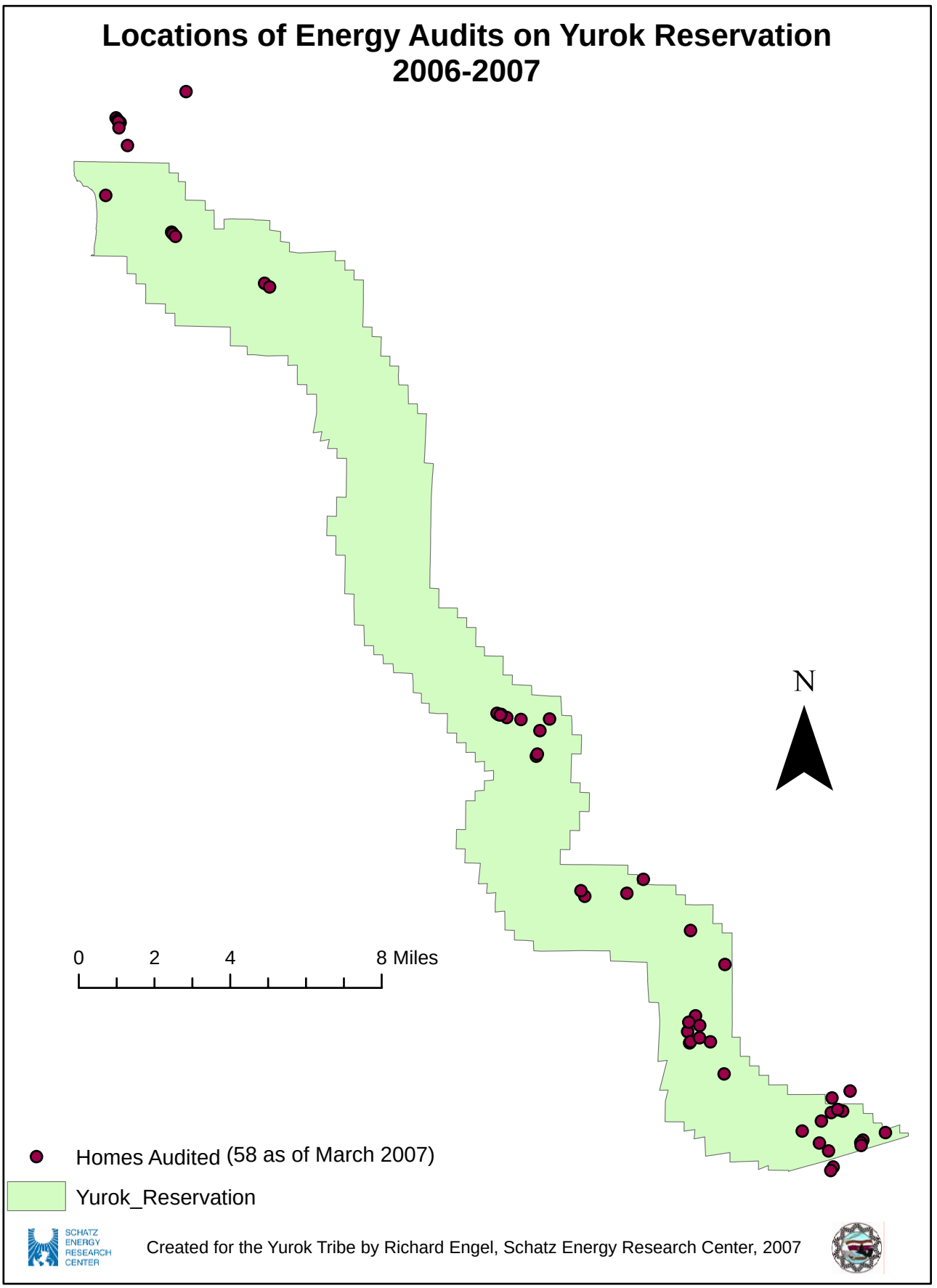
Our key energy recommendations include:

- Providing shading on the air conditioning units' outdoor condensers is expected to yield $100 to $150 per year in energy cost savings. Since the deck extension already planned will provide this shade with no extra capital expenditure, payback on this measure will be instantaneous.
- Reducing the number of fluorescent tubes used in some overlit rooms and adding automatic occupancy sensing switches where appropriate would cost approximately $2,300 and save $582 per year, yielding a 4-year payback.
- Installing a rooftop solar electric system could generate some 15,000 to 17,000 kWh per year, worth approximately $2,500 in avoided electric costs. Further analysis of this opportunity is recommended.
- Enabling power saver standby modes on computers and computer monitors can save $25 to $75 per year at each work station. Implementation costs nothing.

The Weitchpec office is located at the junction of Highway 96 and Highway 169 in north-central Humboldt County. It is a single-story wood-frame building built on a raised foundation with a partial basement (see Figure 1 at end of report). The conditioned space is 5,520 ft^2. The facility was constructed in 1999. Tribal departments using the facility include public safety, fisheries, social services, education, fire, and planning. A satellite clinic of United Indian Health Services (UIHS) is also located at the office. The east and west wings of the building house offices, the health clinic, a fisheries laboratory, restrooms, and a small commercial-type kitchen. The south wing of the building is a single large community meeting room with window walls making up the east, south and west sides. The basement is located beneath the community room.

Appendix 5: Map of audit locations

Locations of Energy Audits on Yurok Reservation 2006-2007



SCHATZ ENERGY RESEARCH CENTER

Created for the Yurok Tribe by Richard Engel, Schatz Energy Research Center, 2007

Appendix 6: Tabulation of data from field energy assessments

Tabulation of Energy Needs Assessment Field Data
for Yurok Human Capacity Building Project
Compiled July 24, 2007
Notes: Where data are given as averages or percentages, these values are calculated based on number of responses to that specific question. The term "home" is used throughout to refer to the buildings surveyed, although five of the 58 buildings are not residences.

Summary Data
Total Number of facilities surveyed: 58
Residences: 53 (91%)
Community/Tribal facilities: 5 (9%)
Home location: Upriver = 43 (74%), Downriver = 15 (26%)
Total occupants in all homes surveyed: 155
Average number of occupants per home: 2.9
Number of elderly occupants: 25 (16% of all residents)
Number of children: 30 (19% of all residents)
Number of disabled occupants: 6 (4% of all residents)
Own: 51 of 55 (93%); Rent: 4 of 55 (7%)
Site built: 43 of 58 (74%); Mobile/modular: 15 of 58 (26%)
Average year built: 1970

Heating Fuels
Out of 52 sites evaluated

fuel	primary	secondary
wood	35 (67%)	3 (13%)
propane	10 (19%)	5 (22%)
kerosene	3 (6%)	9 (39%)
electricity	3 (6%)	5 (22%)
oil/diesel	1 (2%)	1 (4%)

Inspection for Utility Connection Readiness (Off-Grid Homes Only)
Number performed: 16

Feature	Number that have
Weatherhead	2 (13%)
Meter Socket	4 (25%)
Main Breaker Box	9 (56%)
Branch Circuits Equipped with Breakers	6 (38%)
Wiring in Good Condition	12 (75%)
Ext. Cords Instead of Permanent Wiring	3 (19%)

Summary evaluation: Near ready for utility power = 7 (44%); Need moderate work = 4 (25%); Need serious work = 6 (38%)

Site Assessment for Photovoltaics and Microhydro Potential

Solar Site Assessment	Number of responses	Number of "Yes" responses (or average numeric value)		
Roof o.k. for PV	41	25 (61%)		
Ground site o.k. for PV	37	30 (81%)		
PV Distance to House (feet)	25	34.2 ft.		
Microhydro Assessment				
Creek Nearby and On Resident's Property	40	11 (28%)		
		high	med	low
Appx. Head	10	6 (60%)	3 (30%)	1 (10%)
Creek Used for Water Supply	11	10 (91%)		
		high	med	low
Approx. Flow in Creek (High/Med/Low)	9	5 (56%)	4 (44%)	0

Note: The following ranges were used to classify head and flow
High head: >50 feet Medium head: 10 to 50 feet Low head: <10 feet
High flow: >100 gpm Medium flow: 10 to 100 gpm Low flow: <10 gpm
(gpm = gallons per minute)

Renewable/Off-Grid Energy System Evaluation
Number of systems evaluated: 13
Number of systems using renewable energy: 11 (85%)
Breakdown by system type: 6 solar (55%), 1 microhydro (9%), 4 solar/microhydro hybrid (36%)
Number of generator-only systems: 2 (15%)
Client Questions
Number happy with system: 10 out of 11 (91%)
Number where resident maintains own system: 8 out of 11 (73%)
Average system age: 13.3 years
Number reporting problems in past year: 6 out of 11 (55%)
Number having replaced major equipment: 8 out of 11 (73%)
Number that have replaced battery: 7 out of 11 (64%)
Number that have replaced inverter: 4 out of 10 (40%)
Average number of hours per week generator is run: 10
Number who maintain water level in batteries: 9 out of 11 (82%)
Number who use distilled water in batteries: 9 out of 9 (100%)
Number who equalize their batteries: 1 out of 9 (11%)
Average number of months per year microhydro system runs: 10

Equipment Specs
Average PV array size (DC Watts): 672
Battery bank average capacity (Amp-hours): 742
Number of systems including diversion load: 3 out of 11 (27%)
Average inverter rated Watts: 2,750
Average generator rated Watts: 3,900
Generator fuel: propane = 2 out of 9 (22%); gasoline = 7 out of 9 (78%)
PV Assessment
Number of homes where trees need to be trimmed: 3 out of 10 (30%)
Number of homes where modules need to be cleaned: 3 out of 10 (30%)
Number of homes where other problems were identified: 3 out of 10 (30%)
Battery Assessment
Number of homes where electrolyte level in batter is adequate: 8 out of 11 (73%)
Average battery voltage for nominal 6V batteries: 6.74 V (6 homes total)
Average battery voltage for nominal 12V batteries: 12.46 V (2 homes total)
Highest battery specific gravity: 1.25 (10 homes total)
Lowest battery specific gravity: 1.16 (10 homes total)
Number of homes where battery problems were identified: 3 out of 10 (30%)
Microhydro Assessment
Number of homes where intake is OK: 3 out of 3 (100%)
Number of homes where penstock is OK: 4 out of 4 (100%)
Number of homes where system is operating: 3 out of 5 (60%)
Number of homes where problems with system are reported: 1 out of 4 (25%)
Generator Assessment
Number of homes where carbon monoxide problem is present: 1 out of 13 (77%)
Number of homes where generator is adequately protected from weather: 13 out of 13 (100%)
Number of homes where proper oil level is maintained in generator: 11 out of 11 (100%)
Number of homes where generator needs oil change: 0 out of 11 (0%)
Number of homes using separate battery charger: 1 out of 11 (9%)

Recommendations to Client

Recommendation	Number Evaluated	Number of "Yes" Recommendations
Add insulation	23	11 (48%)
Repair/replace heating system	21	3 (14%)
Fix air leaks	24	12 (50%)
Repair/replace water heater	21	8 (38%)
Repair/replace lighting	26	21 (81%)
Repair/replace appliances	20	3 (15%)
Install/replace smoke alarm	26	18 (69%)
Install/replace CO alarm	25	19 (76%)
Make wiring upgrade	20	5 (25%)
Woodstove – clean or increase clearance	19	2 (11%)
Relocate generator	18	0 (0%)
Refer for energy assistance - any program	19	5 (26%)
Provide maintenance for alternative energy system	14	2 (14%)

Program Referrals Made

CARE: 2
Balanced Payment Plan/Equal Pay: 1
Medical Baseline: 1
Energy Partners: 2
FERA (Family Electric Rate Assistance): 1
REACH: 1
Third Party Notification: 1
LIHEAP: 1
RCAA/DNSC Weatherization: 5

NEAT Supplemental Form

Mean latitude	39.18677759		
Mean longitude	117.4328009		
Mean elevation (ft)	505.137931		
	tight	medium	loose
Visual estimate of house tightness	8 (30%)	14 (52%)	5 (19%)
	community	individual pumped	individual gravity
Water system type	23 (45%)	3 (6%)	25 (49%)
Homes served by electric utility	34 (59% of all homes)		
Homes served by PG&E	19 (33% of all homes)		
Homes served by PP&L	15 (26% of all homes)		
Homes that signed utility data release	17 (50% of utility served homes)		
Homes with renewable energy systems	11 (19% of all homes)		
	Value	Number of homes responding	
Typical Electric Bill ($)	54.8	24	
Propane Tank(s) (Gal)	190.4	41	
# Months to Use Prop Tank	3.0	31	
gal/mo	64.4	N/A	
Kerosene Tank (Gal)	212.2	9	
# Months to Use Kerosene Tank	4.0	11	
gal/mo	53.7	N/A	
Cords Wood per Year	3.7	34	

NEAT (efficiency audit for site-built homes)
Stories: 1 story = 21 out of 36 (58%), 2 stories = 15 out of 36 (42%)
Average floor area = 1349 ft2
Average year built = 1963

Exterior Type
wood = 35 out of 37 (95%)
stucco = 0 out of 37 (0%)
metal/vinyl = 0 out of 37 (0%)

brick/stone = 0 out of 37 (0%)
other = 2 out of 37 (5%)

Existing Wall Insulation
blown cellulose = 1 out of 31 (3%)
blown fiberglass = 0 out of 31 (0%)
fiberglass batts = 14 out of 31 (45%)
none = 7 out of 31 (23%)
other = 9 out of 31 (29%)
Average wall insulation R value = 7.4 (measured at 12 homes)

Windows
average number per house: 13.0
wood or vinyl: 19 out of 37 (51%)
metal: 18 out of 37 (49%)
single glazing: 17 out of 37 (46%)
double glazing: 20 out of 37 (54%)
leakiness (out of 33 evaluated):
very tight = 5 (15%); tight = 11 (33%); medium = 7 (21%); loose = 8 (24%); very loose = 2 (6%)

Doors
average number per house: 2.3
Principal type (out of 38 evaluated):
wood hollow core = 9 (24%); wood solid core = 16 (42%); steel insulated = 6 (16%); sliding glass = 7 (18%)

Attic
Type (out of 32 evaluated): finished = 0 (0%); unfinished = 32 (100%)
Average area = 883 ft2
existing insulation = 6.75 inches

Foundation
Average area: 1,163 ft2
Average insulation R value (out of 21 evaluated) = 2.6

Primary Heating System
Type (out of 35 evaluated):
gravity furnace = 0 (0%)
forced air furnace = 5 (14%)
electric resistance heating = 3 (9%)
heat pump =0 (0%)
vented space heater (including wood stove) = 27 (77%)
unvented space heater = 0 (0%)

fuel	Users (out of 39 evaluated)
wood	25 (64%)
electricity	3 (8%)
propane	5 (13%)
kerosene	6 (15%)

Cooling System
Type (out of 35 evaluated):
central: 2 (6%)
window: 2 (6%)
heat pump: 0 (0%)
evaporative: 3 (9%)
none: 28 (80%)

Water Heater
Type (out of 28 evaluated):
electric: 5 (18%); propane: 23 (82%); other: 2 (7%)
average capacity (gallons): 35
average input (kBTUH): 32
Tank R value (out of 5 evaluated): 12
number of water heaters in need of insulation blanket: 7 (25%)

Refrigerator
Average size (out of 25 evaluated): 14.5 ft3
Age (years): <5 yrs: 11 (44%); 5-10 yrs: 9 (36%); 10-15 yrs: 4 (16%); >15 yrs: 1 (4%)
Door seal condition: good: 11 (44%); some wear: 12 (48%); gaps visible: 2 (8%)

Lighting
Main indoor type (out of 35 evaluated):
incandescent: 17 (49%); CFL: 11 (31%); tube fluorescent: 7 (20%); kerosene: 0 (0%); propane: 0 (0%)
Main outdoor type (out of 20 evaluated):
incandescent: 14 (70%); CFL: 6 (30%); HID: 0 (0%)

MHEA (efficiency audit for mobile and modular homes)
Dimensions (out of 15 evaluated)
Average length (ft): 55
Average width (ft): 28
Average height (ft): 8.5
Average floor area (ft2): 1540
Wind shielding (out of 20 evaluated): well shielded: 8 (40%); normal: 10 (50%); exposed: 2 (10%)
Leakiness estimate (out of 13 evaluated): tight: 7 (54%); medium: 4 (31%); loose: 2 (15%)
Number of outdoor water heaters: 3

Walls
Stud size (out of 11 evaluated): 2 X 2: 1; 2 X 4: 7; 2 X 6: 3
Long axis of house orientation: east-west: 8 (67%); north-south: 4 (33%)

