

*Copper in the home of the future*

## Index

1 – THE “WIRED HOME”: COPPER OPTIMISES ENERGY USAGE	3
2 – “SMART” HOMES: COPPER MAKING LIFE EASIER	6
3 – HEALTHY HOMES: COPPER HELPS KEEP WATER QUALITY HIGH	8
4 – AESTHETIC HOMES: ARCHITECTS AND DESIGNERS REDISCOVER COPPER	10
5 – A SHORT PROFILE OF COPPER	12
6 - COPPER: VERY ENVIRONMENTALLY FRIENDLY	13
7 – ABOUT THE EUROPEAN COPPER INSTITUTE	15

**Further information:**

*European Copper Institute*  
**Christian de Barrin**  
Communications Manager  
Tel: + 32 2 777 70 82- GSM: 0476  
30 99 60  
[cdb@eurocopper.org](mailto:cdb@eurocopper.org)

**Press contact:**

*Ogilvy Public Relations*  
**Evelyn Gessler**  
GSM : 0475 23 53 92  
**Lorraine de Fierlant**  
Tel: +32 2 545 65 47  
[Lorraine.defierlant@ogilvy.com](mailto:Lorraine.defierlant@ogilvy.com)

## 1 – The “wired home”: copper optimises energy usage

---

### Copper and the “Fée Electricité”

In just a little over a century, electricity has revolutionised the way in which we live and profoundly changed the level of comfort and convenience we have come to expect in our homes, embodying the idea that “you have to live in your times”. Yet, there wouldn’t be an electricity fable without the presence of copper from the very outset: the battery from the Italian inventor Volta, the Daniell copper sulphate battery, the Faraday Dynamo...

Thanks to its remarkable electrical conductivity, ductility and hard-wearing nature, copper quickly became the material of choice for all electrical applications: not only wires and plugs but also generators, motors and, it goes without saying, electrical appliances. These days, all electrical appliances in the home rely on copper. Offering the best electrical conductivity of all non-precious metals, copper enables more current to flow through a given cable than any other metal, at an equivalent diameter. This is an advantage in the home since copper wires, potentially being smaller, need less space.

### Long-lasting electrical installations

In Europe, around one quarter of the energy generated is consumed at home<sup>1</sup>. And this energy consumption continues to grow by 1% per annum. Buildings account for 40% of the energy consumed in the European Union. Yet, too much energy is still being wasted by inefficient heating and lighting systems.

- **Energy efficiency**

To control this increased energy demand, the first port of call is to encourage rational energy usage (RUE, meaning using the least energy possible to provide the same level of comfort and convenience, focussing in particular on energy efficiency. So, thanks to its amazing conductivity, using copper means it is possible to significantly reduce energy losses. For example, a study published in April 2004<sup>2</sup> showed that in industry over 200 billion kWh could be saved per annum in Europe by increasing the efficiency of systems powered by electric motors<sup>3</sup>. The same applies to homes where the use of highly energy efficient equipment would make it possible to generate significant electricity savings.

In the home, copper’s excellent conductivity has a role to play in optimising the efficiency of electrical equipment, in particular washing machines, dryers and fridges. This is generally achieved by optimising copper usage within the electric motors. On 13 April 2005, the European Parliament passed a framework directive setting eco-design requirements for energy-using products<sup>4</sup>. This directive means that it is necessary to take a more environmentally friendly approach to the designs of electrical products such as hair-dryers, computers, fridges and office equipment.

---

<sup>1</sup> 664,645 GWh out of a total of 2,306,363 GWh - Source: European Energy Agency

<sup>2</sup> Study carried out by the European Copper Institute under the auspices of the European Commission *Motor Challenge* programme, in cooperation with the Catholic University of Leuven, the University of Coimbra and the Fraunhofer Institute for Systems and Innovation Research (Karlsruhe).

<sup>3</sup> This level of energy savings would result in cuts in CO2 emissions of 100 million tonnes per annum, representing over a quarter of Europe’s undertakings under the Kyoto Protocol.

