What are the Compliance Pathways?

In California's 2019 Building Energy Efficiency Standards (Energy Code or Title 24, Part 6), there are two parallel Prescriptive paths for compliance for low-rise residential buildings: mixed-fuel and all-electric. The mixed-fuel pathway is the route most of us are familiar with. It assumes natural gas or propane as an energy source as well as electricity for water heating and space heating. The all-electric pathway is a compliance option that no longer penalizes projects for using only electricity as an energy source for water heating and space heating. This all-electric option can be achieved by using heat-pump space and water heating along with other energy efficiency measures in new single-family and low-rise multifamily buildings, as well as low-rise residential Additions and Alterations.

Why are there two pathways in the Energy Code?

In order to assist the State of California meet its goal of reducing carbon emissions by 80% compared to 1990 levels by 2050, the Energy Code now allows for an all-electric pathway for compliance in addition to the existing mixed-fuel pathway. Doing so will allow California to take advantage of its success developing photovoltaic (PV) systems as a carbon-free energy source, while continuing to offer the flexibility of mixed-fuel options. There also are municipalities that are requiring projects to use the all-electric pathway for compliance as part of their Reach Codes. For more information and a comprehensive list of approved local ordinances, please visit localenergycodes.com.

Relevant Code Sections

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

- Section 110.0 – General Systems and Equipment
- Section 110.1 – Mandatory Requirements for Appliances
- Section 110.2 – Mandatory Requirements for Space-conditioning Equipment
- Section 110.3 – Mandatory Requirements for Service Water-heating Systems and Equipment
- Section 110.5 – Natural Gas Central Furnaces, Cooking Equipment, Pool And Spa Heaters, and Fireplaces: Pilot Lights Prohibited
- Section 110.10 – Mandatory Requirements for Solar Ready Buildings
- Section 150.0(h) – Mandatory Requirements for Space-Conditioning Equipment
- Section 150.0(i) – Mandatory Requirements for Thermostats
- Section 150.0(j) – Mandatory Requirements for Insulation for Piping and Tanks
- Section 150.0(m) – Mandatory Requirements for Air-Distribution and Ventilation System Ducts, Plenums, and Fans
- Section 150.0(n) – Mandatory Requirements for Water Heating Systems
- Section 150.0(o) – Mandatory Requirements for Ventilation and Indoor Air Quality
- Section 150.1(a) – Basic Requirements for Low-Rise Residential Buildings
- Section 150.1(b) – Performance Approach for Low-Rise Residential Buildings
- Section 150.1(c) – Prescriptive Approach for Low-Rise Residential Buildings

Compliance Pathways

Mandatory Measures

Mandatory measures must be met regardless of the compliance approach. For the Mandatory requirements for HVAC and domestic hot water (DHW) systems, a design must comply with the requirements listed in Sections 110.0 - 110.3 and 150.0. These Mandatory measures include requirements for load calculations, controls, installation and testing.

Prescriptive Approach

The Prescriptive Approach is the more rigid pathway, in which each requirement must be met as a stand-alone feature, not allowing for Performance trade-offs between features. Prescriptive measures include requirements based on technology used and the project's Climate Zone. Minimum performance levels of HVAC and DHW equipment listed in §150.1 and §150.2 cannot be traded off with other building components when pursuing the Prescriptive Approach. In the 2019 Energy Code, Tables 150.1-A and B now include a Prescriptive heat pump water heating option along with heat pumps for space heating Climate Zone requirements in addition to existing gas equipment options for mixed-fuel homes.

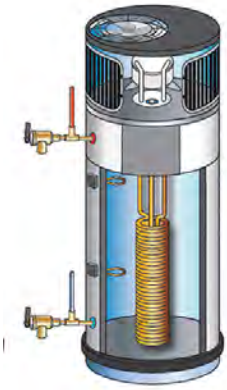
Performance Approach

The Performance Approach is considered the most flexible compliance method. It can be used to analyze and demonstrate compliance for buildings that do not comply with the Prescriptive method. For this Approach in residential applications, the CF1R-PRF-01-E form is used document the fuel type used for HVAC systems and water heating. For both all-electric and mixed-fuel or gas systems, the Performance Approach allows trade-offs when Prescriptive requirements cannot be met and another system can make up the deficit, which allows the project to comply overall. To achieve compliance credit in the Performance Approach, the proposed building must show Time Dependent Valuation (TDV) savings when compared to the Standard Reference Design as defined by the Residential Alternative Calculation Method (ACM) Reference Manual.