Windows
Average number per house: 10.9
North facing: 2.8 (26%)
South facing: 3.4 (31%)
East facing: 2.0 (18%)
West facing: 2.8 (26%)
Frame type (most common in each home, out of 11 evaluated):
jalousie: 1 (9%); awning: 0 (0%); slider: 10 (91%); fixed: 0 (0%); door window: 0 (0%); sliding glass: 0 (0%)
Glazing (out of 11 evaluated): single 4 (36%); double 7 (64%)
Leakiness: very tight: 2 (18%); tight: 4 (36%); medium: 2 (18%); loose: 3 (27%); very loose: 0 (0%)

Doors
Average number per house: 4.2
North facing: 1.0 (24%)
South facing: 1.1 (26%)
East facing: 1.0 (24%)
West facing: 1.0 (24%)
Type (out of 12 evaluated): wood solid: 2 (17%); wood hollow: 0 (0%); std manufactured home door: 10 (83%)

Ceiling/Roof
Type (out of 15 evaluated): flat: 3 (20%); bowstring: 0 (0%); pitched: 12 (80%)
Roof color (out of 14 evaluated): white/reflective: 3 (21%); normal/weathered: 11 (79%)
Insulation type (out of 1 evaluated): batt/blanket, 10 inches

Floor
Number equipped with skirt (out of 13 evaluated): 10 (77%)
Belly condition (out of 11 evaluated): good: 5 (45%); fair: 5 (45%); poor: 1 (9%)
Insulation type (out of 7 evaluated): batt/blanket: 7 (100%); loose fill: 0 (0%); foam core: 0 (0%)
Average insulation thickness (out of 4 evaluated, inches): 6.25

Space Heating System
Primary heating system (out of 15 evaluated): furnace: 5 (33%); heat pump: 0 (0%); space heater (incl. wood stove): 10 (67%); none: 0 (0%)

fuel	Users (out of 17 evaluated)
wood	9 (53%)
electricity	1 (6%)
propane	5 (29%)
kerosene	1 (6%)
other	1 (6%)

average output capacity (out of 2 evaluated, kBTUH): 25.3
average steady state efficiency (out of 1 evaluated): 80.2
duct location (out of 6 evaluated): floor: 5 (83%); ceiling: 1 (17%)
duct insulation location (out of 3 evaluated): around duct: 3 (100%)

Cooling System
Type (out of 16 evaluated): central: 2 (13%); window: 1 (6%); heat pump: 0 (0%); evaporative: 1 (6%); none: 12 (75%)

Water Heater
Type (out of 18 evaluated): electric: 4 (22%); propane: 14 (78%)
Average storage capacity (out of 11 evaluated): 39.5
Average rated input for electric water heaters (out of 2 evaluated, kW): 4.5
Average rated input for propane water heaters (out of 10 evaluated, kBTUH): 29.1
Average label R value (out of 5 evaluated): 7.78
Average number of showerheads per household (out of 14 evaluated): 1.6
Average shower flow rate (out of 7 evaluated): 1.9 gpm
Number of homes in need of an insulation blanket: 4 (7% of all homes)

Refrigerator
Average size (out of 15 evaluated): 13.8 ft3
Label kWh per year (out of 2 evaluated): 293.5
Age (years): <5 yrs: 9 (69%); 5-10 yrs: 2(15%); 10-15 yrs: 1 (8%); >15 yrs: 1 (8%)
Door seal condition: good: 6 (50%); some wear: 5 (42%); gaps visible: 1 (8%)

Lighting
Main indoor type (out of 17 evaluated):
incandescent: 9 (53%); CFL: 4 (24%); tube fluorescent: 4 (24%); kerosene: 0 (0%); propane: 0 (0%)
Main outdoor type (out of 5 evaluated):
incandescent: 5 (100%); CFL: 0 (0%); HID: 0 (0%)

Appendix 7: Summary data on Solar Pathfinder reports

Solar Pathfinder Trace Summary

Potential Solar Radiation (per Pathfinder software, sum of daily averages for each of 12 months)

at Hoopa: 53.68 kWh/m2/day

at Klamath: 53.60 kWh/m2/day

#	Household/Facility	File Name	Has solar?	Pathfinder location	Actual Solar Rad (sum of daily avg. values for each of 12 mos) kWh/m2/day	Daily Average Solar Rad kWh/m2/day	% of potential	
1	Helen Billy	Billy 003	no	on ground, S side of house	44.28	3.69	82.49%	
2	Helen Billy	Billy 004	no	on ground, S side of house	43.82	3.65	81.63%	
3	Helen Billy	Billy 005	no	on ground, S side of house	43.73	3.64	81.46%	
4	Child Care Center	Child Care 0397	no	on ground, near NW corner of building	27.71	2.31	51.70%	
5	Charlene Colegrove	Colegrove 114	no	on ground, S side of house	48.19	4.02	89.77%	
6	Bill Crutchfield	Crutchfield 166	yes	on roof	50.57	4.21	94.21%	
7	Everetta Myers	Everetta Myers 386	no	on ground, across driveway W of house	43.06	3.59	80.22%	
8	Fisheries (Klamath)	Fisheries 404	no	on concrete entry ramp outside building	8.04	0.67	15.00%	
9	Forestry (Klamath)	Forestry 382	no	on concrete ramp to entry	7.87	0.66	14.68%	Minimum
10	Frankie Joe Myers	Frankie Joe Myers 142	no	40' S of S side of house	39.40	3.28	73.40%	
11	Frankie Joe Myers	Frankie Joe Myers 143	no	40' S of S side of house	39.85	3.32	74.24%	
12	Wanda and David Gensaw	Gensaw 332	no	in front yard next to driveway	49.63	4.14	92.59%	
13	Virgil Green Jr.	Green 442	no	on ground, just downhill from house	47.71	3.98	88.88%	
14	Helen Gibbens	Gibbens 263	yes	On roof near solar array	49.11	4.09	91.49%	
15	Helen Gibbens	Gibbens 264	yes	On roof near solar array	48.69	4.06	90.70%	
16	Helen Gibbens	Gibbens 266	yes	On roof near solar array	51.22	4.27	95.42%	
17	Helen Gibbens	Gibbens 267	yes	On roof near solar array	48.87	4.07	91.04%	
18	Eliot Henry	Henry 139	no	on mini deck, ~30' N of house	31.44	2.62	58.57%	
19	Patsy Hunsucker	Hunsucker 317	no	on deck on SW side of house	50.67	4.22	94.39%	
20	Patsy Hunsucker	Hunsucker 318	no	on deck on SW side of house	52.20	4.35	97.24%	
21	Patsy Hunsucker	Hunsucker 319	no	on deck on SW side of house	51.35	4.28	95.66%	
22	Jack Norton School	Jack Norton School 205	no	on roof	47.81	3.98	89.06%	
23	Jack Norton School	Jack Norton School 206	no	on roof	47.95	4.00	89.33%	
24	Jack Norton School	Jack Norton School 200	no	on roof	41.32	3.44	76.97%	
25	Jack Norton School	Jack Norton School 202	no	on roof	48.16	4.01	89.72%	
26	Jack Norton School	Jack Norton School 203	no	on roof	48.46	4.04	90.28%	
27	Victor Knight	Knight 118	no	on ground, just downslope of deck	48.79	4.07	90.89%	
28	Ralph Lemmons	Lemmons 191	yes	on ground, S side of house	50.41	4.20	93.91%	
29	Roscoe & Richard Littlefield	Littlefield 172 (Roscoe and Richard)	no	N of houses on other side of driveway	38.59	3.22	71.89%	
30	Roscoe & Richard Littlefield	Littlefield 173 (Roscoe and Richard)	no	N of houses on other side of driveway	37.62	3.14	70.08%	
31	Tim Littlefield	Littlefield 177 (Tim)	no	On ground, front of house	16.64	1.39	31.00%	
32	Tim Littlefield	Littlefield 178 (Tim)	no	On ground, front of house	17.19	1.43	32.02%	
33	Wayne Littlefield	Littlefield 179 (Wayne)	no	N of driveway on N side of house	40.50	3.38	75.45%	
34	Jim Littlefield	Littlefield 183 (Jim)	no	NW of house, across road	45.07	3.76	83.96%	
35	Jim Littlefield	Littlefield 184 (Jim)	no	NW of house, across road	41.23	3.44	76.81%	
36	Lodge (Tribal Offices)	Lodge 378	no	on ground SE of building	29.96	2.50	55.90%	
37	Nellie McNeal	McNeal 301	no	up hill ~50' behind house	35.61	2.97	66.34%	
38	Nellie McNeal	McNeal 302	no	up hill ~50' behind house	37.24	3.10	69.37%	
39	Melissa Myers	Melissa Myers 286	no	picnic table in yard ~25' W of house	47.27	3.94	88.06%	
40	Louise Morehead	Morehead 394	no	on concrete walkway to entry	47.33	3.94	88.30%	
41	Cindy Niles	Niles 322	no	on ground SW of house	41.57	3.46	77.44%	
42	Neil and Amy Peacock	Peacock 328	no	carport roof? (ask Stephen)	51.68	4.31	96.42%	
43	Bill Pearson	Pearson 242	no	parking area behind house (E of house)	34.86	2.91	64.94%	
44	Bertha Peters	Peters 157	yes	on roof	38.49	3.21	71.70%	
45	Bertha Peters	Peters 158	yes	on roof	36.85	3.07	68.65%	
46	Bertha Peters	Peters 159	yes	on roof	43.58	3.63	81.18%	
47	Dolores Reed	Reed 291	yes	on roof near solar array	49.02	4.09	91.32%	
48	Dolores Reed	Reed 292	yes	on roof near solar array	47.18	3.93	87.89%	
49	Richard Myers	Richard Myers 297	yes	on ground near pole-mount solar array	41.47	3.46	77.25%	
50	Richard Myers	Richard Myers 298	yes	on ground near pole-mount solar array	41.58	3.47	77.46%	
51	Mary Smoker	Smoker 009	no	on ground, ~15' W of house	41.75	3.48	77.78%	
52	Mary Smoker	Smoker 006	no	on ground, ~15' W of house	41.96	3.50	78.17%	
53	Sam Sylvia	Sam Sylvia 445	no	just outside front door on S side of house	39.08	3.26	72.91%	
54	Alberta Sylvia	Alberta Sylvia 310	yes	on ground near pole-mount solar array	47.66	3.97	88.79%	
55	John Trull	Trull 295	no	on ground, ~30' N of house	34.30	2.86	63.90%	
56	Weitchpec Tribal Office	Weitchpec Tribal Office 225	no	on roof, W wing	52.26	4.36	97.35%	Maximum
57	Weitchpec Tribal Office	Weitchpec Tribal Office 227	no	on roof, E wing	47.25	3.94	88.02%	
58	Weitchpec Tribal Office	Weitchpec Tribal Office 229	no	on roof, S wing	49.54	4.13	92.29%	
				Maximum	52.26	4.36	97.35%	
				Minimum	7.87	0.66	14.68%	
				Average	41.80	3.48	77.89%	

Appendix 8: Presentations, agendas and associated materials from staff and Tribal Council trainings

SCHATZ ENERGY RESEARCH CENTER

Creating a Yurok Tribal Energy Program

a presentation by

Richard Engel and Jim Zoellick
Schatz Energy Research Center
Humboldt State University
Arcata, California

For Yurok Tribe Staff
February 6, 2006

What are the goals of the Yurok Tribe's new Energy Program?

- Improve energy services to Tribe members
- Control energy costs for the Tribe
- Ensure Tribal control over energy resources and use
- Increase community understanding of energy issues
- Build human capacity (job training, increased technical know-how)
- Provide economic development opportunities

What kinds of activities will be happening in this Energy Program?

There are <u>two</u> separate grants from the US Dept. of Energy that are funding the program:

- Human Capacity Building grant (expires August 2006)
- Utility Planning grant (already partially implemented by consultant Winzler & Kelly, has been extended to expire in June 2007)

Human Capacity Building grant activities

- Provide energy awareness training for Tribal staff (today's meeting is first piece of that)
- Hire grant-funded Tribal energy staff (2 persons)
- Provide in-depth energy training for new energy staff
- Perform energy needs assessments – field visits to homes
- Conduct community energy awareness campaign
- Identify funding and technical support resources to continue these activities

Utility Planning grant

- Original consultant to Tribe determined it was not economically feasible for the Tribe to establish a conventional energy utility.
- Tribe still has grant funds, will use them to investigate innovative ways the Tribe can provide energy services.
- Dept. of Energy has approved Tribe hiring Schatz Energy Research Center to replace original consultant.

Utility Planning grant activities

- Inventory the Reservation's renewable energy resources
- Develop a plan for providing renewable energy and energy efficiency services for Tribal homes and businesses
- Investigate opportunities for the Tribe to sell locally generated energy and purchase energy in bulk
- Develop a plan for billing Tribe members for energy services
- Develop a plan for integrating Energy Program into the existing Tribal Utility District
- Investigate funding sources for continuing development of a Tribal Energy Program

Role of Tribe in Energy Program

- Tribal staff have long-term responsibility for making the Tribal Energy Program work.
- Tribal Engineer Dustin Jolley is project manager for both Dept. of Energy grants.
- Near term: Tribal funds will not be expended on the Energy Program. Dustin will supervise the two grant-funded "temporary" Tribal energy staff. The consultant (SERC) is also funded by the grants.
- One role of "temporary" staff will be to investigate ways to fund the positions so they can become permanent.

About the Tribe's Grant-Funded Energy Staff

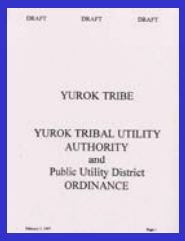
Two new positions are being created:

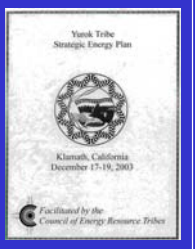
- Energy Specialist: Full-time position, funded for one year, Tribe is accepting applications until Friday (Feb. 10). Will have overall responsibility for setting up energy program.
- Energy Technician: Part-time position, funded for six months, recruiting to begin soon. Will assist Energy Specialist, principally in the field.

Role of Schatz Energy Research Center (SERC) in Energy Program

- SERC is Tribe's consultant on developing Energy Program
- SERC has worked with Tribe for several years, including Schoolhouse Peak telecom project and residential solar project
- SERC helped Tribe secure $100,000 in grant funds for the new Energy Program
- SERC will provide day-to-day support in field work & program administration

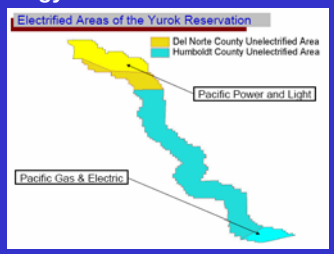
Past Yurok Energy Planning Work





- The Tribe has conducted energy planning and studies in the past, including a Strategic Energy Plan
- Our work will build on, not duplicate, these past efforts

Special Energy issues for the Yurok Reservation



- Served by two utility companies
- Most of Reservation still un-electrified
- Population small and dispersed (About 1200 Tribe members on Reservation, 10 per square mile)
- High energy cost per household, and low income

Why should Tribal staff care about energy?

1. Energy costs and Tribal demographics

- Survey: Yurok Reservation households spend $328/month on energy, vs. $124/month US average
- Household income on Yurok Reservation $9,000/yr, vs. $43,000/yr US median
- 49.2% of Yurok Reservation homes have serious structural deficiencies – homes in this condition are probably not energy efficient
- Energy costs thus have a major impact on Yurok quality of life
- Access to dependable and affordable energy services is essential to Tribal members, especially Tribal elders living remotely

Why should Tribal staff care about energy?

2. Global energy security issues and their local impact

- "Oil Age" may be coming to a close, natural gas supplies also dwindling
- This implies higher energy costs, living with less energy, or finding energy alternatives
- North Coast and Yurok Reservation are fortunate to have many local (and "clean") energy resources:
  - Biomass
  - Hydroelectric power
  - Wave power
  - Solar power
  - Wind power

Why should Tribal staff care about energy?

3. Environmental and public health issues associated with energy use on the Reservation

- Generator fuels (gasoline and diesel) are toxic and have local air quality impacts
- Kerosene used for lighting is toxic and creates indoor air quality problems
- Hydroelectric power is "clean" but impacts watersheds and fisheries when developed on a large scale or in inappropriate locations
- Biomass energy can be renewable (if used sustainably) but can create air quality problems depending on scale, location, and technologies used

Why should Tribal staff care about energy?

4. Value to Tribal economy

- Money spent on energy generally leaves the community
- Energy savings in Tribal facilities means more money in budget for other Tribal programs
- Energy savings in Tribal low income households means less debt, less dependence on social welfare programs, more money available for other important family needs
- Energy generation and energy service projects can provide economic development and employment opportunities

Focus of Tribal Energy Program

The Dept. of Energy grants funding this work are focused on two specific areas:

- Energy Efficiency
- Renewable Energy

Let's look at these two energy topics…

Energy Efficiency

Being as energy efficient as possible reduces our need for energy resources and is typically cheaper and faster than developing new energy supplies.

