



# Fact Sheet

## Cool Roofs

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Cool roofs incorporate a range of technologies that benefit property owners and society as a whole. By making use of plentiful roof space, buildings require less energy and residents become more comfortable. Further, cool roofs can provide several environmental services, including capturing storm water, cleaning the atmosphere, and controlling ambient air temperatures.

### Types

**Naturally Cool Roofs:** By using white vinyl or other white surface materials, a building's albedo (ability to reflect light) can increase to 60 percent, compared to 10-20 percent on a traditional asphalt roof.<sup>1</sup> This reduces heat absorption and cools the building interior.

**Coated Roofs:** Buildings with traditional roofs can receive a solar reflective coating that helps reflect sunlight.<sup>2</sup> Once retrofitted, these roofs function in much the same way as naturally cool roofs.

**Insulated Cool Roofs:** A roofing system that pairs thermally resistant insulation (insulation with a high R-value) with a white or reflective roof coating makes an effective thermal barrier, keeping heat out on hot days and in on cold days. This enables building HVAC systems to work more efficiently. If U.S. commercial roofs were upgraded with high R-value insulation, it is estimated that annual energy savings would exceed \$2 billion.<sup>3</sup>

**Green (vegetated) Roofs:** Some roofs can be covered with plant life, if they are designed or retrofitted to handle the additional weight. Such roofs range from extensive (soil depth of 2-3 inches) to intensive (6 inches or deeper) and work with hundreds of different species of plants.<sup>4</sup> Though green roofs reflect less sunlight, they provide other aesthetic and environmental benefits, including reduced storm water run-off and cleaner air.

### Benefits

**Energy Savings:** Typical roofs can be 50°-90°F hotter than the surrounding air and transfer that solar energy down into the building. By reflecting the sun's energy back into the sky, cool roofs become only 10°F hotter than the ambient air and keep buildings far cooler than either black painted roofs or steel roofs.<sup>5</sup> A cool roof can reduce the amount of energy needed for air conditioning by up to 15 percent on a single story building, leading to substantial savings on energy bills.<sup>6</sup> Cool roofs reduce the need for air conditioning in multi-story buildings as well, cutting down on heat transfer to the top floors, which are often the warmest due to rising heat from lower floors.

**Climate Change Mitigation:** By reducing the amount of fossil fuels that must be burned to generate energy for air conditioning, fewer greenhouse gases are emitted into the atmosphere. A white roof of 1,000 square feet will offset 10 tons of carbon dioxide over its 20 year lifetime, compared to a black roof. Whitening all eligible urban flat roofs on the planet would prevent 24 Gigatonnes of CO<sub>2</sub> emissions, the equivalent of taking 300 million cars off the road for two decades.<sup>7</sup>

**Urban Heat Island Reduction:** Due to the heat absorbing nature of dark surfaces, such as certain roofing and paving materials, as well as the density of these surfaces in cities, urban temperatures can be 2°-10°F higher than nearby rural areas. By reducing this heat accumulation, cool roofs reduce the overall temperature of entire cities, decreasing peak energy demand, heat-related illnesses, and the cost of air conditioning across the region.<sup>8</sup>

**Reduced Roof Maintenance Costs:** By reflecting sunlight, cool roofs reduce the wear and tear that ultraviolet and infrared radiation can cause to a roof over time. This reduces maintenance and replacement costs and, therefore, leads to the production of less construction waste.<sup>9</sup>

**Energy Production:** By reducing surface temperatures, cool roofs can boost the efficiency of photovoltaic (PV) solar power installations. Eliminating excess heat can increase PV energy production by up to 16 percent.<sup>10</sup>

**Green Roofs** do not reflect as much sunlight as other cool roofs, but they:

**-Reduce Storm-water Runoff.** A 3-inch green roof will hold at least 3/4 inches of rain and on average up to 2 inches, preventing that water from running into the sewer system. If 80 percent of rooftop space were greened in Washington, D.C., there would be a 56 percent reduction in rooftop runoff in the city. This would reduce sewer overflows after heavy rains and mitigate the cost of drainage system projects.<sup>11</sup> Also, water retention prevents pesticides, detergents, and other harmful chemicals from being carried into the watershed (e.g. Chesapeake Bay) by runoff.

