

A CALIFORNIA ELECTRIC ENERGY UPDATE

(Solar PV and/or Batteries at Home)

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Electrification is both a catch-phrase and a policy. Consumers are increasingly interested in decarbonization to fight climate change and for stable electricity access without supply interference by foreign or domestic actors. They are resistant to rising electricity bills resulting from expensive conventional generation, and are increasingly interested in home energy independence.

Self-interested business forces want carbon use to remain dominant. But they are losing that battle with consumers' growing awareness of extreme climate events. The strongest citizen activists support public institutions' divestment from shares of fossil stocks, which forces the fossil corporations to raise money for operations more through banks at higher cost. Just in the U.S. alone, it's been shown that the major fossil companies have known via THEIR OWN scientists' work of the last 40 years that carbon combustion causes global warming. But their public face and paid PR advertising copied earlier tactics by the tobacco companies—deny, distract, and deflect the truth while continuing with “business as usual.” They claimed climate change is only a political ideology invented by others.

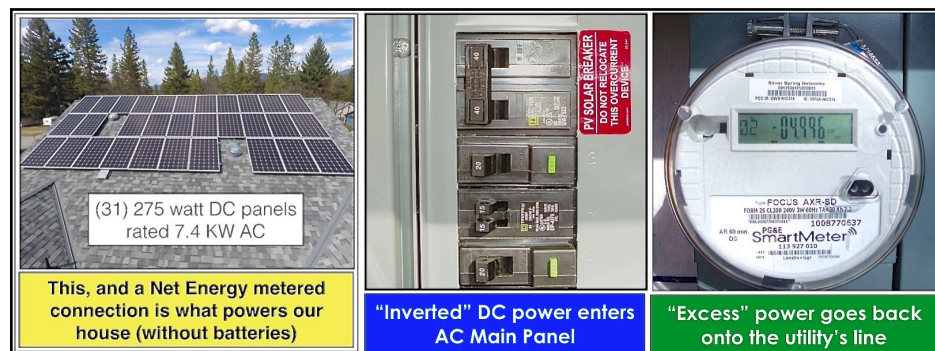


Fortunately, science, data measurement, and direct observation have proven for most what the fossil majors have kept secret. Increased atmospheric CO₂ causes global warming, and the ice caps are indeed melting, raising sea levels, and causing the increased frequency and power of damaging atmospheric events. Weather extremes have become deeper and more common than in past history.

Solar Photovoltaic-

Better known as Solar PV, this technology in a far less efficient form accompanied orbiting satellites in the 1950s to power on-board electronics and radio communications. It has come a very long way since. Mass manufacturing of collecting panels has driven the cost per watt of production capacity to record low prices—expanding their deployment. Their power conversion efficiency has also grown.

A PV panel has no moving parts except for the fact that incoming photons from our Sun hit the semi-conductor material under glass causing electrons to sequentially “jump” at microscopic levels, creating a small (usually 2-volt DC current). When multiple PV cells are series-wired together, their panels generate output voltages around 30 volts DC. And when multiple panels are series-wired together, the voltage can be as high as you like. [My own panels produce 275 watts at 30 volts, and their multi-paneled series strings send DC power to my inverters at 280 volts.]



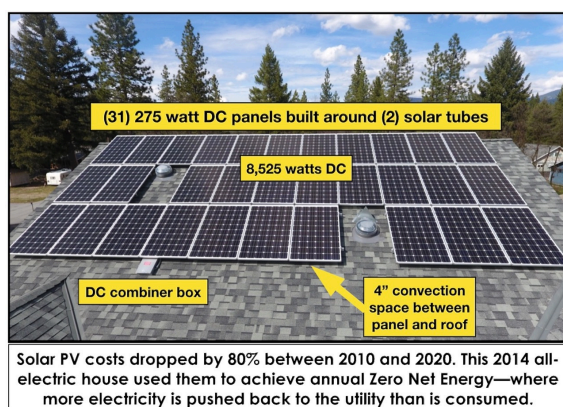
This is why the typical household solar can invert DC power to run its interior AC loads of either 120v or 240v, matching what the

utility normally provides. It's also why this output is strong enough to push any excess back past the meter and up onto the utility's secondary conductors. This (famously) turns a smart meter backward. It's a bit of a thrill when you see this at your own home!

Solar Regulations in Construction-

For some time, the California state requirement have been for solar PV to be included on every newly built residence. Since 1985, it has been possible for residents to make this direct connection (inter-tie) to their electric utility with a single meter (like my own system shown above). During periods of solar gain, if generation exceeds consumption, the meter turns backward. This action “erases” previously consumed electrons passing the meter on a one-to-one basis. But, since California electric utilities maintain a rate system for both summer months and winter months, with multiple consumption tiers and TOU (time of use) pricing using a “smart” meter—consumers with solar could gain credits for their export during peak times of day in summer peak months that far exceeded the value of just “erasing” previous kilowatt hours on that one-for-one basis.

