



**National Tiles  
& Ceramics Ltd.**



*How White Roofs Help in*  
**Reducing Global Warming?**

A Detailed Report Prepared in the Interest of the Public.



**National Tiles  
& Ceramics Ltd.**



A Revolutionary Report Says

**100 Sq.ft White Roof = 1 Tree!!!**





## How White Roofs Help in Reducing Global Warming?

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## Foreword

In our earnest attempt to bring out products that are useful for the people, the community and the earth at large, we have recently introduced INSULATION TILES, a next generation cooling CERAMIC TILE.

We have spent considerable amount of time in Research and Development to bring out this high utility product. We felt it is necessary to highlight the benefits of having it on roof. As we are up against the serious threats of global warming, experts have reiterated that having white roof is one of the important ways to reduce global warming.

Please bear in mind that this report is created to help you understand how white roof helps your building and our earth at large in fighting against global warming. This is not a marketing document and we are not trying to promote our product. This document is intended to be purely informational and helps you understand the crisis situation we are in with regard to global warming and the need to do act before it is too late. The paper highlights ways to reduce global warming through simple efforts.

I take this opportunity to congratulate our customer care and R&D team for bringing out such a high quality and highly informative document.

I look forward to your comments and suggestions in helping us create more such useful documents in future.

Together let us fight global warming and save our earth from depletion.

For National Tiles & Ceramics Ltd.,

Agha Murtaza  
Director Marketing & Promotion

## Executive Summary

The threats of global warming are looming large. We could feel that already our climate cycles are severely altered, we face untimely monsoons and our summers have become hotter. Our river beds are drying up fast and we are facing Tsunamis, Earth quakes, Floods and other disasters quite frequently across the globe.

World over, there is a greater focus to switch to green technologies and find ways to slowdown the global warming. There is considerable amount of efforts are being made by government organization in educating people to switch to green ways of living.

As considerable damage has already been done to our earth through mindless industrialization and technological developments, we are forced to 'Go Green' in every possible way. It is not a great deal though, it involves making a few small changes to our lives, being conscious of the impact of our actions on the environment.

***Among various others, having a WHITE ROOF is one way to slow down the global warming.***

The world is rapidly awakening to the benefits of cool roofs (Insulation Tiles or Cool Roofs), with the concept gaining momentum at a rapid pace. On June 1, 2010, US Secretary of Energy, Mr. Steven Chu (supposed to be the Green Coach of President Obama), announced several steps to implement Cool Roof at the US Department of Energy (DOE) to more broadly implement cool roof technologies on DEO facilities and buildings across the federal government. Insulation Tiles use lighter-colored roofing surfaces or special coatings to reflect more of the sun's heat, helping improve building efficiency by reducing cooling costs and offsetting carbon emissions.

Further, it is estimated that 1,000 Sq.ft area of white rooftop creates the same one-time impact on global warming as 10 tons of carbondioxide (CO<sub>2</sub>) emissions. In other words, having 1,000 Sq.ft area of white roof creates the same impact to the environment as planting 10 trees.



This paper highlights various options available in making your roofs white. Various other aspects, both technical and non-technical issues are discussed in detail and results are given in an understand format. While FAQ section includes all common questions that may arise with everyone new to the topic, we have included expert opinions, roof guidelines and others. Graphical representation of information is given at appropriate places to make things clear.



## Deadly Impacts of Global Warming



### Polar Ice Caps Begin to Melt

- The sea levels will raise. According to a study, if all glaciers and ice caps begin to melt, the sea levels would go up by 230 ft from the existing level.
- It will throw the global eco-system out of gear as melting fresh water will mix with the sea making it less salty, which could adversely affect the marine eco-system.
- It will endanger the species that can live in extremely cold conditions like polar bear, penguin etc.,
- Melting of ice increases the level of water tables, thus increasing the chances of more frequent floods.

### More Forest Fires

- As the planet becomes warmer, the places that are susceptible to wild fires are likely to catch up more frequently and repeat its destructive episodes more often than now.

### Destructive Storms

- With sea temperature being a key factor for hurricane formation, global warming will result in more frequent generation of storms and hurricanes with greater intensity.

### Cold Waves

- A cold wave is characterized by a major plunge in temperature over a hour period. It can be a devastating shock for crops and commerce, and also bring death and injury to humans and animals through accidents, hypothermia and starvation. Damage to pipelines and property can be costly, and, particularly if snowfall accompanies the cold wave, transport systems can grind to a halt, adversely affecting the distribution of food, water and medical supplies.

