

Cool Roofs

Integrating Mitigation and Adaptation Benefits with Cool Roofs

Cool roofs are “one of the quickest and lowest-cost ways we can reduce our global carbon emissions and begin the hard work of slowing climate change,” according to the Department of Energy’s Secretary Chu.¹ By implementing a cool roof program, or providing tax credits or rebates as encouragement for installation, commercial buildings see energy reductions and cost savings. Communities can mitigate urban heat island effects, realize cooler communities, and reduce greenhouse gas emissions with cool roofs.

Background

A traditional dark colored or black roof absorbs heat and increases the temperature of a commercial building. When a building’s temperature rises, the demand on the building’s cooling equipment increases in order to maintain the building’s optimal temperature setting. The increased use of air conditioning required to cool the building increases energy costs and demand on the electricity grid, typically leading to the release of greenhouse gas emissions in the form of emissions from fossil-fired power plants. Cool roofs increase the general amount of surface area that is white or light-colored similar to snow-covered landscapes, which are renowned for their ability to effectively reflect light and heat via the albedo effect, directly reducing Earth heat gain.²



St. Louis volunteer coats a tar roof with reflective white coating.

A cool roof, indicated by a special white or light-colored reflective material, reflects the sun's heat back to the sky instead of transferring it to the building. Coatings, shingles, and a variety of other roofing materials can be used to create a cool roof. According to the Cool Roof Rating Council, "coolness" is measured by solar reflectance and thermal emittance.³ Solar reflectance measures the solar energy reflected by the roof, and the thermal emittance measures the relative ability of the roof surface to radiate absorbed heat. When sun hits a cool roof, 80% is reflected compared to 5% with a traditional black roof.

Benefits

Reduced Energy Consumption. Weighted by conditioned roof area (CRA) of building stock, state-average annual per-CRA cooling energy savings ranged from .31 kWh/sq ft in Alaska to .71 kWh/sq ft in Arizona; with a national average of .47 kWh/sq ft.⁴ A building’s energy reduction will vary based on its climate zone, level of insulation, envelope characteristics, and HVAC equipment. In addition, in most U.S. climates the amount of useful energy reflected by a cool roof in the winter tends to be less than the unwanted energy reflected in the summer.⁵

Increase Roof Longevity. A roof will expand and contract from a building’s constant heating and cooling causing wear and tear. Cooler roofs can minimize the expansion and contraction of a roof as more heat is reflected from a cool roof rather than absorbed, increasing the cool roof’s overall durability. By extending the life of roofing materials, building owners can save money on costly repairs and renovations while reducing their environmental impact by contributing less solid waste to landfills.

Reduction in Expenditures. Based on an annual net energy reduction of 10%, a commercial building with a 1,000 sq ft roof that is converted to a cool roof could expect an annual savings of \$100. According to the California Energy Commission, initial material costs are comparable with traditional roofing materials. Some cool roof products cost less than traditional materials while others cost up to 20% more.⁶ A cool roof's solar reflectance can lower the need for roof repairs and the repair of equipment located on the roof, while also reducing the demand on a building's cooling equipment, contributing to equipment longevity and further decreased maintenance costs. These advantages combined with the low cost of implementation make cool roofing a smart long-term investment.

Getting Started

Many jurisdictions have committed to reducing their municipal and/or community-level energy consumption and greenhouse gas emissions. A cool roof program can provide the commercial sector with a simple, low-cost program that provides resources and cost savings to participants, while engaging buildings in the community's greenhouse gas reduction efforts.

Step 1: Align with a Climate Action, Sustainability, or Adaptation Plan.

Whether a community is in the initial phases of an energy efficiency and conservation measures plan, greenhouse gas inventory, climate action, sustainability, or adaptation plan, consider using a Cool Roof program as an implementation strategy for reducing emissions, energy consumption, and/or urban heat island effect.

Step 2: Collaborate with the Local Utility.

Similar to lighting or mechanical upgrades, local or municipal utilities may also provide rebates and incentives for cool roofs. Traditionally, local governments and utilities both have a common goal of reducing energy consumption and demand. Through collaboration, the program can promote cool roofs as a cost-effective and low-risk approach to reducing cooling loads, demand on the electricity grid, and peak demand during the summer months.

Step 3: Promote the Local Economy Through Green Jobs.

New York City's Cool Roofs program found success through the use of volunteers, corporate workdays, and job training programs. Join forces with a job training program and provide skills to unemployed or transitioning workers to create an additional community benefit.

Existing Policies or Programs

New York City, NY: Cool Roofs

<http://www.nyc.gov/coolroofs>



- **Adopted:** Began as a pilot program in 2009.
- **Affected Property Types:** Any building type, but not all roof types are eligible.
- **Key Requirements:**
 - City code requires new buildings have 75 percent of the roof area covered with reflective, white coating or ENERGY STAR® rated as highly reflective.
 - Roof must be in good condition and without water pooling.
 - Building owner must purchase materials to coat building roof.

