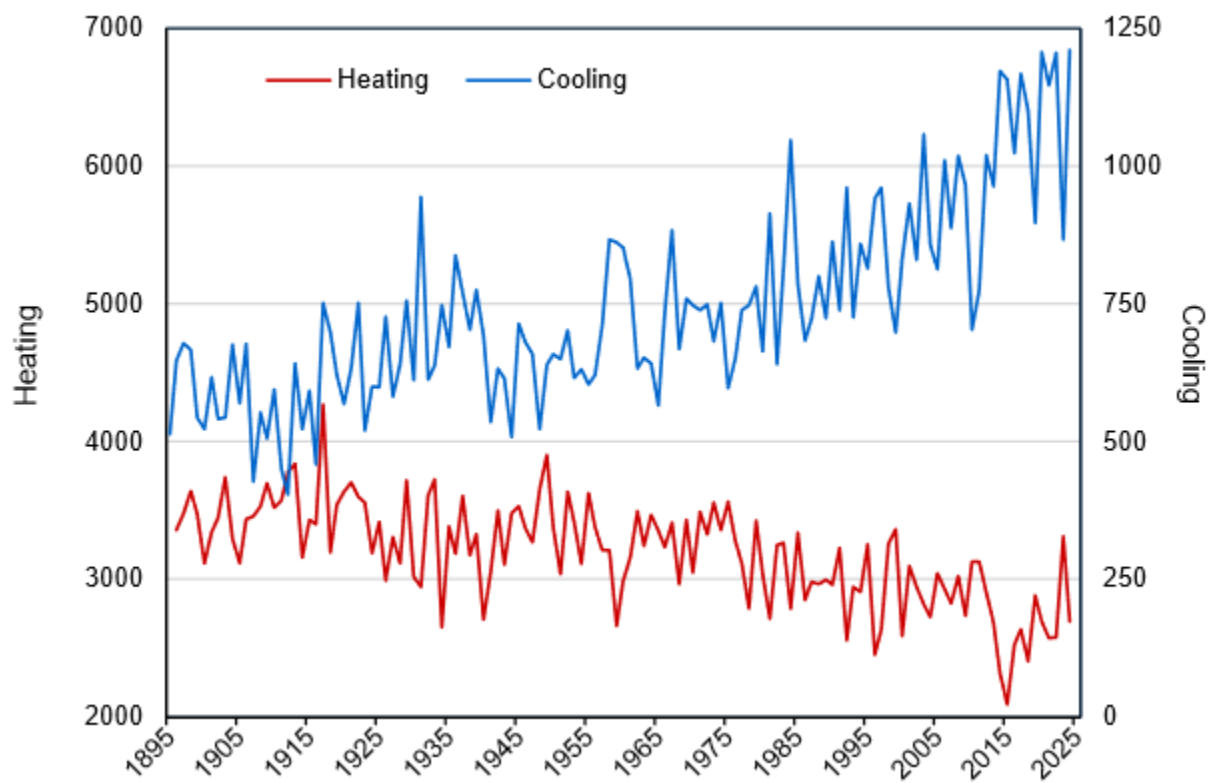


2.5 Cooling and Heating Degree Days

Cooling degree days (CDDs) and heating degree days (HDDs) are temperature-based metrics used to help estimate cooling and heating needs. Other things being equal, the higher the CDDs over a period, the more energy required to cool a building to a given temperature. Similarly, the higher the HDDs, the more energy needed to heat a building. In California, CDDs have increased, and HDDs have decreased.

Figure 2.5.1. Statewide Cooling and Heating Degree Days.



Cooling degree days (CDDs) measure how much the average* daily temperature is higher than a reference temperature of 65°F (18°C); heating degree days (HDD) measure how much it is lower than 65°F (18°C). Each value shown in the graph is the sum of degree days for that year. The “cooling year” during which CDDs are calculated is defined as January 1st to December 31st of the calendar year. The “heating year” during which HDDs are accumulated is defined as July 1st to June 30th of the following calendar year.

