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Project Title:	2022 Energy Code Photovoltaic and Battery Storage Cost Effectiveness Determinations
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Document Title:	Staff Review and Analysis of Monte Vista Apartment Project's Photovoltaic Determination
Description:	The CEC staff report recommends exempting the Monte Vista Apartments Project from the 2019 Energy Code's photovoltaic (PV) requirements due to unique local conditions that make compliance not cost-effective. Specifically, the Turlock Irrigation District's prohibition of Virtual Net Energy Metering (VNEM) and the City of Turlock's requirement for individual PV disconnects for each unit significantly increase system complexity and installation costs. Staff found that these factors raise the PV system's first cost to $4.93 per watt—well above benchmark levels—and that a life cycle cost analysis showed no cost-effective outcome for any of the project's buildings. Based on this analysis, staff concluded that the PV requirements should not apply to this 348-unit low-rise multifamily development.
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CALIFORNIA ENERGY COMMISSION

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California Energy Commission

STAFF REPORT

Staff Review and Analysis of Monte Vista Apartments Project Application for a Photovoltaic Cost-Effectiveness Determination

November 2025 | CEC-400-2025-016

California Energy Commission

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ABSTRACT

The California Energy Commission's (CEC) 2019 Energy Code went into effect January 1, 2020. The 2019 Energy Code requires the installation of photovoltaic (PV) systems on newly constructed single family and low-rise multifamily buildings. In conjunction with those requirements, Section 10-109(k) of the 2019 Energy Code states, "The Commission may … determine that the photovoltaic requirements in Section 150.1(c)14 shall not apply, if the Commission finds that the implementation of public agency rules regarding utility system costs and revenue requirements, compensation for customer-owned generation, or interconnection fees, causes the Commission's cost-effectiveness conclusions, made pursuant to Public Resources Code 25402(b)(3), to not hold for particular buildings."

Pacific West Communities, Inc., submitted an application on September 2, 2025, to the CEC requesting a determination that the 2019 Energy Code PV system requirements should not apply to the Monte Vista Apartments Project, a 348-unit low-rise multifamily development in Turlock (Stanislaus County). Staff performed a cost-effectiveness analysis based on the public agency rules adopted by the Turlock Irrigation District (TID). The analysis used PV system costs estimated in bids from electrical and solar contractors to install the PV system designs that Pacific West Communities, Inc., developed to comply with TID and City of Turlock regulations. Based on that information, staff finds that the photovoltaic system requirements are not cost-effective for the newly constructed 348-unit low-rise multifamily Monte Vista Apartments Project, located within the TID's service territory. Staff recommend that the CEC determine that the 2019 Energy Code photovoltaic system requirements do not apply to the newly constructed low-rise multifamily buildings of the Monte Vista Apartments Project.

Keywords: Photovoltaic, solar, PV, requirement, low-rise, multifamily, apartment, 10-109(k), determination, Building Energy Efficiency Standards, Energy Code, 2019, cost-effectiveness, Turlock, Turlock Irrigation District, TID

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Key Takeaways

- Pacific West Communities, Inc., requested a CEC determination that the 2019 Energy Code PV requirements not apply to the Monte Vista Apartments Project because of local utility and safety rules that significantly increase installation costs. Turlock Irrigation District prohibits Virtual Net Energy Metering, and the City of Turlock requires separate PV disconnects for each unit, resulting in complex wiring and higher labor costs.
- CEC staff found that these conditions raise PV first costs to $4.93/W, well above benchmark levels. A life cycle cost analysis showed that PV systems are not cost-effective for any of the project's buildings. Staff recommends the CEC determine that the PV requirements do not apply to this project.

Background

On May 9, 2018, the California Energy Commission (CEC) adopted the *2019 Building Energy Efficiency Standards* (California Code of Regulations, Title 24, Part 1, Chapter 10 and Part 6; 2019 Energy Code), which include new photovoltaic (PV) system requirements for all newly constructed low-rise residential buildings, including multifamily buildings. These requirements, along with the rest of the 2019 Energy Code, went into effect January 1, 2020.

In conjunction with those requirements, California Code of Regulations, Title 24, Part 1, Chapter 10, Section 10-109(k), states,

> "The Commission may, upon written application or its own motion, determine that the photovoltaic requirements in Section 150.1(c)14 shall not apply, if the Commission finds that the implementation of public agency rules regarding utility system costs and revenue requirements, compensation for customer-owned generation, or interconnection fees, causes the Commission's cost effectiveness conclusions made pursuant to Public Resources Code 25402(b)3, to not hold for particular buildings."

The regulations require that an applicant must provide full information regarding the differences between the public agency rules specified in Section 10-109(k) and the cost-effectiveness determinations that the CEC made in adopting the PV requirements for the 2019 Energy Code, including supplementary information requested by the CEC to enable a full review of the application.

Pursuant to Section 10-110 of the Energy Code, after receiving an application and determining that it is complete, the Executive Director must make the application package available to interested parties during a public comment period. The executive director may request additional information to evaluate the application. The Executive Director must submit a written recommendation on the application and place the application package, any additional information considered, and the recommendation on the business meeting calendar for the full CEC to consider.

Pacific West Communities, Inc., submitted an application to the CEC on September 2, 2025, requesting a determination, as specified under Section 10-109(k), that the PV system requirements should not apply to the Monte Vista Apartments Project, a 348-unit low-rise multifamily development at 1525 W Monte Vista Ave., Turlock (Stanislaus County). The

application was released for public comment on September 12, 2025. (See California Energy Commission Docket Number 22-BSTD-04.) The documents that Pacific West Communities, Inc., submitted with its application, are listed in Table 1. One comment was received on the docket on October 13, 2025, from the California Solar and Storage Association (CALSSA). On October 23, 2025, Pacific West Communities, Inc. responded to CALSSA's comment.

