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PRESS KIT

Recycling of copper waste and WEEE

A RESPONSE TO GROWING DEMAND FOR RAW MATERIALS

Contents

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INTRODUCTION

Recovering waste to meet the need for primary resources

Most of the analysts agree that the world of the 21st century is going to affect the limits of the economy of abundance, to which the western countries have been accustomed during the industrial era, and must change to what economist Philippe Chalmin calls the "new paradigm of rarity". While the world population is going to grow by 50% between now and 2100, bringing with it a rise in consumption, the availability of the so-called "primary" resources will fall.

This switchover to a world of rarity obliges member states and manufacturers to consider waste no longer as detritus but as recoverable products, and thus as potential resources. Recycling is a key element of this new policy aiming to close the materials loop.

Growing waste production, linked to modern society

Improvements in waste recycling are becoming increasingly urgent: in 2020, Europeans will throw away 45% more waste compared to 1995, according to the European Environment Agency. A large part of this increase is due to end-of-life electrical and electronic equipment (computers, mobile phones etc), the products that define our society as modern and contain up to 20% copper by weight.

The rate at which this waste is growing, following techological advancements in society, is a challenge for the 21st century: a report from the United Nations Environment Programme (UNEP) estimates that annual production of Waste Electrical and Electrical Equipment (WEEE) has reached 20 to 50 million tonnes and is increasing by 3 to 5%/year.

Waste Electrical and Electronic Equipment (WEEE) management, a priority for western countries

For the last few years, WEEE management has crystallised all the problems linked to recycling and has become a priority for OECD-country politicians.

The European 2002/96/CE Directive of 27 January 2003 defines WEEE as "equipment that functions by the use of an electric current or electromagnetic field". This Directive sets an objective of collecting 4kg/inhabitant/year, as of 31 December 2006. This quota will be reviewed every other year.

Belgium comes out well in the European Union: it improved on the objective, as of 2003, with 4.5kg/inhabitant collected in that year. In 2006, the year the Directive came into force, the country collected more than 7.7 kg of WEEE/inhabitant.

I. COPPER'S LIFE CYCLE

A. Where does copper come from?

The origins of copper

Copper is a metal that is naturally present in the earth's crust and it is essential to the development of all forms of life. It is the oldest metal used by man: the first copper coins date from 8700 BC.

The natural reserves of copper are currently estimated to be 3 billion tonnes.

Copper: technical data

On the galvanic metal scale, copper is situated among the most noble or precious of metals, just behind platinum, gold and silver.

- **Symbol:** Cu
- **Density:** 8930 kg/m^3
- **Durability:** unlimited
- **Melting point:** 1083°c
- **100% recyclable** without loss of properties
- **Available in bars, extrusions, sheets, strips or tubes**

The various sources of copper supply

Copper is produced from two sources:

1. Extraction and processing (refining) of the raw material, called '**primary production**'
2. Recycling:
   - Recycling of end-of-life products, called '**secondary production**'
   - Direct melt of 'new scrap' (waste resulting from the manufacturing process).

B. Recycling: a major resource

Copper, the recycling champion

- The use of copper, which is extremely durable, helps to limit waste volumes from the outset.
- It is estimated that 80% of the copper used since antiquity is still in circulation.
- The recycling process results in energy savings of up to 85% compared to primary production.
- 100% recyclable, time and time again, without loss of properties, recycled copper is indistinguishable from primary copper.

A material with exceptional properties

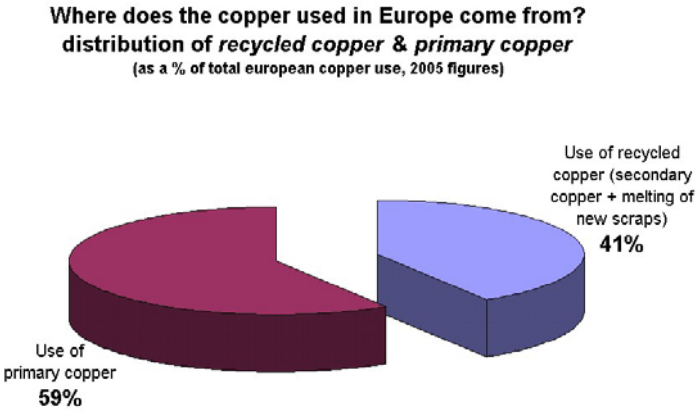
Copper is never thrown away. It is used, recycled and reused easily without any loss of quality or performance. In fact there is no difference between the recycled metal and the metal created from mining. This quality of copper has been known since the dawn of time, and has given rise to a high-technology industrial infrastructure.

