



Indian Green Building Council  
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# EXTRACTS FROM VARIOUS COLLECTIONS ON HOW WHITE ROOF HELPS TO REDUCE GLOBAL WARMING

**Abstracts:** *This article is written and compiled by G.Arivazhagan, M.Tech (ceramics), Proprietor, Designer and Mfr. of abc Weather Proof SRI Tiles, an ideal choice for Cool Roof. This article discusses from fundamental theory to the implementation of Cool Roof. The Q &A system enables the common end users to understand the impact of cool roof on global warming. Role of USA in the field of Cool Roof is really to be appreciated.*

*The century old system of Red Clay - weathering course on roof top is to be eliminated in the present scenario of climate change, power crisis, time management and emerging technology transformation in the field of construction industry. In addition, most of the public's superficial opinion such as "ceramic tiles will be lifted in a few years; ceramic tiles will crack; grouting will crack; too much hot on ceramic tile; ceramic tiles will skid during rain" etc are also discussed.*

*Finally a surprising fact is mentioned that a 1000 sq ft white roof will give the benefit of ten trees (15 years old trees). Apart from individual benefits, white roof option is indeed integrated with social, community and environment issues.*

### [Why we should be scared, very scared, of global warming?](#)

Science says that the average temperature on earth has been rising rapidly. And it says this is the result of growing concentrations of 'greenhouse gases' that are emitted whenever any fuel is burnt to produce energy. Science also says that if something is not done immediately to stop the increase in the concentrations of these gases, there will be catastrophic consequences in the next few decades. Glaciers will melt, sea levels will rise, low-lying areas will be submerged, crops will be damaged, extreme weather events like cyclones and storms will become more frequent. In short, the world will become a difficult place to live in and millions of people may lose their lives.

In USA, California is the first state to enforce building code. A committee was formed and 344 pages for building codes were recommended. One of the foremost codes was white roof to save energy. They are doing white coating of several combinations. There, tiles are expensive.

In our case, white tiles are available at affordable prices. Whether white paint or tiles, the roof surface must be highly reflective. For tiles, the base body must be porous enough to achieve heat insulation for effective cooling. Glazed white tile is the best option instead of glazed floor tiles and vitrified tiles.



## What Is a Cool Roof?

A cool roof is a roof which is designed to stay cool in hot weather, rather than absorbing heat and growing warmer as the day progresses. Cool roofs are useful for a number of reasons, ranging from building efficiency to durability, and they are especially common in tropical and subtropical areas, along with desert regions. Residents of temperate climates can also benefit from using cool roofs in building construction.

## White cools the roof, then what are the benefits?

- White roofs with high reflectivity can be 70°F cooler or more during hot summer days when compared with traditional roofing materials.
- White roof systems save money and energy during peak cooling demand periods - typically mid-days, when electricity demand and costs are highest.
- White roofs are effective in virtually all climates. Building owners in some areas have seen a 40% reduction in energy consumption during peak times of the year after installing white, highly-reflective roofing systems.
- In non-conditioned space, white roofing can reduce workspace heat, improving working conditions, and increasing employee productivity.
- A white roof surface can reduce the cost of operating rooftop HVAC units because the units will use cooler air than if mounted on a dark roof surface.
- White roof systems help reduce the urban heat-island effect by reflecting solar heat rather than absorbing and transferring it to buildings.
- By keeping moisture out while reflecting ultraviolet (UV) and infrared (IR) radiation, a white roof can help to protect underlying insulation and the roofing substrate from deterioration.

**abc Weather Proof SRI Tile offers all above benefits.**

## Are cool roofs affordable?

Yes. Many cool roof varieties cost the same amount as other comparable roofing materials, and for those that cost slightly more, the difference can usually be quickly recovered in savings from reduced energy costs.

A study at Calcutta IIM building shows that payback period for Cool Roof is 2.70 years.

## What is the status of Cool Roof in India?

Delhi govt made mandatory for all govt buildings to install cool roofs, specifically Glazed Tiles. Maharashtra govt is considering following Delhi govt. The central govt made ECBC codes are mandatory for eight states from FY 2012. IGBC is striving to implement Green concepts. ECBC is a wing under the Ministry of Power in Central Govt.



### What is the expected life of roofs?

Hashem Akbari, Dr. Rosenfeld's colleague at the Lawrence Berkeley laboratory, says he is unsure how long it will take cool roofs to truly catch on. But he points out that most roofs, whether tile or asphalt-shingle, have a life span of **20 to 25** years.

### How much carbon di oxide emission can be prevented by white roofs or cool roofs?

The scientist Mr. Chu calls his hero, Art Rosenfeld, a member of the [California Energy Commission](#) who has been campaigning for cool roofs since the 1980s, argues that turning all of the world's roofs "light" over the next 20 years could save the equivalent of 24 billion metric tons in carbon dioxide emissions.

