Improving Energy Efficiency and Self-Sufficiency on the Pechanga Indian Reservation

Feasibility of Expanding Pechanga Western Electric Service Territory to Residential Loads on the Reservation

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Introduction

The Pechanga Band of Luiseño Indians established a tribal electric utility, which they have named Pechanga Western Electric (PWE). PWE began service to the tribe's casino, government center and approximately 21 residences near the government center in October 2017. These loads are now electrically connected to the tribally owned electrical infrastructure. They were previously served by Southern California Edison (SCE).

As of October of 2018, SCE continued to serve a number of other loads on the Pechanga Reservation, including 207 additional residences and three commercial loads, herein called the "Residential Area". The electrical infrastructure in the Residential Area is owned by SCE. It is a mixture of above-ground and underground facilities and is in some cases new and in others needs maintenance. This effort will provide information necessary to assist the tribal staff in making recommendations to the tribe's General Council regarding whether PWE should acquire the SCE infrastructure or in some other manner expand its electrical utility services to the Residential Area.

Due to privacy considerations expressed by the residents in the Residential Area, and due to other tribal privacy considerations, this report will document the grant efforts and summarize the grant reports, while retaining all confidential information in the initial reports that will not be shared outside tribal staff or membership.

Because grant work has been consistently finished on time and underbudget, remaining budget amounts were requested to be used for additional, follow-on tasks. DOE has graciously granted PWE extensions of time and additions to the scope of work to spend the remaining funds and to provide all the information needed by the tribe to make decisions on the best next-steps.

PWE has provided quarterly reports since the grant was awarded and has participated in and created presentations for each DOE Program Review each year since 2017. In addition, numerous grant related initial reports were developed pursuant to this grant for PWE consideration and which are summarized into the below-listed grant reports. The initial reports, which contain detailed information and costs of options included:

For Task 1.

- *Map of Residential Area*
- *"Load Profile Analysis of the Pechanga Residential Area",*
- *"Upgrade Opportunities on a California Tribal Reservation" (Results of demand-side energy efficiency audits),*
- *Energy Efficiency Water Pumping Report,*
- *"Renewable Energy Options for Residential Service Customers"*

For Task 2.

- *"Pechanga 12 kV Conversion Phase 2",*
- *"Pechanga Asset Valuation"*
- *"Overhead Electrical Study",*
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For Task 3.

- *"Annual Cost of Purchasing Market Power through CAISO to Serve Residential Area",*
- *"CHP Cogeneration Study"*

For Task 4.

- *"Underground Electrical Study",*

For Task 5.

- *"Residential Community Solar Analysis", April 22, 2021*
- *"Bids for 1 MW of Solar Installation",*
- *Council Power Point Presentation of June 8, 2021, titled "Responding to Public Safety Power Shutoffs in Pechanga Residential Area",*
- *"Options for Serving Residential Area as of 10/22/21".*

The issues addressed and which are described in this Final Report include:

- ✓ The Loads and Demand Side Option Report. This report includes an assessment of the electrical loads in the Residential Area to understand the scope, size and profile of the potential new load, as follows:
    - Data was gathered on local residential load which supported a spreadsheet indicating the maximum load (kW) and energy (kWh) required to serve the Residential Area.
    - We have attempted to mitigate costs of acquiring power through looking at demand side energy efficiency options, including residential energy audits with mitigation measures recommended and water pumping efficiencies.
    - Renewable energy options were identified and described, then expanded upon in later grant tasks as funding remained after completion of planned efforts.
- ✓ The Distribution System Expansion Report.
    - A survey and valuation of the existing distribution system in the Residential Area to understand what infrastructure is currently being used to provide electrical utility services as well as the potential cost of acquisition.
    - We began the process for determining the numerous real property interests (existing rights of ways, etc.) that would be necessary to address if PWE acquired the SCE system. Upon research and review it was determined that the existing and future rights of ways could be addressed without a detailed review, so the effort was discontinued, with the approval of DOE.
    - We obtained a cost estimate for metering and extending the existing 12 kV distribution facilities from the government center to the Residential Area.
    - We obtained a cost estimate of the option of constructing new underground electrical facilities which may be used as a utility corridor for all utility services such as electrical, fiber, water and sewer.
- ✓ The Power Supply Study includes a review of the options for supplying additional wholesale power resources to serve the Residential Area and the costs of each option.
- ✓ The Engineering/Planning Study developed the costs to build optimal new facilities underground so this cost could be compared to the cost of acquiring existing SCE facilities.
- ✓ The Summary of Options and Costs for a Community Solar Program describes an alternative in which the tribe continues to allow SCE to serve the Residential Area but PWE develops a significant solar and battery program for all residences which will allow them to supply most of their own power, and to remain off-grid, in microgrid mode during Public Safety Power Shut-Offs.
- ✓ A ranking of all reasonable options by cost.

This grant effort is being utilized by tribal staff to make recommendations to the Tribal General Council as they make their decision whether to expend tribal funds and to expand PWE's service territory to the Residential Area.

Load Study

In order to prepare for this study of the utility information in the Residential Area, tribal staff and consultants instituted a visual inspection and survey of all utility facilities and buildings on the reservation. The visual survey included a detailed GIS mapping effort. The survey and mapping effort was completed in February of 2018.

The Residential Area is comprised of 207 residences with a total of 474 structures. In addition, three non-residential loads were identified in the Residential Area, including the church, old school house, and St. Michael's School. An detailed overview map of the current PWE Service Territory and the Residential Area is included in the *Map of Residential Area.*

K. R. Saline & Associates (KRSA) is the engineering firm used by PWE in establishing the tribal utility and is familiar with PWE's system and requirements. KRSA conducted an analysis of electric usage data available from adjacent utilities to develop a 12-month electric load forecast of the target loads in the Residential Area. The intended purpose of the resulting forecast was to assist PWE with deciding whether to proceed with the acquisition of the target loads and as an estimate of energy loads for near-term resource planning and other financial considerations. **Based on the data available, KRSA estimated the annual energy requirements of the target loads to be approximately 2MWH, with a non-coincident peak of approximately 500KW.** This would be a relatively small incremental change to PWE's current annual energy usage of approximately 32MWH and its current peak demand of approximately 15MW.

The estimated monthly loads in the Residential Area are described in the *"Load Profile Analysis of the Pechanga Residential Area".*

Due to the limited knowledge of the energy consumption characteristics of the target loads, actual results are likely to vary from the estimated load forecast. Careful consideration of the limitations of this analysis should be weighed before used for other purposes not intended through this analysis. PWE should consider revisiting and revising their load forecasting as metered energy data continues to become available.

Demand Analysis

For the purposes of this analysis, we have assumed that the monthly energy density and non-coincident and coincident demand to be highly correlated. Therefore, we estimated the monthly demands based on the energy profile we developed and the limited monthly and peak demand data from the Anza Electric Cooperative Statements of Operation.

Demand Side Efficiency Options for Residential Area

PWE has the option of creating an energy efficiency program which can mitigate the new residential loads and can slow load growth in the Residential Area.

To test the likelihood of success for such a program, the grant effort sought to perform energy efficiency audits on 10 residential homes at Pechanga. PWE staff personally contacted numerous tribal members and others living on the reservation, sent out flyers in PWE mailings, posted notices and otherwise offered free energy audits. When it was determined by tribal residents that access to their homes would be required, interest in energy audits immediately shut down. **This exercise indicates that residents' privacy interests exceeds any interest they have in energy efficiency. Any efficiency measures offered in the Residential Area must therefore be non-intrusive and consider the important privacy interests of residents.**

A report of the findings of the energy audits was created by tribal contractors and is included in *"Upgrade Opportunities on a California Tribal Reservation"*. **Implementation of the energy savings measures identified in the report was estimated to reduce energy use by 64% and save tribal residents approximately $968 per year (assuming PWE rates). Propane use could be completely eliminated and homes without cooling could be air conditioned.**

The culture of privacy in the Residential Area will prevent a successful energy auditing or efficiency measures program. However, alternative programs such as the following may be helpful in mitigating new or growing loads and may be done at reasonable cost based on likely rates of return:

1. A free energy efficient lightbulb exchange program. This program could be open to tribal members and other living on the reservation. Such a program could allow members and others to trade in non-efficient light bulbs for efficient bulbs purchased in bulk by PWE. The program could begin small and expand if it is successful.
2. A free or subsidized energy efficient appliance program. This could be by simple application (in order to control cost and inventory) and could include an exchange for old appliances or altogether new appliances. Appliance could include any household appliances including kitchen appliances, water heaters, furnaces, air conditioning, and other residential electrical applications.
3. A free or subsidized energy efficient building materials program. This could be by simple application and could include meeting requests for insulation, new doors or windows, or other energy saving building materials.
4. Individual measures to be considered on a case by case basis.

