ENVIRONMENTAL PRODUCT DECLARATION

as per ISO 14025 and EN 15804

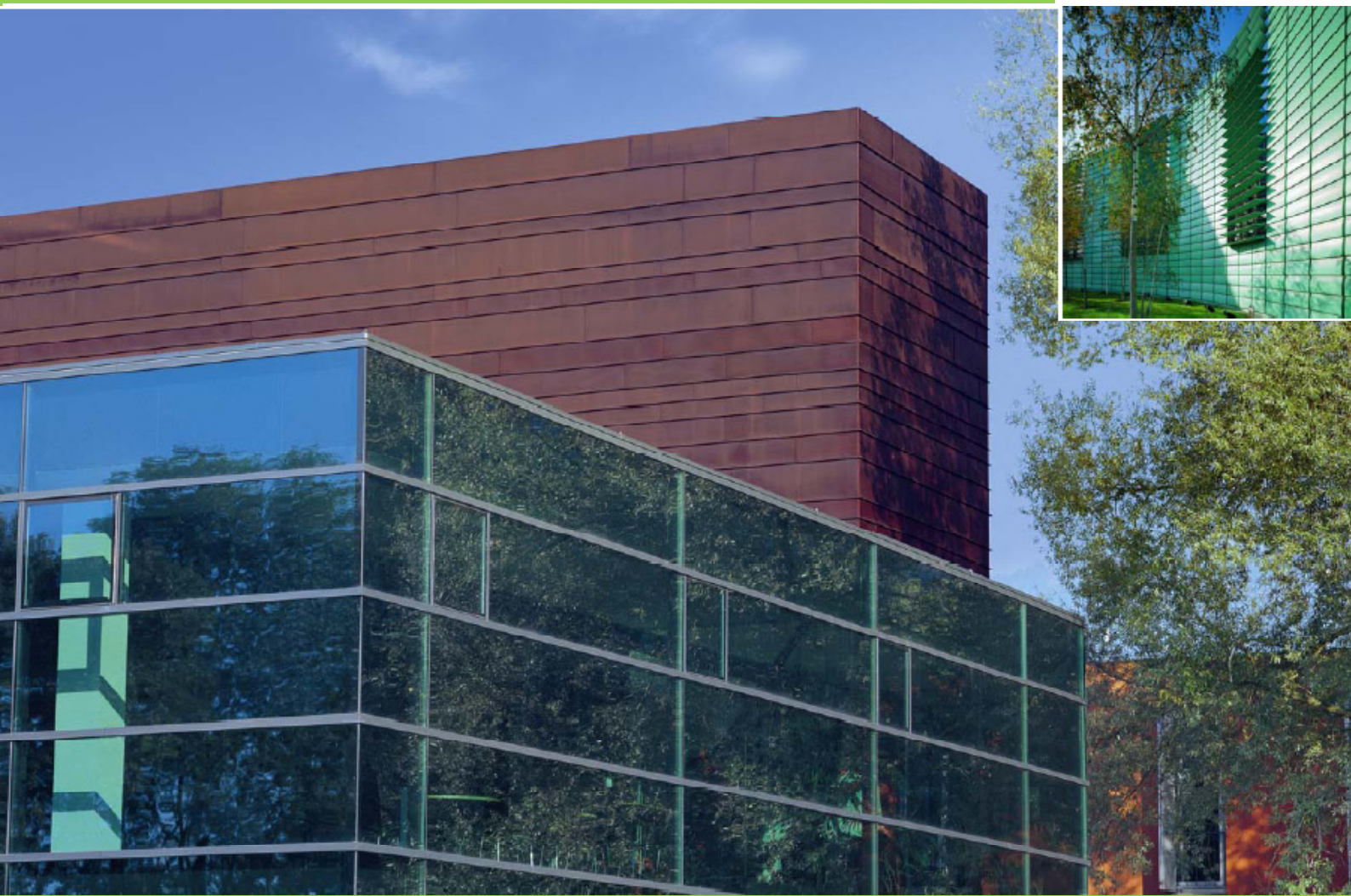
Owner of the Declaration	KME Germany GmbH & Co. KG
Programme holder	Institut Bauen und Umwelt (IBU)
Publisher	Institut Bauen und Umwelt (IBU)
Declaration number	EPD-KME-2012311-E
Issue date	14.12.2012
Valid to	13.12.2017 | 13.12.2018 (in renewal process)

TECU®-Eco copper sheets and strips (TECU®Classic Eco, TECU®Oxid Eco, TECU® Patina Eco)

KME Germany GmbH & Co. KG

Institut Bauen und Umwelt e.V.

www.bau-umwelt.com



1 General information

KME Germany GmbH & Co. KG

TECU®-Eco copper sheets and strips (TECU® Classic Eco, TECU® Oxid Eco, TECU® Patina Eco)

Programme holder
IBU - Institut Bauen und Umwelt e.V.
Rheinufer 108
D-53639 Königswinter

Owner of the Declaration
KME Germany GmbH & Co. KG
Klosterstraße 29
49074 Osnabrück

Declaration number
EPD-KME-2012311-E

Declared product / Declared unit
Copper sheets. The declared functional unit is 1 kg copper sheet with and without surface treatment.