<u>Conservation vs. Efficiency</u>

Conservation: using less energy in total (turning things off)

Efficiency: doing more with less (weatherizing house, buying energy saving appliances)

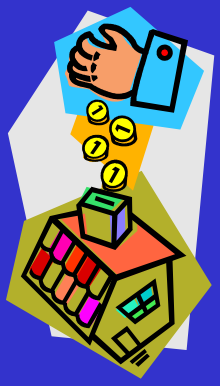
What makes a building energy efficient?

- Weatherization: insulating walls, attic, floor; sealing cracks with caulk or weatherstrip
- Efficient, well maintained heating/cooling systems
- Efficient lighting with appropriate controls (timers, motion sensors)

- Efficient appliances – new Energy Star approved are best, but some older appliances are efficient
- People with energy saving habits – remembering to turn things off, not operating heating or cooling with doors/windows open, etc.

How much can an efficient home save?

- One study showed households participating in Dept. of Energy's Weatherization Assistance Program cut energy costs 13.5% on average
- Much greater savings are possible for households that can invest in high efficiency and learn energy saving habits



What does it cost to make a home efficient?

Depends what's needed. Some typical costs:

Efficient full size refrigerator: $500

Insulate 1000 square foot attic (do it yourself): $500

Replace incandescent light bulbs with compact fluorescent lights: $3 each (with utility subsidy)

Professional furnace tune-up: $75-$100

How can staff help Tribe members with high energy costs?

Referrals to appropriate agencies:

- Tribal Housing Authority – *administers Low Income Home Energy Assistance Program for Tribe*
- Redwood Community Action Agency – *provides residential weatherization services*
- utility companies – *offer discounts to low income customers, rebates, other services*
  - ❖PG&E (upriver),
  - ❖Pacific Power (downriver)
- Redwood Coast Energy Authority – *offers workshops and other services to help manage energy costs*

What energy efficiency opportunities are there on the Yurok Reservation?

- Short answer: We don't know yet! Our field work this year should answer that question.
- Some of the opportunities we expect to find:
  - Homes and businesses in need of weatherization
  - Need for outreach and education to increase awareness of energy efficiency
  - Need for Tribal energy codes for new construction/remodels

Renewable Energy

What is renewable energy?

Energy that is replenished by nature at least as fast as we consume it.

Hydroelectric

Wind power

David Parsons, NREL/DOE

Solar power

Renewable energy opportunities on the Yurok Reservation

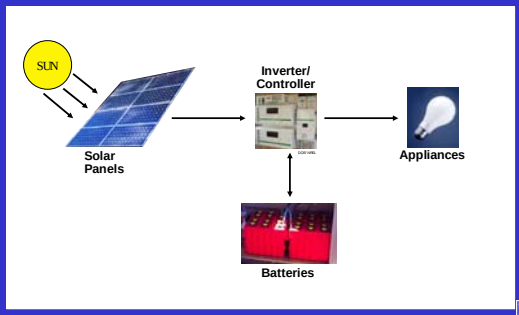
- Off and on grid homes (solar and micro-hydroelectric)

- Economic development via power sales to off-Reservation customers (wind, biomass, hydroelectric power)

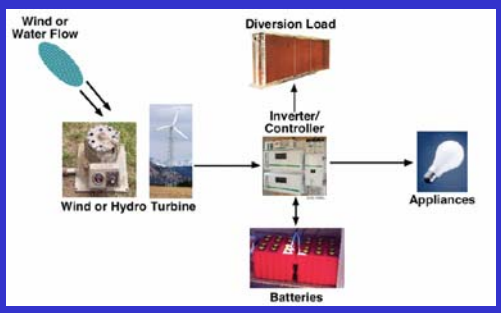
Warren Gretz, NREL/DOE

Dave Parsons, NREL/DOE

How do renewable energy systems work? … Solar Electric …

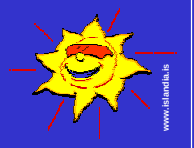


How do renewable energy systems work? … Wind- or Hydro-Electric …



How do renewable energy systems work? … Wind- or Hydro-Electric …

Why is renewable energy beneficial?



- Renewable energy is clean
- It will not run out
- It can be produced locally

Is renewable energy reliable? … YES!

Renewable energy technologies are well proven and reliable. However, numerous issues must be considered in order to ensure a successful project.

- Proper and routine maintenance
- Careful resource studies to make sure enough renewable resource is available
- Proper design to match loads
- Adequate energy storage and/or backup power because the sun doesn't always shine & the wind doesn't always blow

Ken Olson, DOE/NREL

Is renewable energy too expensive?

It depends on the application …

- For on-grid applications, many GOOD renewable energy sources (wind, biomass, hydro) can be cost-competitive with conventional energy sources
- For off-grid applications, renewable energy (micro-hydro, solar, wind) is usually very cost-competitive with non-renewable options or extension of the grid power lines
- Even when renewable energy is more expensive, customers sometimes choose it because of it's many environmental benefits

What are some important considerations in choosing a renewable energy site?

- Solar energy systems need to be installed in locations that are not shaded during most of the day
- Few locations on the north coast make very good large-scale wind sites, but there are some exceptions
- Hydroelectric power requires a stream or creek with sufficient elevation drop and flow
- Where one resource is not adequate, a hybrid system can combine different renewable energy technologies. Example: micro-hydroelectric and solar make good winter/summer complements

Renewable energy vs. generators and the grid

- In areas that have grid access, most people of course use it…it's cheap, convenient, and usually reliable
- Renewable energy can be integrated with the grid – this used to be challenging, but now equipment is widely available, electric codes are more accommodating, and utilities are more supportive
- For people off the grid, getting all your electric power from a generator has drawbacks – noise, fumes, constant need for fuel
- However, generators can be a useful backup for renewable power systems, since renewable power is not always available, and batteries may get drained down over long periods without sun (or wind, etc.)

Choosing among renewable energy and energy efficiency options

- Typically, energy efficiency provides a lot more energy benefit per dollar spent than renewable energy systems do
- Therefore, it's important to make a home or business as energy efficient as possible *before* designing or buying a renewable energy system

Economic considerations

- The Tribe's economic resources are limited and must be allocated wisely if the Energy Program is to succeed
- It is important, especially when comparing different energy alternatives, to be able to quantify the costs and benefits associated with a project
- We will use tools such as payback and life cycle cost analysis to help the Tribe choose wisely among its energy planning options

Environmental considerations

- We recognize the Tribe's commitment to caring for its own lands and the global environment
- All energy technologies have some environmental impact. Even "green" technologies affect the environment:
  - Hydroelectric projects interrupt fish migration
  - Wind turbines can kill birds
  - Solar electric equipment is made from toxic materials
- We will work closely with the Tribe to ensure its environmental values are taken into account in energy development activities and that any impacts are minimized

Balancing many objectives: energy costs, environment, jobs…

- Yurok Reservation residents pay an unreasonably high fraction of their income for energy. The Energy Program needs to address this.
- The Tribe is also concerned with sustainability and environmental responsibility.
- With the environment in mind, it is clear the cheapest solution to a problem is not always the "best" solution.
- Balancing energy cost control and environmental responsibility will be a challenge for this program but should not be insurmountable.

Balancing many objectives: energy costs, environment, jobs…(continued)

- One goal of the Energy Program is to provide employment and job training opportunities to the Tribe.
- However, program costs, including staffing, need to be controlled to ensure success.
- We want to help the Tribe meet its energy needs by making use of its human and natural resources in a sustainable way.

The beginning of a collaborative process

- This is the first of a series of quarterly workshops we will conduct with Yurok Tribe staff. We will be looking to all of you for input and guidance as the Energy Program develops.
- We are available to help Tribal staff make this Energy Program a success. Please feel free to contact us with questions or ideas. You can reach SERC staff at (707) 826-4345.

SCHATZ ENERGY RESEARCH CENTER

The Yurok Tribe

SCHATZ ENERGY RESEARCH CENTER

Energy Savings Opportunities at Yurok Tribal Offices

a presentation by

Richard Engel
Schatz Energy Research Center
Humboldt State University
Arcata, California

For Yurok Tribal Council
December 2006

Presentation Outline

- Objective and Activities
- Findings and Recommendations in Brief
- Why Save Energy?
- How Much Energy Should Facilities Use?
- How Much Energy Do the Yurok Facilities Use?
- What Are the Savings Opportunities?
  - Weitchpec Office
  - Klamath Office
- How Can the Tribe Take Advantage of These Opportunities?

Our Objective

The Schatz Energy Research Center (SERC) is helping the Tribe to implement its new Energy Program, initially funded by a grant from the U.S. Department of Energy.

As part of SERC's work with the Tribe, we are looking at ways to cut energy costs in Tribal facilities and help these buildings shift to more sustainable energy sources.

Our Activities

To achieve this objective, we performed "walk-through" energy audits of the Tribal offices at Weitchpec and Klamath.

We spent one day at each facility, examining lighting, heating and cooling systems, other electric and propane loads, and the buildings themselves to identify ways to save energy or generate clean energy on-site.

We also interviewed maintenance staff and the building users to learn what works well and what doesn't. Then we analyzed and wrote up our findings.

Findings and Recommendations in Brief

Weitchpec Office

- Spending $13,500 per year on electricity, $6,900 per year on propane
- Energy cost per square foot per year is $3.70, compared to regional average of $1.30 to $1.59 for offices and outpatient health facilities
- Main opportunities to cut energy costs:
  - ✓Eliminate excess lighting and add occupancy sensing switches
  - ✓Enable power saving modes on all computers and office equipment
  - ✓Provide shading on air conditioner condensers
  - ✓Install solar electric/hot water systems

Findings and Recommendations in Brief

Klamath Office

- Spending $25,500 per year on electricity, $33,200 per year on propane
- Energy cost per square foot per year is $2.02, compared to regional average of $1.59 for offices
- Main opportunities to cut energy costs:
  - ✓Initiate professional building-wide energy troubleshooting ("retro-commissioning")
  - ✓Replace multiple small heat/cool units with central system *OR* replace individual units with high-efficiency substitutes
  - ✓Repair exterior doors & windows to reduce drafts
  - ✓Disable heat/cool on drinking water dispensers

Why Save Energy?

- Cost savings opportunity
  - Full energy upgrades of existing commercial buildings can save 30% to 50% of annual energy costs*
  - Some opportunities can be implemented at essentially no cost, yielding instant savings
  - Other measures require some investment but offer very attractive return
- Improved comfort and performance with new equipment
- Tribal organization sets good example for Tribal households and businesses
- Reduce environmental impact of Tribal operations
- Lower energy use makes it feasible for Tribe to achieve energy self-sufficiency

*Source: Energy Star for Small Business program

How Much Energy Should These Tribal Facilities Use, and What Should it Cost?

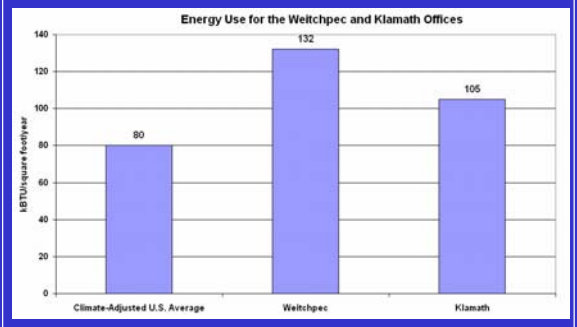
Energy use and costs are affected by many factors:

- Age and condition of building
- Attention to quality & energy efficiency in design and construction
- Applicable energy codes at time of construction
- Local utility rates
- Local climate
- Behavior of building occupants and maintenance staff

Nationally, buildings located in a climate similar to the North Coast use 80 kBTU per square foot per year, at a cost of $1.30 to $1.59 per square foot per year.

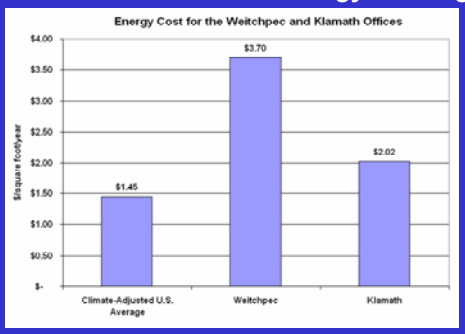
(This includes all existing buildings, new and old.)

How Much Energy Is Being Used…?



On a per-square-foot basis, both of these facilities are substantially above the expected energy use.

…And How Much Is the Energy Costing?



Weitchpec looks even worse in cost terms, because of high use *and* high PG&E electric rates.

What are the Energy Saving Opportunities?

We found significant opportunities at both facilities.

Weitchpec Office

Weitchpec Office

Eliminate excess fluorescent lights in overlit areas

50 foot-candles is adequate for most office tasks. Many rooms at the Tribal office are lit with 60 to 100 foot-candles.

Weitchpec Office

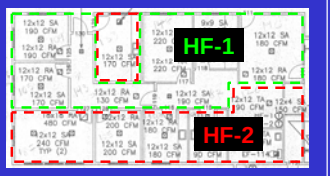
Install occupancy sensing light switches

Combined with "delamping" in overlit areas, this measure could save about $600 a year and pay for itself in 4 years.

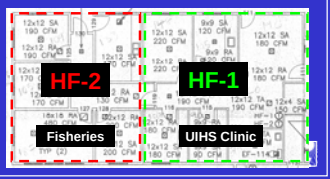
Weitchpec Office

Reconfigure heat/cool zones in west wing

Existing



Proposed



Weitchpec Office

Provide shading on air conditioner condensing units

A simple measure that cuts cooling costs 2 to 3%, improves performance, and makes equipment last longer

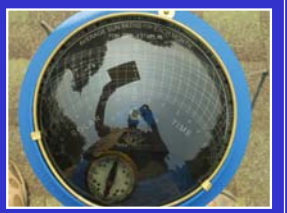
Weitchpec Office

Enable power saving mode on computers and other office machines

Saves $25 to $75 per year at each work station…and costs nothing to implement.

Weitchpec Office

Install a rooftop solar electric and/or solar hot water system



Room to replace 15 to 20% of yearly electricity purchases using available roof space.

Klamath Office

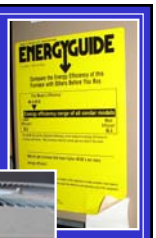
Klamath Office

Engage professional services to *retro-commission* the entire building

Retro-commissioning is a quality assurance process applied to existing buildings to help them operate as intended.

Klamath Office

Evaluate these heating/cooling strategies and pursue one:



- Replace decentralized heating and cooling system with an efficient, centralized HVAC boiler/chiller system.

OR

- Maintain existing HVAC configuration, but replace inefficient heating and cooling equipment with high-efficiency substitutes as funding permits.

Klamath Office

Repair exterior doors and windows

- Inspect exterior doors and rehang or re-weatherstrip the doors as needed to reduce air infiltration.
- Identify failed double-pane windows and pursue replacement under warranty where needed.
- Inspect trim around exterior doors and windows and caulk where needed.

Klamath Office

Reduce interior electric plug loads

- Unplug the building's drinking water dispensers and use other, less expensive methods to heat and cool drinking water and beverages.
- Consolidate the building's refrigerators and unplug unneeded units.
- Discourage use of personal electric space heaters (without making staff uncomfortable).

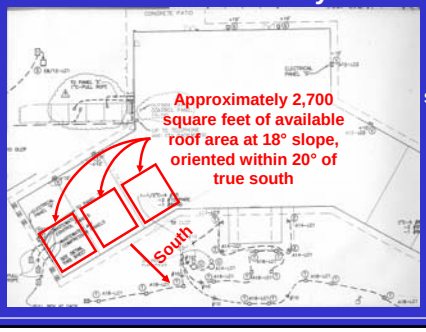
Klamath Office

Analyze building circuits and correctly label breakers in the electrical service panels

Unlabeled panels are a safety hazard and make serious energy management and troubleshooting difficult.

Klamath Office

Install a rooftop solar electric and/or solar hot water system



System shown would replace about 9% of facility's present electric purchases

How Can the Tribe Take Advantage of These Energy Saving Opportunities?