*Average is defined as the midpoint of the hourly minimum and maximum temperature for the day. The values shown are a geographic average of temperature values across California.

Source: NOAA (2025)



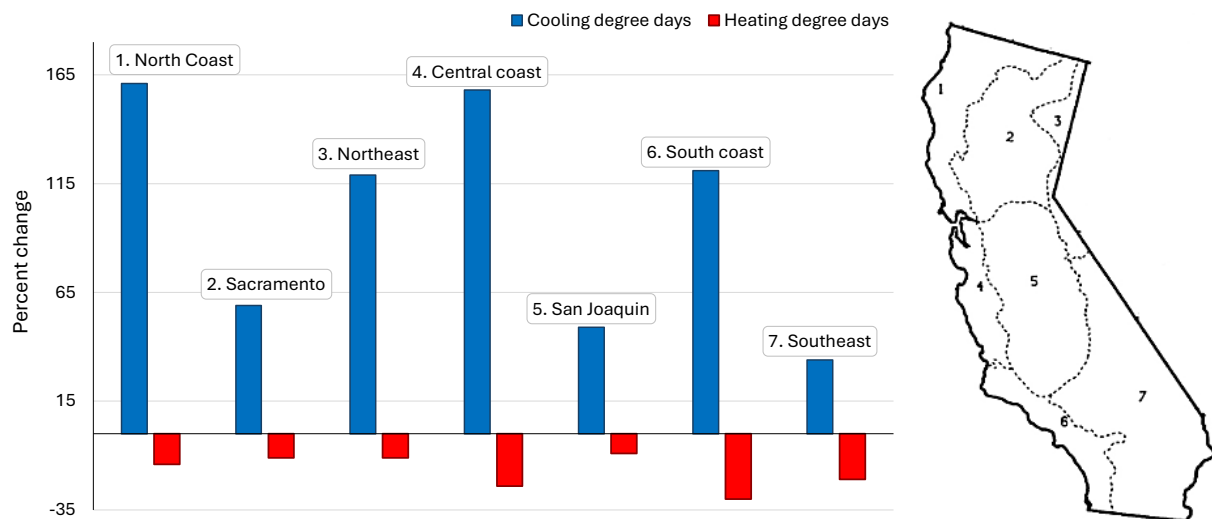
What does the indicator show?

Annual CDDs in California increased between 1895 and 2024, and HDDs decreased (**Figure 2.5.1**). Both trends are consistent with national patterns (NOAA, 2025). They have been especially pronounced in the past five decades: the rate of change for the most recent 50 years (1974-2024) is substantially higher than for the previous time period (1895-1974).

California's 100 million acres encompass diverse terrains and geographies with various climates. Long-term trends in degree days show local variations at the level of federally defined climate divisions (**Figure 2.5.2**, **Figure 2.5.3**, **Figure 2.5.4**, and **Table 2.5.1**) and county (**Figure 2.5.5**) level.

Coastal California shows greater percentage increases in CDDs over the last century compared to inland areas of the state, partly because it had low cooling degree days to begin with. The Central Coast and especially the South Coast had the largest percentage declines in HDDs.

Figure 2.5.2. Divisional Changes in Degree Days.



Source: NOAA (2025)



Table 2.5.1 summarizes these trends as changes in annual CDDs and HDDs for California's seven climate divisions, expressed as linear rates of change per decade. Trends are reported for two periods: 1895 to 1974 and 1975 to 2024. Across all regions and both periods, CDDs increased while HDDs decreased.