This Declaration is based on the Product Category Rules:
Building metals, 06-2011
(PCR tested and approved by the independent expert committee [SVA])

Scope:
The declaration applies to 1 kg copper sheet with and without surface treatment.
The Life Cycle Assessment is based on data from KME Germany GmbH & Co. KG in D-49074 Osnabrück. The plant is located in Onsabrück, Germany. The data is based on the production year 2011.

Issue date
14.12.2012

Valid to
13.12.2017 | 13.12.2018 (in renewal process)

Verification

The CEN standard EN 15804 serves as the core PCR.

Verification of the EPD by an independent third party as per ISO 14025

☐ internally ☒ externally

Prof. Dr.-Ing. Horst J. Bossenmayer
(President of Institut Bauen und Umwelt e.V.)

Prof. Dr.-Ing. Hans-Wolf Reinhardt
(Chairman of SVA)

Dr.-Ing. Ivo Mersiowsky
(Independent tester appointed by SVA)

2 Product

2.1 Product description

The material TECU® copper consists of 100% Cu-DHP according to DIN EN 1172, i.e. oxygen-free phosphorus de-oxidised copper with limited residual phosphorus. The material is obtainable with 3 surface treatment options: TECU® Classic Eco sheets and strips; TECU® Patina Eco sheets, which are green patina-coated on one side; and TECU® Oxide Eco sheets and strips, which are industrially pre-oxidised with a brown colour on both sides.

2.2 Application

TECU® Eco copper sheets and strips are used for roofing, wall cladding and roof drainage systems (roof gutters, pipes and equipment).

2.3 Technical Data

Test standards

DIN EN ISO 6507-1:2005, DIN EN ISO 6507-2:2005, DIN EN ISO 6892-1:2009, ISO 1811-2:1988-10, ISO 4739:1985-05.

Bezeichnung	Wert	Einheit
Coefficient of thermal expansion	0,017	$10^{-6}K^{-1}$
Tensile strength	240 - 285	N/mm^2
Yield strength	180 - 230	N/mm^2
Modulus of elasticity at 20°C	132	kN/mm^2
Melting point	1083	°C
Thermal conductivity at 20°C	293 - 364	W/(mK)
Electrical conductivity at 20°C	42 - 52	m/Wmm^2
Density	8,93	kg/m^3

2.4 Placing on the market / Application rules

DIN EN 504:2000-01, DIN EN 506:2009-07, DIN EN 612:2005-04, DIN EN 1172:2012-02, DIN EN 1462:2004-12, DIN EN 1652:1998-03, DIN EN 1976:1998-05, E DIN 17933-16:1997-07 CE-identification according to DIN EN 14783

2.5 Delivery status

TECU® Classic Eco
Thickness 0,5 – 1,0mm, Width 500 – 1250mm
Ring - inside - Ø für Großcoil 500mm, 600mm
Panel lengths 2000mm, 3000mm
TECU® Oxid Eco
Thickness 0,5 – 1,0mm, Breiten 500 – 1000mm
Ring - inside - Ø für Großcoil 500mm, 600mm
TECU® Patina Eco
Thickness 0,5 – 1,5mm, Breiten 500 – 1000mm
Panel lengths 2000mm, 3000mm

2.6 Base materials / Ancillary materials

The material TECU® copper consists of 100 % Cu-DHP according to DIN EN 1172, i.e. oxygen-free phosphorus de-oxidised copper with limited residual phospho-rus. The degree of purity is at least 99.90 % copper. Only internal and external scrap is used in production. Primary copper cathode is not used.

Additives:

Rolling oil-emulsion: 0.544 g/kg Cu

is a highly refined mineral oil containing organic esters, polyhydrocarbons, and antioxidants which is used for cooling and lubrication during the rolling process. The rolling oil emulsion is biodegradable.

Benzotriazole: 0.000642 mg/kg Cu

is used to temporarily protect the metal. It does not enter the wastewater during production.

In the "Patinating" process of TECU® Patina:

In a thermal mechanical-process, a green Patina is created directly from the copper surface. This process involves the use of an oxidising solution that creates basic copper salts and copper oxides within 6 – 8 weeks at defined cli-matic conditions in the plant.

- In the "Oxidising" process of TECU® Oxide:

The copper strips are cleansed of rolling oil and emulsion in a de-greasing process, and are then subjected to a two-phase oxidation process.