There is a Standard Reference Design for each all-electric, and mixed-fuel or gas fuel type. If the proposed building is all electric, it will be measured against an electric heat pump for space heating and electric heat pump water heater for DHW. If the proposed building is mixed-fuel or gas, it will be measured against a gas furnace for space heating and an instantaneous gas water heater for DHW, as described in Table 1.

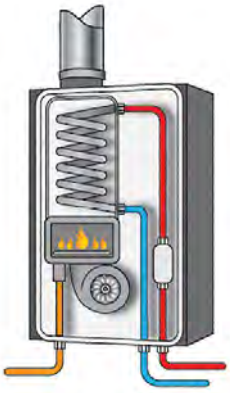
	All-Electric Standard Reference Design	Mixed-fuel Standard Reference Design
Space Heating	8.2 HSPF heat pump with ducts in attic	80% AFUE furnace
Water Heating	2.0 UEF electric heat pump located in garage with compact distribution credit	0.81 UEF gas tankless water heater

Table 1. Standard Reference Design Comparison



ENERGY CODE ACE

Electric Heat Pump Water Heater with Tank



ENERGY CODE ACE

Gas Tankless Water Heater

Table 2 provides a summary of compliance pathways by fuel source for building features in newly constructed residential buildings under the 2019 Energy Code.

Compliance Pathways for Features in Newly Constructed Buildings: 2019 Energy Code				
Building Feature	**Fuel Source**	**Mandatory**	**Prescriptive**	**Performance**
Heating	All Electric	**Sections 110.2 and 150.0** • Electric heat pump efficiency is dependent on the type, size and rating as shown in Table 110.2-B. • Ducted systems must meet duct insulation, HERS testing and MERV-13 filter requirements. • All heating or cooling systems not controlled by a central energy management control system (EMCS) must have a setback thermostat.	**Section 150.1(c)** • System airflow rates need field verification and diagnostic testing in accordance with all applicable procedures specified in Residential Reference Appendix RA3.3 or an approved alternative procedure as specified by Residential Reference Appendix RA1. • Electric resistance heating is not allowed unless it is used as a supplemental heating unit in a space served directly or indirectly by a primary heating system, provided that the unit thermal capacity does not exceed 2 kW or 7,000 Btuh and is controlled by a time-limiting device not exceeding 30 minutes.	**Section 150.1(b)** • When Performance compliance requires installation of a heat pump system, the heating capacity values must be field verified as specified in Residential Reference Appendix RA3.4.4.2. • Compliance credits apply to variable capacity heat pumps when installed per credit criteria and verified by a HERS Rater. • A large reduction in Time Dependent Valuation (TDV) savings will be associated with using electric resistance heating.
	Mixed Fuel	**Sections 110.2 and 150.0** • Ducted systems must meet duct insulation, HERS testing and MERV-13 filter requirements. • All heating or cooling systems not controlled by an EMCS must have a setback thermostat.	**Section 150.1(c)** • System airflow rates need field verification and diagnostic testing in accordance with all applicable procedures specified in RA3.3 or an approved alternative procedure as specified by RA1.	**Section 150.1(b)** • There is compliance credit for using more efficient equipment than the minimum requirements.
Air Conditioning	All Electric	**Section 150.0(i)** • All heating or cooling systems not controlled by a central EMCS must have a setback thermostat. • Efficiency requirements are dictated by Table C-3 of Title 20, Section 1605.1(c) appliance efficiency regulations.	**Section 150.1(c)** • The system must have measurement access holes (MAH). • The system airflow rate must be confirmed through field verification and diagnostic testing either to be 250cfm per ton for small duct high velocity systems: or 350 cfm/ton for all other air-cool air conditioners and air-source heat pumps. • The installer must charge the system according to the manufacturer's specifications through one of the three following options: – The installer and HERS Rater perform the standard charge procedure as specified by Residential Reference Appendix RA3.2.2. – The system is equipped with a fault indicator display (FID) device that meets the specifications of Joint Reference Appendix JA6 and verified by the installer and HERS Rater. – The installer performs the weigh-in charging procedure as specified by Residential Reference Appendix RA3.2.3.1, and then it is verified by the HERS Rater.	**Section 150.1(b)** • Air conditioners installed with higher-than-minimum efficiency ratings require a HERS Rater to verify ratings to receive compliance credit.
	Mixed Fuel	Not Applicable	Not Applicable	Not Applicable