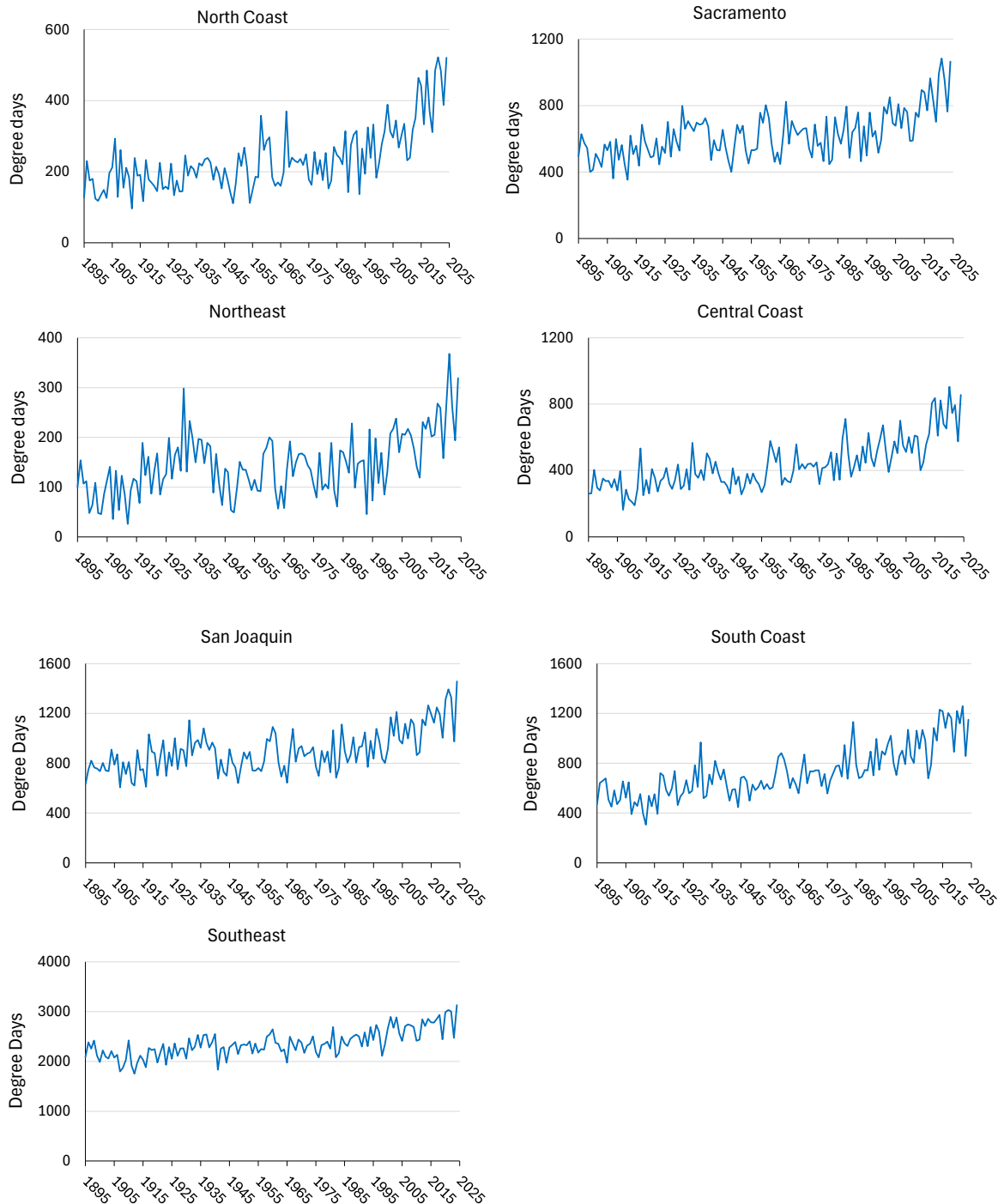
Table 2.5.1. Divisional Trends in Degree Days.

Climate Division	Trends, 1895-1974 (Degree Days per Decade)		Trends, 1975-2024 (Degree Days per Decade)	
	Cooling	Heating	Cooling	Heating
North Coast Drainage	+8	-27	+53	-111
Sacramento Drainage	+18	-12	+76	-95
Northeast Interior Basins	+6	-60	+32	-135
Central Coast Drainage	+16	-35	+69	-138
San Joaquin Drainage	+15	-12	+94	-135
South Coast Drainage	+26	-45	+86	-147
Southeast Desert Basins	+37	-19	+131	-66