Philadelphia, PA: Cool Roof Code

<http://legislation.phila.gov/attachments/10096.pdf>

- **Enacted:** May 2010 / **Effective:** 2010
- **Affected Property Types:** All new commercial and residential construction and additions to existing buildings.
- **Key Requirements:**
 - Roof Coverings over conditioned spaces on low-slope roofs (roof slope <2:12) must be ENERGY STAR rated as highly reflective.
 - "Develop Cool Roof Code" and "Create Neighborhood Competitions" are initiatives outlined in Philadelphia's GreenWorks Plan under Target 2: Reduce citywide building energy consumption by 10 percent. In 2010, RetroFIT Philly launched the "Coolest Block Contest."



Houston, TX: Commercial Energy Conservation Code-Cool Roofs

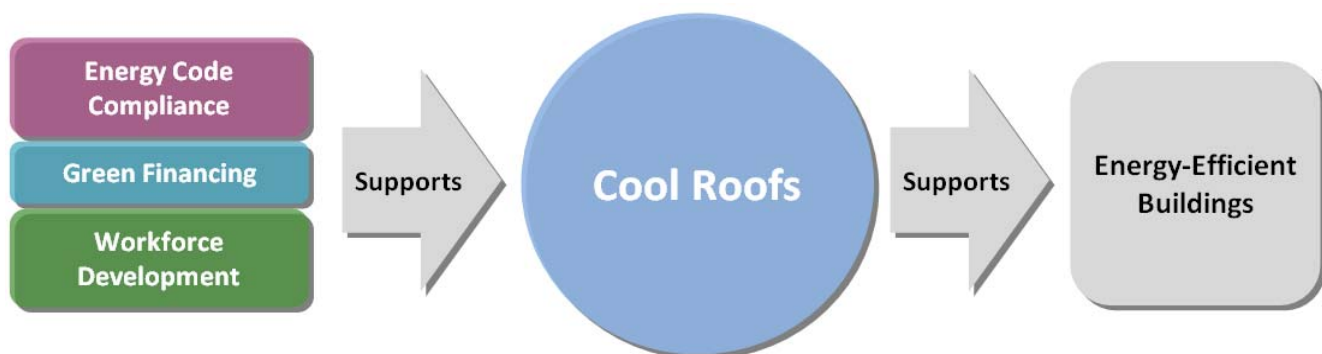
http://documents.publicworks.houstontx.gov/documents/divisions/planning/enforcement/houston_commercial_energy_conservation_code_3rdprinting.pdf

- **Adopted:** April 29, 2008 / **Effective:** August 1, 2008
- **Affected Property Types:** All new and existing buildings that undergo construction or additions including commercial, industrial, multi-family units of three or more, and other buildings types with the exception of low-rise residential buildings.
- **Key Requirements:**
 - Roofing products must be verified by the Cool Roof Rating Council (CRRC).
 - All roofs shall comply with the insulation values of the Commercial Energy Conservation Code.
 - Low slope roofs up to 2:12 shall be provided with a roof covering where the exterior surface has:
 - A minimum total solar reflectance of 0.70 and
 - A minimum thermal emittance of 0.75.



Complementary Policies

Complementary Policy Landscape for Cool Roofs



Complementary policies can make cool roof programs much more effective.

- **Creating or updating existing commercial building codes** or standards can increase efficiency in design, construction, and improvements.
- **Adaptation policies** aimed at reducing the urban heat island effect, reducing smog and air pollution, reducing urban air temperature, and enhancing public health align with the benefits of Cool Roofs programs.

References

1. Science Daily. "Cool Roofs Can Offset Carbon Dioxide Emissions and Mitigate Global Warming, Study Finds." July 20, 2010.
<http://www.sciencedaily.com/releases/2010/07/100719162945.htm>
2. Climate Change. "Global cooling: increasing world-wide urban albedos to offset CO." 2008
http://www.globalcoolcities.org/wp-content/pdf/climaticchange_2008.pdf
3. Cool Roof Rating Council: Cool Roofing Information for Home and Building Owners. 2011.
<http://coolroofs.org/HomeandBuildingOwnersInfo.html>
4. Potential Benefits of Cool Roofs on Commercial Buildings: Conserving Energy, Saving Money, and Reducing Emission of Greenhouse Gas Emissions and Air Pollutants
<http://www.springerlink.com/content/9r48k34558240825/fulltext.pdf>
5. Reducing Urban Heat Islands: Compendium of Strategies. Cool Roofs
<http://www.epa.gov/heatisland/resources/pdf/CoolRoofsCompendium.pdf>
6. California Energy Commission Consumer Energy Center. Frequently Asked Questions about Cool Roofs.
<http://www.consumerenergycenter.org/coolroof/faq.html>
7. Picture Credit: Sustainable St. Louis
<http://sustainstl.org/cool-roofs-help-keep-lid-on-summer-utility-bills/>

Additional Resources

- California 2008 Building Energy Efficiency Standards-Title 24
<http://www.energy.ca.gov/title24/2008standards/>
- The Cool Roof Rating Council (CRRC)
<http://www.coolroofs.org/>
- ENERGY STAR Roofing Comparison Calculator
<http://roofcalc.cadmusdev.com/>
- DOE Cool Roof Calculator
<http://www.ornl.gov/sci/roofs%2Bwalls/facts/CoolCalcEnergy.htm>
- Global Cool Cities Alliance
<http://www.globalcoolcities.org/>
- NYC Cool Roofs Annual Review (2010)
http://www.nyc.gov/html/coolroofs/downloads/pdf/3-29-11_coolroofs_annual_report_2010.pdf