

Solar plus storage vs solar only – Why Storage Saves Money

We are often asked “Why should I pay the extra cost for a solar system with storage?” Let’s start with the answer, and then explain why.

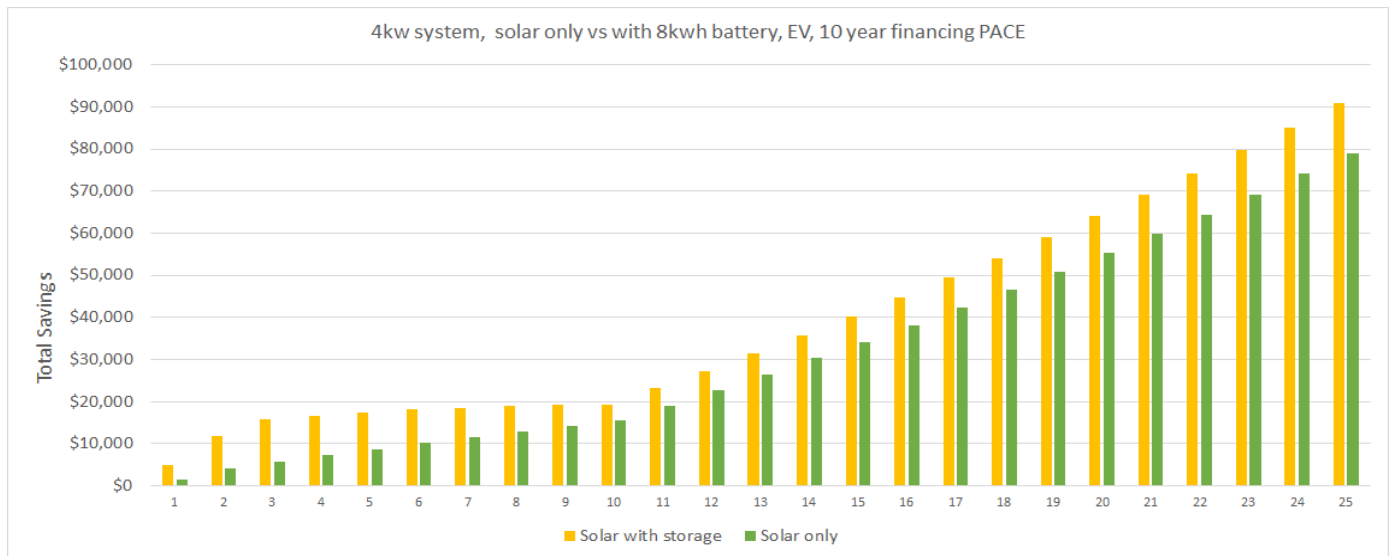


Figure 1. Annual Savings for solar system with or without storage

In Fig 1 we show the amount of money a typical 4kw system, with an electric vehicle, will save each year, using a 10 year PACE financing model (\$0 down). Yellow are the savings with storage, green savings without storage. In the first few years of a solar system with storage, you will receive both the SGIP rebate (\$3775 in this case), plus the Investment Tax Credit (\$8660), which we’ve spread over 2 years. In addition you receive the interest tax credit (\$2037 the first year). In the third year, you’ve accumulated **\$15,891** in savings – that’s cash in the bank. Over the next 7 years, the savings steadily increase. The system is paid off in year 10, so then each year the accumulated savings increases rapidly.

For the case of solar only (green bars), there is no cash rebate, just the ITC & the interest tax credit. So cash savings starts out low and increases slowly to year 10 on payoff, after which savings increases rapidly. **But the solar_plus_storage savings are ALWAYS greater than solar only.**

The savings on electric bills & gas usage per year for solar_plus_storage starts out at \$3124/year. Savings for solar only starts at \$2772/year – a **\$352 difference**. Over time this accumulates – by year 20 you will have saved \$55,233 total for solar only, \$63,952 total with storage – a difference of \$8,719. With our whole home battery backup™ you will now have energy security – if the power fails the storage system will operate everything¹ in your home.

¹ “everything” refers to all of the things that are wired to either the main panel or subpanel that is supplied by the PV & battery storage system

So how does a storage system save you money? In the following, we'll dig into the details of solar systems, and why storage matters.

