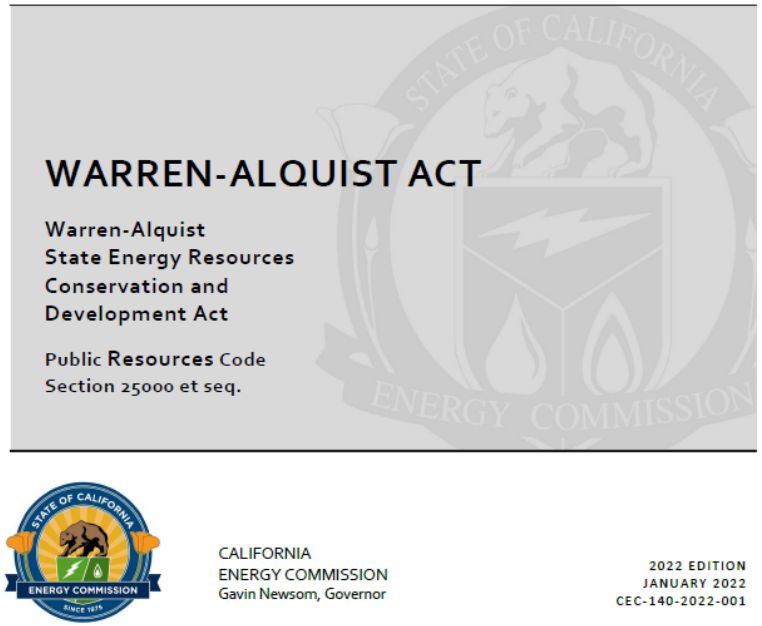
2022 Energy Code
Water Heating – Single Family

Title: 2022 Energy Code, Single-Family Water Heating Overview

Presenter: Allen Wong, Associate Energy Specialist

2022 Energy Code Basics

Energy Code History

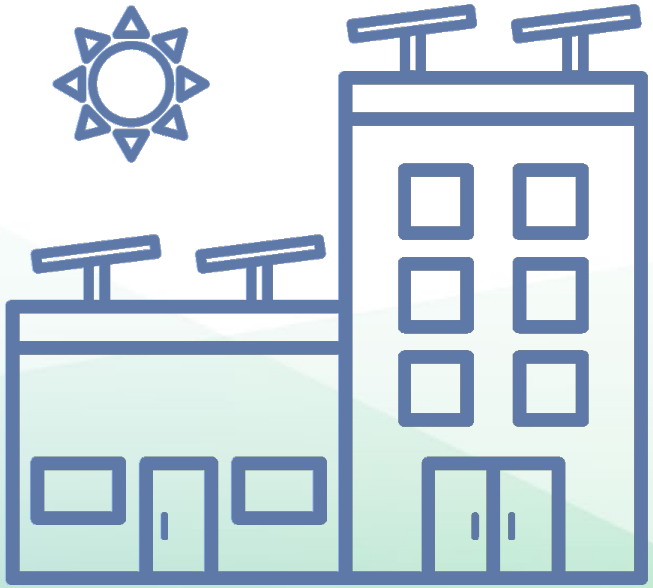


Warren-Alquist Act established CEC in 1974

- Authority to develop and maintain Building Energy Efficiency Standards (Energy Code)
- Requires CEC to update periodically, usually every 3 years
- Requires Energy Code to be cost-effective over economic life of building

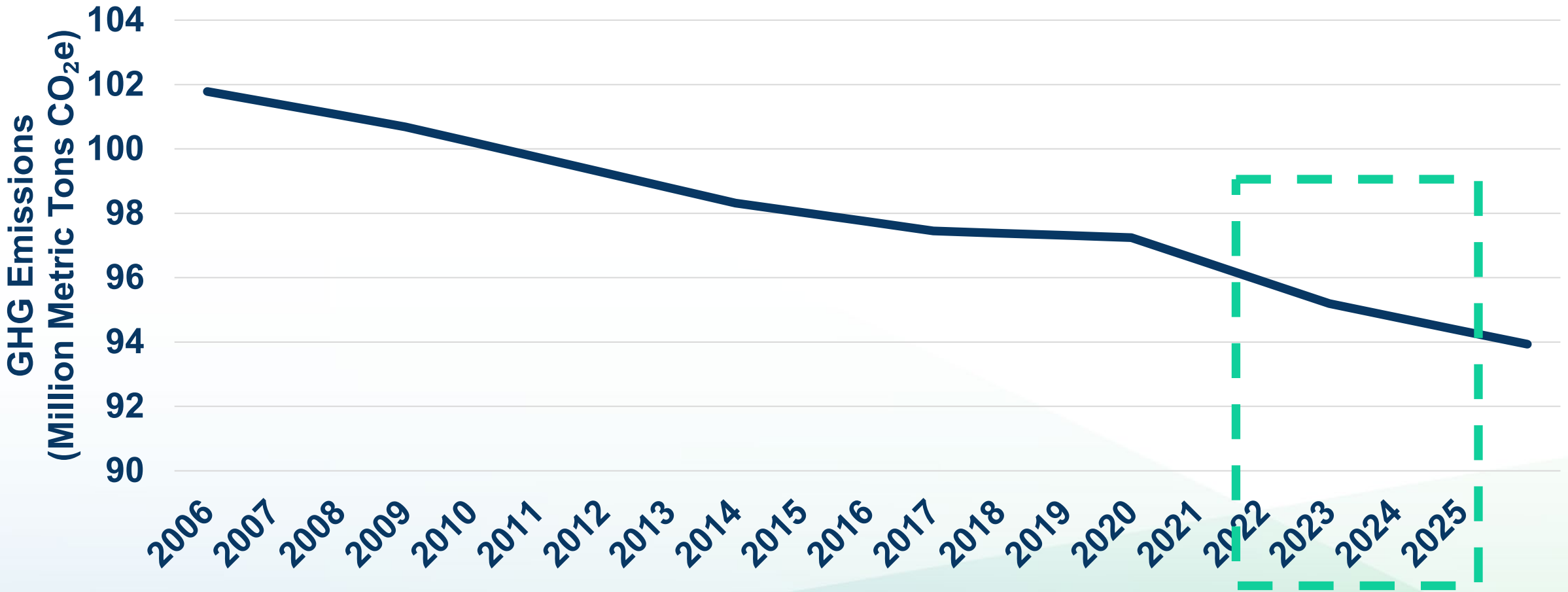
2022 Energy Code Goals

- Increase building energy efficiency cost-effectively
- Contribute to California's greenhouse gas (GHG) reduction goals
- Encourage pathways for all-electric buildings
- Reduce residential building impacts on the electricity grid
- Promote demand flexibility and self-utilization of photovoltaic (PV)
- Provide tools for local government reach codes



Energy Code Environmental Benefit

Reduced Statewide Emissions

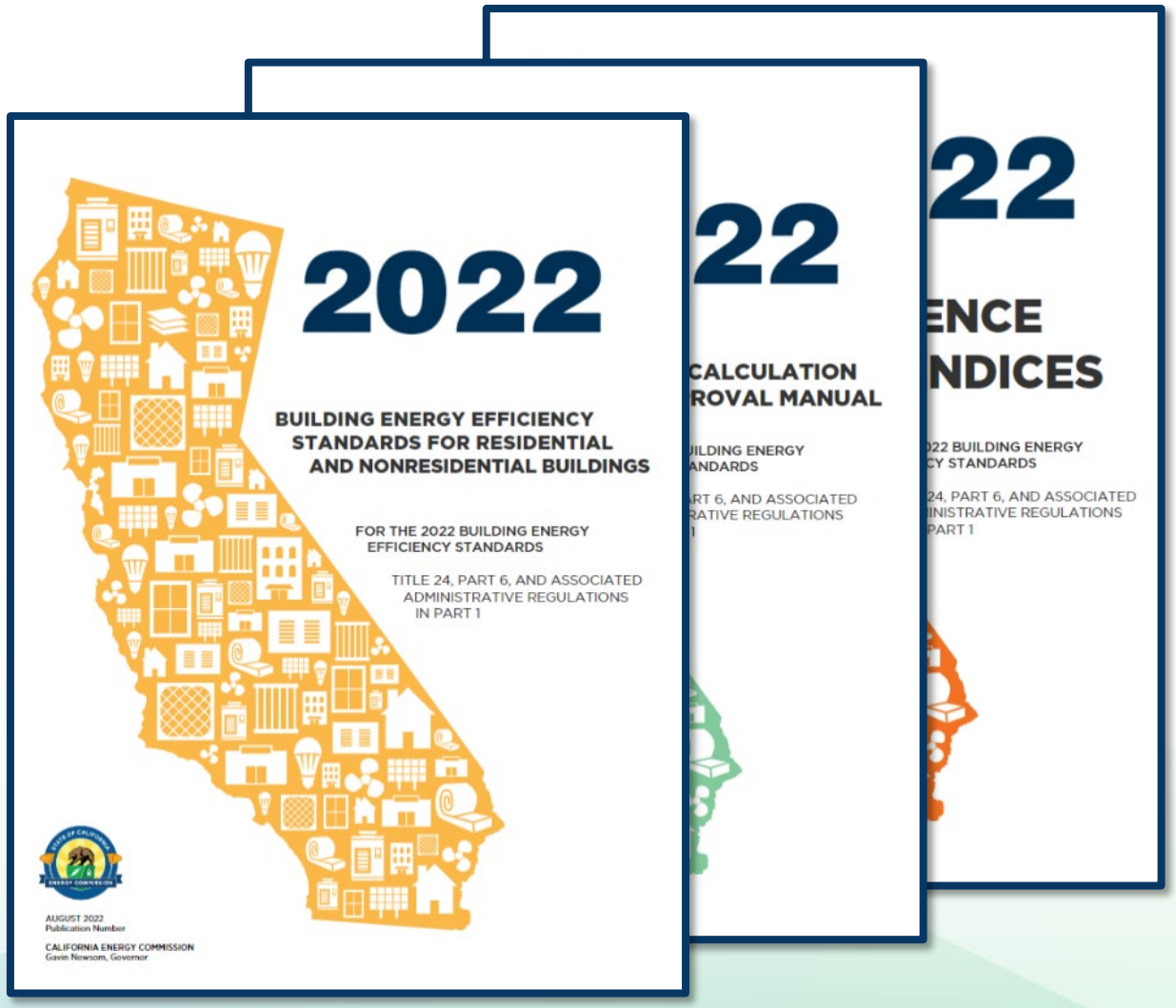


Source: CEC Impact Analysis 2005, 2008, 2013, 2016, 2019, 2022

2022 Energy Code

Effective January 1, 2023

- Building permit applications submitted on or after Jan 1, 2023
- Must use 2022 tools
  - Software
  - Forms



Energy Code Requirements

Mandatory requirements

- Minimum efficiency requirements must always be met
- Can never trade off

Prescriptive requirements

- Predefined efficiency requirements
- May supersede mandatory requirements
- Different requirements for newly constructed buildings, additions, and alterations

Compliance Approaches

Prescriptive approach

- Simple approach, no trade-offs
- Defines the standard building design
- 2022 heat pump baselines

Performance approach

- Most flexible approach, allows for trade-offs
- Must meet all mandatory requirements
- Requires the use of CEC-approved software
- Proposed building design meets or exceed standard building design

2022 Performance Metrics

New for 2022

Energy performance calculations

- Single-family
  - EDR1: hourly source energy
  - EDR2: time dependent valuation (TDV)
    - Efficiency EDR, PV + flexibility EDR, total EDR

2022 Compliance Software

- **Performance approach must use approved compliance software versions**
  - Single-family
    - CBECC 2022.3.0
    - Energy Pro 9.1
    - Wrightsoft Right-Energy Title 24 Version 2022.2.0

Why Do We Have Water Heating Energy Standards?