In addition to considering residential energy efficiency, we also performed a review of efficiency measures related to water pumping. An *Energy Efficiency Water Pumping Report* was presented, including the following equipment:

- RV Booster #1 a 60 horsepower Peerless water pump: Results indicated that pump replacement would result in an efficiency improvement of 42.1% to 70%, and would save 25,366 kWh per year, and would translate to an 11-ton decrease in CO2 emissions.
- RV Booster #2 a 60 horsepower unknown water pump: Results indicated that pump replacement would result in an efficiency improvement of 42.1% to 70%, and would save 69,286 kWh per year, and would translate to a 30-ton decrease in CO2 emissions.
- RV Booster #3 a 60 horsepower Barrett water pump: Results indicated that pump replacement would result in an efficiency improvement of 43.7% to 70%, and would save 32,643 kWh per year, and would translate to a 14-ton decrease in CO2 emissions.
- **It is recommended that updated costs for all water pump replacements be sought**.

Demand side Renewable Energy Options for Residential Area

This section will address the following two major issues. What type of renewable energy services should be offered by PWE to residential customers and what are the options for offering renewable energy service? Our goal is to reduce residential load on the reservation by at least 20%.

What type of Renewable Energy Technologies Are Best for Consideration?

The following renewable energy technologies were considered and ruled out without further research:

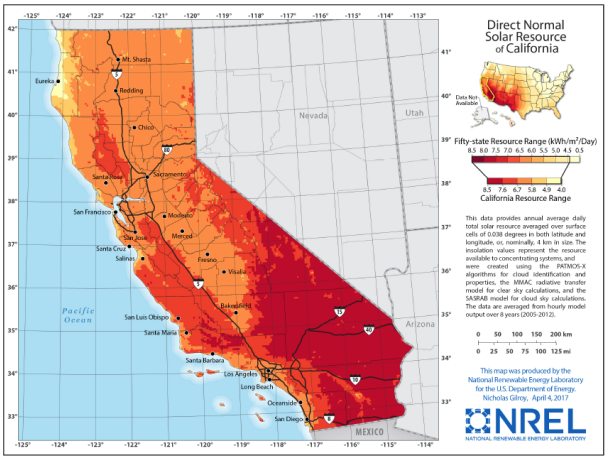
- Wind power because it is not likely sufficiently windy in the residential area of the reservation (the residential area is relatively low-lying), and
- Hydropower as are no consistently flowing waters in the area.
- Biomass because there is no significant biomass source in the area. While residential efficient biomass stoves such as pellet stoves or newly design efficient fireplaces may be useful to replace existing wood burning fireplaces, it is not assumed that fireplaces are often used for heating due to the warm climate. The cost of cooling is generally more of a concern in the local climate.

There is a significant opportunity for various solar applications, and some opportunity for residential geothermal systems, especially as may be provided or encouraged for new structures, as described below. **The preliminary reviews shown in this section, done in 2018, were later expanded as shown below, after the grant Scope of Work was amended in 2020 to more specifically determine various renewable energy related costs in order to compare various options for General Council consideration.**

Solar

Since the beginning of this grant, the use of solar in Southern California has dramatically expanded, in part due to California programs that seek to provide California residents with alternative sources of distributed power during Public Safety Power Shut-Off (PSPS) events. These are time when fire danger is high and wind speeds may down powerlines, sparking fires. The regional power grid has been shut down during these planned events a number of times, leading to inconvenience, and public health concerns for lack of electrical power, especially during the pandemic. PWE has remained electrified and operational during PSPS events, as PWE has enough locally produced power (including the emergency generators) to serve load. This has allowed the Pechanga Reservation to be a safety (and entertainment) option when the local grid is shut down. As such PWE has further invested in solar generation through California state programs and is also in the process of adding significant battery back-up using state funding. The tribe has therefore requested that PWE provide detailed information to decision makers regarding the solar options.

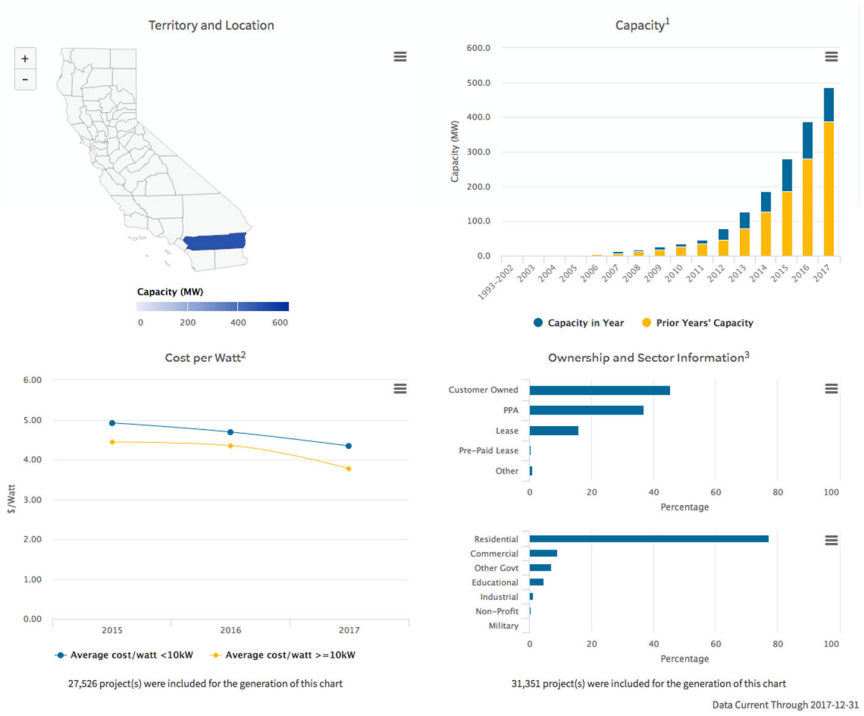
There are numerous solar technologies and applications that are good options considering the excellent solar resource on the Reservation. See the solar resource map of California, published by the National Renewable Energy Laboratories[1], below.



General solar project information related to Riverside County is reported by the State of California Distributed Generation Statistics[2]. This website indicates there was 486.24MW of solar capacity installed in Riverside County by 2017, 77% of which was residential and 45% of which was consumer-owned.

The average cost for a small (less than 10kw) system was $4.34/watt in 2017. For large projects, the average cost per watt was $3.77. The costs are declining as additional service providers enter the market and manufacturing capacity increases.

[1] See https://www.nrel.gov/gis/solar.html
[2] See https://www.californiadgstats.ca.gov/charts/.



Solar technology can be applied to residential settings in many forms. This report will describe the following options:

- Photovoltaics/Solar Panels (off-grid with battery back-up; grid connected with net metering; and community solar)
- Passive Solar/Daylighting/Shade Cooling
- Solar Heating/Cooling

Photovoltaics/solar panels

Grid Connected Photovoltaic Systems

Grid connected systems have the advantage of reliability. The solar system is backed up by the utility so that when the sun is not shining there is no service interruption. There is also no additional environmental impact, cost or inconvenience of the operation and maintenance of stand-alone generators or need for expensive batteries. It was estimated that years to payback was 9.39.

The tribe or PWE providing and maintaining solar systems to SCE residential customers on the reservation may be a viable way for PWE to lower the cost of electricity to reservation residents, obtain reservation customers for solar systems, and enhance tribal self-sufficiency and sovereignty without the need to take over SCE's service territory.

