

General information:

- Technology developer: Laboratori Ecobios
- Assessment of product properties and product qualification: ENEA
- Date of issue (year): 2006

Aims and Objectives:

The use of bright colours for painting the building envelope of buildings is a trademark of vernacular Mediterranean architecture. This was one effective solution to reduce the cooling loads and ensure thermal comfort conditions in the built environment. The modern architecture often does not take into account these concepts and it is daily experimented the increase of cooling loads in residential and commercial buildings, and the thermal discomfort for occupants. Old design concepts merged with new technologies can improve the energy performance of buildings in the Mediterranean area and reduce the increasing heat island effect in large urban areas.

High reflective materials for the opaque components, especially the roof exposed to strong solar radiation, can be useful to reduce the cooling loads for several building typologies. Cool roof materials are characterised by high solar reflectance, to reflect the solar radiation during daytime, and high infrared emittance, to exchange away the heat stored into the structure at night. Respects to conventional materials, other characteristics are required: easy to clean, high durability in maintaining the original colour and resist to ageing phenomena.

Reflective coating also improve the quality of outdoor urban spaces more and more affected by the phenomenon know as *urban heat island effect*. This is the increase of air temperatures in cities respect to the surrounding countryside due to the high construction density, the limited green area, waste of public and private transport, waste of air conditioning systems and others cause.

This technology is crucial to fulfil energy and environment targets in times of global warming. This is recognised at European level, since EU funded the PROMOTION OF COOL ROOFS IN THE EU Project (www.coolroofs-eu.eu) in the framework of the Intelligent Energy Europe Programme.

A Short Description of the Technology:

Laboratori Ecobios (www.ecobios-solaria.it) produces a multi-mineral eco hydro-painting based on a mixture of milk and vinegar, obtained by Mediterranean grapes. The product is an eco-friendly solution for several roofing purposes. An important characteristic is the high solar reflectance (even for non-white colours, see the following figure) and the possibility of being applied practically on almost all the construction (wood, concrete, plaster, metal, glass and so on). It is also suitable for flat and tilted roofs. The first products were surface coatings consisting of several layers, to be prepared and applied on site. Latest technological developments led to the production of single plies to be directly fixed on the roof.

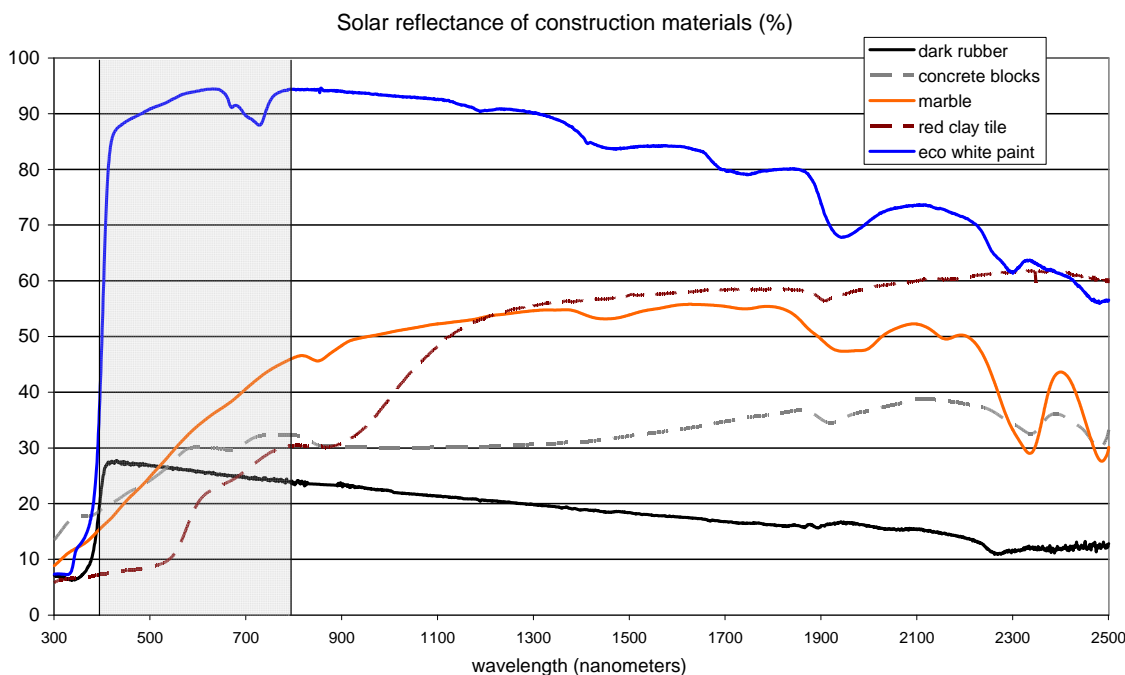


Figure Spectral reflectance of the eco white paint and most common construction materials

- Results from research activity between ENEA and private technology manufacturer

- Cool roof paint and single layer

Once the roof or the other envelope components are treated with this product, most of the solar radiation impinging the building envelope is reflected away. This helps to keep the building environment cool during the cooling season, which is becoming critical in terms of electric consumption and peak demand.