The **world's total use of copper stands at 22,094 million tonnes** (2005 ICSG figure)[1], which breaks down as follows:

- 66% of refined primary copper
- **9.5% of refined secondary copper** (recycling of **end-of-life products)**
- **24.5% of scrap melted directly (recycling of 'new' process scrap)**

Worldwide, recycled copper accounts for 34% (9.5 + 24.5) of copper used.

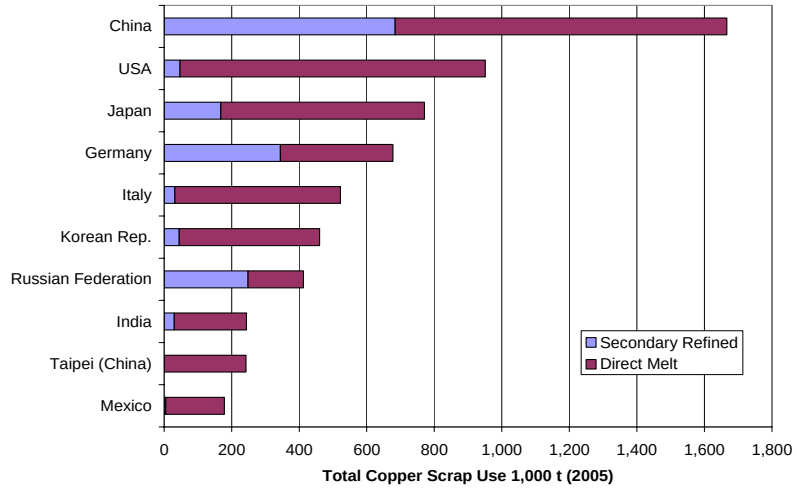
Europe and Asia: the leading users of recycled copper



At a regional level, 41% of the copper usage in Europe is met via recycling, 34% in Asia, 29% in North America and 22% in the rest of the world.

The leading users of copper bearing scraps include China (1.7 million tonnes), the United States, Japan, Germany and Italy. This 'Top 5' accounted for up to 60% of global use of copper scrap in 2005.

Total use of recycled copper, by country, in millions of tonnes (2005 figures)



Will there be enough copper for future generations?

Natural copper mining reserves are estimated at 3 billion tonnes, to which we must add roughly 700 million tonnes of mineral contained in the polymetallic nodules at the bottom of the oceans[2].

In general, economic, technological and societal factors influence the supply of and demand for copper. As society's need for copper increases, the balance between supply and demand depends on a variety of factors, such as exploration efforts, technological developments, product innovations and the selection and substitution of materials.

In any case, recycling will be a major resource in the coming decades.

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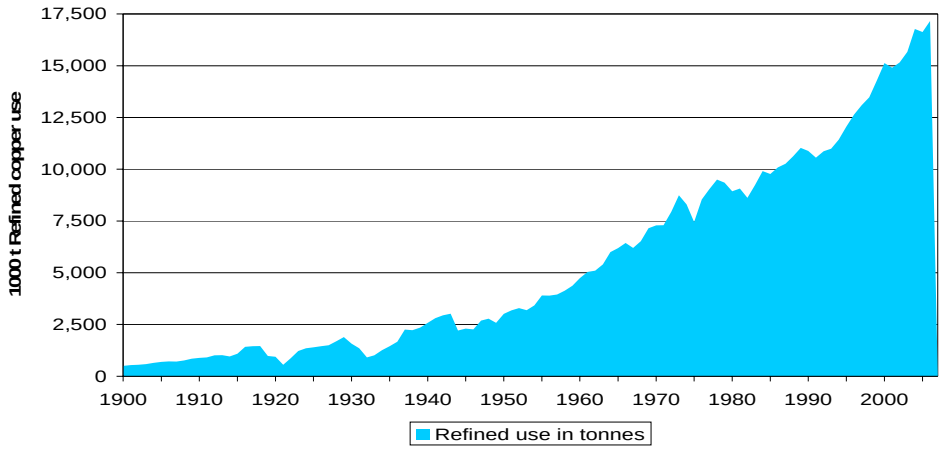
[1] The International Copper Study Group (ICSG) is an inter-governmental organisation, based in Lisbon that publishes copper production and demand statistics.
[2] Source: *International Copper Study Group*.