Off-Grid with Battery Back-up

Another option for PWE service on the residential portion of the reservation is to offer off-grid services to reservation residents. This option would also allow SCE to continue to provide on-grid electric services to some residents, but PWE could choose to serve certain of the residents as full-service customers through solar and batteries.

The added costs of batteries is only part of the added cost of this service. In an off-grid application, the solar system must serve the house's needs and also charge the batteries. Therefore, the solar system must also be larger than for an on-grid system.

While this pay-back period seems long, it should be contrasted with the tribe's per-customer cost for a PWE take-over of the SCE system, not just with the current SCE rate.

Batteries on solar panels make more sense for on-grid systems when time of use rates are considered. They allow the homeowner to charge batteries only when the price is low and to use the batteries during peak times.

Installing a battery as part of a solar system qualifies the battery for the Investment Tax Credit. While California offers some battery incentives, they are available only for certain utilities at this time. Payback period was estimated to be approximately 22 years.

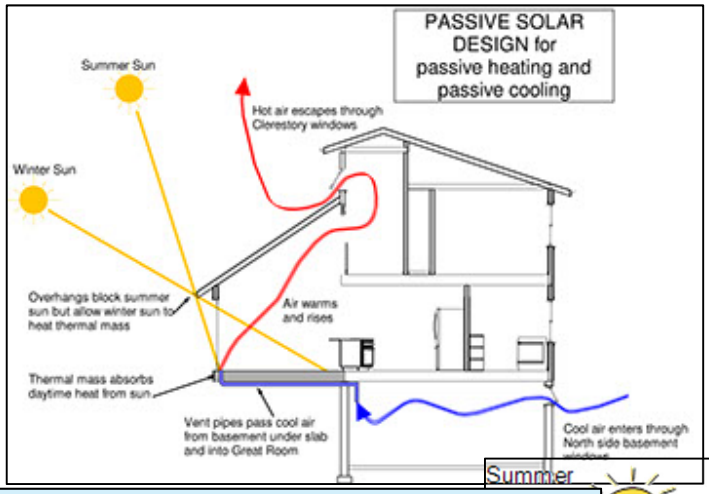
Community Solar

Community solar is also known as "shared solar". These projects are often on public or jointly-owned property and are an easy way for members of a group, renters, condo owners or those with shady rooftops to benefit from a local solar project. These are generally larger solar panel installations which are jointly owned or used by a number of customers.

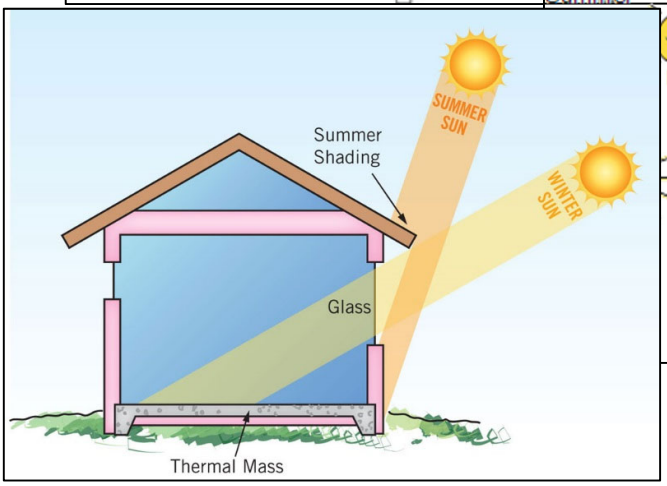
They are also less expensive per kWh and have the ease of consolidated maintenance and planning. Community members can rely on the expertise and efforts of professionals to manage the project rather than becoming experts on their own system. They have improved economies of scale from distributed solar and have optimal

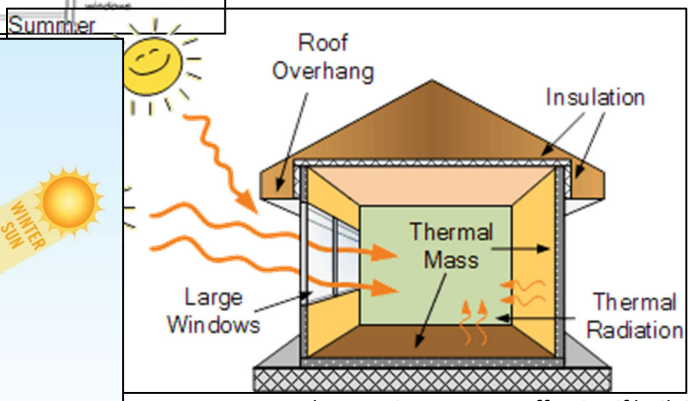
Passive Solar/Shade Cooling

Passive Solar, also known as "daylighting" is a way to use advance planning of a structure's architecture and environment in such a way that lowers energy consumption over the life of a structure or reduces the need to use electricity or natural gas. Shade Cooling is planting of trees to provide for cooler existing structures.



Components of passive solar include the strategic placement of windows, use of insulation, air flow design, design of roofs, orientation of structures and use of materials to trap heat or to reflect sunlight and additions of "sunspaces" or sun rooms. Strategies are known as Direct Gain (sunlight through south facing windows falls on a thermal mass such as a wall of water or dark colored concrete which holds heat); Suntempering (orienting the house to maximize or minimize sun exposure and increasing or decreasing double-paned glass surfaces); Summer Ventilation (allowing heated air to rise and be dispersed in summer) and increased insulation.





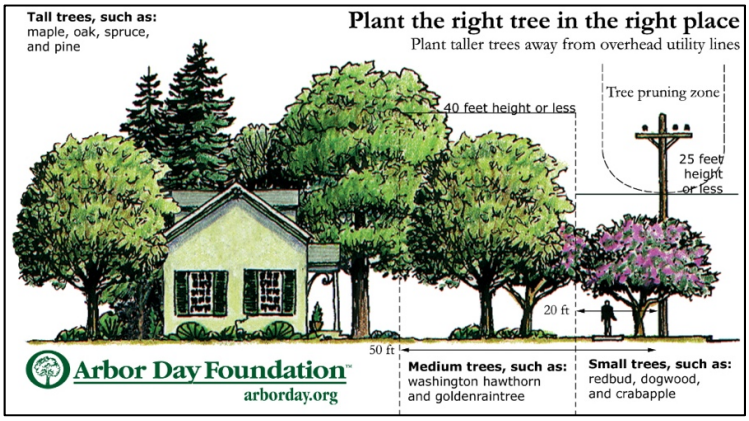
Most of these components and strategies are most effective if built into the initial design of a structure. They also generally benefit from overall community design which maximizes the opportunities for homeowners to deploy the strategies. Graphics showing the options are included here. The most successful passive solar applications are individual to each structure and are part of a structure's design or in some cases re-design. Full use of a passive solar program would require the use of experts to make low cost recommendations on existing structures, and employment of passive solar designs or building codes requiring the use of passive solar design during the development stage of structures. Various architects specialize in passive solar design, such as these members of "Passive House California" organization: http://passivehousecal.org/current-professional-members.

Passive solar design programs are best when instituted and implemented prior to home construction when passive solar concepts can be included in house orientation and structuring, as well as when window and glass choices are made.

While not technically passive solar, the use of trees for shade and cooling is a variation on a passive technology that can maximize the sun's impact on energy costs. According to the U.S. Environmental Protection Agency, trees and vegetation lower surface and air temperatures by providing shade and through evapotranspiration. Shaded surfaces, for example, may be 20-45 degrees cooler than the peak temperatures of unshaded materials[3]. Trees and vegetation are most useful as a mitigation strategy when planted in strategic locations around buildings or to shade pavement in parking lots and on streets. Researchers have found that planting deciduous trees or vines to the west is typically most effective for cooling a building, especially if they shade windows and part of the building's roof.

The benefits of trees and vegetation in urban environments include:

- Reduced energy use: trees and vegetation reduce demand for air conditioning.
- Improved air quality and lower greenhouse gas emissions: By reducing energy demand, tress decrease production of associated pollution. They also remove air pollutants and store and sequester carbon dioxide.
- Enhanced storm water management and air quality: vegetation reduces runoff and improves water quality by absorbing and filtering rainwater.



