



U.S. Department of Housing and Urban Development | Office of Community Planning and Development

Climate Resilience Implementation Guide

Cool Roofs



HUD Support for Climate Resilience



HUD grantees are in a unique position to increase community resilience to climate change. Community members with low and moderate incomes (LMIs) are disproportionately affected by climate change because they are less able to prepare for, respond to, and recover from the impacts of extreme events and natural hazards.^{1,2} Recognizing these risks, HUD promulgated a rule in 2016 that requires grantees to account for resilience to natural hazard risks in their Consolidated Plans. To support grantees in this work, HUD created a [Supporting Local Climate Action webpage](#) with resources on how to use HUD funding to build more resilient communities.

The **Community Resilience Toolkit** provides information on potential impacts from six climate hazards and identifies a broad range of resilience actions that local and state governments can implement to address these risks.

Six **Implementation Guides** provide step-by-step instructions on how to implement specific resilience programs:

- Resilience Education and Outreach Activities
- Cool Roofs
- Nature-based Solutions
- Single-family Retrofits
- Resilient Public Facilities
- Community Driven Relocation

About this Resilience Action

This Implementation Guide provides step-by-step instructions to assist communities in implementing a cool roof program to build resilience to rising temperatures and extreme heat. This guide includes community examples of cool roof programs, although they are not necessarily funded using CPD resources but could be adapted to allow for CPD program support.



Simple strategies, like this roof with a lighter color, can result in significant energy savings

COMMUNITY PLANNING AND DEVELOPMENT (CPD) CONSIDERATIONS

State and local governments may use CPD formula programs – including Community Development Block Grants (CDBG), HOME Investment Partnerships Program (HOME), and Section 108 Loan Guarantee Program (Section 108) – to implement resilience actions. The principal purpose of CPD funding is to benefit low- and moderate-income persons.

Implementation of a cool roof program to address heat may be an eligible activity and allowable cost under CPD-eligible activities categories. Icons correspond to specific CPD-eligible activities categories.

 **Public facilities and infrastructure improvements** with CDBG or Section 108, under certain circumstances.

 **Housing rehabilitation** with CDBG, HOME, or Section 108.

 **New housing construction** with HOME (as part of an eligible rehabilitation project, not a CPD-funded program).

 **Economic development** with CDBG or Section 108.

Implementing Cool Roofs to Build Resilience to Heat

Many areas of the United States are experiencing higher than average temperatures, increasing numbers of extremely hot days, and more frequent or longer extreme heat events. These trends are projected to continue increasing due to climate change. The effects of these trends are greater in urban areas due to the [heat island effect](#), where structures such as buildings and roads absorb and re-emit the sun's heat.

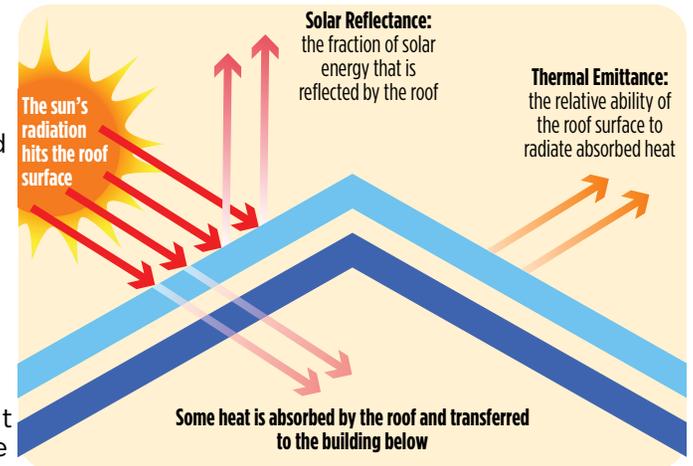
Temperatures may be even higher in LMI communities due to historic disinvestment leading to a lack of cooling green spaces.³ Many households in LMI communities do not have access to air conditioning, exacerbating their vulnerability to extreme temperatures. Young children, older adults, outdoor workers, those experiencing homelessness, and those with certain medical conditions are more vulnerable to extreme heat because they may be less likely to sense and respond to changes in temperatures or more likely to become dehydrated and suffer from heat-related illnesses.

Besides implementing a cool roofs program, several other cost-effective solutions can address rising temperatures and extreme heat, such as creating or preserving green spaces in development plans. The [Nature-based Solutions Implementation Guide](#) provides more information about nature-based solutions to address rising temperatures and extreme heat.