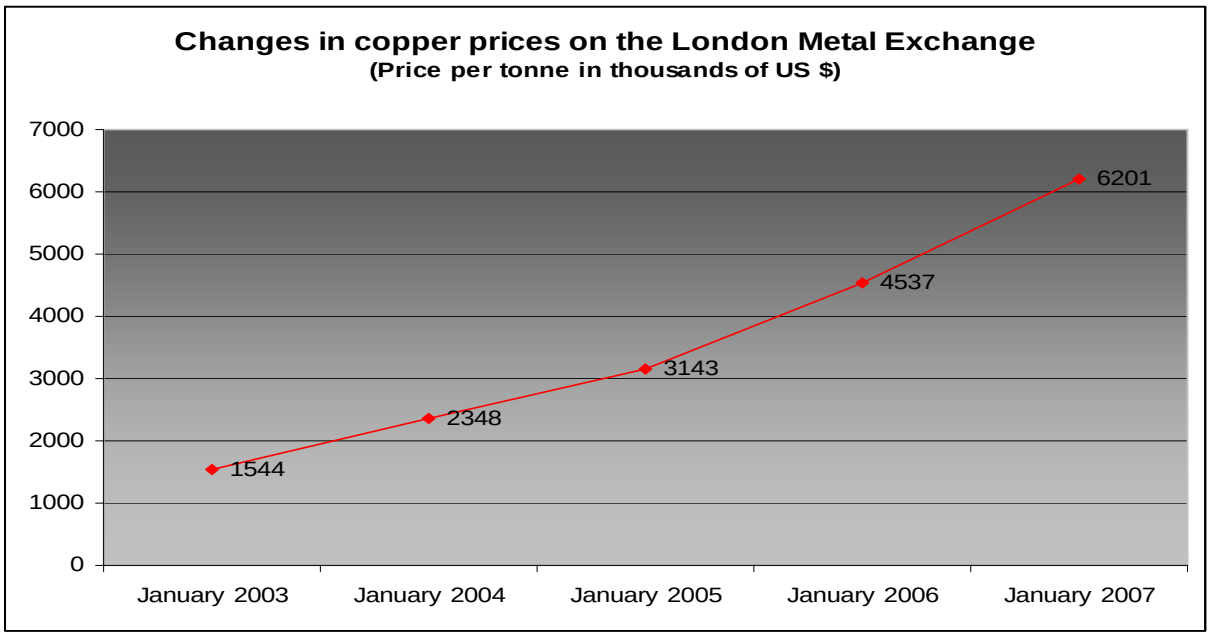
II. COPPER'S PLACE IN THE ECONOMY

A. Global demand and evolution of production

Since the beginning of the 20th century, global demand for refined copper has risen from 0.5 million tonnes (1900 figure) to 17 million tonnes - see graph below. According to ICSG, demand has gone up by 2% between 2005 and 2006, and may still rise by 4.7% in 2007 to reach 17,790 million tonnes.



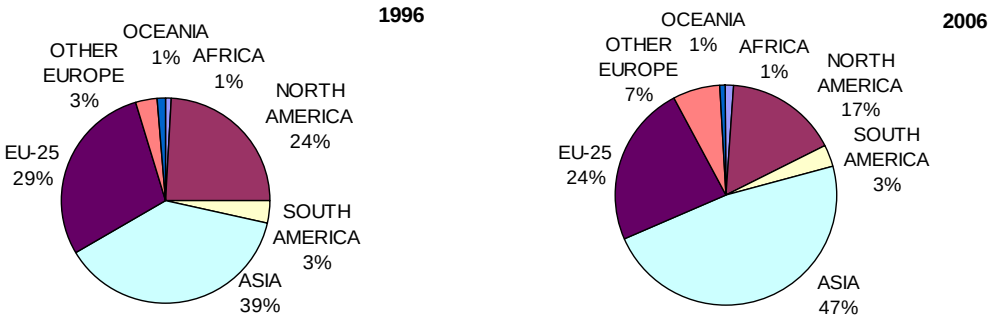
The price of copper has also risen continually since the beginning of 2003:



At 1 May 2007, the price of copper was $8,000/tonne, which means a 30% increase since the beginning of the year.

In 2006, those using the most refined copper were the countries of the former EU-15, China and the United States, followed by Japan and South Korea. Over the past ten years, Europe's share of global refined copper use has been relatively stable, at around 31%, although lower demand in the European Union has been compensated for by an increase in other countries, such as Russia and Turkey (source: International Copper Study Group).

Refined Copper Demand by Major Geography
Comparison: 1996-2006



In 2002, China emerged as the world's largest country user of refined copper (10% of global use in 1996, 21% in 2006), ahead of the United States.