Compliance Pathways for Features in Newly Constructed Buildings: 2019 Energy Code				
Building Feature	**Fuel Source**	**Mandatory**	**Prescriptive**	**Performance**
Water Heating	All Electric	**Sections 110.3 and 150.0(n)** • All applicable Mandatory requirements are listed in Sections 110.3 and 150.0(n). – Water heating recirculation loops serving multiple dwelling units must meet the requirements of Section 110.3(c)4 – Solar water-heating systems and collectors must be certified and rated by the Solar Rating and Certification Corporation (SRCC), the International Association of Plumbing and Mechanical Officials, Research and Testing (IAPMO R&T), or by a listing agency that is approved by the Executive Director. – Instantaneous water heaters with an input rating greater than 2kW must meet the requirements of Section 110.3(c)6.	**Section 150.1(c)** The water heating system cannot be electric resistance and must meet one of the following: • One Northwest Energy Efficiency Alliance (NEEA) Tier 3 or higher heat pump water heater located in the garage or conditioned space. Climate Zones 1 and 16 also must have a: – PV system sized 0.3kWdc larger than required in Section 150.1(c)14 OR – Compact hot water distribution system (HERS verified) • One heat pump water heater located inside the building (i.e., garage, dwelling, basement), plus: – A compact hot water distribution system (HERS verified) OR – In Climate Zones 2 -15, a PV system sized 0.3kWdc larger than required in Section 150.1(c)14 OR – In Climate Zones 1 and 16, a PV system sized 1.1kWdc larger than the required in Section 150.1(c)14.	• A large reduction in TDV savings will be associated with using electric resistance water heating. **Compliance credits:** • HERS-verified compact hot water distribution system (if not being used as an alternative to a gas tank system) • HERS-verified insulated hot water pipes (if not being used as an alternative to a gas tank system) • Solar hot water panels • Geothermal heat pump systems
	Mixed Fuel	**Section 150.0(n)** For systems that use gas or propane to serve individual dwelling units, the following must be included: • A Category III or IV vent, or a Type B vent, with straight pipe between the outside termination and the space where the water heater is installed • A condensate drain that is no more than 2 inches higher than the base of the installed water heater, and allows natural draining without pump assistance • A gas supply line with a capacity of at least 200,000 Btu/h • Systems using gas or propane water heaters to serve individual dwelling units must install electrical infrastructure including: – A dedicated 125 volt, 20 amp electrical receptacle that is connected to the electrical panel with a 120/240 volt 3 conductor, – 10 AWG copper branch circuit within 3 feet of the water heater and accessibility to it – Both ends of the unused conductor must be labeled "spare" and be electrically isolated – A reserved single-pole circuit breaker space labeled "Future 240V Use"	**Section 150.1(c)** A gas or propane water heating system that serves an individual dwelling unit must meet one of the following: • One or more gas or propane instantaneous water heaters with 200,000 Btu/h maximum input • One (1) 55 gallon or less storage gas or propane water heater with 75,000 Btu/h maximum input, plus installed fenestration products with a weighted average U-factor 0.24 maximum and one of the following: – Compact hot water distribution system (HERS verified) – Drain water heat recovery system (HERS verified) • For systems serving multiple dwelling units, a central water-heating system must meet the Executive Director Determination dated December 26, 2019 until a time in which additional Performance compliance options are made available by the Energy Commission.	**Compliance credits:** • High efficiency gas tankless system (exceeding Mandatory equipment efficiencies) • Combined hydronic DHW and space heating systems • Drain water heat recovery