The application stated and provided documentation that the 2019 Energy Code applies to the project, and that the Turlock Irrigation District (TID) does not allow virtual net energy metering (VNEM). VNEM is an energy billing mechanism that allows the electricity generation from a single solar energy system—typically installed on the roof of a multifamily building—to be shared among multiple dwelling units, crediting each tenant's utility bill based on their share of the solar output. The inability to utilize VNEM necessitates the installation of separate photovoltaic (PV) systems for each dwelling unit. This configuration, in turn, triggers additional safety requirements imposed by the City of Turlock Building and Safety Division and Fire Inspector (City of Turlock) — such as extensive alternating current (AC) wiring to the main service meter — substantially increasing installation and interconnection costs. Specifically, the application states that in the absence of VNEM, the PV system for each unit must be connected through extensive AC wiring to the main service metering switchgear at ground level with a NEM PV meter for each dwelling unit. Further, the City of Turlock requires a readily accessible PV disconnect for each dwelling unit, located on the wall near the main service meter, to ensure first responder access in compliance with the California Electrical Code (Title 24, Part 3, Article 690).

CEC staff has confirmed the public agency rules adopted by TID and the electrical requirements established by the City of Turlock Building and Safety Division/Fire Inspector. Staff performed a cost-effectiveness analysis using PV system costs from contractor bids to install designs developed by Pacific West Communities, Inc., in compliance with rules adopted by TID, and electrical requirements of the City of Turlock Building and Safety Division/Fire Inspector.

Staff concludes that the design of the PV system for the buildings resulting from the inability to use virtual net metering, combined with the City of Turlock Building and Safety Division/Fire Inspector electrical system requirements, results in high bids from contractors that cause the CEC's cost-effectiveness conclusion for PV systems specified by Section 150.1(c)14 to not hold for the Monte Vista Apartments Project. Staff recommends that the CEC determine that the 2019 Energy Code photovoltaic system requirements shall not apply to the newly constructed low-rise multifamily buildings in the Monte Vista Apartments Project.

CHAPTER 1: Background

2019 Energy Code Photovoltaic Requirements

Photovoltaic (PV) system requirements were first adopted in the 2019 Energy Code for low-rise residential buildings.[1] Section 150.1(c)14 of the 2019 Energy Code prescribes the minimum PV system size (kilowatts [kW]) based on the conditioned floor area and the number of dwelling units in a multifamily building. Exceptions to the PV requirement were provided under Section 150.1(c)14, based on the amount of solar roof access available and the smallest cost-effective PV size. California Energy Commission (CEC) staff performed a cost-effectiveness analysis[2] to establish the required PV size for low-rise residential buildings. This cost-effectiveness analysis used cost estimates from the 2016 U.S. Solar Photovoltaic System Cost Benchmark report, published by the National Renewable Energy Laboratory.[3]

Chapter 10 of the California Code of Regulations, Title 24, Part 1, contains the administrative regulations related to the 2019 Energy Code regulations. Section 10-109(k) states that the CEC "may, upon written application or its own motion, determine that the photovoltaic requirements in Section 150.1(c)14 shall not apply, if the Commission finds that the implementation of public agency rules regarding utility system costs and revenue requirements, compensation for customer-owned generation, or interconnection fees, causes the Commission's cost-effectiveness conclusions, made pursuant to Public Resources Code 25402(b)(3), to not hold for particular buildings."

The procedure to apply for a determination is also specified: "Applications shall include full information regarding the differences between public agency rules and Energy Commission cost-effectiveness determinations, including all information requested by the Commission to enable full review of the application. Applications shall also include specific recommended limitations to the scope of the determination that is requested, and specific eligibility criteria to determine what buildings would qualify for the determination."

Monte Vista Apartments Project Application

On September 2, 2025, Pacific West Communities, Inc., submitted an application to the CEC requesting a determination, as specified under Section 10-109(k), that the PV system requirements should not apply to the Monte Vista Apartments Project, a 348-unit low-rise multifamily project located at 1525 W. Monte Vista Avenue, Turlock (Stanislaus County), California. The project plans note that it was permitted under the 2019 Energy Code. This Staff

1 California Energy Commission. December 2018. *2019 Building Energy Efficiency Standards for Residential and Nonresidential Buildings*. https://www.energy.ca.gov/sites/default/files/2021-06/CEC-400-2018-020-CMF_0.pdf

2 Energy and Environmental Economics, Inc. September 2017. *Building Energy Efficiency Measure Proposal to the California Energy Commission for the 2019 Update to the Title 24 Building Energy Efficiency Standards for Rooftop Solar PV Systems*. https://efiling.energy.ca.gov/getdocument.aspx?tn=221366

3 National Renewable Energy Laboratory. 2016. *U.S. Solar Photovoltaic System Cost Benchmark: Q1 2016*. http://www.nrel.gov/docs/fy16osti/67142.pdf .

Report describes the analysis performed to determine whether the CEC's cost-effectiveness conclusions in the 2019 Energy Code do not hold for the Monte Vista Apartments Project.

The Pacific West Communities, Inc., application stated and provided documentation that the Turlock Irrigation District (TID) does not allow virtual net energy metering (VNEM). VNEM is a billing arrangement that allows a single solar energy system—typically installed on the roof of a multifamily building—to share the electricity it generates among multiple units, crediting each tenant's utility bill based on their share of the solar output. The inability to utilize Virtual Net Energy Metering (VNEM) necessitates the installation of separate photovoltaic (PV) systems for each dwelling unit. This configuration, in turn, triggers additional safety requirements imposed by the City of Turlock Building and Safety Division and Fire Inspector—such as individual PV disconnects and extensive AC wiring to the main service meter—substantially increasing installation and interconnection costs. Specifically, the application states that in the absence of VNEM, the PV system for each unit must be connected through extensive AC wiring to the main service metering switchgear at ground level with a NEM PV meter for each dwelling unit. Further, the City of Turlock requires a readily accessible PV disconnect for each dwelling unit, located on the wall near the main service meter, to ensure first responder access in compliance with the California Electrical Code (Title 24, Part 3, Article 690). The combination of TID's public agency rules of not allowing VNEM with the City of Turlock Building and Safety Division/Fire Inspector safety regulations cause construction costs and interconnection fees for the Monte Vista Apartments Project to be substantially higher than they would be otherwise, resulting in the PV system for the project to not be cost-effective.

Table 1 provides a summary of documents submitted by Pacific West Communities, Inc. as part of their application. The rest of this report documents the staff analysis performed using the information provided in the application.

