Copper Benelux
A member of the European Copper Institute

european COPPER institute

PRESS KIT

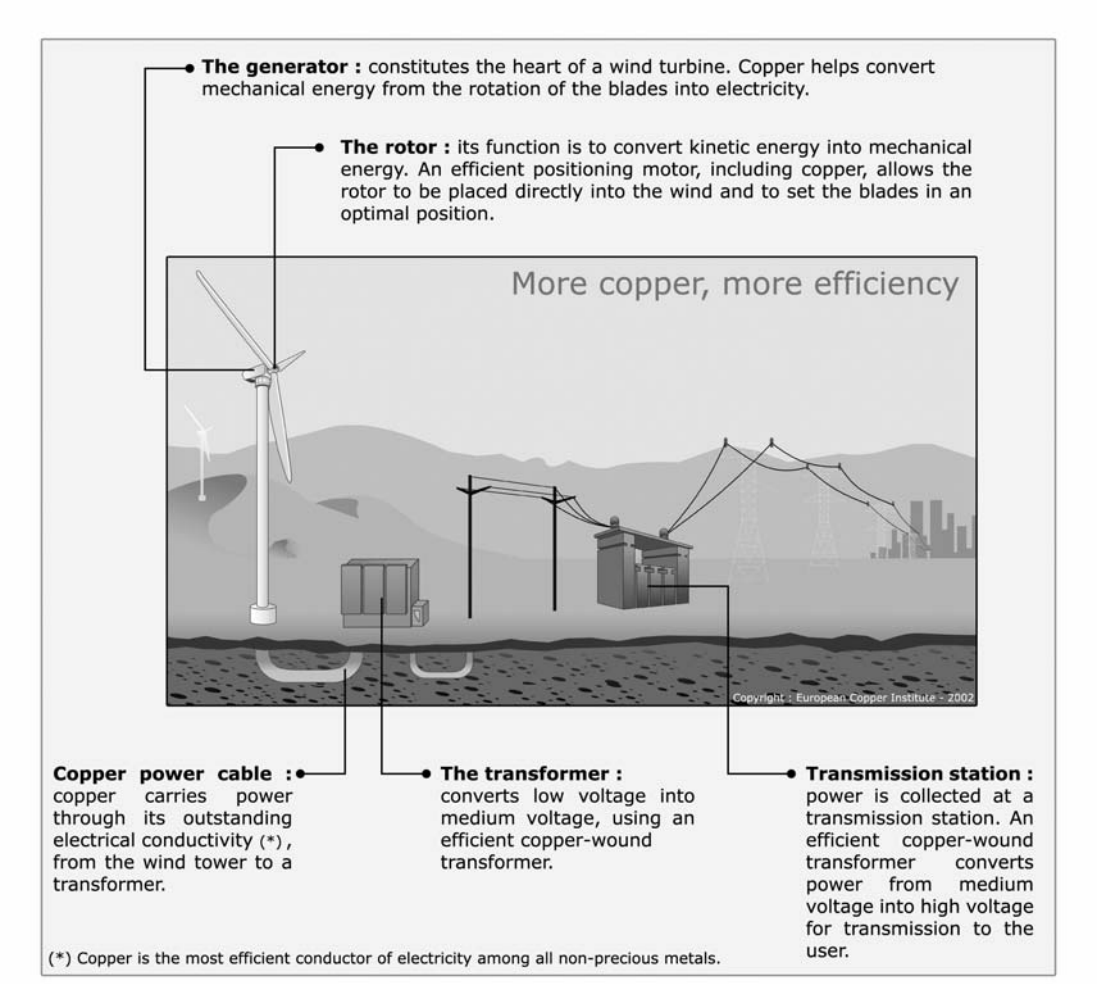
“Copper is blowing in the Wind”

The Energy Efficiency Media Tour
28 November 2002 -The Netherlands

CONTENTS

How Wind Turbines Work…
And How Copper Helps Them Work Better!

Copper's superior electrical conductivity improves the efficiency of wind energy. Wind turbines are composed of five major elements: the rotor, the multiplier, the mechanical transmission, the generator and the transformer.



Source : European Copper Institute, 2002

The rotor

The power supplied by the wind turbine depends on the speed of the rotor.
Its function is to convert kinetic energy into mechanical energy. The most popular turbines have three blades but the amount of energy the system yields actually depends very little on the number of blades. Lightning conductors are placed on the blades, as well as a braking mechanism for use in extremely high winds. A positioning motor allows the rotor to be placed directly into the wind and to set the blades in an optimal position.

