The Rooftop Solar Dilemma: Rising Electricity Rates and the Diminishing Value of Rooftop Solar

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SUMMARY: California's Net Energy Meeting (NEM) program compensates rooftop solar owners for the energy they produce, which offsets their electric bills. However, the program shifts grid maintenance and other costs onto non-solar customers. Despite recent reforms, substantial incentives for early NEM participants continue to have cascading effects on bills and have created a persistent cost shift until at least 2042. This imbalance, along with grid challenges from excess solar generation, underscores the need for further policy adjustments to maintain affordable electricity while supporting California's climate goals.

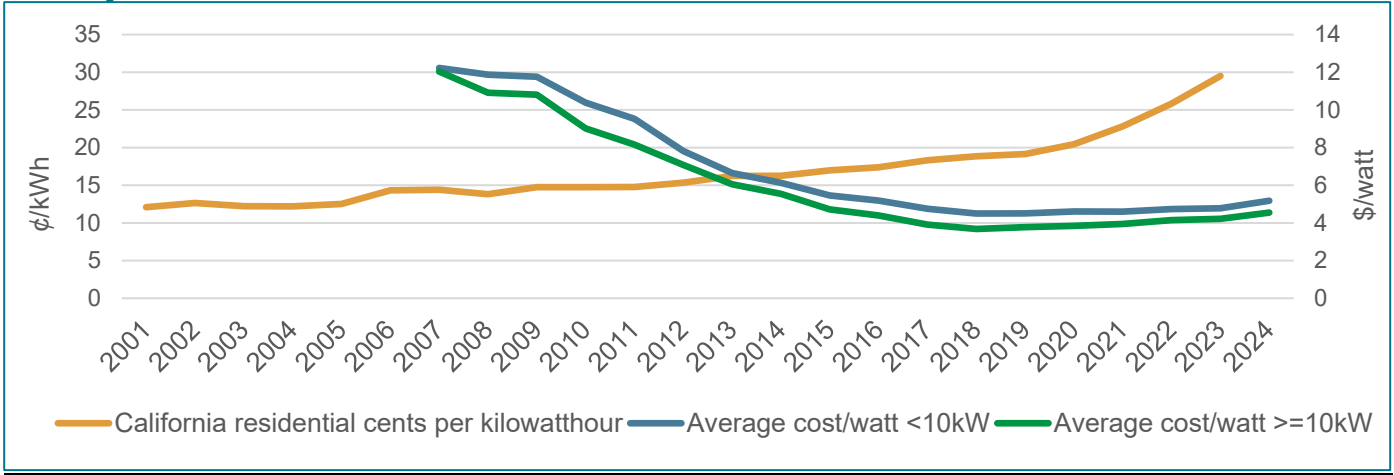
Background

California's Net Energy Metering Program (NEM) is a billing mechanism that allows rooftop solar customers to receive credits for the electricity they generate, based on retail electricity rates. As retail rates continue to increase for all customers, the subsidies for NEM customers become far more lucrative. These growing subsidies, paid for by non-rooftop solar customers, contribute to higher electricity rates and result in a higher cost burden to non-NEM customers.

Additionally, rooftop solar customers do not contribute their fair share of fixed grid costs, such as maintaining power lines and ensuring grid reliability. These costs are shifted onto non-solar customers, who shoulder a disproportionate financial burden.

The figure below shows that while the cost of installing rooftop solar has dramatically decreased, California's average residential electricity prices have steadily increased. This data highlights how linking compensation for early NEM adopters to retail electricity rates, even as installation costs decline, enables growing financial gains for NEM customers at the expense of other ratepayers.