BENEFITS OF COOL ROOFS

Creating cool roofs is a practical, cost-effective action with positive benefits to LMI communities. By reflecting more sunlight than a conventional roof and absorbing less heat, cool roofs lower the temperature of buildings. Collectively, cool roofs can reduce the heat island effect and help communities adapt to rising temperatures and extreme heat.

In addition to deflecting light and shedding heat to reduce temperatures, cool roofs provide many other benefits.



Source: [Cool Roof Rating Council](#)

Cost parity

Up-front costs, maintenance, and lifespans of cool roofs are similar to conventional roofs.

Reduced energy

Cool roofs transfer less heat to a building, which keeps the building cooler and reduces the need for air conditioning. This also reduces peak load on the energy grid during extreme heat events.

Reduced greenhouse gas emissions

By lowering energy usage, cool roofs decrease the production of associated air pollution and greenhouse gas emissions.

Improved thermal comfort and health

Cool roofs make indoor environments more comfortable and may lessen heat-related illnesses.

Equity

Cool roofs are an affordable measure to reduce temperatures and energy bills. When targeted in LMI communities, they often align with community heat equity goals.

Compatible with other strategies

Cool roofs are complementary with broader heat reduction and energy-saving strategies, such as greening efforts and solar energy projects.

Step 1: Determine Whether Cool Roofs Are Part of an Existing Local Program



Many communities across the country are implementing cool roofs as an effective way to lower utility costs and save energy. Cool roof programs and incentives are implemented through building and energy codes, ordinances, incentive programs, or plans. Understanding whether cool roofs are part of an existing or planned local program can help you decide how to advance cool roofs in your community. Local or regional strategic plans, such as strategic or comprehensive plans, and community or regional climate or sustainability plans may provide information on the role of cool roofs in your community.

If cool roofs are not a part of an existing program or are included in existing plans but not yet implemented, grantees can begin taking the steps below toward implementing a cool roof program. In San Antonio, for example, a City Council member wanted to save existing, affordable homes in his district through replacing roofs “the right way.” In 2015, he spearheaded the implementation of a cool roofs pilot program that quickly became very popular and expanded city-wide; the San Antonio **Resilience in Practice** box describes this program.

If your community has implemented a cool roof program, you can expand it using the steps that follow. You can also consider complementary actions that reduce the heat island effect and help your community adapt to rising temperatures and extreme heat. These could include planting shade trees, cool paving and green roof programs, an air conditioning assistance program, and others.

Several resources provide information about cool roof rebates, incentives, codes, and ordinances across states, regions, and cities.

- [Cool Roof Resources \(Cool Roof Rating Council\)](#)
- [Database of State Incentives for Renewables & Efficiency](#)

RESILIENCE IN PRACTICE
San Antonio, TX



Moving from a Pilot to a City-wide Program

[The Under 1 Roof Program](#) aims to save existing, affordable homes and reduce utility bills by replacing worn, damaged roofs with high-reflectance roofs for qualified homeowners. In 2015, City Council member Roberto Trevino (2014-2021) started the program as a pilot, replacing seven roofs in his district. Once the program was proven, it quickly grew in popularity and is now city-wide, replacing 200 to 400 roofs annually with a steady pipeline of homeowners interested in participating. Under the program, the City places a restrictive covenant on the property that requires the homeowners to maintain ownership and occupancy for five years after project completion; this ensures the neighborhood remains affordable. Under 1 Roof uses general funds for the program, budgeting around \$10,000 per roof.

The City initially focused education and outreach on promoting participation, but now the program largely relies on word of mouth. The City’s focus now is educating homeowners about the energy savings and other co-benefits of cool roofs. A 2018 University of Texas at San Antonio study found that the average attic temperature dropped 10.1°F and the average Energy Use Intensity (an indicator of the energy efficiency of a building’s design or operations) dropped 7.3% in homes with cool roofs.

 **CPD Considerations:** This type of cool roof program may be an eligible activity and allowable cost under CPD-eligible single-family housing rehabilitation.

Step 2: Identify and Engage Partners, Collaborators, and Community



Building from available information on existing policies, programs, or plans for cool roofs, align government partners, community members or community groups, and business and industry collaborators for your effort. It is important to build partner networks and staff capacity and obtain leadership buy-in early in the development of a cool roof program. Developing effective partnerships that leverage each partner's strengths can enhance the program, reduce the number of local resources required from your community, ensure timely implementation, and help adapt to extreme heat on a broader scale.

