

What is EDR?

California's 2019 Building Energy Efficiency Standards (Energy Code or Title 24, Part 6) has adopted the Energy Design Rating (EDR). EDR represents both an energy-use index and metric for establishing Energy Code compliance for New Construction low-rise residential buildings using the Performance Approach. The new EDR compliance metric replaces that of Time Dependent Valuation (TDV) energy use included in the 2016 Energy Code for New Construction. However, Additions and Alterations will continue to use the TDV energy-use metric for the Performance Approach.

EDR Index: 0-100

EDR functions on a scale of 0-100, where 0 represents a building that has zero net energy consumption based on the TDV energy use and 100 represents a building that is compliant with the 2006 International Energy Conservation Code (IECC). The EDR Index is designed to help consumers understand how efficient their homes are relative to a zero TDV home. The lower the EDR Index, the more energy efficient the home.

Why?

Much like MPG stickers for cars, the EDR Index allows easy home-to-home comparison of energy efficiency and the effects of renewable energy.

EDR also allows us to incorporate photovoltaic (PV) storage components into the compliance equation while simultaneously requiring the building to be better than the baseline before factoring in renewable energy generated on site.

Relevant Code Sections

2019 California Building Energy Efficiency Standards, Title 24, Part 6:

- [Section 100.1\(b\)](#) – Definitions and Rules of Construction – Definitions
- [Section 150.0](#) – Low Rise Residential Buildings - Mandatory Features and Devices
- [Section 150.1\(a\)](#) – Low-Rise Residential Buildings - Basic Requirements
- [Section 150.1\(b\)](#) – Low-Rise Residential Buildings - Performance Standards
- [Joint Reference Appendix 5 \(JA5\)](#) – Technical Specification For Occupant Controlled Smart Thermostats
- [Joint Reference Appendix 11 \(JA11\)](#) – Qualification Requirements for Photovoltaic System
- [Joint Reference Appendix 12 \(JA12\)](#) – Qualification Requirements for Battery Storage System
- [Residential Alternative Calculation Method \(ACM\) Reference Manual](#)
- [Residential Compliance Manual](#)

Relevant Compliance Forms

- [CF1R-PRF-01-E](#): Certificate of Compliance – Building Components, Performance
- [CF2R-PVB-01-E](#): Certificate of Installation – Photovoltaic Systems
- [CF2R-PVB-02-E](#): Certificate of Installation – Battery Storage Systems

EDR Components

The 2019 Energy Code requires new residential buildings to comply with an Efficiency EDR target and a Final EDR (Efficiency + Solar Photovoltaic, also referred to as Total EDR) target, thus separating building efficiency from on-site generation.

Efficiency EDR

As it was for the TDV energy score of past code cycles, the more efficient the building components (e.g., envelope, HVAC and water heating), the lower the Efficiency EDR score. However, the Efficiency EDR also takes into account unregulated end uses such as lighting, plug loads and appliances.

PV/Flexibility EDR

The PV/Flexibility EDR is based on the solar electric generation and demand flexibility rating, including, but not limited to, the PV system, battery storage and precooling. The more electricity generated on site (within Net Energy Metering (NEM) size limitations), the better the Final EDR score.

Final/Total EDR

Combines the Efficiency EDR and PV/Flexibility EDR into one score. Final EDR = Efficiency EDR – PV/Flexibility EDR.

Demonstrating Compliance with EDR

The building complies when:

- Proposed Efficiency EDR ≤ Standard Efficiency EDR

AND

- Proposed Final EDR ≤ Standard Final EDR

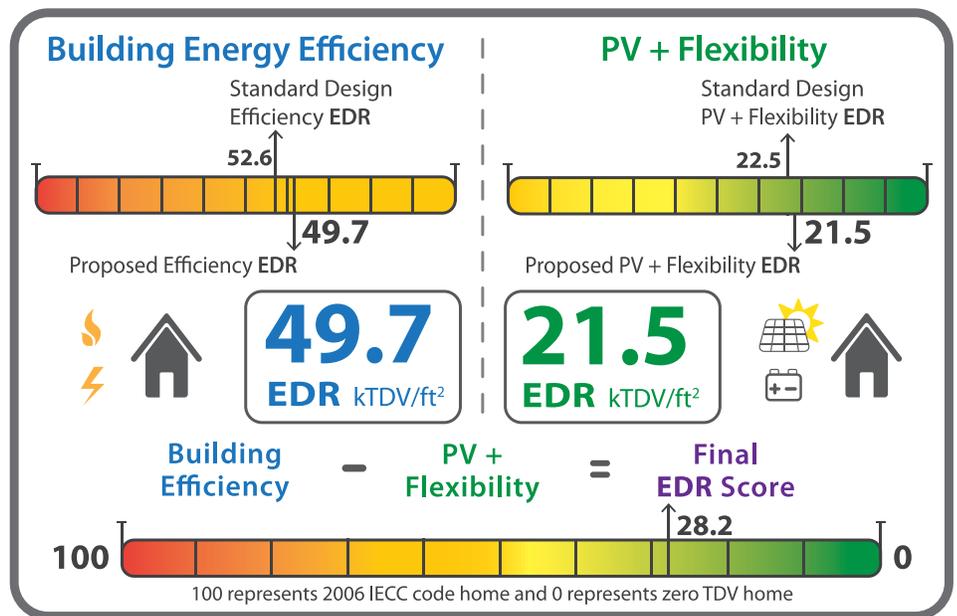
Standard Allowance

The Efficiency EDR Standard allowance is derived from the Mandatory and Prescriptive energy measures applicable to the building (measured in TDV).

2019 Energy Code: Energy Design Rating (EDR) Compliance for New Construction

KEY

- Natural or propane gas energy source.
- Electricity energy source.
- Photovoltaic energy source.
- Battery storage energy source.
- EDR** Energy Design Rating



PV Sizing

The Standard (Baseline) System

When using the Prescriptive Approach, the Standard PV system size is determined using Equation 150.1-C (based on the project's total conditioned floor area (CFA), number of dwelling units and Climate Zone).

When using the Performance Approach, the Standard PV system size is determined by the proposed building's annual kWh electrical consumption, excluding any electricity for water heating and space heating, regardless of the proposed fuel type.

Exceptions to §150.1(c)14

Exception 1 exempts a home that is restricted to less than 80 ft² of effective solar access due to shading from barriers external to the dwelling unit.

Exceptions 2-5 allow for the baseline system to be reduced based on the Climate Zone, number of habitable stories and effective "solar access." Solar access may be determined by using [Energy Commission-approved solar assessment tools](#).

Determining the effective solar access requires an analysis of the proposed surface (rooftop) given its orientation, tilt and shading from obstructions. Only external obstructions (e.g., trees and other buildings) are considered in determining annual solar access.

Exception 6 allows for the baseline PV system size to be reduced by 25%. To qualify for this exception the battery must have a minimum capacity of 7.5 kWh and must meet the requirements specified in [Joint Reference Appendix 12 \(JA12\)](#).

Proposed System

The Energy Code does not allow more PV to be traded for less building energy efficiency, but more building energy efficiency can be traded for less PV. The Proposed System must always comply with NEM rules and requirements specified in [JA12](#). Although it is not recommended, if planning to oversize the Proposed System, consultation with the local municipality is advised.

Net Energy Metering (NEM)

NEM is a special billing arrangement that allows utility customers who generate their own energy using PV or other renewable source to receive financial credit for it. Currently new PV system owners must register under NEM 2.0 rules in order to receive financial credit for any surplus energy fed back to the utility over a 12-month period. NEM 2.0 requires system size limitations equal to the customer's annual load. For additional information regarding NEM rules, contact your utility's interconnection and NEM tariff offices.

New Terms

Solar Irradiance: Represents the average amount of power over a given area. This is commonly expressed as W/m² (watt per square meter). On a clear day the average solar irradiance is 1000 W/m².

Solar Insolation: Represents the quantity of solar energy that is incident on a surface of a given size during an amount of time. This is commonly expressed as kWh/m² (kilowatt-hour per square meter).