### More Outbreaks of Deadly Diseases

- Climate greatly influences some of the most deadly and widespread, as disease causing insects like mosquitoes can multiply at staggering rate with small change in temperature.

### Death of Ocean Life

- Climate change will certainly impact the ocean life and thus bring about a great impact on our food- chain.

## Deadly Impacts of Global Warming



### Diminished Food and Water Supplies

- With reduced rainfall, loss of soil fertility, more severe droughts, food and water supplies would diminish.
- The food and water prices would go up leading to famine, malnutrition, diseases, starvation and ultimately death would be more.

### More Animal Attacks

- We are already witnessing elephants and tigers barging into villages and farm lands. As the climate change affects their habitats, they are forced to find ways to feed them and survive. This could result in more animal invasion and attacks.

### Migration, Conflicts and War

- Reduced resources and unsuitable living conditions might prompt people to migrate to other places, which could result in friction, conflict and ultimately wars.
- With more people turning to comparatively resource-rich countries as refugees, leading to increased efforts on the government to feed and protect refugees, which might anger native residents resulting in internal chaos and unrest.

### Economic Consequences

- Every devastation creates huge economic consequences. Hurricanes cause billions of dollars to be spend to re-build, diseases cost money to treat, to control and manage.
- Rebuilding power stations, refineries, hospitals, bridges and other infrastructure facilities cost quite a fortune.



## Cool Roof - An Introduction



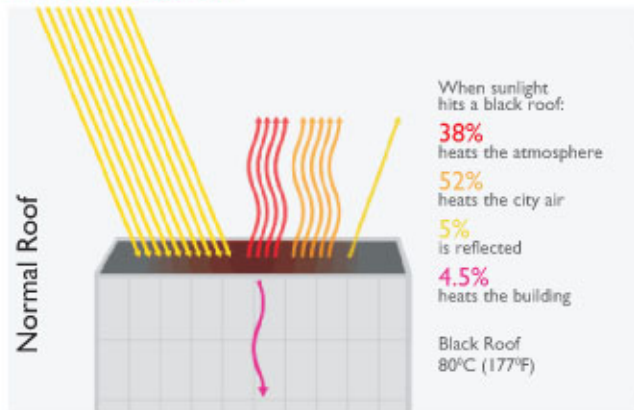
Cool Roof help you stay cool in hot weather and warm during cool weather. Insulation Tiles come with high solar reflectance and high thermal emit properties, which sends the hot rays out of the roof thus allowing the building to remain cool. Insulation Tiles are made of materials that reflect solar energy, moving heat away from the structure below it. These materials can include specially coated metal, tile and even asphalt shingles. In hot climates, Insulation Tiles can reduce the cost of air conditioning by up to 15 percent. Insulation Tiles are widely believed to be white, they actually come in 2 shades. One is a Full body Red Clay Terracotta Tile and the other one has a special HRNT Glaze on its surface

### Benefits of Having White Roof

- Reduces cooling energy load
- Reduces air pollution and greenhouse gas emission
- Reduces building heat gain and thus increases building efficiency and durability
- Improves human health and comfort
- Improves energy efficiency of roofs
- Cools down the building by upto 70° F or more during hot summer compared to traditional roofing materials
- Helps in saving energy consumption upto 30% and considerable amount of money
- When applied to commercial establishments, it helps in reducing workspace heat and thus helps achieve greater productivity
- Extends the roof service life and help mitigating the urban heat island effect.
- Achieves cooling energy savings in hot summers

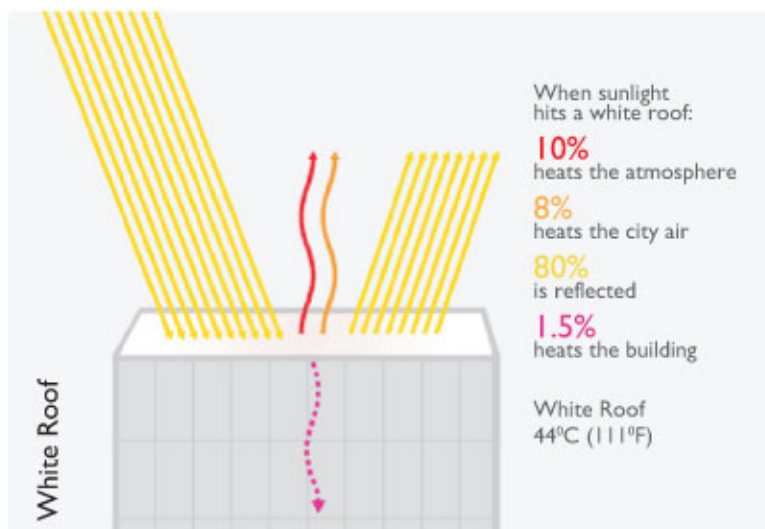
## How white roof works?

