

CALBEM 2026 SYMPOSIUM · WORKING GROUP 1

# Don’t reinvent the wheel: a simulation-based heat-stress test already exists

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THE PROBLEM

# California homes are not built to survive heat

**20% / 29%**

of owner-occupied / rental units have no central or room AC

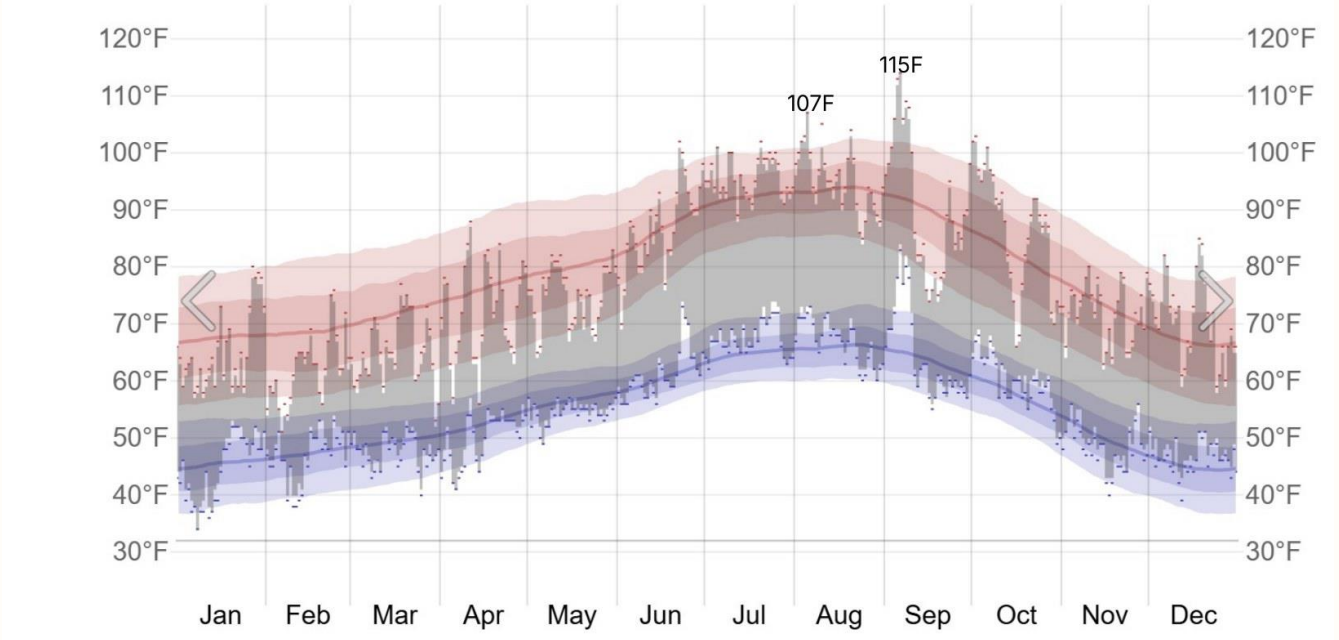
**60%**

of housing units were built before 1979

**115°F**

peak in Riverside, 2024

**Riverside, CA: hourly dry-bulb temperature, 2024**




Sources: UCLA, Protecting CA with Heat Resilient Homes (2022), citing U.S. Census AHS 2020 and ACS 2015–2019

PASSIVE SURVIVABILITY

# A building's ability to maintain critical life-support conditions during extended loss of power or water, or during extraordinary heat spells, storms, or other extreme events.

## Title 24 asks

How much energy will this building use?

## Nobody asks

How hot does the bedroom get at 3 a.m. in a heat wave?

ENGLAND'S BUILDING REGULATIONS

# Overheating is its own regulation, beside the energy code




## Part L

Conservation of fuel and power, ≈ our Title 24 Part 6

## Part F

Ventilation

## Part O

Overheating: health and welfare, not energy

APPROVED DOCUMENT O AT A GLANCE

# In force since June 15, 2022, for all new residential buildings

ROUTE 1

## Simplified method

A prescriptive check: limits on glazing area by orientation and minimum free area for opening windows. No modeling needed.

ROUTE 2

## Dynamic thermal modeling

Hourly simulation per CIBSE TM59, plus Part O's own operating rules. **Required** when a project has communal heating with long pipe runs, mechanical cooling, or night noise too high for open windows.

