Release Notes

Version CBECC 2022.0.7 Alpha March 2022

Overview

CBECC is an open-source software program developed by the California Energy Commission for use in showing compliance with the *2022 Building Energy Efficiency Standards* for nonresidential and multifamily buildings. These Release Notes are for CBECC 2022.0.7 Alpha released in March 2022.

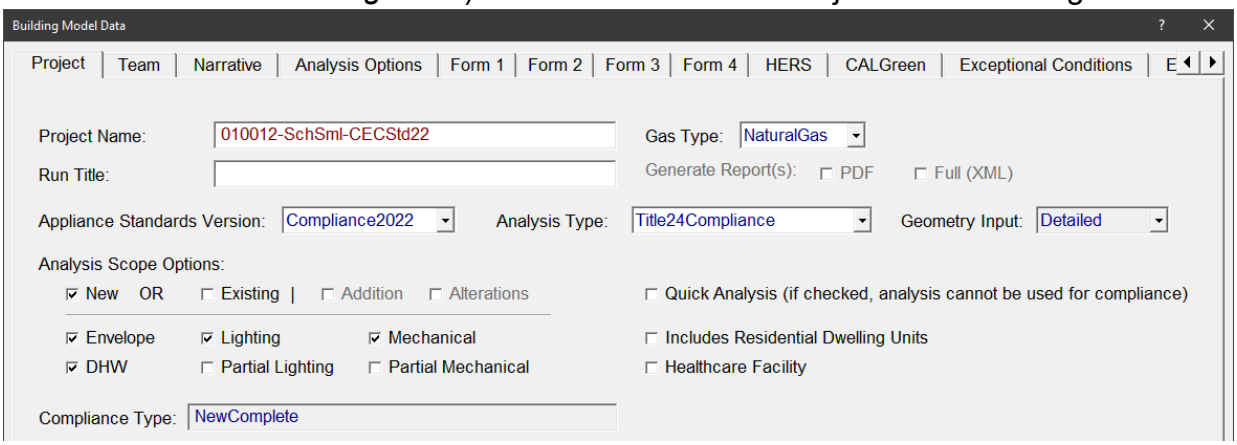
This version has not been approved by the California Energy Commission and cannot be used to show compliance with the 2022 Title-24 Standards.

Capabilities/Enhancements Included in CBECC 2022.0.7 Alpha

Calculate the annual energy use and source energy for both the Proposed Design and the 2022 Standard Design of nonresidential and multifamily buildings.

Software & User Interface

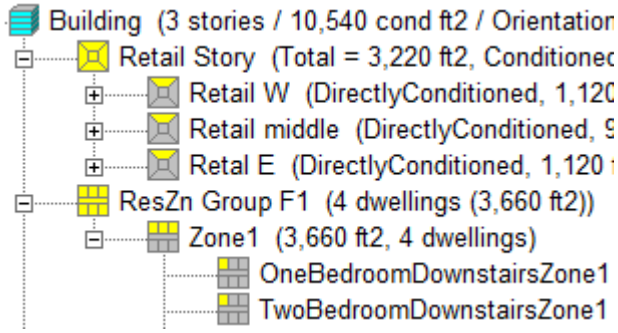
- The 2022 compliance software has been named CBECC. It now integrates both nonresidential (commercial) and multifamily (low-rise and high-rise) modeling capabilities combining both the simulation engines, EnergyPlus from CBECC-Com and California Simulation Engine (CSE) from CBECC-Res.
- **New residential inputs**: Any CBECC project that includes residential dwelling units (lowrise or highrise, not including hotel/motel guest rooms) requires that the user specify the presence of those dwelling units via a checkbox (*Includes Residential Dwelling Units*) on the first tab of the Project tabbed dialog:



  - Many residential object types from CBECC-Res have been added to CBECC 2022 to describe dwelling units and their surfaces and systems that serve them.

Residential zone group (ResZnGrp) is a new object that can be added as a child of a Building, similar to BuildingStory but in this case serving as the parent of Residential zones (ResZn, ResOtherZn (common areas), and others).

- Residential group/zone/dwelling objects (ResZnGrp, ResZn, ResOtherZn, DwellUnit and DwellUnitType) can be easily identified in the building component tree by their icons which display as a center corridor w/ rectangular units on either side vs. nonresidential zones that use a common 5-zone perimeter/core scheme.