- Conduct more detailed analysis to determine which measures make the most financial sense
- Identify funding and technical assistance sources
- Develop and implement a prioritized energy savings action plan

Recommended Action Items

- ✓Council and staff can review the complete energy audit reports provided by SERC
- ✓SERC can assist the Tribe to develop internal policies for more efficient energy use by staff
- ✓SERC can help the Tribe to prioritize the energy recommendations provided
- ✓SERC can assist the Tribe in identifying funding and technical assistance to implement the recommendations

Schatz Energy Research Center Staff Contact Information

Richard Engel
rae7001@humboldt.edu
(707) 826-4351

Proposed Agenda for Meeting with Yurok Tribe Staff on Tribal Energy Needs
Date: Wednesday, May 3, 2006, 2:00 PM (expected meeting duration approx. 2 hours)
Location: Yurok Tribe Office, 190 Klamath Blvd, Klamath, CA

- Brief introductions: name, department, why you are interested in the new Yurok Tribal energy program
- Short presentation (~10 minutes) by Schatz Energy Research Center staff on the Yurok Tribe's two DOE-funded energy projects (human capacity building and utility planning). Will briefly repeat some of the organizational info covered in the previous staff training, assuming some people weren't present last time or need a refresher.
- Round table discussion topics

  Part A: Questions related to summer 2006 field work

  1) Later this month, the Tribe will begin a pilot household energy efficiency and renewable energy needs assessment project designed to reach at least 100 homes on the Yurok Reservation. What do you believe is the most essential information that should be collected during these home visits?
  2) During field visits, what Tribal services/programs should we be aware of?
  3) Should we try to get people connected with available services (housing, social services, etc.)?

  Part B: Questions about Tribal energy needs in general

  4) From your own experience, what do you believe are the unmet energy needs for the Yurok Tribe?
  5) How can a Tribal energy program help to meet these needs?
  6) What energy services and related support does/can the Tribe currently offer to its members using *existing* resources (assuming no additional funding)?
  7) How could this support be improved or increased with *additional* resources?
  8) What would be advantages/disadvantages/challenges for the Tribe in taking on some of the energy services roles currently performed by outside agencies (weatherization, assistance in paying energy bills, energy education)?
  9) What sources of technical and financial support (other than DOE) are available to Tribes to help meet their energy needs?
  10) Given that current funding from DOE is only to be used for human capacity building, assessment, and planning activities…what next steps should be taken once these funded activities have taken place?
  11) Other north coast Tribes, including Smith River Rancheria and the Hoopa Valley Tribe, have recently received DOE grants to set up their own Tribal energy programs or plan energy projects. What opportunities do you see for collaboration with these Tribes?
  12) What resources are you aware of for obtaining free or low-cost weatherization materials (water heater blankets, energy saving lights, etc.) that could be provided to households in the course of performing the energy needs assessments?
  13) What topics would you like to see covered in the remaining quarterly trainings?
- Explain that SERC and Tribal Planning staff will meet in two days with outside agencies to solicit their ideas and help for developing the Tribal energy program (show list of participating agencies)
- Wrap-up and closing thoughts

Instructions for Georgiana

Please get 13 sheets of flip chart paper (25" X 30" or similar size) and on each sheet write one of the 13 questions from the previous page at the top of the sheet, leaving the rest of the page blank to write down people's answers. We should also have a few blank flip chart pages on hand for extra writing space.

For question 4, we will provide examples of "unmet energy needs" on sheets of paper, plus we will provide blank sheets and markers that people can use to add more ideas. We will post all the ideas on the wall as a brainstorm, then rank the ideas by importance.

Please print out each one of the following example energy needs in landscape layout in the largest font possible on an 8½ " by 11" sheet of paper, with a nice looking Tribal style border around the edge. If you use colored paper, don't use green, because we will have people sticking green dots on the papers to "vote" for the ideas they think deserve highest priority:

- assistance with paying energy bills
- access to energy to maintain health and safety for elders or children
- energy efficiency improvements for Tribal homes/businesses
- assessments/repair of existing renewable energy systems for Tribal homes/businesses
- assistance with getting new renewable energy systems for Tribal homes/businesses
- Tribal energy self-sufficiency
- energy-related economic development opportunities
- cleaner energy sources
- easier access to fuels (propane, gasoline, diesel, firewood, etc.)
- household electrification
- power generation on Reservation to sell to utilities as revenue source for Tribe
- training in energy job skills for Tribe members
- energy education for Tribe members (energy consumers)
- energy education for children/youth
- more staffing positions or funding for Tribal energy activities

SCHATZ ENERGY RESEARCH CENTER

YUROK TRIBE

Creating a Yurok Tribal Energy Program, Part 2:
Seeking Tribal Staff Input

a collaborative meeting of
Yurok Tribe staff and
Schatz Energy Research Center staff
May 3, 2006

Let's start off with a quick review…

What are the goals of the Yurok Tribe's new Energy Program?

- Improve energy services to Tribe members
- Control energy costs for the Tribe
- Ensure Tribal control over energy resources and use
- Increase community understanding of energy issues
- Build human capacity (job training, increased technical know-how)
- Provide economic development opportunities

What kinds of activities are happening in this Energy Program?

There are <u>two</u> separate grants from the US Dept. of Energy that are funding the program:

- Human Capacity Building grant
- Utility Planning grant

Focus of Tribal Energy Program

The Dept. of Energy grants funding this work are focused on two specific areas:

- Energy Efficiency
- Renewable Energy

Human Capacity Building grant activities

- Provide energy awareness training for Tribal staff
- Hire grant-funded Tribal energy staff (2 persons)
- Provide in-depth energy training for new energy staff
- Perform energy needs assessments – field visits to homes
- Conduct community energy awareness campaign
- Identify funding and technical support resources to continue these activities

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Utility Planning grant

- Original consultant to Tribe determined it was not economically feasible for the Tribe to establish a conventional energy utility.
- Tribe still has grant funds, will use them to investigate innovative ways the Tribe can provide energy services.
- Schatz Energy Research Center has replaced original consultant.

Utility Planning grant activities

- Inventory the Reservation's renewable energy resources
- Develop a plan for providing renewable energy and energy efficiency services for Tribal homes and businesses
- Investigate opportunities for the Tribe to sell locally generated energy and purchase energy in bulk
- Develop a plan for billing Tribe members for energy services
- Develop a plan for integrating Energy Program into the existing Tribal Utility District
- Investigate funding sources for continuing development of a Tribal Energy Program

Role of Tribe in Energy Program

- Tribal staff have long-term responsibility for making the Tribal Energy Program work.
- Tribal Engineer Dustin Jolley is project manager for both Dept. of Energy grants.
- Near term: Tribal funds will not be expended on the Energy Program. Dustin supervises the two grant-funded "temporary" Tribal energy staff. The consultant (SERC) is also funded by the grants.
- One role of "temporary" staff is to investigate ways to fund the positions so they can become permanent.

About the Tribe's Grant-Funded Energy Staff

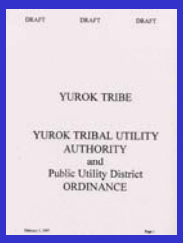
Two new positions:

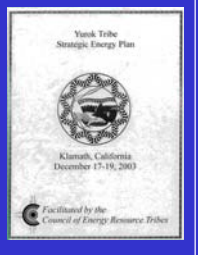
- Energy Specialist: Georgiana Myers began working in this full-time position in March. The position is presently funded for one year. Georgiana has overall responsibility for setting up the energy program.
- Energy Technician: Part-time position, funded for four months. Application period closed April 24, interviews scheduled for May 8. Will assist Energy Specialist, principally in the field.

Role of Schatz Energy Research Center (SERC) in Energy Program

- SERC is Tribe's consultant on developing Energy Program
- SERC has worked with Tribe for several years, including Schoolhouse Peak telecom project and residential solar project
- SERC helped Tribe secure $100,000 in grant funds for the new Energy Program
- SERC provides day-to-day support in field work & program administration

Past Yurok Energy Planning Work





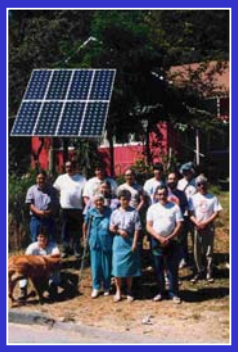
- The Tribe has conducted energy planning and studies in the past, including a Strategic Energy Plan
- Our work is building on, not duplicating, these past efforts

Special Energy issues for the Yurok Reservation

- Served by two utility companies
- Most of Reservation still un-electrified
- Population small and dispersed (About 1200 Tribe members on Reservation, 10 per square mile)
- High energy cost per household, and low income
- Right-of-way issues for installing energy infrastructure, since most of Reservation lands are under non-Tribal ownership

Why should Tribal staff care about energy?

- Yurok Reservation households spend more on energy and earn less than average U.S. households
- Access to dependable and affordable energy is essential to Tribal members, especially elders living off-grid
- Energy costs are increasing everywhere
- Many conventional energy technologies have negative impacts on Yurok lands and people
- Energy cost savings can benefit Tribal government and individual households
- Energy-related economic development opportunities



The next step in this collaborative process

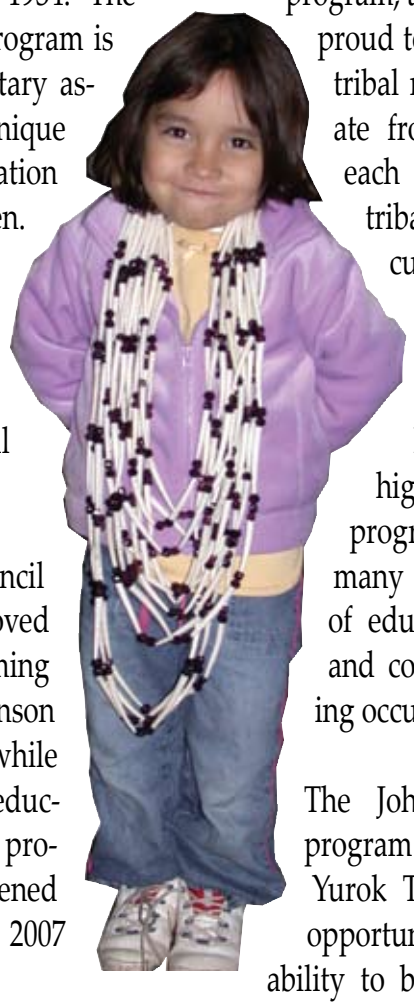
- This is the second in a series of quarterly workshops we are conducting with Yurok Tribe staff. You can all help to make the Energy Program a success.
- Today we have a series of questions we want to ask all of you…

Appendix 9: Articles about the Yurok energy program from the Yurok newspaper and SERC newsletter

The Johnson O'Malley Program

by Jim McQuillen, Education Director

The Bush Administration is proposing the entire elimination of the JOM Program from next year's budget for all tribes across the nation. If this cut is allowed, the educational progress which our tribe has begun could be lost. The Johnson O'Malley Program has been in existence since 1934. The purpose of the JOM Program is to provide supplementary assistance to meet the unique and specialized education needs of Indian children. Johnson-O'Malley funds are supplementary funds and are not to take the place of federal, state or local funds.



The Yurok Tribal Council has unanimously approved a resolution reaffirming its support for the Johnson O'Malley program, while strongly opposing reduction or elimination of program funding as threatened in President Bush's 2007 budget.

The Yurok Tribal Council states that "Yurok children represent the most important and precious part of the Yurok world—they are the future of the Yurok Tribe". Johnson O'Malley funding is critical to providing our Yurok youth with the same educational opportunities that others take for granted.

Since 1994, Yurok Tribe has actively implemented the Johnson O'Malley program, with more than 1,240 children enrolled now. The number of children receiving benefits under the program continues to climb each year. With the assistance of the Johnson O'Malley program, the Yurok Tribe is proud to have nearly 40 tribal members graduate from high school each year now; 170 tribal members are currently receiving assistance from the tribe to attend college or other higher education programs. There are many other examples of educational success and community building occurring.

The Johnson O'Malley program has given the Yurok Tribe hope, new opportunities and the ability to begin to build a successful, self-sustaining community. We have urged our law makers in the strongest possible terms to act now to help preserve this vital educational funding resource for Native American youth. Our tutoring, higher education guidance, youth sponsorship program, summer camp, youth activities, along with a key component of community building, would be set back with a JOM reduction.

If you wish to write and share your opinion with our law makers, send a letter to: U.S. Rep Mike Thompson, 119 Cannon House Office Building, Washington D.C. 20515 (Fax 202-269-9598) or U.S. Sen. Diane Feinstein 331 Hart Senate Office Building, Washington D.C. 20510-0504 (fax: 202-228-3954) or U.S. Sen. Barbra Boxer 112 Hart Senate Office Building, Washington D.C. 20510-0501 (fax: 415-956-6707)

Left, Yurok tribal member Josey Carlson. Photos this page Arnold Nova

Home Energy Assistance Available for Low Income Tribal Members

Low Income Home Energy Assistance Program (LIHEAP) funding is available to help tribal members who reside in Del Norte and Humboldt County meet their energy needs, such as wood, propane, wood pellets, kerosene, diesel, and electricity.

Beginning May 1st, tribal elders, disabled tribal members, and households with children ages 5 and under may apply for assistance. All other low income tribal households may apply beginning June 1st. Applications will be accepted until available funds are depleted.

Questions? Call Krystel Patapoff at 707-482-1350 Ext. 342 or write to: Yurok Tribe, P.O. Box 1027 Klamath, CA 95548. ATTN: LIHEAP.

Tribe Receives Funding for New Energy Services Program

by Georgiana Myers

The Yurok Tribe is working with the Schatz Energy Research Center from Humboldt State University to determine the need for energy efficiency and renewable energy services on the Reservation. A team made up Richard Engel, and Jim Zoellick from the Schatz Energy Research Center, Dustin Jolley Tribal Engineer, Energy Specialist Georgiana Myers and an Energy Technician to be hired in May, will be making energy assessments of residents' homes' on the Reservation beginning in June 2006. The work is being funded by the U.S. Department of Energy. The official name of the project is, "First Steps Towards Human Capacity Building in Energy Efficiency and Renewable Energy System Maintenance for the Yurok Tribe."

What is an energy assessment? The project team will be visiting people's homes and looking for ways to save energy, lower resident's energy bills and increase the comfort of people's homes. This might include things like adding attic insulation, caulking windows and installing energy efficient compact fluorescent lamps. Although current program funds will not allow the installation of these measures, the program will be looking to provide these resources in the future. The energy assessment visits will also include inspections of renewable energy systems, including solar electric and micro-hydro systems, with an eye toward maintenance needs. Watch for the Tribe's energy team in your area this summer!

The long-term goals of the project are:

- Increase the energy self sufficiency of the Yurok tribe
- Create energy related employment and economic development opportunities on the Reservation

Short-term goals include:

- Develop sustainable programs operated by tribal staff to provide energy efficiency and renewable energy services
- Increase the energy awareness of the Yurok Tribal staff and the greater community on the Reservation through training and community workshops
- Assess the need for energy efficiency and renewable energy system services on the Reservation, both up-river and down-river
- Identify and secure resources to address the identified needs

Watch for regular updates on the Tribe's new energy program in this newsletter, and watch for community workshops on energy efficiency and renewability to be hold later this year. If you have any questions about the energy program please contact Georgiana Myers (707) 482-1350 ext. 363.

What's happening at the Yurok Tribe Head Start

Weekly on Wednedays, we will be doing Kindergarten Transitioning activities with Mrs. Wilder's Kindergarten Class.

HIGHLIGHTED EVENTS

May 5 at 11:00 Safety Rodeo at the Yurok Tribe Head Start
Participating: Yurok Tribe Public Safety, Highway Patrol, Del Norte Ambulance, Klamath Fire Department and Del Norte Search & Rescue.

May 12 at the Yurok Tribal Office: waffle ball game challenge between Klamath Head Start families and the Ke-pel, Cutten Home Base families.

May 12 Klamath Head Start Parents/Guardians bake sale at the Yurok Tribal Office 10:30-3:00.

May 18th at 6:00: End of the Year Celebration!! This is the end of the year celebration for the Head Start students and their families. It is a time of honoring all the Head Start students those who are graduating and those who will be returning students next year.

ENROLLMENT FOR NEXT YEAR 2006/2007

The Yurok Tribe Head Start sites Klamth/Ke-pel and Cutten are now taking applications for next fall. The child has to be 3 by December 2nd of 2006.
If interested and would like an application or more information, call:
The Yurok Tribe Head Start at (707) 482-2811.

Left, Head Start children attending a field trip at Ocean World in Crescent City. The children had an opportunity to pet the shark. Right, The Easter bunny visits the Yurok Tribe Head Start on their last day before their week off for Spring Break. The Head Start children also participated in an Easter egg hunt.

Energy Update

By Georgiana Myers & Stephen Kullmann

Summer has finally arrived and with it brought the Yurok Tribe's Energy Program's Energy Efficiency workshop in Klamath, CA and a Renewable Energy workshop in Weitchpec, CA. During the week of May 22 through May 26 the Energy Efficiency workshop was held in Klamath. The next week May 30 through June 2 we moved locations and our focus to Renewable Energy.