Table 1: Pacific West Communities, Inc., Application Documents

#	Document Name	Description
1	The Monte Vista Apartments Project_10-109(k) complete application[4]	Request for determination that CEC's 2019 Energy Code cost-effectiveness conclusions for PV requirements do not hold and should not apply to the Monte Vista Apartments Project buildings.
2	Exhibit A_Discussion and details of project cost analysis and cost drivers	PV rooftop installation cost breakdown and analysis for the Monte Vista Apartments Project.
3	Exhibit B_Bid summary sheet with NREL lifetime incremental maintenance costs	Summary of the Monte Vista Apartments Project PV installation bids with incremental maintenance cost adders. The applicant did not include Exhibit B in the application or include maintenance costs in the project cost estimates. Exhibit B is available upon request.
4	Exhibit C_PV bids, including electrical, monitoring and fire safety	PV installation bids from three contractors detailing the costs to complete the project.
5	Exhibit D_Project spreadsheet with cost category breakdown for the Monte Vista Apartments Project	The Monte Vista Apartments Project PV cost spreadsheet comparing the three bids with costs used in the CEC's cost-effectiveness analysis of the 2019 Energy Code PV requirements.
6	Exhibit E_Email from Turlock Irrigation District — VNEM not permitted	Email from TID indicating VNEM is not available for central PV systems to serve entire buildings and each apartment shall have its own separate PV system.
7	Exhibit F_Email from City of Turlock Building and Safety Division Requiring Separate PV Disconnect at Ground Level	Email from City of Turlock indicating the requirement of PV disconnect for each separate PV system installed on the buildings.
8	Exhibit G_Email from Turlock Irrigation District with supporting information	Additional information about PV system interconnection requirements.
9	Exhibit I_Turlock Irrigation District – Schedule DG Tariff Rate and Net Generation Compensation at Short Run Marginal Cost Daily Averages provided for net generation (exports) compensation	Tariff structure of Turlock Irrigation District (TID) for solar customers and short run marginal costs that TID provides for compensation for net generation (exports), effective January 1, 2025. See TID Self-Generation Rates web page for more information at https://www.tid.org/customer-service/rates-rules/self-generation-rates/#advgb-tabs-tab0
10	Exhibit J_The Monte Vista Apartments Project Title 24 CF1R – Title 24 PV Requirements for buildings A, B, C and D	2019 Energy Code CF-1R compliance forms for each building type of the project.
11	Exhibit K_The Monte Vista Apartments Project ECON1 Forms	Monthly energy use and peak demand calculated by Energy Pro for each building type of the project.

Note: Exhibit H is reserved by the applicant.

Source: CEC staff

4 Pacific West Communities, Inc. September 2026. *Request for a Multifamily Photovoltaic Exemption Determination for Turlock Monte Vista Apartments (10-109[k])*, https://efiling.energy.ca.gov/GetDocument.aspx?tn=265998&DocumentContentId=103011 .

CHAPTER 2:
Staff Analysis

CEC staff performed the following analyses to evaluate the cost-effectiveness of the 2019 Energy Code PV requirements as applicable to the Monte Vista Apartments Project:

1. Reviewed the public agency rules adopted by TID and the electrical requirements established by the City of Turlock Building and Safety Division/Fire Inspector.
2. Reviewed contractor bids submitted to Pacific West Communities, Inc., for installing the PV system on the project buildings. The review and findings are discussed in the next section.
3. Reviewed public comments submitted to Docket number 22-BSTD-04 regarding the application. One comment was submitted by the California Solar and Storage Association (CALSSA) on October 13, 2025, and a response to that comment was submitted by Pacific West Communities, Inc. on October 23, 2025
4. Analyzed whether PV systems required by the 2019 Energy Code are cost-effective based on implementation of public agency rules regarding utility system costs and revenue requirements, compensation for customer-owned generation, or interconnection fees uniquely applicable to buildings in the Monte Vista Apartments Project.

Review of Public Agency Rules Adopted by TID and Electrical Requirements Established by the City of Turlock Building and Safety Division/Fire Inspector

Staff reviewed Exhibits E, F, G, and I, which document the public agency rules adopted by TID, and the PV and electrical system regulations established by the City of Turlock Building and Safety Division/Fire Inspector that apply to the Monte Vista Apartments Project.

Staff confirmed that for multifamily buildings in the City of Turlock served by TID:

- VNEM is not available from TID for central PV systems to serve entire buildings, and as a result, each apartment shall have its own separate PV system.
- The City of Turlock Building and Safety Division/Fire Inspector requires a separate PV disconnect for each separate PV system installed on a multifamily building.
- The City of Turlock Building and Safety Division/Fire Inspector also requires that each PV system for each unit must be connected through extensive AC wiring to the main service metering switchgear at ground level with a NEM PV meter for each dwelling unit and with separate disconnects at that same location.

Review of Public Comments

In response to Pacific West Communities, Inc.'s, application, CALSSA submitted a comment to Docket Number 22-BSTD-04 on October 13, 2025, recommending that the CEC consider the potential applicability of the federal Investment Tax Credit (ITC, IRS Code Section 48E) to the

Monte Vista Apartments Project.[5] CALSSA stated that this tax credit can potentially be applied to PV installations on multifamily buildings as long as the owner of the system is a commercial taxpayer, in order to reduce the system cost to the building owner. The comment also included information regarding when construction must begin or end or both for projects to be eligible for the tax credit.

Pacific West Communities, Inc. responded to the CALSSA comment on the docket on October 23, 2025[6]. They explained that they did not include the federal Investment Tax Credit (ITC) in their feasibility assessment for the project for two reasons:

- PV system construction "physical work" will not start before the end of 2025 or July 4, 2026, which CALSSA indicated would be required to satisfy the 5% safe harbor test and avoid Foreign Entity of Concern component restrictions.
- The project has no direct tax credit purchaser or investor currently involved and is not expected to generate sufficient taxable income within the project entity to utilize the credits.

Given the issues associated with claiming and monetizing the ITC, staff understands the applicant's decision not to consider it for this project. Staff did not include the ITC when determining the cost effectiveness of the PV requirements for the 2019 Energy Code cost-effectiveness analysis. Therefore, staff does not consider the ITC when analyzing this 10-109(k) application for determination of cost effectiveness for this project.

