

CASE STUDY

A COST EFFECTIVE ELECTRICITY GENERATION STORAGE AND DISTRIBUTION SYSTEM FOR HOME BASED MARKETS

Dr. Howard Jelinek
Eenergy Energy Inc.
Chairman and Chief Technology Officer

RENEWABLE ENERGY TECHNOLOGY FOR THE SELF-GENERATION HOMEOWNER CONTINUES TO IMPROVE IN COSTS AND EFFECTIVENESS. SOLAR POWER IS EFFECTIVE IN REDUCING ELECTRIC BILLS WHEN COMBINED WITH ENERGY STORAGE. AN IMPORTANT REMEDY FOR INTERMITTENT SOLAR GENERATION; ALLOWING ALL DAY AND NIGHT DISPATCH OF ENERGY WHEN NO SOLAR GENERATION IS AVAILABLE.

Executive Summary

Replacing fossil fuel generation with renewables is the world's major environmental initiative. Home based Self-Generation using rooftop solar is one of the most effective methods for substantially reducing daytime electrical grid demand and reducing homeowners' costs and carbon footprint. This case study reviews the economic benefits when adding solar plus storage to a home. We explore benefits of using Eenergy Power Plant™ that allows solar energy to be accessed during the most expensive evening load and recharged with daytime solar and at night using the least expensive grid supplied electricity.



Overview

The Eenergy Power Plant™ (EPP) provides an excellent solution for homeowners to dramatically reduce their electric bill, minimize reliance on the grid and reduce their carbon footprint. The EPP is a proprietary system designed with patented technology to forecast next day solar to optimize battery capacity. This self-consumption formula reduces costs and improves cost savings without dependence on utilities for net metering. Efficiency is greatly improved by the EPP using direct charging from the DC solar directly to the batteries; this eliminates many costly components, maintenance and reduces conversion losses.

Power and Cost Estimation

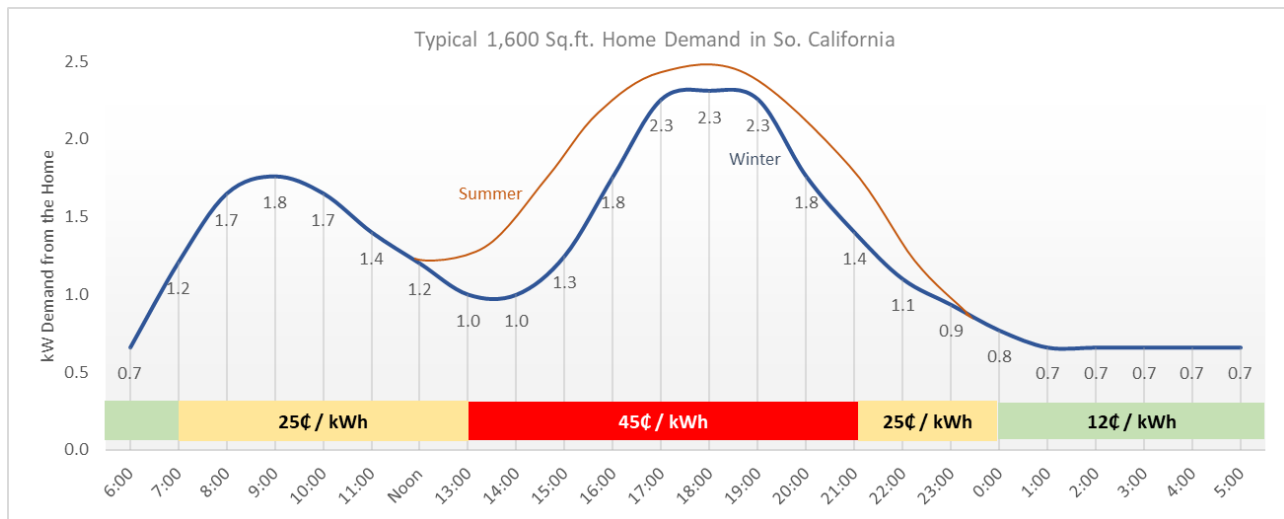
To estimate energy costs and savings for solar and storage, it is important to understand home energy use and utility costs. Most utilities will have a charge for energy over time as well as highest peak power used. It is important to understand both numbers. Energy used by the home over time is measured in kilowatt-hour or kWh. For example, six 100w lightbulbs burning for two hours would = 1,200 Watts-hours or 1.2 kWh. Power is similar but is measured in watts or kilowatts. For example, an air conditioner may have a startup power of about 6-12 kW and running power of 2 kW. The utility must provide this power and account for it in planning for new power plants. In many areas of the

country, peak power used is an additional charge by the utility. Therefore, it is important to reduce both the power and energy used by the home. The table here shows the typical energy usage for a home, according to the data for California by the U.S. Energy Information Administration. A 1,600 sq.ft. home could expect to use 31 kWh of energy throughout the day. This is a key number when determining the size of the battery, or capacity, needed to power the house and for how long.