We had seven participants, including two community members from the Pecwan District, three men from Hoopa's Tribal Civilian Community Corp, and the Yurok Tribe's Energy Specialist and Technician. Throughout the week the trainees learned about many areas of energy efficiency. The subjects included heat losses from a home and ways to prevent them, efficiencies of various household appliances, understanding utility bills, energy audit techniques, and two home site visits. Energy-related job opportunities were also discussed. The participants found the workshop extremely useful and completely relevant to our jobs, communities, and environment. The class was taught by Richard Engel of the Schatz Energy Research Center; Mr. Engel is a Research Engineer who has worked in the energy field for many years. He brought experience and knowledge to the workshop that was invaluable.

Jim Zoellick, Scooter Bussell, Bertha Peters, Henrietta Lewis, Melissa Myers, Erin McDonald

The renewable energy workshop. Top to bottom, left to right: Scooter Bussell, Andrew Lonewolf, Stephen Kullmann, Dustin Jolley, Micah Gibson, Georgiana Myers, Charkie Myers, Richard Engel, Charlie McCovey, Marvin Blocker Jr.

The following week the workshop moved to the Libby Harripop-Nix Community Center in Weitchpec and shifted its focus to renewable energy. Two more students were added and a few other people sat in with us periodically. In week two the trainees were instructed by Jim Zoellick, Senior Research Engineer at the Schatz Energy Research Center, on solar energy and micro-hydro energy. The course discussed the many components of these complex systems, proper site selection, system design and installation, and the basic maintenance these energy systems require. Participants had many opportunities for hands-on experience, including wiring a simple battery based solar energy system, experimenting with a solar hot water system, evaluating a site for a micro-hydro installation, and finally inspecting a combined solar and micro-hydro power system at a Kepel residence.

The two weeks were a huge success; we appreciate everyone's support and encouragement especially those people who allowed us to practice our new skills on their homes; Micah Gibson & Tammy Prouty, Sam Sylvia and Henrietta Lewis. At the end of the two sessions the trainees received certificates showing they had completed the trainings, as well as books and reference materials on energy efficiency and renewable energy. The trainees became friends and found a new respect for the power of water and the sun! The trainees gave enthusiastic evaluations of the workshops. "Everything I have learned I can use to help myself or family members," noted one participant.

The Yurok Energy Specialist, Georgiana Myers, and Energy Technician, Stephen Kullmann, under the supervision of Tribal Engineer Dustin Jolley and Jim Zoellick and Richard Engel of the Schatz Lab, are busy preparing to begin conducting energy audits and renewable energy system evaluations for reservation households. For more information about the Tribal Energy Program, to ask any questions about how you can save energy and lower your energy costs, or to find out about scheduling an energy audit for your home, call 707-482-1366, ext. 363. Please note that due to program funding restrictions, these home energy assessments are only available at this time to Yurok Tribe members living on the Reservation.

NEWS BRIEFS

HSU offers scholarships

Humboldt State University is offering big scholarships to 30 Native American students looking to study in science field.

The state university is currently taking applicants interested in studying Computer Science, Environmental Resources Engineering and Mathematics.

Recipients of the scholarship will receive $3,623 a year for 4-years.

With additional state and federal financial aid, recipients can attain a bachelor's degree without any other money.

Applicants must meet have a GPA of 2.75 or higher and have a need for financial assistance.

The student body of about 7,000 students contains members of more than 40 tribes and HSU is within 60 miles of three of California's largest tribes.

The university also boasts a combination of programs, such as the Indian Natural Resources Program, Sciences and Engineering Program, the Indian Teacher and Educational Personnel Program, the Center for Indian Community Development and numerous Native American Studies courses.

Scholarship recipients will also have the opportunity to participate in an enhanced academic program, including leadership training, professional development, and support services.

Recipients may enroll in an interdisciplinary service learning seminar that will work with Native communities to solve problems using computer science, environmental resources engineering and mathematics. They will also participate in a Scholars' Interest Group, a freshman cohort program that includes common course taking, advising, and other activities.

If you would like to nominate a student to receive application materials in the mail, please send an email to sls@humboldt.edu containing the student's contact information.

Have questions? Please call Dr. Beth Eschenbach, Professor of Environmental Resources Engineering at 707-826-4348 or Dr. Jacquelyn Bolman, Director of Indian Natural Resources, Sciences and Engineering Program at 707-826-4994.

The deadline to apply is April 15, 2007

For more information about HSU and the Scholarship Program please see: http://www.humboldt.edu/

Form changes at Skill Bank

The Skill Bank form has changed.

Please call our office so that we can send you an application. The changes include a new section dedicated to tracking individuals with Cultural Skills; such as Fish Cooker, Net Maker, Language, Singing, Storytelling and Basketry skills.

If you have cultural skills you may have the opportunity to be eligible for short term contracts that are offered occasionally by the tribe.

Here's how it works: once you've updated your application and you've identified that you're a Singer; your name will be entered into our database with Singing as a Cultural Skill.

Later on, if one of the tribal departments wants to hold a class to teach singing, your name will be forwarded to them as a possible candidate to teach the class.

There are certain licensing requirements in order to work with the younger tribal members and you must complete those requirements prior to the work.

We will make every attempt possible to send you the new application, however, we may not have your current address. That is why we are asking you to call us to insure that your application and skills are entered into the database correctly.

Please don't hesitate to contact Cassandra Mitchell at 707-482-1350 ext. 370.

Tribe offers energy

Yurok Social Services is now offering energy assistance to low-income households.

To qualify, Yurok households must reside within the service area of Del Norte and Humboldt Counties and have an annual income of no more than 60 percent of the state's median income.

The energy provided by the Low Income Home Energy Assistance Program comes in the form of the following: wood, pellets, propane, gasoline, kerosene, diesel and electric.

Applications are available at any Yurok Tribal office. Contact Social Services for more information. Phone: (707) 482-1350 ext. 342 or call toll free at 1-866-0684.

ENERGY UPDATE

Do it yourself

By Georgiana Myers
Energy Specialist

Wow it's 2007! Can you believe it? With the New Year comes an opportunity to make changes in your home and save money!

There are many simple ways that you can conserve the electricity that your home uses throughout the year. Keeping our homes warm is the concern of this season. One of the easiest ways that a person can help keep in the warmth is to cover the windows from the outside with plastic. This is less costly than installing new double pane windows, but still saves energy. Several of the other small do it yourself projects include, but are not limited to:

- Caulking any cracks in walls or around windows
- Adding weather stripping around windows and door ways
- Using fans, especially ceiling fans, to circulate the heat around the home
- Burning good dry wood saves on wood
- Adding attic and or wall insulation
- Adding pipe insulation
- Opening drapes to let in sunlight during the day
- Closing drapes at night (insulated drapes will prevent more heat loss)
- Closing the doors to unheated spaces and rooms (careful this can cause moisture or mold problems in unheated rooms).

Also, it may be a good idea to check out the safety of your wood stove. Clogged stove pipes cause house fires every year in Indian Country claiming innocent lives and destroying family homes.

If the household uses an electric heater or propane furnace, it is vital to have the vents and filters cleaned and to use the programmable thermostat setting to ensure the heater will provide the best heat for the lowest amount of money.

At this time the Tribe's energy program does not have funds to perform weatherization on Tribal homes. However, program staff can provide referrals for free weatherization services for income-qualifying homes to the Del Norte Senior Center or the Redwood Community Action Agency. Tribal members may also want to contact Georgiana or call Yurok Indian Housing Authority about Self Help or Rehabilitation Programs for your home (707) 482-1508 or toll free 1 (800) 281-4749.

If you have questions please contact, Georgiana Myers, Energy Specialist at (707) 482-1350 ext. 363 or toll free 1(866)242-0684 ext. 363 also by email gmyers@yuroktribe.nsn.us

BURIALS

Waves lap on the shore just below the historic village of Tsurai.

Cornejo, a Humboldt State metallurgy student, makes and sells jewelry comprised of artifacts similar to those that can be found buried at Tsurai, Thrailkill said.

Following the late-January arrest the Yurok Tribe issued a statement to the local media condemning the acts and demanding the maximum sentence for those convicted of tampering with the site.

According to the Humboldt County District Attorney's Office, Cornejo is charged with two counts of possession of Native American artifacts taken from a grave, one count of removing, destroying, injuring or defacing a Native American historic, cultural or sacred site and one count of driving on suspended license — all felonies.

Energy group offers internships

The DOE's Tribal Energy Program is offering summer internships to Native American students who are interested in renewable energy and who are currently college upper-classmen or graduate students.

To be considered for the 2007 summer program applications must be received by February 23, 2007.

See website for the application. For more on the program and to download an application see, http://www.eere.energy.gov/tribalenergy/internprogram.html.

Get TERO Funds

The Tribal Employment Rights Office is continuing the Job Services Program for another year. The program is funded through TERO tax fees received from Companies conducting business on Yurok Tribal Land. The program funds can be used for the purchase of clothing, tools, bus passes, union or professional licensing fees.

This year we are requiring that each person complete a one page application. Individuals are limited to one-time assistance; however a combination of services may be allowed. Anything over $200.00 must be paid back; however, if we continue to have problems with individuals paying the Tribe back, this portion of the program may be interrupted.

You may contact Cassandra Mitchell in the TERO office at 707-482-1350

Vets meet in Klamath

Numerous services are now available

David Schaffer, of the Redwoods Vet Center, is now coming to Klamath every two weeks on Wednesdays to provide counseling and support for veterans.

Schaffer helps military vets in accessing veteran administration services, such as, service connected disability, claims for Post Traumatic Stress Disorder and other claims.

He also helps vets to get the right benefits.

Other Veterans Affairs benefits Schaffer aids vets in obtaining include: educational assistance for veteran's children, home loans, burial and memorial benefits, pensions, etc.

More than just benefits and services are discussed among the vets at the meetings.

Schaffer has been tossing around ideas with a number of interested veterans in the community, who want to do more for veterans here in Klamath and elsewhere in Yurok Country.

Some of the ideas the vets have come up with so far include: renaming the bridge over the Klamath River to honor vets, a flagpole and memorial in front of the tribal building, and providing honor and color guards at different events.

The next meeting is February 14.

For anyone interested in knowing more contact David O'Neill at (707) 482-0112.

Schaffer can be reached in Eureka at (707) 444-8271 or go to the Vet Center at 2830 G Street, Suite A or leave a message at the Tribal Office.

BY Georgiana Myers
Energy Specialist

That's right, the Yurok Energy Program has now been underway for a full year. In March of 2006 I came on board as the Tribe's Energy Specialist, my main job being to carry out a house-by-house energy needs assessment on the Reservation. Shortly after, Stephen Kullmann joined Tribal staff as an Energy Technician. We helped organize a training event in which we and several interested Tribe members spent two busy weeks learning about home energy savings and renewable energy from the staff of the Schatz Energy Research Center (SERC). Once the training was done, Stephen and I began visiting Tribal homes. In homes that generate their own power, we assessed the condition of their power systems and in some cases were able to perform minor repairs. We were able to help some of the folks we visited switch to lower utility rates, and the compact fluorescent lights and other energy-saving products we distributed are cutting energy costs in many households today.

The information we collected will help the Energy Program move forward, looking for funds and technical assistance to help the Tribe address the needs we identified. The Tribe has just submitted applications to the Bureau of Indian Affairs and the Department of Energy in the past couple of months seeking funds to conduct feasibility studies on increasing use of biomass, wind, and hydro power on the Reservation. If these projects are funded, you will see more info on them in coming issues of this newsletter. Meanwhile, the Tribe and SERC are continuing to make plans to expand the Energy Program into a complete Yurok energy services organization.

My position was only funded for one year, and it's time for me to move on. As an Energy Specialist, I learned a lot about energy and got to know my community better than ever. I have enjoyed my job

See **ENERGY**, page 13

COHO

restored to aid in recovery of Klamath River coho.

YTFP focused on finding the variety of habitats used by juvenile coho to survive high winter flows in the lower river. Sampling at lower river sites began in early November and is expected to extend through March. Technicians Scott Gibson, Josh Lewis, and Joseph Bates have excelled in capturing sizeable numbers of juvenile coho as well as steelhead, and sea-run cutthroat trout migrating upstream out of the main river channel into almost every site YTFP has visited in the lower river.

Examples of these locations include:

- estuarine sloughs, ponds, and tidal channels on the south sides of the estuary;
- lower reaches of tributaries such as Salt Creek, Panther Creek, Hoppaw Creek, and Waukell Creek;
- beaver ponds in Salt Creek, Panther Creek, and Richardson Creek;
- main stem river side-channel ponds adjacent to the Resighini Rancheria Casino and ponds in the side channel connecting Tarup Creek to the Klamath River.

Peak captures of upstream migrating coho followed early season rain storms and river flow increases, although small numbers of coho have continued to migrate upstream from the river all winter. To date (2/26) we have captured well over 1000 juvenile salmonids migrating upstream past this site indicating how important this stream is for fish during winter months. Upper river sampling locations between Tectah Creek and the Trinity River confluence included tributary junctions, main stem river bars, and lower reaches of tributaries such as Roaches Creek. YTFP crews led by Shane Quinn first visited these sites in January during a very dry period with low winter flows, and as a result we may have missed the majority of coho moving past. Coho were found to be using slow water bar habitat near the mouth of Pecwan Creek.

TANF

Plan which is tied to their needs and the path they choose to work for self-sufficiency.

Adults in most families receiving assistance are required to participate in work activities each week.

Yurok TANF can also address emergency needs in order to help a family avoid falling into extreme poverty.

However, TANF Emergency Assistance also has eligibility requirements. The TANF Plan states that all other federal, state and tribal resources are used prior to TANF Emergency Assistance Program funds.

The objectives of the Yurok Tribal TANF Program are:

- Increase the employability of TANF participants
- Increase employment opportunities
- Prevent and reduce unwanted and unplanned pregnancies
- Encourage healthy and stable families

The last two purposes are designed to prevent young people and young families from falling into poverty.

The Yurok Tribal Council decided to focus Yurok TANF prevention activities on young people and to emphasize Yurok Culture in this work.

TANF helps to fund healthy, culturally appropriate activities for young people and families.

Outdoor and family recreation activities are also offered. TANF prevention is mainly implemented through the Yurok Youth Program.

If you have access to the web you can check out Yurok Youth at http://www.yuroktribe.org/departments/socialservices/yurokyouth_000.htm.

Our office in Humboldt County is located at 525 7th Street in Eureka across from the old Eureka Inn. The telephone number is 707-445-2422.

Our temporary office location in Del Norte County is 286 M Street, Suite C in Crescent City.

The telephone number is 465-8305.

We will be moving to a permanent location at Price Mall in Crescent City this summer.

We will also provide TANF services regularly at tribal offices in Klamath and Weitchpec.

WATCH

- Practice and promote various crime prevention and home security measures such as: installing dead bolt locks and light sensors.
- Identify personal belongings by engraving a secure number on them.
- Take precautionary measures as recommended by the Police Department and Tribal Services.

To form a program in your neighborhood call Officer Abasolo at the Klamath headquarters (707-482-8185)

ENERGY

and am grateful for every person who allowed us to their home, into their lives. Without the wiliness of our people our project would have failed. Fortunately, the Energy Program will continue, so if you have any questions or problems involving energy at your home or business, please contact the Planning Department.

Taking care of the world around us is a Yurok value, we teach it when we gather for basket materials, when we fish, and gather acorns. Today we have garbage, an energy shortage, pollution and many other harmful elements to our environment. We should all do our part as human beings to take care of land. Turn off a light when you leave the room, don't let the water run for no reason and most importantly recycle! Take care our land and each other. Wo'hklaw

RISLING

her father.

"In high school playing sports kept me busy and kept me happy because there was really nothing to do on the Rez," Risling said.

While it would have been easier to forget about basketball and just focus on school, work and parenting, Risling said the challenges she has had to overcome were definitely worth it.

Risling, who works as an Administrative Specialist in the Yurok Tribe's Eureka Office, said she decided to return to the basketball court for her own satisfaction.

"I'm doing it for me," Risling said

SERC ENERGY NEWS

Fall 2006
Volume 1, Number 3

Features

In Every Issue

The quarterly newsletter of the Schatz Energy Research Center

HUMBOLDT STATE UNIVERSITY

Sustainable Energy for the Yurok Nation

Richard Engel

The Yurok Tribe, whose remote homeland stretches from the seashore to the inland mountains of northwest California, are close neighbors of SERC. We have worked with the Yurok on a number of occasions, helping them to power a telecommunications repeater station with a SERC fuel cell and build an off-grid residential solar power system to provide tribal elders with reliable electricity. Communities located on the mountainous Yurok Reservation are among the last few in California that have never been connected to the statewide electric power grid...and are also some of the poorest in the state. This situation results in a population with special energy needs.