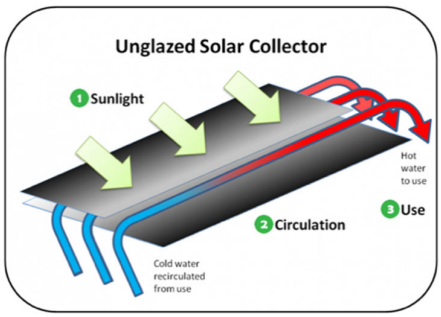
- Reduced pavement maintenance: Tree shade can slow deterioration of street pavement, decreasing maintenance.
- Improved quality of life: Trees provide aesthetic value, species habitat and can reduce noise.

There are a number of local California resources for urban forestry[4]. Selecting the right tree for the place requires consideration of soils, water and other matters. Many resources[5] and professionals[6] are available to assist in tree planting programs.

The use of passive solar and/or shade cooling requires professional design assistance. Passive solar is often used to promote heating while shade cooling is used to promote cooling. Trees can be planted at any time but should not be planted in areas that could counter planned passive solar benefits. While these strategies are very effective and not expensive, they take careful thought, planning and advance consideration of the options. A number of resources are available for further review[7].

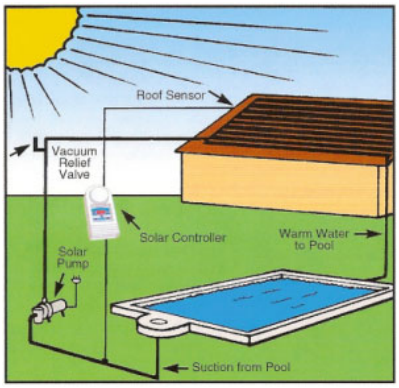
Solar Heating or Cooling

Solar heating and cooling technologies collect the thermal energy from the sun and use this heat to provide hot water, space heating, cooling and pool heating for residential and other applications. They displace the need to use electricity or gas. Solar water heating collectors produce heat energy, distinguishing them from photovoltaic modules, which produce electricity.



[3] https://www.epa.gov/heat-islands/using-trees-and-vegetation-reduce-heat-islands
[4] http://californiareleaf.org/resources/public-grants/
[5] See, for example, http://www.sactree.com/pages/377
[6] For certified arborists, see http://www.isa-arbor.com/certification/index.aspx
[7] See https://www.nrel.gov/docs/legosti/old/17142.pdf; http://passivehousecal.org/design;

Water heating, space heating and space cooling accounted for 72% of the energy used in the average household in the U.S. in 2010.



Active or passive solar collectors can be installed on the roof or other surfaces of a house. There are a number of types of collectors: flat plate, evacuated tube, Integral Collector Storage, thermosiphon and concentrating. Flat plate collectors are the most common type in the U.S. Copper pipes are affixed to an absorber plate contained in an insulated box that is covered with tempered glass or polymer cover plate. The cost can be as low as $1,000 and up to $10,000 depending on the type and size of the system.

These systems can be retrofitted onto existing structures for particular applications such as for hot water heaters or for swimming pools. Whole-house systems are often best when designed for the structure and most economical as part of the initial design of the structure's heating and cooling systems.

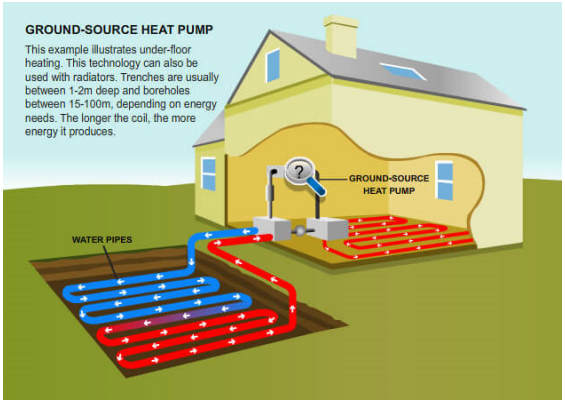
The following are local solar heating companies:

- Apricus Solar Hot Water: 6060 W. Manchester Ave, Suite 109, Los Angeles, CA 90045-4266 inquiry-usa@apricus.com http://www.apricus.com/
- SunEarth Quality Solar Water Heating Products: 8425 Almeria Ave Fontana, CA 92335 1-800-978-6327 http://sunearthinc.com/
- Rheem: http://www.rheem.com/products/water_heating/solar
- Heliodyne: 4910 Seaport Ave, Richmond, CA 94804 888-878-8750 http://www.heliodyne.com/

"Geothermal" Ground Source Heat Pumps

As shown on this map, there are no known geothermal resources suitable for large scale electrical generation on the reservation, the ambient temperature of the earth can be used for geothermal heat pumps.

Geothermal (also known as ground-source) heat pumps heat and cool homes with no fuel and minimal electricity, using the earth's constant internal temperature. Geothermal systems save 30 to 70 percent on energy bills. Unlike conventional heat pumps, which draw in outside air, geothermal systems draw heating and cooling from inside the earth via vertical or horizontal pipes that circulate water or environmentally safe antifreeze through loops



underground or submerged in a pond. In winter, geothermal heat pumps pull warm air from the earth to heat the home. In summer, the process works in reverse, as the system pulls heat out of the home and pumps it back into the ground. The cost is $25,000 to $50,000, depending on home size and climate in new construction; less for retrofits. Generally, the cost is about 30 percent more than installing a conventional HVAC system. However, due to the dramatically lowered long-term heating and cooling costs, the system can break even in as little as five years.

Shallow ground temperatures are fairly consistent throughout the U.S., so geothermal heat pumps can be installed just about anywhere. Systems must be designed for the specific home and site. The local geological properties, such as the composition and properties of soil and rock (which can affect heat transfer rates); hydrological, and spatial characteristics of the structure's land will help a local system supplier and/or installer determine the best type of ground loop for the site.

For example, soil with good heat transfer properties require less piping to gather a certain amount of heat than soil with poor heat transfer properties. The amount of soil available also contributes to system design. System suppliers in areas with extensive hard rock or soil too shallow to trench may install vertical ground loops instead of horizontal ground loops. The amount and layout of land, landscaping, and the location of underground utilities or sprinkler systems also contribute to system design. Horizontal ground loops (which are usually the least expensive option) are typically used for newly constructed buildings with sufficient land space. Vertical installations, or more compact horizontal installations, are often used for existing buildings or smaller yards, because they minimize the disturbance to the existing landscape.

The following are benefits of geothermal systems

- Eco-Friendly - Geothermal systems keep your entire home at the desired temperature naturally, with no or very little electricity required. They minimize the electrical demand for heating and cooling your home which means significantly reducing your home's carbon footprint.
- Energy Cost Reduction - They use less electricity than conventional heating or cooling systems. They generally use one unit of electricity to move three units of heat from the earth.
- Humidity Control - Geothermal units maintain about 50% relative indoor humidity, so they're very effective in both dry and humid regions.
- Design Flexibility - Geothermal heat pump systems can be installed in both new and retrofit situations.
- Smaller Equipment Rooms - Because the hardware requires less space than that needed by a conventional HVAC system, the equipment rooms can be greatly scaled down, freeing valuable square footage for other needs.
- Durability and Reliability - Geothermal systems have relatively few moving parts, and the parts are protected inside a building. This makes the system both durable and highly reliable, with little to no maintenance required.
- Noise-Free - They have no outside condensing units like air conditioners, so there's no concern about noise outside the home. In fact, a two-speed system is so quiet that no one in the home can tell it's running.

