# Are California's Net Metering Tariffs Fair, and How Can We Avoid a Cost-Shift?

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## ABSTRACT

California's Net Energy Metering (NEM) policies have encouraged the adoption of customer-sited resources like solar photovoltaic (PV) systems. NEM tariffs incentivize the installation of PV by compensating customers for energy that is produced and exported to the grid during times when it is not serving onsite load. This paper explores the results of a cost-effectiveness and cost of service evaluation of California's NEM tariff ("NEM 2.0").

Our results show that the NEM 2.0 tariff is cost-effective to participants. However, NEM 2.0 projects are not cost-effective from the perspective of ratepayers and result in a cost shift of more than $12 billion from program participants to non-participants.

The cost of service analysis compares an estimate of the utility cost of servicing a customer with an estimate of the customer's bills. The cost of servicing a customer is based on the customer's use of the grid and an allocation of the fixed costs of service. The cost of service analysis finds that prior to NEM 2.0 system installation, all residential NEM 2.0 customers pay approximately $200 million more in their utility bills than the estimated cost for the utility to provide them service. After installing PV systems, residential customers pay $500 million less in their utility bills than the utility's cost of service.

### Introduction

California's NEM policies are one of a handful of tools available to the California Public Utilities Commission (CPUC) to encourage the adoption of customer-sited renewable resources. California Senate Bill (SB) 656 (Alquist, 1995) required every electric utility in the state, including privately owned or publicly owned utilities, municipally owned utilities, and electrical cooperatives that offer residential electrical service, whether or not the entity is subject to the jurisdiction of the CPUC, to develop a standard contract or tariff providing for net energy metering. SB 656 allowed NEM customers to be compensated for the electricity generated by an eligible customer-sited renewable resource and fed back to the utility over an entire billing period. SB 656 required California utilities to make this NEM tariff available to eligible customers on a first-come, first-served basis until the time that the total rated generating capacity in each utility's service area equaled 0.1 percent of the utility's peak electricity demand forecast for 1996.

Since SB 656 in 1996, California's NEM policies have undergone several changes. Assembly Bill (AB) 1755 (Keeley, Olberg, and Takasugi, 1998) required utilities to provide a standard NEM contract for all eligible NEM customer generators and expanded the list of NEM-eligible technologies to include small wind. Several other bills such as SB 1 (Murray, 2006) expanded the NEM cap for Pacific Gas and Electric Company (PG&E), Southern California Edison Company (SCE), and San Diego Gas and Electric Company (SDG&E) beyond the initial value of 0.1 percent of the 1996 peak electricity demand forecast and modified the maximum allowable customer-sited renewable resource system size.

Passage of AB 327 in 2013 (Perea, 2013), among other things, directed the CPUC to develop a new standard contract for NEM generation that the three large CPUC-jurisdictional investor-owned electric utilities (IOU) (i.e., PG&E, SCE, and SDG&E) must offer after reaching their NEM caps. The NEM 2.0 program went into effect in SDG&E's service territory on June 29, 2016, in PG&E's service territory on December 15, 2016, and in SCE's service territory on July 1, 2017. The program provides customer-generators full retail rate credits (minus non-bypassable charges) for energy exported to the grid and requires them to pay charges intended to align NEM customer costs more closely with non-NEM customer costs. Customer-generators taking service under NEM 2.0 must pay a one-time interconnection fee, pay non-bypassable charges (e.g., Public Purpose Charge, Nuclear Decommissioning Charges), and transfer to a time-of-use (TOU) rate.

## Study Objectives

At the request of the CPUC, Verdant Associates conducted an evaluation to review PG&E's, SCE's, and SDG&E's NEM 2.0 tariffs. This study ("the NEM 2.0 Lookback Study") includes a cost-effectiveness analysis consistent with the CPUC's Standard Practice Manual (SPM) and CPUC Decision (D.) 19-05-019, which guides cost-effectiveness evaluation of customer-sited renewable energy resources. The SPM contains the CPUC's method of evaluating distributed energy resource investments using various cost-effectiveness tests. The four tests described in the SPM assess the costs and benefits of NEM 2.0 from different stakeholder perspectives: the total resource cost (TRC) test, the participant cost test (PCT), the program administrator (PA) test, and the ratepayer impact measure (RIM) test.

The evaluation also includes a cost of service analysis to compare the cost to serve NEM 2.0 customers against their total bill payments. The objectives of the evaluation are to examine the impacts of NEM 2.0 and to compare how different metrics have changed following the transition from NEM 1.0 to NEM 2.0.