**-Clean the Air.** The plants on green roofs absorb several air pollutants through photosynthesis and remove those pollutants from the surrounding environment.<sup>12</sup>

**-Provide Open Space and Visual Amenity.** Green roofs provide opportunities for recreation, gardening, and even small-scale food production, a growing trend in urban areas where empty land is scarce.

**-Create Habitats.** Green roofs provide homes for many species that otherwise would find it difficult to survive in urban areas, such as bees, butterflies, and birds.

## Examples of Cool Roofs in Washington, D.C.

### The United States Department of Energy Headquarters White Roof:

- Is expected to save taxpayers \$8,000 a year in energy cost reductions once it is fully installed.
- The DOE is using this roof to further its Cool Roof Initiative, which aims to dramatically increase the number of federal buildings using this technology. As part of its efforts, the Department has created a [Cool Roof Calculator](#) for those who want to assess the benefits of a Cool Roof on their property.<sup>13</sup>

### The American Society of Landscape Architects Green Roof:

- Includes an extensive data collection system to study the benefits that it provides.
- The roof retained nearly 75 percent of the total rainfall (29 inches) from May - July 2007, keeping 27,512.4 gallons of water out of the city sewer system.
- The roof has been up to 32°F cooler than conventional black roofs on neighboring buildings, reducing overall building energy consumption.<sup>14</sup>

### The World Wildlife Fund Headquarters Green Roof:

- Is the largest green roof on a non-governmental building in D.C. This roof has collected more than 50 percent of total local rainfall since installation.
- The roof helped WWF obtain a LEED Platinum Rating, achieved in 2011.<sup>15</sup>

<sup>1</sup> Akbari, Hashem, Surabi Menon, and Arthur Rosenfeld. "Global Cooling: Increasing World-wide Urban Albedos to Offset CO<sub>2</sub>." *Climatic Change* 95 (2008)

<sup>2</sup> Tijen, Michelle Van, and Rebecca Cohen. "Features and Benefits of Cool Roofs." *Cool Roof Rating Council Program* 3 (2008)

<sup>3</sup> "Cool Roof Bill Poised to Heat Up the Economy." *Polyiso, The Top Performer*. N.p., 3 Oct. 2011.

<sup>4</sup> DC Greenworks. *Benefits of Greenroofs*. Washington DC: DC Greenworks.

<sup>5</sup> "Cool Roofs for Cooler Summers." *Briefings*. [Environmental and Energy Study Institute](#), 21 July 2011.

<sup>6</sup> *Energy Efficiency and Renewable Energy: Cool Roofs*. Washington DC: [US Department of Energy](#).

<sup>7</sup> *ibid*

<sup>8</sup> *ibid*

<sup>9</sup> *ibid*

<sup>10</sup> Casey, Tina. "Green Roofs Pave the Way to Cheap Solar Power." *CleanTechnica*. N.p., 29 Jan. 2012. Web

<sup>11</sup> *ibid*

<sup>12</sup> Kalousdian, Aram. "Green Roofs Save Energy and Reduce Stormwater Runoff." *Sustainable City Network, Inc*. N.p., 17 Dec. 2010.

<sup>13</sup> "Cool Roof Resources for Federal Agencies." *Federal Energy Management Program*. US Department of Energy, n.d. Web.

<sup>14</sup> "ASLA Green Roof Monitoring Results." *ASLA Performance Data*. [American Society of Landscape Architects](#),

<sup>15</sup> "Who We Are." [World Wildlife Fund](#). WWF, n.d. Web.

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