2.7 Manufacture

The manufacturing process consists of 12 steps:

- Pouring: the highly pure Cu-DHP is poured into slabs, i.e. extruded blocks.
- Heating: the slabs are heated in a furnace to a hot-roll temperature of approx. 900°C.
- Hot-rolling: on a roll stand with a top and bottom roller (reversing duo) the copper is roughed down in several passes i.e. the thickness is reduced by decreasing the gap between the rollers.
- Milling: the thermal oxidation due to the high temperatures in heating and hot-rolling causes a scale to form on the surface of the copper, which is re-moved by milling before the metal is subjected to any other surface. In this process, several tenths of a millimetre are removed from each side.
- Cold roughing: on a reverse quartet (four high stand), the copper band undergoescold roughing. With more passes, the material is reshaped and becomesmore solid. • Intermediate annealing: before further processing, the copper is sub-jected to heat treatment involving intermediate annealing, which causes a targeted loss of cohesion in the copper. This process is carried out in a protected atmosphere to prevent a renewed thermal oxidation of the surface.
- Finish rolling: the final thickness of the material, for TECU® Eco copper strips and sheets is normally in the range 0.6 or 0.7 mm with a desired stabilityof usually R-240 (see page 3, "Mechanical properties of Cu-DHP") are achieved in the stability or condition rolling process.
- Stretcher levelling: in a stretch-levelling plant, the tolerances with regard to linearity and surface evenness are further reduced.
- Packing: After the production, the products are packed.

2.8 Environment and health during manufacturing

Air: The air is purified in filter plants to below the maximum values required by law in terms of emissions to air (TA Luft).

Water/soil: No additional impact on water or soil occurs. The cooling of the cast-ing process is based on a closed water circuit. The wastewater produced by the etching plant is cleaned in a neutralisation plant and discharged into the city sew-age system after daily analysis and provision of retention samples.

Noise: Due to adequate acoustical absorption devices, measurements of sound levels have shown that all values inside and outside the production plant are far below the limits required by public law.

There are no measures relating to health protection during the manufacturing process extending beyond national guidelines (of the production country) needed.

No separate certification according to the requirements of the ISO 14001 has taken place.

2.9 Product processing / Installation

During transportation and storage, store (in the original packaging at room temperature) in a dry place.

For temperatures below 0°, before opening the packaging units, first allow them to warm up to room temperature.

Material can be processed tension-free.

When installing and working with the building material, changes in length due to temperature conditions should be taken into account.

Limiting processing temperatures: none (recrystallisation level 180°C).

Copper alloys can be used in all atmospheres apart from areas with a high am-monia concentration in the air.

Detailed information on working with the material, such as mounting methods, deformation and joining techniques can be found in the corresponding KME-information leaflets.

2.10 Packaging

Packaging materials used:

- Taut ribbon: PP/Polyester
- Disposable / reusable palettes, wood
- Cardboard boxes, cardboard / paper
- Plastic film (polyethylene foil (LDPE))

With regards to transport, packaging and storage, no special demands over and above the normal due care and attention are placed on TECU® Classic Eco, TECU® Oxide Eco and TECU® Patina Eco.

Detailed information on transport, packaging and storage can be found in the KME-information leaflets. The reusable palettes can be reused. Not reused packing material is incinerated.

2.11 Condition of use

TECU® Eco copper is Cu-DHP, oxygen-free phosphorous-deoxidised copper. The constituents correspond to the basic substances named in sec-

tion 2.6. The changes in colour of the surface are caused by:

Further weathering causes the oxide layer to gradually grow; the thicker and denser it gets, the slower this growth becomes.

Green Patina: the building geometry and the local climate can cause the formation of the green patina that is typical for copper.

If TECU® products with a pre-oxidised or pre-patinated surface (TECU® Oxide, TECU® Patina) are subjected to weathering; copper compounds also form in the above-described manner.

2.12 Environment and health during use

There will be no affects to health if the TECU® Eco products are used according to their designated function.

2.13 Reference service life

TECU® Eco copper is UV-resistant and does not corrode. It is resistant to condensation(hot water corrosion), to a rust film and to most of the chemical substances used in building construction.Copper can be washed away in soluble or insoluble form by rain. The rates of copper elutriation under atmospheric weathering are between 0.7 g/m² a and 1,3g/m² a. This means the lifespan of copper roof cladding is > 250 years.

2.14 Extraordinary effects

Fire

Fire performance:

The TECU® products comply with DIN 4102, Part 1 the Requirements of Building Material Class A1 “non-combustible”.

Smoke production/smoke concentration:

No smoke develops. A small amount of smoke can only develop with TECU® Patina Eco products if the temperature exceeds approx. 400°C.

Toxicity of the fumes:

When patina decomposes above approx. 440°C water vapour and small quantities of HCl are released. The resulting Cu(I)Cl melts at approx. 400°C.

Change of state (burning drip down/drop-out):

The melting point is + 1083 °C.

Water

Besides the naturally occurring, geologically-related copper content in water, widely-distributed anthropogenic sources add their share too. There is no evidence to sug-gest that precipitation water running off TECU® Eco copper roofs into flowing waters poses any violation of the general quality requirements for flowing waters.

In bodies of water, copper gets embedded in the sediment. The water in natural bod-ies of water only releases as much copper as is required by the water organisms, provided there is enough copper present. A natural balance is created. The deciding factor is the bonding form of the copper which determines its bioavailability.