B. How is refined copper used?

The manufacturing of semi-products and the use of finished products

During the last 20 years, the production of semi-products has more than doubled, primarily as a result of the growing increase of outlets in electrical and electronic applications. The largest copper semi-product producing regions and countries are the 15 Member States of the European Union (26% in 2006), China, the United States and Japan, which together represent more than 80% of the world's production of semi-products.

After manufacture and distribution, the final goods may be used in society for between 1 and 100 years. In general, the copper contained in finished products will become recyclable once they have reached the end of their service lives. As a result, finished products in use represent a reserve comparable to a huge mineral deposit that can be available for future use, which is sometimes called 'urban mining'.

The largest industry users of refined copper: energy and building

The use of refined copper in Europe is broken down as follows[3]:

- **Electricity and energy**: **58%**;
  Examples: cables/wires, generators, motors, transformers…
- **Building Construction**: **26%**;
  Examples: building facades, pipes, window frames, roofs…
- Engineering: 10%;
  Examples: machine tools, coins and everyday objects
- Transport: 5%;
- Other: 1%.

A few examples of final applications

Copper is everywhere in our day-to-day lives… although it is not always visible. Here are a few examples of 'hidden' copper:

1. Underground: power cables, lighting, gas pipes, water distribution network, underground transportation systems, etc.
2. Behind walls: telephone lines, data cabling, electricity network, domestic water pipes, valves and fire sprinkler systems
3. Inside household appliances: as wires, transformers, motors, ventilators, switches, refrigeration tubes, air conditioners, printed circuit boards, etc.

Beyond its hidden presence, copper is used in many household objects that are part of our everyday lives: taps, radiators, door handles, furniture, saucepans, etc.

[3] Source: *International Wrought Copper Council* (IWCC).

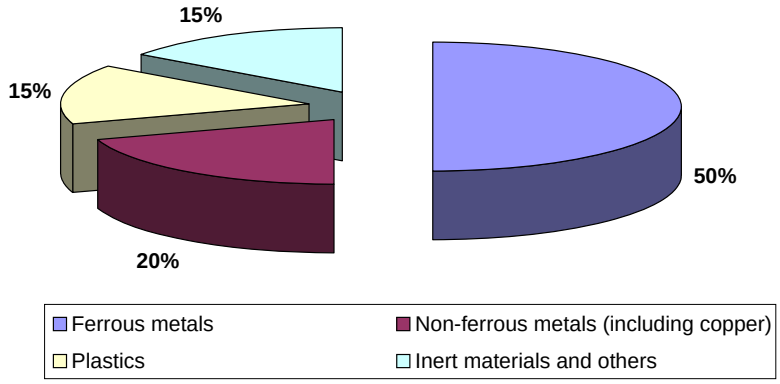
III. WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT (WEEE)

A. WEEE, a copper mine

Copper accounts for a large proportion of WEEE's recyclable material. The best electrical conductor of all metals used for distributing electricity, it is at the heart of all electrical and electronic devices. Retail electronic products, electrical goods and telecommunication devices, New Information and Communication Technologies could not function without copper.

Generally speaking, between 5 and 20% of WEEE's weight is copper, and the more copper there is, the more attractive it is to recycle.

Composition of WEEE



For example, today, computers and mobile phones alone account for 4% of total WEEE products produced every year within the European Union, i.e. 7.4 million tonnes[4]. And, these two products require relatively large amounts of copper:

- Some 14% of the weight of a mobile telephone is comprised of copper (as much as 19% if we count the battery and the charger cable). In 2006, more than 1 billion mobile telephones were sold[5], the equivalent of 20,000 tonnes of copper. In France, there are 51 million active mobile telephones[6], and more than 4 out of every 5 French people have a mobile phone. Moreover, the average user changes mobile phone every 20 months[7].
- A computer contains an average of 1.5 kg of copper. Given that 240 million computers are sold worldwide each year (2006 figure), recycling these computers will yield the equivalent of a mine producing 360,000 tonnes of copper per year.

B. A "model" material for recycling, according to IBM

François Cottin, Environment Manager at IBM France said because it was a major constituent of high-technology products, "copper is a model material for recycling". He added: "A tonne of telephone cards contains 180 kg of copper. It is also found in ceramic substrates, in supply wires, connectors, transformers, coils and computer ventilator motors, as well as in computerised cards."
At its Montpellier site, IBM now processes 3,000 tonnes a year of end-of-life computers.