- Residential dwelling unit inputs that used to be entered into space (Spc) objects are now entered via DwellUnitType, which allows specification of area, loads and systems that serve it. Note: Hotel/Motel guest room inputs remain in Spc object.

- The California Simulation Engine (CSE) is used to model residential zone groups and related objects. This brings modeling capabilities such as pressure-based airflow modeling to capture stack effect and interactions between infiltration and mechanical systems.
- Determination of building compliance is now based on three separate metrics (Efficiency and Total Compliance TDV and Total Compliance Source Energy), as opposed to just Compliance TDV in the 2019 code cycle. The overall compliance result and each of the metrics described above are listed in a new Compliance Summary tab of the analysis results dialog. Other dialog tabs provide model and enduse results for site & source energy, TDV, and CO2 emissions. Note that Total Compliance TDV and Source Energy include the impacts of user-entered (proposed) and prescribed standard design photovoltaic and battery systems.
- Photovoltaic and Battery systems were optional inputs in prior releases, but as of the 2022 code these systems are much more critical to achieving compliance. These systems can be created in the Mechanical component tree by ‘right-clicking’ on the topmost Project object and selecting Create > PhotovoltaicArray and Create > Battery. Once created, they will appear toward the bottom of the mechanical component tree and are editable via dialogs like all other building objects.

Current Limitations

- Residential input screens for central heating/cooling and ventilation systems have been added, but simulation of these systems is not yet supported. Central systems include:
  - Water Source Heat-Pumps (WSHP), Four Pipe Fan Coil (FPFC) and Variable Refrigerant Flow (VRF)
  - Centralized supply, exhaust or balanced ventilation systems, including combinations of central + in-unit systems.
- Photovoltaic and Battery system inputs have not yet been updated to include the latest features from their CBECC-Res counterparts (PV solar access, power electronics, CFI2, etc.). These updates as well as new features such as charging batteries from the grid will be included in the subsequent release.
- Updates to the project tabbed dialog for HERS and CALGreen have not been implemented.
- Backward compatibility to import previous 2019 CBECC-Com high-rise residential and 2019 CBECC-Res low-rise residential models is currently not supported.

Envelope Loads

- **Nonresidential**:
  - Revised solar properties of standard design steep-sloped roofs as per 2022 standard prescriptive requirements.
  - Revised standard design u-factor of metal framed walls as per 2022 standard prescriptive requirements.
  - U-factor and solar properties for altered roofs in the standard design follow the 2022 prescriptive requirements.
  - Revised standard design fenestration U-factor and SHGC to reflect 2022 changes.
  - Added Project and Building level inputs for Air Barrier. The Air Barrier inputs will determine the infiltration rates for the buildings conditioned spaces.
- **Multifamily:**
  - Residential construction descriptions (similar to previous CBECC-Res) and layer-by-layer constructions added to describe exterior surfaces of dwelling units.

Current Limitations

- Air Barrier inputs currently only affect the infiltration rates for nonresidential spaces modeled in EnergyPlus. Implementation of the Air

Barrier requirements for Residential Zone Groups simulated using CSE is not yet implemented.

Internal Loads

- Revised space function categories to reflect changes as per Table 140.6-C
- Standard design interior 'Area Category' and 'Tailored' general and additional lighting power allowances updated to reflect 2022 changes.
- Revised lighting control credits and checks to reflect 2022 changes, including mandatory requirement for automatic daylighting controls in secondary sidelit daylit zones and daylight dimming controls.
- Internal load and HVAC schedules are still based on the predominant schedule set for the BuildingStory (with exceptions for Lab and other process spaces). The predominant schedule is also used to determine when standard design system map exceptions for School, Retail, and Office buildings <= 3 stories.

Current Limitations

- Lighting power density and lighting control rules for multifamily common areas have not been added. Lighting in the proposed and standard designs are modeled the same using the code minimum lighting power allowances.
- The list of SpaceFunctions common to many building types that can have their schedule group edited will be expanded, and 'Sports Arena 'space functions will not be considered as 'Retail' for the purposes of determining the 'Retail' standard design system.