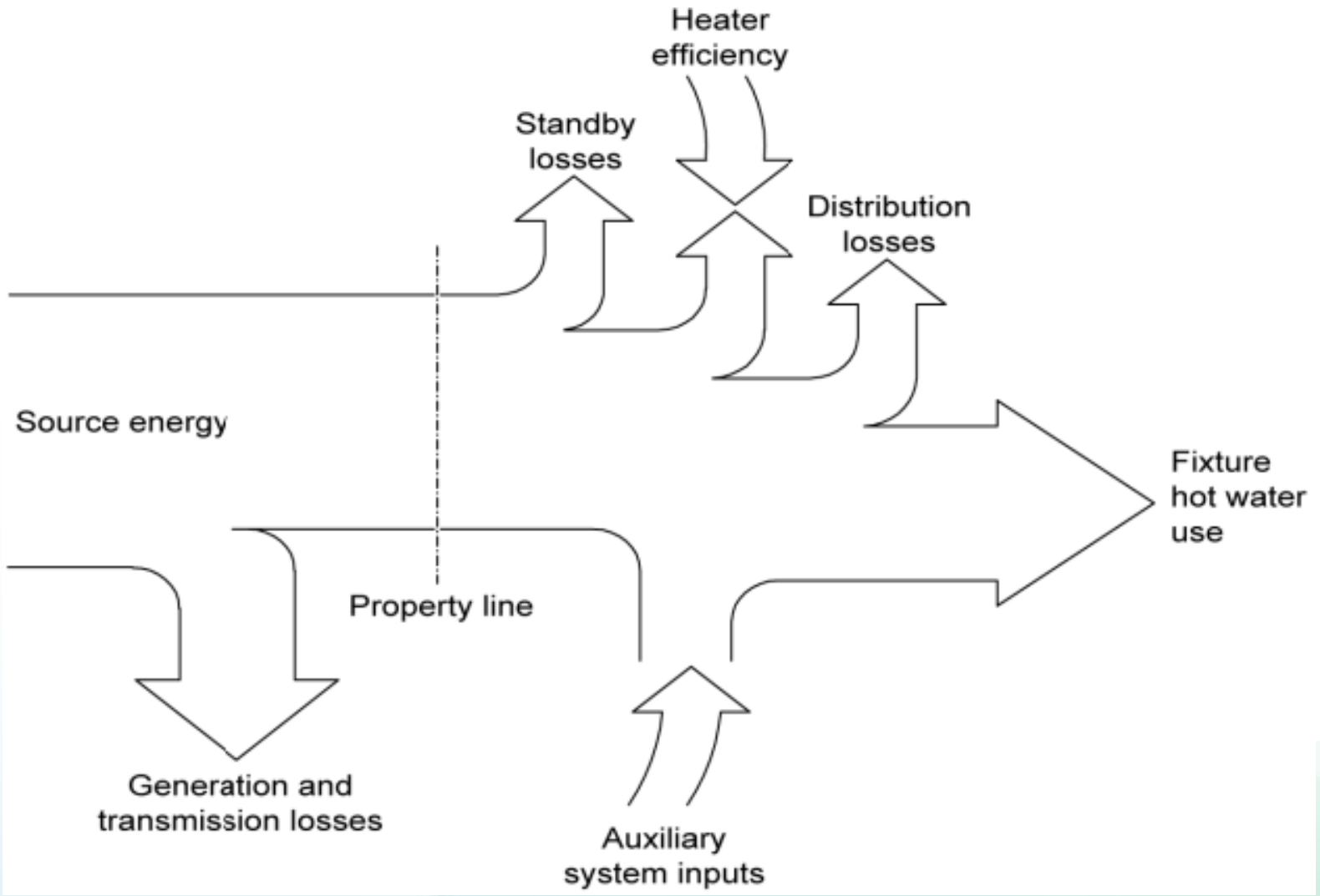


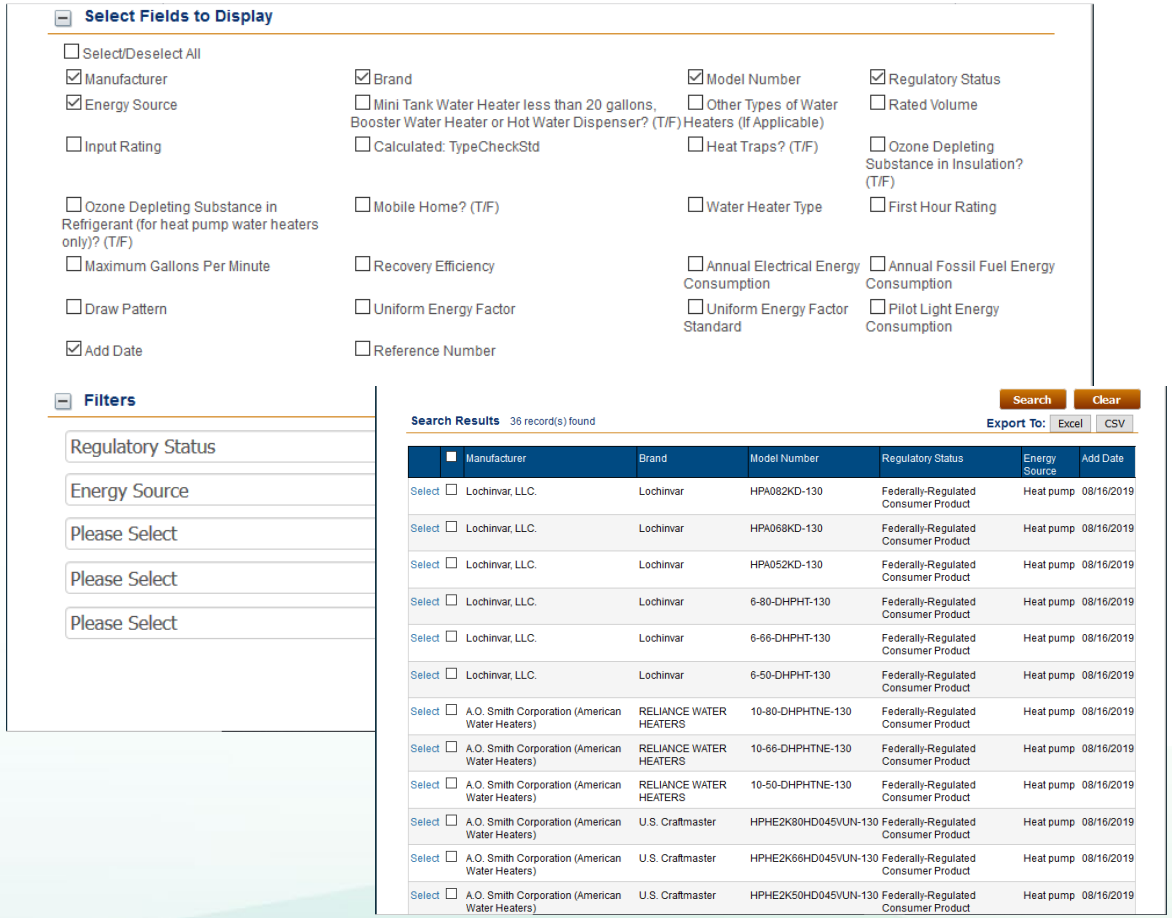
Table 100.0-A, Single Family

	Mandatory	Prescriptive	Performance
New Constructed Buildings	110.3 150.0(j)&(n)	150.1(c)8	150.1(b)
Additions	110.3 150.0(j)&(n)	150.2(a)&(a)1D	150.2(a)2
Alterations	110.3 150.0(j)	150.2(b)1&(b)1H	150.2(b)2

Mandatory Requirements – All Occupancies §§110.1 & 110.3

§110.1(a)&(b) - Mandatory Requirements; Appliances

- Water heaters must meet Title 20 minimum efficiencies (Title 20, §1605.1) to be installed
- Verify efficiency via
  - MAEDbS database
  - Equivalent federal directory, or
  - Approved trade association directory



Look up appliances on the Modernized Appliance Efficiency Database

§110.1(c) - Mandatory Requirements; Appliances

If efficiency can't be verified for these reasons, assume mandatory efficiency or follow CEC-approved procedures when:

1. Unavailable data
2. No field testing method approved by the CEC
3. Field modification
4. DOE testing waiver, but no way to determine efficiency

§110.3(a)&(b) – Mandatory Requirements; Service Water-Heating Equipment

- Water heating equipment must meet/have:
  - Manufacturer certification as meeting §110.3
  - All Title 20 requirements (§1605.1(f)):
    1. All listed standards
    2. All listed test methods
    3. All requirements for all functions
    4. Min/max rated capacity must be made possible by controls at steady-state operation

§110.3(c)2&3 - Mandatory Requirements; Service Water-Heating Installation

- Systems with circulation pumps or heat trace – must have auto-off capability
- Unfired tanks and solar water heating backup tanks – must meet one of the following:
  - Insulation (external R ≥ 3.5; internal + external R ≥ 16)
  - Tank surface heat loss rating < 6.5 Btu/h-ft^2 (based on water-air temperature difference of 80°F)

§110.3(c)5

State buildings – Water heating energy must be at least 60% site solar or recovered energy

§110.3(c)6

- Instantaneous (“tankless”) water heaters > 6.8 kBtu/h (2 kW) shall have isolation valves on both water lines, with fittings for maintenance flushing

Source: homedepot.com

Mandatory Requirements §150.0(j)&(n)

§150.0(j) – Insulation

1. Piping must be insulated as follows:
   A. All domestic hot water piping – meet California Plumbing Code §609.11
   B. Solar water-heating collector loop pipes; hydronic heating distribution piping:
      - Insulate recirculating system piping, first 8-ft of hot and cold outlet piping (if non-recirculating storage system), and externally heated pipes
      - Insulation must either meet thickness or R-value from Table 120.3-A or §120.3(c)2 equation
2. Pipe insulation must be protected per §120.3(b) :
   – Exposed to weather – outdoor-suitable cover (water retardant, shields from solar radiation). Adhesive tape *cannot be used* for this protection.
   – Buried below grade - waterproof and non-crushable casing/sleeve

Table 120.3-A

Fluid Operating Temperature Range (°F)	Insulation Conductivity			Nominal Pipe Diameter (in inches)				
	Conductivity (in Btu·in/h·ft²·°F)	Mean Rating Temperature (°F)		< 1	1 to <1.5	1.5 to < 4	4 to < 8	8 and larger
Space heating and Service Water Heating Systems (Steam, Steam Condensate, Refrigerant, Space Heating, Service Hot Water)				Minimum Pipe Insulation Required (Thickness in inches or R-value)				
Above 350	0.32-0.34	250	Inches	4.5	5.0	5.0	5.0	5.0
			R-value	R 37	R 41	R 37	R 27	R 23
251-350	0.29-0.32	200	Inches	3.0	4.0	4.5	4.5	4.5
			R-value	R 24	R 34	R 35	R 26	R 22
201-250	0.27-0.30	150	Inches	2.5	2.5	2.5	3.0	3.0
			R-value	R 21	R 20	R 17.5	R 17	R 14.5
141-200	0.25-0.29	125	Inches	1.5	1.5	2.0	2.0	2.0
			R-value	R 11.5	R 11	R 14	R 11	R 10
105-140	0.22-0.28	100	Inches	1.0	1.5	1.5	1.5	1.5
			R-value	R 7.7	R 12.5	R 11	R 9	R 8

- Example:
  - 4-in., diameter
  - Fluid temperature for service water heating:105°F – 140°F
  - Pipe insulation conductivity of 0.27 Btu-in./hr-sqft-°F
  - ***Insulate to 1.5-in. thick or R-9***

Equation (§120.3(c)2)

If your insulation has conductivity range not in TABLE 120.3-A, use this equation to

calculate the thickness: $T = PR\left[\left(1 + \left(\frac{t}{PR}\right)\right)^{\frac{K}{k}} - 1\right]$

T = minimum insulation thickness, for material with conductivity K (inches)

PR = pipe outer radius (inches)

t = insulation thickness, from Table 120.3-A (inches)

K = conductivity of alternate material at mean rating temperature in Table 120.3-A for applicable fluid temperature range (Btu-in./h-ft^2-°F)

k = lower value of conductivity range in Table 120.3-A for the applicable fluid temperature range (Btu-in./h-ft^2-°F)

Using Equation (§120.3(c)2), Example

What is the required thickness for insul. with a conductivity (from the mfr. spec at 200°F) of 0.40 Btu-in./h-ft²-°F on a 4" dia. pipe carrying 300°F fluid?

