Designing Single-family Homes to Run on Clean Energy

Goals to Reduce Greenhouse Gas Emissions

This fact sheet explains how newly constructed single-family homes, such as single-family dwellings, duplexes, townhomes of any size and accessory dwelling units (ADUs), can help to meet California's energy goals by installing more efficient systems and moving to cleaner energy sources.

California is aiming to reduce its greenhouse gas (GHG) emissions while creating an energy system that is resilient to climate risks, spurring innovation and a low-carbon transition nationally and internationally.

California met its 2020 target four years early in 2016, and emissions have continued to drop since then (Figure 1). California's next climate targets are to reduce emissions by 40% below 1990 levels by 2030 and by 80% below 1990 levels by 2050.

According to a California Energy Commission (CEC) report from 2021, homes and businesses account for 25% of California's GHG pollution. These include direct emissions from burning fossil fuels for heating and cooking, gas leaks and refrigerant leaks, plus indirect emissions from generating the electricity used in buildings. See Figure 2 for a snapshot of these GHG emissions in 2018.

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Energy Efficiency

When considering cleaner energy sources for a new home, it is important to make sure that the building overall is as energy efficient as possible. Building energy efficiency measures include, but are not limited to:

- Building envelopes (windows, walls, roof, floors and other exterior surfaces) designed to limit heat loss in the winter and heat gain in the summer: Homes in most parts of California will benefit from high insulation levels and high-performing windows, glass doors and skylights. Hot areas will need added features to help keep a building cool, such as cool roof coatings and window overhangs.
- High-efficiency and thoughtfully designed space-conditioning and water-heating systems
- Efficient household appliances, such as those with EnergyStar ratings

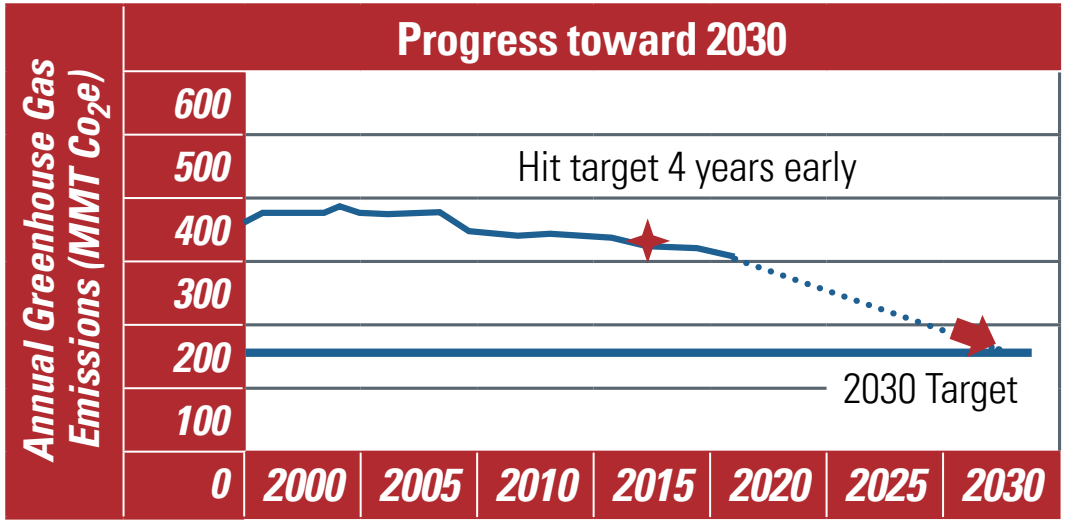

Figure 1. *Closing in on California's 2030 Climate Target (Adapted from the CalEPA California Climate Dashboard)*

Electrification

Energy efficiency and electrification work together to help decarbonize buildings. Energy efficiency is a critical step on the way to electrification because efficient buildings need less electricity to function properly.

Electrification is the process of replacing technologies that use fossil fuels, such as natural gas and propane, with technologies that use electricity.

Replacing fossil fuel technologies can reduce carbon emissions and improve air quality.

Commercially available electric technologies exist such as:

- Electric heat pump space heaters
- Electric heat pump water heaters
- Electric induction cooktops
- Electric resistance or heat pump clothes dryers

All-electric vs. Mixed-fuel Options

To reduce GHG emissions, California's 2022 Energy Code encourages a move toward all-electric homes and away from mixed-fuel options.

A mixed-fuel home has both electricity and natural gas, propane or another fossil fuel available at the building site. The electricity is often generated at remote power plants or on-site using solar photovoltaic (PV) systems. The natural gas or other fossil fuel is also usually delivered from some outside location. Mixed-fuel homes in California typically use natural gas or propane for space and water heating, while using electricity for air conditioning, lighting and other plug-in appliances. In a mixed-fuel building, cooking equipment and clothes dryers might be powered by either on-site fossil fuel or electricity.

By contrast, an all-electric home uses only electricity for all of these needs, and it may not have any fossil fuel available on site.