#### ▪ Copper aiding innovation

The excellent thermal conductivity of copper pipes combined with their high corrosion resistance makes copper the material of choice for the development of innovative heating systems such as low temperature heating tiles, which help to optimise heating installations. Thanks to the large surface over which it gives off heat (the whole floor area), this system makes it possible to provide an even temperature throughout the home. This system not only provides comfort and convenience, it is also ecological. Combined with a water heating system, such as a condensing boiler or geothermal energy system, it enables optimal energy usage.

#### ▪ Green electricity

By 2007, the European Union internal electricity and gas markets will be fully liberalised, including for individuals who will thus be able to freely choose their supplier<sup>5</sup>. Some see it as an opportunity to create a genuine market for "green" electricity (generated using renewable energy) and cogeneration. By 2010, electricity generation using renewable energy should reach 22% in Europe. This is the goal set by the 2001 European Directive which encourages electricity generation using renewable energy<sup>6</sup>.

Copper is a key player in wind power. A 1MW wind turbine uses at least 4.4 metric tons of copper. Copper is in fact used throughout the whole wind power generation process, in particular in the batteries that store the electricity produced.<sup>7</sup>

The thermal conductivity of copper is also exploited in solar panels, which are used for electricity generation (photovoltaic panels) and for heating the internal water system. Copper can also be found in the piping systems of thermal pits of systems using geothermal energy.

### **Copper and electrical safety**

Well known to installers, copper electrical technology is easy to employ and is efficient. Where an electrical network uses copper, the home is unquestionably safer. There is no problem with connections corroding and in particular, less risk of over-heating due to its excellent conductivity.

Over the past fifty years, however, the number of electrical applications in the home has increased dramatically, in particular household appliances and multimedia gear. As a result there is a need to adapt electrical installations so as to avoid causing damage or even accidents. According to a study carried out by the *Forum for Electrical Domestic Safety* (FEEDS)<sup>8</sup>, 60% of European homes are over 30 years old and only 0.32% of these properties are brought in line with electrical standards every year. In other words, most electrical installations do not meet safety standards. There are a host of problems: no grounding, insufficient voltage, lack of differential, improper usage in damp environments, lack of child proofing, etc.

Since installations are not adapted to modern needs, occupants tend to increase their use of dangerous practices: numerous appliances working off a single socket, extension cords under

---

<sup>4</sup> Directive 2005/32/EC on eco-design of energy-using products.

<sup>5</sup> In Belgium, this is already happening in Flanders.

<sup>6</sup> Directive 2001/77/EC of 27 September, 2001 on the promotion of electricity produced from renewable energy in the internal electricity market

<sup>7</sup> Source: University of Leuven

<sup>8</sup> FEEDS, Enhancing electrical safety in European homes, Communication Paper, 22 October, 2004.

*March 2006*

carpets, unsafe DIY work... As a result, over 16,000 people are injured and 540 killed in Europe every year in electrical accidents<sup>9</sup>. In France, over a third of the 200,000 household fires recorded annually are caused by an electrical fault. Many of those involved in electrical safety are thus calling for the establishment of regular mandatory inspections to progressively bring installations up to standard<sup>10</sup>.

---

<sup>9</sup> Source: International Federation for the Safety of Electricity Users (FISUEL)

<sup>10</sup> See the Working Group on Electrical Safety in the Home – [www.gresel.org](http://www.gresel.org)

## 2 – “Smart” homes: copper making life easier

---

### **The telephone: a basic convenience**

Invented in 1876, the telephone slowly crept into European homes and the success has been astounding. Graham Bell, the inventor, made no mistake in using a coil wrapped in copper wire for his first prototype telephone. Thanks to its remarkable electrical conductivity, high mechanical resistance and exceptional ductility, copper quickly became the material of choice in communications. It is estimated that the existing copper network represents over 700 million lines worldwide.

### **ADSL, a copper technology**

This copper network was moreover able to keep up with the pace of technological change. The home is now connected to the world via the Internet: young and old use it to work, play and communicate with each other. And copper is playing a major role in this household revolution through ADSL. Invented at the end of the 1970s, this asymmetrical digital subscriber line makes it possible to make the most out of the copper network, transmitting not only voice but also high speed digital data<sup>11</sup> Through the telephone jack, and using a single existing copper telephone line, the user can telephone while being on the Internet.