PR = 2"

t = 4.5" (from the table – 4" pipe, 300°F)

K = 0.40 (Btu-in.)/(h-ft²-°F) (from mfr. spec at 200°F)

k = 0.29 (Btu-in.)/(h-ft²-°F) (the lower value of the range for 300°F fluid)

TABLE 120.3-A PIPE INSULATION THICKNESS

Fluid Operating Temperature Range (°F)	Insulation Conductivity: Conductivity (in Btu·in/h·ft²·°F)	Insulation Conductivity: Mean Rating Temperature (°F)		Nominal Pipe Diameter (in inches): < 1	1 to <1.5	1.5 to < 4	4 to < 8	8 and larger
Space heating and Service Water Heating Systems (Steam, Steam Condensate, Refrigerant, Space Heating, Service Hot Water)				Minimum Pipe Insulation Required (Thickness in inches or R-value)				
Above 350	0.32-0.34	250	Inches	4.5	5.0	5.0	5.0	5.0
			R-value	R 37	R 41	R 37	R 27	R 23
251-350	0.29-0.32	200	Inches	3.0	4.0	4.5	4.5	4.5
			R-value	R 24	R 34	R 35	R 26	R 22

$$T = 2\left[1 + \left(\frac{4.5}{2}\right)^{\frac{0.4}{0.29}} - 1\right] = 8.2"$$

§150.0(j)1 – Pipe Insulation, Exceptions

Piping meeting these conditions do not require pipe insulation:

2. Penetrating framing members, throughout penetration
    - Metal pipes penetrating metal framing require tight-fitting insulation to prevent metal-to-metal contact.
3. In walls meeting Quality Insulation Installation (QII) requirements (RA3.5)
4. Surrounded with 1” of wall, 2” of crawlspace, or 4” of attic insulation

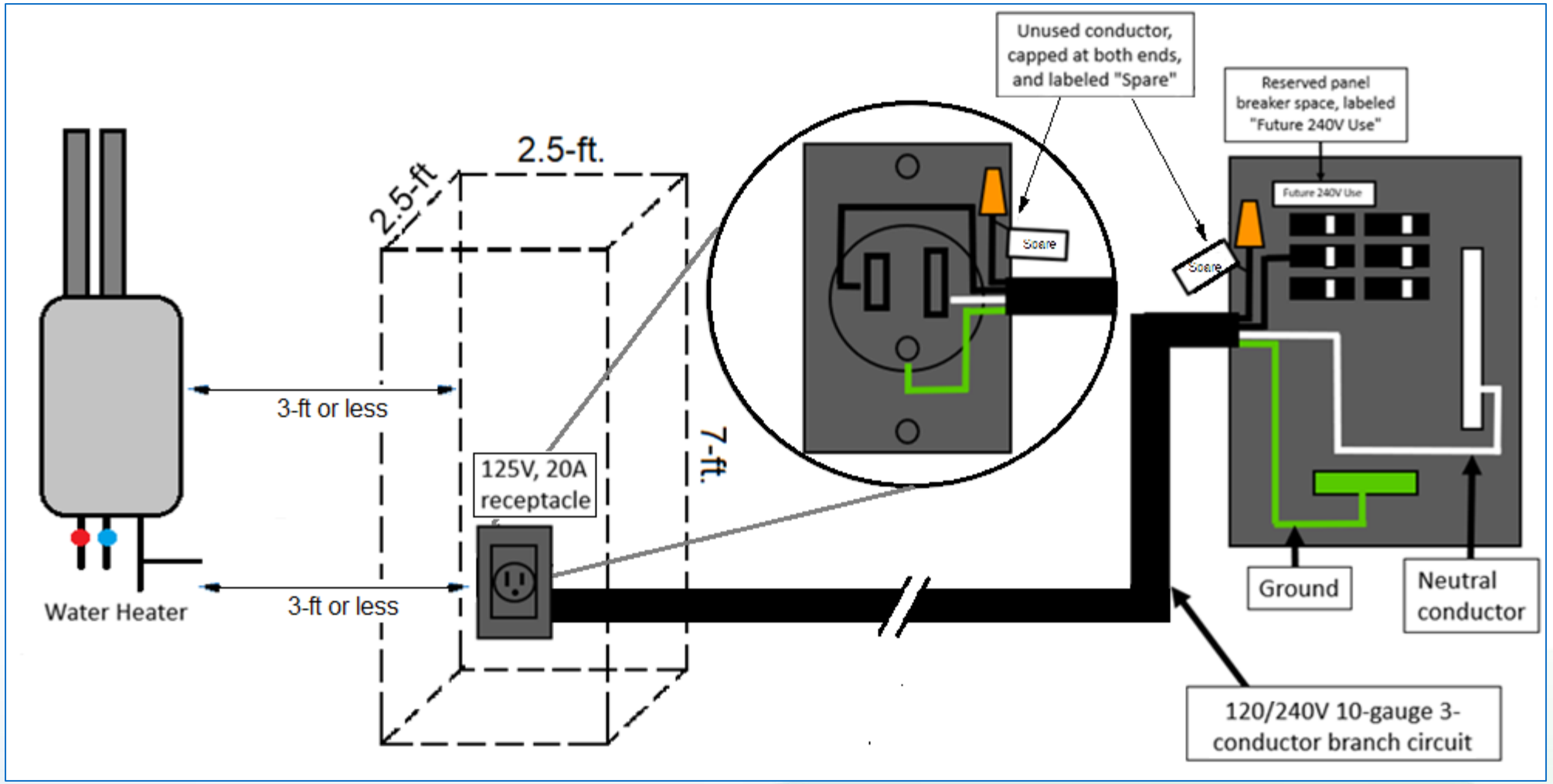
§150.0(n) – Gas/Propane Water Heaters

1. Heat pump water heater (HPWH)-ready requirements
   - Reserved 2.5’ x 2.5’ x 7’ space (“HPWH space”); location relative to gas water heater determines electrical and plumbing requirements
2. Recirculation loops serving multiple dwelling units must meet §110.3(c)4
3. Solar water heaters and collectors must be certified by SRCC, IAPMO R&T, or an Executive Director-approved listing agency
4. Tankless water heaters > 6.8 kBtu/h (2kW) must have isolation valves for flushing (§110.3(c)6).

§150.0(n)1A – Gas/Propane Water Heaters

- If HPWH space is ***3-ft. or less*** from water heater
  - Dedicated 125V, 20A receptacle within 3-ft. from water heater, unobstructed
    - 120/240V 3-conductor, 10 AWG copper branch circuit; unused conductor capped at both ends, labeled “spare”
  - Reserved single-pole panel space next to circuit breaker above, labeled “Future 240V Use”
  - Condensate drain no more than 2 inches above base of installed water heater (allows natural draining)

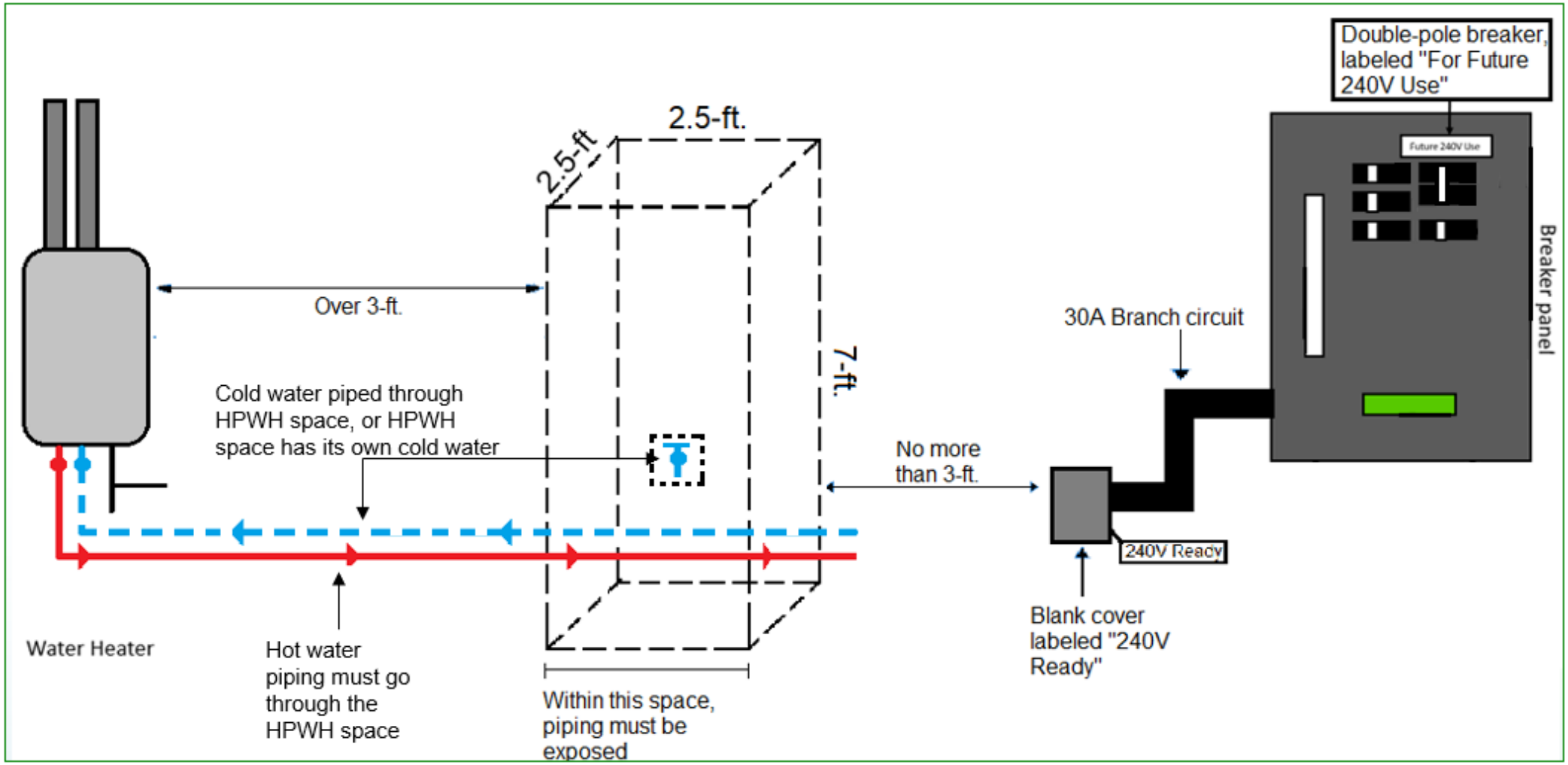
§150.0(n)1A Diagram



§150.0(n)1B – Gas/Propane Water Heaters

- If HPWH space is ***more than 3-ft.*** from the water heater
  - "HPWH-ready" electrical requirements
    - Panel must allow double-pole breaker installation
    - 240V, 30A branch circuit, within 3-ft. from HPWH space
  - "HPWH-ready" plumbing requirements
    - Hot water piped through HPWH space
    - Cold water piped through HPWH space, or HPWH space gets own cold water
    - Piping within HPWH space must be exposed and accessible

§150.0(n)1B Diagram



§150.0(n)1A&B Summary

Distance between HPWH Space and Water Heater	Receptacle/Branch Circuit	Panel	Plumbing
3-ft or less (§150.0(n)1A)	• Dedicated 125V, 20A receptacle no further than 3-ft. from water heater, unobstructed • 120/240V 3-conductor, 10 AWG copper branch circuit; unused conductor capped at both ends, labeled “spare”	Reserved single-pole panel space next to circuit breaker above, labeled “Future 240V Use”	Condensate drain no higher than 2” above water heater base
More than 3-ft (§150.0(n)1B)	• Dedicated 240V, 30A no further than from HPWH space • Blank cover labeled “240V ready”	Reserved space in main panel to ***allow install of double pole breaker***; permanently marked “For Future 240V use”	• Own cold water supply, ***or*** cold water supply piped through HPWH space before reaching water heater • Hot water supply coming from water heater must pass through HPWH space before serving fixtures • Hot and cold water piping at HPWH space exposed and accessible • Condensate drain no more than 2” higher than the water heater base

Prescriptive Requirements, Newly Constructed Buildings §150.1(c)8

§150.1(c)8– Prescriptive Water Heating Requirements, Newly Constructed Buildings

- If recirculation used, only demand recirculation systems with manual on/off (RA4.4.9) allowed
- Water heater must meet specifications of table below:

Option	Type	Compact Hot Water Distribution System (RA4.4.6) Required?	Drain Water Heat Recovery (RA3.6.9) Required?	Other Requirements
A	HPWH, 240V	Climate Zones 1 & 16	Climate Zone 16	Tank in garage or conditioned space
B	HPWH, NEEA Tier 3 or higher, 240V	No	Climate Zone 16	Tank in garage or conditioned space
C	Solar water heater, SSF ≥ 0.7	No	No	Electric backup (RA4)

§150.1(c)8 Exceptions

Exc.	Allowed Water Heater(s)	Condition(s)
1	Gas/propane tankless, 200k Btu/h or less	• CZs 3,4,13,14 • Space-conditioning system must be a heat pump, per §150.1(c)6
2	Electric tankless with point-of-use distribution (RA4.4.5)	New dwelling units, 500 square feet or less of conditioned floor area
3	120V HPWH (vs 240V)	New dwelling units, 1 or fewer bedrooms

Compact Hot Water Distribution System (CHWDS) (RA4.4.6)

- Only for dwelling units with individual water heaters
- Requires plan calculations (next slide)
- *Expanded credit* available with HERS testing (RA3.6.5) – HERS rater must verify:
  - No hot water pipes > 1” diameter
  - No more than 8-ft., total, of pipes 1” in diameter
  - 2- and 3-story buildings – no hot water pipes in attic, unless water heater is also in attic
  - HERS-verified Demand Recirculation (RA4.4.17)

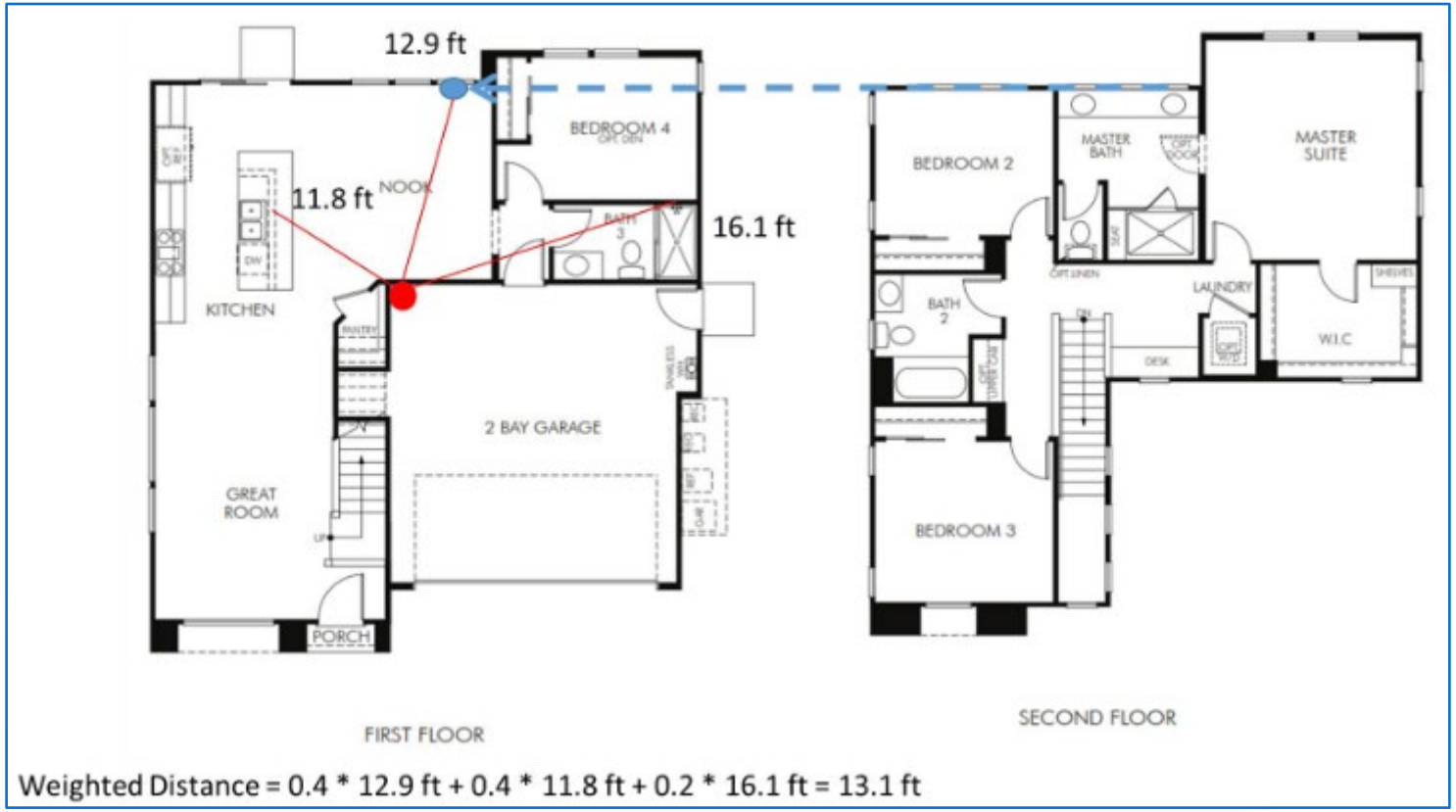
CHWDS Calculation

- In plans, *measure straight-line distances between water heater and 3 certain fixtures, in ft.*
  - *Transpose second floor fixtures onto first floor*; vertical piping is ignored
- Apply equations for weighted distance and qualification distance in RA4.4.6; *for credit, weighted distance < qualification distance*

CHWDS Calculation (Example A)

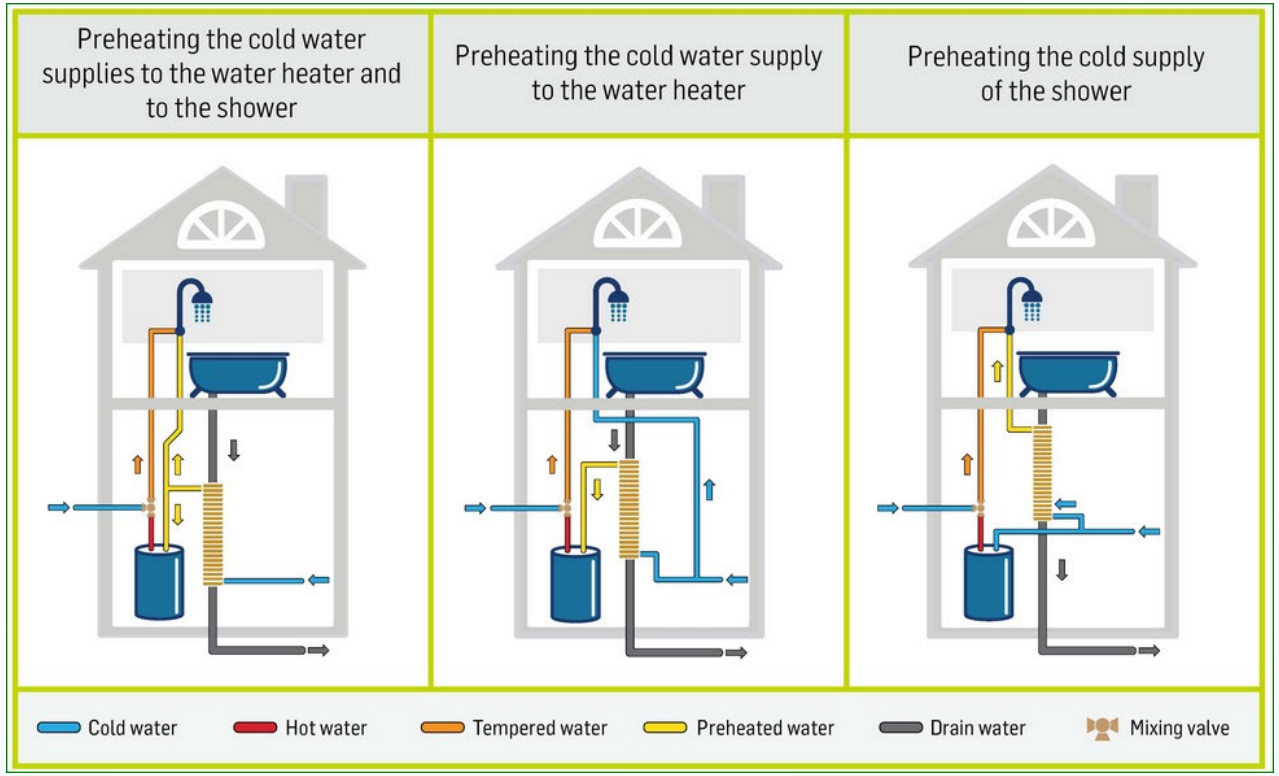
- Weighted distance = (0.4 x 28.9) + (0.4 x 31.1) + (0.2 x 34.3) = 30.9 ft
- Qualification distance = (15 + 0.0045 × 1814)/1 = 15 + 8.163 = *~23 ft*

CHWDS Calculation (Example B)



- Weighted distance = 13.1 ft
- Qualification distance = (15 + 0.0045 × 1814)/1 = 15 + 8.163 = *~23 ft*

Drain Water Heat Recovery (DWHR) (RA3.6.9)



- Three configurations – Equal flow, unequal flow (water heater), and unequal flow (fixture)
  - *Equal flow* preheats water to both fixture and water heater (maximizes benefit)
  - Unequal flow preheats water going to fixture *or* water heater
- Requires HERS verification

Source: https://ecoinnovation.ca/thermodrain-residential-resources/homeowner/

DWHR Credit Requirements

For credit, DWHR unit must…

- Be certified to CEC
  - Effectiveness ≥ 42%
  - Meets table at right
- Be HERS verified
  - Matches plans and documents
  - Certified to CEC as credit-eligible*
  - Transfers heat from master shower(s) above first floor back to showers served by water heater or water heater, itself
  - Installed per CA Plumbing Code within 1° of rated slope

Unit Type	Meet These Standards	Testing/Labeling per
Vertical	CSA B55.2	CSA 55.1 *or* IAPMO IGC 346-2017
Sloped	IAPMO PS 92	IAPMO IGC 346-2017

*Download the Certified List

Prescriptive Requirements, Additions & Alterations §150.2

§150.2(a) – Additions, Prescriptive Approach

- **Additions** must meet §§ 110.0 - 110.9, 150.0(a) - (q), and 150.2(a)1 (prescriptive) or 2 (performance).
  - *For water heating – §§ 110.1, 110.3, 150.0(j)&(n)*
  - EXCEPTION 2: Existing inaccessible piping does not require insulation per §150.0(j)1

§150.2(a)1D – Additions, Water Heating

- If a second water heater is installed in an addition, it must be one of the following:

Option	Type	Other Requirements
i	One HPWH	• Tank indoors, atop incompressible insulated surface (R ≥ 10) • Comms interface that either meets §110.12(a) or has ANSI/CTA-2045-B port
ii	One HPWH, NEEA Tier 3 or higher	
iii	Gas/propane tankless, up to 200,000 Btu/h	
iv	Electric tankless with POU distribution (RA4.4.5)	Only for additions up to 500 square feet
v	Any water heating system determined by Executive Director to use no more energy than one listed here	

§150.2(b)1 – Alterations, Prescriptive Approach

Alterations, including in conjunction with a change into a single-family residential occupancy, must meet:

1. Altered component and any newly-installed equipment serving alteration must meet §110.0 - 110.9, §150.0(a) - (m)10, (p) - (q)
    - *For water heating - §§ 110.1, 110.3, 150.0(j)*

§150.2(b)1H – Alterations, Water Heating

i. Newly installed and existing accessible piping must meet §150.0(j)1.

ii. If recirculation is used, it must be demand recirculation with manual on/off control (RA4.4.9).

iii. Water heating system must be one of:

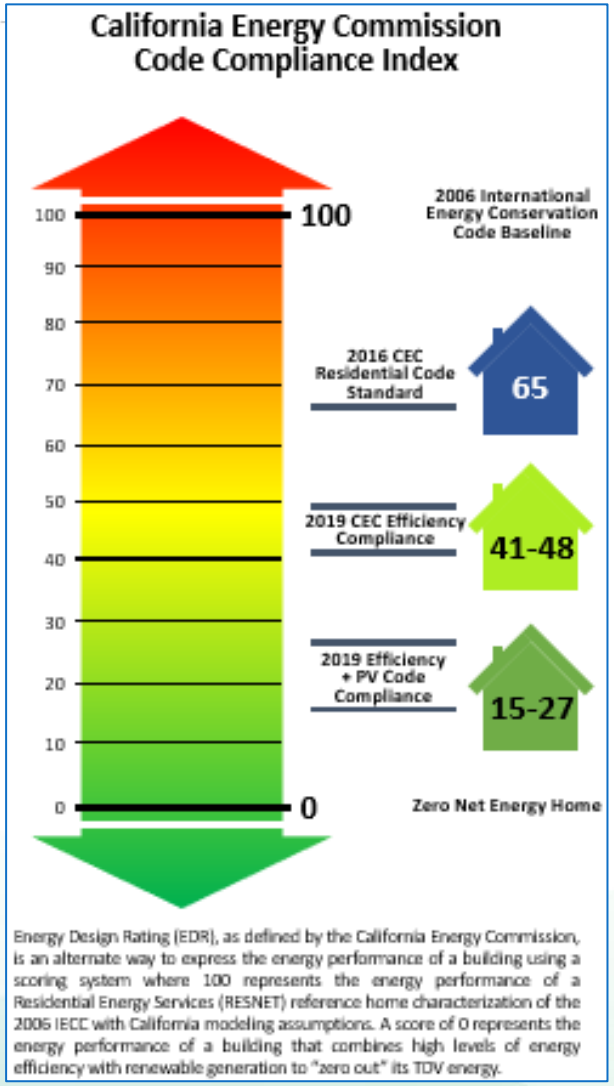
Option	Type	Other Requirements
iiia	Natural gas/propane water-heater	
iiib	HPWH	• Tank indoors, atop incompressible, rigid insulated surface (R-10 or higher) • Water heater interface that either meets §110.12(a) or has ANSI/CTA-2045-A B port
iiic	HPWH, NEEA Tier 3 or higher	
iiid	Consumer electric water heater	Existing system must be electric resistance
iiie	Approved by Executive Director as using no more energy than i-iv	Electric water heater allowed if no gas connected to existing water heater location

Performance Standards §§150.1 & 150.2

What is EDR?

Energy Design Rating (EDR) score is based on total estimated energy use

- 100 represents a home built to 2006 IECC; 0 represents a zero net energy home
- 3 EDR scores must be met individually – EDR1, $EDR2_{tot}$, $EDR2_{eff}$
- EDR metric used for newly constructed buildings; TDV used for additions and alterations



§150.1(b)1 – Newly Constructed Buildings

- 3 EDR scores, based on TDV energy
  - EDR1 – source energy; accounts for GHG emissions to aid energy decarbonization
  - Total EDR2 – two parts:
    - Efficiency EDR2; energy savings from building systems, plus limited credit for battery
    - Solar Electric Generation & Demand Flexibility EDR2
- EDR1, efficiency EDR2, and total EDR2 must not exceed standard design

§150.1(b)2&3 – Newly Constructed Buildings

- CF1R(s) must demonstrate building's EDRs meet or exceed Standard Design for Climate Zone
  - Compliance can be shown for any orientation of proposed building, if documents show compliance in all four cardinal orientations
- When performance above prescriptive requirement is necessary for compliance, field verification is required; results on CF2Rs and CF3Rs

§150.2(a)2A&B – Additions

- Performance calculations must meet §150.1(a)-(c), pursuant to A and B below.

A. Addition complies if, alone, can meet the energy budget

B. E+A+A (existing + addition + alteration):

Design	Existing Components to Remain	Components to be Altered	Additions
Standard	Existing conditions	Existing conditions, OR meet §150.2(b)1, whichever is more efficient	Proposed features meeting §150.2(a)1
Proposed	Existing conditions	Actual values of proposed components	Actual values of proposed components

§150.2(b)2 – Alterations

- Altered components must meet §§110.0-110.9, 150.0(a)-(m)10, (p)-(q) […]
- When third-party verification required, all proposed components for additional credit must be verified.
- Existing components to be replaced considered altered for determining energy budget

Design	Altered Components	Unaltered Components
Standard	Existing conditions, or meet Table 150.2-D, whichever is more efficient	Existing conditions
Proposed	Actual values of proposed components	Existing conditions

Compliance Forms

Certificate of Compliance (CF1R) Forms for Water Heating

	New Construction	Additions	Alterations
Prescriptive	• CF1R-NCB-01-E	• CF1R-ADD-01-E (≤ 1,000 ft^2) • CF1R-ADD-02-E	• CF1R-ALT-01-E • CF1R-ALT-05-E
Performance	• CF1R-PRF-01-E*		

* Performance approach CF1R's are generated by approved compliance software

CF1R-PRF-01

CERTIFICATE OF COMPLIANCE - RESIDENTIAL PERFORMANCE COMPLIANCE METHOD — CF1R-PRF-01E

Project Name: 1 Story Example PV+Battery — **Calculation Date/Time:** 2023-06-05T15:37:43-07:00 — (Page 3 of 14)

Calculation Description: 1 Story Example — **Input File Name:** 1storyExample.ribd22

ENERGY USE SUMMARY

Energy Use	Standard Design Source Energy (EDR1) (kBtu/ft² -yr)	Standard Design TDV Energy (EDR2) (kTDV/ft² -yr)	Proposed Design Source Energy (EDR1) (kBtu/ft² -yr)	Proposed Design TDV Energy (EDR2) (kTDV/ft² -yr)	Compliance Margin (EDR1)	Compliance Margin (EDR2)
Space Heating	6.6	28.95	6.67	29.2	-0.07	-0.25
Space Cooling	0.42	14.92	0.31	11.15	0.11	3.77
IAQ Ventilation	0.33	3.56	0.33	3.56	0	0
Water Heating	1.39	14.67	1.61	16.42	-0.22	-1.75

REQUIRED SPECIAL FEATURES

The following are features that must be installed as condition for meeting the modeled energy performance for this computer analysis.

- PV System: 2.8 kWdc
- Battery System: 5 kWh
- Whole house fan
- Cool roof
- Insulation below roof deck
- Window overhangs and/or fins
- Northwest Energy Efficiency Alliance (NEEA) rated heat pump water heater; specific brand/model, or equivalent, must be installed

- Water heating EDR scores appear in the Energy Use Summary
- Special Features

CF1R-PRF-01 (cont.)

WATER HEATING SYSTEMS

01	02	03	04	05	06	07	08	09
Name	System Type	Distribution Type	Water Heater Name	Number of Units	Solar Heating System	Compact Distribution	HERS Verification	Water Heater Name (#)
DHW System	Domestic Hot Water (DHW)	Standard	Heat Pump	1	n/a	None	n/a	Heat Pump (1)

WATER HEATERS - NEEA HEAT PUMP

01	02	03	04	05	06	07	08
Name	# of Units	Tank Vol. (gal)	NEEA Heat Pump Brand	NEEA Heat Pump Model	Tank Location	Duct Inlet Air Source	Duct Outlet Air Source
Heat Pump	1	50	Generic	WhirlpoolHPSE2K50	Garage	Outside	Outside

WATER HEATING - HERS VERIFICATION

01	02	03	04	05	06	07
Name	Pipe Insulation	Parallel Piping	Compact Distribution	Compact Distribution Type	Recirculation Control	Shower Drain Water Heat Recovery
DHW System - 1/1	Not Required	Not Required	Not Required	None	Not Required	Not Required

- Water Heating Systems
  - System Type, Distribution Type, quantity
- NEEA Heat Pump Water Heater table, if applicable
  - Tank volume, model number, location
- HERS verification, if applicable, for credits

Certificate of Installation (CF2R) Forms for Water Heating

Non-HERS

- CF2R-ADD-02-E: Additions, Prescriptive
- CF2R-ALT-05-E: Alterations
- CF2R-PLB-02-E: Single Dwelling, Hot Water Distribution*

HERS

- CF2R-PLB-22-H: Single Dwelling, Hot Water Distribution*

CF2R-PLB-22-H, Tables A & B

A. Design HERS Verified Dwelling Unit Water Heating Systems Information (other than HPWH)
This table reports features of the water heating system(s) other than **HPWH** system specified on the registered CF1R compliance document for this project.

01	02	03	04	05	06	07	08	09	10	11	12
Dwelling Unit Name	Water Heating System ID or Name	Water Heating System Type	Water Heater Type	# of Like (or Identical) Water Heaters in System	Fuel Type	Rated Input Type	Rated Input Value	Central DHW System Distribution	Dwelling Unit DHW System Distribution Type	Compact Distrib.	Drain Water Heat Recovery

A2. Design HERS Verified Dwelling Unit HPWH System Information
This table reports the water heating system(s) that were specified on the registered CF1R compliance document for this project.

01	02	03	04	05	06	07	08	09
Dwelling Unit Name	Water Heating System ID or Name	Modeled Equipment Make and Model	# of Like (or Identical) Water Heaters in System	Tank Location	Exterior Tank Insulation R-value	Dwelling Unit DHW System Distribution Type	Compact Distribution	Simulated Equipment Make and Model

B. Installed HERS Verified Dwelling Unit Water Heating Systems Information
This table reports features the water heating system other than **HPWH** systems installed in this project

01	02	03	04	05	06	07	08	09	10	11	12
Dwelling Unit Name	Water Heating System ID or Name	Water Heating System Type	Water Heater Type	# of Like (or Identical) Water Heaters in System	Fuel Type	Rated Input Type	Rated Input Value	Central DHW System Distribution	Dwelling Unit DHW System Distribution Type	Compact Distrib.	Drain Water Heat Recovery

- A – Water heating systems and features on CF1R
- B – Water heating system and features installed

CF2R-PLB-22-H, Tables C to E

C. Design HERS Verified Dwelling Unit Water Heating Efficiency Information

This table reports the water heater(s) efficiency features specified on the registered CF1R compliance document for this project. (Not needed for central systems)

01	02	03	04	05	06	07
Water Heating System ID or Name	Heating Efficiency Type	Heating Efficiency Value	Standby Loss (%)	Exterior Insulation R-Value	Water Heater Storage Volume (gal)	Tank Location

D. Installed HERS Verified Dwelling Unit Water Heating Efficiency Information

This table reports the water heater(s) efficiency features installed in this project. (Not needed for central systems)

01	02	03	04	05	06	07
Water Heating System ID or Name	Heating Efficiency Type	Heating Efficiency Value	Standby Loss (%)	Exterior Insulation R-Value	Water Heater Storage Volume (gal)	Tank Location

E. Installed Water Heater Manufacturer Information

01	02	03
Water Heating System ID or Name	Manufacturer	Model Number

- C – Water heater efficiency from CF1R
- D – Installed water heater efficiency
- E – Installed water heater manufacturer info

CF2R-PLB-22-H, Tables F to H

G. HERS-Verified Compact Hot Water Distribution Expanded Credit (CHWDS-H-EX) (RA3.6.5)

For dwelling units with multiple systems, enter the master bath distance and kitchen distance to the closest water heater, and enter the average of the furthest fixture to each water heater.

01	02	03	04	05	06	07	08	09
Dwelling Name	Number of Stories	Master Bath distance of furthest fixture to Water Heater in feet	Kitchen distance from furthest fixture to Water Heater in feet	Furthest Third furthest fixture to Water Heater in feet (Avg for multiple water heaters)	Weighted Distance	Qualification Distance	Design Compactness Factor	Calculated Compactness Factor

08	No hot water piping >1 inch diameter is allowed.
09	Length of 1 inch diameter piping is limited to 8 feet or less.
10	Two and three story buildings cannot have hot water distribution piping in the attic, unless the water heater is also located in the attic.
11	Eligible recirculating systems must be HERS-Verified Demand Recirculation: Manual Control conforming to RA4.4.17.

The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met.

H. Compact Hot Water Distribution (CHWDS) (RA4.4.6)

For dwelling units with multiple systems, enter the master bath distance and kitchen distance to the closest water heater, and enter the average of the furthest fixture to each water heater

01	02	03	04	05	06	07	08	09
Dwelling Name	Number of Stories	Master Bath distance of furthest fixture to Water Heater in feet	Kitchen distance from furthest fixture to Water Heater in feet	Furthest Third furthest fixture to Water Heater in feet (Avg for multiple water heaters)	Weighted Distance	Qualification Distance	Design Compactness Factor	Calculated Compactness Factor

The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met.