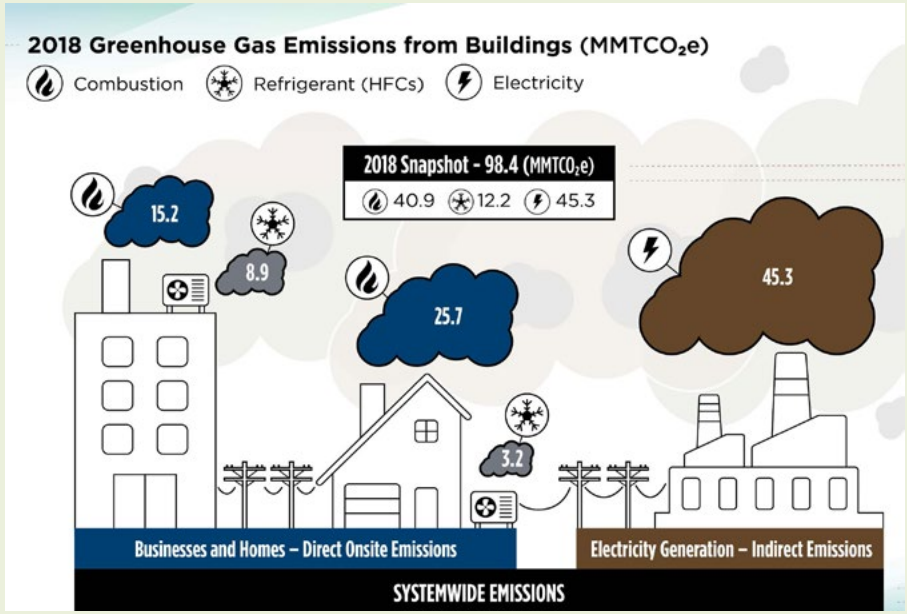

Figure 2. *California's 2018 Greenhouse Gas Emissions from Buildings (from California Energy Commission "Assembly Bill 3232 and the California Building Decarbonization Assessment")*

Reduction in Greenhouse Gas Emissions as a Home Is Electrified

See how the GHG emissions compare for an all-electric versus mixed-fuel 1990s era single-family home in Sacramento in 2020, 2030 and 2050 (Figure 3).

Figure 3 shows that, even accounting for the amount of fossil fuels used to generate electricity, the all-electric option has lower GHG emissions than mixed fuel because, as of 2020, 59% of California's electricity was already coming from low-carbon fuels (Figure 4).

Switching from natural gas-powered furnaces, water heaters and stoves to electric heat pump space- and water-heating equipment and electric induction cooktops potentially means over a 40% reduction in GHG emissions for residences.

California is working to decarbonize electricity generation and delivery even more, with the goal of achieving 100% low-carbon source energy for electricity by 2045. In Figure 3, the example home in 2050 shows 82% lower GHG emissions for the all-electric option compared to the mixed-fuel option.

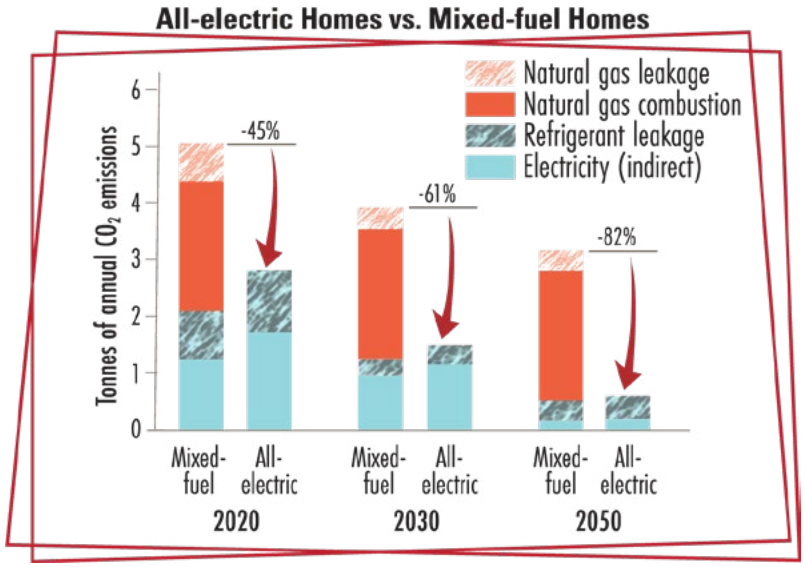

Figure 3: *All-electric vs. Mixed-fuel: Annual GHG Emissions for a 1990s Vintage Single-family Home in Sacramento (from "Residential Building Electrification in California", E3, April 2019)*