Potential partners, collaborators, and stakeholders in your community might include:

- Nonprofit, faith-based, or other organizations that support LMI populations
- Energy auditors
- Renewable energy companies, such as solar installers
- Energy utilities
- Professional associations including those for builders, realtors, or bankers
- Sustainability, climate resilience, or emergency management agencies
- Housing authorities
- Homeowner associations
- Affordable housing providers and developers
- Home builders, home contractors, home improvement professionals, and remodelers
- Government departments such as building, environment, general services, health, public works, and transportation
- Other community and volunteer groups (e.g., AmeriCorps)
- Academic institutions

Education and outreach are particularly critical for LMI communities, which may have fewer resources to cope with climate risks and increase their resilience. Keep in mind that organizations representing or made up of LMI community members may have concerns of higher priority than cool roofs, such as meeting basic needs for housing, food, employment, childcare, or transportation.

The [Resilience Education and Outreach Activity Implementation Guide](#) provides more information about engaging partners, collaborators, and other stakeholders.

CPD CONSIDERATIONS

If your community is considering CDBG funds for a cool roof program, ensure that it meets a [National Objective](#) by documenting heat impacts and program benefits to LMI communities. Such benefits can be documented on an area-benefit or direct-benefit basis, depending on whether the program is focused on public facilities, such as neighborhood centers, or on single-family or multifamily housing. Note that single-family housing occupants and at least 51 percent of multifamily housing occupants should be qualified as LMI.

Consider consulting with local health experts to obtain data on local need and potential impact and with other public and private agencies – including code enforcement, permitting, planning, and public works – to help identify opportunities and barriers to implementation of cool roof programs.

Ensure that community consultation is consistent with the established [Citizen Participation Plan](#) when CPD funding is used.

Step 3: Establish Goals for the Cool Roof Program



With input from partners and collaborators, define the goals of the cool roof program, including how the program goals contribute to the overarching resilience goals, and how you will measure the success of those activities. Step 6 covers additional elements of measuring success.

Define the Goals. Long-term goals for the deployment of cool roofs might focus on reducing the heat island effect. Other goals might focus on greenhouse gas reduction, energy savings targets, or public health and equity objectives, such as improving access to cooling, reducing heat-related illnesses, or maintaining home integrity. Using the “SMART” goal approach can help ensure your goals are Specific, Measurable, Attainable, Relevant, and Time-based. SMART goals can be tracked over time to measure the success of the program. At the start of the program, it is critical to identify the metrics, establish baselines, and create systems to capture and track the data over time. Resilience goals do not need to be constrained to natural hazards; consider where resilience solutions can address multiple objectives. For example, a cool roof program could be a job training or job creation opportunity.

Identify Metrics. To determine what metrics to track, consider your program’s goals and how you can measure its success. Identify what you will measure, how you will measure it, and who will collect the information. Consider whether you can draw on existing metrics rather than create new ones. Where appropriate and possible, track metrics by income, neighborhood, or race/ethnicity, which will allow you to identify the impact of your program on different communities. Identifying a team or point person in charge of metrics will help ensure consistency and success. Consider partnering with Community Housing Development Organizations, Community Action Partnership agencies, and other partners that might more easily track some of your selected metrics.

Establish Baselines. Gathering data on your metrics at the start of your program establishes a baseline against which you can measure the program’s impact. For cool roof activities, baseline metrics may include the square footage of dark surface roofs, land surface temperatures as measured by satellite data, citizen science measures of local heat island patterns, indoor temperatures, or average energy bills. Also consider

CPD CONSIDERATIONS

As you establish goals, keep in mind that cool roofs or other heat mitigation measures can be incorporated into broader goals included in the Strategic Plan portion of the Consolidated Plan, such as “Rehabilitate existing housing stock (homeownership or multifamily).” Such goals can include outcomes from an owner-occupied (single-family) rehabilitation and reconstruction program, a CDBG-funded minor repair program, or another program focused on energy efficiency.

HUD strongly encourages grantees to consider environmental review requirements early in their planning to allow for the broadest range of options to streamline the process and avoid delays. HUD [Regional and Field Environmental Officers](#) are available to help design a procedure to document efficient and effective environmental reviews.

tracking community knowledge before and after campaign activities, tracking participation in programs before and after the campaign, and monitoring community use of resources over time (e.g., website traffic, resource downloads).

This is one resource that can help in process planning and goal setting.

- [Develop SMART Objectives \(U.S. Centers for Disease Control and Prevention\)](#)

Step 4: Design the Cool Roof Program

1

Determine priorities

2

Engage partners

3

Establish goals

4

Design the program

5

Implement the program

6

Measure and reassess

In line with your goals, determine what type of cool roof program you can effectively implement in your community. There are several types of programs you can consider, including voluntary or mandatory programs. Voluntary programs can attract willing participants and be a good approach when piloting a program, but their reach may be limited. Mandatory programs will have stronger impacts from broader participation, but they can be expensive, take longer to implement, and meet resistance.

