

2024 Recommendations to Reduce a Project's Contribution to the Urban Heat Island Effect

Urban Heat Island Effect

According to the Capital Region Transportation Sector Urban Heat Island Mitigation Project ([UHI Project](#)), the urban heat island (UHI) effect already presents a serious challenge for our region. The UHI effect results from the conversion of undeveloped land to developed land. Developed areas in Sacramento are 3 to 9 degrees Fahrenheit warmer than their surrounding undeveloped areas due to pavements, roofs, and roads, which absorb and retain heat during the day. Higher air temperatures increase the formation of ground-level ozone, a respiratory system irritant, and the Sacramento region is currently designated “nonattainment” for federal and state ozone standards. Extreme heat and extended heat waves can lead to health effects such as heat stress, heat stroke, and even heat mortality, especially for the elderly, children, people working outdoors, people who are unhoused, people who have lower incomes, and those with pre-existing health conditions. Urban heat islands can be mitigated through cool roofs, cool pavements, trees and green infrastructure, and other cooling strategies.

The following recommendations, informed by UHI Project findings and the California Green Building Standards Code, would help reduce this project’s contribution to the urban heat island effect.

Residential Projects

ROOFING & FENESTRATION (WINDOWS)

*For all new residential structures and additions, Sac Metro Air District recommends the use of certified cool (reflective or vegetated) roofing materials as defined in the 2022 California Green Building Standards Code Title 24, Part 11 items [A4.106.5](#) and [A4.106.6](#).

***For all new structures and additions, Sac Metro Air District recommends that all opaque east-, south-, and west-facing walls utilize shading devices or reflective materials to reduce greenhouse gas (GHG) emissions from energy use according to the non-residential recommendations set in 2022 California Green Building Standards Code Title 24, Part 11 item [A5.106.7](#). Shading or reducing the albedo of walls lowers wall surface temperatures, reducing daytime heat flow into the building’s occupied space. In California climate zone 12, this leads to net yearly reductions in energy costs and GHG emissions ([California Energy Commission Cool Walls Report](#)).

SHADE & PAVEMENT

To the extent feasible, Sac Metro Air District recommends reducing pavements and paved surfaces – which absorb and amplify heat – in favor of increased tree canopy and vegetation cover utilizing native and drought-tolerant vegetation. We recommend that 50% of remaining nonroof hardscape areas incorporate one or more of the following methods to reduce the urban heat island effect per California Green Building Standards Code Title 24, Part 11 item [A4.106.7](#):

- *Plant shade trees that mature within 15 years of planting
 - o ***Per the California Green Building Standards Code Title 24, Part 11 item [5.106.12](#) non-residential requirement, we recommend shade tree plantings mature and provide shade

*Corresponds to CA Green Building Standards Code [Residential](#) Tier 2 Voluntary Guidelines (not enforceable)

**Corresponds to CA Green Building Standards Code [Non-residential](#) Tier 2 Voluntary Guidelines (not enforceable)

***Corresponds to CA Green Building Standards Code [Non-residential](#) language used as technical guidance for a [Residential](#) development suggestion

for over 50% of surface parking areas, and 20% of landscape and hardscape areas within 15 years for applicable residential projects.

- For single-family residential plots, Sac Metro Air District recommends at least one shade tree per plot.
- Further, we recommend that all projects incorporate the maximum possible number of air quality-supportive trees to shade pavements and structures. A directory of air quality-supportive trees fit for the Sacramento climate is available in the Sacramento Tree Foundation's [Shady Eighty Guide](#). A more extensive tree list is available on page 153 of the [UHI Technical Analysis Report](#). Benefits of adding vegetative shade include urban heat island effect reduction, improved energy efficiency, and improved air quality.
- *Use reflective pavement materials for remaining hardscape areas but keep the following exceptions in mind:
 1. Highly reflective materials may increase thermal load on pedestrians and infrastructure in the absence of adequate shade. As such, cool surfaces may not be appropriate for open, unshaded areas. Examples include unshaded plazas with high pedestrian traffic, children's play areas, and patios.
 2. Ground-level surfaces such as roadways and walls in or adjacent to vehicle-use zones should not exceed a solar reflectance of 0.35 to avoid glare issues for vehicle traffic ([UHI Project Summary Report](#) page 12).
- *Use an open-grid pavement system.
- *Locate 50% of parking underground or use multilevel parking.