## NEM Population Overview

By the end of 2019, California customers had interconnected more than one million NEM generators onto the three large electric IOU systems representing nearly 8.5 gigawatts ($GW_{AC}$) of capacity. Figure 1 shows the growth in NEM 1.0 (defined as any interconnection prior to the current NEM tariff) and 2.0 projects over time. The number of NEM 1.0 interconnections peaked in 2015 and the last NEM 1.0 system received permission to operate during 2017. By the end of 2019, there were 616,308 NEM 1.0 systems and 413,982 NEM 2.0 systems interconnected on the grid.

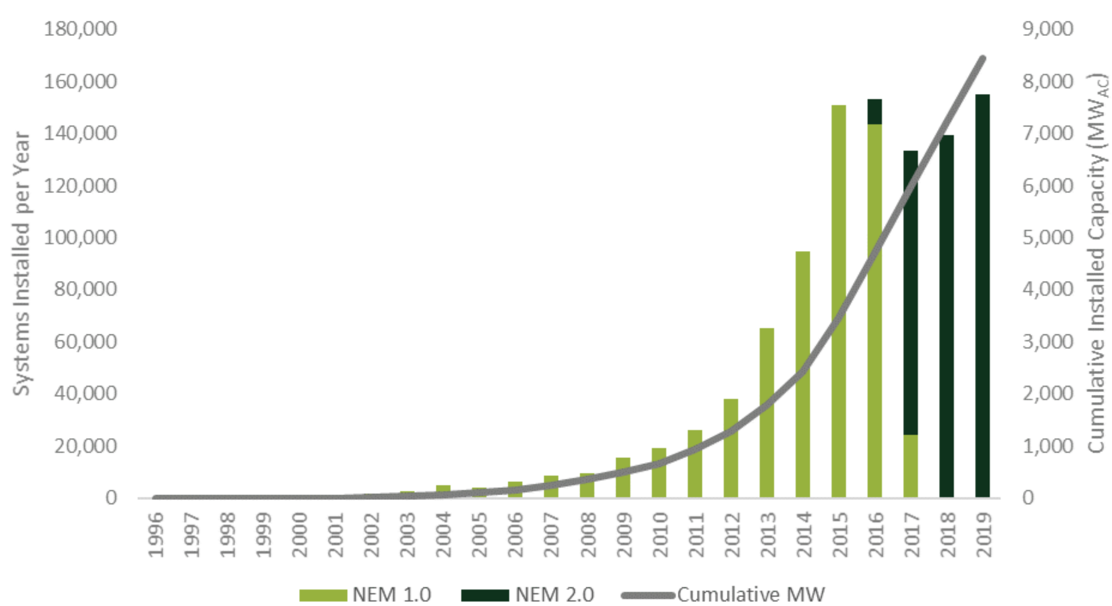


Figure 1. Installed NEM systems by NEM 1.0/2.0 tariff over time.

## System Size and Consumption

We compared the estimated electricity output from NEM PV systems to the customer electricity consumption. Table 1 presents the average annual load statistics for NEM 2.0 and NEM 1.0 residential customers. NEM 2.0 residential annual average energy consumption ranged from 7,824 kWh for SDG&E customers to 10,513 kWh for SCE customers. PG&E residential NEM 2.0 customers consumed 8,425 kWh on average per year. These consumption amounts are slightly higher than the normalized average annual consumption by all single-family customers of 7,701 kWh for PG&E, 7,450 kWh for SCE, and 7,453 kWh for SDG&E. Average NEM 2.0 generation accounted for 89 percent (PG&E) and 96 percent (SDG&E) of residential customer post-interconnection consumption. Notably, we found that residential customers increased their consumption by between 10 and 30 percent relative to their pre-interconnection consumption. These increases in consumption are associated with adoption of electrification technologies and increased HVAC usage.

Table 1. Residential average annual load statistics.

| Customer Type | Metric | PG&E Residential | SCE Residential | SDG&E Residential |
|---|---|---|---|---|
| NEM 2.0 | Avg. Pre-Interconnection Electricity Consumption (kWh) | 8,425 | 10,513 | 7,824 |
| | Avg. Post-Interconnection Net Consumption (kWh) | 1,249 | N/A | 416 |
| | Change in consumption after interconnection (kWh) | 2,520 | | 2,252 |
| | Avg. Post-Interconnection Electricity Consumption[6] (kWh) | 10,945 | | 10,076 |
| | Avg. System Size ($kW_{DC}$) | 5.9 | 6.9 | 5.6 |
| | Avg. PV Annual Generation[7] (kWh) | 9,696 | N/A | 9,661 |
| | % Pre-Interconnection Consumption Supplied by PV | 115% | | 123% |
| | % Post-Interconnection Consumption Supplied by PV | 89% | | 96% |
| NEM 1.0 (CSI) | Avg. Post-Interconnection Electricity Consumption (kWh) | 14,830 | 16,118 | 15,036 |
| | Avg. System Size ($kW_{DC}$) | 5.3 | 5.9 | 5.9 |
| | % Post-Interconnection Consumption Supplied by PV | 63% | 63% | 69% |
| | Home Median Square Footage for CSI Customers ($ft^2$) | 2,200 | 2,356 | 2,433 |
| CA Statewide | Avg. Consumption for Single Family Residential Customers | 7,701 | 7,450 | 7,453 |
| | Home Avg. Square Footage for Single Family Residential Customers ($ft^2$) | 1,859 | 1,877 | 2,018 |