[4] Source: European Union WEEE working group, 2004.
[5] Source: Strategy Analytics.
[6] Arcep, Dec. 2006.
[7] TNS Sofres-Afom Survey, Nov. 2005.

IV. WEEE MANAGEMENT: SITUATION IN EUROPE?

Currently, nearly 90% of WEEE escapes collection and processing and ends up in landfills or being incinerated. According to the French Environmental Agency, ADEME, in the countries which have been practising the collection of waste from electrical and electronic equipment for many years (the Scandinavian countries in particular), the amount of WEEE recycled can reach up to 10 kg/inhabitant/year. The situation is very variable, however, depending on the country.

A. What is the situation in Europe?

Systems in use vary from one member state to another. The WEEE Directive provides overall targets of recycling, but leaves the choice of methods to the individual states. Some states have chosen to have only one organisation in charge of managing the whole sector (Belgium, Denmark, Cyprus, Greece, Luxembourg, Sweden). Others have opted for several eco-organisations (Hungary, Estonia, Finland, Latvia, Lithuania, The Netherlands, Poland, Portugal, the Czech Republic, Austria, Germany, Ireland, Italy, Slovakia, Slovenia).

In Germany, the Federal Environment Bureau currently estimates the volume of new equipment put onto the market each year to be 1.1 million tonnes. Downstream, the volume of waste from electrical and electronic equipment collected annually by the local authorities is between 300,000 and 400,000 tonnes, or about 4.4 kg/inhabitant/year.

In Spain, all 17 autonomous Communities must authorise eco-organisations, currently standing at 7. Catalonia and the Basque country are the leading regions for recycling waste electrical and electronic equipment.

In Ireland, each eco-organisation is in charge of a region, a system that has proved effective: the collection target of 4 kg of WEEE/year/inhabitant has already been improved upon (in May 2006, the figure was 6.8 kg).

In the United Kingdom, the WEEE was adopted on 1 January 2007, more than 2 years after other states. An eco-organisation was founded, Valpak Retail WEEE Services, to be in charge of collection and setting up of centres. Since 1 March 2007, electronic and electrical equipment makers have been required to register with one of 37 collection systems authorised for WEEE. According to the British national environment agency, the collection volume today is only around 80,000 tonnes/year, i.e. 1.4kg/inhabitant/year.

B. A Few Figures

Quantities of WEEE collected in various European countries (examples) :

	Belgium	Netherlands	Sweden	Norway	Switzerland
Collection rates (in kg/inhabitant)	**3.5 kg** (figure for 2002) *(the figure is currently in excess of 7kg)*	**4.13 kg** (figure for 2000)	**7 kg** (figure for 2001)	**7.9 kg** (figure for 2002)	**8 kg** (figure for 2002)

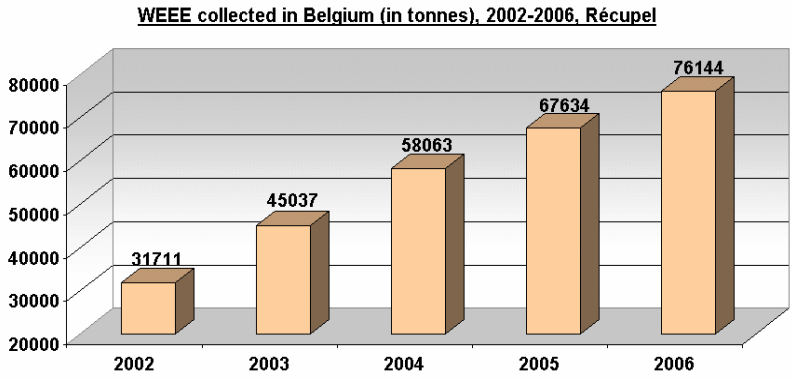
Overview of ecoburden sharing in Europe:

Comparison of the ecotaxes on 4 EEE categories

Type of article	Belgium	Netherlands	Sweden	Switzerland	France
Washing machine	**€10**	**€5**	**€9.33**	**€17.06**	**€6**
Coffee machine	**€1**	**€1**	**€0.44**	**€0.68**	**€0.50**
Television set	**€11**	**€8**	**€8.80**	**€10.24**	**from €1 to 8** (according to screen size)
Refrigerator	**€20**	**€17**	**€26.40**	**€27.30**	**€13**

V. The situation in Belgium

A. An exemplary collection and reprocessing system



Stealing a march on the EC Directive, Belgium put selective WEEE collection in place in 2001 and exceeded the targets in 2003.

