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Performance Method

Performance Method Overview

This chapter explains the performance method of complying with the *Building Energy Efficiency Standards* (Energy Code). The performance method provides maximum flexibility to trade off the energy performance of different building components to achieve compliance. For new construction, the energy budget is expressed in terms of the long-term system cost (LSC) and source energy. Energy Commission approved compliance software calculate total source energy for the proposed building and compares it to the total source energy budget of a standard design building. Approved compliance software also calculate an efficiency LSC for the proposed building and compares it to the efficiency LSC budget of a standard design building. The efficiency LSC includes LSC energy for space-conditioning, water heating and mechanical ventilation. Finally approved compliance software calculate the total LSC for the proposed building and compares it to the total LSC of a standard design building. The total LSC includes efficiency LSC and LSC from photovoltaic systems, battery energy storage systems, lighting, demand flexibility and other plug loads.

The standard efficiency includes water heating, space heating, space cooling, indoor air quality (IAQ) fan energy, and solar generation. Energy use from lighting and appliances is not eligible to be traded off.

The Energy Commission approved compliance software programs calculate space-conditioning and water-heating energy use in accordance with a set of rules.

Modeling capabilities are in the *Residential Alternative Calculation Method (ACM) Reference Manual*. All approved software programs use the California simulation engine to simulate the energy use, and the same report generator to create the certificate of compliance (CF1R), as the public domain program, California Building Energy Code Compliance - Residential (CBECC-Res). Approved software vendors have can create their own user interface, documentation, and additional forms. Each approved program is required to have a compliance supplement with information on how to use the software.

A discussion of performance method for additions and alterations is in Chapter 9.

What's New for 2022

- LSC and source energy metrics used for compliance.
- Photovoltaic performance procedures (See Chapter 7).

Compliance Basics

Compliance Process

Reference: Section 10-109, Single-family ACM Reference Manual

Any approved compliance software may be used to show compliance with the Energy Code using the performance method. The following steps are an outline of the typical compliance software procedure:

- Collect all necessary data on each component.

    - For the building envelope, the area of each fenestration, wall, door, roof, ceiling, and floor is needed. For each component, the applicable energy characteristics needs to be defined including U-factor, solar heat gain coefficient (SHGC), solar reflectance, and thermal mass values.
    - For HVAC systems, the equipment type and efficiency are required. For hydronic space heating, the specific water heater type and efficiency are required. For fan-forced air conditioning systems, the location and amount of insulation on the duct system are needed.
    - For DHW systems, the water heater type, number, efficiency, and area served are required, along with the information about the hot water distribution system. Additional information will be required for features such as solar thermal systems and drain water heat recovery devices. More information is in Chapter 5.
    - For PV systems, size and location information--such as roof slope and orientation-- are required. Battery storage capacity and control information must be described if battery storage is proposed. Refer to Chapter 7 for more information.
- Enter the basic building envelope data such as square footage, number of stories, occupancy type, and climate zone. Define each opaque surface with the orientation, area, and thermal performance properties. Add the doors and fenestration associated with each opaque surface, including any fixed shading such as overhangs and side fins. Enter the data of the equipment and distribution systems for the space conditioning and water-heating systems. The input values and assumptions must correspond to the information on the final approved plan set, and the inputs must be at least as energy efficient as the relevant mandatory measures. (Software compliance programs may not automatically check for compliance with mandatory measures.)
- Launch a computer simulation to calculate the source energy, efficiency LSC, and total LSC of the standard design and the proposed design.

For additions and alterations, compliance is based on LSC energy, and not the source energy criteria that is used for newly constructed buildings. In existing buildings, where the values of installed features are unknown, default values may be used based on the year of the construction. Refer to Table 8-1: Standard Design for an Altered Component, at the end of this chapter. The proposed design complies if all mandatory measures are met and the total LSC energy use is the same as or less than the standard design LSC energy budget.

When creating a computer input file, use the space provided for the project title information to concisely describe the building being modeled. User-designated names should be clear and internally consistent with other orientations and/or surfaces being analyzed. Title names and explanatory comments should assist in the compliance and enforcement processes.

Defining the Standard Design Efficiency

Approved compliance software programs automatically calculate the standard design efficiency based on data entered for the proposed building.

The program defines the standard building by modifying the geometry of the proposed building and inserting the features of Table 150.1-A of the Energy Standards. Details on how the proposed and standard design energy budget are established can be found in the *Residential ACM Reference Manual*.

Note the details of how the standard design efficiency is determined. Deviations from the prescriptive requirements will be reflected in the compliance margin. For example, if the prescriptive requirements from Table 150.1-A include a heat pump space heating system, and the proposed building is modeled with a central gas furnace, it will significantly increase the heating source energy in the energy usage simulated by the compliance software.