Review of PV Installation Cost Bids

The Monte Vista Apartments Project is a low-rise multifamily residential community consisting of 13 buildings at 1525 W. Monte Vista Avenue, Turlock (Stanislaus County). The project includes 12 tenant-occupied buildings and 1 community building. The project has a total of 348 residential dwelling units. The twelve residential buildings have a mix of configurations: two 24-unit buildings (Type A), five 30-unit buildings (Type B), one 30-unit building (Type C), three 30-unit buildings (Type D), and one 30-unit building (Type E). This application pertains specifically to the 12 tenant-occupied buildings. Figure 1 shows the site plan, and Table 2 provides the number of dwelling units and floor area of each building in the complex. The apartment community is served by the Turlock Irrigation District (TID), and the building permitting agency is the City of Turlock Building and Safety Division.

5 Yung, Dara. October 13, 2025. CALSSA Comments on Monte Vista Apartments PV Cost Effectiveness & ITC Eligibility. https://efiling.energy.ca.gov/GetDocument.aspx?tn=266526&DocumentContentId=103456 .

6 Pacific West Communities, Inc. October 23, 2025. *Addendum 1: Regarding Federal Investment Tax Credits.* https://efiling.energy.ca.gov/GetDocument.aspx?tn=266798&DocumentContentId=103887

Table 2: Number of Dwelling Units and Building Floor Area Summary, by Building Type

Building Type	No. of Units	Building Floor Areas, ft^2
A	24	19,152
B	30	25,968
C	30	26,820
D	30	95,706
E	30	31,902

Source: Pacific West Communities, Inc.

Pacific West Communities, Inc., submitted an informal inquiry in June 2025, presenting construction cost concerns and a breakdown of bid costs associated with the Monte Vista Apartments Project. The inquiry included three turnkey PV system installation bids from PV system subcontractors, supporting correspondence from the City of Turlock and the Turlock Irrigation District (TID), 2019 Energy Code Title 24 CF-1R sheets, and ECON1 forms. In response to a request from CEC staff, Pacific West Communities, Inc., submitted a formal application on September 2, 2025.

The bids provided in the formal application for the total cost of installing the PV system on the Monte Vista Apartments Project buildings were significantly higher than the U.S. Solar Photovoltaic System Cost Benchmark: Q1 2016, published by National Renewable Energy Laboratory (NREL) and used in the 2019 Energy Code cost-effectiveness analysis[7]. The applicant provided comparison costs to the more recent Q1 2022 U.S. Solar Photovoltaic System and Energy Storage Cost Benchmarks, published by the National Renewable Energy Laboratory in 2022.[8] Staff notes that the 2019 Energy Code cost-effectiveness analysis adjusted the national average labor rates used by NREL to reflect California labor rates and prevailing wage requirements. The 2022 NREL benchmark costs shared by Pacific West Communities, Inc. did not include the adjustment to reflect California labor rates that were made for the 2019 Energy Code cost effectiveness analysis. The applicant identified the following key reasons for the elevated bids:

1. TID prohibits virtual net energy metering (VNEM) and does not allow PV systems to back feed more energy through a meter than is consumed behind that meter.
2. Due to the VNEM prohibition and City of Turlock additional safety regulations required because of the VNEM prohibition, each unit requires a separate rooftop PV system with AC wiring routed to a ground-level PV disconnect and meter at the main service switchgear, then back to the unit's subpanel—resulting in extensive wiring and labor.
3. The 2019 Energy Code cost-effectiveness analysis was based on a single-family building PV installation. Three-story, flat-roof multifamily construction involves more complex and labor-intensive installation than single-family homes, including long conduit runs.
4. The thermoplastic polyolefin (TPO) roofing system commonly used in multifamily construction to allow roof installation of heating, ventilation and air conditioning

[7] National Renewable Energy Laboratory. 2016. "U.S. Solar Photovoltaic System Cost Benchmark: Q1 2016." http://www.nrel.gov/docs/fy16osti/67142.pdf. Accessed March 1, 2017

8 National Renewables Energy Laboratory. September 2022. *U.S. Solar Photovoltaic System and Energy Storage Cost Benchmarks, Q1 2022*, https://www.nrel.gov/docs/fy22osti/83586.pdf .

systems requires custom sealing of all penetrations, installation of walk pads, and coordination with the roofing subcontractor to maintain the roof warranty, adding to labor and material costs.

5. The small system size per dwelling unit (roughly 2.39 kW) results in a higher cost per watt compared to the larger systems modeled in the NREL cost-effectiveness analysis, which considered 5.6 kW or 7.9 kW systems.

At the CEC's request, the applicant provided a detailed cost breakdown covering the same categories as the NREL benchmark. The analysis focused on the Cal Solar bid, which had the lowest turnkey cost of $4.93/Watt (excluding federal tax credits). The NREL breakdown included:

1. System hardware.
    - PV modules.
    - Microinverters.
    - Structural and electrical balance of system.
    - Sales tax.
2. Installation labor, permitting, inspection, interconnection, and overhead.
    - Rough-in and waterproofing labor.
    - Monitoring systems and cellular plans.
    - Blocking and racking.
    - General overhead, sales and marketing, and profit.
3. Lifetime incremental maintenance costs
    - Microinverter replacement and operations and maintenance (O&M) costs (not discounted for future years).

Table **3** shows a summary of the cost breakdown of the Cal Solar bid. The cost analysis referenced in the NREL documents shows a more detailed description of the items within the bid categories. Table 3 compares the total price/watt ($/W) compared to the total NREL estimate in $/W.

Table 3: PV System Installation First Cost Breakdown Comparison

Cost Breakdown	Cal Solar ($/W)	NREL 2022 ($/W)
Base Bid Material (System Hardware)	$2.03	
Base Bid Labor + Design	$0.84	
Permit Fees	$0.17	
Utility Fees	$0.19	
Rough-in Labor	$0.18	
Rough-in Material	$0.44	
Monitoring (Labor + Material)	$0.82	
Blocking (Labor + Material)	$0.28	
Total	**$4.93**	**$3.82**
PV Size (kW_{dc})	834 (2.4 per system)	7.9

Source: Pacific West Communities, Inc.; National Renewables Energy Laboratory. September 2022, *U.S. Solar Photovoltaic System and Energy Storage Cost Benchmarks, Q1 2022,* https://www.nrel.gov/docs/fy22osti/83586.pdf

Staff reviewed the PV system installation cost breakdown and noted the following items. PV installation costs for the Monte Vista Apartments Project buildings are higher than NREL's estimate. The primary factors driving the higher costs are:

a. Extra AC wiring and associated labor costs because every dwelling unit is required to have its own PV system, which must be separately wired to both a disconnect and meter at the ground-level location of the main service metering switchgear, as well as a NEM PV meter at each dwelling unit. (These requirements are necessary because VNEM is not available, and thus unique electrical system requirements are required by City of Turlock regulations.)

b. Permit and utility fees, which include Turlock Building and Safety Department fees and TID interconnection fees, are higher than NREL estimates.