Compliance Pathways for Features in Newly Constructed Buildings: 2019 Energy Code				
Building Feature	**Fuel Source**	**Mandatory**	**Prescriptive**	**Performance**
Photovoltaics	All-Electric and Mixed-Fuel	**Section 150.1(c)14** • PV panels are required to meet orientation, shading, system monitoring and interconnection requirements.	**Section 150.1(c)14** • All low-rise residential buildings must have a photovoltaic (PV) system. – Minimum requirements in Joint Reference Appendix JA11 – Minimum sizing determined by Equation 150.1-C Exceptions are related to solar access, Climate Zones, dwelling units and battery storage systems.	**Section 150.1(b)** • If solar electricity is generated onsite, this can be deducted from the Total Energy Design Rating (EDR) which helps when reaching compliance. • If it is a community shared PV system, there are specific exemptions such as energy bill reduction or utility credits that will not let the project take credit for the PV system in the Performance Approach. **Compliance credits:** • Qualifying battery backup systems

Table 2. Compliance Pathways for Features in Newly Constructed Buildings: 2019 Energy Code

Additions and Alterations

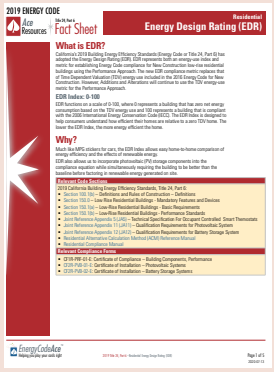
For Additions, there are slight differences called out between the all-electric and mixed-fuel pathways. Section 150.2(a)1D states that when adding a second water heater, the requirements of Section 150.1(c)8 must be followed per the water heater's fuel source.

For Alterations, the 2019 Energy Code allows existing space heating systems that have natural gas or LPG as a fuel type to be replaced with a heat pump, as stated in the exceptions to Sections 150.2(b)1Cii and 150.2(b)1G.

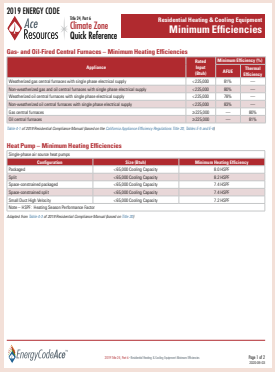
Per Section 150.2(b)1H, water heating systems must be one of the following:

- Fueled by natural gas or propane if there is a gas connection OR
- For Climate Zones 1-15, a single heat pump water heater OR
- A consumer electric water heater if there is no gas connection OR
- A water heating system that is determined by the Executive Director of the Energy Commission to use less energy than a gas or electric water heater

If a single heat pump water heater is chosen and the project is in Climate Zones 1 - 15, the simplest way to comply with the Energy Code is to install a water heater that meets the NEEA Advanced Water Heater Specification Tier 3 or higher. If a heat pump water heater is selected that does not meet this specification, it must then be placed on an incompressible rigid insulated surface with a minimum R-value of R-10 and have a communication interface per Section 110.12(a). If a heat pump water heater is installed, the storage tank cannot be installed outdoors.



For more information on the Performance Approach and PV requirements, see the Energy Code Ace fact sheet on Energy Design Rating (EDR) 2019.



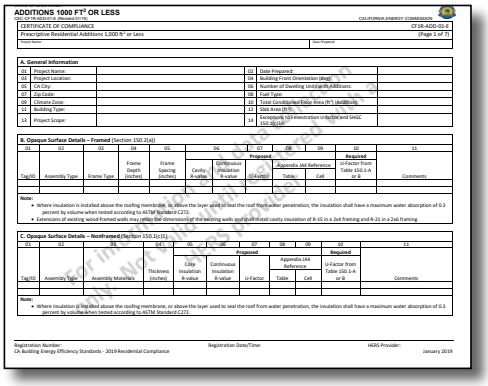
For a quick view of heat pump, furnace, air conditioner and water heater minimum efficiencies, see the Energy Code Ace Quick Reference Sheet on Residential Minimum Heating & Cooling Efficiencies 2019.

Forms- Which and When

During Design

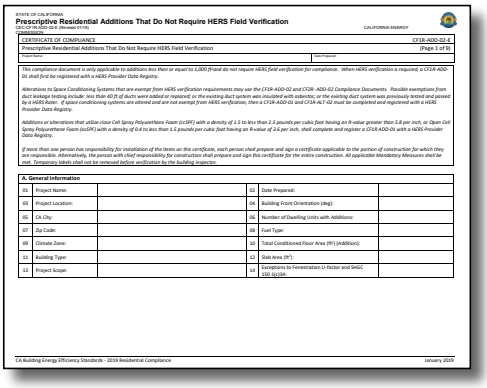
Whether the project is classified as an Addition or as New Construction determines which CF1R forms are required. All forms must be completed through compliance software (CF1R-PRF-01-E) or through the HERS Provider's registry and must be submitted to the building department during permit application.