Solar Access: The ratio of solar insolation including shade to the solar insolation without shade. This is commonly expressed as a percentage of annual solar access.

Effective Solar Access: Must be ≥ 70% of the output of an unshaded PV array on an annual basis.

PV Sizing Equation (Equation 150.1-C)

$$kW_{PV} = (CFA \times A) / 1,000 + (N_{dwell} \times B)$$

WHERE:

- kW_{PV} = kWdc size of the PV system
- CFA = Conditioned floor area
- N_{dwell} = Number of dwelling units
- A = Adjustment factors from [Table 150.1-C](#)
- B = Dwelling adjustment factor from [Table 150.1-C](#)

Table 150.1-C: CFA and Dwelling Adjustment Factors

Climate Zone	A-CFA	B-Dwelling Units
1	0.793	1.27
2	0.621	1.22
3	0.628	1.12
4	0.586	1.21
5	0.585	1.06
6	0.594	1.23
7	0.572	1.15
8	0.586	1.37
9	0.613	1.36
10	0.627	1.41
11	0.836	1.44
12	0.613	1.4
13	0.894	1.51
14	0.741	1.26
15	1.56	1.47
16	0.59	1.22

Sample Prescriptive Sizing Requirements

Climate Zone	CFA Ft ²	Standard System Size (kWdc)
3	2,000	2.38
	2,500	2.69
	3,000	3.00
5	2,000	2.23
	2,500	2.52
	3,000	2.82
13	2,000	3.30
	2,500	3.75
	3,000	4.19

Load Shifting/Flexibility Strategies

Battery Storage

Coupling a PV system with a battery ≥ 5 kWh allows for a “Self-utilization” credit that can be used with the Performance Approach to reduce the Proposed building energy use. “Self-utilization” minimizes hourly exports back to the grid and maximizes the in-house use of all electricity generated.

Coupling a PV system with battery storage can also allow for compliance with smaller PV systems via Exception 6 to §150.1(c)14. To qualify for this exception, the battery must have a minimum of 7.5 kWh capacity and meet the minimum requirements of JA12.

Precooling

Precooling is another demand flexibility strategy that offers PV/flexibility credit. It involves cooling the house by a few degrees before peak time-of-use (TOU) hours, so that the building is using less electricity during those peak TOU hours. To obtain the precooling credit, the homeowner must install smart thermostats that meet the minimum requirements of Joint Reference Appendix 5 (JA5). If battery storage credit has already been used, additional precooling credit may have a negligible effect on improving your EDR score. Precooling can provide significant cost savings for homeowners.

Roles & Responsibilities

Designer

Building designers cannot rely on oversized PV systems to counterbalance inefficient building components. The EDR compliance structure requires buildings to comply without the help of electricity generation through the Efficiency EDR. Also, NEM rules include size limitations. Designers should instead look to design buildings with demand flexibility strategies such as battery storage or precooling.

Plans Examiner

Plans examiners must now make sure to verify that compliance with both Efficiency EDR and Final EDR. The plans examiner must also verify the proposed PV and storage system indicated in the compliance documents matches those in the plans.

Building Inspector

Building inspectors must verify the certificates of installation are valid:

- [CF2R-PVB-01-E](#): PV system specs including size (kW), Azimuth, Tilt, inverter efficiency and shading
- [CF2R-PVB-02-E](#) (if applicable): Battery capacity, controls, charging and discharging efficiency

The building inspector also verifies that the PV and battery storage system (if applicable) is programed and operational with minimum requirements as specified in [Joint Reference Appendix 11 \(JA11\)](#)

Forms: Which and When

- [CF1R-PRF-01-E](#): Certificate of Compliance – Building Components, Performance
 - Generated through approved computer compliance software
- [CF2R-PVB-01-E](#): Certificate of Installation – Photovoltaic Systems
 - Completed by the installing contractor and available for the inspector when on site
- [CF2R-PVB-02-E](#): Certificate of Installation – Battery Storage Systems
 - Completed by the installing contractor and available for the inspector when on site