- F – mandatory requirements
- G – HERS-verified CHWDS (expanded credit) specs
- H – CHWDS (basic credit) specs

CF2R-PLB-22-H, Tables I to Q

I. HERS-Verified Drain Water Heat Recovery System (DWHR-H) (RA3.6.9)

DWHR devices shall comply with these requirements.

Design DWHR System Information			
01	02	03	04
System ID/Name	Rated Effectiveness	Installation Configuration	Percent of shower served by the DWHR device

Installed DWHR System Information						
05	06	07	08	09	10	11
System ID/Name	Manufacturer	Model Number	Rated Effectiveness	Installation Configuration	Percent of shower served by the DWHR device	DWHR System Certified by CEC (Yes/No)

12	For water heating system serving a single dwelling, the DWHR system shall, at the minimum, recover heat from the master bathroom shower and must transfer that heat either back to the respective shower(s) or the water heater.
13	For central water heating system serving multiple dwellings, the DWHR system shall, at the minimum, recover heat from half the showers located above the first floor and must transfer that heat either back to all the respective showers or the water heater.
14	The DWHR unit(s) shall be installed within 1 degree of the rated slope. Sloped DWHR shall have a minimum lengthwise slope of 1 degree. The lateral level tolerance shall be within plus or minus 1 degree.

The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met.

- I – HERS-verified DWHR specs
- J to Q – Responsible person's signature affirms requirements met
  - Parallel piping
  - POU
  - Recirculation

Certificate of Verification (CF3R) Forms for Water Heating

- Completed and signed by the HERS Rater
- Forms
  - CF3R-EXC-20-E: Existing Conditions, Alterations
  - CF3R-PLB-22-H: Single Dwelling, Central Hot Water Distribution

CF3R-PLB-22-H, Tables A & B

A. Design HERS Verified Dwelling Unit Water Heating Systems Information (other than HPWH)
This table reports features of the water heating system(s) other than HPWH system specified on the registered CF1R compliance document for this project.

01	02	03	04	05	06	07	08	09	10	11	12
Dwelling Unit Name	Water Heating System ID or Name	Water Heating System Type	Water Heater Type	# of Like (or Identical) Water Heaters in System	Fuel Type	Rated Input Type	Rated Input Value	Central DHW System Distribution	Dwelling Unit DHW System Distribution Type	Compact Distrib.	Drain Water Heat Recovery

A2. Design HERS Verified Dwelling Unit HPWH System Information
This table reports the water heating system(s) that were specified on the registered CF1R compliance document for this project.

01	02	03	04	05	06	07	08	09
Dwelling Unit Name	Water Heating System ID or Name	Modeled Equipment Make and Model	# of Like (or Identical) Water Heaters in System	Tank Location	Exterior Tank Insulation R-value	Dwelling Unit DHW System Distribution Type	Compact Distribution	Simulated Equipment Make and Model

B. Installed HERS Verified Dwelling Unit Water Heating Systems Information
This table reports the water heating system features installed in this project.

01	01	02	03	04	05	06	07	08	09	10	11
Dwelling Unit Name	Water Heating System ID or Name	Water Heating System Type	Water Heater Type	# of Like (or Identical) Water Heaters in System	Fuel Type	Rated Input Type	Rated Input Value	Central DHW System Distribution	Dwelling Unit DHW System Distribution Type	Compact Distrib.	Drain Water Heat Recovery

- Similar to CF2R-PLB-22
- Available only from HERS Providers and should ALWAYS have a HERS watermark
- A – Water heating features and systems on CF1R
- B – Water heating features installed

CF3R-PLB-22-H, Tables C to E

C. Design HERS Verified Dwelling Unit Water Heating Efficiency Information

This table reports the water heater(s) efficiency features specified on the registered CF1R compliance document for this project. (Not needed for central systems)

01	02	03	04	05	06	07
Water Heating System ID or Name	Heating Efficiency Type	Heating Efficiency Value	Standby Loss (%)	Exterior Insulation R-Value	Water Heater Storage Volume (gal)	Tank location

D. Installed HERS Verified Dwelling Unit Water Heating Efficiency Information

This table reports the water heater(s) efficiency features installed in this project. (Not needed for central systems

01	02	03	04	05	06	07
Water Heating System ID or Name	Heating Efficiency Type	Heating Efficiency Value	Standby Loss (%)	Exterior Insulation R-Value	Water Heater Storage Volume (gal)	Tank location
08	Compliance Statement					

E. Installed Water Heater Manufacturer Information

01	02	03
Water Heating System ID or Name	Manufacturer	Model Number

- C – Water heater efficiency from CF1R
- D – Installed water heater efficiency
- E – Installed water heater manufacturer info

CF3R-PLB-22-H, Tables F to H

G. HERS-Verified Compact Hot Water Distribution Expanded Credit (CHWDS-H-EX) (RA3.6.5)
For dwelling units with multiple systems, enter the master bath distance and kitchen distance to the closest water heater, and enter the average of the furthest fixture to each water heater.

The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met unless otherwise noted in the Verification Status and the Corrections Notes in this table.

01	02	03	04	05	06	07	08	09
Dwelling Name	Number of Stories	Master Bath distance of furthest fixture to Water Heater in feet	Kitchen distance from furthest fixture to Water Heater in feet	Furthest Third furthest fixture to Water Heater in feet (Avg for multiple water heaters)	Weighted Distance	Qualification Distance	Design Compactness Factor	Calculated Compactness Factor

08	No hot water piping >1 inch diameter is allowed.	
09	Length of 1 inch diameter piping is limited to 8 feet or less.	
10	Two and three story buildings cannot have hot water distribution piping in the attic, unless the water heater is also located in the attic.	
11	Eligible recirculating systems must be HERS-Verified Demand Recirculation: Manual Control conforming to RA4.4.17.	
12	Verification Status:	1. Pass - all applicable requirements are met; or 2. Fail - one or more applicable requirements are not met. Enter reason for failure in corrections notes field below; or 3. All N/A - This entire table is not applicable
13	Correction Notes:	

H. Compact Hot Water Distribution (CHWDS) (RA4.4.6)
For dwelling units with multiple systems, enter the master bath distance and kitchen distance to the closest water heater, and enter the average of the furthest fixture to each water heater.
The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met

01	02	03	04	05	06	07	08	09
Dwelling Name	Number of Stories	Master Bath distance of furthest fixture to Water Heater in feet	Kitchen distance from furthest fixture to Water Heater in feet	Furthest Third furthest fixture to Water Heater in feet (Avg for multiple water heaters)	Weighted Distance	Qualification Distance	Design Compactness Factor	Calculated Compactness Factor

- F – mandatory requirements
- G – HERS-verified CHWDS (expanded credit) specs
- H – CHWDS (basic credit) specs

CF3R-PLB-22-H, Tables I to R

I. HERS-Verified Drain Water Heat Recovery System (DWHR-H)

DWHR devices shall comply with these requirements

The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met unless otherwise noted in the Verification Status and the Corrections Notes in this table.

Design DWHR System Information			
01	02	03	04
System ID/Name	Rated Effectiveness	Installation Configuration	Percent of shower served by the DWHR device

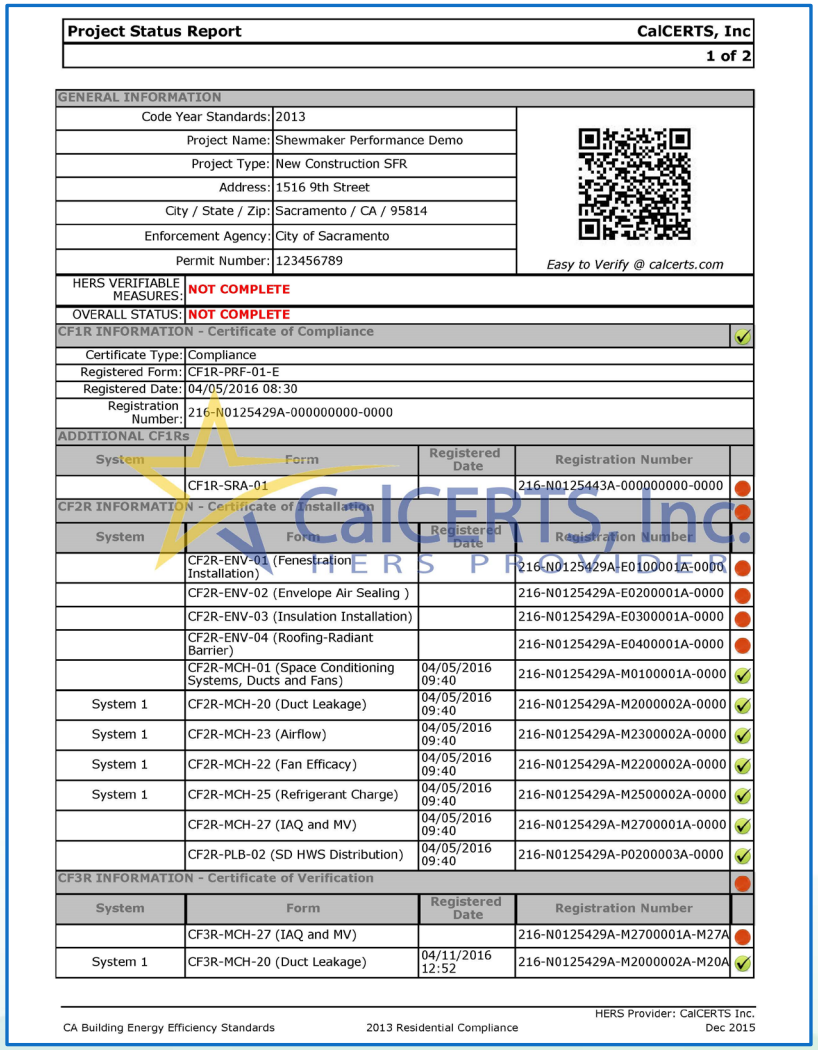
Installed DWHR System Information						
05	06	07	08	09	10	11
System Name/ID	Manufacturer	Model #	Rated effectiveness	Installation Configuration	Percent of shower served by the DWHR device	DWHR System Certified by CEC (Yes/No)
12	For water heating system serving a single dwelling, the DWHR system shall, at the minimum, recover heat from the master bathroom shower and must at least transfer that heat either back to the respective shower(s) or the water heater.					
13	For central water heating system serving multiple dwellings, the DWHR system shall, at the minimum, recover heat from half the showers located above the first floor and must at least transfer that heat either back to all the respective showers or the water heater.					
14	The DWHR unit(s) shall be installed within 1 degrees of the rated slope. Sloped DWHR shall have a minimum lengthwise slope of 1 degree. The lateral level tolerance shall be within plus or minus 1 degree.					
15	Verification Status:	1. Pass - all applicable requirements are met; or 2. Fail - one or more applicable requirements are not met. Enter reason for failure in corrections notes field below; or 3. All N/A - This entire table is not applicable				
16	Correction Notes:					

R. Determination of HERS Verification Compliance

- I – HERS-verified DWHR specs
- J to Q – Responsible person's signature affirms requirements met
  - Parallel piping
  - POU
  - Recirculation
- R – HERS Verification Compliance

A Handy Tool – The PSR

- Available through HERS Provider registry
- Compiles and summarizes progress of compliance documentation
- Some jurisdictions may accept these during inspections



Project Status Report — **CalCERTS, Inc** — 1 of 2

GENERAL INFORMATION

Code Year Standards:	2013
Project Name:	Shewmaker Performance Demo
Project Type:	New Construction SFR
Address:	1516 9th Street
City / State / Zip:	Sacramento / CA / 95814
Enforcement Agency:	City of Sacramento
Permit Number:	123456789

Easy to Verify @ calcerts.com

HERS VERIFIABLE MEASURES: **NOT COMPLETE**

OVERALL STATUS: **NOT COMPLETE**

CF1R INFORMATION - Certificate of Compliance ✓

Certificate Type:	Compliance
Registered Form:	CF1R-PRF-01-E
Registered Date:	04/05/2016 08:30
Registration Number:	216-N0125429A-000000000-0000

ADDITIONAL CF1Rs

System	Form	Registered Date	Registration Number	
	CF1R-SRA-01		216-N0125443A-000000000-0000	●