kWh/Day Ave for a 1,600sq.ft. home in So. California		
	kWh	%
Space Heating	4.65	15%
Water Heater	4.34	14%
A/C	5.27	17%
Refrigeration	2.17	7%
Lighting	3.1	10%
TV and Electronics	2.17	7%
Dryers	1.55	5%
Appliances & Other	7.75	25%
Total	31	100%

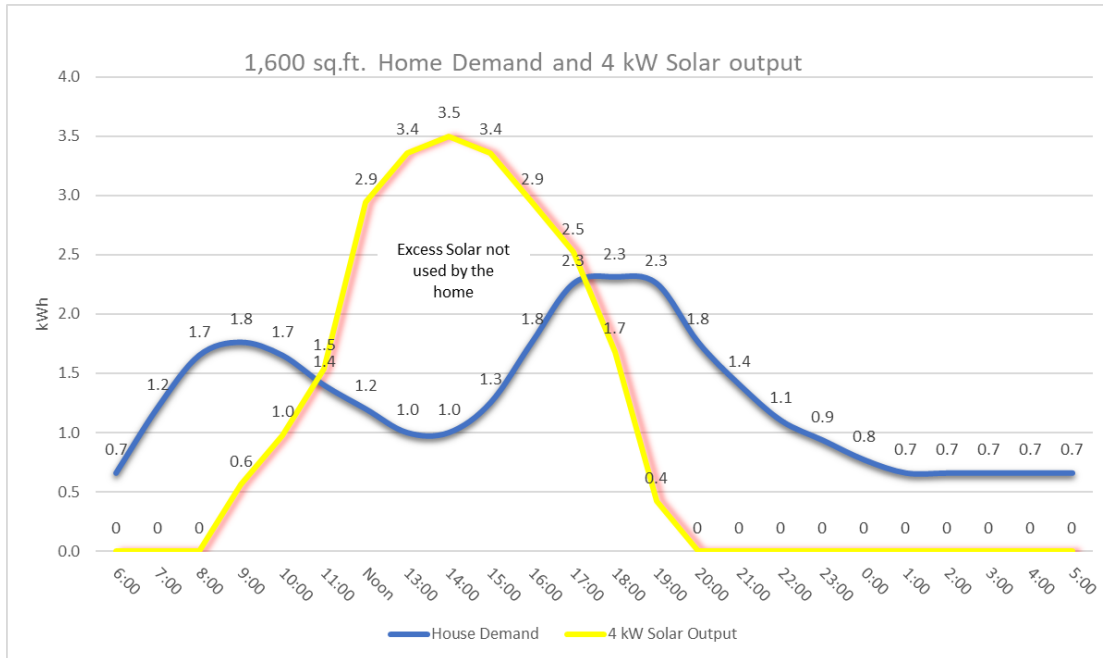
Utility power costs for most homes = \$305/month estimated electric bill

Residential electricity use is typically low during the night from 10 PM to 7 AM in the morning and high during the period from 7 AM to 10PM. In our 31 kWh 1,600 sq.ft. example, roughly 23 kWh is used during the day between 7AM and 10PM. This is also the costliest utility electricity for the home. In the evening, the electrical usage would be only 7 kWh at the lowest utility costs. The utility will generate the total usage for various billing periods and send you a monthly bill. For our example above of a modest house, our total comes to \$305 per month, or \$3,660/year.