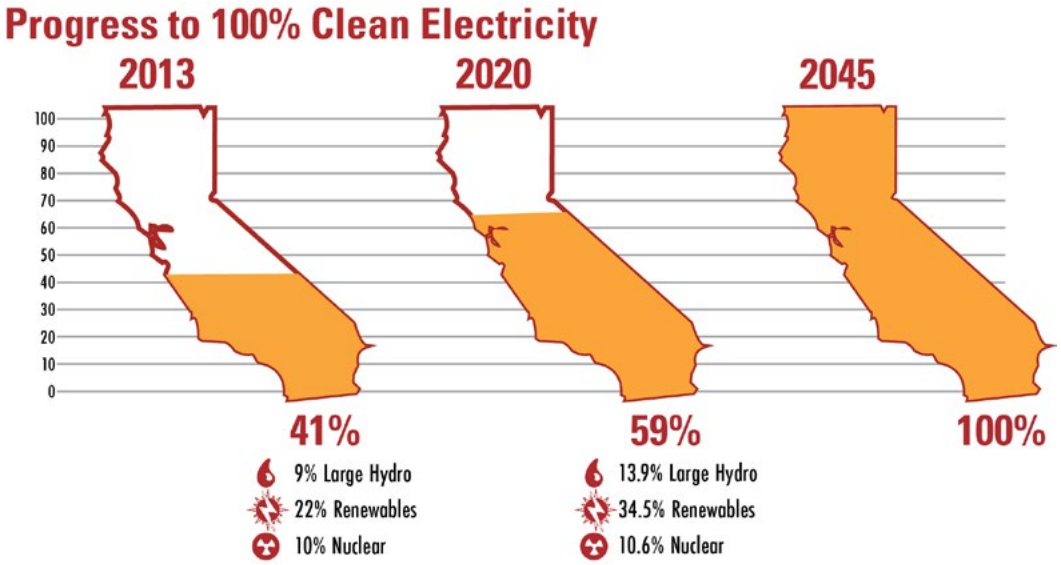

Figure 4: *Progress to 100% Clean Energy (adapted from CalEPA California Climate Dashboard)*

Is an all-electric home free of all greenhouse gas emissions?

Both electricity delivered through the grid and fossil fuels directly used on site may contribute to greenhouse gases (GHGs) due to home energy use.

Fossil fuels generate GHG emissions when burned either directly to heat a house, among other uses, or indirectly to generate electricity at a power plant.

The amount of GHG pollution from electricity is a direct result of the underlying energy source used to generate that electricity.

Electric Grid Stability: Storing and Using Home-generated Solar Electricity

Role of the Electric Grid

Solar electricity from home photovoltaic (PV) systems in combination with battery storage is part of meeting California climate goals. It is an increasing part of California's electrical grid, but the grid evolved over many years to work with central power plants serving cities or regions rather than wide-spread decentralized electricity inputs from home PV.

Solar electricity is generated when the sun shines during the day, most reliably in the middle of the day, but peak home energy use is in the late afternoon and early evening between 4 and 9 pm. For the statewide grid to stay stable and reliable, the power in must be balanced with the power out.

The existing power grid does not have enough central storage capacity to store of all the home-generated solar electricity for use later in the day. However, home battery storage can help solve that problem.

Does the move to electrification mean that I can't use gas at all?

The 2022 Energy Code encourages electrification for single-family homes, but it does not ban natural gas.

Keep reading to learn what influences whether or not a building complies using natural gas for space or water heating.

Role of Home Battery Storage Systems

Home battery storage systems help to keep the electricity levels in the grid stable and balanced by backing up mid-day solar electricity for use during peak use periods on the site where it was generated, rather than moving home-generated electricity to the grid at mid-day and then taking electricity from the larger grid at peak use periods.

The 2022 Energy Code does not require battery storage to be installed for new single-family homes, but it does require energy storage system (battery) readiness.

The 2022 Energy Code encourages sizing home solar systems to meet home electricity needs, and it gives Energy Code compliance credits for installing home battery storage systems.

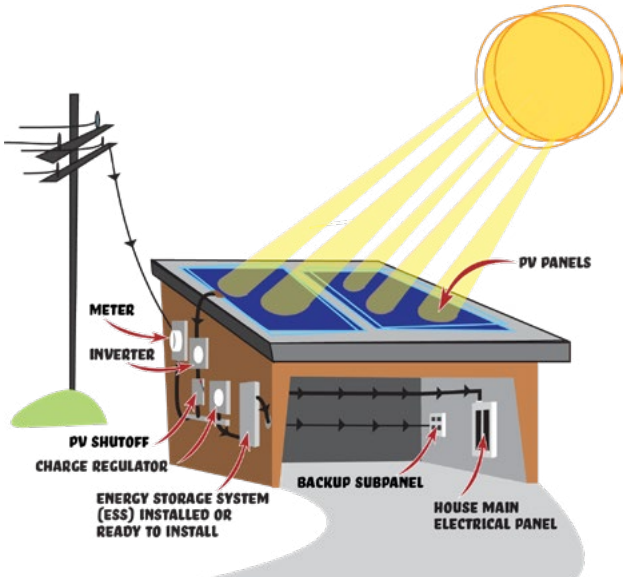

Figure 5. *Solar PV plus Battery Storage*

Role of Virtual Power Plants

Utilities are also working together with groups of people in their service territories who have installed solar PV with home battery storage systems to create virtual power plants (VPPs) that can provide backup electricity during power emergencies.