The multiplier

The name says it all: the multiplier increases the power coming from the rotation of the rotor by a complex system of gears.

The mechanical transmission

It is composed of a primary or lower speed cam, which transmits the energy from the rotation of the rotor to the multiplier. The secondary or high-speed cam transmits the

multiplied energy to the generator. At this stage of the system, kinetic energy has been converted into mechanical energy and transmitted to the generator.

The generator

The generator constitutes the heart of the wind turbine. Its function is to convert mechanical energy from the rotation of the blades into electricity. To understand the principle of conversion into electric currents, we need to remember our physics lessons and the electric current running through a bobbin of copper. The magnetic field created by the bobbin drives a motor. Here the principle is reversed. The rotor (the motor in our physics lesson) is coupled with the rotating secondary cam. Its movement creates the magnetic field and electrical current is generated.

The transformer

It steps up the voltage so that power can be transmitted over large distances to the point of use.

How copper makes wind turbines more efficient

Copper found in the armature windings and commutators, as well as in the field poles and interpoles of the generator, helps to convert the mechanical energy of the spinning rotor blades into electricity. A copper cable carries power from the wind tower to a transformer, where low voltage is converted into medium voltage. Next, for wind farms, power is collected at a transmission station, where medium voltage is transformed into high voltage and then transmitted.

As electricity flowing through copper wires meets far less resistance than any other metal, except silver, **using more copper in high efficiency transformers, optimal power cables and high-end premium efficient motors can reduce energy losses by up to 70%** (including the optimal use of other metals such as magnetic steel). In the whole process, the optimal use of copper ensures the highest level of energy efficiency.

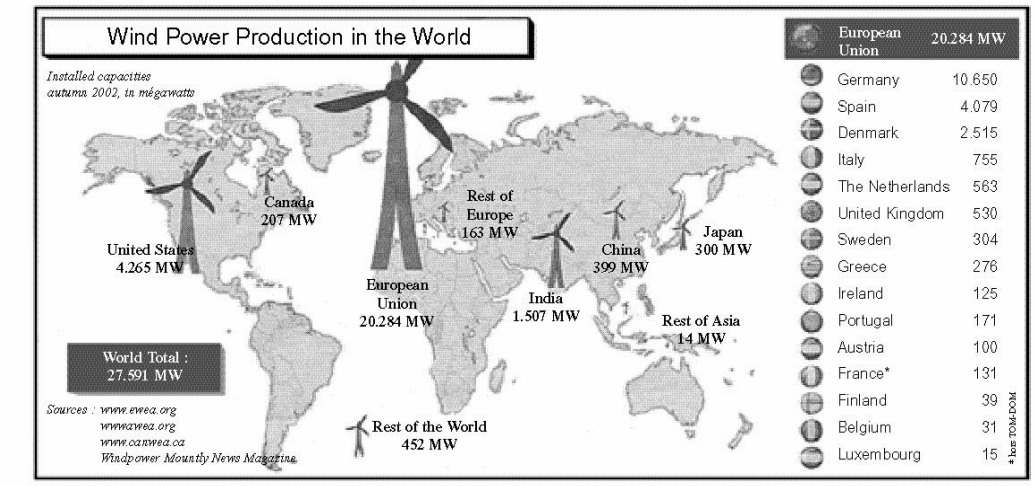
When the generators are finally retired, usually not before decades of service, all the copper can be recycled.

On average, a wind turbine of 1 MW contains 4.4 tons of copper *(source: Leuven University).*

Europe Leads the Way in Wind Power

With **more than 27,000 megawatts* of capacity world-wide** at the end of October 2002, wind power certainly has the wind in its sails these days. And, with the cost of wind energy production reduced by 80% in the past two decades, the industry is in full flight with an average 30% annual growth over the last five years. The European Union continues to be the driving force in the world wind power market with 20,284 * megawatts installed, producing 47 billion kWh/year. This is equivalent to 74% of world capacity - almost four times that of the United States of America.

Wind Power Production in the World



Source: European Copper Institute, 2002.

Germany alone represents more than 50% of installed power capacity in the European Union and has announced a plan to boost wind power's share of electricity consumption to "at least 25% by 2025". Spain, in second place, has tripled its capacity in the last two years. In third place, Denmark now supplies more than 10% of the country's electricity consumption from Wind power. **The Netherlands is in 5th place, with 563 MW installed** at the end of October 2002.*

Hundreds more megawatts are scheduled to be built in France next year and Austria celebrated its 100 MW landmark on the back of one of the tallest wind farms in the world situated at 1,900 metres in the Styrian Alps.