SERC recently launched a partnership with the Tribe to develop an ongoing Yurok energy program. The program's goals are to improve energy security and reduce energy costs for Tribe members while providing energy-related job training and employment opportunities to the Tribe. The Yurok Tribal Council is also interested in achieving economic development using natural resources found on their reservation, including biomass, hydroelectric, and solar energy. However, the Tribe have made it clear that any energy development projects must minimize impacts on their land, their waters, and their many sacred cultural sites.

SERC engineer Jim Zoellick explains solar hot water and solar electric technologies to Yurok tribe members participating in an intensive two-week course on energy.

The Tribe has been awarded two grants by the U.S. Department of Energy (DOE) to begin creation of their energy program. SERC is working under contract to the Tribe to help implement both grants. SERC's activities with the Tribe to date include:

- Providing quarterly trainings to tribal staff on practical energy topics.
- Conducting a two-week intensive training course for Tribe members in residential energy efficiency auditing and the design, installation, maintenance, and repair of home renewable energy systems.
- Providing training and ongoing field support to two energy specialists as they conduct house-by-house energy audits on the reservation and perform minor repair and maintenance of solar and microhydroelectric systems.
- Creating a public outreach program to raise community energy awareness through brochures and direct one-on-one outreach.

The funding from DOE will also allow the Tribe to examine the feasibility of creating a tribal energy services utility. The energy audit data being collected will help us identify the unique energy needs on the Reservation. In addition, SERC is working with tribal staff to perform an inventory of the Tribe's energy resources and determine what steps are necessary for the

(continued on page 3)

UNPEPP (*continued from page 2*)

source. The propane generator will operate in winter or during consecutive cloudy days when the PV system cannot meet the total load. Given the limited solar resource at this often foggy Northern California coastal site, Matthew and Erin estimate that the PV portion of the system will meet 38% of the year-round residential electric load.

Although the design from 2000 recommended the purchase of new equipment, the 2006 project obtained all major components from previous RNSP installations; a successful strategy that offset the need to spend additional money on equipment. After revisiting the UNPEPP 2000 interns' site recommendation, load calculations and solar resource data, and then testing the performance of the old equipment, the interns determined where to place system components for best performance. Working closely with SERC machinist Ray Glover, Erin and Matthew designed and constructed a custom steel rack to hold the PV modules. The interns then transported the rack and equipment to the project site and installed them with the assistance of Park employees.

For the past six years, UNPEPP interns have had rewarding educational experiences while helping our national parks become more sustainable. Interestingly for SERC, what may be our final UNPEPP collaboration turned out to be the completion of our first; the UNPEPP 2006 interns installed a solar electric system based on design recommendations made by the UNPEPP 2000 interns, and the renewable energy system for the Espa Lagoon ranger residence has come full circle.

Interns Erin McDonald and Matthew Smith (*lower right*) pose with RNSP employees after successful installation of Espa Lagoon's new PV system.

"UNPEPP provided an amazing opportunity to apply classroom engineering theory to a real world need and create a more renewable solution."
Erin McDonald

Yurok Energy Program (*continued from page 1*)

Tribe to increase its sustainable use of these resources, for the Tribe's own use and possibly for export to bring needed income to the Tribe.

SERC's relationship with the Yurok Tribe brings new opportunities to the Tribe and allows SERC to deliver on its commitment to increase reliance on clean energy in our north coast region.

Hydrogen Safety and Awareness Training

Jim Zoellick

SERC Director Dr. Peter Lehman and Senior Research Engineer Jim Zoellick recently provided a hydrogen safety and awareness training to staff and safety officials at the State University of New York at Buffalo. SUNY Buffalo just received two hydrogen powered Toyota Prius hybrid vehicles and a portable refueling appliance from Quantum Technologies. The project is funded by the New York State Energy Research and Development Authority.

SERC provided safety and code review services for SUNY Buffalo's proposed refueling installation. SERC also conducted a very successful three-hour safety and awareness training. According to Paul Hoffman, the maintenance department manager at SUNY Buffalo, his crew was very concerned about handling hydrogen vehicles. In fact, they had gone to their union steward and asked whether they could be forced to fuel the vehicles. However, following the SERC training Paul said his crew was very enthusiastic and had no problems fueling and handling the vehicles. One of the points we stress in our trainings is that if hydrogen is handled properly, it is no more dangerous than other transportation fuels we are accustomed to using. We think they got it.

Docent Corner

Allison Oakland

Docents Get HyTEC

Fall has begun and with it a flurry of activity in our education and outreach program. We added four new docents to our program, three Environmental Systems graduate students and one undergraduate in Environmental Resources Engineering. Our program now has eight docents, our largest group thus far.

During their first week, docents received training in our Hydrogen Technology and Education Curriculum (HyTEC) electrolyzer/fuel cell lab equipment and then provided backup support for the HSU Engineering classes that performed the lab. Even though the HyTEC project was developed for high school chemistry students (as described below), the positive feedback received after performing the lab in college courses demonstrates how the lab can be readily incorporated into college level courses.

New docents Lucas Siegfried, Kristen Radecsky, Joe Purdon and James Apple *(left to right)*.

(continued on page 4)

H_2 Safety Training for UTC Power & CT Transit Jim Zoellick

SERC recently added UTC Power to their list of clients for whom they have provided hydrogen safety and awareness training. That list also includes Chevron, AC Transit, SunLine Transit, and the State University of New York at Buffalo.

UTC Power, a Connecticut-based company, has led an industry team to build New England's first fuel cell bus, which will be operated by CTTRANSIT. The bus will debut in Hartford in April. A $2.9 million Federal Transit Administration grant is paying for the bus and associated infrastructure development. The bus features a UTC Power PureMotion™ 120 kW fuel cell power system, a VanHool chassis, and a hybrid all-electric drive system integrated into the bus by ISE Research Corporation. The bus will be fueled at a new hydrogen fueling station at UTC Power, and will be housed and maintained at CT Transit's central bus terminal.

SERC's hydrogen safety and awareness training was delivered to mechanics at CT Transit who will be performing routine maintenance on the bus. The day before SERC arrived, CT Transit received the fuel cell power system and installed it in the bus with the help of UTC Power engineers. The fuel cell power module is essentially a plug-and-play system that was installed in a matter of hours. SERC also provided a hydrogen safety and awareness training to local first responders. The awareness training set a context for hydrogen as a transportation fuel and provided an overview of hydrogen technology. The safety training covered basic hydrogen safety concepts, presented details about the facilities and equipment associated with the project, and highlighted facility safety features and emergency response procedures.

SERC Helps Turn Schools Green Richard Engel

Over the past two years, SERC has worked with the Washington, DC-based Alliance to Save Energy (ASE) on the creation of an energy efficiency curriculum intended for nationwide use in high schools. The curriculum, known as Student Energy Auditor Training (SEAT), teaches students about energy by having them perform an energy audit on their own campus. SERC staff have pilot-taught the three-day curriculum in a half dozen schools across northern California, receiving positive reviews from students and teachers. In several cases, schools have gone on to make energy-saving upgrades based on the students' recommendations.

However, the three-day format of the SEAT curriculum has gotten mixed reviews from school administrators, already hard-pressed to make sure students cover all their existing curricula. SERC and ASE have responded by producing a new, one-day version of the curriculum that is correlated to California's state educational content standards. This approach will help teachers to integrate SEAT into their existing lesson plans. ASE has also asked SERC to produce a new version of SEAT adapted for use in middle schools, also standards-aligned. ASE plans to launch the new, streamlined SEAT curricula in southern California this spring.

SERC has also expanded its partnership with ASE through involvement in the Green Campus program. This ASE-sponsored program works with university students, staff, administrators, and faculty to improve energy efficiency on U.S. college campuses. The students of Humboldt State University's Green Campus team recently recruited SERC's Richard Engel as their staff advisor. Richard accompanied the team to Berkeley for a

Yurok Energy Project Update Richard Engel

SERC's ongoing effort to help the Yurok Tribe develop a Tribal energy program has recently been strengthened by a new collaboration with engineering students and faculty at Humboldt State University (HSU). The students, enrolled in Dr. Eileen Cashman and Dr. Arne Jacobson's capstone engineering design course for graduating seniors, are investigating options for hydropower development on the Yurok Reservation's many creeks. The class is learning how to operate within numerous technical, economic, environmental, and cultural constraints. The Tribe is eager to make greater use of on-Reservation energy resources but is also wary of potential impacts on fisheries or Yurok sacred and ceremonial sites.

The students will present their findings to SERC staff and the Yurok Tribal Council later this spring. SERC staff are excited about this opportunity to leverage the students' pro bono assistance on the project, while the students benefit from being involved in an exciting, real-world engineering project right here in Humboldt County.

Yurok Tribal Engineer (and former SERC employee) Dustin Jolley explains the Wautec community water system to HSU engineering students and faculty. *Photo by Richard Engel.*

SERC Helps United Indian Health Service Go Solar

Local health care provider United Indian Health Services (UIHS) recently received a grant from the State of California to install a 40-kW solar electric power system on the rooftops of two wings of UIHS's Potawot Health Village here in Arcata. SERC assisted UIHS in developing a conceptual design for the system and writing their grant proposal. Once UIHS received funding, they retained a professional solar contractor to install the system and hired SERC to help them with other aspects of the project.

For starters, we are developing interpretive materials to explain how the system works and promote renewable energy. The display SERC is developing will include an interactive computer display showing how much power the system is producing in real time, as well as a static display sign and a brochure visitors can take with them. UIHS wants these interpretive materials to convey to its clients and staff the connections between clean energy, health, and Native American values of living sustainably on the land.

SERC will also help UIHS with quality assurance, making measurements to ensure the solar system is generating as much power as it should. Finally, we will provide a training workshop for the UIHS community at large to increase understanding of clean energy resources and encourage greater use of these resources among Tribes in northwestern California.

Solar panels atop the maintenance wing of the UIHS facility. *Photo courtesy of UIHS.*

Conference *(continued from page 2)*

River Ridge; Greg Lamberg from Pacific Gas and Electric Company presenting on PG&E's proposed repowering of the Humboldt Bay Power Plant and their plan to study wave power in Humboldt County; and Pat King of DG Energy discussing DG Energy's biomass energy projects. SERC will also feature speakers at the conference, including Jim Zoellick delivering the plenary address, Michael Winkler speaking on renewable energy scenarios for Humboldt County, Peter Johnstone presenting on SERC's hydrogen power park project, and Stephen Kullmann discussing the economics and environmental impact of refrigerator replacement.

Outreach on the Klamath

This past spring, SERC visited three elementary schools on the Yurok Reservation: Weitchpec Elementary, Margaret Keating School, and Jack Norton School. The goal was to inspire and teach Yurok youth about basic energy concepts, renewable energy technologies, and energy efficiency. The events were part of a community-wide energy education campaign for SERC's "Human Capacity Building in Energy Efficiency and Renewable Energy" project with the Yurok Tribe.

Our elementary energy curriculum starts with a primer on what we mean by "energy" and "power" and where energy comes from. We then explain how renewable energy is different from conventional energy sources, and provide real-world examples of renewable energy through discussing some of the renewable energy projects we are involved in at SERC.

Once the foundation of energy concepts are laid, we play our power consumption guessing game called "Watts Up?" to help the students understand energy use. In the game, teams of students have the task of guessing how much power typical home appliances consume. The appliance is plugged into a power meter, turned on, and the team that was closest gets a point. In addition to the inevitable surprises we get from the difference between a radio and a toaster (4 W vs. 1000 W), "Watts Up?" gives students the opportunity to do math and convert watts of power to watt-hours of energy. Finally, we challenge students to put renewable energy in action by building their own solar electric circuits that power buzzers and fans. This hands-on activity is a fun way to end the lesson and for students to get first hand experience making solar energy work, even when it is cloudy like it was at Margaret Keating School. Luckily for the Jack Norton school children, it was sunny enough to demonstrate a solar oven, and we cooked cinnamon rolls during the outside activities. The oven was able to reach temperatures of 250 °F and cooked the rolls in about 45 minutes. After lunch, we shared our solar powered dessert with the whole school; it was a big hit.

It is heartening to see how students think about energy. In particular, the students at Jack Norton School have a unique perspective on energy, as all the students live off the grid. And, in addition to providing students the tools they need to think about energy efficiency and conservation, each student was given a compact fluorescent light bulb (one of the "Watts Up?" appliances) and energy information brochures so that they could put into practice at home what they learned in the classroom.

"The whole team was surprised that the twirly light bulb was only 14 watts..." (Thank you letter from a Margaret Keating School student.)

Appendix 10: Yurok energy brochures

WHERE TO GET MORE INFORMATION

For more information about wood stoves and air quality, contact the North Coast Unified Air Quality Management District at (707) 443-3093 or visit the California Air Resources Board's website at www.arb.ca.gov.

Humboldt County Building Division: (707) 445-7245

Del Norte County Building Inspection: (707) 464-7253

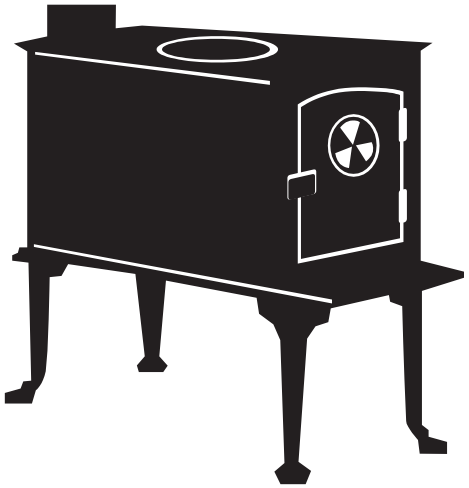
To get more information about energy for your home or business in Yurok country, contact the Yurok Tribe Energy Program: (707) 482-1350 ext. 363.

Some of the material used in this brochure was adapted from the California Air Resources Board's Wood Burning Handbook and Natural Resources Canada's Getting the Most Out of Your Wood Stove.

Yurok Tribe Energy Program
P.O. Box 1027Klamath, CA 95548

Heating Your Home With Wood

Tips for Keeping Your Family Warm and Safe… and Getting the Most Out of Every Cord of Firewood



Yurok Tribe Energy Program

INTRODUCTION

Many people on the Yurok Reservation heat their homes with wood. One recent survey found that more than 80% of homes in the upriver area rely on wood as their main heating fuel. In a region where wood is so abundant and other fuels are expensive and hard to come by, it makes sense to heat with firewood. However, improper use of woodstoves can be dangerous and costly. This brochure explains how to heat with wood safely, cleanly and efficiently.

PROBLEMS WITH BURNING WOOD FOR HEATING YOUR HOME

Aside from the occasional forest fire, the Yurok Reservation is blessed with clean air. However, a woodstove that is not properly maintained or operated can produce serious indoor air pollution, causing respiratory and eye problems for your family and moisture problems for your house. In addition, an old-fashioned or poorly maintained wood stove may be inefficient, costing you extra money for firewood and placing an unnecessary burden on our local forests.

Open fireplaces generally make poor heaters. They can actually make a house colder by drawing in heated air from the house's interior and pulling cold outside air into the house.

SAFETY CONCERNS

A safe woodstove must be equipped with a suitable chimney, and adequate clearance between the stove and combustible surfaces is critical. Normal clearance is 36", but this can be reduced to 12" where needed when adequate heat shielding is used. Call your County building department for more specific guidance (see back of this brochure).

Every home should be equipped with smoke and carbon monoxide (CO) alarms and an "ABC" type fire extinguisher. Make sure to change the batteries twice a year on battery-operated alarms, and check the gauge regularly on your fire extinguisher to see if it needs to be recharged. To avoid chimney fires, have your chimney cleaned at least once a year or whenever ¼" of creosote builds up in the stovepipe.

Never burn painted or treated wood, plastic, or garbage in a wood stove or fireplace.

PRACTICES FOR IMPROVING EFFICIENCY AND REDUCING EMISSIONS

- Use only dry, seasoned wood. Properly seasoned wood is gray and shows cracks in the end grain. Don't store unseasoned wood indoors or stacked against outside walls, as it may cause mold and moisture problems or bring pests into your home. Unseasoned firewood will produce more smoke and less heat than seasoned wood.
- Burn short, small, hot fires instead of stuffing the stove full of wood and setting a slow, smoldering fire.
- Open all air inlets on the stove to ensure good airflow when starting a fire. This pre-dries the firewood, primes the chimney to produce a strong draft, and loosens any creosote that has recently accumulated in the chimney. Once a bed of hot coals is established, reduce the air flow.