- CF1R-PRF-01-E: Certificate of Compliance, Building Components, Performance
  - Used to show compliance for the Performance Approach
- CF1R-ADD-01-E: Certificate of Compliance, Prescriptive Additions < 1000 ft^2
  - Used to show compliance when HERS verification is required
- CF1R-ALT-01-E: Certificate of Compliance, Prescriptive Alterations
  - Used to show compliance when HERS verification is required
- CF1R-ALT-02-E: Certificate of Compliance, Prescriptive Alterations to Space Conditioning Systems
  - Used to show compliance when HERS verification is required
- CF1R-NCB-01-E: Certificate of Compliance, Prescriptive New Construction
  - Used to show compliance when HERS verification is required
- CF1R-ADD-02-E: Certificate of Compliance, Prescriptive Additions
  - Used to show compliance when HERS verification is not required
- CF1R-ALT-05-E: Certificate of Compliance, Prescriptive Alterations
  - Used to show compliance when HERS verification is not required


ADDITIONS 1000 FT² OR LESS

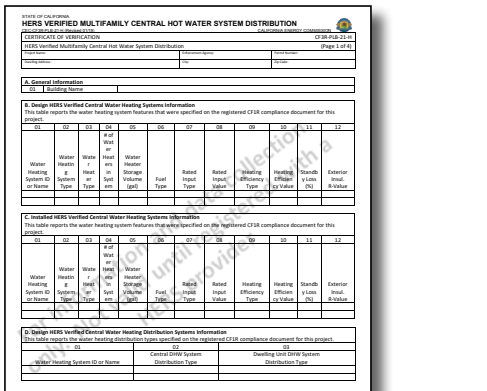
CERTIFICATE OF COMPLIANCE

Prescriptive Residential Additions 1,000 ft² or Less


Prescriptive Residential Additions That Do Not Require HERS Field Verification

CERTIFICATE OF COMPLIANCE

Prescriptive Residential Additions That Do Not Require HERS Field Verification


HERS VERIFIED MULTIFAMILY CENTRAL HOT WATER SYSTEM DISTRIBUTION

CERTIFICATE OF VERIFICATION

HERS Verified Multifamily Central Hot Water System Distribution

During Construction

CF2R documents demonstrate installations are compliant with the Energy Code at the time of construction and should be submitted by the installer to the inspector. For projects requiring HERS verification, CF3R forms are completed by the HERS Rater and also submitted to the inspector.

- CF3R-PLB-21-H: Certificate of Verification- HERS Multifamily Central Hot Water System Distribution
- CF3R-PLB-22-H: Certificate of Verification - HERS Single Dwelling Unit Hot Water System Distribution
- CF3R-MCH-25-H: Certificate of Verification - Rated Space Conditioning Equipment Verification
- CF3R-MCH-33-H: Certificate of Verification - Variable Capacity Heat Pump Compliance Credit
- CF2R-ADD-02-E: Certificate of Installation - Additions less than 1000 ft^2
- CF2R- PVB-01-E: Certificate of Installation - Photovoltaic Systems
- CF2R- PVB-02-E: Certificate of Installation - Battery Storage Systems
- CF2R-MCH-25: Certificate of Installation - Refrigerant Charge
- CF2R-MCH-26: Certificate of Installation - Rated Space Conditioning Equipment
- CF2R-MCH-33: Certificate of Installation - Variable Capacity Heat Pump Compliance Credit

New Terms

- ALL-ELECTRIC BUILDING: a building that has no natural gas or propane plumbing installed within the building and that uses electricity as the source of energy for its space heating, water heating, cooking appliances, and clothes drying appliances.
- ELECTRIC RESISTANCE HEATING: the production of heat by passing electric current through a resistive element.
- HEAT PUMP: an appliance, that consists of one or more assemblies; that uses an indoor conditioning coil, a compressor and a refrigerant-to-outdoor air heat exchanger to provide air heating; and that may also provide air cooling, dehumidifying, humidifying, circulating, or air cleaning.