Staff evaluated these factors to determine whether local rules are the basis for the project's lack of cost effectiveness. Staff reviewed the other differences between the Monte Vista Apartments Project bids and the NREL report and the added costs of choices related to the roof design, and concluded these other costs do not have a substantive impact on the cost-effectiveness determination.

Staff picked information from the lowest bid, shown in Table 4. The "total" rows show the final costs after including the following items to all contractor bids:

1. Roof penetration sealing costs, which were obtained from a specialized roofing subcontractor
2. Building department and interconnection fees
3. O&M and inverter replacement costs (from NREL)[9]

The lowest bid of the three bids received was from Cal Solar.

9 Ibid.

Table 4: PV System Installation Bids Summary

Cost Breakdown	Cal Solar	Tenco Solar	Citadel Roofing and Solar
PV System Cost - as bid	$4,114,883	$6,145,560	$4,257,363
System Size (kW_{dc})	834.33	845.64	840.84
Cost per W_{dc}– as bid	$4.93	$7.27	$5.06

Source: CEC staff

The ITC was not included in the applicant's total bid costs.[10]

Life-Cycle Cost Analysis

Approach

The CEC uses a standardized approach for evaluating the cost-effectiveness of Energy Code measures, comparing the life-cycle benefits to the life-cycle costs (LCC). This approach has been documented in the analysis performed to establish the PV requirements in the 2019 Energy Code for low-rise residential buildings, which apply to the Monte Vista Apartments Project buildings. Staff used the same LCC analysis approach to evaluate this application.

The LCC analysis compares the net present value of energy cost savings (the benefits) to the net present value of the first cost and operations and maintenance costs associated with a measure (the costs) over a 30 year period. The PV system is considered cost-effective when the present value of benefits is greater than the present value of costs, resulting in a benefit-to-cost-ratio that is greater than one.

The cost-effectiveness of a PV system for each apartment type in Table 5 was evaluated because under the non-VNEM rules of the Turlock Irrigation District, each apartment unit receives its own energy bill based on the respective energy consumption and generation of the respective PV system. The consumption of the building is of no consequence to the energy bill of individual apartment units. Staff modeled each apartment type using the 2019 California Building Energy Code Compliance software for residential buildings (CBECC-Res), evaluated the 30-year benefits as explained in the next sections, and summed the benefits for each building type. The 30-year net present value cost for each apartment type's PV system was also evaluated.

Inputs

The LCC analysis required several inputs that are described below:

1. Period of analysis: The period of analysis was set to 30 years, as is the standard practice for all Energy Code measure evaluations.

10 Pacific West Communities Inc. September 2025. *Request for a Multifamily Photovoltaic Exemption Determination for Turlock Monte Vista Apartments Project. Application*, Exhibit D. Page 37. https://efiling.energy.ca.gov/GetDocument.aspx?tn=265998&DocumentContentId=103011 .

2. Turlock Irrigation District Electric Utility rates: The latest residential tariffs were obtained from the TID website for the analysis. The Schedule DE Domestic Service rates[11] apply to nonsolar customers (Table 6). The Schedule DG Domestic Self-Generation Service rates[12] apply to solar generation customers (Table 7). The demand charges and energy charge tiers apply to net energy consumption (monthly energy import) and net demand in the peak hour in months when energy consumption or demand exceeds generation. If there are months where the generation in the month would exceed the energy consumption in that month, TID would provide compensation based on the short run marginal cost.[13] TID establishes the short-run marginal cost on a daily basis. The daily short-run marginal costs for on-peak and off-peak periods are defined in Schedule DG. TID posted the Schedule DE and DG rates for 2025, 2026 and 2027, and staff calculated the annual PV cost savings for these years separately.
3. Energy escalation rate: An energy escalation rate of 2.7 percent was used for 2028 onward, as is the standard practice for Section 10-109(k) Energy Code measure evaluation for future years for which the load-serving entity has not established utility rates.
4. Discount rate: A discount rate of 3.0 percent was used, as is the standard practice for Energy Code measure evaluations.
5. Incremental first cost: The incremental first cost of the PV system was based on the lowest cost bid (Cal Solar) of $4.93/W, as shown in Table 4.
6. Table 14 shows the PV sizes calculated by the CBECC-Res compliance software for the standard design for each apartment type and summed for each building type.
7. Energy models: Upon staff request, the applicant provided the 2019 Energy Code compliance model files for each of the building types, which were used to perform the energy modeling and determine the electricity consumption and savings (kWh) resulting from installation of the PV system. The compliance software calculates the electricity hourly import energy in each hour by subtracting the electricity generated by the PV system from the building energy consumption in each hour. The compliance software also calculates the electricity hourly export energy by subtracting the building energy consumption from the electricity generated by the PV system in that hour. Staff's analysis subtracted the total hourly imports and total hourly exports in each month to determine the monthly import and monthly export energy to calculate the energy cost savings using the TID rates.

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11 Turlock Irrigation District Electric Utility. *Summary of Residential Electric Rates. Schedule DE Domestic Service*, https://www.tid.org/wp-content/uploads/2024/10/DE-Rate-Tariff-Effective-2025.pdf .

12 Turlock Irrigation District Electric Utility. *Summary of Self-Generation Rates. Schedule DG Domestic Self-Generation*, https://www.tid.org/wp-content/uploads/2024/10/DG-Rate-Tariff-Effective-2025.pdf .

13 Turlock Irrigation District Electric Utility. *Short Run Marginal Cost,* https://www.tid.org/wp-content/uploads/uploads/TIDSRMCDailyAvg.pdf .