About 80% of all wind turbines sold world-wide are manufactured by European companies.*

The Future of Wind Power is All at Sea

Experts are convinced that the future of wind power will be played out at sea. The first offshore wind plants are all European and Denmark is at the leading edge. The first real wind powered electricity generating plant in the marine environment is under construction off the Danish coast. It will be capable of powering 150,000 Danish households. It has 80 turbines, each with a unit power of two megawatts, making a total of 160 megawatts of installed power.

The advantages of offshore wind power have been known for a long time. Firstly, the winds are stronger than on land. Typical wind speeds are 1 m/s higher at 10 km from the shore and exceed 8 m/s over large areas of the North Sea and the Baltic. Secondly, they are more constant than on land. Energy yield is higher and the turbines, less exposed to gusts, have longer life times. Thirdly, the spaces are immense and much less in demand than on shore, where the best sites are already in use in most countries. As for environmental assessments, they do not reveal any actual adverse impact on marine fauna or birds "as long as the sites are carefully selected" admits the DEWI report from Greenpeace ecologists.

National projects under development

Several European countries have announced targets for offshore wind energy plants. By 2030, offshore installed power should approach 20,000 megawatts, with contributions from Germany (5,000), Denmark (4,000), Sweden (2,300), the Netherlands (1,500), the United Kingdom (1,500), etc.**

In the Netherlands, two important offshore developments are currently underway. The construction of a 100 MW offshore project in the North Sea, 8 to 12 km off Egmond should start by 2003. A 60-turbine (120 MW) farm should also start in 2003, 23 kilometres off the coast of Egmond and Petten.

Earlier this year, Ireland approved a plan to build the world's largest offshore wind farm which will generate 520 megawatts of electricity and, with 200 turbines, should supply about 10% of Ireland's energy needs.***

Sources:

* *European Wind Energy Association – November 2002*
EuroObserver 2002 - Wind Power Monthly 2002

** *Renewable Energy Journal 2002*

*** *Irish Ministry of Marine and Natural Resources*

Wind Power, a Key Resource for Renewable Energy

Wind is a significant and valuable renewable energy resource with a major role to play in a sustainable future

A global commitment

The United Nations framework convention on climate change, signed in Kyoto on December 11th 1997, calls for the enhancement of energy efficiency in relevant sectors of the national economy. It also requires research into and the promotion, development and increased use of new and renewable forms of energy, of carbon dioxide reduction technologies and of other advanced and innovative, environmentally sound technologies.

A European priority

EC Directive 2001/77, dated 27th September 2001, on *the promotion of electricity produced from renewable energy sources in the internal electricity market,* states that the national indicative targets should be consistent with the global indicative targets of 12% of gross national energy consumption by 2010. In particular they should match the 22.1% indicative share of electricity produced from renewable energy sources in total community electricity consumption being achieved by 2010.

One answer is blowing in the wind

Wind is safe and abundant and can make an important contribution to future clean, sustainable and diversified electricity supplies. Unlike other forms of energy, wind does not pollute the atmosphere and does not create any hazardous waste. Whereas the costs of the customary types of energy will rise over time, with reducing fossil fuel supplies, the costs of wind energy are actually coming down, as technology advances.

Rapid development

The installed capacity in Europe has increased by about 40% per year over the past six years. Today, wind energy farms across Europe have an installed capacity of 20,477* megawatts, which provide 47 billion kWh - enough electricity to meet the domestic needs of 11.8 million European households. Had that amount of electricity been produced in coal-fired power plants, it would have required the burning of 18 million tonnes of coal. The electricity production from the 20,477 megawatts installed capacity in Europe will prevent the emission of 19 million tonnes of CO_2 annually.

Ambitious goals

In its strategy document entitled Wind Force 12, launched at the Earth Summit in September and at the UN climate negotiations in India in October, the European Wind Energy Association outlines that by 2010, the world is capable of installing 230,000 megawatts. This would meet the needs of nearly 300 million people.

** Source: European Wind Energy Association, November 2002*
Europe: European Union (20,284); Norway (97); Poland (29); Turkey (19); Czech Republic (12); Switzerland (5) and Romania (1).

