

Hixon Center for Urban Sustainability

CASE STUDY

Reflective Roofs to Cool Cities

Climate Ready City



Climate Issue: Urban Heat Island

Urban areas are typically **warmer** than surrounding areas due to the **Urban Heat Island (UHI)** effect.

- Materials such as asphalt and concrete are very effective at absorbing energy from the sun
- This energy is then re-released into the build environment as heat
- Without intervention, the UHI effect will intensify in cities as the climate warms.

Cities require effective urban cooling techniques to protect citizens, infrastructure and wildlife.

Reflectivity: A Cooling Solution for Cities

Science shows that increasing the reflectivity of building materials can cool cities.

- Reflective surfaces allow for solar radiation to be bounced back to the atmosphere rather than absorbed by the built environment material
- Reflectivity can be measured from 0 - 1
- A black surface has a value of 0, meaning that all incoming energy is absorbed
- A white surface has a value of 1, as all incoming energy is reflected.

An effective strategy to cool your city is to change building surfaces from dark to light.

Chicago: A Successful Reflective Zoning Code

The city of Chicago has suffered greatly from intense heatwaves. High temperatures, amplified by the UHI, resulted in 739 deaths in a five-day period in 1995.

In an attempt to reduce the UHI, Chicago updated its zoning code in 2008 to **require all new low-sloped roofs** to have a **minimum 3-year reflectance of 0.5**, or initial reflectance greater than 0.72.

Chicago's
reflectivity code
increased
the amount of
light surfaces
across the city.
This policy
intervention
cooled the city.

-6.3°C
Maximum recorded
temperature decrease
from reflectivity

+51.9KM²
Land that increased in
reflectivity above
0.2 after policy

2.4GW
Energy reflected due
to city-wide reflectivity
increase of 0.016

65,000
Number of AC units
required running full-time
in summer to achieve
equivalent cooling power

IN A NUTSHELL

- Cities need urban cooling strategies to mitigate the heat impacts of global warming
- Cooling the city can help protect citizens from harmful heatwaves
- To combat urban heat, cities can mandate roof surfaces be painted a lighter color
- This was successfully done in Chicago via an updated zoning code.

WHAT CAN YOUR CITY DO?

REDUCE the amount of black building surfaces to immediately cool your city. This can be done by painting surfaces lighter colors or white

CREATE or update zoning codes to require minimum reflectivity for new and existing roofs

FOCUS on large roofs, such as warehouses. These are particularly effective at cooling once painted white.

To find out more information on this case study, contact **Professor Xuhui Lee** at xuhui.lee@yale.edu. Case study based off Mackey, C. , Lee, X. , & Smith, R. . (2012). Remotely sensing the cooling effects of city scale efforts to reduce urban heat island. BUILDING AND ENVIRONMENT, 49, 348-358. <https://doi.org/10.1016/j.buildenv.2011.08.004>