### Planet Protection



Normally, when the sunlight strikes a rooftop, most of it gets reflected back into the sky but some of its energy is absorbed into the roof system in the form of heat. White roofs reflect more sunlight and absorb less heat than traditional dark-colored roofs. The effectiveness of a white roof is measured by its solar reflectance and thermal emit properties. Research and common observation have proved that heat from the sun is the single dominant factor that causes the degradation of roofing membranes and thus affects roof durability. Insulation Tiles also help increase the

life of roofing systems because extreme cycles of heating and cooling tend to wear out the material as they expand and contract with the temperatures. White surfaces reflect more than half of the radiation that reaches them, while black surfaces absorb almost all. White or coated roofing membranes, or white gravel cover or tiled roof would appear to be the best approach to control roofing membrane damage.



If all urban, flat roofs worldwide were whitened, the reduction in carbon emissions would be 24 Giga tones, or equivalent to taking 300 million cars off the road for 20 years. This is based on the fact that a 1,000-sq.ft (93 m<sup>2</sup>) white roof will offset 10 tons of CO<sub>2</sub> over its 20-year lifetime.



## Types of Roof Cooling Products

There are four types of cool roofing products available:

1. High-albedo paint
2. Lime coating (that can be applied on visible patches on roof surface)
3. Thermal Insulation Tiles (National Tiles Insulation Tiles)

While the lime coating is cheaper, it requires repainting every six months. Application of high-albedo paint, is cost effective but it lasts for two years only.

Thermal Insulation Tiles by National Tiles



### Insulation Tiles for **Roof & Deck**

Heat Reflective | Waterproof | Stainfree | Anti-Skid

Insulation Tiles can be effectively used for 'roof cooling' solutions. The tiles are made using HR Technology. HR is nothing but application of geo-inorganic products that can be used for the efficient reflection of heat or cold and to mitigate the extremes of temperature. While tiles reflect the heat, the surface of the roof remains relatively cool than other products. With Thermal Insulation Tiles by National Tile fixed, one can practically walk without slippers on a hot day on the terrace comfortably.

#### Salient Features

- Provides thermal insulation leaving the terrace cool
- Replaces lime terracing and it is cost effective
- Roof can be used for functions or other family activity
- Ensures maintenance of congenial natural environment
- Reduces consumption of AC and thus reduces CFC emission
- Saves on the electricity usage
- Can withstand considerable amount of load
- Provides excellent surface finish and acts as a good waterproofing
- Comes with anti-skid treatment
- Stain-free and washable



## White Roof – Global Scenario



### United States of America

On June 1, 2010, US Department of Energy Secretary Steven Chu announced a series of initiatives underway at the DOE to more broadly implement cool roof technologies on DOE facilities and buildings across the federal government. CRs use lighter-colored roofing surfaces or special coatings to reflect more of the sun's heat, helping improve building efficiency by reducing cooling costs and offsetting carbon emissions. President Obama and Secretary Chu have made it clear that the federal government should play a leading role in moving the nation towards a more sustainable future.

The US was the first to endorse the concept. With President Barack Obama advocating it strongly, the concept has gained tremendous ground within the States and is now trending in other developed and developing countries.

### Europe

The European Commission is supporting CRs as a deliberate stimulation toward the transformation of CR technology from lab to roofs to reduce energy consumption throughout the European building sector. The take-up of CR in the European market is influenced by policies set by EU institutions, as well as increasingly strict energy efficiency policies set by national and even sometimes local governments. It is based on information from the EU as well as Greece, Italy, France and the UK, as part of the CR project consortium.