Local resources for Geothermal Heat Pump Service Companies follow:

- California Geothermal Heat Pump Association: https://www.californiageo.org/ (See their list of qualified installers: https://www.californiageo.org/members-of-california-geothermal-heat-pump-association/directory/service-providers/)
- ClimateMaster: 7300 SW 44th St. Oklahoma City, OK 73179 (405) 745-6000 http://www.climatemaster.com/
- GeoComfort: http://geocomfort.com/about
- GeoExchange: https://www.geoexchange.org/
- WaterFurnace: https://www.waterfurnace.com/residential/

Options for Offering Services

With such a variety of energy saving renewable based options potentially available, the tribe can make decisions about which services should be offered and to whom. Some approaches for designing renewable energy services are as follows:

- ✓ Provide broad based energy services regardless of tribal membership or location of home. In this approach, PWE or another tribal energy affiliate could become a renewable and energy efficiency service provider who could provide services for profit or as a non-profit enterprise. Discounts could be offered to various classes of customers such as PWE customers, tribal members, reservation residents, low-income people or even to all members of the local community. With the competitive costs of renewable energy installations and the opportunities for energy efficiency, establishing a tribal program staffed with energy professionals could become a profitable business for the tribe or could be a valuable community service, especially if the tribe were able to use appropriate funds to subsidize the program.
- ✓ Benefit PWE customers. It is common for utilities to offer various conservation or environmentally appropriate programs to their customers which are subsidized by utility rates. Common programs include net metering (allowing customers to install renewable energy devices and receive credit for them on their utility bills while also allowing the customer to sell unused generated power back to the utility at a set price, generally the utility's avoided costs); efficiency programs (low cost energy audits and discounts for installation of energy conserving mitigation); feed-in-tariffs (For an example of an organization that helps design these feed-in-tariff programs, see http://www.clean-coalition.org/our-work/renewable-utility-programs/unleashing-clean/about-clean-programs/); offers of financial incentives for renewable installations or efficiency; or the establishment of a PWE renewable portfolio standard which may require advancing levels of renewable energy usage as a goal or a mandate.
- ✓ Prioritize Pechanga tribal members regardless of their location and service provider. The tribe or PWE could decide to fund or subsidize renewable energy or efficiency programs for tribal members. These could be low-cost solar or battery installations, technical advice, energy audits, or other services. These could be "grants" of funds to pay for others to provide services, or PWE could contract for renewable energy and technical services to be directly supplied to tribal members.
- ✓ Prioritize anyone living on the reservation. Prioritizing residences on the reservation would be consistent with a tribal exercise of sovereignty over the entire jurisdiction of the reservation, regardless of the status of the structures on the reservation.
- ✓ Different programs for different types of residences. It may be practical to determine if particular structures should be prioritized, such as older structures in need of retrofitting, mobile homes which generally are inefficient and hard to heat and cool, homes with low-income or handicapped or elderly residences, etc. A review of the types or categories of structures and the needs of potential customers through a general growing local knowledge of the residents' electricity related issues will inform this determination.

Tribal Rates for Renewable Energy Services

An additional issue is whether some services could be provided by the tribe at no cost, or whether some services should be sold for a profit through a tribally owned energy service company. These are policy questions which require a determination of how tribal funds should be used, how rates should be set among rate classes, and whether services are subsidized, non-profit, or for-profit. These decisions may be made by PWE or could be the result of long-term business planning of a separate professional energy services company owned by the tribe.

Some Examples of Ways to Provide Services

- ➢ Provide Information about Renewable Energy Services and Service Providers on PWE Website. This approach will allow any person to review renewable energy information that is tailored to the Pechanga Reservation.
- ➢ Net Metering for PWE Customers.
    - o Currently there are approximately 25 residential customers of PWE. They were included as customers when it was determined they were electrically connected to other tribal commercial loads. PWE has chosen to treat these customers as a "Pilot Project" to test policies, procedures, and management of residential load.
    - o Currently PWE has one existing tribal utility customer who has a solar energy system. This system generates power onto the PWE system at times, however, PWE has not yet developed a policy or rate for accounting for this energy.
    - o There have been additional requests for net metering or renewable energy system installations.
    - o PWE's rates are lower than Southern California Edison's rates, so greater cost savings would be achieved if systems were targeted for non-PWE customers.
    - o A net metering program would allow any existing customers to install solar panels and use PWE service as back-up. As the solar panels produce more energy than the house needs, the solar panels would be used by PWE to service its other loads. This program would require the acquisition of the appropriate types of meters and analysis of the residential solar as a PWE resource.

- Tribal Funding of Renewable and Energy Savings Programs. A PWE tribally funded Renewable Energy Program could be any of the following:
    - Tribal funds allocated to paying for all or part of the cost of individual renewable energy systems to be acquired from and installed by approved companies (or PWE) by application on either a first-come-first-served or if demand exceeds supply, then by lottery or by providing priority:
        - To PWE customers
        - To Pechanga tribal members
        - To residences on the Reservation
    - A community solar program whose energy or revenue can be credited to either specific residences or to all PWE served residences.
    - Additional car charging services
    - Tree planting
    - Numerous other creative options can be developed to target tribal renewable energy funds to their best uses.
- Residential Electrical Savings Reviews. One service that could be offered by PWE is an interview of a homeowner and a review of their home so that recommendation of suitable renewable or energy efficiency options could be given based on the particular home and homeowner's situation and needs. This would require PWE to have professionals on staff or under contract who could assess particular homes' options as well as the homeowner's desire and ability to pay for various options and then to recommend appropriate renewable energy solutions, related service companies or PWE programs. Options for offering a Residential Electrical Savings Review include:
    - In response to submission of a written application form- provided on a first-come-first-served basis;
    - Required for any new service request so that energy savings and efficiency is built in to service;
    - Available only to tribal members, or available to any reservation residence, or available to anyone affiliated with the tribe whether living on or off reservation but within an approved radius, or available only to PWE customers.
    - As a matter of tribal law or regulation (building code for new or existing buildings) or when living or providing services on the reservation (environmental obligations).
- Need Based Program(s). The tribe or PWE could establish some programs for energy conservation or renewable installations on a need-basis such as for any low-income homes, elderly or ill residents, residents who cannot easily connect to the grid, or other need-based assistance criteria.
- New Structure Program. The tribe or PWE could either require homeowners intending to build on the reservation, through building codes or permitting processes, or could simply provide voluntary assistance in the form of either information or funding during the up-front design and planning of new buildings. Assistance in the form of information or funding could promote energy efficient design, passive solar, geothermal heat pumps, landscape planning and tree shading, and other residential energy conservation programs.
- Establish an Energy Services Business either as a stand-alone entity or as another role of PWE who could:
    - Design, acquire and install residential (and commercial) solar and/or battery systems.
    - Provide individualized homeowner reviews for both planned structures and existing structures which can identify best energy practices for a particular home and offer to implement the recommendations.
    - Expand services to other CA tribes or to other tribal utilities.
    - Hire an experienced arborist with knowledge of the local climate and environment and experience in using plants for energy efficiency purposes to review the reservation to make specific recommendations for establishment of an energy related tree/plant planting program. Many businesses may do this for very little cost if there is a possibility they may be contracted to sell the plants or do the planting.
- Require SCE to virtually net meter a tribal community solar project if a tribal utility is not planned for the residential area of the reservation.
- For any new structure to be built on the reservation, or for significant remodeling, mandate or offer a review and recommendations for passive solar, shade tree plantings, geothermal heat pumps, solar options and energy efficiency design.
- PWE could contact the Clean Coalition[8], or other non-profit clean energy organizations for potential partnership opportunities.

[8] See http://www.clean-coalition.org/connect/partner/. This organization is actively looking for potential partners in advancing clean energy. They have a deep knowledge and expertise in California renewables and have established "CLEAN Programs" in Sacramento, Marin, Palo Alto and Los Angeles with "transparent, streamlined process and guaranteed, long term payments for energy" to limit investment risk for developers and financiers. They encourage energy to be produced and used locally.

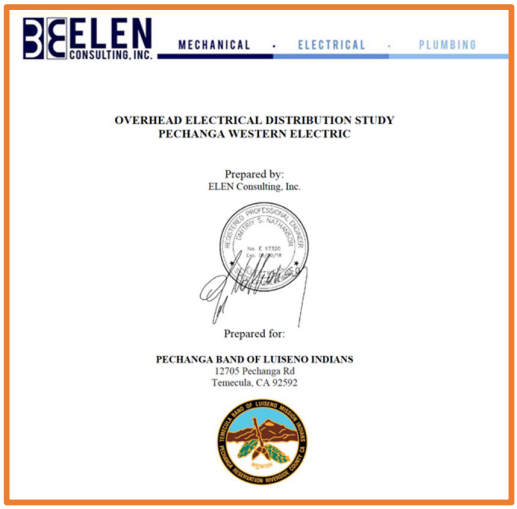
- Establish a PWE net metering policy and rate which applies to the existing solar system on our system and to any future systems.
- Include public information on renewable energy systems on the PWE website, and as appropriate as news releases or as announcements to the tribal utility community or the local community.
- Determine the scope and desire for need-based programs.