Trends are shown for each of California's climate divisions, with values corresponding to the slope of linear trends. These slopes represent the rate of change in cooling or heating degree days per year. Source: NOAA (2025)



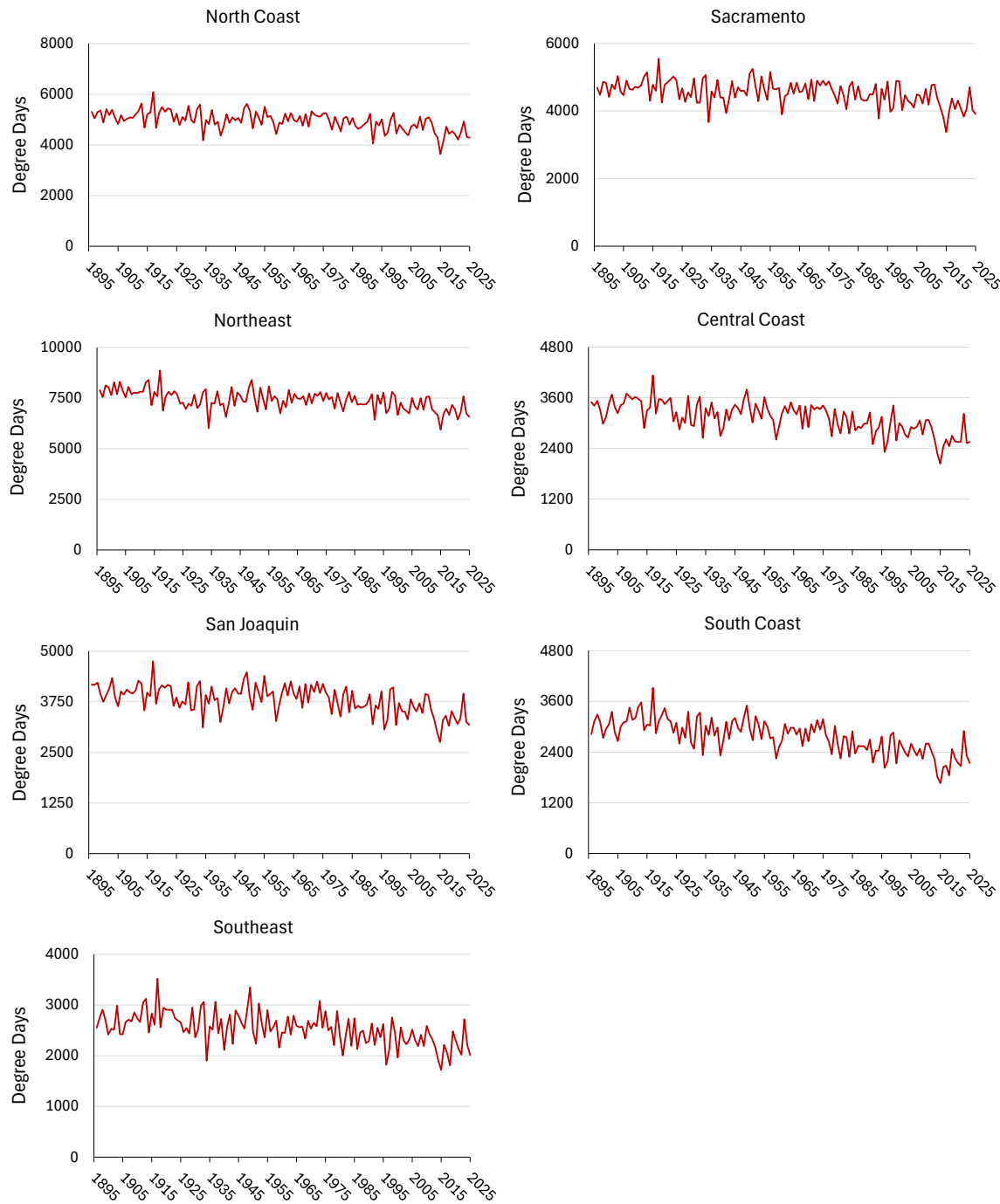
Figure 2.5.3. Cooling Degree Days by Division.