CF2R INFORMATION - Certificate of Installation ●

System	Form	Registered Date	Registration Number	
	CF2R-ENV-01 (Fenestration Installation)		216-N0125429A-E0100001A-0000	●
	CF2R-ENV-02 (Envelope Air Sealing)		216-N0125429A-E0200001A-0000	●
	CF2R-ENV-03 (Insulation Installation)		216-N0125429A-E0300001A-0000	●
	CF2R-ENV-04 (Roofing-Radiant Barrier)		216-N0125429A-E0400001A-0000	●
	CF2R-MCH-01 (Space Conditioning Systems, Ducts and Fans)	04/05/2016 09:40	216-N0125429A-M0100001A-0000	✓
System 1	CF2R-MCH-20 (Duct Leakage)	04/05/2016 09:40	216-N0125429A-M2000002A-0000	✓
System 1	CF2R-MCH-23 (Airflow)	04/05/2016 09:40	216-N0125429A-M2300002A-0000	✓
System 1	CF2R-MCH-22 (Fan Efficacy)	04/05/2016 09:40	216-N0125429A-M2200002A-0000	✓
System 1	CF2R-MCH-25 (Refrigerant Charge)	04/05/2016 09:40	216-N0125429A-M2500002A-0000	✓
	CF2R-MCH-27 (IAQ and MV)	04/05/2016 09:40	216-N0125429A-M2700001A-0000	✓
	CF2R-PLB-02 (SD HWS Distribution)	04/05/2016 09:40	216-N0125429A-P0200003A-0000	✓

CF3R INFORMATION - Certificate of Verification ●

System	Form	Registered Date	Registration Number	
	CF3R-MCH-27 (IAQ and MV)		216-N0125429A-M2700001A-M27A	●
System 1	CF3R-MCH-20 (Duct Leakage)	04/11/2016 12:52	216-N0125429A-M2000002A-M20A	✓

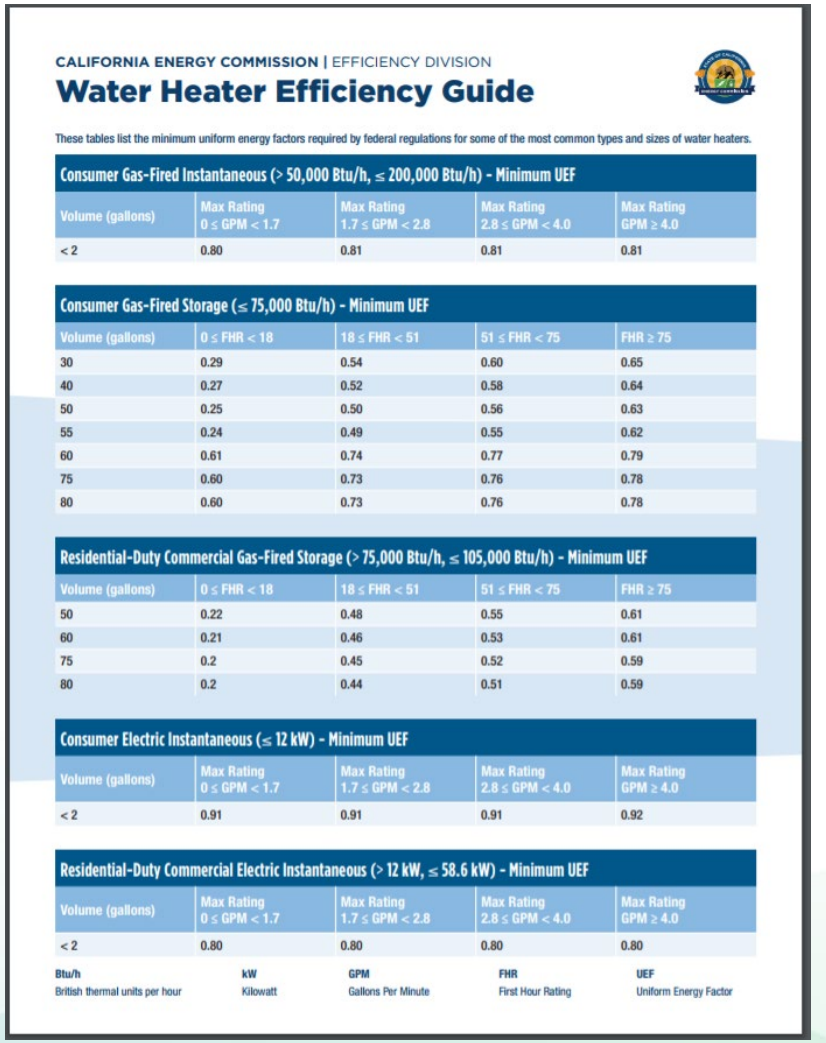
CalCERTS Inc. HERS PROVIDER

CA Building Energy Efficiency Standards — 2013 Residential Compliance — HERS Provider: CalCERTS Inc. Dec 2015

Resources

Water Heater Efficiency Guide

[Download the Water Heater Efficiency Guide]



CALIFORNIA ENERGY COMMISSION | EFFICIENCY DIVISION

Water Heater Efficiency Guide

These tables list the minimum uniform energy factors required by federal regulations for some of the most common types and sizes of water heaters.

Consumer Gas-Fired Instantaneous (> 50,000 Btu/h, ≤ 200,000 Btu/h) - Minimum UEF

Volume (gallons)	Max Rating 0 ≤ GPM < 1.7	Max Rating 1.7 ≤ GPM < 2.8	Max Rating 2.8 ≤ GPM < 4.0	Max Rating GPM ≥ 4.0
< 2	0.80	0.81	0.81	0.81

Consumer Gas-Fired Storage (≤ 75,000 Btu/h) - Minimum UEF

Volume (gallons)	0 ≤ FHR < 18	18 ≤ FHR < 51	51 ≤ FHR < 75	FHR ≥ 75
30	0.29	0.54	0.60	0.65
40	0.27	0.52	0.58	0.64
50	0.25	0.50	0.56	0.63
55	0.24	0.49	0.55	0.62
60	0.61	0.74	0.77	0.79
75	0.60	0.73	0.76	0.78
80	0.60	0.73	0.76	0.78

Residential-Duty Commercial Gas-Fired Storage (> 75,000 Btu/h, ≤ 105,000 Btu/h) - Minimum UEF

Volume (gallons)	0 ≤ FHR < 18	18 ≤ FHR < 51	51 ≤ FHR < 75	FHR ≥ 75
50	0.22	0.48	0.55	0.61
60	0.21	0.46	0.53	0.61
75	0.2	0.45	0.52	0.59
80	0.2	0.44	0.51	0.59

Consumer Electric Instantaneous (≤ 12 kW) - Minimum UEF

Volume (gallons)	Max Rating 0 ≤ GPM < 1.7	Max Rating 1.7 ≤ GPM < 2.8	Max Rating 2.8 ≤ GPM < 4.0	Max Rating GPM ≥ 4.0
< 2	0.91	0.91	0.91	0.92

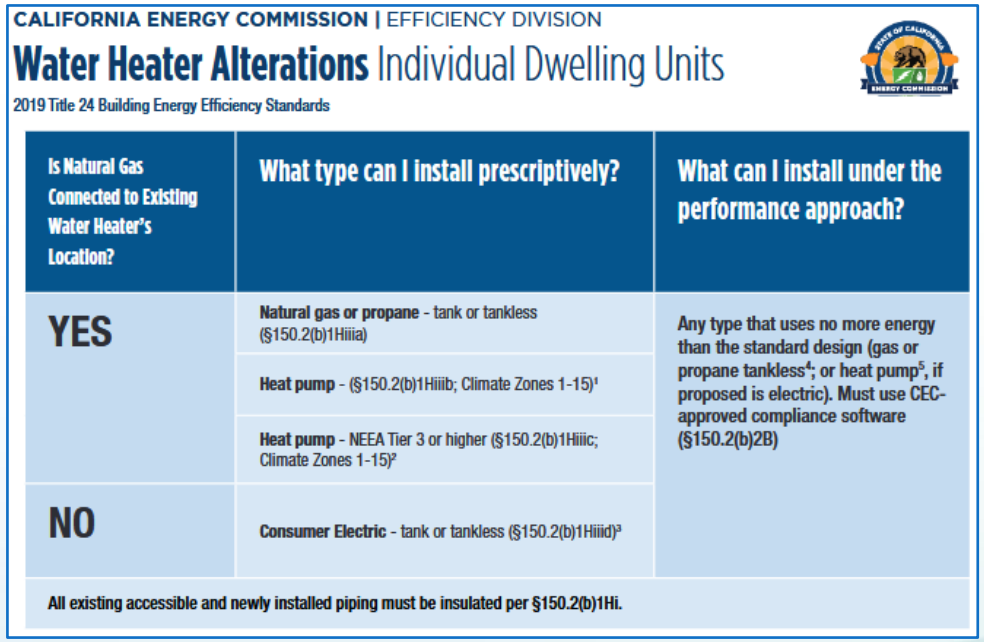
Residential-Duty Commercial Electric Instantaneous (> 12 kW, ≤ 58.6 kW) - Minimum UEF

Volume (gallons)	Max Rating 0 ≤ GPM < 1.7	Max Rating 1.7 ≤ GPM < 2.8	Max Rating 2.8 ≤ GPM < 4.0	Max Rating GPM ≥ 4.0
< 2	0.80	0.80	0.80	0.80

Btu/h British thermal units per hour
kW Kilowatt
GPM Gallons Per Minute
FHR First Hour Rating
UEF Uniform Energy Factor

Water Heater Alterations Counter Card

[Download the Water Heater Alterations Counter Card](#) - Perfect for permit technicians!



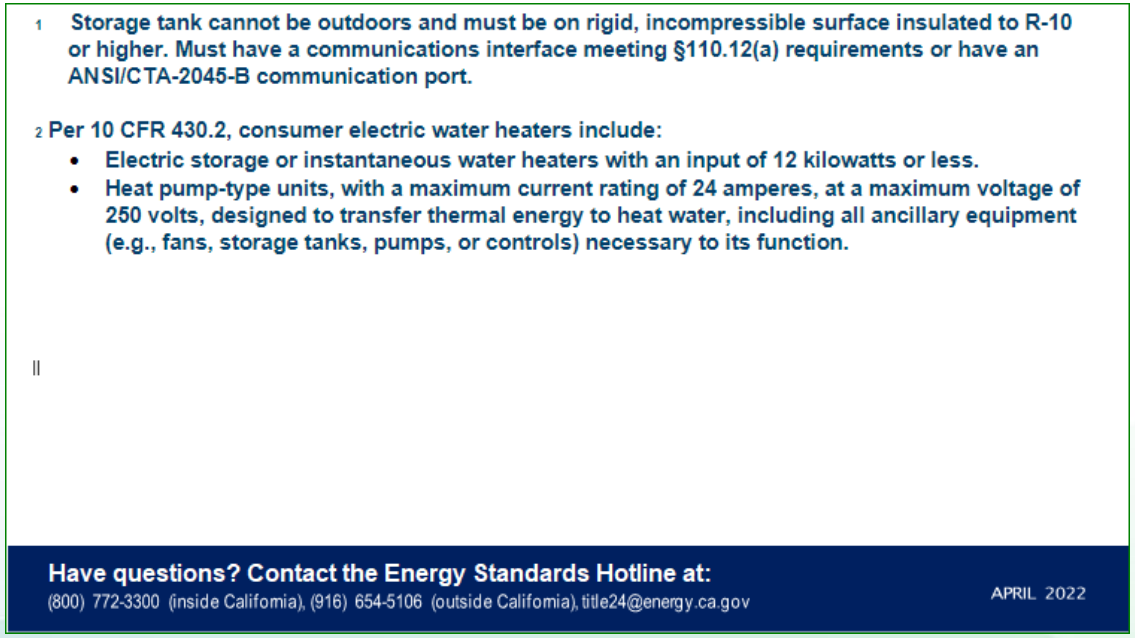
CALIFORNIA ENERGY COMMISSION | EFFICIENCY DIVISION

Water Heater Alterations Individual Dwelling Units

2019 Title 24 Building Energy Efficiency Standards

Is Natural Gas Connected to Existing Water Heater's Location?	What type can I install prescriptively?	What can I install under the performance approach?
YES	**Natural gas or propane** - tank or tankless (§150.2(b)1Hiiia)	Any type that uses no more energy than the standard design (gas or propane tankless[4]; or heat pump[5], if proposed is electric). Must use CEC-approved compliance software (§150.2(b)2B)
	Heat pump - (§150.2(b)1Hiiib; Climate Zones 1-15)[1]	
	Heat pump - NEEA Tier 3 or higher (§150.2(b)1Hiiic; Climate Zones 1-15)[2]	
NO	**Consumer Electric** - tank or tankless (§150.2(b)1Hiiid)[3]	

All existing accessible and newly installed piping must be insulated per §150.2(b)1Hi.