Note that residential customer household square footage data were not available for NEM 2.0 customers.

## Demographic Trends – Household Income and Disadvantaged Communities

We analyzed solar adoption trends as compared to ZIP code median household income in 2018, using 2018 dollars. Figure 2 shows the distribution of NEM systems and California's population by the median income in each ZIP code. ZIP codes with median incomes between $50,000 and $74,000 and $75,000 to $100,000 have the largest proportion of NEM 1.0 and NEM 2.0 customers. This is also the income bracket with the highest proportion of Californians. However, areas with higher incomes show higher percentages of NEM installations relative to California's population.

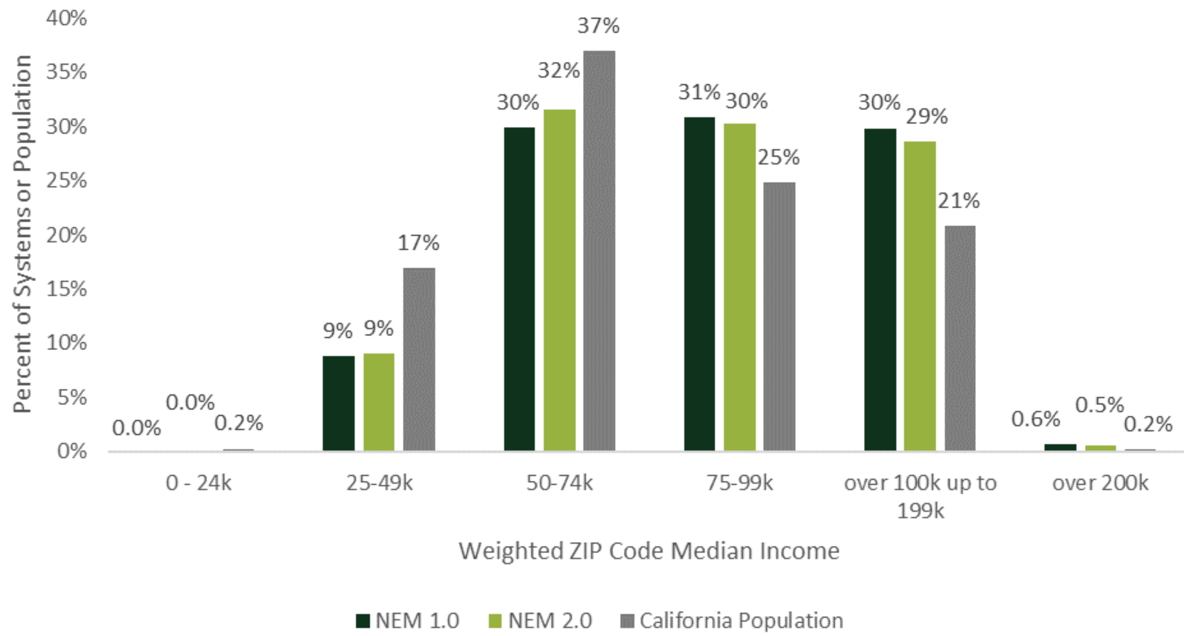


Figure 2. Distribution of NEM systems and California population by ZIP code median income.

Solar adoption in disadvantaged communities (DAC) is shown in Figure 3. DACs are defined as areas with the top 25 percent of scores from CalEnviroScreen 3.0 (as updated in 2018), along with other areas with high amounts of pollution and low populations as defined by SB 535. Eleven percent (NEM 1.0) to twelve percent (NEM 2.0) of residential NEM systems are installed in disadvantaged communities. This proportion of disadvantaged community designation is much lower than the state population of 25 percent.