Distribution System Expansion Report

Elen Consulting, Inc. (Elen) is the electrical engineering and facilities design firm used by PWE in establishing the tribal utility. Elen is familiar with PWE's system and the surrounding infrastructure. They were asked to perform an engineering review of the existing distribution system in the Residential Area, including the creation of a detailed survey of the SCE facilities with an estimate of their value, and then to provide a design summary and costs of the infrastructure upgrades necessary to extend PWE's existing electrical facilities into the Residential Area. They were also asked to estimate the cost to PWE to establish an underground utility corridor for the Residential Area.

Review of the Existing Distribution System in the Residential Area

Elen toured the Residential Area with tribal staff and were also given access to the tribe's detailed GIS mapping data and related photographs. Elen also obtained SCE's system drawings and reconciled the data to include height, voltages and feeder sizes. Through this process, Elen was able to create spreadsheets with detailed listings of all the overhead assets and all the underground assets. Elen then reviewed SCE's previous valuation of similar assets which SCE provided to the tribe during PWE's initial acquisition of assets from SCE. Elen used that asset sale to create comparable numbers for the SCE assets in the Residential Area. The Elen Overhead Electrical Distribution Study is included as Elen's resulting total estimate for acquiring the SCE system, plus the cost for doing the electrical work necessary to cut-over the system on the Residential Area as to PWE was described in *"Pechanga Asset Valuation" and "Overhead Electrical Study"*,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OVERHEAD ELECTRICAL DISTRIBUTION STUDY
PECHANGA WESTERN ELECTRIC

Prepared by:
ELEN Consulting, Inc.

Prepared for:

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In total, it appears the likely cost for PWE to acquire the SCE personal property assets is approximately ${see study}. Elen states, "It might be prudent to add some healthy contingency factor onto this…" The study does not assess the real property implications of acquiring the distribution system, such as which existing SCE rights of ways may be transferred to PWE, and where PWE may need to acquire new rights of ways. The value of the rights of ways are not estimated. The study also takes no position on whether stranded costs or departing load charges are applicable.

Expanding PWE Facilities into the Residential Area

Two options were considered for expanding PWE facilities into the Residential Area. The first option is acquisition of the existing SCE facilities with a cut-over to service by PWE. The second option is not to acquire the SCE facilities, but instead to build a new underground electrical system in alignments that would be suitable for all utility facilities, including power, water, sewer, gas and fiber.

Cutting-Over SCE Facilities to PWE Service

To determine the cost of PWE connecting its current system to the current SCE system (a "cut-over"), Elen then provided a preliminary design for the upgrades to the existing PWE facilities which would be necessary to connect the current SCE system to the PWE system. They provided two engineering drawings summarizing the work necessary. Elen's estimated cost for expanding the existing PWE 12 kV system so that it may also serve the Residential Area, and to provide needed meters for the 12kV system is shown in "*Pechanga 12 kV Conversion Phase 2*".

It was noted that SCE would also be required to participate in the "cut-over" of the system from SCE to PWE service. Elen estimated the additional cost for SCE's participation based on the previous invoices for similar work from SCE.

Additional Utilities That Could Be Extended into the Residential Area

PWE has worked with other Pechanga staff and consultants in order to consider the potential to leverage the construction of a new underground electrical distribution system by extending other utility systems from the commercial/governmental areas into the residential areas of the reservation. Utility systems considered include telecommunications, natural gas, sewer and upgrade of the existing potable water distribution system. Also evaluated was the potential for upgrading affected roadways in the residential areas once trenching and utility installation has been performed.

Pechanga currently maintains a telecommunications distribution network to residences using overhead fiber optic cable attached to existing SCE-owned and privately-owned wood poles. Should the option to install an underground electrical distribution system be pursued, this would present an opportunity to also place the telecommunications distribution system underground using the same trench alignments as the electrical duct bank. A high-level estimated cost to have a new underground telecommunications distribution system installed alongside a new underground electrical system is approximately ${see study}.

The Pechanga Water Department currently maintains a potable and recycled water system that services the reservation and its commercial enterprises. An estimated cost of ${see study} is projected for needed improvements to include water service in the utility corridor. The Pechanga Water Department also maintains a sanitary sewer collection system that services the reservation's commercial enterprises and is extended up to the Community Center. A high-level estimated cost of ${see study} is projected for needed improvements to include sewer service in the utility corridor.

Pechanga currently maintains an existing high-pressure and low-pressure gas distribution system. The high-pressure system services power production facilities in the commercial areas and the low-pressure system is reduced off the high-pressure and services the existing community center only. A high-level estimated cost of ${see study} is projected for needed improvements to include natural gas service in the utility corridor.

Since the identified electrical utility improvements would likely occur along existing dirt roads, there will be an economy of scale in adding roadway improvements at the same time. While no engineering study was performed to determine the extent of these improvements, an estimate of ${see study} was identified for roadway improvements. The range in cost is a product of the varying types of roadway widths and section depth of the roadway.

Power Supply Study

This portion of our analysis identifies and compares the power supply options for serving the Residential Area, and for potential load growth over the next 10 years. At current growth rates, it is likely that the load in the Residential Area could double in 10 years.

Options considered as power sources for the new loads include:

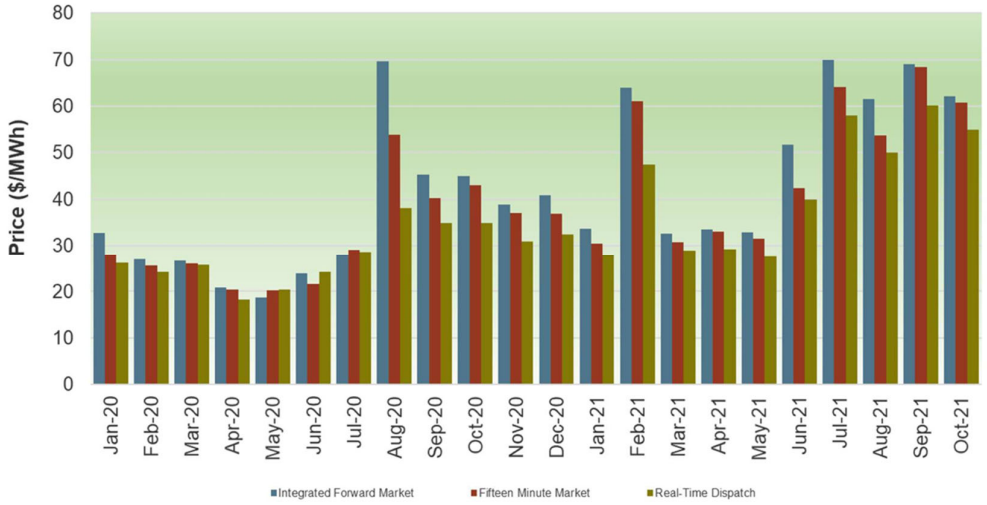
- Market power/commercial wholesale power resources
- Expansion of the tribe's cogeneration facility
- Wholesale Scale Renewable Energy
- We have also considered PWE's ability to mitigate new loads or load growth through energy efficiency programs, as described in the next section.