### Australia

The South Australian Government released a discussion paper on CRs regulation in South Australia in December 2010. The paper evaluated the benefits of placing an upper limit on the solar absorption value of roofs installed in South Australia. The paper also sought public contribution to the discussion in a number of areas related to the proposed establishment of CRs in commercial buildings. The scope of the initiative, estimated costs and benefits were areas of emphasis in seeking public views.

In USA, California is the first state to enforce a standard building code which insisted on having white roof as a means to save energy.



## White Roof - Scenario in Pakistan



### Islamabad

The Federal government is all set to implement the 'Cool Roof' concept in a bid to promote energy conservation. As part of the pilot project, the government will introduce cool roofing on its big buildings such as Islamabad Secretariat, hospitals, schools, etc. The government also plans to bring out a manual to increase awareness about the concept.

“We want to encourage cool roofs in the Capital. They have the ability to reflect and reject heat because the roofs are prepared with materials which have properties of high solar reflectance,” Environment Minister said after attending a presentation on the concept.

### Sindh

The Sindh Government wants to promote Insulation Tiles to conserve energy. The state environment department has tied up with Director of the International Energy Group of the renowned California based Lawrence Berkeley National Laboratory for this.

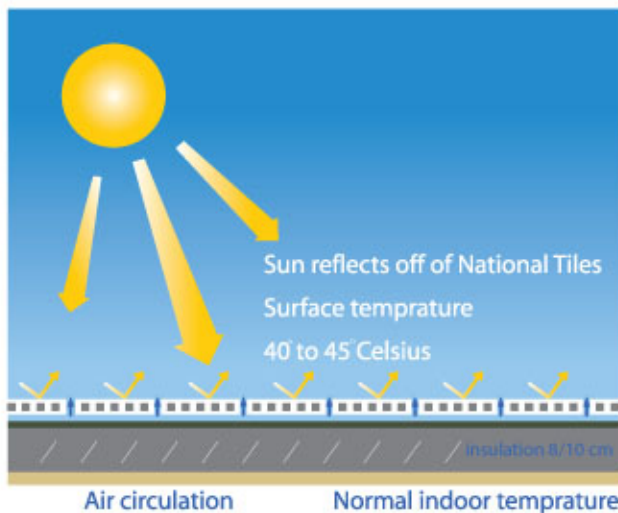
"Models used in Karachi and Hyderabad, where the concept has already been introduced, are being examined." In Karachi, the government has modified building norms to make "Insulation Tiles" an option in new buildings. On completion of the ongoing study, the state urban development (UD) department could be asked to check the feasibility of introducing similar changes in development control norms.

To bring down carbon emissions and slow down global warming effects, the state has been promoting use of green and environment-friendly building construction materials. Interestingly, the California research laboratory had also suggested use of light-colored Insulation Tiles to reduce carbon emissions.



## Normal Roof vs White Roof - A Comparison Study

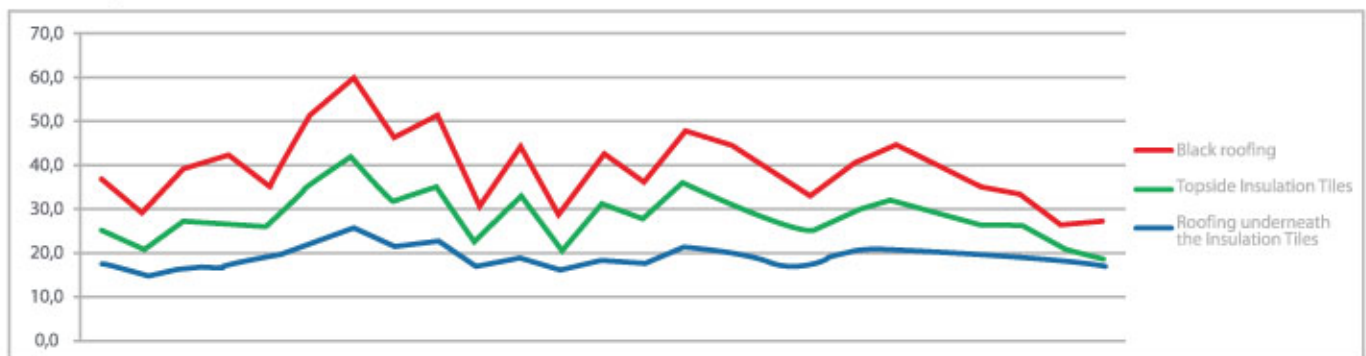
A series of tests were conducted in seven retail shops in a strip mall in Cocoa, Florida to examine how roof whitening would impact air conditioning load. The roof of the strip mall was conventional. Below the insulation was the roof plenum which contained both the air handler and duct air distribution system. Cooling was accomplished in each shop by a dedicated direct expansion air conditioning (AC) system between 3 and 4 tons in size. Building temperatures as well as meteorological conditions were also obtained on a 15-minute basis. The roof was then resurfaced white at mid-summer using a commercially available coating product. The measured roof surface reflectivity was altered from approximately 29% to 75%. The tests were phased over a two summer period so that the impact of surface degradation could be measured in the second year of exposure.(1)