For parking lots where cool pavements or tree shading are not feasible, Sac Metro Air District recommends solar photovoltaic shade structures where feasible, to reduce urban heat islands, generate renewable energy, and provide shading to parked vehicles. Shading parked vehicles can reduce evaporative emissions of volatile organic compounds from conventional, gasoline-powered cars and help cool electric vehicles, protecting their battery health and charging speeds.

EV CHARGING¹

Electric vehicles (EVs) can help reduce UHI impacts because they generate 80% less waste heat compared to conventional internal combustion engine vehicles, which release heat via tailpipe exhaust. Thus, the conversion of vehicle fleets to electric and zero-emissions models will reduce waste heat from tailpipe emissions and result in localized cooling through a reduction of roadway surface temperatures by up to 5 to 6 degrees Fahrenheit ([UHI Project Summary Report](#) pages 14-15). Sac Metro Air District recommends that EV spaces are consistent with minimum 2022 California Green Building Standards Code Title 24, Part 11 item [4.106.4](#) residential EV Charging Requirements. For multi-family residential projects, hotels and motels, and new residential parking facilities, the code specifies that 40% of the spaces shall be equipped with low power Level 2 EV charging receptacles and 10% shall be equipped with Level 2 EV chargers. *Tier 2 standards suggest that 55% of the total number of parking spaces for all projects shall be equipped with low power Level 2 EV charging receptacles and that 20% of all spaces shall be equipped with Level 2 EV chargers. Further details on technical specifications and exceptions by

¹ For Sac Metro Air District's official CEQA guidance on electric vehicles, refer to the Best Management Practices found in the [Recommended Guidance for Land Use Emission Reductions document](#) pages 11-12.

*Corresponds to CA Green Building Standards Code [Residential](#) Tier 2 Voluntary Guidelines (not enforceable)

**Corresponds to CA Green Building Standards Code [Non-residential](#) Tier 2 Voluntary Guidelines (not enforceable)

***Corresponds to CA Green Building Standards Code [Non-residential](#) language used as technical guidance for a [Residential](#) development suggestion

project type can be found in California Green Building Standards Code Title 24, Part 11 item [4.106.4](#) and [A4.106.8](#).

For additions and alterations of parking facilities serving existing multifamily buildings that require a building work permit, 10% of parking spaces added or altered shall be EV capable spaces. For further details, see California Green Building Standards Code Title 24, Part 11 item [4.106.4.3](#).

Non-Residential Projects

ROOFING & FENESTRATION

**For all new structures and additions, Sac Metro Air District recommends that roofing products meet minimum California Energy Code requirements outlined in [Section 140.3](#). Sac Metro Air District additionally recommends the use of certified cool (reflective or vegetated) roofing materials that meet the standards set by 2022 California Green Building Standards Code Title 24, Part 11 item [A5.106.11.2](#).

**For all new structures and additions, Sac Metro Air District recommends that all opaque east-, south-, and west-facing walls utilize shading devices or reflective materials to reduce GHG emissions from energy use according to the 2022 California Green Building Standards Code Title 24, Part 11 item [A5.106.7.1](#). Shading or reducing the albedo of walls lowers wall surface temperatures, reducing daytime heat flow into the building's occupied space. In California climate zone 12, this leads to net yearly reductions in energy costs and GHG emissions ([California Energy Commission Cool Walls Report](#)).

SHADE & PAVEMENT

To the extent feasible, Sac Metro Air District recommends reducing pavements and paved surfaces – which absorb and amplify heat – in favor of increased tree canopy and vegetation cover utilizing native and drought-tolerant vegetation. Per the California Green Building Standards Code Title 24, Part 11 item [5.106.12](#) requirement, we recommend shade tree plantings mature and provide shade for over 50% of surface parking areas, and 20% of landscape and hardscape areas within 15 years.

- Further, we recommend that all projects incorporate the maximum possible number of air quality-supportive trees to shade pavements and structures. A directory of air quality-supportive trees fit for the Sacramento climate is available in the Sacramento Tree Foundation's [Shady Eighty Guide](#). A more extensive tree list is available on page 153 of the [UHI Technical Analysis Report](#). Benefits of adding vegetative shade include urban heat island effect reduction, improved energy efficiency, and improved air quality.

