



Project Category: building envelope
Type of Energy: cooling medium

Type of Measure: no / low cost
Deficiency: poor insulation / high heat gain

Cool Roofs: Reflective Roof Coating for Energy & Maintenance Savings

A “cool roof” is a light colored roofing system employed at two Roche facilities that reflects the sun’s heat and damaging rays and readily emits any absorbed solar heat. This lowers the roof and building temperatures while protecting the roof from sunlight degradation.

Ordinary dark roofs can get very hot baking in the sun—up to 190° F. A cool roof can drop the roof temperature down 50° to 70° F, with a major affect on energy demand and roof longevity. Energy savings have reached as high as 40-50%, though more typical savings average about 20%, with a simple payback of a few years.

While the energy savings are a definite benefit, the maintenance benefits can be even more substantial. Dramatic temperature changes cause the roof to expand and contract, causing thermal fatigue and cracking. Cool roofs reduce these temperature fluctuations and the rate of any chemical breakdown. These factors enable cool coatings to increase roof life and significantly decrease roof maintenance and expenditures. Thus these benefits should be calculated and added to the energy savings to determine the real return on investment.

Below are bullets to address key areas:

- **Heat loss in the winter:** Since the roof reduces heat gain from the sun, it also does this in the winter, increasing heating costs. However the gains from reduced summer-time cooling far outweigh this loss. (see the link to the energy savings calculator for verification)
- **Best Buildings for ROI:** Buildings that are best suited for cool roof applications have one or more of the following conditions: 1) Is in hot and sunny climate during at least part of the year; 2) Uses significant cooling energy and/or has problems maintaining comfort; 3) Has a large roof area compared to the rest of the building’s surface area; and 4) Has roofing which tends to crack and age prematurely from sun damage or has increased maintenance costs forthcoming.
- **Cost & Installation:** Cool coatings most often can be added directly over an existing roof in working condition, after making certain necessary repairs. Cost per square foot estimates depend on existing roof conditions and may be acquired by contacting a local contractor. Cool coatings are also recommended to cool and protect brand new roofs. For new construction, “cool materials” can be used, and have little to no cost premium for new roofs. Cool coatings can not plug leaks for fix and unsound roof. Recoating a sound roof every ten to fifteen years or so helps the underlying roof last indefinitely at a fraction of the cost of re-layering or replacing old roofing.
- **Sustainability:** The cumulative effect of thousands of dark roofs, dark roads, and dark parking lots contributes to a phenomenon known as the urban heat island, raising the ambient temperature by as much as 6° to 8° F relative to the surrounding countryside. This in turn exacerbates smog levels and increases the need for air conditioning, which pushes summer peak demand higher, at considerable cost. Cool roofs work to reduce this problem.
- **Variability in Energy Savings:** The savings from these installations can vary from building to building due to differences in roof insulation, building configuration, cooling loads, cooling system equipment, the local climate, and other variables. Energy savings in California have ranged by up to six times, from .06 kWh/ft²/yr to .59 kWh/ft²/yr. Go to <http://www.ornl.gov/sci/roofs+walls/facts/CoolCalcPeak.htm> to calculate potential energy savings in one of your buildings
- **Vendors & Products:** The two sites in California used National Coatings, whose product is FM listed and UL Approved. Note that a “cool roof” is not a specific product, but rather a common term used to describe roofs and roof coatings with a high level of reflectance and emittance. There are a variety of products, one for every kind of roof.

- **The Roche Experience:** Both facilities installed the system based on upcoming roof maintenance requirements. Their general comments are listed below.
 - **Roche Palo Alto:** It is not easy to determine the amount of heat gain reduction from the installation of the “cool roof” materials because of metering. However, consumption has gone down. The one thing that is very noticeable is the air temperature on the roof that has been replaced with a cool roof material is now much cooler in the sunny portions, and is about the same in the shady portions.
 - **Roche Molecular Diagnostics:** Using an infrared thermometer, it is very obvious this roof project has resulted in a significantly cooler roof. Unfortunately, due to increased occupancy and weather variables, it is very difficult to quantify the savings due to the project. One study in our high bay warehouse indicates that the cooling demand has been dramatically reduced. By reviewing HVAC trends that compared a 100 degree day in 2003 in the warehouse versus a similar day in 2004, it was very clear that the air handler run time was significantly reduced after the cool roof installation, and the period between air handler start cycles was greatly extended.

See below pictures of the before and after in Pleasanton