If you don't have or are not planning to have an EV, the E-6 rate is the rate that gives the best value for solar. It is being eliminated by PG&E at the end of NEM 1.0. With an EV, rate EV-A is the best value. Figure 2 shows details of these rate structures.

E-6 Rate. Summer is from May 1 to October 31 (6 months).

E-6 Time-of-Use Periods		
Summer (May-October)		
Peak:	1:00 pm to 7:00 pm	Monday through Friday
Partial-Peak:	10:00 am to 1:00 pm	Monday through Friday
	7:00 pm to 9:00 pm	Monday through Friday
	5:00 pm to 8:00 pm	Saturday and Sunday
Off-Peak:	All Other Hours	Including Holidays
Winter (November-April)		
Partial Peak:	5:00 pm to 8:00 pm	Monday through Friday
Off-Peak:	All Other Hours	Including Holidays

Tou A and B rates. The same except for peak periods. Summer is from June 1 to September 30 (4 months).

	E-TOU-A	E-TOU-B
Summer 6/1-9/30		
Peak Period*	3pm-8pm*	4pm-9pm*
Off Peak all other time periods	Yes	Yes
Winter 10/1-5/31		
Peak Period*	3pm- 8pm*	4pm-9pm*
Off Peak all other time periods	Yes	Yes
Additional Facts		
Baseline	Credit	No Credit

Figure 2. E-6 & TOU Rates

E-1 is the rate that was replaced by E-6.

- E-1 baseline – 0.18353 per watt
- E-1 101-200% - 0.24276 per watt
- E-1 Greater than 200% - 0.40307 per watt

For our residential area: (X= Coastal)

- Baseline is 11.0 kwh
- 101-200% = 11.01 – 22.0 kwh
- Over 200% = 22.01 on up kwh

The new rates from PGE are TOU-A and TOU-B. These rates become available at the end of NEM 1.0 and with the advent of NEM 2.0.

Under NEM 2.0 you can only choose between TOU-A and TOU-B and EV A or EV-B. TOU-A and EV-A are the better ones.

The peak period for TOU rates is projected to be 4-8 pm from 2017 to 2020 and 3-9 from 2020 on. Note these are not peak solar hours, and in fact less than 20% of daily solar power comes after 3pm.

PG&E E-TOU as Proposed

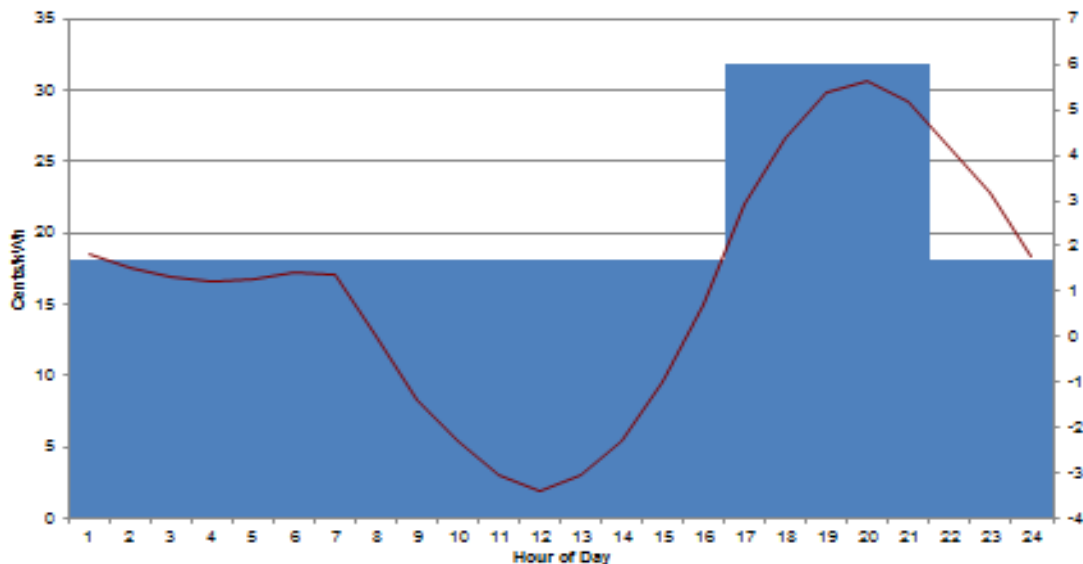


Figure 3. TOU rates (blue) vs consumption profile (red line) with solar

Having a battery energy storage system allows **load-shifting** – storing the solar power from the daytime and using it to support the load (in the house, for charging the car, cooking, et cetera, or other loads) during the new TOU peak periods from 3-8 or 4-9 pm. Depending on how much power you use each day for this period, load-shifting can save a significant amount of money.