The graphs show annual cooling degree days for each climate division from 1895 to 2024. The y-axis scales differ so that the trends of each region are more visible. Source: NOAA (2025)



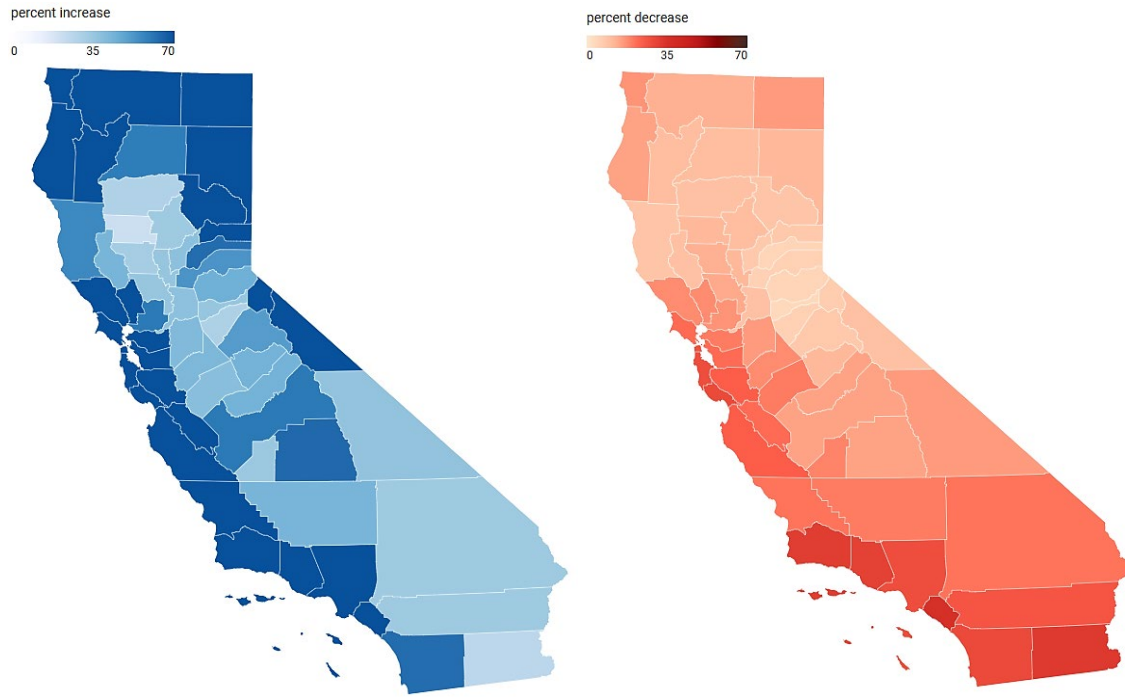
Figure 2.5.4 Heating Degree Days by Division.



The graphs show annual heating degree days for each climate division from 1895 to 2024. The y-axis scales differ so that the trends of each region are more visible. Source: NOAA (2025)



Figure 2.5.5. Change in Degree Days per Decade (1895 to 2024).



The maps show the county-level average per decade changes estimated from linear regression trendlines for CDDs (left) and HDDs (right).

Source: NOAA (2025)

Why is this indicator important?

Degree days provide a standardized temperature-based metric widely used in energy and climate modeling and forecasting. Since the 1930s, degree days have been used to estimate energy needed to cool or heat buildings, benchmark building performance, and support utility planning and construction decisions (Marston, 1935; Meng and Mourshed, 2017; NOAA, 2005).

As the climate continues to warm, heating needs will likely decline, and energy consumption is expected to shift from cooler months to warmer months (CEC, 2015) due to increased cooling energy use from expanded presence of air conditioning and higher levels of use. Meeting a growing demand for cooling creates challenges for new energy generation and distribution infrastructure (CEC, 2020). At the same time,



warming temperatures, sea level rise, and wildfires can negatively impact the operation or the efficiency of power plants, transmission networks, and natural gas facilities (CEC, 2009, 2012, 2020; Patrick and Fardo, 2009). Climate change can also affect renewable energy generation, given its dependence on natural resources like water, wind, biomass and available incoming solar radiation, which are all influenced by climate variations (CEC, 2009).