Spurred on by the Récupel waste management agency (whose job it is to collect, transport and process WEEE), the collection rate rose to 7.7 kg/inhabitant by the end of 2006, a European Union record.

Belgium is showing strong involvement on the part of manufacturers and retailers, and also exemplary levels of investment by the local authorities in WEEE management. The Liège region (population approximately 1 million) is a good example: the intermunicipal consortium there opted for selective collection comprising container depots backed up by a mustering centre for the articles collected by the distributors. Récupel pays it a fee per tonne collected.

- **Effective collection, increasing steeply since 2001 (source : Récupel*)**

	End 2001	End 2002	End 2003	End 2004	End 2005	End 2006
Number of "container depot" collection points	288	379	554	518	518	518
Number of collection points set up by associations	27	24	19	18	17	19
Number of collection points set up by distribution (stores)	1184	1964	1812	2374	2691	2904
Total number of collection points	**1499**	**2367**	**2385**	**2910**	**3226**	**3441**
Volume of appliances collected (in kg/inhabitant)	**2 kg**	**3,6 kg**	**4,5 kg**	**5,7 kg**	**6,46 kg**	**7,22 kg**
Number of WEEE consignment trips/day	93	123	134	104	113	185

**Récupel figures are embargoed until 1st July 2007*

According to the annual RECUPEL report, 76,144 tonnes of WEEE were collected in Belgium in 2006.

B. SIMS Recycling Solutions & the Sint-Niklaas plant

SIMS Recycling Solutions is the world's largest ferrous and non-ferrous metals recycling business, with over 120 sites and 4,000 employees. It currently recycles 210,000 tonnes of WEEE per annum and just under 90 million tonnes of metal.

SIMS opened an electronic appliance recycling works in Saint-Nicolas, in Flanders, on 19 April 2007. The site will have an overall capacity of 40,000 tonnes per annum and will set out specifically to meet the requirements of the WEEE Directive by collecting end-of-life electrical and electronic equipment and recovering raw materials, including copper, from it. The appliances it treats primarily comprise television sets, computer screens and central processing units, modems and other information technology systems. The site is expected to have about 75 employees on its payroll by the end of 2007.

VI. FOCUS: THE METALLO-CHIMIQUE RECYCLING PLANT IN BEERSE

The Metallo-Chimique plant in Beerse (Flanders) is Belgium's major secondary copper refinery.

Founded in 1919 by the Société Générale de Belgique, Metallo-Chimique went into recycling after the end of World War II. Since then, it has become its core business, giving metals recovered from the products of present-day society a new lease of life by placing them back in the materials cycle.

Metallo-Chimique: identity card

- Business: turning non-ferrous metal scrap into high-quality raw materials, striking the best possible environmental balance
- Number of employees: about 300
- Suppliers: scrap metal dealers (from: the European Union, Germany in particular; Russia)
- Clients: European manufacturers
- Quantities of scrap processed and end products:
  - 250,000 tonnes of scrap metal processed per annum
  - **120,000 tonnes of copper anodes and cathodes produced per annum**
- Types of scrap processed:
  - cables
  - electronic equipment (computer screens, central processing units, chip cards, decoders…)
  - used copper tubes (conduits…)
  - electric motors, armatures, rotors…
  - radiators and other motor car components with a high metal content

  Most of this scrap comes in the form of residue (granules) or, as far as WEEE is concerned, has been previously stripped down.
- Breakdown of turnover: copper anode sales account for 75% of billings, and copper cathode and other recovered metal sales for 25%.

Distinguishing features:

- All the processes and industrial technologies used on the site (founding, treatment and refining), have been developed by in-house engineers, and they include 2 technologies unique the world over:
  - Metallo-Chimique has the capability to treat "mixed" metal, meaning impure copper anodes containing up to 8% of nickel (as opposed to just 2% in the recycling industry in general)
  - The engineers have developed a highly economical WEEE recycling process whereby metal-rich computer screen or chip card parts can be melted down directly.

- The copper cathodes produced by the works are registered on the London Metal Exchange (LME) and have won the "SME" mark, which guaranties 99.99%-pure copper.

- The site is exemplary from the environmental point of view:
  - Infrastructure improvements and projects setting out to limit the environmental impact of the work performed there absorb 30% of investments every year
  - The works are ISO 14001 certified; the management negotiates directly with the European Commission experts regarding the application of the new environmental regulations governing recycling, and WEEE reprocessing in particular.