The development of mobile telecommunications was also dependent on copper: a mobile phone contains on average 15 grams of copper and copper alloys. This represents some 14% of its weight, rising to 19% if you include the battery and the charger cables. A base station uses close to 250 kg of copper.

### **The electronic revolution in the home**

Copper has also played a critical role in the development of microelectronics, not only for the cables but also for the microchips, transistors, conductors and pins. The use of copper in the latest generation of microchips in particular has led to a significant increase in power. Copper is thus used in all the electrical appliances found in the home: cooker, washing machine, dishwasher, fridge, toaster, computer (which contains on average 1.5 kg of copper), microwave oven, radio, television, DVD player, lamp, not forgetting the thermostat, lightning rod... All these items that help ensure the comfort and safety of the home use copper.

### **The interactive home**

The home of the future will combine computing, telecommunications and electronics. New home concepts are already including additional automation not only of conveniences but also energy, communications, safety and comfort management.

---

<sup>11</sup> There are different types of Digital Subscriber Lines, with the acronym xDSL covering all such technologies including ADSL (“A” for asymmetrical), SDSL (“S” for symmetrical), HDSL (“H” for high bit rate), and RADSL (“R” Rate Adaptive).

*March 2006*

Household applications also play a role in security: deterrence and anti-intrusion devices, but also protection of persons (for example, a person with reduced mobility or a child falling into a swimming pool) or property in the event of, for example, a flood, a gas leak or the freezer turning off, an electricity outage... The same goes for energy efficiency: for heating, water heating, load shedding or automatic shutting down of needless lighting, centralised closing of shutters... Household automation would make it possible to generate electricity savings of between 25% and 35%<sup>12</sup>. "Smart" domestic appliances are increasingly being equipped with Internet access, with reliable wiring being required for high speed connections. In fact, these days "smart" homes are already wired even before the walls are put up, and copper is playing a key role.

---

<sup>12</sup> Source: EDF

## 3 – Healthy homes: Copper helps keep water quality high

---

### Originally used for water

Well before it was employed for electrical uses, copper had historically been the metal of water. Remains of copper water pipes have been found that date from 2750 BC. The Berlin Museum has a wonderful selection of such systems from the Temple of King Sa-Hu-Re at Abusir in Egypt. More generally, copper has been used for thousands of years to make containers, pipes and water holders. Pipes, heating systems, not to mention roofing, gutters, drainpipes, rainwater shoots are also traditional copper applications.

### Copper is safer

The Ancients were on the right track. Copper's malleability makes it an easy material to fit, work and mix with other metals to make ever more effective alloys. It adapts to all situations and is long-lasting. 100% impermeable, including against solvents and chemical agents, copper represents a shield against all external pollution. Thanks to its high mechanical resistance, copper piping can easily handle pressure, fire, shocks and is rodent resistant. This is why copper makes it possible to build systems that meet the latest quality and safety standards, including for gas. Copper's excellent corrosion resistance has led to its approval for use by the Swedish Government for radioactive waste containers with a service life requirement of 100,000 years.

### Natural and antibacterial

A host of scientific studies have recently improved our knowledge with regard to the positive effects of copper on human health. Firstly, we know that copper is naturally present in our environment: it is one of the elements required for the human body to function properly and is an essential mineral for staying in good health. It has in fact been proven that a lack of copper can have a negative impact on human health, in particular for pregnant women and new-born babies. According to the World Health Organisation, even a minor lack of copper is more harmful for human health than too much.

Countless studies have also shown that copper helps fight the growth of bacteria in water supply systems. A study published in 2003 by KIWA<sup>13</sup>, a Dutch water quality research institute, shows in particular that the use of copper piping helps fight the growth and proliferation of the bacteria responsible for Legionnaires' disease. Simulating household usage of various hot water supply systems over a year, the study analysed the proliferation of the *Legionella pneumophila* bacterium, which is responsible for 90% of cases of Legionnaires' disease. At the end of the experiment, the water flowing through the copper tubes had 10 times less bacteria than that found in other materials. Other recent studies undertaken by various microbiological research centres have also shown the positive role played by copper in the fight against *Listeria*, *E-coli* 0157 and staphylococci, all three of which are pathogenic.