The key factor is that the **RATE** that you are charged and credited for is **highest during this peak period** – and your system will draw power from the storage system during this period NOT the grid – thus saving you the difference between the very high peak rates (as high as \$0.43/kwh) and off-peak and partial-peak rates. It's also important to realize that under the new TOU rates, **ANY POWER YOU DRAW FROM THE GRID** also has the "Non-Bypassable Charges" added, roughly an ADDITIONAL \$0.02/kwh that ALL solar customers will be charged. This was a concession the solar industry was forced to make by the utilities, and is still hotly contested. **SOLAR WITH STORAGE ELIMINATES THE NBC'S.**

Net Load Profile

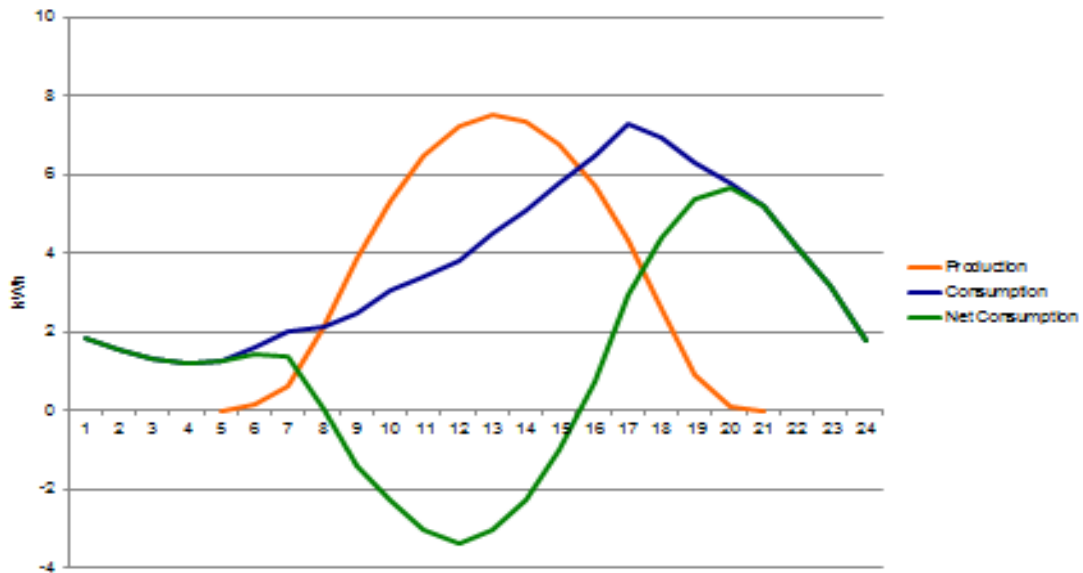


Figure 4. Typical Solar production and consumption without storage

Net consumption (in green) is the difference between the solar power produced (in orange) and the energy used (in blue). The amount of solar power available from the solar PV system drops at about the same time that the energy consumption rises in the late afternoon and evening

Summary Cost Est.				
Annual				
	TOU-A	TOU-B	E-6	EV-A
Total	\$1,539.14	\$1,581.01	\$1,241.88	\$1,763.95
Summary Cost Est. with Solar				
Annual				
Total	\$359.82	\$360.74	\$95.87	\$451.88
Savings	\$2,639.32	\$2,680.26	\$2,606.01	\$2,772.07
Savings less EV	\$1,179.32	\$1,220.26	\$1,146.01	\$1,312.07
Summary Cost Est. with Solar+Batteries				
Annual				
Total	\$239.58	\$254.98	\$76.10	\$99.56
Savings	\$2,759.56	\$2,786.02	\$2,625.78	\$3,124.39
Savings less EV	\$1,299.56	\$1,326.02	\$1,165.78	\$1,664.39
Total usage	6459 kwh		\$1,460.00	EV savings
Total solar	6524 kwh		3.6 kw AC Solar	
Surplus	65 kwh		7.55 kwh Battery 30 mile/day EV	
Notes: E-6 not available after NEM 1.0 closes EV-A rate for Electric Vehicle charging				