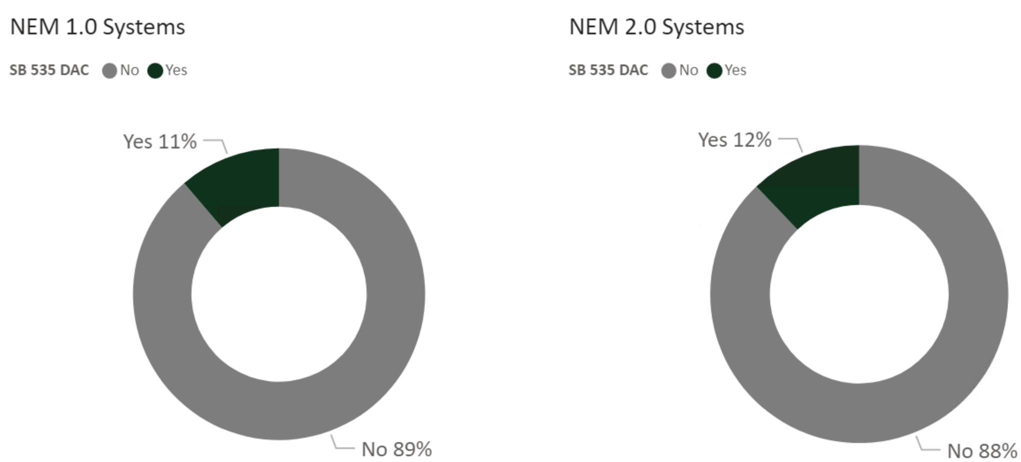


Figure 3. Residential NEM systems in disadvantaged communities.

## Cost-Effectiveness Methodology

In 2009, the CPUC adopted an evaluation framework and methodology for assessing cost-effectiveness of distributed generation (DG) technologies. The 2009 CPUC decision on DG cost-effectiveness provides guidance on the tests to be used, the costs and benefits to be included in each test, and the avoided cost inputs to be used when calculating program costs and benefits. This analysis considers the cost-effectiveness of NEM 2.0 systems using five distinct tests: The Participant Cost Test (PCT), Program Administrator (PA) test, Total Resource Cost (TRC) test, societal TRC test, and Ratepayer Impact Measure (RIM) test. Table 2 summarizes what constitutes a cost and benefit for each of the cost-effectiveness tests, excepting the STRC test.

Table 2. Standard practice manual test components.

<table>
<tr><th rowspan="2">Component</th><th colspan="2">Participant Cost Test (PCT)</th><th colspan="2">Program Administrator (PA) Test</th><th colspan="2">Total Resource Cost (TRC) Test</th><th colspan="2">Ratepayer Impact Measure (RIM) Test</th></tr>
<tr><th>Benefit</th><th>Cost</th><th>Benefit</th><th>Cost</th><th>Benefit</th><th>Cost</th><th>Benefit</th><th>Cost</th></tr>
<tr><td>Electricity Avoided Costs</td><td></td><td></td><td>X</td><td></td><td>X</td><td></td><td>X</td><td></td></tr>
<tr><td>Electric Bill Savings</td><td>X</td><td></td><td></td><td></td><td></td><td></td><td></td><td>X</td></tr>
<tr><td>State (SGIP) Rebate</td><td>X</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>REC Revenue</td><td>X</td><td></td><td></td><td></td><td>X</td><td></td><td></td><td></td></tr>
<tr><td>Equity Investment</td><td></td><td>X</td><td></td><td></td><td></td><td>X</td><td></td><td></td></tr>
<tr><td>Net Finance Costs</td><td></td><td>X</td><td></td><td></td><td></td><td>X</td><td></td><td></td></tr>
<tr><td>O&M Costs</td><td></td><td>X</td><td></td><td></td><td></td><td>X</td><td></td><td></td></tr>
<tr><td>Partial Equip. Replacement Cost</td><td></td><td>X</td><td></td><td></td><td></td><td>X</td><td></td><td></td></tr>
<tr><td>Insurance Costs</td><td></td><td>X</td><td></td><td></td><td></td><td>X</td><td></td><td></td></tr>
<tr><td>State Tax Refund / Paid</td><td colspan="2">X</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Federal Tax Refund / Paid</td><td colspan="2">X</td><td></td><td></td><td colspan="2">X</td><td></td><td></td></tr>
<tr><td>Investment Tax Credit[‡]</td><td>X</td><td></td><td></td><td></td><td>X</td><td></td><td></td><td></td></tr>
<tr><td>Utility NEM Costs</td><td></td><td></td><td></td><td>X</td><td></td><td>X</td><td></td><td>X</td></tr>
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While the Investment Tax Credit is listed as a benefit, it is modeled as a reduction in costs to be consistent with the Standard Practice Manual

Note that in Table 2, Federal and State taxes are listed as a potential benefit or cost. This is a nuance for commercial customers – capital acquisition costs result in a potential reduction in taxes paid. However, bill savings result in lower operating costs and consequently increased tax liability. The overall directionality of the tax refund/payment depends on the specifics of the customer and the technology.