HVAC

- **Nonresidential:**
  - Standard design HVAC system mapping updated to reflect 2022 changes, including building specific systems and use of single-zone heat pumps (all-electric or dual fuel, depending on climate zone).
  - Standard design fan power and fan power credits updated to utilize new W/cfm allowances based on system capacity.
  - Fan Energy Index (FEI) inputs have been added for the new mandatory requirement.
  - Expand standard design economizer requirements to systems >33 kBtu/hr, and revise to use fixed dry bulb temperature control limit based on climate zone.
  - Revise standard design 'Computer Room' system air flows sizing to meet 100% of cooling load when outdoor air dry bulb temperature 65°F and below.

- Add heat recovery to standard design systems based on climate zone and outside air ratios. Allow heat recovery to be modeled for all systems, even if not 100% outside air.
- Revise minimum air flow rate (i.e. deadband flow) of standard design VAV systems with DDC to be minimum ventilation rate.
- Update standard design efficiency and proposed design minimum efficiency checks to reflect 2022 Section 110.2 efficiency table changes.
- Standard design hot water boilers with a capacity greater than 300,000 Btu/hr will have a thermal efficiency of 90%. Heating hot water systems will have a supply temperature of 160°F and a return temperature of 120°F (40°F delta T).

- **Multifamily:**
  - Data model expanded to support describing central heating/cooling systems, such as water-source heat pumps, fan coils, and VRF.

Current Limitations

- Not all applicable mandatory efficiency and control requirement checks have been fully implemented.
- Special fan power rules for 'Healthcare' and HVAC alterations, such as an additional fan power allowance for standard design systems in existing buildings, have not been implemented yet.
- No new features or rules for DOAS control have been implemented; DOAS modeling capabilities are unchanged from previous versions.
- In both proposed and standard design heat pump AirSystems, the supplemental heating temperature operation (shut-off) limit is not simulated. The supplemental heating coil will be used anytime the heat pump cannot meet the zone load or supply air temperature setpoint.
- User Interface and data model elements for residential central ventilation & HVAC systems are included however these systems currently cannot be modeled in this release.

Ventilation and IAQ

- **Nonresidential:**
  - Update ventilation space functions to reflect changes to Table 140.6-C.
- **Multifamily:**
  - Data model expanded to support describing central ventilation systems.
  - Enable modeling of parking garage ventilation systems

Service Hot Water Heating

- Updates to Standard Design gas water heating system efficiency to have an efficiency of 90% if the total input capacity is 1 MMBtu/h or greater as per Section 140.5(c).

  Current Limitations

  - Standard design heat-pump water heater for school buildings as per Section 140.5(a) cannot be modeled in this release, but will be available in the subsequent release.

Residential Water Heating

- As with residential building envelope and loads, water heating is input and simulated using objects ported from CBECC-Res, including the very latest Central HPWH features such as multi-pass compressors and series vs. parallel secondary tanks.

Reporting

- Reporting for 2022 performance compliance forms is currently disabled and under development.

Bugs Fixed in CBECC 2022.0.7 Alpha 4

- Fix rule evaluation area related to SchDay:Sum related to new schedule type.
- Fix rule evaluation error ThrmlZn:VentSysExhFlowWithMult observed when ventilation air flow specified for system was greater than supply flow.
- Fix ZnSys:Type = ‘VRF’ screen
- Fix issue causing standard design to not have correct ventilation when a zone has both code required ventilation and exhaust flow.
- Fix supply air temperature control rule for lab systems that use a control scheme other than ‘Warmest’ reset.
- Fix problem resulting in ActiveBeams to not be simulated for certain lab configurations. Add rule to check for consistency between ActiveBeam terminal quantities and HVACZoneCount, and

Known Issues:

- General Issues
  - No resizing of standard design systems if unmet load hour (UMLH) requirement is not met.
- Spaces
  - Increasing the number of occupants in the space only currently impacts the ventilation calculation when using DCV. It does not increase the prescribed occupant density assumed in the compliance simulation.
- HVAC Secondary Systems
  - Simulation of supply air temperature and flow controls may not match ACM requirements
  - Specifying DCV for all zones of a multi-zone system results in unexpectedly high energy use.
  - The simulated supply air temperature for FPFC systems may be less than expected; which can result in more hours of fan operation and therefore high fan energy use.
  - AirSystem SZVAV systems with economizers act as constant volume systems when the economizer is not active. A higher economizer control limit is recommended to alleviate this.
  - AirSystem SZVAV systems with water-source cooling coils have higher cooling loads and energy use than comparable air-source cooling coils.
  - Heat pump supplemental heating coil temperature limit is not used for air-source heat pumps used in AirSystems.
- HVAC Primary Systems
  - Simulation failures have been observed for WSHP models, where the condenser water loop temperature runs (high) out of the accepted E+ temperature range. Potential workarounds for this issue include:
    - Modeling the WSHP system as an AirSystem (Type = ‘SZHP’ or ‘SZVAVHP’ with ‘WaterSource’ as the condenser type).
    - Modeling CW system with a single variable-speed pump on the return FluidSegment.
  - Some models with constant speed pumps on hot water loops may see errors where the water temperature exceeds upper limits due to an EnergyPlus issue where pumps run and add heat to the loop during periods when there is no heating demand.
  - All pumps on primary loop of primary/secondary pumping systems will run if there is any demand on the secondary loop
  - Evaporative-only cooling systems that cycle to meet cooling loads are not simulated correctly.
- Material Data

- The values in Table 4.3.8 of JA4 are being reviewed for potential revision. Spandrel panel and curtain wall material data are based on the current values in the table.

Example Input Files: A series of example models are installed along with CBECC in the Projects directory. These models are of various building types and HVAC systems.

CEC Standard Tests

1. 010012-SchSml-CECStd
2. 020012-OffSml-CECStd
3. 020012S-OffSml-CECStd
4. 030012-OffMed-CECStd
5. 030012S-OffMed-CECStd
6. 040012-OffLrg-CECStd
7. 050012-RetlMed-CECStd
8. 060012-RstntSml-CECStd
9. 070012-HotSml-CECStd
10. 080012-Whse-CECStd
11. 090012-RetlLrg-CECStd

VRF Tests

1. 021013-OffSml-VRFSys
2. 021015-OffSml-VRFSys
3. 021016-OffSml-VRFSys
4. 021113-OffSml-VRFSysHR
5. 021115-OffSml-VRFSysHR
6. 021116-OffSml-VRFSysHR

Multifamily

1. MF117Unit_10Story_ELEC-CZ12
2. MF36Unit_3Story_NGAS-CZ12
3. MF88Unit_5Story_ELEC-CZ12
4. MF8Unit_2Story_ELEC-CZ12

Other Tests

1. 010112-SchSml-PSZ22
2. 010212-SchSml-PVAVAirZnSys22
3. 010312-SchSml-VAVFluidZnSys22
4. 040112-OffLrg-AbsorptionChiller22
5. 040112-OffLrg-VAVPriSec22
6. 040112-OffLrg-Waterside Economizer22
7. 050112-RetlMed-SZVAV22
8. 050312-RetlMed-Alterations22
9. OffLrg-PrkgExhaust22
10. OffLrg-PrkgLab22
11. OffLrg-PrkgLabKitchen22
12. OffLrg-RetailHlthcare22
13. OffLrg-RetailHlthcarewithPlant22
14. OffLrg-ThermalEnergyStorage_ChillerPriority22
15. OffLrg-ThermalEnergyStorage_StoragePriority22

16. OffMed-CoreAndShell22
17. OffMed-CoreAndShellwithPlant22
18. OffMed-FanPowerAdj22
19. OffSml-ActiveBeams22
20. OffSml-CombDHWSpcHt22
21. OffSml-CommKit_SZVAV22
22. OffSml-Data_SZVAV22
23. OffSml-DOASCV+RadiantCeiling22
24. OffSml-DOASCV+RadiantFloor22
25. OffSml-DOASCV+RadiantFloorSimplified22
26. OffSml-HtRcvry22
27. OffSml-HtRcvryFromExh_AllZn22
28. OffSml-HtRcvryFromExh_OneZn22
29. OffSml-Lab_SZVAV22
30. OffSml-MiniSplit22
31. OffSml-Office_SZVAV22
32. OffSml-PassiveBeams-DOASCV+HtRcvry22
33. OffSml-PassiveBeams-DOASVAV22
34. OffSml-PassiveBeams22
35. OffSml-PSZ-Evap22
36. OffSml-WSHP22
37. RetlMed-PVAV-IndirDirEvap22
38. RetlSml-DOAS+FPFC22