As you consider the type of cool roof program for your community, also think about the parameters of your program:

- Minimum solar reflectance, thermal emittance, or other properties of the roofing materials
- Preferred types of cool roofing materials, including coatings versus tiles or shingles
- Desired aesthetic appearance of the roofing material; for example, some manufacturers offer materials with an appearance similar to conventional roofing
- Requirements for new versus existing construction, for commercial versus residential properties, or for properties or buildings of a certain size
- Variation in program parameters based on the roof slope or surface type
- Exceptions for green roofs or roofs with solar panels
- Eligibility for rebate, incentive, loan, or cost-sharing programs

If you have limited resources or limited experience implementing cool roofs, or if you are unsure about which program parameters will be the most effective, consider starting with a pilot, voluntary program and then expanding. A pilot can achieve quick wins, demonstrate success, and build support for your program. A pilot also allows you to adjust your program.

Many resources exist to help evaluate heat vulnerability and cool roof potential.

- [Urban Heat Island Map \(Trust for Public Land\)](#)
- [Urban Heat Island Maps \(National Integrated Heat Health Information System\)](#)
- [U.S. Surface Urban Heat Island \(SUHI\) Disparity Explorer](#)
- [Cool Roof Calculator \(Oak Ridge National Laboratory\)](#)

CPD CONSIDERATIONS

If your community is considering CDBG or other CPD formula program funds, consider whether cool roofs can be added as an element to an existing program or activity, such as housing or commercial/industrial rehabilitation, public facilities, or energy conservation. Grantees should also consider the applicable cross-cutting requirements, including compliance with HUD [labor standards](#) and [environmental review requirements](#). Consider the varying impact of focusing on single-family versus multifamily, institutional or commercial structures in implementing the program.

VOLUNTARY

- Conducting informational education and outreach programs
- Creating cool roof plans or guidelines
- Undertaking incentive or rebate programs
- Implementing loans or cost-sharing
- Pursuing green building certification

VOLUNTARY OR MANDATORY

- Creating or adopting procurement guidelines
- Implementing ordinances

MANDATORY

- Developing zoning or building codes
- Incorporating design standards

Step 5: Implement the Cool Roof Program

1

Determine priorities

2

Engage partners

3

Establish goals

4

Design the program

5

Implement the program

6

Measure and reassess

Implementing the cool roof program will depend on your community's goals (Step 3) and the program type selected by your community (Step 4). It may involve rolling out an incentive or rebate program; incorporating design standards to stipulate the use of cool roofs; or installing cool roofs on single-family, multifamily, or institutional/commercial structures. Sometimes the program goals and type can shift over time. For example, the goals of the NYC CoolRoofs program in New York City shifted after a City ordinance was passed; the **Resilience in Practice** box describes this program.

During the implementation step, you will need to engage your stakeholders. Communicate any new requirements or opportunities to your community by developing outreach materials. Education and outreach to the community can increase awareness; increased awareness can lead to higher participation once you implement the cool roof program. Early outreach to leadership, such as mayors, city council members, and business leaders, can help ensure projects are completed in a timely fashion and meet the program goals.

The [Resilience Education and Outreach Activity Implementation Guide](#) provides more information about engaging stakeholders.

RESILIENCE IN PRACTICE New York City, NY



Installing Cool Roofs with a Focus on LMI Communities

The [NYC CoolRoofs program](#) began as a volunteer-based pilot focused on public-private partnerships to support NYC's climate change goals and aimed to coat one million square feet of rooftops per year. NYC staff worked with private partners to secure real estate and coordinate volunteers to coat the roofs of community colleges, large hospitals, public housing authority buildings, and other private and public buildings. Leadership support was critical to guaranteeing adequate participation and ensuring the program's early success. In 2011, NYC implemented a [Cool Roof Ordinance](#) to require cool roofs on new and replacement low-sloped roofs, but the NYC CoolRoofs program continued.

By 2015, the program shifted to workforce development training where New Yorkers gain paid work experience and earn credentials in the construction sector. The program offers cool roofs to all NYC buildings but provides cool roofs at no cost to affordable housing and nonprofit buildings. Installations and outreach are prioritized in areas most vulnerable to heat as identified through the City's [Heat Vulnerability Index](#). The program aims to train 70 workforce participants per year for two 10-week sessions. In 2019, legislation was passed to strengthen the cool roof requirement in the building code by extending reflectivity requirements to sloped roofs and requiring solar panels or green roofs on all new construction.



