How do you cool a city in a warming world?

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Globally, 2016 was the warmest year on record. In Los Angeles, temperature records were shattered last summer during scorching heat waves that saw highs of 100 degrees for five days straight.

If you think the city is too hot, you've got company at City Hall. Los Angeles Mayor Eric Garcetti agrees, and he wants to do something about it.

As part of a sweeping plan to help L.A. live within its environmental means, Garcetti has pledged to reduce the average temperature in the metropolis by 3 degrees over the next 20 years.

It's a noble goal. Not only will it make you more comfortable, it will reduce energy consumption and improve air quality. It may even save lives - extreme heat kills more people each year than hurricanes, floods or tornadoes.

But how do you turn down the thermostat of an entire city in a warming world? And in a place as vast, sprawling and heterogeneous as Los Angeles, how do you measure success?

These questions have never been more relevant. L.A.'s heat problem is expected to worsen over the coming decades.

Climate models suggest that by 2050, the temperature in downtown L.A. will exceed 95 degrees 22 days per year. In 1990, only six days were that warm. The San Fernando Valley is expected to see 92 days of this extreme heat per year, compared with 54 in 1990.

Climate change is primarily responsible for the warming trend, but it's not the only force at work. Angelenos are also contending with an additional layer of misery caused by what's known as the "urban heat island effect." It means that cities - with their asphalt streets, dark roofs, sparse vegetation and car-clogged roads - are almost always a few degrees warmer than the more rural areas that surround them.

The mayor's plan to cool the region won't compensate for all the effects of climate change.

"We can't geoengineer the atmosphere," said Matt Petersen, chief sustainability officer for the office of the mayor.

But Petersen believes we can do something about the way the city traps heat. By counteracting this heat island effect, he hopes to reduce the amount of warming L.A. will experience in the future.

In early July, Petersen's team convened a group of about 20 civil servants and university scientists to determine how to bring the city's temperature more in line with what it would have been if Los Angeles had never been developed.

"What we are trying to do is create a research collective to help us reach our target," Petersen said. "It's a huge challenge."

The city has already teamed up with USC environmental engineer George Ban-Weiss. A veteran of the Lawrence Berkeley National Laboratory's Heat Island Group, he said there is no better place to test different ways of reducing urban heat than L.A.

"There is all this variation across the city," Ban-Weiss said. "You can't get a richer place to study climate and meteorology."

The built environment is mostly responsible for the problem. More than half of city surfaces are covered by dark pavements and dark roofs. Traditional asphalt absorbs up to 90 percent of the sun's radiation. As the asphalt gets hotter, it warms the air around it, adding to the overall heat. Even after the sun goes down, that accumulated heat lingers for hours and continues to transfer warmth to the night air.

One way to combat this heat sink is to replace the city's streets and sidewalks with high-tech materials that reflect more sunlight and stay cooler during the

day and at night. Some of these "cool pavements" reflect light only in the infrared part of the spectrum, which we cannot see.

In the summer of 2015, the city's Bureau of Street Surfaces tested one of these cool pavements at the Balboa Sports Complex parking lot in Encino. The new surface was approximately 11 degrees cooler than regular pavement in the mid-afternoon.

Scientists and policymakers are also investigating "cool roofs" and their potential to reduce the overall temperature of the city. Studies have found that in Los Angeles, widespread deployment of cool roofs could reduce the city's temperature by as much as 2 degrees Fahrenheit.

But it's unlikely that a single strategy will be the most effective option for all neighborhoods.

"The heat island effect is a regional phenomenon, and the way you choose your mitigation strategy could vary block to block," Ban-Weiss said.

If an area has no tree cover but lots of cool roofs, adding more cool roofs won't be as useful as planting trees. On the other hand, if an area has lots of trees, adding reflective pavements won't reduce temperatures because the sidewalks don't get much sunlight anyway.

Also, some regions of the city require more cooling than others. The biggest factor affecting temperature in the Southland is the influence of sea breezes. As those winds travel east, they pick up heat from the land and deliver it to those who live inland.

To address the hyper-local nature of the heat island effect, Ban-Weiss and his graduate students are modeling microclimates of areas as small as a few city blocks. They started with a neighborhood in El Monte, a city that is relatively warm compared to its surroundings.

After painstakingly building a computer model that included each tree and building, the researchers were able to analyze the effects of various heat mitigation strategies, comparing how it would feel if streets had more reflective surfaces, if every grassy yard were shaded by trees, and if every roof were covered in grass.

They found that cool roofs and green roofs had little effect on the thermal comfort of a person walking down the street, and that putting more trees in unshaded areas was the most effective cooling strategy. However, in areas that were already shady, the most significant effect came from cool pavements.

In another project, the team determined that the current zeal for xeriscaping could make L.A. up to 3.4 degrees Fahrenheit warmer in the daytime by depriving the soil of water and limiting the amount of evapotranspiration that occurs.

"Evapotranspiration works as an air conditioner," Ban-Weiss said. "When water evaporates, it removes energy from the system and cools it down."

But at night, different forces are at work: Heat rises from the subsurface of the Earth, moves through the soil and dissipates into the air. Dry soil slows this heat transfer. That means drought-tolerant landscaping could reduce the nighttime temperature by about 5.4 degrees.

Ban-Weiss and his collaborators used computer models to identify regions of greater Los Angeles that are particularly hot compared with the areas around them (downtown L.A., Northridge), and those that are particularly cool (South Pasadena, San Marino).

Working with heat island researchers at Lawrence Berkeley and with funding from the California Energy Commission, he is installing about a dozen high-tech weather stations to measure these hot and cool islands and watch how they change over time.

"We're spending a lot of time and going to a good deal of effort to determine the best places to put these weather stations," Ban-Weiss said. "We want to make sure that we put them in locations that will measure the heat island effect, and not the signal from the ocean."

That's why two of Ban-Weiss' grad students spent weeks roaming the streets of Los Angeles with a tube-shaped contraption on the roof of their car. The tube, designed at Lawrence Berkeley, holds a needle-thin thermometer that Arash Mohegh and Mo Chen have been squiring around, searching for pockets of heat.

The job is tedious. To get accurate measurements, they spend hours weaving up and down streets in their target neighborhoods. They visited the San Fernando Valley on a particularly scorching day in June.

"We're about to go from an industrial area to a more residential neighborhood, so we'll see how the temperature changes," Mohegh said as Chen steered the car through Chatsworth.

Sure enough, as blocky office buildings gave way to tree-lined streets with green lawns, the dashboard thermometer dropped from 102 to 100 degrees.

Petersen said work like this will help the city identify which areas should be targeted for cooling and which strategies will work best. By 2019, he hopes to have a better idea of how realistic the goal of lowering the temperature by 3 degrees really is, as well as the best way to achieve it.

The cooling of Los Angeles is still years away, but the groundwork has begun.