The standard design assumes the same total conditioned floor area and volume as the proposed design and the same gross exterior wall area as the proposed design, except that the wall area in each of the four cardinal orientations is divided equally. The standard design uses the same roof/ceiling area, raised floor area, slab-on-grade area, and perimeter as the proposed design, but uses the standard insulation R-values from Table 150.1-A of the Energy Code.

The standard design includes all features of the prescriptive compliance tables, including quality installation of insulation, walls with the prescriptive U-factor, below- deck roof insulation or radiant barrier, and a solar PV system.

Total fenestration area in the standard design is equal to that in the proposed design if the fenestration area in the proposed design is less than or equal to 20 percent of the conditioned floor area (CFA), Otherwise, the fenestration area is equal to 20 percent of the CFA. Fenestration area in the standard design is evenly distributed among the four cardinal orientations. SHGC and U-factors in the standard design are the same as those listed in the prescriptive tables, with no overhangs.

The standard design includes minimum efficiency heating and cooling equipment, as well as the minimum duct insulation R-value required for Option B from Table 150.1- A of the Energy Code. Ducts are assumed to be sealed as required by §150.0(m).

The standard design also assumes correct refrigerant charge as required by §150.1(c)7A**.**

For water-heating systems that serve dwelling units, the standard design is a NEEA Tier 3 heat pump water heater with a uniform energy factor equal to 2.0, and the distribution system meets all mandatory requirements specified in §150.0.

Standard Reports

For consistency and ease of enforcement, the way building features are reported by compliance software programs is standardized. Energy Commission-approved compliance software programs produce compliance reports in a standard format.

The principal report is the certificate of compliance (CF1R-PRF-01-E).

The CF1R-PRF-01-E includes two feature summary sections, one for required special features and modeling assumptions, and a second for features requiring Energy Code Compliance (ECC) field verification and/or diagnostic testing. These sections provide a general overview during compliance verification by the local enforcement agency and the ECC-Rater. Items in the special features and modeling assumptions section indicate that if such features or assumptions used for compliance are not installed, the building would not comply, and they

call for special consideration by the local enforcement agency. Items in the ECC-Verification section rely on diagnostic testing and verification by an approved ECC-Rater to ensure proper field installation. Diagnostic testing and verification by ECC-Raters is separate from local enforcement agency inspections.

Professional Judgement

Please refer to Chapter 8.3.3 of the *2022 Single-family Residential Compliance Manual*.

Subdivisions and Master Plans

Please refer to Chapter 8.4 of the *2022 Single-family Residential Compliance Manual*.

Individual Building Approach

Please refer to Chapter 8.4.1 of the *2022 Single-family Residential Compliance Manual*.

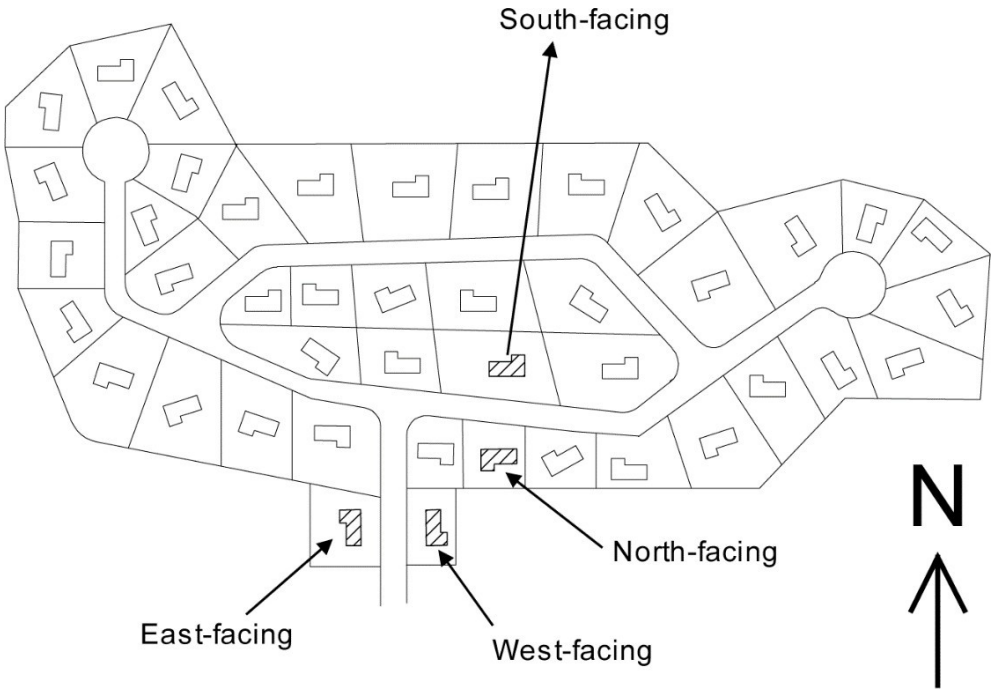
Multiple Orientation Alternative: No Orientation Restrictions