Sources: HM Government, Approved Document O (2021); CIBSE Journal, "Overheating warning" (2022)

PRESET RULE LIBRARY · 1 OF 2: INPUTS

# Nobody argues about the assumptions

## Occupancy

Fixed people-per-room and hourly profiles by room type

## Internal gains

Preset equipment and lighting loads, 75 W sensible per person

## Weather

CIBSE design summer year (DSY1): 2020s, high-emissions, 50th percentile, nearest site

**Table 2** Occupancy and equipment gain descriptions

| Unit/ room type | Occupancy | Equipment load |
|---|---|---|
| Studio | 2 people at 70% gains from 11 pm to 8 am | Peak load of 450 W from 6 pm to 8 pm*. |
| | 2 people at 100% gains from 8 am to 11 pm | 200 W from 8 pm to 10 pm |
| | | 110 W from 9 am to 6 pm and 10 pm to 12 pm |
| | | Base load of 85 W for the rest of the day |
| Double bedroom | 2 people at 70% gains from 11 pm to 8 am | Peak load of 80 W from 8 am to 11 pm |
| | 2 people at full gains from 8 am to 9 am and from 10 pm to 11 pm | Base load of 10 W during the sleeping hours |
| | 1 person at full gains in the bedroom from 9 am to 10 pm | |

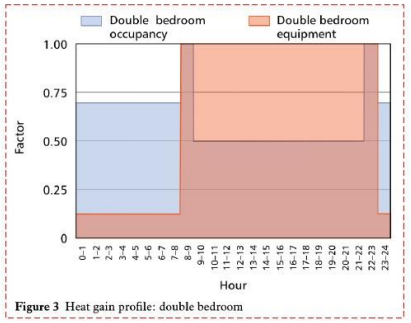



**Figure 3** Heat gain profile: double bedroom

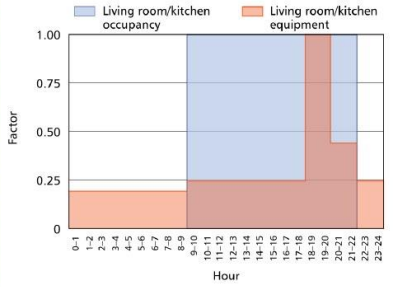



**Figure 4** Heat gain profile: combined living room/kitchen

Source: CIBSE TM59 (2017), Table 2 and Figures 3–4; IES VE and DesignBuilder TM59 documentation

PRESET RULE LIBRARY · 2 OF 2: OPERATION

# The occupant’s behavior is written into the rule

| Rule | What the model must do |
|---|---|
| Daytime windows | Start opening above 72°F (22°C); fully open at 79°F (26°C) |
| Night bedroom windows | Open all night only if the room is above 73°F (23°C) at 11 p.m., and only above the ground floor |
| Bedroom doors | Closed 11 p.m. to 8 a.m. |
| Internal blinds | No credit; the envelope has to do the work |
| Noise and security | Windows count as closed where noise or ground-floor access rules them out |

Source: Approved Document O (2021), dynamic modeling requirements, as summarized in DesignBuilder and CIBSE Journal guidance

FAILURE CRITERIA · CIBSE TM59

# Two pass/fail tests per room

### A · Living rooms, kitchens, bedrooms

**≤ 3% of occupied hours**

at 1.8°F (1 K) or more above the adaptive comfort limit, May through September

### B · Bedrooms, 10 p.m. to 7 a.m.

**≤ 32 hours a year**

above 79°F (26°C), which is 1% of annual sleeping hours

**STILL EVOLVING**

TM59:2026 (July 2026) moves bedrooms to a nightly-mean test: no more than 4 nights above 79–81°F (26–27°C). Part O still cites the 2017 edition.

Sources: CIBSE TM59 (2017) and TM59 (2026); DesignBuilder TM59:2026 documentation

ALREADY IN THE SOFTWARE

# Load the template, run the year, print the report

## IES VE

- Pre-loaded TM59 profile templates
- Dynamic blind and window-opening control
- TM59 analysis report script
- CIBSE DSY weather files

## DesignBuilder (EnergyPlus)

- TM59 residential activity templates
- Built-in “TM59 rules” natural ventilation
- Part O window-opening logic
- TM59:2026 pass/fail report plugin

The rule set lives in the tool, not in each consultant’s spreadsheet.