CPD Considerations: This type of cool roof program may be an eligible activity and allowable cost under CPD-eligible single-family or multifamily rehabilitation, rehabilitation of eligible public facilities, and HOME eligible rehabilitation.



Step 6: Measure Success and Promote



Tracking and evaluating the metrics you identified during goal setting (Step 3) helps you measure the success of your program and identify areas for improvement. Tracking your metrics can also help you report progress and outcomes to funders and the public, especially as they relate to your original program goals. The **Measuring Success** box covers examples of metrics to track.

Capture Data. Determine how the point person or team will collect data, how they will convey it, and to whom. Where possible, turn qualitative issues into quantitative data so you can track progress consistently over time.

Evaluate the Data. Determine how often you will analyze and evaluate the data. Some data may be reviewed annually whereas you may review other data more frequently. Where possible, compare the data you collect over time to the baseline data.

Share the Data. Reporting success is an effective way to solicit public, political, and financial support for the program. Consider how you should share its results. Think about your audiences, delivery methods, format, content, language, timing, and messengers.

Reassess Your Program. Use data to assess strengths and weaknesses and identify opportunities to improve the cool roof program. You may discover, for example, that you are not reaching your target population or need to increase community engagement. Give the community the opportunity to weigh in on program modifications. Strong engagement at every step will help increase transparency and build trust.

CPD CONSIDERATIONS

For CPD-funded heat mitigation, whether incorporated into another rehabilitation activity or independent, activities would be set up during the creation of the Annual Action Plan, along with all other proposed activities. The appropriate matrix code depends on the specific activity and associated plan goal. For example, you could use the matrix code 03E if the program focuses on installation of cool roofs on public facilities, such as construction or rehabilitation of neighborhood facilities in eligible, LMI areas. The appropriate matrix code may be 14A (single-family) or 14B (multifamily) if the activity is structured as part of a housing rehabilitation program.

If your community is considering CDBG or other CPD formula grant programs to fund a cool roof program, remember that all key reporting elements must be integrated into HUD's Integrated Disbursement and Information System (IDIS). Grantees typically create new IDIS activities through the AP-35 Projects screens while setting up their Annual Action Plan. This also is the best way to ensure that any activity funded through CPD sources is properly tied to the Action Plan.

MEASURING SUCCESS

Cool roof program metrics help track the performance of your program. If a goal is equity, consider tracking metrics by income, neighborhood, or race/ethnicity where appropriate and possible. Doing so will allow you to identify the impact of your program on different communities and subgroups.

Sample Equity Metrics

- Number of LMI individuals reached during a cool roof program (e.g., receive a flyer, click on a website or social media post, attend an information session)
- Number of structures or square footage of coated roof in target areas or meeting LMI criteria, broken down by household income as appropriate

Sample Resilience Metrics

- Amount of electricity use for air-conditioned buildings during the month of August before and after program
- Average daytime indoor air temperature after two or more 90-degree days before and after program
- Average surface temperature of roofs on a 90-degree or more day before and after program



Additional Resources

- [Cool Roofs and Cool Pavements Toolkit \(Global Cool Cities Alliance\)](#)
- [Reducing Urban Heat Islands: Compendium of Strategies; Cool Roofs \(U.S. Environmental Protection Agency\)](#)

Additional Funding Opportunities

HUD CPD funding can be combined with other funding opportunities to create more comprehensive resilience programs in communities.

- [AmeriCorps through your State Service Commission \(AmeriCorps\)](#)
- [Grants.gov](#)
- [Smart Growth Technical Assistance Programs \(U.S. Environmental Protection Agency\)](#)

Notes

1. U.S. Global Change Research Program. 2018. “Human Health” (Chapter 14). In Fourth National Climate Assessment. Volume II: Impacts, Risks, and Adaptation in the United States. doi: [10.7930/NCA4.2018.CH14](#)
2. U.S. Environmental Protection Agency. 2021. Climate Change and Social Vulnerability in the United States: A Focus on Six Impacts. EPA 430-R-21-0003. <https://www.epa.gov/cira/social-vulnerability-report>
3. Hoffman J.S., V. Shandas, and N. Pendleton. 2020. “The Effects of Historical Housing Policies on Resident Exposure to Intra-Urban Heat: A Study of 108 US Urban Areas.” *Climate* 8(1): 12. doi: [10.3390/cli8010012](#)

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