Figure 1. Average Residential Retail Price of Electricity Has Increased Even Though Rooftop Solar System Installation Costs Have Decreased[1]



[1]Average residential electricity prices are found at the US Energy Information Administration (EIA). Average price of electricity is calculated by dividing electric revenue from ultimate consumers by the corresponding sales of electricity. The average price of electricity to ultimate consumers represents a weighted average of consumer revenue and sales within sectors and across sectors for all consumers and does not reflect the per kWh rate charged by the electric utility to the individual consumers. Solar system installation costs are from California Distributed Generation Statistics (DGS), which is self-reported by applicants with no additional verification. Between 2007 to 2015, DGS calculated cost per watt by dividing CEC-PTC Rating (AC) by Total System Cost and bucketed by the First Incentive Claim Request Review Date from the California Solar Initiative. Values are not adjusted for inflation. From 2015 to 2024, DGS's method was adjusted by representing all NEM Solar cost using AC capacity and all Energy Storage cost/watt values are represented using Storage Size (kW AC). From 2015 and on, to remove erroneous data, the top and bottom 1% of applications have been removed.

The Cost Shift Under NEM 1.0 and NEM 2.0

In 2022, the California Public Utilities Commission (CPUC) reformed the NEM program with the introduction of the Net Billing Tariff (NBT) to better align incentives with the value provided by enrolled systems. Although the NBT is an improvement, customers who continue to benefit from the previously established incentives – commonly known as NEM 1.0 and NEM 2.0 – will continue to receive generous subsidies for up to twenty years.

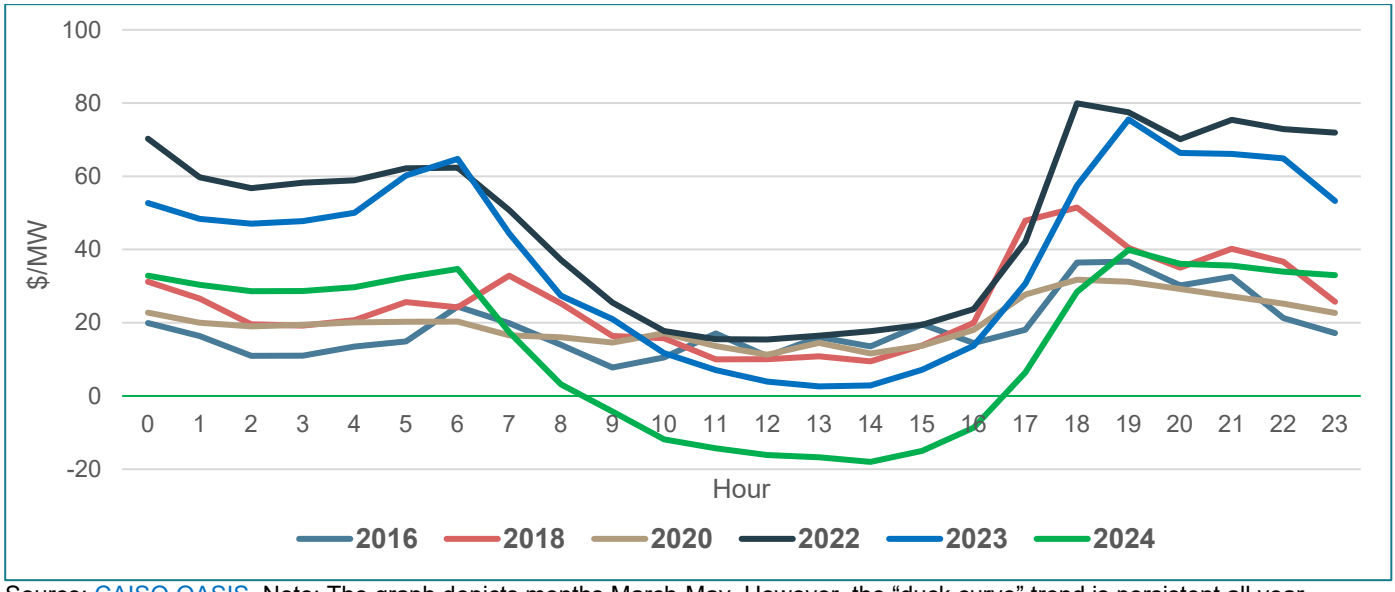
The subsidies funded by non-rooftop solar customers – commonly referred to as a cost shift – are a contributing factor to high electricity rates. The cost shift to non-rooftop solar customers of Pacific Gas and Electric, Southern California Edison, and San Diego Gas & Electric has risen from $3.4 billion annually in 2021 to $8.5 billion annually by the end of 2024. Without further intervention, the NEM cost shift will continue to grow.