About one ton carbon-di-oxide can be prevented per 100 sq ft (10x10 ft area) of white roof per year.

A 15000 sq ft of white roof can set off 150 ton Carbon di oxide gas per year.

Recently 15000 sq ft ABC tiles were supplied and laid in Chennai. **Ref: ABC Weatherproof Tile distributor 9841039696, one of the finest qualities - conscious distributor cum field worker. His deep and committed involvement encourages for new range of products.**

**About one lac square feet of abc Weather Proof SRI Tiles are sold out successfully through distributors from Chennai and Trichy.**

### How effective is the white roof in terms of temperature reduction on roof surface?

1. Roof before treatment, thermometer reads **178**-degree Fahrenheit at the roof surface on a hot summer afternoon. (Conventional dark colour roof).
2. After a cool roof was installed, there was a dramatic decrease in roof air temperature **93**-degree Fahrenheit. (White paint or white tile).



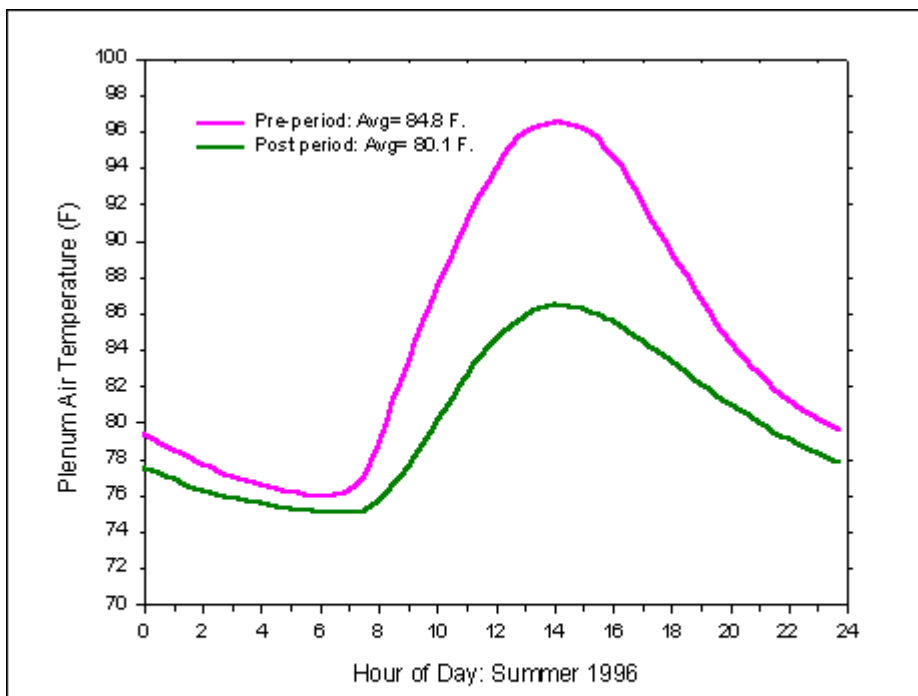
**Is there any comparative research between normal roof and white roof?**

Yes. Please read following selective data out of a 37 page report prepared in Florida, USA,

**Comparative Average Performance Before and After Roof Whitening.  
Before: June 27 - July 26, 1996; After: Aug. 19 - Sept. 10, 1996 Weather Conditions**

Ambient Temperature (°F)	Relative Humidity (%)	Wind Speed (m/s)	Solar Irradiance (W/m <sup>2</sup> )	Roof Temperature (°F)
81.3 81.2 0.1	78.8 79.6 -0.8	2.77 2.90 -0.13	240 235 5.0	92.8 79.1 13.7

Store Front	Plenum Temp.	Interior Temp.	AC/kWh Day	Peak Plenum Temp. (F)	Peak Interior Temp. (F)	AC Pk kW
<u>Bagel Shop</u>						
Before white	84.6	74.8	48.18	92.5	75.6	2.245
After white						
Difference	79.9	74.9	41.79	83.8	74.3	1.834
Percent	4.7	-0.1	6.39	8.3	1.3	0.411
			13.3%			18.3%
<u>Realty office</u>						
Before	84.8	72.7	37.32	95.4	73.1	2.051
After	80.1	73.4	30.11	85.0	74.1	1.565
Difference	4.7	-0.70	7.21	10.4	-1.0	0.486
Percent			19.3%			23.7%



**Figure 26. Measured average roof surface and plenum air temperatures above the bagel shop in the pre and post period in 1996.**

