

**REFERENCE MATERIAL FOR PRESS KITS:**

**Architecture: The Merits of Copper**

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- Brussels, June 29, 2005-

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## COPPER IN ARCHITECTURE

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Completed towards the end of 2004, the imposing contemporary Padre Pio Basilica in San Giovanni Rotondo, southern Italy, is a perfect example of the passion of modern architects for copper. Built in the form of a snail shell, its 19,500 square metre roof (the largest to have ever covered a European church) was entirely designed in pre-patinated green copper. Such a structure continues the evolution of copper in architecture from countless ancient buildings fitted with copper roofs. Mankind has in fact used copper for many thousands of years, in particular in architecture during the Middle Ages when many European churches had copper roofs. This amazing modern construction shows the range of copper's aesthetic and technical properties and demonstrates the increased interest in copper by contemporary architects throughout Europe.

### A copper roof stands the test of time

Used in the past for prestigious buildings, copper roofs are increasingly used in office blocks, apartment blocks and private houses. This is because the benefits of copper as a roofing and cladding material are appealing to more and more architects:

- **Longevity:** While people often talk of a 100-year lifespan, some buildings can attest to the fact that a copper roof can last more than 400 years.
- **Hard-wearing:** A copper roof does not need any special maintenance thanks to the natural process of forming the patina, a green surface coating that is waterproof, insoluble and very adhesive, protecting the copper from the environment.
- **Lightness:** A copper roof weighs on average only half that of a lead roof and a mere quarter of a tiled roof.
- **Thermal expansion:** Copper expands by around 20% less than lead or zinc. With less movement caused by changes in temperature, longevity is greatly increased. At the other end of the spectrum, copper can be worked without tearing, even at low temperatures, making it the natural choice for higher altitudes.
- **Malleability:** Copper is particularly suited for bending and for use in facings. Flat roofs, complex cuts, audacious curves - copper is fully adaptable, giving the designer great freedom.

### Rainwater Systems

The widespread use of copper as a material for rainwater systems is a natural extension of the tradition of those working in metal coverings. The architect can thus ensure continuity between the roof and the gutters. Copper rainwater systems also work with any type of roofing material - tile, slate, stone or shingle – and any architectural style or trend.

### Facades revisited

The great innovation of modern architectural creations is in the use of copper in facades. Smooth, raised or truncated surfaces, in the form of a scale or shingle, in cascade or in panels, copper simply allows great creativity.



### **Copper also appeals to designers**

As well as inspiring architects, copper is also attracting an increasing number of designers who are rediscovering the amazing properties of this noble material and who are using it in a host of modern applications: from lighting to fireplaces and furniture to accessories. For the second consecutive year, last November Milan hosted an annual exhibition entirely devoted to the use of copper in interior design: *Abitare con il Rame*. The 2004 event offered a surprising collection of creations on the theme of 'Light and Heat'. The displays included lighting, fireplace accessories and radiators designed by talented young designers, all demonstrating the aesthetic and practical qualities of copper.

## All copper's colours

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The aesthetic aspect is a key factor in the rediscovery of copper by contemporary architects. Copper is the only commonly used metal with a distinctive colour, all others, apart from gold, being grey.

### A palette of colours

Copper offers architects not just a single colour but rather a whole palette of colours:

- a shining **orange-red**, evoking light and opulence in its initial flamboyant phase
- a **chocolate-brown** that is more or less darkened by the progressive oxidation of the metal as cuprous oxide forms.
- and progressively an **almond-green finish**, the insoluble, waterproof and very adhesive properties of which naturally protect the copper.

### A living material

In the same way as leather develops a beautiful finish as it ages, copper is remarkable in being a living material, with the colour gradually changing over time as it patinates. The speed of this process depends on both atmospheric and climatic conditions, with the patina developing more quickly in a marine climate or industrial environment, on a surface with a shallow slope or if very exposed to the wind. On average it takes between 8 and 12 years in an urban environment and 15 to 20 years in rural areas for it to be adorned with its easily recognisable green finish.

### Pre-finished surfaces

To meet the needs of architects and developers, copper producers have devised a range of pre-finished shades right from the production line. In other words, it is now possible to install a copper roof with a green finish on a completely new building.