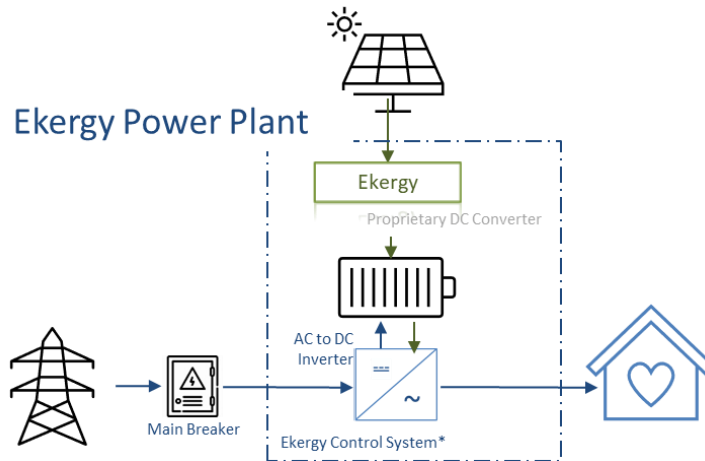


Solar Generation = \$147/month estimated electric bill

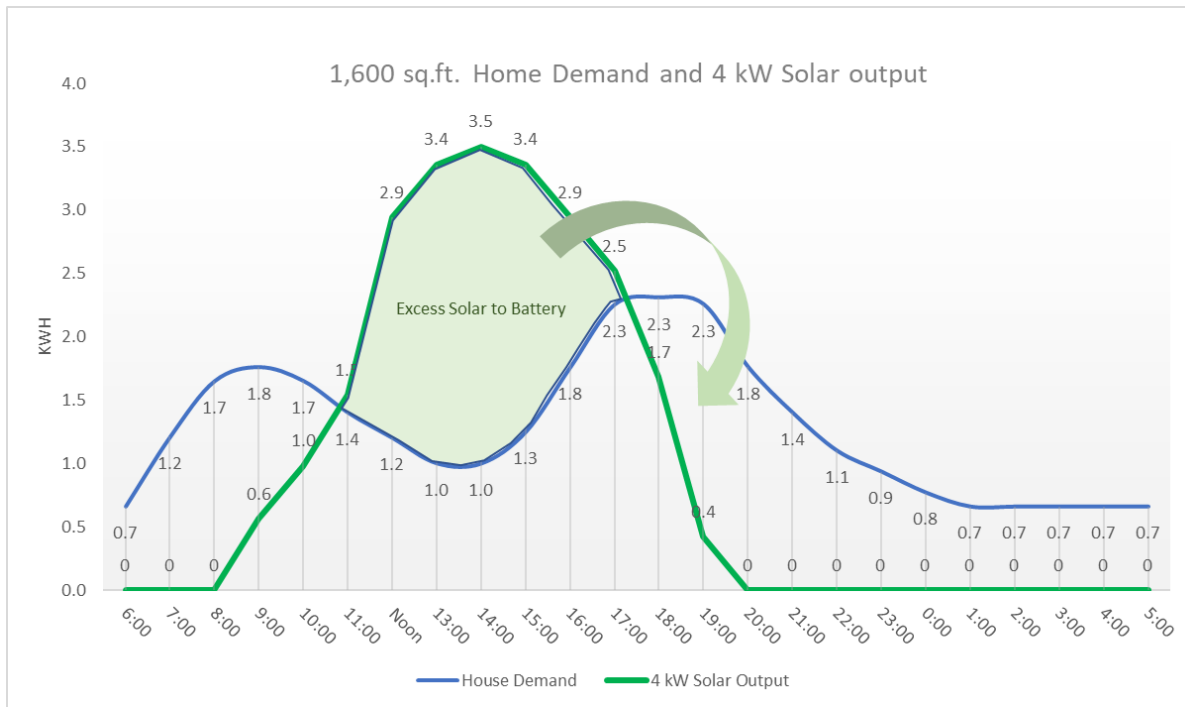
On sunny days, the measurement of solar irradiance or ‘insolation’ from a 6 kW solar PV array produces up to 30 kWh. On a low insolation day, the array may produce 12-20 kWh energy.