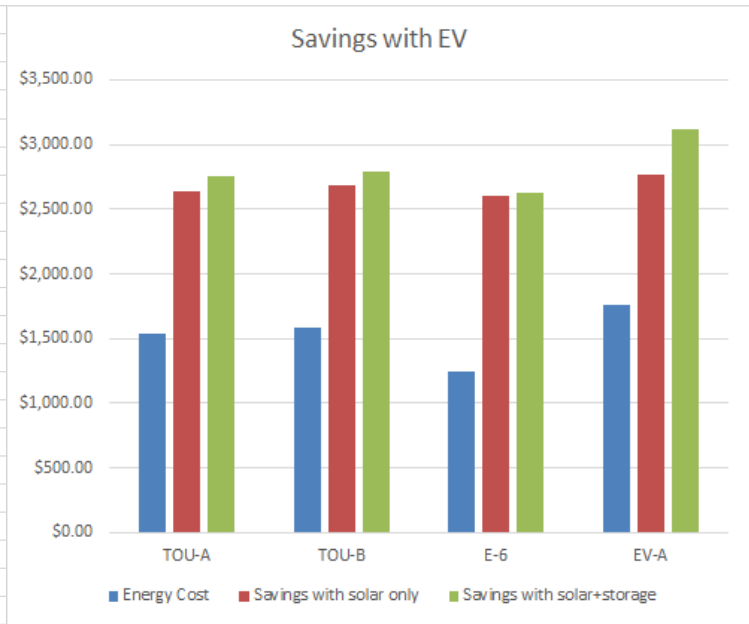


Figure 5. Comparison of Costs

The top group on the left shows your annual costs with each of the rate schedules WITHOUT any solar, using the usage data you provided (blue bars in the chart on the right).

The middle group on the left shows your total costs with a SOLAR ONLY system (the amount you'll pay PG&E) for each rate, followed by the total savings. (green bar in chart on the right is with an EV, red bar in chart on the right is without an EV).

The bottom group shows your total cost with SOLAR PLUS STORAGE, the total amount you will pay PG&E, followed by the total savings with an EV (green bar on right chart and red bar in the chart on the right represents savings without an EV). These savings are assuming a daily commute of 30 miles in an electric vehicle.