CLEANER AND MORE EFFICIENT ALTERNATIVE TECHNOLOGIES

The best way to burn wood cleanly is to use a modern, efficient wood stove certified by the U.S. Environmental Protection Agency (EPA). The most efficient types of stoves include:

- **Catalytic stove.** The catalytic combustor in these stoves allows the volatile gases to burn at lower temperatures. Efficiency does drop over time; the catalyst device requires replacement after several years.
- **Non-catalytic efficient stove.** These stoves are designed with baffles or secondary combustion chambers, which route the burnable gases through the hottest part of the firebox and mix them with sufficient air to burn them more completely.
- **Pellet stove.** The most efficient woodstove type, but they can be costly ($1,200 or more) and require store-bought pellets as well as electricity (about 100 kWh per month) to operate the automated pellet feed and air circulation fans.

Fire Hazards

Follow these tips to prevent fires:

- Never store fuel for your generator in the home. Gasoline, propane, kerosene, and other flammable liquids should be stored outside of living areas in properly-labeled, non-glass safety containers. Do not store them near a fuel-burning appliance, such as a propane water heater in a garage. If the fuel is spilled or the container is not sealed properly, invisible vapors from the fuel can travel along the ground and can be ignited by the appliance's pilot light or by arcs from electric switches in the appliance.
- Before refueling the generator, turn it off and let it cool down. Fuel spilled on hot engine parts could ignite.

WHERE TO GET MORE INFORMATION

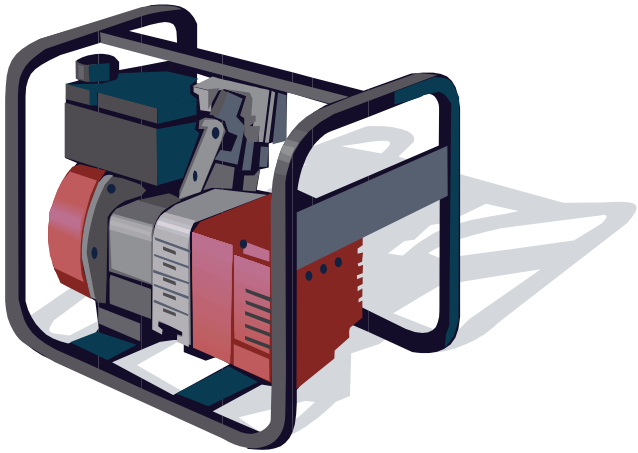
The material used in this brochure was adapted from the U.S. Consumer Product Safet Commission's bulletin *Safety Alert: Portable Generator Hazards*. **For more information about generator safety, call the CPSC at 1-800-638-2772 or visit www.cpsc.gov.**

To get more information about energy for your home or business in Yurok country, contact the Yurok Tribe Energy Program: (707) 482-1350 ext. 363.

Yurok Tribe Energy Program
P.O. Box 1027Klamath, CA 95548

Portable Generator Safety

Protecting Your Family from Carbon Monoxide, Electrical, and Fire Hazards



Yurok Tribe Energy Program

Introduction

Many Yurok families rely on generators for their main or backup home power source. These generators are useful, but they also can be hazardous. The primary hazards to avoid when using a generator are carbon monoxide (CO) poisoning from the toxic engine exhaust, electric shock or electrocution, and fire.

It is important to understand where to locate your generator and how to use it safely. Every year, people die in incidents related to portable generator use, mainly due to CO poisoning from generators used indoors or in partially-enclosed spaces

Carbon Monoxide Hazards

NEVER use a generator in enclosed or partially-enclosed spaces. Generators produce high levels of CO very quickly. When you use a portable generator, remember that you cannot smell or see CO. Even if you can't smell exhaust fumes, you may still be exposed to CO.

If you start to feel sick, dizzy, or weak while using a generator, get to fresh air RIGHT AWAY. DO NOT DELAY. The CO from generators can rapidly lead to full incapacitation and death.

If you experience serious symptoms, get medical attention immediately. Inform medical staff that CO poisoning is suspected. If you experienced symptoms while indoors, have someone call the fire department to determine when it is safe to re-enter the building.

Follow these safety tips to protect against CO poisoning.

- NEVER use a generator indoors, including in homes, garages, basements, crawl spaces, and other enclosed or partially-enclosed areas, even with ventilation. Opening doors and windows or using fans will not prevent CO buildup in the home.
- Follow the instructions that come with your generator. Locate the unit outdoors and away from doors, windows, and vents that could allow CO to come indoors.
- Install battery-operated CO alarms or plug-in CO alarms with battery back-up in your home, according to the manufacturer's installation instructions. The CO alarms should be certified to the requirements of the latest safety standards for CO alarms (UL 2034, IAS 6-96, or CSA 6.19.01).
- Test your CO alarms frequently and replace dead batteries.

Electrical Hazards

Follow these tips to protect against shock and electrocution:

- Keep the generator dry and do not use in rain or wet conditions. To protect from moisture, operate it on a dry surface under an open, canopy-like structure. Dry your hands if wet before touching the generator.
- Plug appliances directly into the generator. Or, use a heavy duty, outdoor-rated extension cord that is rated (in watts or amps) at least equal to the sum of the connected appliance loads. Check that the entire cord is free of cuts or tears and that the plug has all three prongs, especially a grounding pin.

If your home is connected to utility power, follow these additional generator safety tips.

- NEVER try to power the house wiring by plugging the generator into a wall outlet, a practice known as "backfeeding." This presents an electrocution risk to utility workers and neighbors served by the same utility transformer and may bypass built-in household circuit protection devices.
- If you must connect the generator to the house wiring to power appliances, have a qualified electrician install the appropriate equipment in accordance with local electrical codes. Or ask the utility company to install an appropriate power transfer switch.
- For power outages, permanently installed stationary generators are better suited for providing backup power to the home. Even a properly connected portable generator can become overloaded, possibly leading to a generator failure.

WHERE TO GET MORE INFORMATION
For information and resources about insulating your home…

Redwood Coast Energy Authority
serves Humboldt County residents and businesses with information on energy efficiency and renewable energy
Energy Answerline
(800) 931-7232

Redwood Community Action Agency
offers weatherization services including insulation for residents of Humboldt County on a limited income
(707) 444-3831

Del Norte Senior Center
offers weatherization services including insulation for residents of Del Norte County on a limited income
(707) 464-3069

PG&E Smarter Energy Line
(800) 933-9555

Pacific Power Customer Service
(888) 221-7070

To get more information about energy for your home or business in Yurok country, contact the Yurok Tribe Energy Program: (707) 482-1350 ext. 363.

Yurok Tribe Energy Program
P.O. Box 1027
Klamath, CA 95548

FAST FACTS ABOUT INSULATING YOUR HOME

Yurok Tribe Energy Program

INTRODUCTION

Heating and cooling ("space conditioning") account for 50–70% of the energy used in the average home. Unless your home was constructed with special attention to energy efficiency, adding insulation will probably reduce your fuel bills or firewood costs. Even in a newer home, adding insulation may save enough money in reduced fuel or firewood costs to pay for itself within a few years and continue to save you money for years to come.

IMPORTANCE OF INSULATION

Inadequate insulation and air leakage are leading causes of energy waste in most homes. Proper insulation is a key element for a more comfortable and energy efficient home. It is important to have a continuous boundary of insulation between the conditioned, indoor spaces and the unconditioned, outdoor spaces. This boundary is referred to as the "building envelope" and consists of the walls, floor, and ceiling or roof. Low insulation levels and gaps or voids in the insulation materials can provide paths through which heat and air easily flow into or out of the residence.

INSULATION PRIORITIES

- Insulate your attic to the recommended level, including the door, or hatch cover.
- Insulate under floors above unheated spaces and on the edges of a slab-on-grade.
- Insulate exterior walls to recommended levels in new house construction. When remodeling or re-siding your house, consider using the levels recommended for new construction in your existing walls.

R Values for Insulation Materials

Insulation Material	R Value (per inch thickness)
Fiberglass Batts	**2.6 to 4.2**
Loose Fill Fiberglass	**2.4 to 4.4**
Polystyrene Board	**3.6 to 5.0**
Loose Fill Cellulose	**3.0 to 3.6**

INSULATION MATERIALS

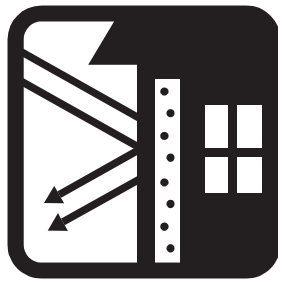
Available insulation materials include batt-type, loose-fill, rigid foam panels, and spray-type. Insulation materials are rated according to their ability to resist heat flow. This thermal rating is commonly known as an "R-value." The higher the R-value of a material, the better its ability to resist heat flow. See the table for insulation values of some typical materials.

BEFORE YOU INSULATE

- Reduce air leakage—Air travels through any openings in your walls, floors, or ceilings. It is important to stop these leaks before adding attic insulation that may make them less accessible. Attic insulation itself will not stop these leaks, and you will not save as much energy as expected.
- Control moisture—Water vapor from the interior can pass into the insulation and condense, significantly reducing the material's insulating value and leading to mold growth, peeling paint, and rotting of structural wood. Use a vapor barrier on the interior-facing side of the insulation and adequate attic or crawl space ventilation to avoid moisture problems.
- Improve ventilation—Adequate ventilation will prevent excessive moisture and the build-up of stale air and indoor air pollutants.

BENEFITS OF INCREASED INSULATION

- Improved comfort—Increased insulation makes it easier to maintain comfortable temperatures inside your home.
- Lower energy costs—Increased insulation reduces the amount of energy consumed for home heating and cooling, lowering current energy bills and protecting you from future increases in fuel or firewood costs.
- Improved indoor air quality—Increased insulation reduces the gaps and voids through which unconditioned air can leak into a house, avoiding dirt, dust, and other impurities that negatively affect indoor air quality.



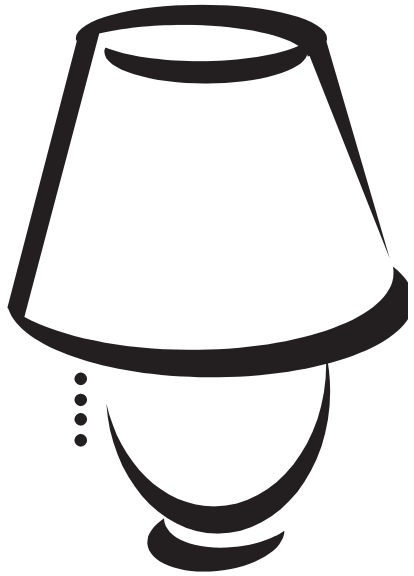
WHERE TO GET MORE INFORMATION

To get more information about energy for your home or business in Yurok country, contact the Yurok Tribe Energy Program: (707) 482-1350 ext. 363.

Yurok Tribe Energy Program
P.O. Box 1027Klamath, CA 95548

Energy-Efficient LIGHTING

For Your Home



Yurok Tribe Energy Program

INTRODUCTION

The type of lighting you use in your home affects how well you can see and perform tasks, how your home looks, and of course how much you pay for energy. Technologies developed during the past few years can help cut your lighting costs up to 75% while enhancing lighting quality and reducing environmental impacts.

BENEFITS OF ENERGY-EFFICIENT LIGHTING

- Installing high-efficiency lighting in the most used fixtures in a home can **reduce lighting energy consumption (and costs)** by half or more.
- Greater efficiency in lighting translates into **less waste heat** to be removed from the space by air conditioning equipment.
- Energy- efficient outdoor lighting technologies can **improve the safety and security** of a home. Safety can also be improved by eliminating high-wattage light bulbs that are fire hazards.
- Technological advances in fluorescent lighting have produced **fluorescent lamps that are essentially equivalent to incandescent lamps** for color quality and instant start.

You can cut lighting costs by 1) **choosing the most efficient** appropriate lighting technology, 2) reducing electricity consumed by **lowering lamp wattage** in fixtures, or 3) reducing the length of time the light source is on by **improving lighting control devices**.

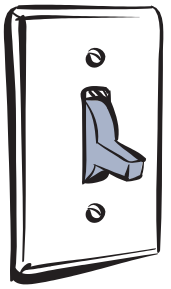
CHOOSE THE RIGHT TECHNOLOGY

Many Yurok households are not served by electric utilities. Some of these homes are still using kerosene or propane lamps. But did you know that it costs about five times as much to operate a pressurized kerosene lamp compared to an incandescent light bulb of the same brightness using generator power? Compared to an energy-saving compact fluorescent lamp (CFL), the kerosene lamp is nine times as expensive! Your "low-cost" light source may be costing more than you think.

REDUCE LAMP WATTAGE

Replace standard incandescent lamps that are used often with CFLs for substantial energy savings. CFLs can replace incandescents that are 3 to 4 times their wattage, saving up to 75% of the initial lighting energy. Although CFLs cost more than comparable incandescent bulbs, they can last 10 times as long.

Replace halogen torchieres with CFL torchieres. A 60-watt CFL torchiere will produce more light at an operating temperature 500ºF cooler than a 300-watt halogen. In addition to wasting energy, halogen torchieres can cause household fires because of their high temperatures.



IMPROVE LIGHTING CONTROL DEVICES

Lighting controls are devices for turning lights on and off or for dimming them.

- Snap switches, located in numerous convenient areas, make it easier for people in large, shared spaces to turn off lights in unused areas.
- Photocells turn lights on and off in response to natural light levels. Photocells switch outdoor lights on at dusk and off at dawn, for example.
- Mechanical or electronic time clocks automatically turn on and off indoor or outdoor lights for security and safety.
- Spring-driven crank timers limit lights to short durations where the need for light is brief.
- Occupancy sensors activate lights when a person is in the area and then turn off the lights after the person has left. They also offer security advantages over continuous lighting. When lights suddenly come on, they startle intruders and alert residents and neighbors to motion in the area.
- Dimmers reduce the wattage and output of incandescent and fluorescent lamps. Dimmers also increase the service life of incandescent lamps significantly. Dimming fluorescents requires special dimming ballasts and lamp holders.

WHERE TO GET MORE INFORMATION

To learn more about phantom loads, see:
http://standby.lbl.gov/

To get more information about energy for your home or business anywhere in Yurok country, contact the Yurok Tribe Energy Program: (707) 482-1350 ext. 363.

For general information and resources about saving energy in your home…

Redwood Coast Energy Authority
serves Humboldt County residents and businesses with information on energy efficiency and renewable energy.
Energy Answerline
(800) 931-7232

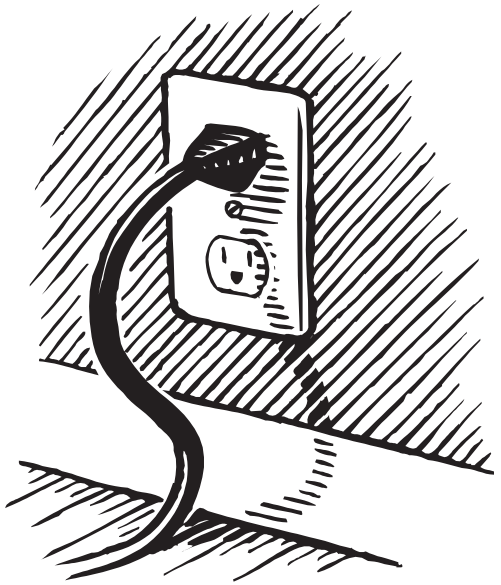
PG&E Smarter Energy Line
(800) 933-9555

Pacific Power Customer Service
(888) 221-7070

Yurok Tribe Energy Program
P.O. Box 1027
Klamath, CA 95548

Is Your Home Wasting Electricity...

When You're Not Even There?



Yurok Tribe Energy Program

"Phantom Loads" May Be Costing You A Lot

Phantom loads are small constant loads in electronic devices that consume electricity, even when the device is turned "off" or not performing its principal function. Examples of phantom loads are the clocks in VCRs and microwave ovens, the small (usually black) wall cubes that adapt DC appliances to run on AC house current, and the instant-on features in televisions and home entertainment centers. These loads typically range from 1 to 10 Watts per appliance.

"Leaking electricity", "standby loads", "standby consumption" and "energy vampires" are other terms used to describe phantom loads. They contribute to significant amounts of energy consumption by drawing power out of sight and out of mind , 24 hours a day, 365 days a year. This constant power draw adds up.

How Much Energy Is Being Wasted?

An average grid-connected house on the Yurok Reservation might constantly leak between 50 and 100 Watts of energy. This could be adding $3 to $12 a month to your electric bill. If you live off-grid, these loads could be costing you several times that in generator fuel or contributing to premature failure of your batteries.