Copper's Contribution to Energy Efficiency

Through the use of more efficient electrical equipment, **copper can help to reduce CO_2 emissions by over 20 million tons per year across Europe**, i.e. 7.5% of the EU's Kyoto target.

It is recognised that the adequate generation and supply of electrical energy and its efficient use are essential enablers of sustainable development in all its aspects, economic, social and environmental.

Energy efficiency is a tool to reduce operating costs at the user level and to lower greenhouse gas emissions from fossil fuel generation. The energy efficiency of electrical equipment is strongly enhanced by increasing the volume of copper, the most efficient conductor of electricity of all non-precious metals. The results are lower losses and therefore increased energy savings.

More copper, more efficiency

As electricity flowing through copper wires meets far less resistance than any other metal except silver, using more copper in high-end premium efficiency motors, high efficiency transformers and optimal power cables can reduce energy losses by up to 70% (including the optimal use of other metals such as magnetic steel). As a consequence, this generates energy savings and the reduction of CO_2 emissions.

Copper's contribution to a wide range of alternative energy sources

	Technology	Potential for a sustainable energy future	Copper's importance	Where is the copper?
Renewable energy sources	Wind	**	***	Generator, motor, cable, transformer (4,4T/MW)
	Solar thermal	**	**	Heat exchanger, piping
	Solar photo-voltaic	**	*	Converter, transformer, cable
	Biomass & biofuels	**	*	Generator, cabling
	Hydroelectric	**	**	Generator, transformer, cable
	Wave power	unknown	**	Generator, cabling for power collection & transmission
Efficient use of fuel sources	Co-generation	n/a	**	Generator, heat exchanger
		n/a	**	Heat exchanger, motor
		n/a	*	Heat exchanger, motor

Source : European Copper Institute, 2002.

Substantial emission reductions are possible

Improved electrical energy efficiency in wind power is feasible by increasing the size of winding wires in the generator, in power cables and in the transformer.

A study for the European Commission, published in December 1999, predicts that the potential savings through the use of energy-efficient transformers in the utility network have been estimated at 22 TWh per year* for Europe, equivalent to saving 9 million tons of CO_2. The energy saving potential from high-end premium efficiency electric motors is 27 TWh per year**.

Copper's total contribution to energy efficiency, when including other energy saving options such as optimum cable & busbar sizing, amounts to well over 50 TWh of electricity per year, thereby reducing CO_2 emissions by 20 million tons***, i.e. 7.5% of the EU's Kyoto target.

Sources:

* *THERMIE report STR/1678/98/UK, Published Dec. 1999 (available from www.efficient-transformers.org)*

** *European Commission - 1996*

*** *50 TWh / year * 0.4 kg CO_2/kg = 20 million tonnes CO_2; 0.4 kg/CO_2 average EU CO_2 emission, source IIEC – www.cerf.org/iiec*

Copper, the Green Metal

Copper is an element naturally present in the earth's crust. It is found in soil, in water and all life forms. It is a metal that has been one of mankind's most useful and valuable materials since time immemorial.

As an essential micro-nutrient, copper is required for the optimal growth and development by virtually all life forms. Without it, life as we know it would be impossible for most of earth's organisms.

100% recyclable

Copper, referred to as the green metal, is 100% recyclable, without any loss of performance. Copper is used, recycled and reused, generating little or even no waste. In 2001, 40% of Europe's annual demand for copper was supplied by recycling. It is estimated that 80% of all copper ever mined is still in use today.

Copper recycling saves energy

Copper recycling offers important opportunities to conserve natural resources, minimise waste, and reduce energy use. Copper is not "consumed" in the sense of being "used up". Pure copper scrap is easily melted in furnaces or smelters. Alloys, such as brass and bronze, along with mixed scrap are processed in converters, where certain impurities and intermediate products are removed. Cable scrap, electronic etching solutions, electroplating sludge and catalyst residues can all be converted into new copper.

Copper recycling is less energy intensive than mining copper ore. While recycling requires collection and sorting, the amount of energy required to recycle copper is about 25% of that needed to convert copper ore to metal.

Extremely durable

Copper is extremely durable. In ancient times, it was used in products designed to last more than a lifetime. For example, copper tubing in the water plumbing system in Egypt's ancient Cheops Pyramid is intact and serviceable after 5,000 years. One of the famous Dead Sea Scrolls, found in Israel, was made with copper instead of fragile animal skins, providing today's archaeologists with a key source of information about the past. Copper cookware and artefacts in museums, dating back some 50 centuries, have also stood the test of time.