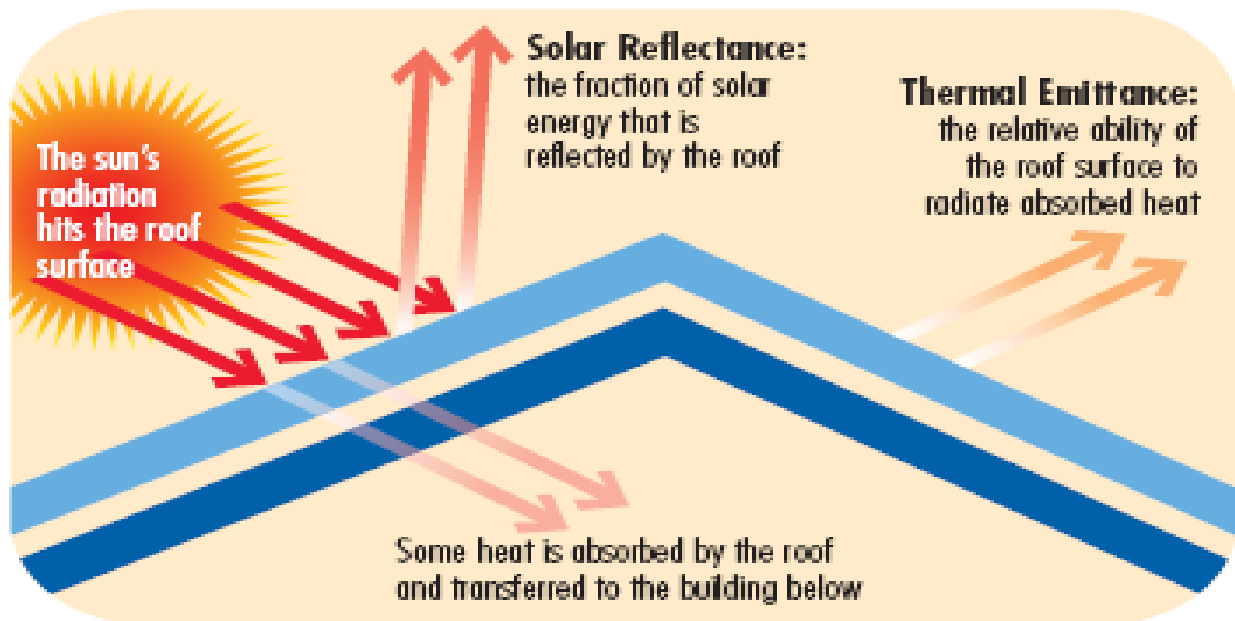
Red color: before white coat Green color: after white coat

The above information from the original research paper of 37 page report.



**What are Solar Reflectance and Thermal Emittance? (these two properties are required for cool roofs)**

Solar reflectance and thermal emittance are the two radiative properties used to measure the "coolness" of a roof.



**Where the white roofing is compulsory as one of the building codes?**

California, Florida and Georgia have adopted building codes that encourage and insist white-roof installations for commercial buildings. Tax benefits are also offered for white roof.



## [How to use the Cool Roofing Materials Database?](#)

Examine the relative “coolness” of various types of building materials, to select a type of roofing or roof coating which may meet your needs to reduce air conditioning energy use or to improve comfort.

The table below shows the temperature rise in full sun. Assumed that there is little wind (wind helps cool the roof). Keep in mind that this is the temperature rise, not the temperature itself. Thus a temperature rise of 90 degrees F on a 100 degree F day means the roof temperature peaks at 190 degrees F!

Material	Roof temperature rise above air temperature (degrees F, full sun, no wind)	Remarks
Bright white smooth materials	15 F	The coolest construction materials. Can be roof coating, membrane, metal, <b>glazed tile</b> , etc. A soiled white is warmer, about 30 F.
Rough white surface	35 F	Rough surfaces of any given material absorb more sunlight than smooth surfaces
Very light (pastel) colours	15 to 55 F	
Intense but not very light colours (green, red, blue, etc.)	79 to 83 F	Research may identify cooler colours
Medium grey	52 F	Reflectance half way between white and black
Built-Up Roof (BUR) covered with gravel	61 - 83 F	Cooler values obtained with lighter gravel
Black materials	90 F	



### How carbon credit is calculated and what is the rate?

Most existing flat roofs are dark and reflect only 10 to 20% of sunlight. Resurfacing the roof with a white material that has a long-term solar reflectance of 0.60 or more increases its solar reflectance by at least 0.40. Akbari et al. estimate that so retrofitting 100 m<sup>2</sup> (1000 ft<sup>2</sup>) of roof offsets 10 tonnes of CO<sub>2</sub> emission per year. (For comparison purposes, we point out that a typical US house emits about 10 tonnes of CO<sub>2</sub> per year.) Emitted CO<sub>2</sub> is currently traded in Europe at about \$25/tonne, making this 10-tonne offset worth \$250.