**Sac Metro Air District also recommends that all remaining hardscape areas use one or a combination of the following strategies to reduce the impacts of the urban heat island effect with exceptions for surface parking areas covered by solar photovoltaic shade structures or shade structures ([A5.106.11.1](#)):

- Use an open-grid pavement system.
- Locate 50% of parking underground or use multilevel parking.
- Use reflective pavement materials for remaining hardscape areas with the following exceptions in mind:

1. Highly reflective materials may increase thermal load on pedestrians and infrastructure in the absence of adequate shade. As such, cool surfaces may not be

*Corresponds to CA Green Building Standards Code [Residential](#) Tier 2 Voluntary Guidelines (not enforceable)

**Corresponds to CA Green Building Standards Code [Non-residential](#) Tier 2 Voluntary Guidelines (not enforceable)

***Corresponds to CA Green Building Standards Code [Non-residential](#) language used as technical guidance for a [Residential](#) development suggestion

appropriate for open, unshaded areas. Examples include unshaded plazas with high pedestrian traffic, children’s play areas, and patios.

2. Ground-level surfaces such as roadways and walls in or adjacent to vehicle-use zones should not exceed a solar reflectance of 0.35 to avoid glare issues for vehicle traffic ([UHI Project Summary Report](#) page 12).

For parking lots where cool pavements or tree shading are not feasible, Sac Metro Air District recommends solar photovoltaic shade structures where feasible to reduce urban heat islands, generate renewable energy, and provide shading to parked vehicles. Shading parked vehicles can reduce evaporative emissions of volatile organic compounds from conventional, gasoline-powered cars and help cool electric vehicles, protecting their battery health and charging speeds.

EV CHARGING²

Electric vehicles (EVs) can help reduce UHI impacts because they generate 80% less waste heat compared to conventional internal combustion engine vehicles, which release heat via tailpipe exhaust. Thus, the conversion of vehicle fleets to electric and zero-emissions models will reduce waste heat from tailpipe emissions and result in localized cooling through a reduction of roadway surface temperatures by up to 5 to 6 degrees Fahrenheit ([UHI Project Summary Report](#) pages 14-15). Sac Metro Air District recommends providing EV charging consistent with minimum 2022 California Green Building Standards Code Title 24, Part 11 item [5.106.5.3](#) EV Charging Requirements and **Tier 2 voluntary standards [A5.106.5.3](#). These codes specify the total number of parking spaces that would be required to be Electric Vehicle Capable Spaces (EVCS) and Electric Vehicle Supply Equipment (EVSE). Further details on how these standards vary across project types can be found in California Green Building Standards Code Title 24, Part 11 item [5.106.5.3](#) and [A5.106.5.3](#).

Common Definitions:

- **Albedo:** Synonymous with solar reflectance, which is a ratio of the energy reflected back into the atmosphere to the energy absorbed by the surface, with 100% being total reflectance.
- **Cool Roof:** A roof that is designed to reflect more sunlight than a conventional roof and absorb less solar energy, lowering the temperature of the building. Cool roofs have high thermal emittance giving them the ability to shed heat by efficiently emitting any heat that was absorbed.
- **Solar Reflectance:** A measure of the fraction of solar energy that is reflected by a surface. It is measured on a scale of 0 to 1.
- **Solar Reflectance Index (SRI):** A measure of a material surface’s ability to reflect solar heat. It includes solar reflectance, the ability to reflect solar heat, and thermal emittance, the ability to release absorbed energy. It is quantified such that a standard black surface is 0 and a standard white surface is 100.
- **Thermal Emittance:** The relative ability of a surface to radiate absorbed heat. It is measured on a scale of 0 to 1.

² For Sac Metro Air District’s official CEQA guidance on Electric Vehicles, refer to the Best Management Practices found in the [Recommended Guidance for Land Use Emission Reductions document](#) pages 11-12.

*Corresponds to CA Green Building Standards Code [Residential](#) Tier 2 Voluntary Guidelines (not enforceable)

**Corresponds to CA Green Building Standards Code [Non-residential](#) Tier 2 Voluntary Guidelines (not enforceable)

***Corresponds to CA Green Building Standards Code [Non-residential](#) language used as technical guidance for a [Residential](#) development suggestion