Mechanical destruction

Not environmentally relevant for TECU® Eco copper sheets.

2.15 Re-use phase

The process and new scrap materials that occur in the manufacture and processing of TECU® products are entirely fed back into the production process. Separated waste occurring on the construction site and old scrap is collected and sold to secondary smelting companies either directly or via scrap metal dealers. The return rate of this construction waste is almost 100 %. As opposed to many other recycled materials, copper scrap is characterised by its very high recyclability. The scrap can be processed into new building products with relatively little expenditure and energy. Energy savings as a result of copper extraction from recycled material are 80 - 92 % compared to primary metal production.

2.16 Disposal

The srcap that occurs during the production and further processing of TECU® Eco Copper is completely fed back into the production process.

Due to the effective recycling process, no copper from roof cladding or roof drainage systems has to be disposed of. Waste code: B1010.

The packaging materials that are used – paper / cardboard, polyethylene (PE film), polypropylene (PP film) and steel can be recycled. If collected separately, they can be returned via INTERSEROH (INTERSEROH- Certificate Contract no. 25945) where packaging is collected from its point of origin in returnable containers, taking statutory regulations into account. The returnable wooden and steel pallets are returned and refunded (deposit system).

2.17 Further information

www.kme.com

KME Germany GmbH & Co KG

Architectural Solutions

Klosterstr. 29

49074 Osnabrück

3 LCA: Calculation rules

3.1 Declared unit

The declaration applies to 1 kg copper sheet with and without surface treatment. The declared unit is the production and recycling of one kg plain copper sheet(TECU® Classic Eco) and surface treated copper sheet (TECU® Oxid Eco, TECU® Patina Eco).

3.2 System boundary

Type of EPD: cradle to gate - with options.

The following processes were considered in the product stages **A1-A3** of the copper sheet production:

- The provision of resources, additives and energy
- Transport of resources and additives to the production site
- Production process of copper sheets on site including energy, production of additives, disposal of production residues, consideration of related emissions, and recycling of production scrap (“looping back”)
- Recycling of copper sheets at End-of-Life (“looping back”).

3.3 Estimates and assumptions

For transports, an average transport distance of 300 km was assumed.

The wooden pallets are assumed to be circulation material that is to be reused. Therefore they are not considered within the declared modules.

The catalyst used in Patina-coating is assumed to be copper-chloride

3.4 Cut-off criteria

All material flows that enter the system and are over 1 % of their entire mass or contribute more than 1 % to the primary energy consumption, were taken into consideration on the input side.

All material flows that exit the system and whose environmental impact makes up more than 1 % of the total impact in an impact category considered, are covered on the output side.

3.5 Background data

In order to model the life cycle for the production and recycling of the copper strips, the GaBi 5 software system developed by PE International was used /**GaBi 5**/. All relevant background data necessary for the production of copper strips were taken from the software GaBi 5 or were made available by the KME Germany GmbH & Co. KG. All datasets in relation with the production can be found in the GaBi 5 documentation /**GaBi 5 Documentation**/

3.6 Data quality

All data used in the Life Cycle Assessment was taken from the databases of the GaBi 5 Software. All data used was updated less than 8 years ago.

3.7 Period under review

The data for the Life Cycle assessment is based on a datacollection of KME Germany GmbH & Co. KG from the production year 2011.

3.8 Allocation

In this product system, the following allocation is made:

The “recycling potential” was calculated according to the requirement of the IBU PCR document “Construction Metals”.

It describes the ecological value of a material’s “accumulation” in the “technosphere”. It states how many environmental burdens may be avoided in relation to a new pro-duction of the material (here, the avoidance of primary copper production). For this purpose, a collection rate of 99% is assumed. This value is taken from KME sources. Taking into account this collection rate and today’s technologies in metal recycling for one kilogram of copper strip.

The amount of scrap available in the end-of-life phase has to be corrected by the loss rate of one percent. This loss of scrap, leads to a defizit of scrap in the life cycle. There is more scrap needed in the system as it is available in the system. Thereby primary material has to be added. This leads to a burden in Modul D. This represents the life cycle view.

3.9 Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to FprEN 15804 and the building context, respectively the product-specific characteristics of performance, are taken into account.

4 LCA: Scenarios and additional technical information

The following technical information is a basis for the declared modules or can be used for developing specific scenarios in the context of a building assessment if modules are not declared (MND).

Transport to the construction site (A4)

The transport to construction is not part of the life cycle assessment.

Installation in the building (A5)

The declared copper sheets and strips can be used roofing, wall cladding and roof drainage systems (roof gutters, pipes and equipment).

Use (B1)

See chapter, 2.11 Usage. The Usage is not considered in this study and has to be added for the assessment of a whole building.

Reuse- Recovery- and Recycling potential (D)

Modul D contains the recyclingpotential. A collection rate of 99% was assumed. The amount of copper scrap that is available for the end-of-life recycling after the scrap required for production has been subtracted is credited.