### What the US president says about white roofs?



**WORLDnews** network

[Obama says paint your roof white to save energy](#) [The Examiner](#)  
2009-05-27

LONDON(AFP) (AFP) - US [Energy](#) Secretary Steven Chu said Tuesday the Obama administration wanted to paint roofs an energy-reflecting white, as he...





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### **[What about the insulation value of a tile roof?](#)**

Tile roofs are good insulators. The combined effect of the SRI roof tiles, thermal mass and the air space within the tiles allows for better air circulation and thereby reduces direct heat transfer. This results in lower air conditioning costs in the summer and decreases the formation of ice dams in the winter.



### How long will the glazed tiles last?

If the right product is selected (similar to abc quality) for the area and if it's maintained properly, the tile could **last the lifetime of the home.**

### What kind of tiles (properties) are good for roof top and why?

abc weatherproof SRI tiles are the best. These are at par with ECBC/IGBC guidelines.

White glaze is on wall tile body and 90% whiteness. The glaze coat contains 10% zirconium oxide. This is one of the excellent ingredients for opaque glaze.

Solar Reflectance Index (SRI) is 95. This is a certified value as per ASTM.

95% heat is reflected and hence easily possible to walk even during hot summer noon time without chapel. Century old red clay tile's reflection is only 20%.

abc Tiles are 100% stain free and hence the reflection (95%) will remain for life time. Only periodical cleaning on roof top is required. abc tiles are acid resistant and any kind of cleaning aids can be used.

Less weight when compared with conventional roofing system.

Base body is about 30% porous and tile's back side is provided with deep grooves for better bonding with bed material.

### Ceramic tiles will skid during raining and can't we use the roof top?

Tile top surface is embossed for better gripes. This enables to walk on the tiled surface during rain without any fear of skid. Surface is made semi-matt for the purpose of anti skid effect as well as for easy cleaning.



## How to fix abc Tiles?

There are certain methods strictly to be followed for the best result and contact your local dealer for instructions. This is to avoid common problems such as tile lifting and water seepage through grouting etc.

## abc Tile is an ordinary ceramic tile and how it is suitable for roof top?

Yes, abc Tile is ordinary ceramic tile but certain properties are constantly maintained without any deviation. The common issues like tile lifting and crack will not appear in abc Tiles. An optimum SRI value, sufficient anti skid effect and availability in different shades are additional strength for abc Tiles.

We also prescribe the most suitable laying methods. Ceramic tiles are heated and baked at 1100 deg C. Nothing will happen when ceramic tiles are used on roof top if tiles are fixed properly and roof top is properly maintained.

SRI value is tested and assured for abc Tiles. This is the first brand with certified SRI value.

## abc Tiles are expensive as high as vitrified tiles: we can't afford such costlier tiles for roof top: we are only contractors and some one going to use the roof top.

Compare the price with **white** vitrified tile and not with Ivory base tiles. Cost is due to the addition of white pigments.

Payback period for white roof is 2.7 years as this is clearly established in a report carried out at IIM building in Calcutta. When a building is planned for beautiful interior and elevation, roof top is neglected. In fact, roof top decides the life span of a building.

Building owner has to insist for roof top specification as well as engineers / contractors have to mention roof specification at the planning stage itself. Builders also have to mention specification for roof top.



### **Glazed tiles will reflect more solar heat and glare at noon time of summer and how to over come this glare?**

More reflection means more glare. This is applicable for all cool roofs. This is a little discomfort when compared with huge benefits.

If the roof is to be used frequently during noon time (rare case), use light colour tiles like pink and blue etc. SRI value will be 85 to 90.

### **We may construct one more floor in future and what to do?**

In this case, use any light colour tiles which can be used as floor when one more roof is constructed. Consult our engineers for guidance.

### **Trees Vs White Roofs – an unbelievable fact!!**

A satellite image in USA confirmed that white roofs are more effective than planting trees. This does not mean that growing trees are bad idea!!! The white roofs are also as effective as growing trees. A tree will take years and years to grow and to give benefit whereas white roofs are beneficial from the day one after the installation.

### **How much CO2 gas is absorbed by one tree?**

### **What is the ratio of white roof and tree?**

It depends on the size of tree, type of tree and other factors. Following data is collected from various sites.

One tree absorbs 7.5 to 13 kg co2 gas per year.

1000 kg co2 gas is absorbed by one tree per year.

1 kg co2 gas is absorbed by 1.5 kg of tree per year

1000 kg co2 gas is absorbed by one cubic meter of timber per year.

To sum up by using above data, a 1000 sq ft white roof is equivalent to 10 trees.

A 1000 sq ft white roof reduces 10 ton (10000 kg) CO2 gas per year.