Table 6: TID Residential (Non-Solar) Electric Rate

	Year 2025	Year 2026	Year 2027
Customer Charge per month	$22	$26	$30
Energy Charge Winter 0–700 kWh, per kWh	$0.1289	$0.1338	$0.1338
Energy Charge Winter Over 700 kWh, per kWh	$0.1461	$0.1470	$0.1525
Energy Charge Summer 0-700 kWh, per kWh	$0.1358	$0.1410	$0.1463
Energy Charge Summer 700–1100 kWh, per kWh	$0.1656	$0.1719	$0.1783
Energy Charge Summer Over 1100 kWh, per kWh	$0.1822	$0.1891	$0.1962

Source: CEC staff

Table 7: TID Residential Self Generation (Solar) Electric Rate

	Year 2025	Year 2026	Year 2027
Customer Charge per month	$22	$26	$30
Demand Charge Winter, per kW	$2.55	$3.4	$4.25
Demand Charge Summer, per kW	$3.00	$4.00	$5.00
Energy Charge Winter On-peak, per kWh	$0.1198	$0.0994	$0.0835
Energy Charge Winter Off-peak, per kWh	$0.0749	$0.0622	$0.0522
Energy Charge Summer On-peak, per kWh	$0.1559	$0.1294	$0.1087
Energy Charge Summer Off-peak, per kWh	$0.1122	$0.0931	$0.0782

Source: CEC staff

Results

The method used to evaluate cost-effectiveness — including assumptions, inputs, and calculations — was applied consistently across all apartment types (1, 2, 2AS, 2B, 2BS, 2C, 3 and 3S).

To maintain brevity and clarity in this staff report, the detailed analytical process is presented only for Apartment Type 1, with specific results for other apartment types summarized in the tables provided:

1. The first step was to use the 2019 CBECC-Res Building models, separating the total building model into models for individual apartment types, to construct an apartment unit model (including the associated plug loads, heating, ventilation and air conditioning [HVAC], and domestic hot water [DHW] systems, and envelope for the other apartment units). All other apartment units were deleted from the model, leaving only the desired apartment unit in the model. Surfaces separating two apartment units were modeled as adiabatic assuming that the heat transfer across those surfaces would be zero. This step was repeated for all apartment types in the model. Staff ensured model integrity by running the models and eliminating errors, when present. The individual apartment unit models were then simulated, and the hourly consumption and PV generation output was extracted.
2. The model output was brought into a spreadsheet, where the hourly import kWhs (that is, net energy consumption when energy consumption is equal to or greater than PV generation in each hour) and the hourly export kWhs (that is, net PV generation when PV generation is greater than energy consumption in each hour) were calculated for each apartment unit. The hourly import and export kWhs were then summed for each month to establish monthly import and export kWhs. Consistent with the Schedule DG rate, the monthly export kWhs were subtracted from the monthly import kWhs to determine energy charges and the hourly export kWs were subtracted from the monthly import kWs to determine demand charges. If in any month the monthly export kWhs exceeded the monthly import kWhs to result in net generation for the month (monthly exports minus monthly imports), those exports would be compensated at the short run

marginal cost to arrive at monthly export credits. Staff emphasizes that the analysis determined there was very little net generation in any month for any of the apartment types. Table 9, Table 10, and Table 11 show the calculation results for an example Apartment Type 1 for 2025. Table 12 shows the calculation results for a summary of the first three years (2025-2027) savings for Apartment Type 1. The demand charges are determined by multiplying the maximum net hourly kWs in the month times the demand charge per kW shown in Table 7.

3. Table 13 shows the 30-year incremental net present value (NPV) estimated savings for Apartment Type 1. Annual savings from 2028 through 2055 are calculated by applying the utility escalation rate of 2.7%, as indicated in Table 8 for these future years.
4. The same steps were repeated for other apartment types (2, 2AS, 2B, 2BS, 2C, 3 and 3S). Table 14 shows 30-year NPV Savings and Standard PV Size for all apartment types.
5. Table 15 shows standard PV size for each building type by multiplying the PV size for each apartment type in Table 14 by the number of apartment types in each building indicated in Table 5.
6. Table 16 shows the 30 year-NPV savings for each building type by multiplying the standard PV size for each apartment type shown in Table 14 by the number of apartment types in each building shown in Table 5.
7. Table 17 shows the PV life-cycle costs used in the analysis, including the first cost ($/W) from Table 4 and the estimated operations and maintenance cost ($/W) derived from the 2019 Energy Code measure proposal report, adjusted for inflation. It also shows the total 30-year net present value (NPV) PV costs ($/W) used for all PV systems in the Monte Vista Apartments Project, which is the sum of these.
8. Table 18 shows the 30-year NPV savings, incremental NPV costs, and the benefit-to-cost ratio for each building type.

Energy Code requirements are cost-effective when the life-cycle energy savings exceed the life-cycle costs. When both the benefits and costs are positive, the benefit-to-cost ratio would have to be greater than 1.0 for the requirements to be cost-effective.

This analysis finds that for all building types, the life-cycle benefits do not exceed the costs, and the benefit-to-cost ratio is less than 1.0. This analysis indicates that local rules in Turlock cause the CEC's cost-effectiveness calculations for the 2019 Energy Code to not hold.

Table 8: LCC Inputs

Assumptions		**Source**
Energy Escalation Rate	2.7%	CEC assumption
Discount Rate, Real	3.00%	CEC assumption
Life Cycle Period (years)	30	CEC assumption

Source: CEC staff

Table 9: Net Energy Consumption Results and Net Energy Bill Charges for 2025 for Apartment Type 1 With No PV System

Month	Total Net kWh	Tier 1 Net kWh	Tier 2 Net kWh	Tier 3 Net kWh	Total Energy Bill Charges ($)
1	281.9	281.9	0.0	0.0	36.3
2	242.3	242.3	0.0	0.0	31.2
3	266.4	266.4	0.0	0.0	34.3
4	273.3	273.3	0.0	0.0	35.2
5	295.8	295.8	0.0	0.0	38.1
6	297.8	297.8	0.0	0.0	40.4
7	343.2	343.2	0.0	0.0	46.6
8	356.4	356.4	0.0	0.0	48.4
9	342.3	342.3	0.0	0.0	46.5
10	267.7	267.7	0.0	0.0	36.4
11	310.4	310.4	0.0	0.0	42.2
12	285.7	285.7	0.0	0.0	36.8
Total ($)	3563.3	3563.3	0.0	0.0	472.5

Source: CEC staff

Note: Summer months are June through November, that is, months 6 to 11. See Table 6 for TID residential electric rates for non-solar customers.