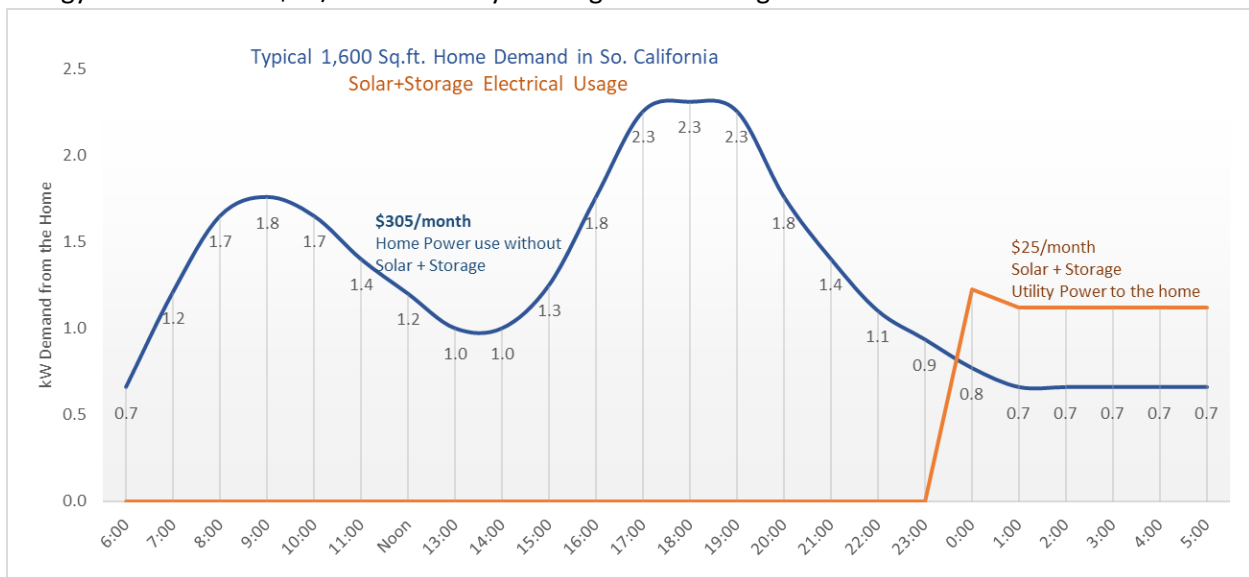
Energy Storage to capture Solar Generation = \$25/month estimated electric bill



On typical days, the solar panels will provide extra energy mid-day that can be stored in the battery and then dispatched in the evening when solar power drops. On typical days, this cycle can provide 75% to 100% of the home's energy requirement.