Sources: IES, “CIBSE TM59 Holland Park” (2021); DesignBuilder v2025.1 help, CIBSE TM59 2026

A SHOPPED COMMODITY

# You can buy a Part O assessment online, starting under $300

| UK provider | Simplified | TM59 model | Turnaround |
|---|---|---|---|
| Part O Expert | $80 | $270 | “Quick” |
| Easy EPC | $200 | $270 | On invoice |
| Gradwell Group | – | $300 | 5 days (case) |
| Future BY Energy | – | $675 | 5 working days |

**~$270–675**

advertised starting price for a TM59 model

**1,000+**

projects claimed by one specialist firm alone

Advertised “from” prices, before VAT, converted at $1.35 per £ (Nov 2026). Large multifamily jobs are quoted per project. Sou rces: provider websites; tm59expert.co.uk

THE GOVERNMENT'S OWN MATH

# The rule pays for itself

**$680M**

net present social benefit (best estimate)

**$3.1M**

the only cost to business it counted: learning the new rule

**$490M**

saved on capital and replacement costs, mostly less glazing and less cooling plant

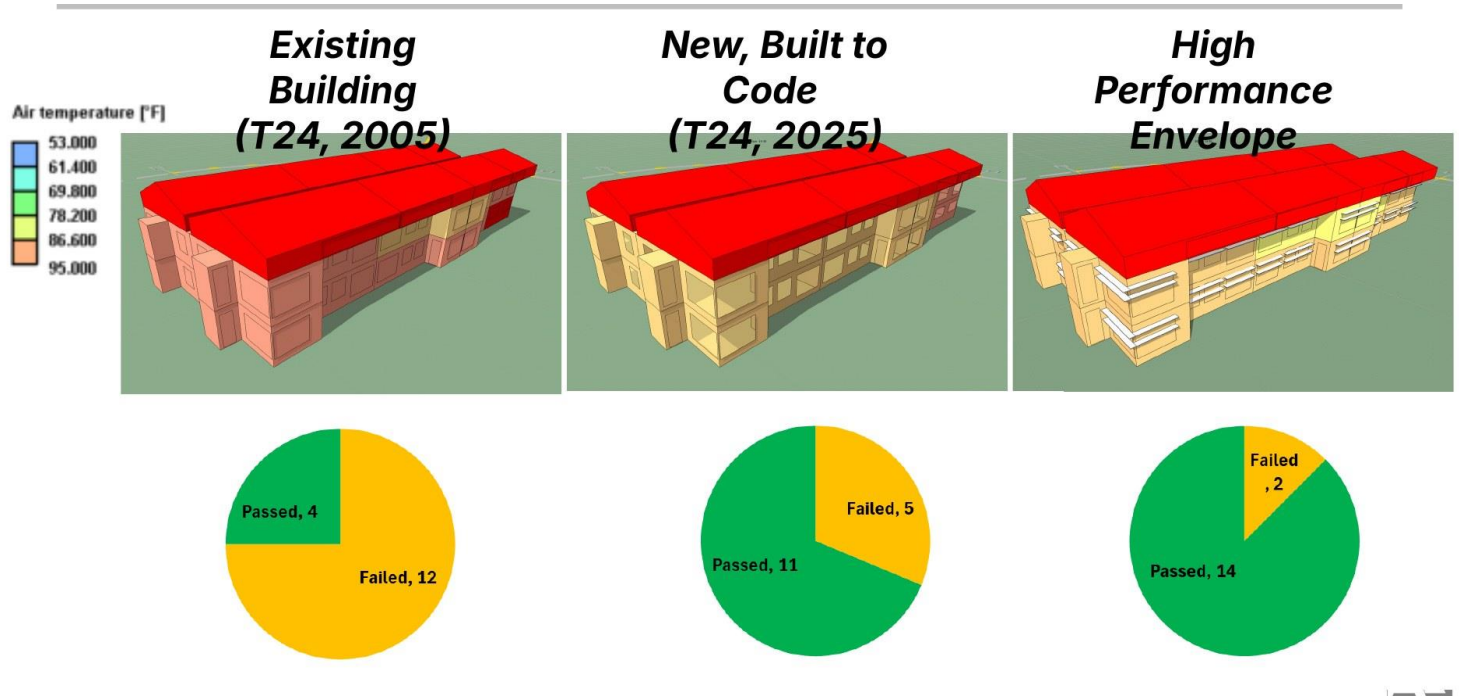
**$72M**

in reduced heat-related deaths

Source: DLUHC, Final Stage Impact Assessment, new requirement on overheating (Dec 2021). Present values; converted at $1.35 per £ (Nov 2026).