Benefits of Reducing Phantom Loads

Reducing the amount of energy phantom loads waste can help by:

- Saving money
- Decreasing pollution
- Lessening the risk of fire and shock hazards
- Ensuring and prolonging the proper performance of electrical devices

Controlling Phantom Loads

To cut your phantom load demand:

- Unplug devices that are not in use.
- Whenever possible place electrical devices where there is a manual on/off switch between the device plug and outlet, such as a power strip, extension cord with toggle switch or wall switch.
- When buying new appliances, purchase those with the Energy Star label or similar low-watt off mode consumption standard.

Average number of kilowatt-hours (kWh) used in a month while in "off" mode, and the cost per month using average residential rates for PG&E and PP&L customers.

Appliance	kWh/mo.	PG&E $/mo. (@ $.13/kWh)	PP&L $/mo. (@ $.082/kWh)
Computer off/sleep	1.3/22.3	$0.17/$2.90	$0.11/$1.83
Monitor off/sleep	1.5/6.0	$0.20/$0.78	$0.12/$0.49
Copier	3.8	$0.50	$0.31
Rechargeable vacuum	1.6	$0.21	$0.50
Range	2.0	$0.26	$0.16
Rice Cooker	1.5	$0.20	$0.12
Cordless phone	1.8	$0.23	$0.15
DVD player	3.1	$0.40	$0.25
VCR	4.4	$0.57	$0.36
Video game console	0.7	$0.09	$0.06
TV	3.3	$0.43	$0.27
Compact stereo	7.3	$0.95	$0.60
Cable box digital/analog	16.6/7.8	$2.13/$1.01	$1.36/$0.64
Satellite TV system	2.2	$1.60	$0.18
Microwave	2.1	$0.27	$0.17
Rechargeable screwdriver	1.5	$0.20	$0.12
Ink-jet printer	3.7	$0.48	$0.30
Answering machine	2.2	$0.29	$0.18
Total	**76.2/92.9**	**$9.92/$12.11**	**$6.25/$7.62**

Sources: Alan Meier and Karen Rosen, Lawrence Berkeley National Lab; Leo Rainer, Davis Energy group

BATTERY SAFETY

Wear rubber gloves and safety goggles when maintaining batteries. Batteries contain concentrated sulfuric acid that can cause severe and permanent damage to skin, eyes, and clothing.

Batteries can release flammable gases during charging. Never smoke, use open flames, or generate sparks near batteries.

Use only well insulated tools when working with batteries and be careful not to drop metal objects across battery terminals. A short-circuited battery may explode and cause serious injury.

WHERE TO GET MORE INFORMATION

For more information about care and maintenance of solar electric systems, as well as other questions about energy issues in Yurok country, contact the Yurok Tribe Energy Program at (707) 482-1350 ext. 363.

Yurok Tribe Energy Program
P.O. Box 1027
Klamath, CA 95548

Solar Electric System Maintenance

Tips for Getting the Most Out of Your Solar Electric System

Yurok Tribe Energy Program

INTRODUCTION

Solar electric systems are a cost-effective and environmentally friendly way to provide electricity in remote locations. In areas of the Yurok Reservation where there currently are no electric power lines, solar electric systems are a popular energy system choice. These systems can provide many years of good service if properly maintained. However, without proper maintenance these systems are prone to premature failure.

This brochure outlines a few simple maintenance tasks that will help keep your solar electric system working well, save you money, and help you avoid problems with your system.

COMMON PROBLEMS WITH SOLAR ELECTRIC SYSTEMS

Solar electric systems work well when properly operated and maintained. When problems do occur, they are often associated with the batteries. In the wintertime, when there is not much sunlight available, batteries tend to become deeply discharged. If they are left discharged for long periods they will lose capacity and will be permanently damaged. Although they may still work, they won't work nearly as well as they once did. In addition, battery fluid levels must be adequately maintained or batteries will become damaged.

Other problems associated with solar electric systems can include loss of power due to shading of the solar electric modules. A small amount of shade will significantly reduce system output. Charge controllers and inverters are other components in a system that can become damaged and need repair or replacement. If you suspect problems with your inverter or charge controller, contact the Yurok Tribe Energy Program for assistance.

SIMPLE MAINTENANCE TASKS

Below is a list of simple maintenance tasks that can help ensure proper system performance and a long system life.

Maintaining Batteries

The two most important battery maintenance tasks are to maintain water levels and to keep batteries adequately charged.

- Once per month, check water levels in all battery cells. Add water as needed. Use ONLY PURE DISTILLED WATER. Water levels should be about one half inch above internal plates. Do not overfill.
- Once every two months, perform an equalization charge. Most charge controllers or inverter battery chargers offer this feature. This procedure charges the batteries for 1-2 hours at an elevated voltage. After the equalization charge top off the battery water level as needed.
- Keep batteries adequately charged in the winter when there is limited sunlight. When running your generator, charge the batteries at least once per week to a full state of charge.
- Keep battery tops clean and dry. Keep battery wire connections free of corrosion.

Note: See the back of this brochure for important battery safety tips.

Managing Electrical Loads

If loads are too large, batteries will get severely discharged. Reduce your loads when solar power is scarce. Run your generator as needed and use it to recharge your batteries.

Where possible, use energy efficient appliances. Use compact fluorescent instead of incandescent lights. They use 75% less energy. Turn off or disconnect lights and appliances when not in use.

Cleaning Solar Electric Modules

Solar electric modules have no moving parts and need little to no maintenance. However, in areas that get dusty and dirty, periodic washing of the solar modules will help maintain performance. If safe to do so, wash the modules with a mild soap and water solution and rinse with clean water. Wash modules in the early morning or early evening; do not wash modules in the heat of the day. This could cause the glass to break or cause build up of minerals on the glass.

Trimming Trees to Eliminate Shading

A small amount of shade will seriously reduce the output from your system. Ideally the solar modules should be free from shade from 9 AM to 3 PM. If trees or shrubs are causing shading during these hours, they should be trimmed back. Remember that shading will be more problematic in the wintertime when the sun's path is low across the sky. Also, remember that this is an on-going task because trees and shrubs tend to grow back.

WHERE TO GET MORE INFORMATION
For information and resources about weatherizing your home…

Redwood Coast Energy Authority
serves Humboldt County residents and businesses with information on energy efficiency and renewable energy
Energy Answerline
(800) 931-7232

Redwood Community Action Agency
offers weatherization services for residents of Humboldt County on a limited income
(707) 444-3831

Del Norte Senior Center
offers weatherization services for residents of Del Norte County on a limited income
(707) 464-3069

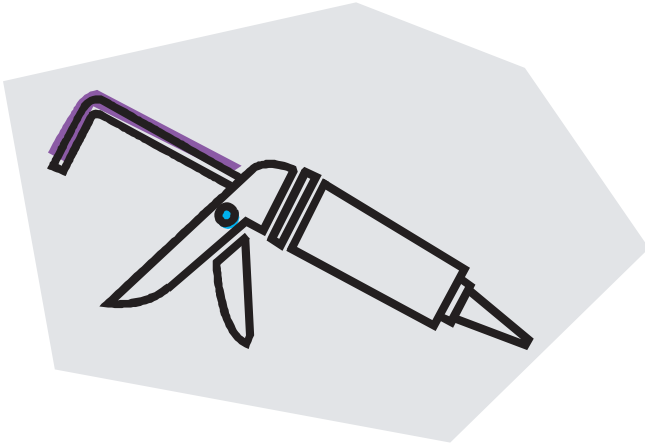
PG&E Smarter Energy Line
(800) 933-9555

Pacific Power Customer Service
(888) 221-7070

To get more information about energy for your home or business in Yurok country, contact the Yurok Tribe Energy Program: (707) 482-1350 ext. 363.

Yurok Tribe Energy Program
P.O. Box 1027
Klamath, CA 95548

FAST FACTS ABOUT WEATHERIZING YOUR HOME



Yurok Tribe Energy Program

INTRODUCTION

Sealing your home with caulking and weather stripping is one of the most cost-effective ways to reduce energy waste. Caulking seals cracks and joints in the house. Weather stripping reduces air infiltration around moving parts of the house, such as doors and windows. Caulking and weather stripping will alleviate drafts and help your home feel warmer when it is cold outside, but these weatherization techniques do not replace the need for proper insulation throughout your home.

VENTILATION IS IMPORTANT

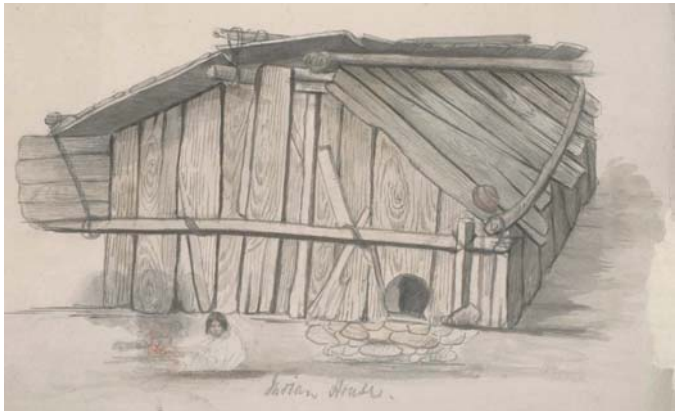
Sealing air leaks in a home, without proper ventilation, can also seal in indoor air pollutants. Therefore, any plan to tighten the thermal envelope of a home should be accompanied by an evaluation of the home's ventilation needs. Active ventilation may be needed to provide fresh air.

WHERE ARE THE AIR LEAKS?

Look at areas where different materials meet, like between a brick chimney and wood siding, or between the foundation and walls. Also inspect around the following for any cracks or gaps that could allow air leakage:

- Door and window frames
- Mail chutes
- Electrical and gas service entrances
- Cable TV and phone line entrances
- Outdoor water faucets
- Dryer vents
- Air conditioners
- Vents and fans

For a more accurate measurement of air leakage, hire a technician to conduct a blower door test in your home.



source: www.calisphere.universityofcalifornia.edu

CAULKING

Caulk forms a flexible seal for cracks, gaps, or joints that are less than one quarter-inch wide. In addition to plugging air leaks, caulking can also prevent water damage inside and outside the home when applied around water pipes, ceiling fixtures, and plumbing fixtures.

Applying Caulk

Although not a high-tech operation, caulking can be tricky. It is best applied when outdoor temperatures are between 50° and 65°F, when most building materials are at the midpoint of contraction and expansion and differences between indoor and outdoor temperatures are minimized. Read and follow the instructions on the compound cartridge. Avoid trouble by remembering a few important tips:

- Clean and dry all areas to be caulked for good adhesion. Remove any old caulk and paint, using a putty knife or a large screwdriver.
- Hold the gun at a consistent angle. Forty-five degrees is best for getting deep into the crack. You have the right angle when the caulk is immediately forced into the crack as it comes out of the tube.
- Caulk in one straight continuous stream, if possible. Avoid stops and starts.
- Send caulk to the bottom of an opening to avoid bubbles.
- Release the trigger before pulling the gun away to avoid applying too much. A caulking gun with an automatic release makes this much easier.
- If caulk oozes out of a crack, use a putty knife to push it back in.
- Make sure caulk sticks to both sides of a crack .
- Don't skimp. If the caulk shrinks, reapply it to form a smooth bead that will seal the crack completely.

WEATHER STRIPPING

Weather stripping can seal leaks around movable joints, such as windows or doors. The weather stripping you choose should seal well when the window or door is closed while allowing it to open freely. You need to choose an appropriate product for each specific location. The weather stripping will need to withstand the friction, weather, temperature changes, and wear and tear associated with its location.

Applying Weather Stripping

Weather stripping supplies and techniques range from the simple to the technical. Consult the instructions on the weather stripping package. Here are a few basic guidelines:

- Weather stripping should be applied to clean, dry surfaces in temperatures above 20°F.
- Measure the area to be weather stripped twice before cutting anything.
- Apply weatherstripping snugly against both surfaces. The material should compress when the window or door is shut.

WHERE TO GET MORE INFORMATION
For information and resources about saving energy in your home…

Redwood Coast Energy Authority
serves Humboldt County residents and businesses with information on energy efficiency and renewable energy.
Energy Answerline
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Yurok Tribe Energy Program
P.O. Box 1027
Klamath, CA 95548

Home Energy Checklist for Action

Yurok Tribe Energy Program

Home energy checklist for action

Did you know that the average Yurok Tribe household spends over $325 per month on home energy? You have the power to do something about this by using energy more efficiently. Here's a simple checklist to give you an idea of some things you can start doing today to cut energy costs at home.

To Do Today

· Turn down the temperature of your water heater to the warm setting (120°F). You'll not only save energy, you'll avoid scalding your hands.

· Look for opportunities to replace incandescent lights with compact fluorescent lights (CFLs). CFLs can save three-quarters of the electricity used by incandescents. The best targets are 60-100W bulbs used several hours a day. Measure the clearance in the fixtures to make sure they will accommodate compact fluorescents, which can be slightly bigger than incandescents.

· Check the age and condition of your major appliances, especially the refrigerator. You may want to replace it with a more energy-efficient model before it dies.

· Check if your water heater has an insulating blanket. An insulating blanket will pay for itself in one year or less!

· Start using energy-saving settings on refrigerators, dishwashers, washing machines, and clothes dryers.

· Clean or replace air filters on furnace and air-conditioner .

This Week

· Visit the hardware store. Buy a water-heater blanket, low-flow showerheads, faucet aerators, and compact fluorescents, as needed.

· Rope caulk very leaky windows.

· Assess your heating and cooling systems. Determine if replacements are justified, or whether you should retrofit them to make them work more efficiently to provide the same comfort (or better) for less energy.

This Month

· Collect your utility bills. Separate electricity and propane bills. Target the biggest bill for energy conservation remedies.

· Crawl into your attic or crawlspace and inspect for insulation. Is there any? What type? How many inches thick?

· Insulate hot water pipes and ducts wherever they run through unheated areas.

· Seal up the largest air leaks in your house—the ones that whistle on windy days, or feel drafty. The worst culprits are usually not windows and doors, but utility cut-throughs for pipes ("plumbing penetrations"), gaps around chimneys and recessed lights in insulated ceilings, and unfinished spaces behind cupboards and closets. Better yet, hire an energy auditor with a blower door to point out where the worst cracks are. All the little, invisible cracks and holes may add up to as much as an open window or door, without you ever knowing it!

· Install a clock thermostat to set your thermostat back automatically at night.

This Year

· Insulate. Bring your attic insulation level up to at least R-38. Install R-19 insulation under your floors if you have an accessible crawl space.

· Replace aging, inefficient appliances. Even if the appliance has a few useful years left, replacing it with a top-efficiency model is generally a good investment.

· Upgrade leaky windows. It may be time to replace them with energy-efficient models or to boost their efficiency with weatherstripping and storm windows.

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American Council for an Energy-Efficient Economy
1001 Connecticut Ave, NW Ste 801 Washington, DC 20036
(202) 429-8873
aceee.org

Appendix 11: Tally of Tribal staff energy program priorities

Green Dots Tally

For this training exercise, Tribal staff members were each given a sheet of green dot stickers. They were asked to distribute their stickers among a set of energy priorities, placing the most dots on the priorities they felt were most important for the Tribe to achieve. The numbers below are the total number of dots that were assigned to each of the priorities.

Cleaner Energy Sources=11
Tribal Energy Self Sufficiency=24
More staffing positions or funding for tribal energy activities=10
Assistance w/ paying energy bills=1
Energy efficiency improvements for Tribal homes & businesses= 14
Energy education for Tribal member (energy consumers) =16
Energy Education for children and youth=9
Assistance with getting new renewable energy systems for tribal homes & businesses= 5
Assessment/repair of existing renewable energy systems for Tribal homes/business=7
Training in energy job skills for Tribal members=8
Power generation on Reservation to sell to utilities as revenue source for the Tribe=4
Household electrification=9
Easier access to fuels (propane, gasoline, diesel, firewood, etc.)=9
Access to energy to maintain health and safety for elders or children=17
Energy-related economic development opportunies=6

Appendix 12. Energy Education Resources for Teachers

"The Energenius Program," Pacific Gas & Electric Company, http://www.pge.com/energenius/

Various lesson plans/modules from the National Energy Education Development Project (NEED), http://www.need.org/curriculum.php

"School Power," New York State Energy Research and Development Authority http://www.powernaturally.org/Programs/SchoolPowerNaturally/InTheClassroom/default.asp

"Dr. E's Energy Lab," US Dept. of Energy, Energy Efficiency and Renewable Energy, http://www1.eere.energy.gov/kids/

Various multidisciplinary lesson plans from the Alliance to Save Energy, http://www.ase.org/section/_audience/educators/lessons

Energy efficiency education resources from Bonneville Power Authority, http://www.bpa.gov/Energy/N/education/

List of multiple renewable energy education materials from the US Dept. of Energy, Energy Information Administration: http://www.eia.doe.gov/bookshelf/eer/renew.html