APPENDIX 1: DEFINITIONS AND KEY INFORMATION ON RECYCLING

Recycling and re-use: what do they mean?

The term "recycling" is often used as a generic term to describe the fact that waste material is used in a manufacturing process, as a replacement for a primary production raw material. For example, cans for cold drinks can be recovered and converted to make a bicycle. In reality, it is useful to distinguish between ***recycling***, ***re-use*** and ***redirection***:

1. **Recycling** involves the collection, dismantling, sorting and processing of a waste material which can then find a new calling as "raw material" intended for similar use. This is the case for copper, but also for glass for example.
2. **Re-use** consists of reusing an element of waste without transforming it, for a similar use, such as to act as a container once again.
3. **Redirection** refers to the use of an element of waste for a purpose other than that of its original application or the manufacture of a different product or one of a different quality, from this waste. As an example, plastic bottles are converted and used in the textile industry.

Where does the waste come from?

There are 3 main sources of waste:

1. **Waste obtained from mining activities** (residues from metallurgical processes);
2. **Waste obtained from industrial sources**, off-cuts from the manufacture of half-finished products (sheeting, bars, pipes, wires, etc.), which are linked to the act of production and are sometimes re-injected directly into the production chain;
3. And above all, **waste obtained from products at the end of their lives**, which supplies about 50% of recyclable copper. They form two categories:
   - **The debris of construction** (associated with demolition work: plumbing installations, gas and heating installations, electric cables, etc. are easy to recycle.
   - **Household waste** (associated with day-to-day consumption): collections by districts, by collection associations (e.g. Emmaüs), or directly by the distributors (e.g. recovery of domestic appliances on the purchase of a new appliance), when they are then incorporated into the recycling chain.

Since, for the most part, they are rich in non-ferrous metals like copper, recycling of waste obtained from these different sources constitutes one of the main challenges with which the developed countries are now confronted.

What is "WEEE" or "W3E"?

Wastes from Electrical or Electronic Equipment, known as WEEE or W3E, include all equipment using electrical power (that is having an electric mains connection, a dry battery, or a rechargeable battery). The WEEEs are generally classified into 3 categories:

1. White goods: *(domestic electrical appliances)*	Washing machines, dishwashers, ovens, refrigerators, freezers, households robots, vacuum cleaners, etc.	
2. Brown goods *(audio-visual appliances)*	Television sets, recorders, hi-fi chain, DVD players, etc.	
3. Grey goods *(Computer and telecommunication appliances)*	Computers, telephones, fax machines, scanners, printers, etc.	

Dry and rechargeable batteries, as well as components and consumables, are not considered to be WEEE.

APPENDIX 2: THE RECYCLING PROCESS FOR COPPER AND ITS ALLOYS

- **Plan illustrating recycling process of copper wastes :**

Stage 1: melting
The different wastes of copper and zinc are mixed in a melting furnace.

Stage 2: pouring
The brass is poured and transformed into ingots, solid cylindrical blocks measuring 10 tonnes and 10 metres.