CALIFORNIA PROOF · RIVERSIDE, CZ09

# We ran Part 0 on a 16-unit California apartment building




**12 of 16**

units fail, existing (Title 24, 2005)

**5 of 16**

units fail, new to code (Title 24, 2025)

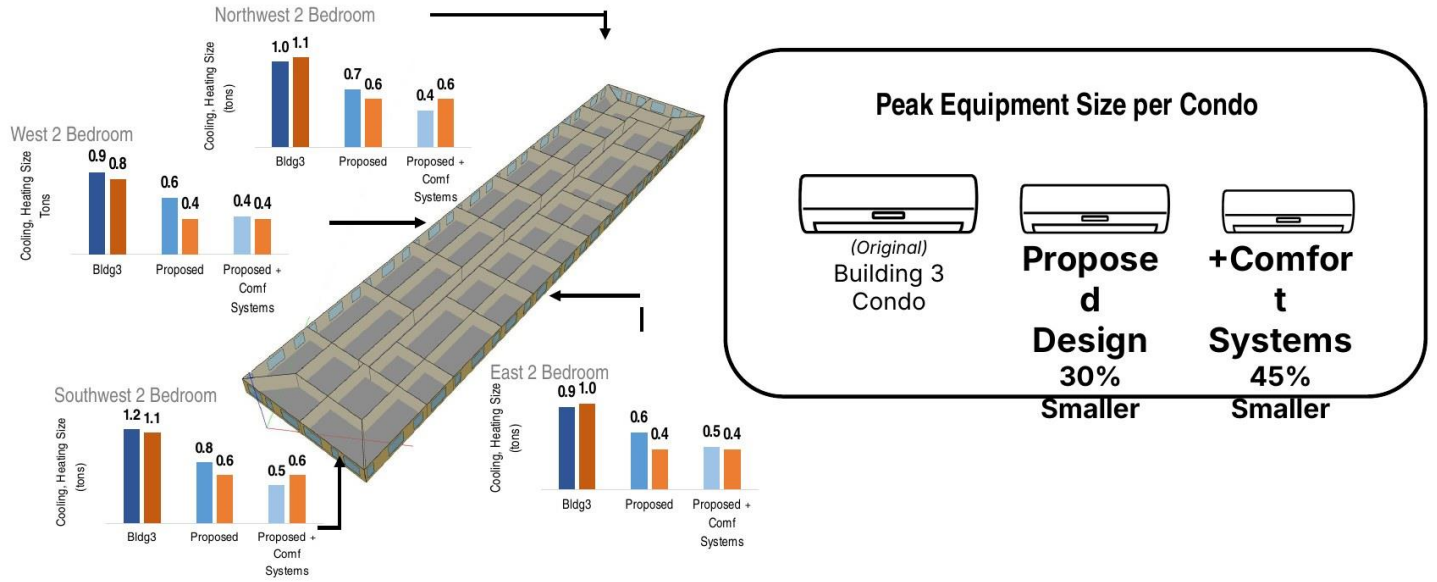
**2 of 16**

units fail, high-performance envelope

A2 Efficiency analysis: 14,000 sf, 30% WWR, natural ventilation, no cooling, CZ09 typical weather (2025)

WHAT THE TEST DRIVES

# Better envelopes mean smaller cooling equipment




**30%**

smaller peak equipment with the improved design

**45%**

smaller with comfort systems added

**1–1.3 ton**

all-in-one heat pump plus ventilator per unit

A2 Efficiency analysis, per-condo peak cooling and heating size by orientation

TRANSLATING IT TO CALIFORNIA

# Adopt the method, swap in the local pieces

| Element | England today | California starting point |
|---|---|---|
| Code home | Part O, beside Part L | Adjacent to Title 24 Part 6, not inside it |
| Scope | All new residential | Start with new multifamily, then scale |
| Inputs and rules | TM59 profiles, Part O window rules | Adopt as-is; adjust only where CA use differs |
| Weather | CIBSE DSY1, 2020s high emissions | Future-shifted CZ files or recent hot years |
| Pass/fail | TM59 criteria A and B | Same tests, reported in °F |
| Engines | IES VE, DesignBuilder | Same tools plus EnergyPlus / CBECC workflows |

THE ASK FOR WORKING GROUP 1

# We don’t have to reinvent the wheel

1

### Pilot it

Pick a program or reach code to trial a heat-stress check on new multifamily

2

### Pick the weather

Agree on the California design-summer files every model will use

3

### Run real projects

Modelers in this room test a handful of recent CA buildings against TM59

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