In August of 2022, almost 2,500 participants in a California VPP came together to send up to 16.5 MW of solar power from their battery storage systems into the grid in response to a state call for energy conservation.

Should I install a large PV system to send energy back to the California electrical grid?

The Energy Code promotes installing solar photovoltaic (PV) systems in new single-family homes to generate enough electricity to power the home itself, but not necessarily more than that.

Energy Code Compliance Options

Mandatory Measures and Prescriptive and Performance Options

The 2022 Energy Code encourages electrification in combination with energy efficiency, but it does not rule out using natural gas or other fossil fuels for some purposes in new homes.

There are minimum Mandatory Measures supporting electric readiness for new homes using gas, plus other measures requiring appliance efficiency for all new homes.

Beyond the Mandatory Measures, new homes must also comply with the Energy Code using either the Prescriptive or Performance Approach (Figure 6).

The particular Energy Code requirements for each home related to electrification are influenced by the compliance approach selected. The Prescriptive Approach has a list of fixed requirements, while the Performance Approach allows more flexibility.

The Prescriptive Approach is a simple but inflexible "all or nothing" approach to compliance. It offers a list of options for different building features, and a building must comply with every measure that applies to their project to comply with the Energy Code.

The Performance Approach is more flexible because it allows trade-offs between some more energy- and carbon-efficient design features versus less efficient measures. Mandatory Measures related to the proposed building design must be met regardless of the compliance approach. They may not be traded away even if using the Performance Approach.

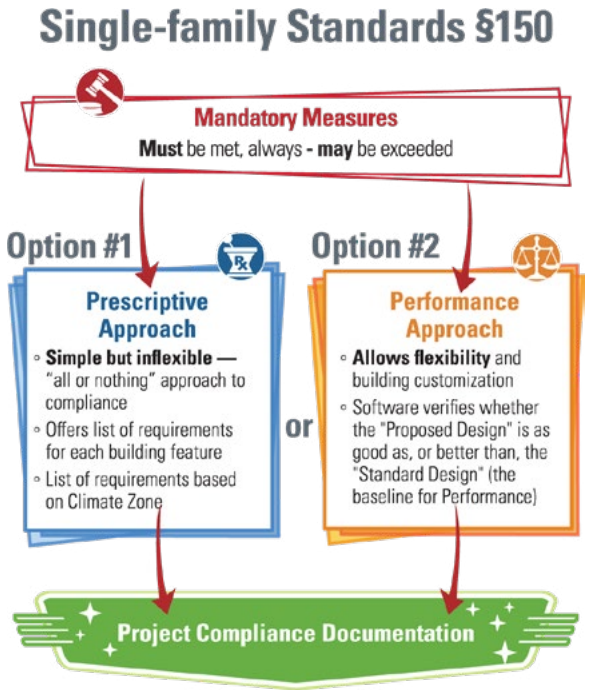

Figure 6: *Single-family Standards Mandatory Measures, Prescriptive and Performance Approaches*

Minimum Compliance Requirements

All new single-family residences in California must comply with the Energy Code using either the Prescriptive or Performance Approach, and they must meet all applicable Mandatory Measures. The builder, homeowner or other responsible person must submit a signed Certificate of Compliance Form CF1R to the local building department or other authority having jurisdiction (AHJ) when applying for a building permit. The CF1R together with a list of applicable Mandatory Measures document all of the specific measures that must be included.

Climate Zone

Building location and Climate Zone make a big difference in the overall design of a home and its Energy Code requirements. For example, there are different building insulation requirements for cool coastal climates such as Climate Zones 3 and 5 compared to hot inland regions like Climate Zones 10 through 15.

One particular difference relating to electrification in the 2022 Energy Code is that there are different Prescriptive water-heating and space-heating requirements for Climate Zones 3, 4, 13 and 14 compared to the rest of the state (Figure 7), and these differences carry through to the Performance Approach Standard Design. See Tables 1 and 2 for details on the Prescriptive requirements and Performance Approach Standard Design for space- and water-heating equipment.

Figure 7: *California Climate Zones with Different Baselines for Space and Water Heating*

Mandatory Electrification Measures

What's generally non-negotiable related to electrification? There are three types of Mandatory requirements that are directly related to electrification:

- Appliance efficiency
- Electric readiness
- Energy storage system (battery) readiness

Other Mandatory Measures are essential to single-family Energy Code compliance overall. For more information on these other Mandatory requirements, see §150.0.

Appliance Efficiency

All new space-heating, space-cooling and domestic water-heating equipment used in single-family homes must meet or exceed Mandatory minimum efficiency requirements.

The California Appliance Efficiency Regulations (Title 20), combined with federal appliance standards, set minimum efficiency levels for energy and water consumption in consumer, commercial and industrial appliances. When planning for electrification and working to have an energy efficient home, examples of regulated consumer appliances include:

- Air conditioners, heating equipment and fans
- Clothes washers and dryers
- Cooking equipment
- Lighting products
- Water heaters

To sell these regulated products in California, manufacturers must certify their efficiency in the CEC's Modernized Appliance Efficiency Database System (MAEDbS). Builders, homeowners and contractors can search MAEDbS to find certified equipment.