## Cost of Service Methodology

To estimate the full cost of service, Verdant reviewed each utility's most recent Phase 2 general rate case (GRC) filings. While the final allocation of utility costs to customer rates is a negotiated process that abstracts to some degree from the public information available in the Phase 2 GRC filings, using the GRC filings provides a transparent approach to approximating components of the utility's full cost of service.

Not all components of the cost to serve a customer are presented within the Phase 2 GRC. The regulatory and transmission costs and the costs specific to NEM 2.0 customers' interconnection, billing, and incremental grid costs were not presented in the GRC Phase 2 filings. The regulatory and embedded transmission costs were derived from utility tariffs. The regulatory costs are items that are added to the customer bills but not developed as part of the GRC. Table 3 lists the marginal cost terms and sources that are included in the cost of service analysis.

Table 3. Cost of service components and sources.

| Cost of Service Component | PG&E | SCE | SDG&E |
|---|---|---|---|
| Marginal Energy Cost (MEC) | 2017 GRC | 2018 GRC | 2016 GRC |
| Marginal Generation Capacity Cost (MGCC) | 2017 GRC | 2018 GRC | 2016 GRC |
| Marginal Distribution Capacity Cost (MDCC) | 2017 GRC | 2018 GRC | 2016 GRC |
| Embedded Transmission (T) | Tariff Pass Through | Tariff Pass Through | Tariff Pass Through |
| Regulatory (Reg) | Tariff Pass Through | Tariff Pass Through | Tariff Pass Through |
| Marginal Customer Cost (MCC) | 2017 GRC | 2018 GRC | 2016 GRC |
| Net Energy Metering Costs (NEMC) | Advice Letter 5640-E dated 10/10/2019 | Advice Letter 4047-E dated 10/10/2019 and NEM Labor Costs | Advice Letter 3426-E dated 9/30/2019 |

Each utility's full cost of service development is unique. In general, the utility marginal costs were multiplied by the NEM account's costing determinants, including hourly energy usage, peak demand coincident with generation, transmission and distribution peaks, and their maximum demand. A stylized full cost of service formula is described below:

*Full COS = MEC · Load · EPMC(G) + MGCC · Generation Allocation Factor · Load · EPMC (G) + MDCC · Distribution Allocation Factor · Demand · EPMC(D) + (T + Reg) · Load + MCC · EPMC(D) + NEMC*

*Where:*

*Load = Hourly kWh observed by the utility.*

*EPMC = Equal percentage marginal costs are factors to scale the different marginal cost components to enable the utility to reach their revenue requirements. The MEC and the MGCC are* *multiplied by the EPMC for energy generation (G) while the MDCC and the MCC are multiplied by the EPMC for energy distribution (D). Multiplying the marginal cost components by the EPMC scales the marginal costs to the allocated cost of service.*

*Generation Allocation Factor = Generation allocation factors allocate the MGCC to hours where generation capacity needs are likely to be high. These factors were supplied by the utilities in response to data requests.*

*Distribution Allocation Factor = Creates a weighted load for different customer classes where generation capacity needs are likely to be high. These factors were supplied by the utilities in response to data requests.*

Comparison of the estimated full cost of service to the estimated utility bills provides information on a group's over or under payment relative to their costs to serve, but there are many reasons why the estimates of the cost of service and their utility bill estimates diverge. The GRC Phase 2 findings used for this study represent the GRC filings in effect during the NEM 2.0 lookback study time period. These filings, however, do not present the utility's cost of service differentiated by the customer's NEM 2.0 status. The cost of service estimate includes additional utility costs, not included in the GRC Phase 2 filings, associated with NEM 2.0 interconnection and distribution upgrades influenced by NEM 2.0 customers. It is likely, however, that the cost of service estimates developed for groups of NEM 2.0 customers differ from their utility bills due in part to incomplete information on NEM 2.0 specific costs, the regulated rate making process, and the heterogeneity of customer costs and bills that are difficult to reflect in modeling exercises. It is also true that the cost of service estimates and utility bills for NEM 2.0 customers in the year prior to their NEM 2.0 system installation may differ; likely for many of the same reasons as to why post-installation bill and cost of service estimates differ. Customer rates are a regulated process that can cause group-specific utility bills to differ from utility costs. Costs and rates are developed for large groups of customers; NEM 2.0 customers tend to have larger consumption than the average customer (See Table 1), which could cause their bills to diverge from their cost of service. When reviewing the findings from the cost of service analysis, it is important to recall that both the cost of service and the bills are estimates and that there are many reasons why these numbers may diverge for specific groups.