Table 10: Net Energy Consumption Results and Net Energy Bill Charges for 2025 for Apartment Type 1 With PV System

Month	On-Peak Monthly Imports(kWh)	Off-Peak Monthly Imports (kWh)	On-Peak Energy Charges (On-peak Monthly Imports – On-peak Monthly Exports)*On-peak rate) ($)	Off-Peak Energy Charges (Off-peak Monthly Imports– Off-Peak kWh Monthly Exports)*Off-peak rate) ($)	Demand Charges (Highest hourly Imports – Exports) * Demand rate) ($)	Total Charges (Energy Charges + Demand Charges ($)
1	78.1	146.1	6.9	9.6	11.4	28.0
2	51.4	115.5	1.2	5.0	10.4	16.6
3	61.0	108.0	1.0	1.7	6.7	9.4
4	52.4	111.4	0.2	0.0	9.4	9.7
5	68.0	107.6	1.0	0.0	7.2	8.2
6	72.5	97.9	1.3	0.0	14.1	15.4
7	84.1	125.8	5.0	0.0	9.2	14.2
8	112.9	115.4	8.1	0.0	11.8	19.9
9	94.5	138.2	7.9	3.1	11.5	22.4
10	69.4	102.8	4.4	1.6	6.8	12.8
11	91.8	146.7	9.2	13.5	19.7	42.3
12	63.5	162.1	6.0	10.1	7.5	23.5
Total ($)	899.8	1477.5	52.3	44.4	125.6	222.3

Note: Summer months are June through November, that is, months 6 to 11. See Table 7 for residential electric rates for self-generation customers.

Source: CEC staff

Table 11: Export Credit for 2025 for Apartment Type 1 With PV System

Month	On-Peak Monthly Exports (kWh)[14]	Off-Peak Monthly Exports (kWh)[15]	Avg On-Peak SRMC Rate[16] ($/kWh)	Avg Off-Peak SRMC Rate[17] ($/kWh)	On-Peak Credit (applies only when On-peak Monthly Imports kWhs > On-peak Monthly Exports KWh) ($)	Off-Peak Credit (applies only when Off-peak Monthly Exports kWhs > Off-peak Monthly Imports KWh) ($)	Export Credit ($)
1	-20	-17	0.02	0.04	0.0	-0.0	-0.0
2	-41	-49	0.03	0.04	0.0	-0.0	-0.0
3	-52	-86	0.03	0.04	0.0	-0.0	-0.0
4	-50	-114	0.03	0.04	0.0	-0.095	-0.1
5	-60	-121	0.05	0.04	0.0	-0.6	-0.6
6	-64	-125	0.04	0.04	0.0	-1.1	-1.1
7	-52	-133	0.03	0.04	0.0	-0.3	-0.3
8	-61	-117	0.02	0.04	0.0	-0.1	-0.1
9	-44	-113	0.03	0.04	0.0	-0.0	-0.0
10	-41	-90	0.03	0.03	0.0	-0.0	-0.0
11	-33	-34	0.04	0.04	0.0	-0.0	-0.0
12	-14	-28	0.03	0.04	0.0	-0.0	-0.0
Total ($)	-532.9	-1027.0	0.03	0.04	**0.0**	**-2.1**	**-2.1**

Note: Summer months are June through November, that is, months 6 to 11. Export credits are based on TID's monthly export rates for overgeneration.

Source: CEC staff

Table 12: First Three Years (2025-2027) Savings Summary for Apartment Type 1

CASE	Annual Energy Bill Charges	2025 Energy Bill ($)	2026 Energy Bill ($)	2027 Energy Bill ($)
With PV	Import Charges (Annual $)	222.3	246.8	253.8
	Export Credit (Annual $)	-2.1	-2.1	-2.1
Without PV	Non-PV Charges (Annual $)	472.5	490.6	509
	First Year Savings (Annual $)	**252.3**	**245.9**	**257.3**

Source: CEC staff

14 The negative numbers represent the monthly net exported kWhs by onsite PV during on-peak hours.

15 The negative numbers represent the monthly net exported kWhs by onsite PV during off-peak hours.

16 The average of daily on-peak short run marginal costs published on TID's Short Run Marginal Cost Daily Average data website at the time of the analysis.

17 The average of daily off-peak short run marginal costs published on TID's Short Run Marginal Cost Daily Average data website at the time of the analysis.

Table 13: 30-Year Net Present Value Estimated Savings for Apartment Type 1

Year	Apartment Type 1 ($)
1	252.3
2	245.9
3	257.3
4	264.2
5	271.3
6	278.7
7	286.2
8	293.9
9	301.9
10	310.0
11	318.4
12	327.0
13	335.8
14	344.9
15	354.2
16	363.7
17	373.6
18	383.6
19	394.0
20	404.6
21	415.6
22	426.8
23	438.3
24	450.1
25	462.3
26	474.8
27	487.6
28	500.8
29	514.3
30	528.2
Total NPV ($)	$6,366

Source: CEC staff

Note: Years 1, 2, and 3 are 2025, 2026 and 2027, respectively.