Challenges of Excess Solar Generation: The "Duck Curve"

In 2013, the California Independent System Operator (CAISO) introduced the "Duck Curve" to illustrate how solar power affects grid demand.[2] During sunny days, solar production often exceeds demand, leading to energy waste or "curtailment." This oversupply can result in negative pricing during midday, when solar producers may actually pay to offload their excess energy.

As shown in Figure 2 below, CAISO's average wholesale electricity rates follow this trend, with sharp price drops during periods of high solar production. The increasing mismatch between solar supply and demand makes solar less valuable and leaves the grid struggling to balance demand during the evening when solar power inevitably and drastically drops off, known as the "evening ramp period—as the sun sets and solar generation ends, non-solar resources meet the increased demand of customers returning home.

Figure 2. CAISO Average Wholesale Electricity Rates Follow the "Duck Curve" Trend[3]



Source: CAISO OASIS. Note: The graph depicts months March-May. However, the "duck curve" trend is persistent all year.

[2] The US Department of Energy describes the transition point for solar energy, known as the Duck Curve, when the difference in electricity demand and the amount of available solar energy throughout the day is a consequence of high solar adoption.
[3] Average wholesale electricity rates are found at the EIA. Average wholesale rate is calculated by dividing Total Revenue from Wholesale Electricity Sales by Total Electricity Sold (MW).