Electric Readiness

Single-family electrification generally means installing the following electric equipment instead of systems powered by natural gas or other fossil fuels:

- Heat pump space heating and cooling
- Heat pump water heating
- Electric induction or electric resistance cooktops
- Electric resistance or heat pump clothes dryers

None of these electric products and systems are Mandatory for new single-family homes in the 2022 Energy Code. However, if you use gas or propane to power any of this equipment, the Energy Code mandates that you make your new residence electric ready.

In general, when systems or appliances using gas or propane are installed in New Construction, dedicated wiring installed within 3 ft of the gas-fired appliance and reserved electrical breaker space must be provided for the future installation of electric units. Pre-installing the electric wiring and reserving electrical breaker space for future electric heat pumps, cooktops and clothes dryers makes it easier and less expensive to replace the gas or propane equipment with electric systems in the future.

For more details about the full list of requirements to make homes electric ready, see the Residential Electric Readiness Fact Sheet and the Energy Code sections below:

- Electric clothes dryer: §150.0(v)
- Electric cooktop: §150.0(u)
- Heat pump space heater: §150.0(t)
- Heat pump water heater: §150.0(n)

Energy Storage System (Battery) Readiness

The 2022 Energy Code encourages, but does not require, battery energy storage systems to pair with PV systems in new single-family residences. However, to make it easier and less expensive to install future battery storage, the 2022 Energy Code mandates that all new single-family residences be energy storage system (ESS) ready, also known as battery ready.

Battery readiness requires providing the electric infrastructure needed to install a battery storage system, including at least four branch circuits from any future battery to important end uses including a refrigerator, primary egress lighting and a bedroom receptacle outlet. For the full list of requirements, see §150.0(s) and the Single-family and Low-rise Multifamily Solar and Battery Systems Fact Sheet.

CEC and ECA Resources

Modernized Appliance Efficiency Database System (MAEDbS) bit.ly/MAEDbS

ECA Building Fact Sheets

bit.ly/building-fact-sheets

- Residential Electric Readiness Fact Sheet
- Single-family and Low-rise Multifamily Solar and Battery Systems Fact Sheet

California Fire Codes

Don't forget to consider other building code requirements. For example, note that California's 2022 Fire Code, Section 1207 covers specific fire safety requirements for electric energy storage systems (ESSs) in dwelling units regarding where and how battery storage systems may be installed. For example, one of these rules is that an ESS must not be installed in habitable spaces of dwelling units. Keep the Fire Code as well as the Energy Code in mind when planning future battery storage systems.

The California Department of General Services Buildings Standards Commission offers subscriptions to view these codes at www.dgs.ca.gov/BSC/Codes

Prescriptive Approach

Compliance Options

To comply with the Prescriptive Approach requires meeting all applicable measures in 2022 Energy Code Table 150.1-A. Table 1 lists the Prescriptive water-heating and space-heating compliance options for different Climate Zones.

Generally, the Prescriptive Approach allows minimum efficiency electric heat pump space conditioning in all Climate Zones and minimum efficiency gas space heating in Climate Zones 1, 2, 5-12, 15 and 16. Electric resistance space heating is not allowed Prescriptively.

All Climate Zones allow two different heat pump water-heating options, plus the option of solar water heating with electric backup. One tankless gas or propane water heater is also allowed in Climate Zones 3, 4, 13 and 14, but it cannot be combined with gas space heating using the Prescriptive Approach.

PV systems comply Prescriptively when they meet the sizing and installation requirements described in 2022 Energy Code §150.1(c)14. The calculated size of the PV system may be reduced by 25% if it is installed together with a battery storage system with a minimum usable capacity of 7.5 kWh that meets the requirements of Joint Appendix JA12.

Compliance Options[1]	Climate Zones			
	1	2, 5-12, 15	3, 4, 13, 14	16
Prescriptive Space-heating Options				
Electric heat pump meeting minimum Mandatory HSPF or HSPF2	**Yes**	**Yes**	**Yes**	**Yes**
Gas heating meeting minimum Mandatory AFUE	**Yes**	**Yes**	No	**Yes**
Electric resistance heating	No	No	No	No
Prescriptive Water-heating Options [2, 3]				
One 240-volt heat pump water heater meeting minimum Mandatory UEF[4]	**Yes[5]**	**Yes**	**Yes**	**Yes[6]**
One 240-volt heat pump water heater meeting NEEA Tier 3 or higher	**Yes**	**Yes**	**Yes**	**Yes[7]**
Solar water heating with electric backup, annual solar savings fraction ≥ 0.7	**Yes**	**Yes**	**Yes**	**Yes**
One gas or propane tankless water heater, ≤ 200 kBtuh input	No	No	**Yes[8]**	No

***AFUE** = annual fuel utilization efficiency; **HSPF** = heating seasonal performance factor; **NEEA** = Northwest Energy Efficiency Alliance; **UEF** = uniform energy factor.*