The range of pre-finished or copper alloy products is extensive:

- An **almond green** copper, as a result of a mechanical and chemical treatment that makes it possible to obtain a deep and harmonious finish, very close to the natural patina. Over time, the pre-patinated copper will naturally evolve, enhancing the natural green finish.
- A **matt brown** copper, which corresponds to the intermediate brown of natural copper. It is obtained by oxidising the copper. Once the pre-oxidised copper is exposed to the atmosphere it will continue to evolve until it has a natural almond green finish.
- The **warm brown** bronze (copper/tin alloy). The bronze makes it possible, with only small amounts of tin, to obtain tones that are pinker than pure copper, which will evolve towards brown, remaining stable over time.
- A **metallic grey** tin-coated copper. The roof will remain grey but will retain all the properties of copper (thermal resistance, malleability, corrosion resistance...).

The golden yellow, a hue that will remain stable over time, of the copper/aluminium alloy should also be noted, as should the strong yellow of brass, a copper/zinc alloy, mainly used for interior decoration (handles, floors, walls, door and window frames...).

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## **COPPER: VERY ENVIRONMENTALLY FRIENDLY**

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### **For sustainable construction**

The future is one of sustainable construction that is environmentally friendly, an area which is being driven by public authorities. At a European level, in particular, several programmes encourage the application of sustainable development criteria in architecture, for example:

- The European Directive on the "energy performance of buildings" (2002/91/EC) that will come into force in January 2006. This is designed to promote improvements in the energy performance of buildings, taking into account outside climatic conditions, special local conditions, requirements with regard to the indoor climate and cost effectiveness.
- The European Interreg III B "ENCOURAGE" project that seeks to reduce the ecological footprint of the sites of economic activity in new French, Dutch and British towns.

In some European countries label schemes have begun to emerge: this has happened, for example, in the UK where the Building Research Establishment created a label for new buildings (mainly offices) in order to evaluate the environmental performance of buildings. The programme now covers over 25% of the office blocks in the UK.

In the early 90s, a High Environmental Quality [HQE] initiative began in France. Founded in 1996, the HQE association now has 43 local -branches. The HQE initiative is not built on strict legal regulations or any outside standards but acts as an encouragement for developers to design buildings that are more environmentally friendly. The HQE nevertheless operates on the basis of specific rules and requirements, relating to the construction and life of the building and set out in the form of 14 goals that the developer must seek to achieve when building.

### **Architects rediscover the 'green metal'**

Leading practices appreciate copper's environmental credentials. This can be seen, for example, in the specification of copper for the facades of the highly environmentally friendly 'La Glacière' complex in Brussels, currently being designed by the Art Urbain firm.

### **The global environmental contribution of copper**

Copper's essential properties fit into a global environmental approach covering the whole life cycle of a building, from design to recycling.

- Durable, resistant to corrosion and easy to install, the use of copper helps to limit the volume of waste upstream and cut maintenance to a minimum.
- 100% recyclable, the copper available on the market already contains recycled copper. The recycling process changes none of copper's properties and recycled copper is melted down with new copper and can be used in exactly the same way as new copper. It is estimated that recycled copper accounts for over 40% of copper demand in Europe thus saving raw materials. As well as saving resources, the recycling process generates energy savings of close to 85%<sup>1</sup> when compared to the extraction of new copper.

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<sup>1</sup> Source: BIR (Bureau of International Recycling)

Recycling is becoming a major issue: it is estimated that more than a quarter of all the waste produced in Europe comes from the demolition and renovation of buildings. Yet, half of the waste from this sector is still thrown away without being reused or recycled. Around 30% of the materials used in construction are recycled, whereas 90% of them could be<sup>2</sup>.

- Copper plays a natural role in the environmental performance of buildings due to its exceptional electrical conductivity (the best of all non-precious metals), a factor in the improvement of the energy efficiency of electrical installations. It is known, for example, that increasing the amount of copper in electrical appliances such as motors or transformers minimises heat loss, thereby increasing efficiency. Now, as in the past, whenever there is an electrical application in a building, you'll find copper.

#### **Profile of copper**

On the galvanic scale, copper is located amongst the most noble metals, just behind platinum, gold and silver.