The credit for the copper left-over is calculated with the dataset of the primary copper-cathode production.

5 LCA: Results

The following tabels show the results oft the LCA Environmental Impact Assessment, the Ressource Use, the waste-flows and other output-flows of 1 kg copper sheet produced by the KME Germany GmbH & Co. KG. The result of the environmental impact assessment is only a relative statement. It gives noch Information about end-points of the impact assessment, if threshold Values are exceeded, safety margins or risiks.

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)

PRODUCT STAGE			CONSTRUC-TION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARYS
Raw material supply	Transport	Manufacturing	Transport	Construction-installation process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 kg Copper Sheet TECU® Classic Eco, TECU® Oxid Eco, TECU® Patina Eco (blank/surface treated)

		TECU® Classic Eco		TECU® Oxid Eco		TECU® Patina Eco	
		Manufacturing	Credits	Manufacturing	Credits	Manufacturing	Credits
Parameter	**Unit**	**A1-3**	**D**	**A1-3**	**D**	**A1-3**	**D**
GWP	[kg CO_2-Äq.]	7,1E-01	3,8E-02	9,4E-01	3,8E-02	1,1E+00	3,8E-02
ODP	[kg CFC11-Äq.]	1,3E-09	4,9E-09	1,4E-09	4,9E-09	3,2E-09	4,9E-09
AP	[kg SO_2-Äq.]	7,9E-04	2,3E-04	1,0E-03	2,3E-04	1,4E-03	2,3E-04
EP	[kg PO_4^{3-}- Äq.]	1,0E-04	3,2E-05	1,3E-04	3,2E-05	1,6E-04	3,2E-05
POCP	[kg Ethen Äq.]	6,2E-05	2,1E-05	9,5E-05	2,1E-05	1,0E-04	2,1E-05
ADPE	[kg Sb Äq.]	1,7E-07	8,0E-06	3,9E-07	8,0E-06	5,1E-06	8,0E-06
ADPF	[MJ]	8,6E+00	3,9E-01	1,3E+01	3,9E-01	1,2E+01	3,9E-01
Caption	GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non fossil resources; ADPF = Abiotic depletion potential for fossil resources						

RESULTS OF THE LCA - RESOURCE USE: 1 kg Copper Sheet TECU® Classic Eco, TECU® Oxid Eco, TECU® Patina Eco (blank/surface treated)

		TECU® Classic Eco		TECU® Oxid Eco		TECU® Patina Eco	
		Manufacturing	Credits	Manufacturing	Credits	Manufacturing	Credits
Parameter	**Unit**	**A1-3**	**D**	**A1-3**	**D**	**A1-3**	**D**
PERE	[MJ]	6,7E-01	3,0E-02	6,9E-01	3,0E-02	2,0E+00	3,0E-02
PERM	[MJ]	0	0	0	0	0	0
PERT	[MJ]	6,7E-01	3,0E-02	6,9E-01	3,0E-02	2,0E+00	3,0E-02
PENRE	[MJ]	9,7E+00	4,5E-01	1,4E+01	4,5E-01	1,5E+01	4,5E-01
PENRM	[MJ]	0	0	0	0	0	0
PENRT	[MJ]	9,7E+00	4,5E-01	1,4E+01	4,5E-01	1,5E+01	4,5E-01
SM	[kg]	1,1E+00	-	1,1E+00	-	1,2E+00	-
RSF	[MJ]	1,5E-04	4,0E-05	2,2E-04	4,0E-05	2,2E-04	4,0E-05
NRSF	[MJ]	1,6E-03	3,3E-04	2,3E-03	3,3E-04	2,3E-03	3,3E-04
FW	[m³]	6,7E-04	3,2E-06	7,0E-04	3,2E-06	1,5E-03	3,2E-06
Caption	PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non renewable primary energy excluding non renewable primary energy resources used as raw materials; PENRM = Use of non renewable primary energy resources used as raw materials; PENRT = Total use of non renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non renewable secondary fuels; FW = Use of net fresh water						

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: 1 kg Copper Sheet TECU® Classic Eco, TECU® Oxid Eco, TECU® Patina Eco (blank/surface treated)

		TECU® Classic Eco		TECU® Oxid Eco		TECU® Patina Eco	
		Manufacturing	Credits	Manufacturing	Credits	Manufacturing	Credits
Parameter	**Unit**	**A1-3**	**D**	**A1-3**	**D**	**A1-3**	**D**
HWD*	[kg]	-	-	-	-	-	-
NHWD	[kg]	-	--	-	-	-	-
RWD	[kg]	4,5E-04	1,6E-05	4,7E-04	1,6E-05	1,0E-03	1,6E-05
CRU	[kg]	-	0	-	0	-	0
MFR	[kg]	-	0	-	0	--	0
MER	[kg]	-	0	-	0	-	0
EE [electricity]	[MJ]	-	-	-	-	-	-
EE [therm. energy]	[MJ]	-	-	-	-	-	-
Caption	HWD = Hazardous waste disposed; NHWD = Non hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EE = Exported energy per energy carrier						

* The indicators are not reported according to the temporary agreement of the advisory board meeting from 04.10.2012.