Today, products containing copper are made to last from several years to up to hundreds of years, depending upon the application. The durability of copper remains an important sustainable benefit, providing users with lower operating costs and negligible environmental impact during use.

Siemens Wind Turbine in Zoetermeer and the new Wind Farm of Rotterdam's Harbour

Siemens Wind turbine in Zoetermeer

As supplier of sustainable energy solutions and projects, Siemens built a special turbine at its Business Centre in Zoetermeer. It is situated near the A12 highway (Utrecht-The Hague) and has been in operation since November 2000. There is an observation platform, which is accessible via a spiral staircase of 377 steps.

With a hub height of 85 metres and a rotor diameter of 70.5 metres, its full height is 120 metres. The installed power of 1.5 megawatt generates over 3.5 million kWh of electrical energy from wind, meeting the needs of 1,250 households.

Siemens Builds De Slufter Wind Farm for ENECO Energie

Siemens Nederland, The Hague, recently built a wind farm for ENECO Energie, Rotterdam in which 8 turbines supply around 11,000 households with power. The farm is situated in the De Slufter region on the plain of the River Maas to the west of Rotterdam. This turnkey order was worth about 14 million euro.

The wind turbines, with an output of 1.5 MW each and 12 MW in total, are making a major contribution to the production of "green power" in the Netherlands and are fully in line with power company ENECO's policy of promoting the use of sustainable sources of energy. ENECO Energie sells the electricity generated by the wind turbines under the name of Ecostroom.

Siemens Nederland was responsible for implementing all aspects of the project, including supplying the wind turbines, transformers, electrical engineering infrastructure and looking after the civil engineering aspects.

ENECO Energie runs the wind farm. The old turbines at De Slufter had a total output of 6.5 MW, and had come to the end of their technical and economic life. Siemens dismantled them to make way for the new farm, which has almost twice the output.

Siemens in the Netherlands

Customers come to the Siemens Group in the Netherlands for products, systems and services in almost all fields of electrical engineering and electronics, in the public and private sector as well as among ordinary consumers. In fiscal 2002 (October 1, 2001 to September 30, 2002) the sales of all consolidated Siemens companies in the Netherlands amounted to approximately 1,569 million euro. New orders totaled 1,862 million euro.

With a workforce of over four thousand, the Siemens Group is one of the leading companies in electrical engineering. Siemens in the Netherlands also has a number of Centers of Competence, offering customers international expertise, products and solutions in many different fields, from harbor transshipment systems and industrial combined heat & power plants to simulation techniques and wind farms.

Worldwide the Siemens Company, which is composed of 426,000 people, operating in more than 190 countries, generated a turnover of 84,016 million euros for 2002.

The Siemens Group in the Netherlands is now made up of a number of companies. The majority of its activities take place under the auspices of Siemens Nederland N.V. in The Hague. As a key player in the market, it offers solutions in the following business segments: Energy, Industry, Building, Information & Communications, Transportation, Health Care, Household and Services.

Energy Sector

Deregulation and privatization are buzzwords in the energy world. Siemens occupies a prominent place in this segment, with its solutions for environmentally-friendly power generation and optimized power transmission & distribution. For instance, Siemens Netherlands as a Center of Competence constructs combined heat and power plants in the United Kingdom and Turkey as well as in Bangladesh, and wind farms inside and outside the Netherlands – including the highest windmill in the country. It has also constructed the largest European solar roof at the Floriade horticultural fair in the Netherlands.

For more information:
SIEMENS Nederland, ***Bernard H. Bos*** *at +31 (0)70 333 2325*
URL : http://www.siemens.nl or http://www.siemens.com - E-mail: bernard.bos@siemens.nl

The International Union of Electricity Applications (UIE)

The International Union for Electricity Applications (UIE) is a non-profit making organization founded in 1953 whose mission is to favour, at the international level, the development and institutional promotion of the use of electricity, alone or through multi-energy.

UIE ambition is to be a network for exchanging ideas and information, to present a collection of expertise with a vocation to have all actors of economy (industrials, communities, etc.) benefit from the performance of electric solutions. These performances contribute not only to the optimisation of operating conditions by improving productivity, quality of products and services, automating, process reliability, but also to the improvement of the quality of the environment.