The results for both phases of the project, showed a 25.3% average reduction (8.6 kWh) in summer space cooling energy (34.1 kWh/day to 25.5 kWh/day) in the seven shops with a range of savings of 13 - 48%. The percentage savings varied with the temperature maintained in the shops; those maintaining the lowest interior temperatures saved the least on a percentage basis.

Total annual air conditioning in the seven monitored shops averaged 6,780 kWh; estimated savings averaged 1,670 kWh.

### Example months over summer





## White Roof - Green Specifications

### Trees Vs White Roofs

It may be hard to believe. But a study in USA based on a satellite imaging confirms that white roofs are more effective than planting trees. This in no way discourages growing trees. In all practical purposes, we can take white roofs to be as effective as growing trees when it comes to protecting our planet. However, we should not forget that a tree will take years to grow to give the required benefit, while that can be achieved through white roofs from day one of the installation.

### How much CO<sub>2</sub> can a tree normally absorb? What is the ratio of white roof and tree in that aspect?

The absorption level is dependent on various factors such as size of the tree, type, green spread etc., The information from various sources confirms that one tree absorbs approximately 7.5 to 13 kg CO<sub>2</sub> gas per year. 1 kg CO<sub>2</sub> gas is absorbed by 1.5 kg of tree per year. 1000 kg CO<sub>2</sub> gas is absorbed by one cubic meter of timber per year. To sum up by using above data, a 1000 sqft white roof is equivalent to planting 10 trees. A 1000 sqft white roof reduces 10 ton (10000 kg) CO<sub>2</sub> gas per year.

### How much CO<sub>2</sub> emission can be prevented by white roofs under normal circumstances?

The scientist Mr. Chu 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 CO<sub>2</sub> emissions. About one ton carbon-di-oxide can be prevented per 100 sqft (10x10 ft area) of white roof per year. A 15000 sqft of white roof can set off 150 ton CO<sub>2</sub> gas per year.

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

1. White roofs are proven to reduce roof temperature drastically. It was found out that roof before treatment on a hot summer registered 178-degree Fahrenheit (Conventional dark colour roof).
2. A properly installed white roof under same circumstances showed dramatic decrease in roof air temperature which stood at 23-degree Fahrenheit. (White paint or white tile).



## FAQs

### I really like thermal insulation tile roofs, is it expensive?

No. During the past few years, the installed cost of tile roofs has not increased as much as wood shakes and asphalt shingles. Concrete and clay roof tiles are also incredibly durable, withstanding severe weather conditions. Moreover, their superior aesthetics increase the value of any structure.

### What is the life of tile roof?

Both concrete and clay tile roofing systems, when installed properly, withstand weather conditions and lasts for many years.

### Tiles last a long-time, but how long will the color last?

Some roof tile manufacturers guarantee their tiles against fading for 50 years. Colors achieved by adding pigment will last indefinitely.

### What about the insulation value of a tile roof?

White Tile roofs are good insulators. The combined effect of the roof tiles, decking, and the "air space" between the tiles allows for better air circulation and thereby reduces direct heat transfer, resulting in lower air conditioning costs in the summer and a decrease in the formation of ice dams in the winter.

### Should my building have to be a lot stronger and more costly to support a tile roof?

Most commercial or quality residential structures require little or no additional bracing. Additional costs, if any, to support tiles are usually an extremely small portion of the total project.

### How environment friendly is roof tile?

Both clay and concrete roof tiles are made from naturally occurring materials that do not deplete precious natural resources. They are manufactured without chemical preservatives, and old tiles can be recycled to make new tiles or other products. Moreover, roof tiles are energy efficient: because of the superior thermal capacity of roof tiles and the ventilated air space that their placement on the roof surface creates, a tile roof can lower air conditioning costs in hotter climates and produce more constant temperatures in colder regions, which reduce potential ice accumulation.