6 LCA: Interpretation

For almost all Impact categories assessed for the products **TECU® Classic Eco**, **TECU® Oxid Eco** and **TECU® Patina Eco** the pre-chains for the generating of thermal and electrical energy have a siginficant relevance. Modul D contains a burden. This is is caused by the additional need of primrary material, because of the collection loss in the end-of-life phase.

As there is no primary copper cathode used in the production, **ADP-Elments** for the products **TECU® Classic Eco** and **TECU® Oxid Eco** in the production phase is dominated by the used deionized water (Classic) and Sodium Hydroxide (Oxid). The corresponding values are very low and can therefore be neglected.

For **PERT** the main contributers are the used charcoal and the pre-chains for generating electricity. The main contributers to **PENRT** are the pre-chains for generating electricity and thermal energy.

GWP is mainly influenced by the geration of electricity and thermal energy. In addition, the production processes itself have a significant contribution.

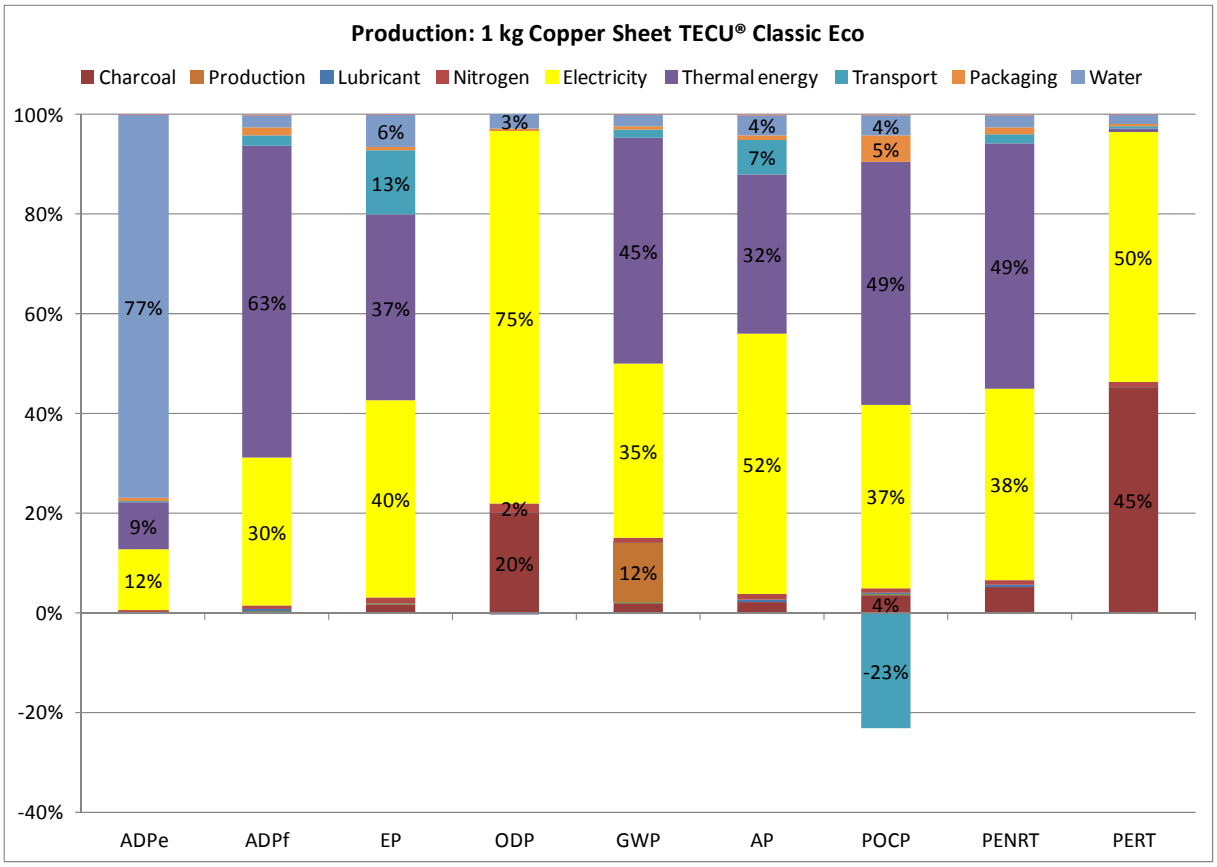
The Ozon Depletion Potential (**ODP**) is mostly influenced by the generation of electricity and the provision of charcoal.