## Less maintenance

Thanks to its bactericidal, algaecidal and fungicidal properties, copper helps to considerably reduce the presence of micro-organisms in toilets and washing facilities. Experts are very much aware of the problems caused by silt in heating systems. Generally speaking, the silt represents all the water borne particles that are deposited across the system. They can negatively impact system performance and can, in the most extreme cases, even lead to blockages. In many systems, silting problems require tedious and expensive maintenance. Copper piping offers a natural solution to this problem as a result of copper's intrinsic properties which prevent the proliferation of living organisms such as microscopic algae.

---

<sup>13</sup> Source: the findings of the study carried out by KIWA were published in the Netherlands in the May and June 2003 editions of the *Intech* magazine and in the May 30, 2003 edition of the *H2O* magazine.

## 4 – Aesthetic homes: architects and designers rediscover copper

---

Copper based metals have always played an important role in architectural aesthetics, both inside and outside buildings. Copper, bronze and brass have always been used by architects, sculptors and designers. Modern designers are just now rediscovering the technical and aesthetic properties of copper.

### Technical benefits

Reserved in the past for prestigious buildings, copper is now being increasingly used in office blocks, apartment blocks and private houses. In particular, the benefits of copper as a roofing material are appealing to more and more architects:

- **Longevity:** while people often talk of a 100-year lifespan, some buildings attest to the fact that copper roofs can last up to 400 years.
- **Corrosion resistance:** thanks to its natural finish, copper doesn't need any special maintenance. Insoluble and very adhesive, the green finish protects the copper from the environment.
- **Lightness:** a copper roof weights on average less than half a lead roof and a mere quarter of a tiled roof.
- **Thermal resistance:** copper expands by much less than lead or zinc, which means it lasts longer. On the other hand, copper can be easily worked without tearing, even at low temperatures.
- **Malleability:** As a result of its ability to stretch, copper is particularly suited for shaping and working. Complex cuts, audacious curves, copper is fully adaptable, giving the designer great freedom.

Even more ground breaking, these properties are also show-cased for facades: easy to work, either for raised or truncated surfaces, in the form of a scale, in cascade or in panels, copper enables great creativity. The "Arts et Metier" Paris metro station provides a colourful example of copper.

These same technical properties also appeal to designers either in pure copper or a copper alloy. Long seen on doors, door handles and stair banisters, brass inherit copper's prophylactic properties.

Designers are, however, now also having recourse to copper for more artistic applications. An annual exhibition in Milan thus presents the work of talented young designers who through the use of breathtaking shapes take a fresh look at copper for radiators, lighting and kitchen and bathroom utensils.

## Copper's palette

Copper is the only common metal that has a natural colour. In fact the palette it offers is playing an important role in the rediscovery of copper by contemporary architects and designers. This is because it has a whole palette of colours:

- ✓ A shining **orange-red**, evoking light and opulence in its initial flamboyant phase.
- ✓ A **brown** that is more or less darkened by the progressive oxidisation of the metal as a result of the formation of cuprous oxide.
- ✓ And progressively an **almond green finish**, the insoluble, waterproofs and highly adhesive properties of which naturally protect the copper.

So as to meet market needs, manufacturers are offering pre-finished shades right from the production line:

- ✓ The **almond green** of the finish,
- ✓ The golden yellow of the copper / aluminium alloy
- ✓ The strong yellow of brass, a copper / zinc alloy, mainly used for interior decoration
- ✓ A **metallic grey**, thanks to a deposit of tin on the surface of the copper.

They also offer pre-oxidised versions right from the production line:

- ✓ The **matt brown** of the pre-oxidisation intermediate brown of natural copper,
- ✓ The **warm brown** of bronze thanks to a copper / tin alloy.

## 5 – A short profile of Copper

---

Copper is a natural metal found in the earth's crust and essential for the development of life. It is humanity's oldest metal: the first copper coins found date from 8,700 BC.

Global natural copper reserves are currently estimated at 2.3 billion metric tons. Mining only accounts for 60% of the copper supply, the rest being sourced from recycling.