In my own case, I could enjoy a monthly billing in July where I exported past the KWh levels of Baseline, past Tier 2, and deep into Tier 3, increasing the financial credit I made. In Tier 3, my exports would generate 47¢ per kilowatt hour at a time when my off-peak consumption cost me only 25¢ per Kwh. That's definitely a two-fer.



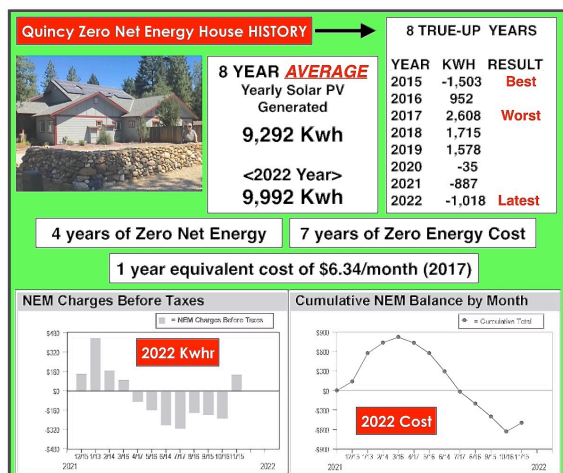
Even as an all-electric customer with a large house in a tough climate, I consumed lots of energy to drive my geo heat pump and all other needs during winter months. This seemed like a fair deal to me, since I was exporting to the utility during summer peaks with my \$30k solar system when they could avoid importing more from out-of-state.

My 7.4 KW solar PV array was completed in 2014 and was established as an NEM-1 system. Afterward, customer inducements slipped with an NEM-2 arrangement. As of 4-15-23, the latest deal becomes effective for new

solar installations. It is called NBT (Net Billing Tariff) and was built to be more equitable to all customers. The oversight for these policy changes was provided by the California Public Utilities Commission.



Cost Shifting and Equity-



I was resistant for some time to the evolution toward NBT and was weary of utilities claiming that solar PV customers (like me) were causing increased cost for non-solar customers. I wanted my utility to consider me as a generating station during peak summer hours and show me that portion of their math to justify any changes to our “deal.” What was my system worth to the grid? But, I finally came to see it differently.

While I was regularly getting to my annual (November) True-up date, achieving “zero **cost** energy” seven out of eight years and “zero **net** energy” four of those eight years, non-solar customers faced increased rates that I did not (now 36¢ off-peak and 40¢ on-peak in 2023). This phenomenon is replicated where former gas customers go to electric heat pumps and water heaters. Fewer customers remain to carry the cost of gas

infrastructure—raising the cost burden for those who remain (often those least able to afford such a conversion). That is a social equity problem that now resonates with me. Therefore, although I am grandfathered into the NEM 1.0 column for 20 years to compensate for my large personal investment, I will not complain about the transition toward NBT for later adopters. My solar expenditure is getting some protection and I can't complain, since the federal government paid for 30% of my system through a tax credit.

The following table (from the CPUC) shows differences in the California net metering transitions:

Key differences between the three standard NEM/NBT tariffs are described below.

	NEM 1.0	NEM 2.0	NBT
Eligible import rate schedule	Any	TOU rates	Specific “electrification” TOU rates
Onsite use of generated energy avoids energy imports	Yes	Yes	Yes
Credits for energy exports before true-up basis	Import rates	Import rates	Price of energy that IOUs could buy elsewhere instead
Credits for net surplus energy at true-up basis	Wholesale price of energy to IOUs	Wholesale price of energy to IOUs	Wholesale price of energy to IOUs
Non-bypassable charges calculation basis	Net energy consumed (imports minus exports) in a year	Net energy consumed in a metered interval (1 hour for residential and 15 minutes for nonresidential customers)	All energy imports
Interconnection fee	None	\$75-145	\$75-145
Billing and true-up period	Annual billing, annual true-up (both charges and credits roll over for 12 months)	Annual billing, annual true-up (both charges and credits roll over for 12 months)	Monthly billing (pay monthly); annual true-up (credits roll over for 12 months)
Installation size limit	Customer’s annual electric load with limited exceptions; capped at 1 MW	Customer’s annual electric load with limited exceptions	Customer’s annual electric load plus up to 50% if customer attests to need

Solar PV is here to stay, and with costs likely to drop and usefulness up with a link to batteries and electric cars, it will probably continue expanding. Lenders will increasingly look favorably toward loans or mortgages containing significant solar investments because they offset monthly utility bill savings.



At left, Feather River Solar’s Bill Battagin works on the installation of my DC combiner box that heads for the DC-AC inverters, right.

—Bill Martin