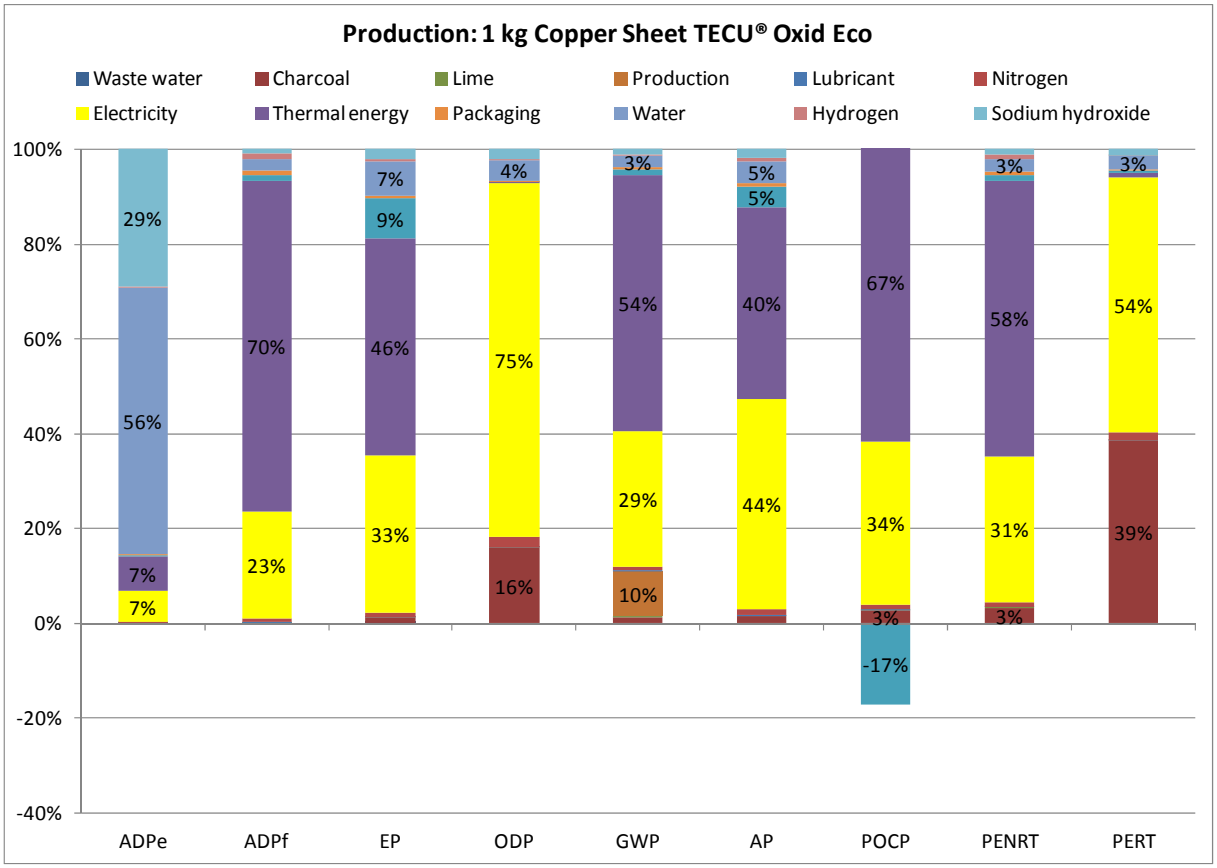
In the production process, the main contributer to the Eutrophication Potential (**EP**), is the gernation of thermal and electrical energy.

Acidifiation Potential (**AP**) and the Photochemical Ozone Creating Potential (**POCP**) are also mainly dominated by the generation of electricity.

Transports for the **TECU® Eco** products, in the case of POCP, have a positive effect. The reason is, that the Nitrogenmonoxide-Emissions that occure during transportation, have a negative characterization factor in the impact assessment. This leads to a Credit, regarding POCP, for transports.

For the **TECU® Patina Eco,** 96% of the contribution to **ADP-Elements** is from the catalyst (assumed to be copper-chloride).