## FAQs

### Why thermal insulation tile is the best for roof top?

Insulation Tiles by National Tiles reflects 96% of the heat and hence allows you to walk with bare foot on a sunny afternoon. It weighs less compared to conventional roofing system and it is made of anti-skid properties which gives you a better grip. It is easy to maintain and practically requires no maintenance.

### Will the tile roof skid?

No. It comes with semi-matt finish allowing you to enjoy anti-skid surface.

### In which part of the world White Roof is compulsory?

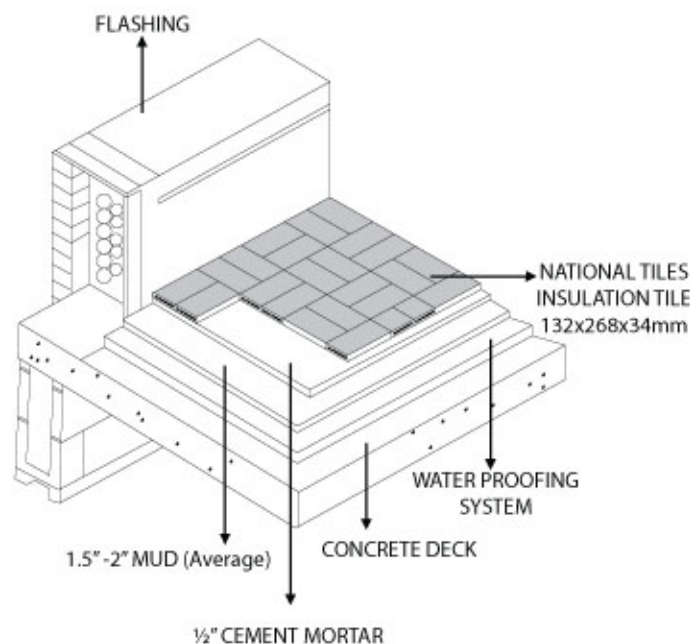
California, Florida and Georgia have adopted building codes that encourage and insist on white-roofs. Tax benefits are also offered for those who fix white roofs.

### White tiles seem to be expensive compared to normal roofing tiles?

The slight increase in cost is due to the expensive raw materials. It is estimated that the pay back period is 2.7 years. Engineers and building owners should consider the fact that the life span of the building increases with white tile installation.

### We may construct one more floor in future, what to do with thermal insulation tiles that time?

If that be the case, you can use a colored tile, which can be used for flooring if you prefer. You can consult your engineer in such a case. All we can say is white roof is the ideal choice if you are concerned about the life of your building.





## Conclusion

White Roof is certainly the future. You can be rest assured that Pakistan will adopt strict building codes requiring every one to install white roof in the roof, irrespective of whether it is commercial or residential.

For all those people who are conscious about the hazards of global warming, it is time to wake up and do your bit to replace your existing roof with a white roof, irrespective of the product of your choice. But make sure it is white reflects the sunlight maximum and serves our purpose.

Please feel free to write to us **[sales@nationaltiles.com](mailto:sales@nationaltiles.com)** regarding this report.

We invite your feedback, suggestions and improvements to the content. We have made conscious efforts to provide you the most accurate information. However, if you find anything inaccurate, kindly let us know, as we are ready to do make improvisation in order to bring out a more accurate version of the report.

Together let's determine to fight global warming and do our bit as environmental conscious global citizens.

*Thank you* for your patient and attentive reading.



Insulation Tiles by National Tiles - Certified for performance and quality



## Insulation Tiles for Roof & Deck

Heat Reflective | Waterproof | Stainfree | Anti-Skid

National Tiles has developed Insulation Tiles for Roof & Terraces with Special Heat Reflective glaze (HRNT-613) which contributes to energy saving by decreasing cooling & heating cost.

National Insulation Tiles consist of 34mm thickness with cavity of 12mm HRNT-613 (I). The Tiles are highly durable and enable significant energy saving on non-insulated and poorly insulated roofs and provides large saving in term of energy costs and normal insulation cost.

Now you can have the advantage of National Insulation Tiles for the insulation from heat/ Cold/ Frost proofing of roofs of residential projects, industrial projects, commercial buildings and storage facilities.



*More than a tile!*



*By*



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