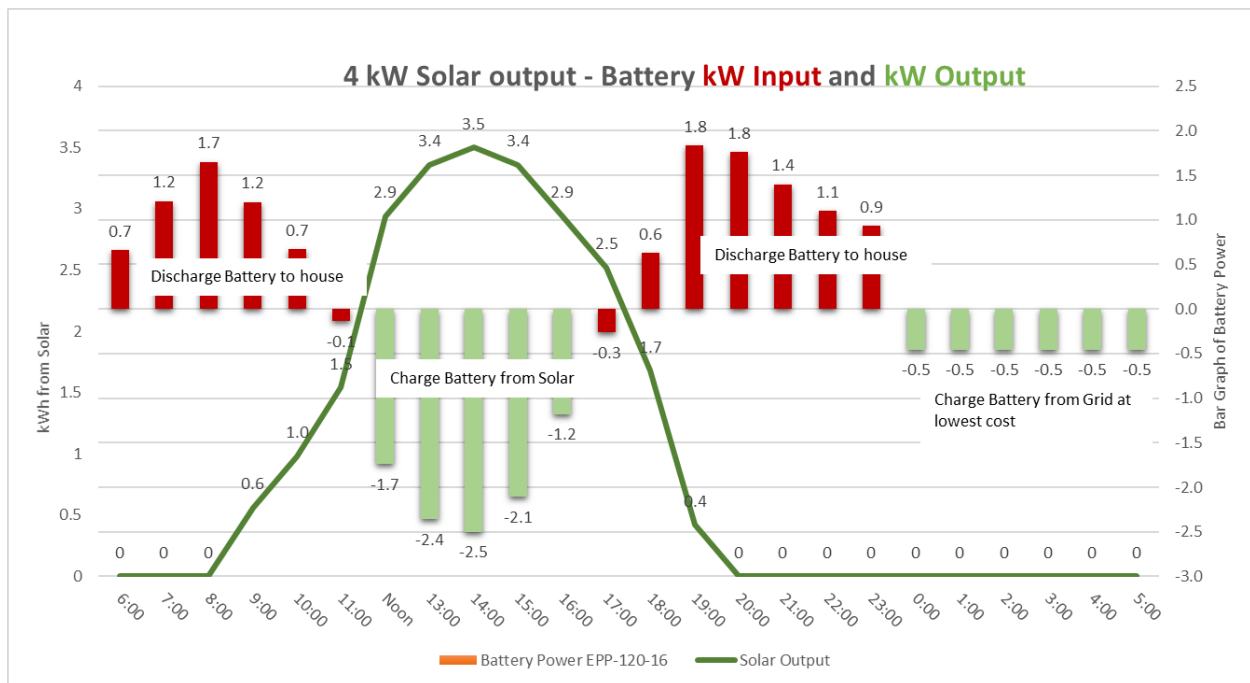


Eenergy models show that a 4 kW solar will provide days of insufficient generation into the evening. The Eenergy Power Plant makes up the deficit by ‘topping up’ energy in the battery from the utility at the best rates available, typically midnight to 6am. Also, high solar output sunny days bring higher demands from air conditioning. Consequently, there will often be a need to forecast the expected generation and usage and compensate with utility power. The forecasting features of the patented EPP, will allow for charging to be done at the lowest cost nighttime utility rates. The EPP also manages the battery to maintain optimal values of battery state of charge (SOC). This assures the battery has enough overhead to capture excess solar energy as well as enough power to dispatch during the high cost day and evening cycle. When provided with properly scaled solar and storage, a home that typically runs a \$305/month energy bill could see a \$25/month rate by utilizing solar + storage.



Forecasting next day solar and adjusting battery with low-cost night power

An important aspect of solar-plus-storage is the ability to look ahead and calculate the daily demand. The goal is to eliminate the use of high-cost daytime electricity and utilize as much solar energy as possible. The Eenergy system includes a proprietary software that projects the next day solar and adjusts the battery state of charge (SOC) by providing needed energy from the grid that is forecasted for the next day. Charging is done at times when energy cost is at the lowest cost nighttime utility power. This is the essence of self-generation: it allows the homeowner the liberty to eliminate the complexity of net metering while still using the grid electrical to ensure maximum resiliency. For the electrical bill, the Eenergy design maximizes the generation for the expensive day and evening demand, while using inexpensive nighttime power to increase the SOC to the appropriate level as a buffer for tomorrow's solar conditions.

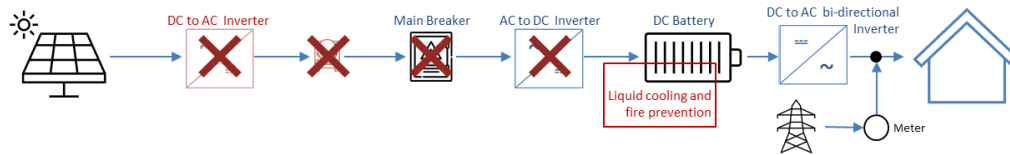


Engineered Simple

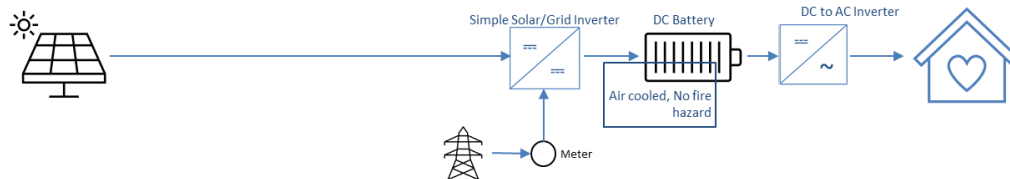
The Eenergy Power Plant™ utilizes proprietary systems noted previously to greatly reduce the use of utility power. This system does not require net metering to provide savings.

Eenergy has engineered a robust direct DC charging system that uses solar energy directly without conversion losses from solar DC to AC and back to DC for battery storage. This design eliminates many costly components found in competitive systems and reduces the failure issues and maintenance typically found in AC coupled storage systems.

Competition



Solar power to Home with Eenergy



There will be no need to re-wire the electrical service into the home to separate out critical circuits due to lack of power. The Eenergy system can handle the whole home; this greatly simplifies installation.



The installation team will mount 4 cabinets of batteries approximately 6.5" thick to the wall with one Eenergy control cabinet, also a compact 6.5" thick and 2 x 3.5'. The install team will bring in power after the meter through the EPP and back to the main house power. No breakout of critical circuits and extra power panels is required.

Eenergy entry into the market is expected to be at least 20% more affordable than other systems found in the market. The Eenergy 'minimalist design' reduced upfront costs, maintenance, installation, and warranty. It is ideal for the underserved market of small to medium homes. It is our strong belief that this underserved home market can account for giga-watts of utilized solar energy in homes currently outside the financial break even calculation. This will bring about a dramatic and sustainable renewable surge into the residential market. With the advent of continued government programs that assist with solar + storage, additional savings are available.

BONUS: Home value assessments with solar + storage are higher.

Intelligent Energy Storage