1. ***Important Note:** Prescriptive compliance requires meeting all applicable measures in 2022 Energy Code Table 150.1-A, not just those listed here.*
2. *One electric resistance water heater with point-of-use distribution is allowed for new dwellings with 500 ft² conditioned floor area or less.*
3. *A 120-volt heat pump water heater is allowed instead of a 240-volt heat pump water heater in a new dwelling unit with one bedroom or less.*
4. *The storage tank must be located in the garage or conditioned space.*
5. *Compact distribution is required.*
6. *Compact distribution and drain water heat recovery are required.*
7. *Drain water heat recovery is required, and the storage tank must be located in the garage or conditioned space.*
8. ***Note:** If a gas or propane water heater is selected in Climate Zones 3, 4, 13 or 14, space-heating equipment must be an electric heat pump.*

***Table 1:** 2022 Single-family Prescriptive Space Heating and Water Heating Compliance Options[1]*

Photovoltaic System Requirements

Many people ask whether all newly constructed single-family buildings really need a PV system.

Solar electricity generated by PV panels is required for single-family Prescriptive compliance and is part of the Performance Approach Standard Design, so it is strongly encouraged in the 2022 Energy Code, but it is not Mandatory.

There are exceptions for buildings without enough solar access and designs that require very small PV capacity. However, most new single-family residences are likely to need solar PV systems to comply with the Energy Code regardless of compliance approach, although there is more flexibility using the Performance Approach.

Successful solar PV systems require careful analysis of the available solar access roof area (SARA) for the specific building design and location, and verification of adequate solar access for proposed PV installations using solar assessment tools approved by the CEC. To make sure that the proposed PV system meets all these requirements, it is a good idea to work with a PV consultant early in the design process.

Certified Energy Analyst (CEA)

Certified Energy Analysts (CEAs) have demonstrated their mastery of the Residential and/or Nonresidential California Energy Code.

Since energy consultants are not regulated by the state, the California Association of Building Energy Consultants (CABEC) designed the certification to be a statement of an energy consultant's working knowledge and understanding of the California Energy Code. For more information about this certification and a list of CEAs, see https://cabec.org/cea/

Ace Tips

ECA Fact Sheet

See the Single-family and Low-rise Multifamily Solar and Battery Systems Fact Sheet for more information on specific design and installation requirements.

You can find this fact sheet on the ECA website at bit.ly/building-fact-sheets.

Performance Approach

Compliance Options

Performance Approach compliance requires creating a computer model of the proposed building using CEC-approved energy compliance software. The software compares the Proposed Design to a Standard Design energy budget that incorporates elements of the Prescriptive requirements for the building overall.

To comply with the Performance Approach, the designer or homeowner typically works with a building energy consultant, preferably a California Association of Building Energy Consultants (CABEC) Certified Energy Analyst (CEA), to determine if the proposed residence complies with the Energy Code as designed or if it needs to be modified.

Table 2 lists the Performance Approach Standard Design assumptions for water heating and space heating. There are other Standard Design assumptions for the building envelope (i.e., exterior windows, walls, roof, floor) and other features. In contrast to the Prescriptive requirements, the Performance Standard Design sets an energy baseline rather than being exact measures that must be included in the final building. The CEC-approved energy compliance software generates the required CF1R form that includes the compliance results and the specific features required to meet the Energy Code.

The Performance Approach allows Energy Code compliance modeling of any of the Prescriptive space- and water-heating systems or any other systems that the manufacturer has certified as meeting state and federal minimum Mandatory efficiency requirements.

The computer model can also include whatever PV and battery system the designer or homeowner selects, or they may decide to see if the building will comply without a PV or battery system.

If the proposed building overall, including the chosen space- and water-heating systems plus any PV and battery storage, meets all applicable Mandatory Measures and complies with the Energy Code when modeled with CEC-approved compliance software, then that design is allowed.

Standard Design Type[1]	Climate Zones			
	1	2, 5-12, 15	3, 4, 13, 14	16
Space-heating Standard Design				
Central gas furnace, 80% AFUE (minimum efficiency)[2]	**Yes**	**Yes**	N/A	**Yes**
If proposed water heating **is not** gas fired: central gas furnace, 80% AFUE	N/A	N/A	**Yes**	N/A
If proposed water heating **is** gas fired: central heat pump 8.2 HSPF or 7.5 HSPF2 (minimum efficiency)	N/A	N/A	**Yes**	N/A
Domestic Water-heating Standard Design				
One heat pump water heater, 2.0 UEF (minimum efficiency)[2]	**Yes**[3]	**Yes**	N/A	**Yes**[4]
If proposed water heating **is not** gas fired: one heat pump water heater, 2.0 UEF	N/A	N/A	**Yes**	N/A
If proposed water heating **is** gas fired: one gas or propane tankless water heater, 200 kBtuh input, 0.81 UEF (minimum efficiency)	N/A	N/A	**Yes**	N/A