Market Power

The easiest way to serve load in the Residential Area would be to slightly increase PWE's purchase of market power from commercial wholesale power resources. All California entities buying power from outside their own system must do so from the California Independent System Operator (CAISO). CAISO sells power using locational marginal pricing, which is based on the location of the buyer and the lowest offered price available to that area from all regional generators. PWE currently generates some of its power needs in-house using its cogeneration facilities and acquires all additional needed power from

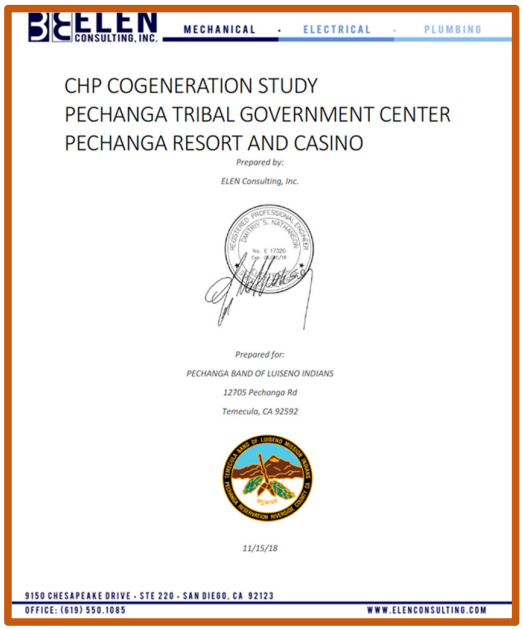
CAISO. (PWE also sells its allocations of power from federal dams in Arizona into the CAISO market at the California/Arizona border which offsets its power purchase costs). Market power purchases currently range from 5MW to 8MW per month. Serving the additional .5MW (or approximately 1MW in load growth over ten years) would simply require updating our load forecasts and schedules for purchases with CAISO. **The annual cost of purchasing market power for the new loads in the initial year, is estimated to be ${see study} (given current CAISO market prices in PWE's location). This price is expected to double with load increases in 10 years (assuming CAISO local power prices remain stable).**

CAISO's Market Performance Update of December 17, 2021[9] indicates the following real-time prices:



Expansion of Cogeneration Facility

Another option considered was an expansion of the existing natural gas generation capacity at PWE. Cogeneration (cogen) through combined heat and power (CHP) is the simultaneous production of electricity with the recovery and utilization of heat. Cogeneration is a highly efficient form of energy conversion and it can achieve primary energy savings of approximately 40% compared to the separate purchase of electricity from the national electricity grid and a gas boiler for onsite heating.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CHP COGENERATION STUDY
PECHANGA TRIBAL GOVERNMENT CENTER
PECHANGA RESORT AND CASINO

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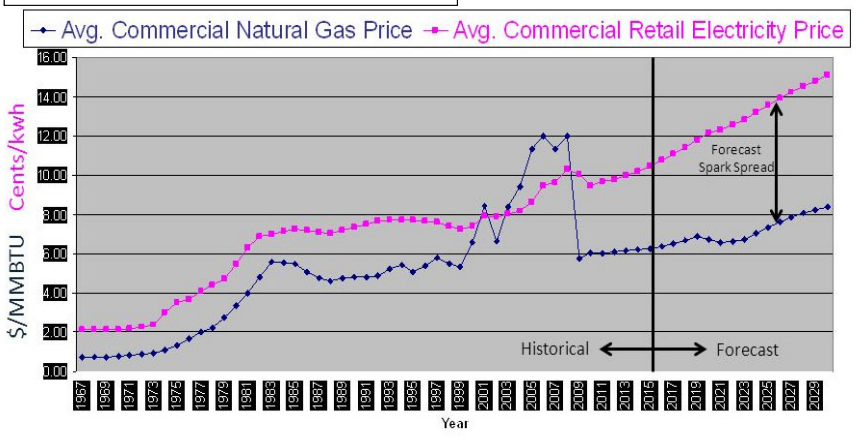
The high efficiency of a CHP plant compared with conventional market electricity and site-produced heat will provide Pechanga Western Electric (PWE) several benefits including:

- On site production of power and ability to operate in microgrid configuration
- Reduced energy costs
- Reduction in emissions compared to conventional electrical generators and onsite boilers

Continuous increasing of electrical utility costs with relatively stable gas prices makes CHP cogeneration projects financially feasible with relatively high Return on Investments (ROI). The diagram below shows historical Spark Spread which is the difference between the price received by a generator for electricity produced and the cost of the natural gas needed to produce that electricity.

[9]http://www.caiso.com/Documents/Market-Performance-Update-Dec-2021.pdf#search=Market%20Performance

Sparks Spread Historical



The Spark Spread chart shows current and forecasted future growth of the difference between electrical and gas energy costs which makes CHP cogeneration projects financially feasible.

The study reviewed technical and financial feasibility of adding new CHP cogeneration plants at two major facilities served by Pechanga Western Electric (PWE): Pechanga Government Center and Pechanga Resort and Casino. The new CHP plants at these facilities will include the following major components shown in the diagram below:

- Gas fired engine generator or turbine
- Heat Recovery Units
- Absorption Chillers
- Electrical Switchgear
- Monitoring and Control System

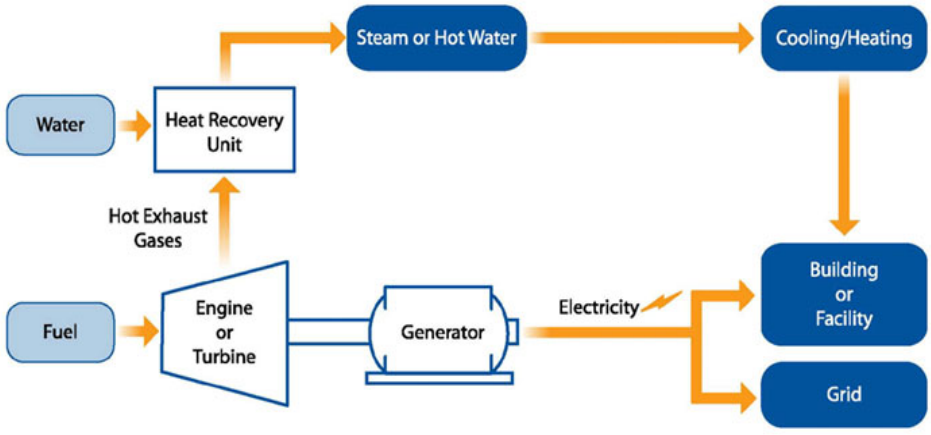


Figure 2: CHP Flow Diagram

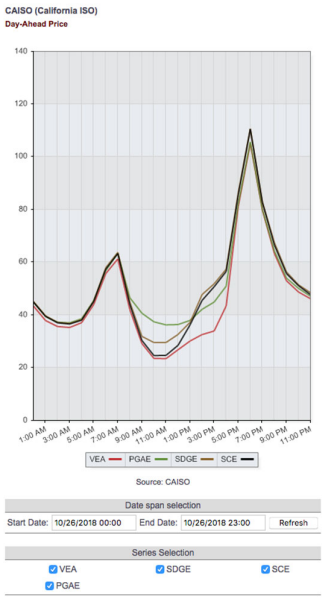
The CHP Cogeneration Study, analyzes two number of options, including descriptions, drawings, calculations and ROI analyses:

- Adding a 400kW gas fired CHP plant at the Pechanga Government Center with heat recovery units, absorption chiller and other auxiliary electrical and control equipment. Benefits of this option include improved energy efficiency due to the captured heat for pool heating, space heating and cooling of the Recreation Center and domestic hot water. It would allow the Government Center to operate in a microgrid mode and would allow the Recreation Center to be used as an Emergency Rescue Shelter.
- Adding a 5MW solar Mercure 50 gas turbine at the casino with heat recovery units, absorption chiller and other auxiliary electrical and control equipment.

On-Site Large Scale Solar Generation

PWE is installing 1MW of solar to be located on the parking garage at the resort, and a large battery back-up system. A summary analysis of the bid responses was considered by the Tribal Council. Costs per watt are consistent with regional cost expectations. It is expected that the proposed solar and battery system installation would offset all load in the Residential Area during daylight hours, both currently and with expected load growth over the next 10 years.

In addition to the cost of solar installation, additional expense will be needed to serve the loads. First, annual costs for maintenance of the solar system is to be covered through our solar and battery supplier. The cost of maintenance varied widely. The cost of the chosen system must be added to the annual cost of this option.