Table 14: 30-Year NPV Savings and Standard PV Size for All Apartment Types

Apartment Type	Conditioned Floor Area per Unit (ft^2)	First-Year Bill Savings ($)	30 Year-NPV Savings ($)	Standard PV Size, kW
1	644	$252	$6,366	1.73
2A	884	$326	$8,772	2.09
2AS	983	$330	$8,883	2.10
2B	961	$330	$8,905	2.10
2BS	981	$330	$8,880	2.10
2C	952	$330	$8,888	2.10
3	1204	$378	$10,110	2.45
3S	1185	$377	$10,085	2.44

Source: CEC staff

Note: Apartment types are 1, 2 or 3 bedrooms with different configurations and conditioned floor area

Table 15: Standard PV Size, kW for Each Building Type

Apartment Type	Standard PV Size Building Type A	Standard PV Size Building Type B	Standard PV Size Building Type C	Standard PV Size Building Type D	Standard PV Size Building Type E
1	20.8	20.8	10.4	0.0	0.0
2A	0.0	12.5	0.0	0.0	0.0
2AS	0.0	0.0	0.0	25.2	25.2
2B	0.0	0.0	25.2	0.0	0.0
2BS	0.0	0.0	0.0	12.6	12.6
2C	25.2	12.6	25.2	0.0	0.0
3	0.0	14.7	0.0	0.0	0.0
3S	0.0	0.0	0.0	29.3	29.3
Sum	**46**	**60.6**	**60.8**	**67.1**	**67.1**

Source: CEC staff

Note: See Table 8 for number of apartment types in each building and Table 14 for the standard PV size for each apartment type.

Table 16: 30-Year NPV Savings ($) for Each Building Type

Apartment Type	30-Year NPV for Building Type A	30-Year NPV for Building Type B	30-Year NPV for Building Type C	30-Year NPV for Building Type D	30-Year NPV for Building Type E
1	$76,392	$76,392	$38,196	$0	$0
2A	$0	$52,635	$0	$0	$0
2AS	$0	$0	$0	$106,591	$106,591
2B	$0	$0	$106,855	$0	$0
2BS	$0	$0	$0	$53,281	$53,281
2C	$106,659	$53,329	$106,659	$0	$0
3	$0	$60,658	$0	$0	$0
3S	$0	$0	$0	$121,017	$121,017
Sum	$183,050	$243,013	$251,710	$280,889	$280,889

Source: CEC staff

Note: See Table 5 for number of apartment types by building type and Table 14 for 30-year NPV savings by apartment type.

Table 17: PV Life-Cycle Costs

First Cost_Lowest Bid	$4.93/Watt
30 year-Operations and Maintenance Cost	$0.54/Watt[18]
Total 30 year-NPV PV Cost	$5.47/Watt

Source: CEC staff

18 $0.45/Watt O&M cost in the PV report inflated 3% to $0.54/Watt. See Energy and Environmental Economics, Inc. September 2017. Building Energy Efficiency Measure Proposal to the California Energy Commission for the 2019 Update to the Title 24 Building Energy Efficiency Standards for Rooftop Solar PV Systems. https://efiling.energy.ca.gov/getdocument.aspx?tn=221366

Table 18: 30-Year-NPV Cost, Savings and Benefit to Cost Ratio for Each Building Type

	Building Type A	Building Type B	Building Type C	Building Type D	Building Type E
30-year-NPV PV Cost	$251,401	$331,482	$332,467	$366,928	$366,928
30-year-NPV Savings (Table 16)	$183,050	$243,013	$251,710	$280,889	$280,889
Benefit-to-Cost Ratio	0.73	0.73	0.76	0.77	0.77

Source: CEC staff

Note: See Table 15 for the standard PV size (kW) for each building type.

CHAPTER 3:
Staff Recommendation

Staff Recommendation

Based on staff's analysis of the application submitted by Pacific West Communities, Inc., for the Monte Vista Apartments Project within the Turlock Irrigation District, staff recommends that the CEC determine that the CEC's cost effectiveness conclusion for 2019 Energy Code photovoltaic system requirements under Section 150.1(c)14 do not hold for the newly constructed low-rise multifamily buildings in the project.

This recommendation is based on:

- The Turlock Irrigation District (TID) does not allow virtual net energy metering (VNEM). VNEM is an energy billing mechanism that allows the electricity generation from a single PV system—typically installed on the roof of a multifamily building—to be shared among multiple dwelling units, crediting each tenant's utility bill based on their share of the PV system output,
- The inability to utilize Virtual Net Energy Metering (VNEM) necessitates the installation of separate photovoltaic (PV) systems for each dwelling unit, which triggers additional safety requirements imposed by the City of Turlock Building and Safety Division Fire Inspector (City of Turlock)—such as individual PV disconnects and extensive alternating current (AC) wiring to the main service meter location, and
- The resulting high installation costs reflected in contractor bids.

In accordance with Section 10-109(k), staff therefore recommends that the CEC determine that the PV system requirements in the 2019 Energy Code not apply specifically to the Monte Vista Apartments Project's 348-unit newly constructed low-rise multifamily buildings described in the application referenced above.

REFERENCES

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GLOSSARY

California Energy Commission (CEC) is the state agency leading the state of California to a 100 percent clean energy future for all. As the state's primary energy policy and planning agency, the Energy Commission is committed to reducing energy costs and environmental impacts of energy use while ensuring a safe, resilient, and reliable supply of energy.

CBECC (California Building Energy Code Compliance) is an open-source compliance software that may be used by code agencies, rating authorities, or utility programs in the development of energy codes, standards, or efficiency programs. Architects, engineers, and energy consultants may also use CBECC to demonstrate compliance with energy codes or beyond-code programs.

Energy Code also referred to as the California's Building Energy Efficiency Standards, is adopted by the CEC to reduce wasteful and unnecessary energy consumption in newly constructed buildings, and additions and alterations to existing buildings. The Energy Code is updated every three years. Buildings whose permit applications are applied for on or after January 1, 2020, must comply with the 2019 version of the Energy Code.

National Renewable Energy Laboratory (NREL) is the United States Department of Energy laboratory that is assigned responsibility for renewable energy systems.

Net energy metering (NEM) is a billing mechanism that compares the amount of electricity generated by customer-owned solar energy systems to the amount of electricity that the customer consumes and provides compensation for the amount that is consumed and the amount that is generated in excess of the consumption following rules established for the utility.

Net present value (NPV) compares the present value of life cycle benefits to the present value of life-cycle costs of an investment.

Photovoltaic (PV) systems are composed of one or more solar-electric panels combined with an inverter and other electrical and mechanical hardware that use energy from the sun to generate electricity.

Turlock Irrigation District (TID) is the electric utility that serves customers in the Turlock area.

Virtual net energy metering (VNEM) is an energy billing mechanism that allows a central PV system serving a multifamily facility to be interconnected to the utility directly without being interconnected to each dwelling unit. The resulting electric generation is allocated virtually to establish energy bill credits for the dwelling units.