AFUE = *annual fuel utilization efficiency;* ***HSPF =*** *heating seasonal performance factor;* ***UEF =*** *uniform energy factor.*

1. *Standard Design data is excerpted from the 2022 Single-family Residential Alternative Calculation Method (ACM) Reference Manual.*
2. *The Standard Design values for domestic water heating and space heating for Climate Zones 1-2, 5-12 and 15-16 do not change based on the Proposed Design.*
3. *The Standard Design in Climate Zone 1 includes compact distribution.*
4. *The Standard Design in Climate Zone 16 includes compact distribution and drain water heat recovery.*

Table 2: *2022 Single-family Performance Approach Standard Design for Space Heating and Water Heating[1]*

Performance Approach Metrics

The particular metrics used to determine Performance Approach compliance have changed over the history of the Energy Code. For the 2022 Energy Code, a new single-family home has to comply with three different energy design ratings (EDRs).

Energy Design Rating

An energy design rating (EDR) is a way to express the energy performance of a home using a scoring system where 100 represents the energy performance of a reference design building meeting the envelope requirements of the 2006 International Energy Conservation Code (IECC). A score of zero represents the energy consumption of a building that has zero net energy consumption. The lower the score, the better.

To comply with the Performance Approach, a new single-family residence must comply with Source EDR1, Efficiency EDR2 and Total EDR2 separately. This means that the Proposed Design score for each of them must be less than or equal to the Standard Design score.

Source Energy

Source energy represents the underlying energy sources such as coal, natural gas or solar used to power building systems and equipment. Source energy includes transmission, delivery and production losses. When generating electricity, different fuel types have very different carbon footprints. In the 2022 Energy Code, the CEC encourages low-carbon energy sources like solar power rather than high-carbon fuel sources like coal or natural gas, and part of that is bringing source energy use assessments into the Performance Approach.

Time Dependent Valuation Energy

Time dependent valuation (TDV) energy starts with the energy used at the building site as shown on utility bills (i.e., electricity kWh, natural gas therms, and fuel oil or LPG gallons). To convert site energy to TDV energy, the site energy for each fuel type is multiplied by a TDV multiplier. TDV multipliers vary for each hour of the year and by energy type (electricity, natural gas or propane), by Climate Zone and by building type. This reflects regional and hourly differences in the cost and availability for different energy sources. TDV energy assessments in the Performance Approach support the idea that energy efficiency measure savings have different impacts depending on when the savings occur. This helps reflect the actual costs of energy to consumers, the utility system and society.

EDR1: Source Energy

The source energy design rating EDR1 rates the building energy efficiency based on hourly source energy use for the home measured in kBtu/ft²-yr. It includes energy use for the building envelope, indoor air quality (IAQ), HVAC, water heating and unregulated loads. This new metric approximates the building's greenhouse gas (GHG) emissions to support California's GHG reduction goals.

EDR2: Efficiency

The efficiency energy design rating EDR2 rates the building energy efficiency based on hourly time dependent valuation (TDV) energy use for the home measured in kTDV/ft²-yr. It includes energy use for the building envelope, indoor air quality (IAQ), HVAC, water heating and unregulated loads.

EDR2 Total: Efficiency plus PV and Flexibility

The total energy design rating EDR2 represents the building's total hourly TDV Energy use measured in kTDV/ft²-yr factoring in solar PV and flexibility measures. It includes energy use for efficiency, PV, battery storage and precooling.

*A building complies with the Performance Approach **ONLY** if all **three compliance scores** are met. (Each Proposed Design score must be less than or equal to the Standard Design score.)*

Mixed-fuel vs. All-electric Options

High-efficiency Gas Furnace + Water Heating?

Q: If my energy consultant analyzes my new home for Energy Code compliance using the Performance Approach, can I install a gas furnace and an instantaneous gas water heater and still comply?

A: It will probably be challenging to meet EDR1 for Source Energy with both gas space and water heating, even if you use high-efficiency equipment. When sample homes in Climate Zones 3, 5, 12 and 14 (see the Preliminary Performance Studies for FAQs) were combined with a high-efficiency gas furnace (97% AFUE) and a high-efficiency instantaneous gas water heater (0.93 UEF), all of the test runs showed EDR1 Source Energy far out of compliance. This puts the whole project out of compliance.

Your energy analyst can check whether adding some combination of other efficiency measures plus battery storage and more solar PV helps to bring your home into compliance.

High-efficiency Heat Pump Space Heating + High-efficiency Gas Water Heating?

Q: How about Performance compliance for high-efficiency heat pump space conditioning plus high-efficiency instantaneous gas water heating?

A: Changing from a gas furnace to a heat pump for space heating reduces GHG pollution and improves the EDR1 source energy score.

However, because water heating is used all year long compared to space heating, having even a high-efficiency gas water heater may still be a substantial EDR1 Source Energy penalty, except in Climate Zones 3, 4, 13 and 14. If a new house in those Climate Zones has a gas water heater, it is compared to a minimum efficiency gas water heater for compliance, rather than to a heat pump water heater (Table 2).