Production: 1 kg Copper Sheet TECU® Oxid Eco
Waste water
Charcoal
Lime
Production
Lubricant
Nitrogen
Electricity
Thermal energy
Packaging
Water
Hydrogen
Sodium hydroxide
100%
80%
60%
40%
20%
0%
-20%
-40%
29%
56%
7%
7%
70%
23%
7%
9%
46%
33%
4%
75%
16%
3%
54%
29%
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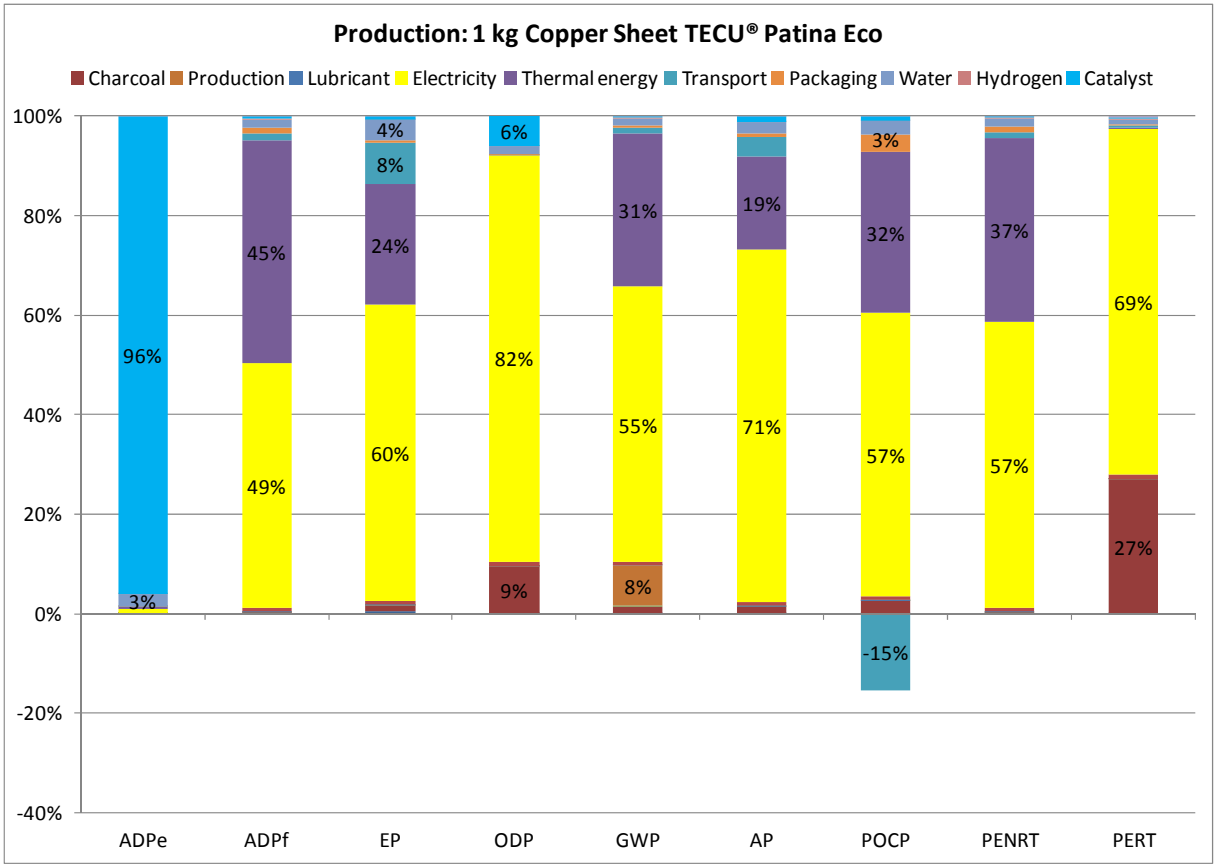
AP
POCP
PENRT
PERT


Production: 1 kg Copper Sheet TECU® Patina Eco
Charcoal
Production
Lubricant
Electricity
Thermal energy
Transport
Packaging
Water
Hydrogen
Catalyst
100%
80%
60%
40%
20%
0%
-20%
-40%
96%
3%
45%
49%
4%
8%
24%
60%
6%
82%
9%
31%
55%
8%
19%
71%
3%
32%
57%
-15%
37%
57%
69%
27%
ADPe
ADPf
EP
ODP
GWP
AP
POCP
PENRT
PERT

7 Requisite evidence

7.1 Withering

Calculation model for copper elutiration:

A formula was developped on the basis of publicly available and laboratory data, which calculates the elutiration in a grid of 50 m² in Europe. The key parameters in this formula are the SO2-Concentration, the pH-Value of rain, the precipitation and the roof pitch. Experimental setup: acccordint to ISO 17752, trial period 2007 – 2010, trial site Duisburg.http://www.corrosionsience.se/runoff/

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Institut Bauen und Umwelt e.V.	**Publisher** Institut Bauen und Umwelt e.V. Rheinufer 108 53639 Königswinter Germany	Tel. Fax E-mail Web	+49 (0)2223 29 66 79- 0 +49 (0)2223 2966 79- 0 info@bau-umwelt.com **www.bau-umwelt.com**
Institut Bauen und Umwelt e.V.	**Programme holder** Institut Bauen und Umwelt e.V. Rheinufer 108 53639 Königswinter Germany	Tel. Fax E-mail Web	+49 (0)2223 2966 79- 0 +49 (0)2223 2966 79- 0 info@bau-umwelt.com **www.bau-umwelt.com**
KME DIE EVOLUTION DES KUPFERS	**Owner of the Declaration** KME Germany GmbH & Co. KG Klosterstraße 29 49074 Osnabrück Deutschland	Tel. Fax: E-mail: Web	+49 (0) 541321 4332– 200 +49 (0) 541321 4332– 2111 info-tecu@kme.com **http://www.kme.com**
PE INTERNATIONAL EXPERTS IN SUSTAINABILITY	**Author of the Life Cycle Assessment** PE International AG Hauptstraße111 - 113 70771 Leinfelden-Echterdingen Deutschland	Tel. Fax: E-mail: info@pe-international.com Web: **www.pe-international.com**	+49 (0) 711 34 18 17-0 +49 (0) 711341817-25