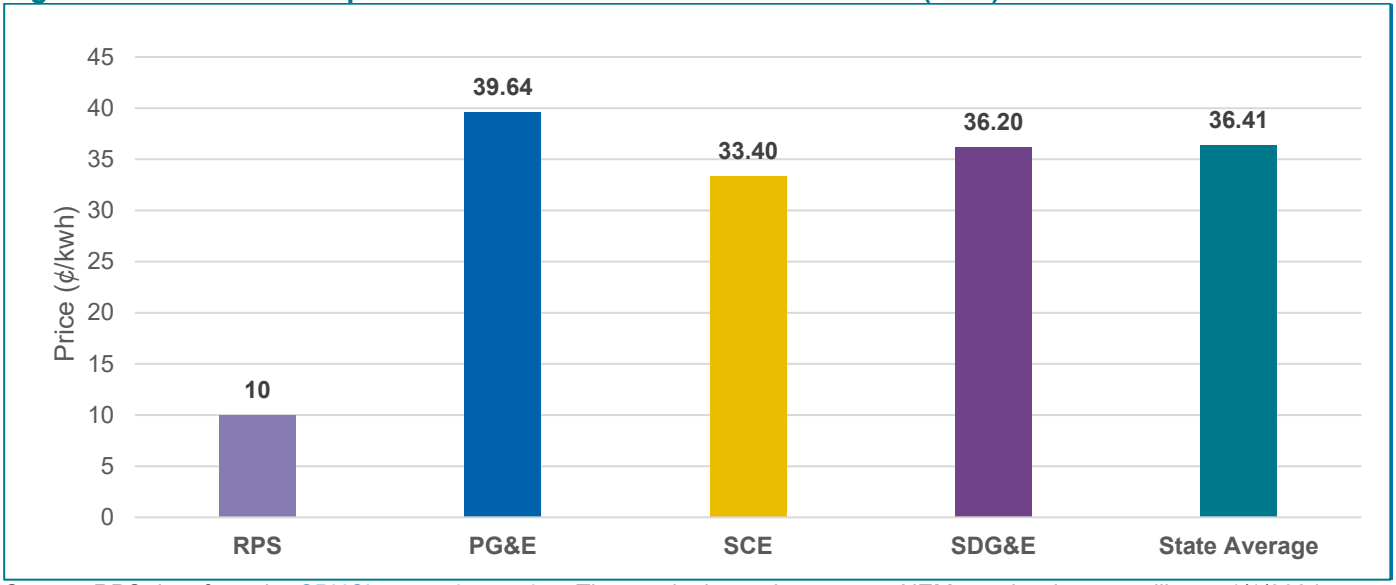
Rooftop Solar v. Grid-Scale Renewables

NEM is one of many programs supporting California's renewable energy goals, but it is far less cost-effective than the Renewable Portfolio Standard (RPS), which focuses on utility-scale renewable projects, including grid-scale solar.[4]

In 2023, renewable energy from large RPS projects cost approximately 10 cents per kilowatt-hour (¢/kWh) under long-term contracts.[5] By comparison, the average cost of energy from rooftop solar under NEM in 2024 was 3.6 times higher.[6]

This disparity arises because legacy NEM customers receive credits equal to retail rates. These credits are much higher than the actual savings or "avoided costs" that this extra energy provides to the system. Consequently, energy generated through NEM is significantly more expensive than large-scale renewable generation when it comes to adding renewable energy to the grid.

Figure 3. NEM Cost Comparison to Renewable Portfolio Standard (RPS) Executed Contracts



Source: RPS data from the CPUC's annual reporting. The graph shows the average NEM cost burden per utility on 1/1/2024 compared to the state's average cost of executed RPS contracts in 2023.

Proposed Policy Reforms

Without additional reforms, California's ratepayers will continue subsidizing legacy rooftop solar incentives established under NEM 1.0 and NEM 2.0 until 2042. As electricity rates and affordability of rooftop solar systems evolve, the grid will face increasing challenges from the growing share of renewable energy. Aligning rooftop solar policies with today's grid needs and renewable energy costs can help to reduce electricity rates and maintain California's progress toward its climate goals.

To achieve meaningful cost savings, our office recommends the following solutions:

1. Adjust Compensation for NEM 2.0 Customers

- Provide NEM 2.0 customers with compensation set at the electric rates in effect at the time of the adoption of the incentives rather than the current rule, which provides that their compensation for the excess energy that their systems generate increase with retail rates.

[4] All retail sellers utilize a mix of RPS resources such as wind, solar PV, solar thermal, hydroelectricity, geothermal, and bioenergy to meet their renewable procurement targets.
[5] According to the CPUC's RPS website, procurement Expenditures for 2023 include costs for all procurement from online RPS-eligible facilities that generated electricity in 2023, excluding Renewable Energy Credit (REC)-only contracts and renewable utility-owned generation costs. IOU procurement expenditures include payments for curtailment volumes which generally increases the unit price of energy reported.
[6] The average state retail electricity rate is acquired by averaging the 3 IOUs' retail rates in 1/1/2024, which are provided by IOUs.

This new approach still results in rooftop solar customers realizing the full benefit of their investments in a reasonable timeframe of 10 years.

2. **Transition Legacy Accounts to the Net Billing Tariff Upon Property Sale**

   - Convert NEM 1.0 and 2.0 accounts to the NBT program upon the sale of a home or after 10 years of interconnection. This change would gradually reduce the cost shift without penalizing new homeowners who did not install the original systems. This proposed change is fair as it takes away nothing from new homeowners because they did not have a role in installing the system. And even with this change, the system will provide new homeowners with bill savings over the system's operating life.
   - Alternatively, mandate a transition to NBT for all NEM systems after 10 years of interconnection. This policy would still enable customers to realize significant returns on their investments given the relatively short payback periods for rooftop solar.