Depending on the Climate Zone and the efficiency of the building design overall, this combination may comply.

High-efficiency Gas Furnace + NEEA Tier 3 Heat Pump Water Heating?

Q: What about Performance Approach compliance using a high-efficiency gas furnace plus a NEEA Tier 3 heat pump water heater?

A: Using a NEEA Tier 3 heat pump water heater instead of a high-efficiency gas water heater is likely to make a big improvement in the EDR1 Source Energy score. Preliminary Performance studies for a sample building that met Performance envelope and PV baselines showed EDR1 Source Energy complying with the combination of 97% AFUE gas furnace and a NEEA Tier 3 heat pump water heater. Both EDR2 Efficiency and Total scores complied, too, although the positive compliance margins were relatively small.

This set of space and water heating measures looks promising, as long as the rest of the building design is energy and carbon efficient.

Preliminary Performance Studies for FAQs

To answer these frequently asked questions, preliminary Performance studies were run for a sample home modeled in cool, coastal Climate Zones (CZs) 3 and 5 and in hot, inland CZs 12 and 14. Those CZs represent important variations in the Performance Approach Standard Design from Table 2. The test homes met Performance Standard Design requirements for the solar photovoltaic (PV) system and for the building envelope for the particular CZs. The sample buildings were modeled with different combinations of space-conditioning and water-heating systems. The exact EDR1 Source Energy results varied by CZ, especially comparing cool coastal zones to hot inland zones, but the compliance trends were similar.

Heat Pump Space Conditioning + Heat Pump Water Heating?

Q: So, if I go with both heat pump space conditioning and heat pump water heating, will my new house definitely comply with the Energy Code using the Performance Approach?

A: Choosing heat pumps for both space conditioning and water heating gives the biggest reduction in GHG pollution compared to mixed-fuel options and, therefore, the best compliance results for EDR1 Source Energy and the most promising chance at Energy Code compliance overall.

However, the Performance Approach balances the energy- and carbon-efficiency of the whole building design, so if you install heat pump equipment into an inefficient building envelope, for example, then it may cause compliance challenges.

Sample homes meeting the Prescriptive envelope and PV baseline, and with either minimum- or high-efficiency heat pumps for both space conditioning and water heating, met the EDR1 Source Energy and EDR2 Efficiency and Total goals easily.

Assuming that there is an energy- and carbon-efficient overall building design, a new home with both heat pump space and water heating is likely to comply with the Energy Code.

For More Information

CALIFORNIA ENERGY COMMISSION

www.energy.ca.gov

Learn more about the California Energy Commission (CEC) and its programs on its website.

2022 Building Energy Efficiency Standards
bit.ly/CEC2022Standards

Explore the main CEC web portal for the 2022 Energy Code, including information, documents and historical information.

2022 Energy Code Compliance Software
bit.ly/CEC-2022-Compliance-Software

Use this software when following the Performance Approach of compliance for the 2022 Energy Code for a single-family home.

Energy Code Hotline

Call: 1-800-772-3300 (Free)

Email: Title24@energy.ca.gov

Online Resource Center
bit.ly/CEC-ORC

Use these online resources developed for building and enforcement communities to learn more about the Energy Code.

ADDITIONAL RESOURCES

Reach Codes
LocalEnergyCodes.com

Collaborating with cities, counties and stakeholders to drive reach code development and adoption for long-term climate and energy efficiency benefits. View a list of adopted ordinances at www.LocalEnergyCodes.com

Energy-Smart Homes
www.caenergysmarthomes.com

Learn more about incentives for installing advanced energy measures in all-electric homes.

EnergyCodeAce™

www.energycodeace.com

Stop by this online "one-stop-shop" for no-cost tools, training and resources designed to help you comply with California's Title 24, Part 6 and Title 20.

Tools

www.energycodeace.com/tools

Explore this suite of interactive tools to understand the compliance process, required forms, installation techniques and energy efficiency regulations in California.

Reference Ace
www.energycodeace.com/content/reference-ace-2022-tool

Navigate the Title 24, Part 6 Energy Code using an index, keyword search and hyperlinked text.

Q&Ace
www.energycodeace.com/QAndAce

Search our online knowledge base or submit your question to Energy Code Ace experts.

Training

www.energycodeace.com/training

On-demand, live in-person and online training alternatives are tailored to a variety of industry professionals and address key measures.

Of Special Interest:

- 2022 Title 24, Part 6 Essentials – Residential Standards: What's New

bit.ly/ECA-training-2022-res-whats-new

Resources

www.energycodeace.com/resources

Downloadable materials provide practical and concise guidance on how and when to comply with California's building and appliance energy efficiency standards.

Of Special Interest:

Fact Sheets
bit.ly/building-fact-sheets

- Quick Reference Sheet: Residential Space Heating/Cooling and Water Heating Minimum Heating & Cooling Efficiencies
- 2022 Single-family and Low-rise Multifamily Solar and Battery Systems Fact Sheet

Check EnergyCodeAce.com for our latest 2022 tools, training and resources!

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