For More Information

Primary Documents

- Energy Code Section 100.1(b) – Definitions and Rules of Construction – Definitions
energycodeace.com/site/custom/public/reference-ace-2019/Documents/section1001definitionsandrulesofconstruction.htm
- Energy Code Section 150.0 – Low Rise Residential Buildings – Mandatory Features and Devices
energycodeace.com/site/custom/public/reference-ace-2019/Documents/section1500mandatoryfeaturesanddevices.htm
- Energy Code Section 150.1(a) – Low-Rise Residential Buildings - Basic Requirements
energycodeace.com/site/custom/public/reference-ace-2019/Documents/section1501performanceandprescriptivecomplianceapproachesforlowr.htm
- Energy Code Section 150.1(b) – Low-Rise Residential Buildings - Performance Standards
energycodeace.com/site/custom/public/reference-ace-2019/Documents/section1501performanceandprescriptivecomplianceapproachesforlowr.htm
- Energy Code Joint Reference Appendix 5 (JA5) – Technical Specification For Occupant Controlled Smart Thermostats
energycodeace.com/site/custom/public/reference-ace-2019/Documents/appendixja5technicalspecificationsforoccupantcontrolledsmarthther.htm
- Energy Code Joint Reference Appendix 11 (JA11) – Qualification Requirements for Photovoltaic System
energycodeace.com/site/custom/public/reference-ace-2019/Documents/appendixja11qualificationrequirementsforphotovoltaicsystem.htm
- Energy Code Joint Reference Appendix 12 (JA12) – Qualification Requirements for Battery Storage System
energycodeace.com/site/custom/public/reference-ace-2019/Documents/appendixja12qualificationrequirementsforbatterystoragesystem.htm
- Energy Code Residential Alternative Calculation Method (ACM) Reference Manual
energycodeace.com/site/custom/public/reference-ace-2019/Documents/1introduction2.htm
- Energy Code Residential Compliance Manual
energycodeace.com/site/custom/public/reference-ace-2019/Documents/1introduction.htm
 - 7.3 Performance Approach Compliance for Photovoltaic Systems
 - 7.5 Battery Storage System
 - 8.2.1 What's New for 2019 - Determining Compliance – Energy Design Rating (EDR)

California Energy Commission Information & Services

- Energy Code Hotline: 1-800-772-3300 (Free) or Title24@energy.ca.gov
- Online Resource Center:
www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/online-resource-center
 - The Energy Commission's main web portal for the Energy Code, including information, documents and historical information
- Home Energy Rating System (HERS) Program Sub-site:
www.energy.ca.gov/programs-and-topics/programs/home-energy-rating-system-hers-program

Additional Resources

- California Advanced Homes EDR Fact Sheet:
cahp-pge.com/CAHP_TRC_EDRFactSheet_2018-09-20.pdf
- IOU Interconnection and Net Energy Metering Tariff Office Contact
 - Pacific Gas & Electric (PG&E)
pge.com/en_US/for-our-business-partners/interconnection-renewables/interconnections-renewables.page?ctx=large-business
 - Southern California Edison (SCE)
sce.com/residential/generating-your-own-power/net-energy-metering/getting-started
 - San Diego Gas & Electric (SDG&E)
sdge.com/residential/savings-center/solar-power-renewable-energy/net-energy-metering
- Energy Code Ace:
EnergyCodeAce.com
 - An online “one-stop-shop” providing free resources and training to help appliance and building industry professionals decode and comply with Title 24, Part 6 and Title 20. The site is administered by California's investor-owned utilities.
Of special interest:

- Fact Sheets
energycodeace.com/content/resources-fact-sheets/
 - What's New In 2019 Residential Energy Code
 - What's Changed for 2019 – Low-Rise Residential
- Training
energycodeace.com/training
 - Decoding What's New: Let's Talk 2019 Title 24, Part 6
- Checklists
energycodeace.com/content/resources-ace/file_type=checklist
 - 2019 Residential Plans Examiner Checklist
 - 2019 Residential Building Inspector Checklist

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