1 Storage tank cannot be outdoors and must be on rigid, incompressible surface insulated to R-10 or higher. Must have a communications interface meeting §110.12(a) requirements or have an ANSI/CTA-2045-B communication port.

2 Per 10 CFR 430.2, consumer electric water heaters include:

- Electric storage or instantaneous water heaters with an input of 12 kilowatts or less.
- Heat pump-type units, with a maximum current rating of 24 amperes, at a maximum voltage of 250 volts, designed to transfer thermal energy to heat water, including all ancillary equipment (e.g., fans, storage tanks, pumps, or controls) necessary to its function.

Have questions? Contact the Energy Standards Hotline at:
(800) 772-3300 (inside California), (916) 654-5106 (outside California), title24@energy.ca.gov

APRIL 2022

Online Resource Center

www.energy.ca.gov/orc

- **Handouts**
- Fact sheets
- Guides
- **Tools**
- Checklists
- Blueprint newsletter
- **Training**
- Presentations
- Videos
- **Links**
- Internal resources
- External resources

Field Verification & Diagnostic Testing Program

Program information

- 2022 Energy Code approvals in process
- Providers and registries for 2022 Energy Code

CalCERTS, Inc. HERS PROVIDER

- Newly constructed buildings
- Additions
- Alterations of residential and nonresidential buildings
- California whole-house home energy ratings
- HERS building performance contractors

CHEERS

- Newly constructed buildings
- Additions
- Alterations of residential and nonresidential buildings

Blueprint Newsletter

- Energy Code quarterly newsletter
- Updates
- Clarifications
- Frequently asked questions

Issue 138 | April - June 2022

BLUEPRINT

CALIFORNIA ENERGY COMMISSION

EFFICIENCY DIVISION

IN THIS ISSUE

- 2022 Energy Code: Multifamily Summary
- 2022 Energy Code: Compliance Software
- 2019 Energy Code: HERS Verifications
- Q&A
  - Solar PV for Multifamily Buildings
  - Multifamily Water Heating
  - Multifamily Common Use Areas

For additional help with the Energy Code see Energy Code Ace's **online offerings** of trainings, tools, and resources.

2022 Energy Code: Multifamily Summary

The 2022 Building Energy Efficiency Standards (Energy Code) reorganizes low-rise (three or fewer habitable stories) and high-rise (four or more habitable stories) multifamily buildings into one building type, updates the multifamily buildings definition in § 100.1, and moves all requirements for multifamily buildings to §§ 160.0-180.4. This and other significant changes include:

Mandatory Requirements

- Updates minimum efficiencies for HVAC equipment; adds minimum efficiency requirements for dedicated outdoor air systems (DOAS), heat pump, and heat recovery chiller packages. § 110.2
- Changes demand responsive lighting controls trigger to 4,000 watts or more; adds requirements for controlled receptacles. §§ 110.12, 160.5(b)4E
- Unifies envelope insulation, vapor retarder, and fenestration requirements. § 160.1
- For dwelling units
  - Adds requirements for central fan integrated ventilation systems requiring a motorized controlled damper, damper controls, and variable ventilation. § 160.2(b)2Aii
  - Requires vented kitchen range hoods ventilation rates or capture efficiencies based on conditioned floor area and fuel type per Tables 160.2-E, F, G. § 160.2(b)2Avic2
  - Requires a HERS-verified maximum fan efficacy of 1.0 Watts per cfm for heat recovery ventilation (HRV) and energy recovery ventilation (ERV) systems. § 160.2(b)2Biii
  - Adds mechanical acceptance testing requirements. § 160.3(d)2
  - Adds electric-ready requirements when gas equipment is installed for space heating, cooking, and clothes dryers. § 160.9(a-c)

1

Stay Connected

Receive Energy Code updates

- Subscribe to Efficiency Division emails
  - Appliances
  - Blueprint
  - Building Standards
- Respond to confirmation email

Follow the California Energy Commission

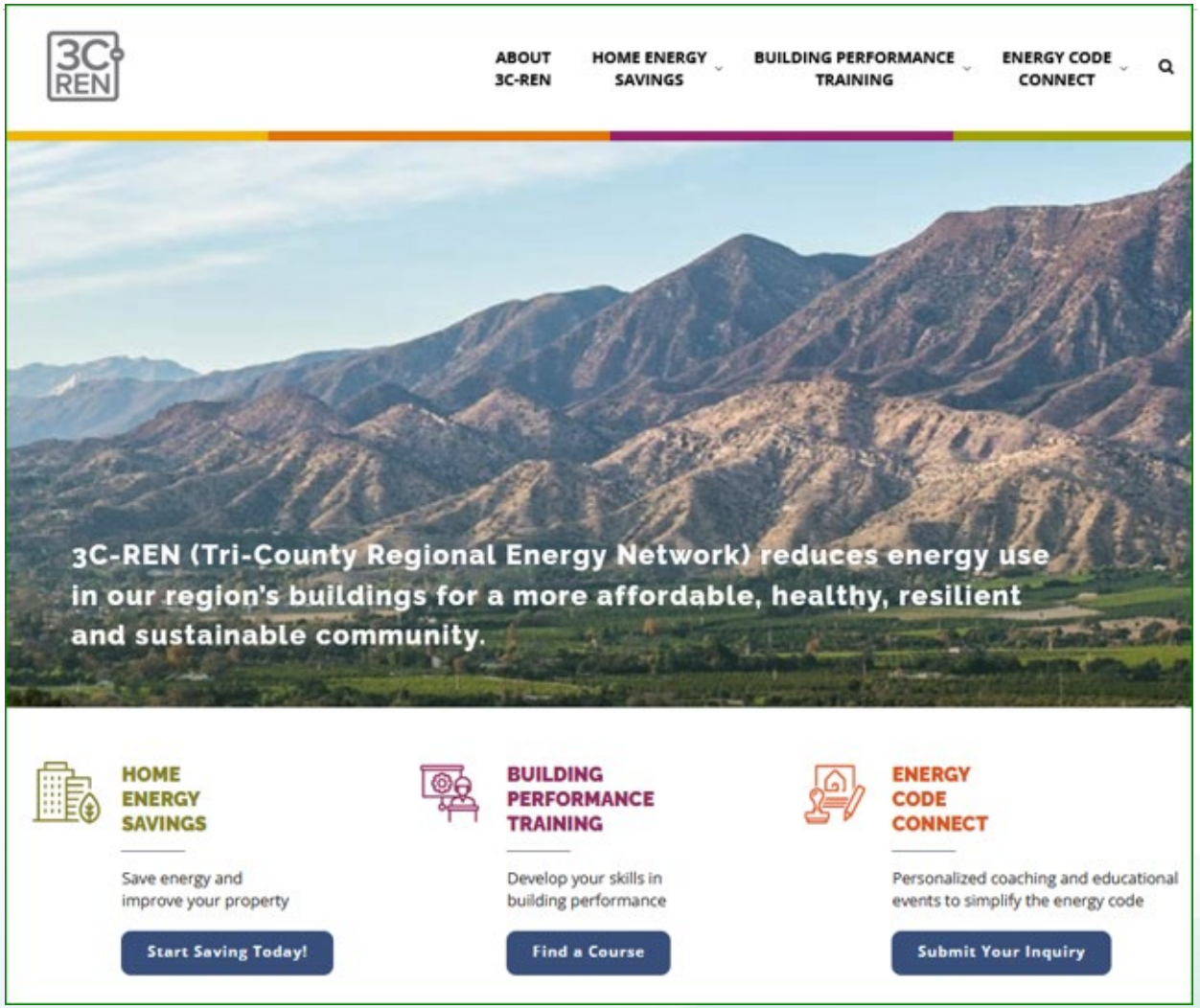
Energy Code Hotline

- Monday through Friday
  - 8:00 a.m. to 12:00 p.m.
  - 1:00 p.m. to 4:30 p.m.
- Call
  - 800-772-3300 in CA
  - 916-654-5106 outside CA
- Email
  - Title24@energy.ca.gov

Other Available Resources – Energy Code Ace

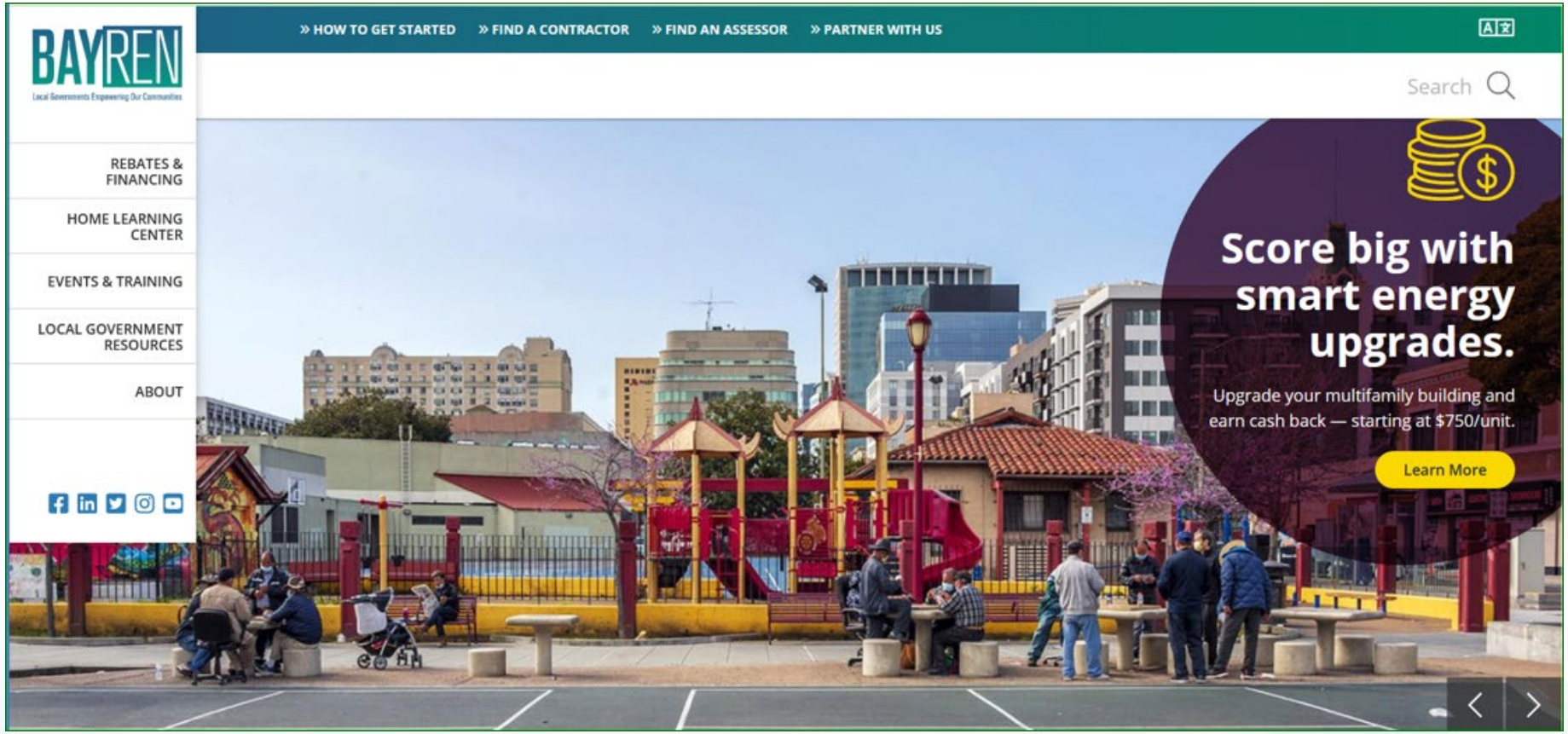
* Not affiliated with, or endorsed by, the CEC

Other Available Resources – 3C-REN



* Not affiliated with, or endorsed by, the CEC

Other Available Resources - BayREN



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Questions?

Thank You!