The main uses of copper are:

- ✓ Electricity and electronics: 65% (includes copper wiring in buildings)
- ✓ Construction: 25% (architecture and piping)
- ✓ Transportation: 7%
- ✓ Other: 3% (coins, sculptures, etc.)

Annual global copper usage has increased twofold since the 1970s, amounting to 20 million metric tons in 2004, 70% of which was from mining (14 million metric tons) and 30% from recycling (6 million metric tons). In 2004, global demand grew by 5.4%.

Over the past decade, copper usage in Europe has risen by 14%. Extremely well organised, the European copper recycling industry is very efficient and meets 41% of Europe's annual copper needs (i.e. over 2 million metric tons).

China, on the other hand, is the leading consumer of copper, using some 23% of the global total compared to only 9% in 1995.

### Copper technical datasheet

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 many forms - eg wire, tube, sheets or strips

Durability: over 700 years

100% recyclable with no loss of properties

## 6 - Copper: very environmentally friendly

---

### For more environmentally friendly construction

The future is eco-construction. At a European level, in particular, several programmes encourage the application of sustainable development criteria in architecture. This is the case, for example, of the European Directive on the "Energy Performance of Buildings" (2002/91/EC) which will come into force in member states on 4 January, 2006. It 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.

Some European countries have also introduced labelling schemes: in the UK, for example, the Building Research Establishment created a label for new buildings (largely offices) in order to evaluate their environmental performance. The programme now covers over 25% of the office blocks in the UK. In the early 90s, a High Environmental Quality programme [HQE] initiative also began in France. Founded in 1996, the HQE association now has 43 local chapters.

### The "green metal"

Industry professionals are increasingly taking over and innovating. The proof:

- The use of copper in the highly environmentally friendly "La Glacière" complex in Brussels, currently being designed by the Art Urbain firm, which intends to cover the facades in copper and use it for the water supply systems.
- In Cornwall, copper was chosen for the roof of the Eden project education centre. The largest greenhouse in the world with over 4,000 plants from 3 different climate zones, the Eden project is designed to raise awareness of, and provide training in, sustainable development.
- In Madrid, copper was also widely used in the renovation of the new "Palacio de los Deportes". Burnt to the ground in a 2001 fire and reopened three years later, this magnificent sporting and cultural complex is one of the most striking examples of eco-construction in Spain.

### The global environmental contribution of copper in construction

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

- Durable, corrosion resistant and easy to employ, 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. In fact, the recycling process changes none of copper's properties: the recycled copper can be melted down with the new copper and can be reused in exactly the same way. It is

March 2006

estimated that recycled copper accounts for over 40% of copper demand in Europe.<sup>14</sup> And by including recycled copper in the overall volume of copper used, raw materials are being saved! The recycling process generates energy savings of up to 85%<sup>15</sup> compared to the extraction of new copper. Yet recycling is in the process of becoming a major issue: it is estimated that in fact 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>16</sup>.

- A factor in the improvement of the energy efficiency of electrical installations thanks to its exceptional electrical conductivity (the best of all non-precious metals), copper naturally plays a role in making buildings more energy efficient. It is known, for example, that increasing the amount of copper in electrical appliances such as motors and transformers minimises heat loss and thereby obviously increases efficiency.

---

<sup>14</sup> Source: International Copper Study Group – [www.icsg.org](http://www.icsg.org)

<sup>15</sup> Source: BIR (Bureau of International Recycling)

<sup>16</sup> Source: CSTC RecyHouse Programme [www.recyhouse.be](http://www.recyhouse.be)

## 7 – European Copper Institute

---

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:

- Electric & 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 electric energy:** ECI is the founder of a community action programme for professional training (LEONARDO Power Quality Initiative) to improve the quality and reliability of electric energy by reducing electrical interference. Present in 12 countries, this programme, involving more than 50 organisations, including renowned universities, companies and professional bodies, has the target 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 axes:

- **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 on copper's outstanding electrical conductivity as a key factor 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, on 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:***

*Christian de Barrin,*

*Communications Manager*

*Tel: + 32 2 777 70 82*

*Email: [cdb@eurocopper.org](mailto:cdb@eurocopper.org) – Website: [www.eurocopper.org](http://www.eurocopper.org)*