Section 150.1(b)

The performance method may be used to demonstrate that a building plan complies regardless of its orientation within the same climate zone. To ensure compliance in any orientation, the annual energy consumption must be calculated using all four cardinal orientations (a single CF1R with results for north, east, south, and west).

The building must have the identical efficiency measures and levels, and comply with the energy budget in all orientations. Cardinal compliance can be used to show compliance for a reversed floor plan.

Figure 8-1: Subdivisions and Master Plans Compliance Option



Source: California Energy Commission

For compliance, submit certificate of compliance documentation of the energy budgets for each of the four orientations to the enforcement agency. Only one CF1R compliance document that shows compliance for all four orientations is required to be submitted to the enforcement agency for each unique or reverse plan.

Master plans that use the multiple orientation alternative must establish a connection to the CF1R in the ECC registry. For the multiple orientation compliance approach in a master plan subdivision, the required documentation for each dwelling unit should be a multiple orientation master plan certificate of compliance (CF1R), a dwelling-specific certificate of installation (CF2R), and a dwelling-specific certificate of verification (CF3R).

HVAC Issues

No Cooling Installed

When a building has no cooling system, the software simulates a hypothetical system with the characteristics required by Table 150.1-A as if a cooling system were installed.

Wood Heat

Please refer to Chapter 8.5.2 of the *2022 Single-family Residential Compliance Manual*.

Multiple HVAC Systems

Please refer to Chapter 8.5.3 of the *2022 Single-family Residential Compliance Manual*.

ECC-Verified Efficiency

When higher than minimum efficiency is modeled, a ECC Rater must verify the efficiency. This includes:

- Seasonal Energy Efficiency Ratio 2 (SEER2)
- Energy Efficiency Ratio 2 (EER2)
- Combined Energy Efficiency Ratio (CEER)
- Heating Seasonal Performance Factor 2 (HSPF2)

Existing + Addition + Alteration Approach

Please refer to Chapter 8.5.5 of the *2022 Single-family Residential Compliance Manual*.

Table 8-1: Standard Design for an Altered Component

Altered Component	Standard Design Without Third Party Verification of Existing Conditions Shall be Based On	Standard Design With Third Party Verification of Existing Conditions Shall be Based On
Ceiling Insulation, Wall Insulation, and Raised-floor Insulation	The requirements of Sections 150.0(a), (c), and (d)	The existing insulation R-value

Fenestration	The U-factor of 0.40 and SHGC value of 0.35. The glass area shall be the glass area of the existing building.	If the proposed U-factor is ≤ 0.40 and SHGC value is ≤ 0.35, the standard design shall be based on the existing U-factor and SHGC values as verified. Otherwise, the standard design shall be based on the U-factor of 0.40 and SHGC value of 0.35. The glass area shall be the glass area of the existing building.
Window Film	The U-factor of 0.40 and SHGC value of 0.35.	The existing fenestration in the alteration shall be based on Table 110.6-A and Table 110.6-B.
Doors	The U-factor of 0.20. The door area shall be the door area of the existing building.	If the proposed U-factor is < 0.20, the standard design shall be based on the existing U-factor value as verified. Otherwise, the standard design shall be based on the U-factor of 0.20. The door area shall be the door area of the existing building.
Space-Heating and Space-Cooling Equipment	TABLE 150.1-A for equipment efficiency requirements; Section 150.2(b)1C for entirely new or complete replacement systems; Section 150.2(b)1F for refrigerant charge verification requirements.	The existing efficiency levels.
Air Distribution System – Duct Sealing	The requirements of Sections 150.2(b)1D and 150.2(b)1E	The requirements of Sections 150.2(b)1D and 150.2(b)1E
Air Distribution System – Duct Insulation	The proposed efficiency levels.	The existing efficiency levels.
Water Heating Systems	The requirements of Section 150.2(b)1Hii	The existing efficiency level.
Roofing Products	The requirements of Section 150.2(b)1I.	The requirements of Section 150.2(b)1I
All Other Measures	The proposed efficiency levels.	The existing efficiency levels.

SOURCE: California Energy Commission Energy Code Table 150.2-D