Symbol: Cu

Density: 8930 kg/m<sup>3</sup>

Melting point: 1083°C

Available in sheets or in strips

Durability: over 700 years

100% recyclable with no loss of properties

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<sup>2</sup> Source: CSTC RecyHouse Programme [www.recyhouse.be](http://www.recyhouse.be)



## **COPPER BENELUX**

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Copper Benelux is the copper information centre for Benelux. A partnership between the world's copper producers and the Belgian, Dutch and Luxembourg manufacturers of semi-finished products, Copper Benelux is responsible for providing information on and promoting copper in its various applications. The Centre designs and implements technical information programmes, particularly in the key sectors of construction, electricity and manufacturing.

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## **EUROPEAN COPPER INSTITUTE**

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The European Copper Institute is a joint venture between the world's mining companies (represented by the International Copper Association, Ltd.) and the European copper industry. Its mission is to communicate copper's benefits to modern society across Europe through its Brussels office and a network of eleven Copper Development Associations.

ECI is active in 4 key areas in Europe:

- Electricity & Electronics
- Building Construction & Automotive
- Environment
- Health

### **1) ECI Electricity and Electronics Programme**

The ECI Electricity and Electronics Programme is aimed at promoting the rational use of energy, in the context of sustainable development, in three areas:

- **Energy efficiency:** in increasing research, awareness and market development activities, in particular by participating in community action programmes, like the 'European Union's Motor Challenge Programme', which encourage industry to use energy efficient motor driven systems.
- **Quality of electrical energy:** ECI is the founder of a community action programme for professional training (LEONARDO Power Quality Initiative) to improve the quality and reliability of electrical energy by reducing electrical interference. Present in 12 countries, this programme, involving more than 80 organisations, including renowned universities, companies and professional bodies, aims to save European industry 10 billion euro per year through reducing electrical interference.
- **Electrical safety and convenience:** ECI brought together the main players in the field to focus efforts on enhancing electrical safety and convenience in the home (the FEEDS partnership - Forum for Enhanced Electrical Domestic Safety).

## 2) ECI Construction and Automotive Programme

Construction and automotive are key sectors of activity for ECI. Promotional activities in these fields are centred on 3 main areas:

- **Architecture and piping systems:** to promote copper's aesthetic properties, its durability as well as its natural antibacterial properties, in particular in systems distributing drinking water, heating and gas.
- **The role of copper in solar energy:** to raise awareness of copper's outstanding electrical and thermal conductivity as key factors in efficiently exploiting solar energy.
- **The advantages of copper in modern vehicles:** to communicate copper's essential role in improving the safety and comfort of modern cars and to make possible the electric cars of the future.

## 3) ECI Environmental Programme

The ECI environmental programme is mainly aimed at understanding copper's role in soil and water. The results are used in discussions on regulations both at a European Union and national level. All research is undertaken with the assistance of eminent scientists.

## 4) ECI Health Programme

The ECI health programme is primarily aimed at understanding the role of copper as an essential element in health. The results are used to improve health by contributing to the discussions on regulations both at a European Union and national level.

### ***Further Information:***

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## Appendix: Illustrations

### Copper in Architecture



Roof of the Padre Pio Basilica, Italy  
Architects: Renzo Piano

Phosphor bronze weave cladding of the  
Plymouth Theatre Royal Production Centre,  
United Kingdom  
Architects: Ian Ritchie Architects



Façade facing  
'Vázquez Díaz' Museum, Nerva Huelva, Spain  
Architect: Julio A. Sánchez Prieto

Façade facing  
Cinema complex in Strasbourg  
Architects: Valode & Pistre, Paris, France



## Copper's Colours

Flamboyant orange red copper  
Coast Surveillance Centre, Lisbon  
Architects: G.B. Arquitectos, Lisbon, Portugal



Pre-oxidised brown copper  
Office complex, Amsterdam  
Architects: Atelier Pro, The Hague, The Netherlands

Pre-patinated green copper  
Warehouses in Hamburg, Germany  
Architect: Jan Störmer, Hamburg, Germany



Grey copper  
'Saint Mary of the Angels' funeral chapel,  
Rotterdam  
Architect: Mecanoo Architecten, Delft