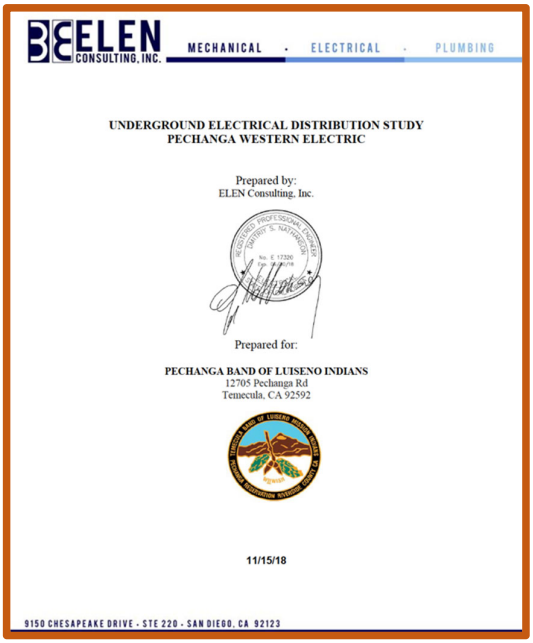
Second, we considered additional purchased power costs. Since the solar is not a firm resource, power would still need to be purchased when the system was not producing energy. Power prices after the sun sets are often some of the highest prices during the day, as shown in the following graphic of average day-ahead prices for October 2017-October 2018. We are assuming new solar panels without battery storage would offset approximately one half of the power purchase price. This option was deemed less attractive as back-up power is not available during PSPS events. The battery system option was more advantageous and was subject of a California State funding program which PWE was eligible to apply for as a natural gas customer of SoCal Gas.

Engineering/Planning Study

This study is an engineering review of the location and an overview of the design of optimal new underground utility facilities in the Residential Area. Underground systems were considered to mitigate for local extreme fire risks, lower maintenance costs related to above-ground facilities and to assure incorporation of other tribal infrastructure such as water lines, fiber optics and other facilities on the same right of way.

This study allows for a comparison of the cost of an underground system to the acquisition of the existing SCE system.

Elen provided an estimate for upgrading the existing SCE system into an underground electrical system which could also accommodate all utility facilities in the Residential Area.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UNDERGROUND ELECTRICAL DISTRIBUTION STUDY
PECHANGA WESTERN ELECTRIC

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The estimate to have a new underground distribution throughout the residential areas in lieu of assuming overhead assets from SCE is included in the *Electrical Study".*

Please note the following assumptions:

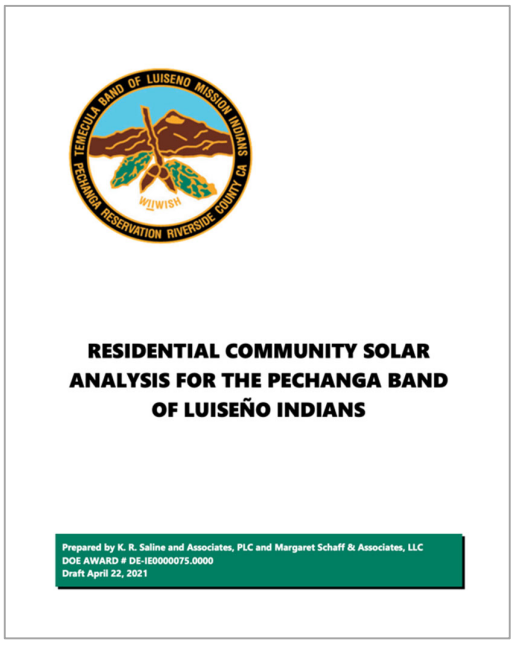
- The study of converting the existing electrical system to an underground includes all residential areas of the including the area north of the government previously connected to the PWE under the conversion from SCE to PWE. See sketches E-2 in the study for a layout of the electrical system installed the Phase 2 *"Underground* overhead electrical system reservation, center that was Phase 1 UG-E-1 and UG-system.
- The new primary duct bank will consist of two 5" concrete encased conduits. One will be used for the 12 kV power conductors, and one as a spare power conduit.
- The new secondary duct bank will consist of one 3" direct buried conduit that will be used for 120/240V secondary conductors to the residences.
- The new duct bank follows the road alignments rather than the existing overhead pole alignments.

- There will be a pad-mounted electrical junction cabinet installed about every 450' along the main primary duct bank, and wherever a tap is required to extend in a new direction.
- 230 residential electrical meters were assumed.
- Unit prices for duct banks and cables generally follow the previously received pricing for the Phase 1 Government Center feeder, with a 25% factor added for difficult terrain.
- Some of the SCE facilities, or perhaps at least some of the SCE rights of ways would also need to be acquired in order to transfer from SCE service to PWE service.

Summary of Options and Costs for a Community Solar Program

We considered the engineering options for a PWE community solar program that could serve the customers in the residential area.

The options and price estimates are as follows:



1. A PWE acquired battery system at each of the 111 tribal member owned residences, without solar back-up. Because the battery systems are relatively operation and maintenance free, the systems would be transferred to the homeowners. Batteries would be charged using current SCE service.

2. A Residential Area microgrid system with PWE acquired battery systems as above, supplemented with a PWE owned, operated and maintained community solar array, which would be subject to SCE negotiations and agreement. We have provided an estimated cost for a community solar system. We considered whether individual systems (at each residence) would be an option. This could be the subject of an industry request for proposals. Because the specifics of each residence would need to be included, we did not include this as an option. One could assume that if individual systems were added at each house, the cost per kW for the solar would increase slightly, or significantly, depending on the operational, maintenance, and other services acquired.

3. A "no-action" alternative under which local residences purchase their own solar and/or battery systems, either on their own or with a subsidy from the tribe.

Upon presentation of this report to the Tribal Council, a request for proposals was authorized to obtain industry bids for individual battery and solar systems. The RFP was issued to industry and bids were received. Upon review of bids by the tribal energy team, it was determined that in addition to the bid prices for systems, significant additional upgrades would likely be needed to the SCE system and to control systems to assure that distributed solar and battery systems could be effectively controlled and used by PWE as a "resource" that was recognized by CAISO. A contingency cost was estimated for these purposes.

Ranking of All Reasonable Options by Cost

PWE, the Tribal Council, and staff are considering the results of all these efforts and options. The options were grouped into two categories, an option where PWE owns the distribution system in the Residential Area and options where SCE continues service and PWE supplements existing service with either subsidies to residents or with solar/battery systems. The costs of the options were presented, along with the pros and cons of each option. The following is the graphic summarizing these options, with proprietary costs deleted. The final decision will be made after a vote of the General Council.

Option #1 PWE Owned Distribution System

Option	Information	ESTIMATED Cost	Pros	Cons
PWE Builds New Underground Distribution System and Serves Residences	Expansion of PWE service to residences	$x * $x**	Sovereignty, self sufficiency, Full Protection during PSPS; incorporation of water, fiber and service to future growth potential	Added Staff and equipment needed for Customer Service, maintenance, operation, real estate issues
PWE Acquires SCE Distribution System and Serves Residences	Expansion of PWE service to residences	$x* $x**	Sovereignty, self sufficiency, Full Protection during PSPS	Same as above, plus old facilities
Power Supplies If PWE Takes Over Distribution	Annual Market Power Add 400kW Cogen at Gov Center Add 5MW Cogen Community Solar	$x $x + fuel $x + fuel $x	PWE manages. Can use new generation for RA, marketing, future loads Lower utility bills for Residents	Added staff needed!

*Cost of system acquisition/build only. Metering not included.
** First year system cost including system acquisition/build and first year of wholesale power costs (*measured at 500kW*), SCE substation upgrade study and administrative costs. Any cost of substation upgrade is not included. Potential stranded costs are not included. Metering not included.

Option #2 SCE Continued Service/Solar and Batteries

Option	Information	ESTIMATED Cost	Pros	Cons
Solar and Batteries at 120+ Residences	SCE continues "back-up" service but PWE provides solar and batteries	x x	PWE manages systems at each home, consolidates systems for Resource Adequacy, Partial PSPS protection	Only partial PSPS protection. Likely substantial unknown upgrades of SCE facilities and homeowner properties, land issues. Continued SCE bills
Tribe Subsidizes Residences to buy their own systems	SCE continues service but residences can purchase systems	$x	Easier administration	Does not necessarily work for PSPS, Continued SCE bills.