For lower-income households, heating and cooling costs often represent a bigger fraction of household income than for higher-income households (CalEPA, 2010). The impact of increased summer heat is disproportionate across households and communities. Lower-income households are less likely to own well-functioning efficient air conditioners or even any air conditioners at all (Chen et al., 2020; Fernandez-Bou et al., 2021).

What factors influence this indicator?

Since heating and cooling degree days reflect trends in temperature, factors that influence temperature affect this indicator. These factors are discussed in the *Air Temperature* chapter.

The relationship between degree days and building heating and cooling energy use is approximate and is dependent on many factors that vary by building and over time. These include building construction and thermal characteristics (e.g., building size, ventilation, insulation, placement and energy efficiency rating of windows and doors); building type and function (single-family residential, multi-family residential and the myriad of commercial and industrial uses); the type and efficiency of cooling and heating technologies, and occupant practices (for example, based on occupancy, tolerance for heat or cold, and use of heat-generating appliances and equipment) (Meng and Mourshed, 2017). In addition, compressor-based air conditioning was not widely available in U.S. homes until the mid-20th century (Cooper, 1998). Prior to its widespread adoption, residential cooling relied primarily on passive and low-energy strategies (e.g., high ceilings, operable windows, cross-ventilation, building orientation, and the use of fans in some regions). As a result, household energy use for cooling was minimal. Other such changes in cooling practices and associated energy demand can



be expected as energy use patterns and technology evolve, such as more effective building design for energy conservation (Bal and Rani, 2025).

Technical considerations

Data characteristics

The values for degree days are downloaded from National Oceanic and Atmospheric Administration (NOAA's) [Climate at a Glance](#) website (NOAA, 2025). They are derived by NOAA using daily temperature observations at major weather stations in the United States with NOAA's Climate Divisional Database (nClimDiv). nClimDiv uses a 5 kilometer (km) gridded approach to compute temperature, precipitation, and drought values for the United States climate divisions. A mean daily temperature (average of daily maximum and minimum temperatures) of 65°F (18°C) serves as the reference temperature for degree day calculations for this data set. Cooling degree days over a given period are calculated by summing the positive differences between the mean daily temperature and the 65°F (18°C) reference temperature. Heating degree days for a period are calculated by summing the positive differences between 65°F and the mean daily temperature.

Strengths and limitations of the data

The nClimDiv dataset is an improved version of an older climate dataset from NOAA, benefiting from additional quality assurance reviews and temperature bias adjustments and providing more robust values than its predecessor. New methodologies include a transition to a grid-based calculation and several thousand additional stations nationwide from before the 1930s (NOAA, 2021; Vose et al., 2014).

There are important limitations to consider when relating degree days to energy use. First, thermal comfort of building occupants does not depend on indoor temperatures alone (Kwok and Rajkovich, 2010). Heating and cooling energy use for a given set of degree days also depends on factors beyond the technical characteristics of structures and equipment, including occupant and social practices such as thermostat setpoints, hours of occupancy, use of supplemental heaters or fans, window-opening, and broader thermal comfort management regimes (Deumling et al., 2019; McGilligan et al., 2011).



Second, degree days do not fully capture the complexity of weather variability, spatial patterns, or how these changes may affect indoor conditions (Azevedo et al., 2015). For example, in much of California, especially since 2000, nighttime low temperatures have increased more rapidly than daytime high temperatures (Lindsey, 2018; see the *Air Temperature* chapter). This can reduce the contribution of nighttime temperatures to natural cooling but is captured only limitedly in degree days indicators. Also, though 65°F is the standard base temperature used for computing degree days in U.S. energy applications, different base temperatures, such as a higher base temperature for CDDs (US EIA, 1983), could give different results for energy predictions.

OEHHA acknowledges the expert contribution of the following to this report:



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