## NEM 2.0 Cost-Effectiveness Analysis Results

Table 4 on the following page summarizes the cost-effectiveness of NEM 2.0 technologies by utility and technology type. A benefit-cost ratio greater than or equal to 1.0 indicates that the technology is cost-effective based on the SPM test. Overall, our results show that the NEM 2.0 tariff is cost-effective to participants. However, NEM 2.0 projects overall are not cost-effective from the perspective of ratepayers.

**Total Resource Cost (TRC) Test.** The statewide NEM 2.0 population weighted average TRC benefit-cost ratio is 0.84 and the IOU-specific TRC ratios range from a low of 0.80 for PG&E to a high of 0.91 for SCE. At the aggregate utility level, we find that the NEM 2.0 tariff is not cost-effective based on the combined participant and utility perspective. The TRC benefit-cost ratio is consistently higher for solar PV systems when compared to solar PV + storage systems. This suggests that while energy storage systems can achieve higher avoided cost benefits, the incremental costs of energy storage are greater than the avoided cost benefits they currently provide. Future energy storage cost reductions would tend to improve the TRC for solar PV + storage systems.

Table 4. Summary of cost-effectiveness results by technology type and utility.

| Utility | Technology | Weighted Average Benefit-Cost Ratio | | | |
|---|---|---|---|---|---|
| | | PCT | TRC | RIM | PA |
| PG&E | Solar PV | 1.82 | 0.80 | 0.33 | 41.97 |
| | Solar PV + Storage | 1.52 | 0.74 | 0.38 | 28.52 |
| | Wind | 1.63 | 1.89 | 0.92 | 8,641 |
| | ***PG&E Total*** | ***1.81*** | ***0.80*** | ***0.33*** | ***41.08*** |
| SCE | Solar PV | 1.56 | 0.90 | 0.48 | 10.50 |
| | Solar PV + Storage | 1.39 | 0.95 | 0.56 | 17.63 |
| | Fuel Cells | 0.93 | 1.11 | 0.98 | 733.30 |
| | ***SCE Total*** | ***1.54*** | ***0.91*** | ***0.49*** | ***10.99*** |
| SDG&E | Solar PV | 2.09 | 0.85 | 0.31 | 119.18 |
| | Solar PV + Storage | 1.55 | 0.78 | 0.39 | 439.77 |
| | Fuel Cells | 1.84 | 1.05 | 0.38 | 49,009 |
| | ***SDG&E Total*** | ***2.03*** | ***0.84*** | ***0.31*** | ***129.59*** |

**Participant Cost Test (PCT).** The PCT is a measure of the quantifiable benefits and costs to the consumer due to participation in NEM 2.0. Participant test benefits include bill savings, state rebates (e.g., Self-Generation Incentive Program), and any tax refunds/credits that may apply. Participant costs are the capital, financing, and other expenditures associated with installing the NEM 2.0 system. The population weighted average participant benefit-cost ratio is 1.77, suggesting that the NEM 2.0 program is cost-effective for program participants. The participant test is primarily sensitive to the cost of the NEM system and the bill savings associated with operating the PV or PV + Storage system. The relationship between NEM system costs and the participant test benefit-cost ratio is intuitive – as the system cost increases the participant benefit-cost ratio decreases. Notably, the PCT benefit-cost ratio is consistently lower for solar PV + storage technologies when compared to standalone solar PV systems. This suggests that the incremental bill savings opportunities available with energy storage (e.g., charging during off-peak periods and discharging during on-peak periods) are less than the incremental cost of energy storage. The participant benefit-cost ratio is also highest for residential customers; this is likely due to residential customers being able to achieve larger bill reductions than nonresidential customers. Most nonresidential NEM 2.0 customer rates have large fixed charges, minimum bills, and demand charges which tend to lower the potential for bill savings with solar PV.

**Ratepayer Impact Measure (RIM) Test.** The RIM test measures what happens to short-term customer rates due to changes in utility operating revenues and costs caused by the NEM 2.0 program. The NEM 2.0 population weighted average RIM benefit-cost ratio is 0.37. Rates increase for non-participating and NEM 2.0 customers if revenues collected under NEM 2.0 implementation (i.e., utility avoided costs) are less than the total costs incurred by the utility in implementing NEM 2.0 (i.e., reduced bill payments and program implementation costs). A RIM benefit-cost ratio less than 1.0 indicates the NEM 2.0 program will result in an increase in rates for all customers and an increase in bills for non-participating customers. The RIM benefit-cost ratio tends to increase as the participant benefit-cost ratio decreases. Bill savings for the participant equate to reduced revenue for the utility. Notably, solar PV + storage systems achieve a lower participant benefit-cost ratio and a higher RIM benefit-cost ratio. Put differently, solar + storage systems provide greater ratepayer benefits but reduced benefits to the participant. Avoided costs are higher, but customer economic effects (after accounting for storage acquisition costs) are less favorable.