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 110.0 – General Systems and Equipment
  energycodeace.com/site/custom/public/reference-ace-2019/Documents/section1100systemsandequipmentgeneral.htm
- Energy Code Section 110.2 – Mandatory Requirements for Space-conditioning Equipment
  energycodeace.com/site/custom/public/reference-ace-2019/Documents/section1102mandatoryrequirementsforspaceconditioningequipment.htm
- Energy Code Section 110.3 – Mandatory Requirements for Service Water-heating Systems and Equipment
  energycodeace.com/site/custom/public/reference-ace-2019/Documents/section1103mandatoryrequirementsforservicewaterheatingsystemsand.htm
- Energy Code Section 110.5 – Natural Gas Central Furnaces, Cooking Equipment, Pool And Spa Heaters, and Fireplaces: Pilot Lights Prohibited
  energycodeace.com/site/custom/public/reference-ace-2019/Documents/section1105naturalgascentralfurnacescookingequipmentpoolandspahe.htm
- Energy Code Section 110.10 – Mandatory Requirements for Solar Ready Buildings
  energycodeace.com/site/custom/public/reference-ace-2019/Documents/section11010mandatoryrequirementsforsolarreadybuildings.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 150.0(h) – Mandatory Requirements for Space-Conditioning Equipment
  energycodeace.com/site/custom/public/reference-ace-2019/Documents/section1500mandatoryfeaturesanddevices.htm
- Energy Code Section 150.0(i) – Mandatory Requirements for Thermostats
  energycodeace.com/site/custom/public/reference-ace-2019/Documents/section1500mandatoryfeaturesanddevices.htm
- Energy Code Section 150.0(j) – Mandatory Requirements for Insulation for Piping and Tanks
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- Energy Code Section 150.0(m) – Mandatory Requirements for Air-Distribution and Ventilation System Ducts, Plenums, and Fans
  energycodeace.com/site/custom/public/reference-ace-2019/Documents/section1500mandatoryfeaturesanddevices.htm
- Energy Code Section 150.0(n) – Mandatory Requirements for Water Heating Systems
  energycodeace.com/site/custom/public/reference-ace-2019/Documents/section1500mandatoryfeaturesanddevices.htm
- Energy Code Section 150.0(o) – Mandatory Requirements for Ventilation and Indoor Air
  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 Section 150.1(c) – Low-Rise Residential Buildings - Prescriptive Standards
  energycodeace.com/site/custom/public/reference-ace-2019/Documents/section1501performanceandprescriptivecomplianceapproachesforlowr.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

California Energy Commission Information & Services

Title 24, Part 6

- Energy Code Hotline: 1-800-772-3300 (Free) or Title24@energy.ca.gov
- Online Resource Center:
  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:
  energy.ca.gov/programs-and-topics/programs/home-energy-rating-system-hers-program

Title 20 - Appliance Efficiency Regulations

- Title 20 sets minimum efficiency levels for energy and water consumptions in production, such as electronic, household appliances and plumbing equipment. For a variety of equipment the Energy Code references Title 20 for certification requirements per Section 110.0(b).
  energy.ca.gov/rules-and-regulations/appliance-efficiency-regulations-title-20
- Modernized Appliance Efficiency Database (MAEDbS):
  https://cacertappliances.energy.ca.gov/Login.aspx

Additional Resources

- 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:
    Forms Ace
    energycodeace.com/content/tools-ace/tool=forms-ace
    - Identify and print the forms you need for your project. And for 2019 NRCC forms, use the Virtual Compliance Assistant to help you complete your forms online and verify compliance.

    Fact Sheets
    energycodeace.com/content/resources-fact-sheets/
    - What's New In 2019 Residential Energy Code
    - What's Changed for 2019 – Low-Rise Residential
    - Energy Design Rating (EDR) – Residential
    - Quick Reference Sheet: Residential Minimum Heating & Cooling Efficiencies 2019

    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
    - Residential Plans Examiner Checklist 2019
    - Residential Building Inspector Checklist 2019

    Application Guides
    energycodeace.com/content/resources-ace/file_type=application-guide
    - Residential HVAC and Plumbing 2019
    - Residential Envelope, Solar Ready and PV 2019

    Please register with the site and select an industry role for your profile in order to receive messages about all our free offerings!

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