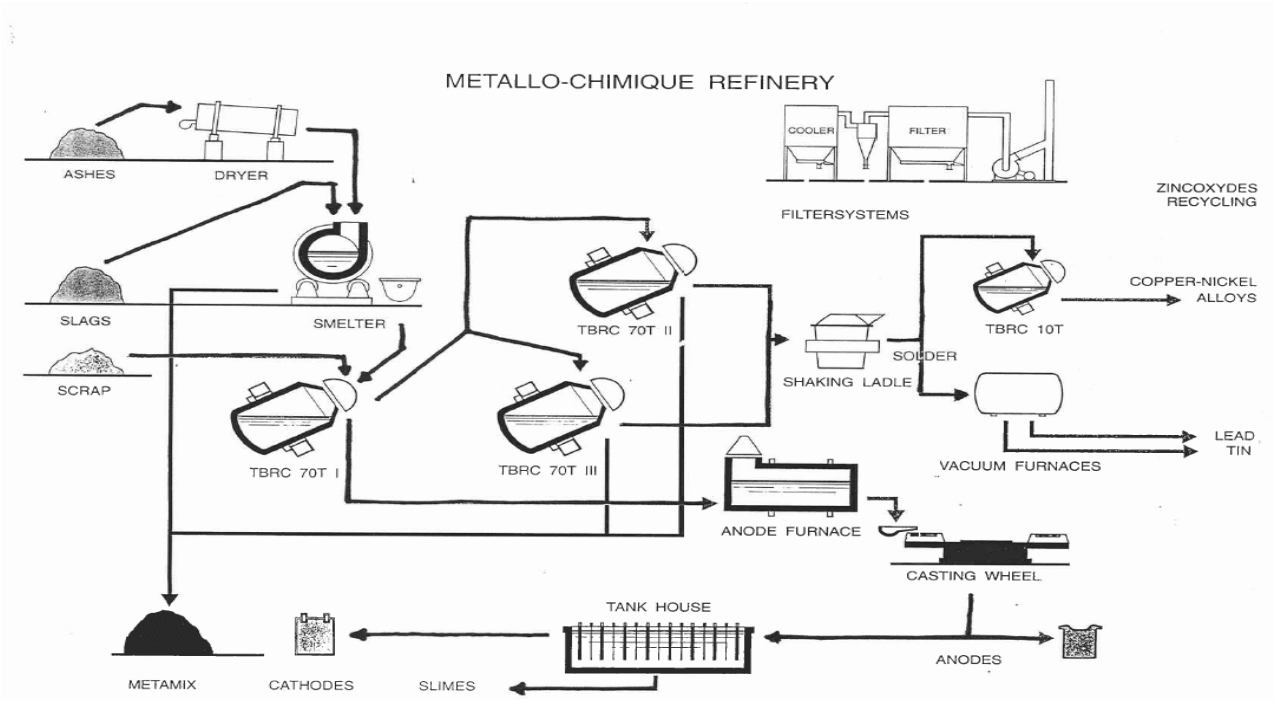
Stage 3: extrusion
The ingots, sawn into billets are heated to +700°C for the extrusion press, which is used for the creation of a rough or blank.

Stage 4: drawing
The remarkable malleability of copper-like products finally allows these rough or blanks to be drawn cold until the required dimensions are achieved.

Stage 5: reintegration into the production cycle
After a final quality check and packaging, these half-finished brass products, made from recycled copper and zinc, have exactly the same characteristics as those which were produced from new metals. They are ready to be used by industry for the manufacture of products for mass consumption.

When their useful life has ended, these brass products will once again be recycled for future generations. **Thus 80% of already-produced copper is still in use today.**

- **How the Metallo-Chimique secondary copper refinery in Beerse works :**



APPENDIX 3: THE EUROPEAN COPPER INSTITUTE

The *European Copper Institute* (ECI) 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 promote copper's benefits to modern society, through its headquarters in Brussels and its European network of 11 copper information centres. ECI is active in four key areas in Europe:

1) ECI's electricity and energy programme

The purpose of ECI's electricity and energy programme is to promote the rational use of energy with a view to achieving sustainable development in the following key areas:

- **Energy efficiency**: through market intelligence, participating in advocacy and education actions, and by participating in Community action programmes such as the 'Motor Challenge', which motivates industry to use systems using more efficient electric motors.
- **The quality of electrical power**: ECI is the founder of a Community vocational training action programme (LEONARDO Power Quality Initiative) to improve the quality of electrical energy by reducing electrical disturbances. Implemented in 12 countries, this programme involves more than 100 partners, including leading universities, companies and professional organisations. The goal is to save EUR 10 billion per year by reducing electrical disturbances.
- **Electrical safety and convenience**: ECI has set up a European working group on improving domestic electrical safety, including the system's main players: the FEEDS (Forum for Enhanced Electrical Domestic Safety).

2) ECI's automotive and building programme

Construction is one of ECI's key sectors, as is the automobile industry. ECI's promotional efforts in these areas are organised around:

- **Architecture and piping systems**: the goal is to promote copper's aesthetics, as well as its durability and natural antimicrobial properties that are widely recognised in drinking water, heating and gas distribution systems.
- **Copper's role in solar power**: harness copper's remarkable thermal conductivity as a key factor in using solar energy.
- **Copper's advantages in automotive construction**: promote copper's role in improving the safety and comfort of modern cars and developing tomorrow's electric cars.

3) ECI's environmental programme

ECI's environmental programme is mainly focused on understanding the potential effects of copper on soil and water. The results are used to dialogue with regulators at both EU and national levels. All research is carried out with the assistance of eminent scientists.

4) ECI's health programme

ECI's health programme is mainly focused on understanding copper's role on health. Results are used to improve health by contributing to regulatory discussions.

Information:

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About Copper Benelux:

Copper Benelux is the association responsible for copper promotion for Belgium, Luxembourg and the Netherlands. It is an information centre serving architects, engineering design offices, installers, private individuals and anyone who wants to know more about the applications of copper and its alloys.

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