**Program Administrator (PA) Test.** The PA test measures the net costs of a program as a resource option based on the costs incurred by the PA (including incentive costs) and excluding any net costs incurred by the participants. The PA test can apply to utilities or to third parties that may administer a program. NEM 2.0 tariffs are implemented by the three large California electric IOUs. The benefits in the PA test are the avoided costs due to the operation of a NEM 2.0 system. The costs are the utility's costs to operate the NEM 2.0 program (e.g., distribution upgrades, telemetry, and incremental billing costs). PA benefit-cost ratios are high across the board, suggesting that the total avoided cost benefits greatly outweigh the utility NEM implementation costs. The PA test results are highly sensitive to the assumptions made about utility upfront costs and ongoing NEM costs. Utilities that report the lowest NEM operating costs, like SDG&E, have the highest PA benefit-cost ratios.

## Nonresidential NEM 2.0 Cost of Service Analysis Results

The full cost of service analysis compares an estimate of the utility cost of servicing a NEM 2.0 customer for one year to an estimate of the customer's first year bills. The cost of service analysis finds that prior to NEM 2.0 system installation, the average nonresidential NEM 2.0 customer pays more in their utility bills than the estimated cost for the utility to provide them service. Post-installation, the average nonresidential customer continues to pay more in their bill than the estimated utility cost of service.

Figure 4 shows the aggregate customer bills and cost of service estimates pre- and post-NEM installation for all nonresidential customers taking service under NEM 2.0. Prior to the installation of the NEM-eligible generator, nonresidential customers that take service under a NEM 2.0 eligible tariff are estimated to pay higher bills than the cost of their utility service by $288 million. After the installation of the NEM generator, NEM 2.0 nonresidential customers pay approximately $117.5 million more in utility bills than the estimated cost for the utilities to provide them service.

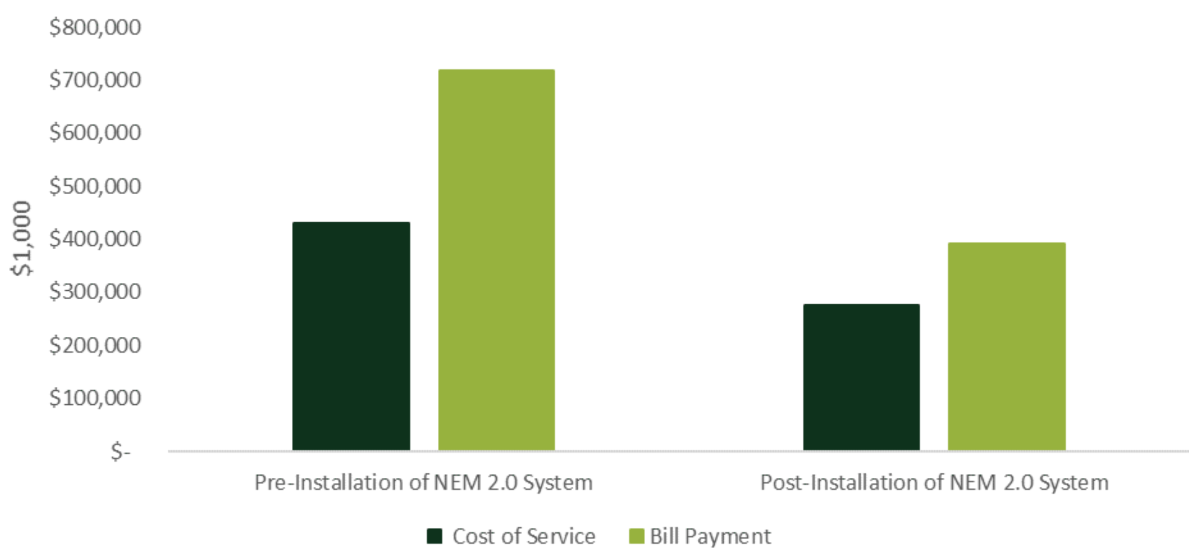


Figure 4. Nonresidential aggregate first year bill payment and cost of service pre- and post-NEM 2.0.

## Residential NEM 2.0 Cost of Service Analysis Results

Figure 5 illustrates the residential aggregate pre- and post-installation utility bill versus cost of service estimates. Prior to the installation of the NEM eligible generator, residential NEM 2.0 customers pay approximately $112.5 million more on their bills relative to the costs for the utilities to provide them service. Following the installation of the NEM generator, these same customers are estimated to pay approximately $618.6 million less on their bills relative to the utilities' cost to provide service.

