CalBEM

California Building Energy Modeling

CBECC-Com Software FAQs

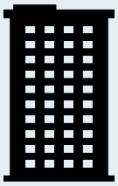
NR Compliance Pathways

Frequently asked questions about CBECC-Com modeling for California's 2019 Building Energy Efficiency Standards, Title 24, Part 6.

Q: How can all-electric buildings be modeled for the Energy Code?

Modeling optimized energy savings in all-electric buildings requires strategic tradeoffs in building features. Below are recommended areas of focus for four common nonresidential building types to meet Energy Code compliance.

Large Office

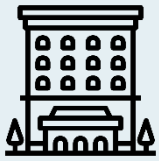


- Reduce Lighting Power Density (LPD)
- Reduce Window to Wall Ratio (WWR)
- High efficiency cooling equipment
- Low Solar Heat Gain Coefficient (SHGC) to reduce cooling load

Retail

- Reduce Lighting Power Density (LPD) and design lighting specifically to highlight merchandise
- Variable Air Volume (VAV) HVAC fans
- High efficiency cooling equipment

High-Rise Residential, Hotel/Motel



- Reduce Lighting Power Density (LPD)
- High efficiency cooling equipment
- Heat pump water heaters rather than electric resistance water heating
- Increase DHW pipe insulation and enable flow reduction

Schools, Small Office

- Reduce Lighting Power Density (LPD)
- Variable Air Volume (VAV) HVAC fans
- High efficiency cooling equipment

Why is this important?

In order to assist the State of California to meet its goal of reducing carbon emissions by 80% compared to 1990 levels by 2050, municipalities are putting into effect local energy ordinances that require projects to use the all-electric pathway for compliance as part of their adoption of Reach Codes. 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 in other jurisdictions.

For nonresidential buildings, all proposed system types are compared to a gas system in the Standard Reference Design, so it is important to look at ways to trade-off building features and meet Energy Code compliance. When pursuing the performance approach with an all-electric heating system, a way to account for a reduced Time Dependent Valuation (TDV) savings deficit is by balancing the energy cost with other energy efficient and building envelope features.

Key Features and Limitations

When creating an energy model for Title 24, Part 6, there are certain limitations that need to be considered. To start, all Energy Code compliance models must be completed in an approved software by the California Energy Commission. The software has schedules for system operations dependent upon the building occupancy type that is noted in the design plans.

As previously mentioned, all proposed systems will be compared to a gas system in the Standard Reference Design. This will usually result in a penalty in the Time Dependent Valuation (TDV) compliance margin for all-electric systems. To comply with an all-electric system, additional efficiency measures will need to be considered to increase the overall TDV savings. Modelers will want to work with the architect and engineers to design a building with a lighting power density (LPD) and variable volume fan systems that beat the prescriptive requirements.

Specific efficiency measures also are dependent on the climate zone (CZ) for TDV savings. For example, milder CZs show smaller penalties for heat pumps, whereas colder CZs show a larger penalty since the optimal temperature for heat pump operation is 40 degrees and above. Increased efficiency heating systems may be particularly beneficial in colder climates.

Building occupancy type also needs to be considered when choosing what efficiency measures to pursue. In an office building, a low solar heat gain coefficient (SHGC) could have a large impact on reducing cooling loads since there is typically a large amount of glazing. In most cases, building thermal envelope improvements show less of an impact than other efficiency measures because the prescriptive code generally already requires sufficient insulation.

Example: Methods and Documentation

In this example, the performance approach is examined to show how pursuing an all-electric reach code can impact the model when compared to a gas baseline.

Step 1: Local building ordinance requires all-electric proposed system

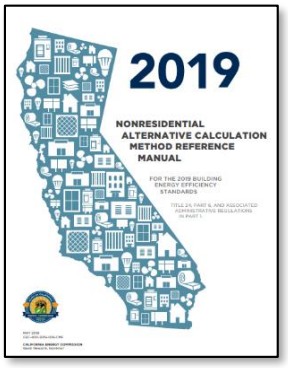
When designing a small office building, the team proposes an RTU with heat pump system which is compared to gas system in the Standard Reference Design. The energy cost differences pushes the proposed TDV into noncompliance with the Energy Code.

C1. COMPLIANCE RESULTS FOR PERFORMANCE COMPONENTS (Annual TDV Energy Use, kBtu/ft ²-yr)			
DOES NOT COMPLY			
Energy Component	**Standard Design (TDV)**	**Proposed Design (TDV)**	**Compliance Margin (TDV)[1]**
Space Heating	11.32	13.63	-2.31
Space Cooling	84.53	79.58	4.95
Indoor Fans	126.91	130.61	-3.70
Heat Rejection	--	--	--
Pumps & Misc.	--	--	--
Domestic Hot Water	8.17	8.10	0.07
Indoor Lighting	27.46	27.46	--
ENERGY STANDARDS COMPLIANCE TOTAL	**258.39**	**259.38**	**-0.99 (-0.4%)**

Step 2: Optimize the all-electric building to comply with Energy Code

In order to comply, the design team reduces the lighting power density by 25%.

C1. COMPLIANCE RESULTS FOR PERFORMANCE COMPONENTS (Annual TDV Energy Use, kBtu/ft ²-yr)			
COMPLIES			
Energy Component	**Standard Design (TDV)**	**Proposed Design (TDV)**	**Compliance Margin (TDV)[1]**
Space Heating	11.32	14.13	-2.81
Space Cooling	84.53	78.33	6.20
Indoor Fans	126.91	130.59	-3.68
Heat Rejection	--	--	--
Pumps & Misc.	--	--	--
Domestic Hot Water	8.17	8.10	0.07
Indoor Lighting	27.46	20.59	6.87
ENERGY STANDARDS COMPLIANCE TOTAL	**258.39**	**251.74**	**6.65 (2.6%)**



2019 Nonresidential Alternative Calculation Method Reference Manual

Find the Manual here: energy.ca.gov/2019publications/CEC-400-2019-006/CEC-400-2019-006-CMF.pdf

Additional Resources:

CalBEM: calbem.ibpsa.us/

Energy Code Hotline:

1-800-772-3300 (Free) or Title24@energy.ca.gov

CBECC-Com: bees.archenergy.com/

Approved Local Ordinances: localenergycodes.com/

2019 NR Compliance Manual:

energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/2019-building-energy-efficiency-1

Online Resource Center:

energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/online-resource-center

Energy Code Ace: energycodeace.com

Unmet Hours unmethours.com/questions/