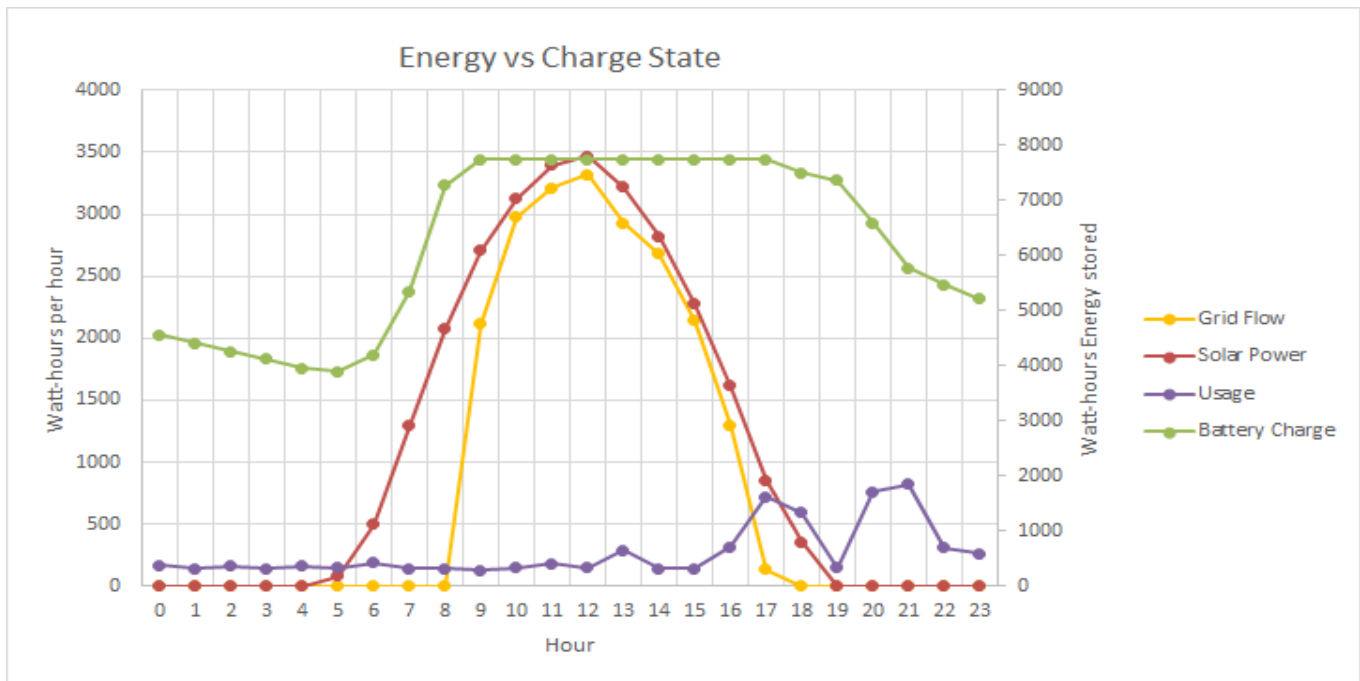


Figure 6. Your power usage with storage

How it works

Figure 4 shows what happens with a solar system WITHOUT storage. The system exports excess power back to the grid during the day, but then draws heavily to cover loads – typically during peak rate periods.

Figure 6 shows a typical summer day, using typical home consumption data (blue line), to illustrate how solar-plus-storage with load-shifting works. At night your home is operating off the battery storage (green line). The power level gradually decreases until the sun (red line) comes out, which quickly recharges the battery. Once full, the excess power is sent back to the grid, for which you receive credit (yellow line). As the solar power wanes, the battery storage picks up and again operates your home loads. As long as there is enough energy stored in the battery **THE SYSTEM NEVER DRAWS POWER FROM THE GRID.** To receive the SGIP rebate, PG&E requires you to stay grid-connected. However the system is configured to provide power to your home even if the grid goes down, should that occur.

If you are on NEM 1.0 and choose the E-6 rate, you will save slightly less than on the EV-A rate if you have an EV. The E-6 rate is grandfathered under NEM 1.0 for 5 years, after which you have to choose either TOU-A or TOU-B rate in place at that time unless you have an EV, where you can choose EV-A or EV-B.

If you are on NEM 2.0 and choose a battery energy storage system, on the TOU-A rate with energy-storage-and-solar you save **\$120** annually compared to the TOU-A solar system without batteries. With an EV your savings are greater because you save on gasoline costs. In this example with an average commute of 30 miles per day, you gain an additional **\$1460/year in savings** from avoided fuel costs.

If instead of TOU-A you choose the EV-A rate, with batteries you save **\$352** a year, compared to without batteries, and again, will save on gasoline because you do not need to purchase gas. You will also lower your carbon footprint and reduce greenhouse gas production from a combustion vehicle. We have also noticed

that the maintenance costs on a hybrid vehicle with an electric engine are also greatly reduced compared to a standard gasoline-burning car.

Another change in NEM 2.0 is the determination that for power that is made by the solar renewable system which is greater than that determined to be appropriate for your location, tilt and azimuth on PV Watts (found on the NREL site,) the utility can accept your power but not credit you with that power on your bill. Without a battery energy storage system, you will not be credited for or reduce your bill using any energy created by the solar system that is greater than that computed by the utility. So not only will you be paying more for the power during the peak demand periods in the evening, you will not be getting credit for excess renewable power produced by the PV system in the afternoon. If your solar system is less than 10 kW (which it would be at 4 kW) you can size your battery storage as needed, and you do not have to install a separate meter. You have the option of installing a more accurate meter if you wish, however the rules will still be the same.

On NEM 1.0 and the E-6 rate, you still get retail value for the renewable energy generated during the day. That rate is grandfathered for only 5 years.

Summary

Despite the additional initial cost of a solar system with storage, solar-plus-energy-storage generates savings greater than a system with only solar. In the long run, solar-plus-storage saves more money than solar only plus provides your home with energy security should the grid fail for any reason.