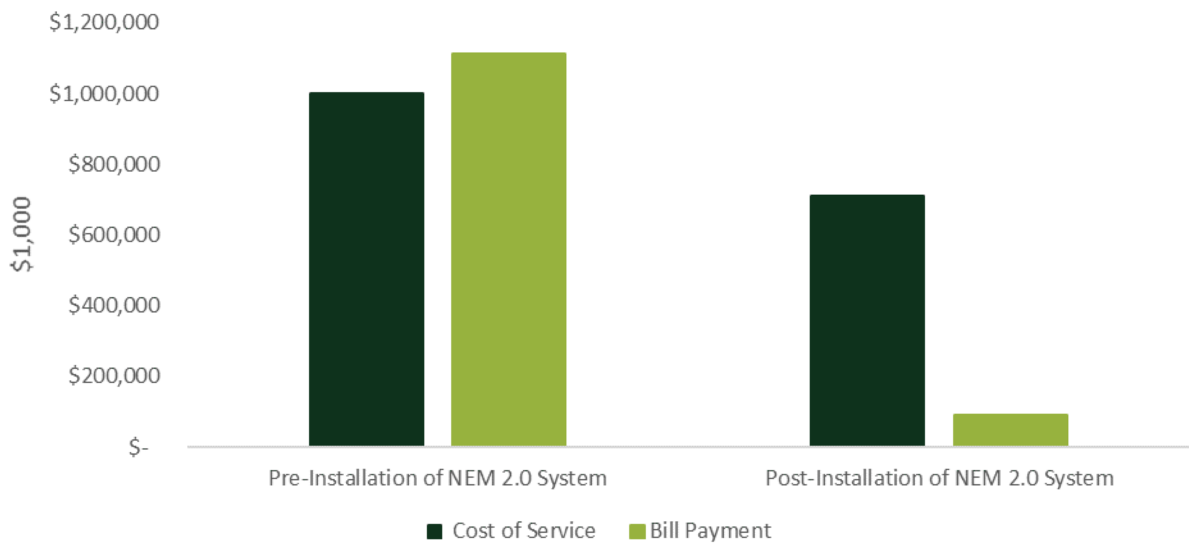


Figure 5. Residential aggregate first year bill payment and cost of service pre- and post-NEM 2.0.

## Key Takeaways

We conducted an evaluation that quantified the cost-effectiveness and cost of service impacts of customer-sited renewable resources subject to NEM 2.0 rules. We found that in general, the benefits to customers (primarily bill savings and the federal ITC) outweigh the costs. NEM 2.0 systems are not generally cost-effective from a combined participant/utility perspective, as illustrated by a TRC benefit-cost ratio that is less than 1. On average, customer-sited renewables taking service under a NEM 2.0 tariff have a RIM benefit-cost ratio less than 1, indicating that the NEM 2.0 program may result in an increase in rates for ratepayers.

The cost of service analysis points to a similar conclusion. For both residential and nonresidential customers, we estimate that the average bill payments prior to installing a NEM 2.0 system are higher than the cost of service. Residential customers that install customer-sited renewable resources on average pay lower bills than the utility's cost to serve them. On the other hand, nonresidential customers pay bills that are slightly higher than their cost of service after installing customer-sited renewable resources. This is largely due to nonresidential customer rates having demand charges (and other fixed fees), and the lower ratio of PV system size to customer load when compared to residential customers.

## References


CalEnviroScreen 3.0 | OEHHA. https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-30

California Assembly Bill 327, Perea. October 7, 2013. https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201320140AB327

California Assembly Bill 1755, Keeley, Olberg, and Takasugi. February 4, 1998. http://www.leginfo.ca.gov/pub/97-98/bill/asm/ab_1751-1800/ab_1755_bill_19980925_chaptered.html

California Senate Bill 1, Murray. August 21, 2006. https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=200520060SB1

California Senate Bill 656, Alquist. February 22, 1995. http://www.leginfo.ca.gov/pub/95-96/bill/sen/sb_0651-0700/sb_656_bill_950804_chaptered.html

California Standard Practice Manual: Economic Analysis of Demand-Side Programs and Projects, October 2001. https://www.cpuc.ca.gov/-/media/cpuc-website/files/uploadedfiles/cpuc_public_website/content/utilities_and_industries/energy_-_electricity_and_natural_gas/cpuc-standard-practice-manual.pdf

CPUC Decision Adopting Cost-Effectiveness Analysis Framework Policies for All Distributed Energy Resources. May 21, 2019. http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M293/K833/293833387.PDF