White paint on a flat roof

Sample	Light	Dark
	$\rho_e(\%)$	$\rho_e(\%)$
White	85.9	
Red	75.2	69.4
Yellow	80.6	77.7
Rose	69.3	61.7
Green	82.6	76.4
Grey	62.0	51.8

Solar reflectance of the different milk and vinegar paints

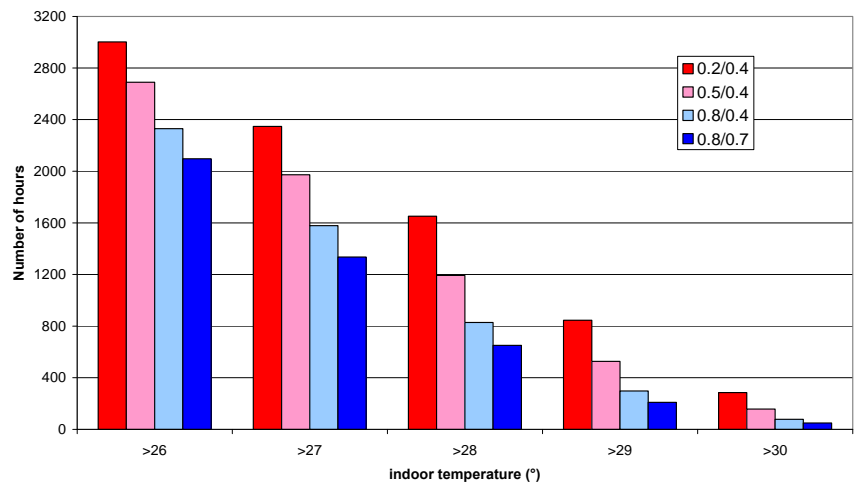
Results and Achievements

The various products were used to paint more than 700,000 square meters of roofs for: construction companies, residential buildings, public buildings, industry buildings.

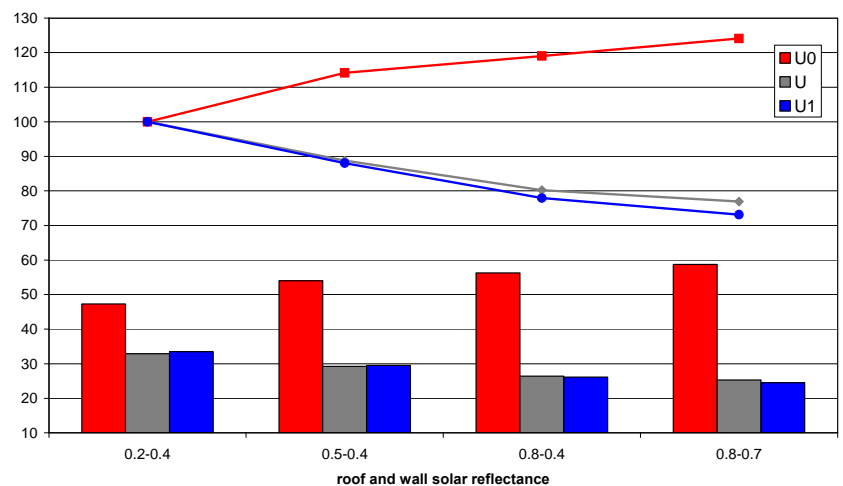
Many numerical and experimental analyses were carried out to assess the potential energy savings deriving from application of cool roof technologies in residential and commercial buildings. The simulations were run using a dynamic tool (TRNSYS) for several climatic localities in the Mediterranean area, taking into account cooled and not cooled buildings.

Figures in right side report the results obtained from a single story house in Palermo. The upper figure presents the cumulative distribution function of the indoor air temperature with respect to the threshold values in X-axis during the cooling season. The bars refer to the couple of solar reflectance values in the legend (left refers to the roof, right to the vertical walls). The lower figure shows the results of the same house with a cooling system installed (the roof solar reflectance as X-axis and the energy demand/consumption on the Y-axis). As a function of different solar reflectance (same couples of the left figure), the histogram graphs present energy consumption, expressed in kilowatt-hour per square meter per year, while the lines refer to the percentage of energy savings. This graph presents the results for three level of insulations: according to the Italian energy code (U in the legend), 20% more insulated than the standard (U1), no insulation (U0).

CUMulative distribution of the air temperature



Energy consumption (kWh/m2 year) and savings (%)



The project aims at promoting and widespread disseminating EU innovative Research and Technology Development and Demonstration results, as well as eco-sustainability criteria in building sector, which include:

- energy efficient building materials, components and systems not yet introduced into the building market or in their first market phase;
- innovative applications of heating/cooling and power supply technologies, combined with the use of renewable energy sources, in building sector;
- best EU demonstration eco-building projects.

Eco-friendly cool roof technology

- Results from research activity between ENEA and private technology manufacturer

The results show how the thermal and energy performance of residential building can be improved using this technology.

The application is promising for commercial building as well, since high internal and solar gains make more critical the impact of cooling demand in the overall energy performance of the building.

Possible application area:

Residential and commercial buildings. Cooled and not cooled buildings.

Reference: The research comes from a combined activity between a small enterprises and ENEA, public body operating in the energy efficiency sector. ENEA supplied manpower and knowledge, Ecobios supplied products and market experience.

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Eco-Building Club: an innovative RTD&D results' promotion approach

Different from common market promotion approaches, where market operators are only simple message receivers, the project proposes an innovative approach: Eco-Building Club is a virtual round table, around which building market operators will be main actors for market penetration of research and demonstration results, through the following actions:

- determining what are more appropriated innovative RTD&D results for local market transferring;
- demonstrating the feasibilities of the research and demonstration results on real cases.