For its action, UIE:

- gathers within international networks scientific, technical and industrial experts dealing with electricity applications, such as teachers, researchers, consultants, manufacturers, electricity suppliers;
- establishes links with the survey and information organisations such as technical centres, laboratories, information centres, energy services companies;
- establishes links with national and international organisations having collateral activities, such as professional organisations, electricians associations and societies, normalisation organisations;
- cooperates with intergovernmental organisations, such as the European Union and international energy agencies.

UIE is organised around a permanent secretariat, which coordinates the activities of a set of qualified bodies open to experts of research, education, applications and information.

The main orientations of UIE deal with the use of electrical energy in the following sectors:

- buildings (residential, commercial, industrial);
- manufacturing industry;
- transportation (goods and people);
- as well as sciences and techniques that contribute to these activities (economic surveys, environment, etc.).

Based on knowledge and know-how, UIE offers its members platforms of actions organised as interactive networks with the following aims:

- improving the acquisition of required knowledge and skills through the promotion of research, technological watch, regulation follow-up;
- exploiting relevant knowledge and skills by the support given to the study, the development, the implementation of innovating and efficient electricity applications;
- facilitating the access to useful knowledge and skills by sharing synthetic, rigorous information through education and training, communication on the evolution of techniques and their ability to bring an answer to modern society challenges.

For more information:

UIE General Secretary, ***Michel Machiels*** *at +33 1 41 26 56 48*
URL : http://www.uie.org - E-mail: uie@uie.org

Professor Ronnie Belmans

Ronnie J.M. BELMANS obtained his Master of Science in Engineering (Electromechanical engineering, section electrical engineering, option power engineering) from the K.U. Leuven in 1979 . He obtained his PhD in 1984 and a special PhD in 1989. In 1993 he obtained the Habilitierung of the RWTH in Aachen, Germany.

From 1979 until 1985, he was assistant researcher at the K.U.Leuven. He is currently a full professor teaching electrical energy, variable speed drives and power quality. His field of research ranges from power quality and variable speed drives to the technical aspects of the electricity market deregulation. As Von Humboldt Fellow he worked at the Laboratory for Electrical Machines of the RWTH, Aachen (October 1988-September 1989). From October 1989 until September 1990, he was a guest lecturer at the Mc Master University, Hamilton, Ont., Canada. During the academic year 1995-1996, he occupied the chair offered by the Anglo-Belgian Council at the London University. Since 1997 he has been an invited lecturer at the RWTH in Aachen and since 1999 at Imperial College in London.

Prof. Belmans is a Fellow of the IEE (United Kingdom), senior member of the IEEE and member of the Royal Flemish Association of Engineers (KVIV). Since June 2002, professor Belmans has been president of the Board of Directors of Elia, the Belgian transmission system operator.

The European Copper Institute (ECI)

The European Copper Institute is a joint venture between the world's mining companies (represented by the International Copper Association, Ltd) and the leading European fabricators. Its mission is to promote copper's benefits to modern society across Europe, through its Brussels office and a network of 11 Copper Development Associations.

ECI is active in 4 key areas in Europe:

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

The ECI Electric & Electronics Programme

1) Energy efficiency, with the target of saving 50 TWh/yr, equivalent to 20 million tonnes of CO_2 each year.
2) Power quality: an ECI & Leonardo adult education programme involving leading academia, industry and vocational institutes, aimed at reducing electrical disturbances, with the target of saving 10 billion euro/year for European business.
3) Safety & functionality: a steady programme of housing renovation to improve domestic electrical safety standards in Europe.

The ECI Building Construction & Automotive Programme

Renewable energies: a programme to communicate copper's superior electrical conductivity as a key player in harnessing solar and wind energy.

Automotive sector: a programme to communicate copper's role in improving the safety and convenience of modern cars and in making possible the future electric car.

Piping systems: a promotion and research programme to communicate copper's durability and natural antibacterial properties in providing safety and hygiene in drinking water, heating and gas distribution systems.

The ECI Environmental Programme

ECI's environmental programme is primarily directed at understanding any potential impacts in soil and water. Results are used to contribute to regulatory debates both at the EU and at national level. All research is carried out with the support of prominent scientists.

The ECI Health Programme

ECI's health programme is primarily directed at understanding any potential effects on humans. Results are used to improve human health by contributing to regulatory initiatives both at EU and at world level.

For more information:

Christian de Barrin, Communications Manager, Tel: + 32 2 777 70 82
E-mail: cdb@eurocopper.org – URL: www.eurocopper.org