

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-2012321-E
Issue date	14.12.2012
Valid to	13.12.2017 13.12.2018 (in renewal process)

**TECU® copper alloys sheets and strips (TECU® Bronze, TECU® Gold)
KME Germany GmbH & Co. KG**

www.bau-umwelt.com



Institut Bauen
und Umwelt e.V.



1 General information

KME Germany GmbH & Co. KG

Programme holder

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

Declaration number

EPD-KME-2012321-E

This Declaration is based on the Product Category Rules:

Building metals, 06-2011
(PCR tested and approved by the independent expert committee [SVA])

Issue date

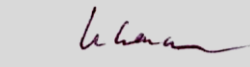
14.12.2012

Valid to

13.12.2017 | 13.12.2018 (in renewal process)



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



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

TECU® copper sheets and strips

(TECU® Bronze, TECU® Gold)

KME Germany GmbH & Co. KG

Owner of the Declaration

KME Germany GmbH & Co. KG
Kolsterstrasse 29
49074 Osnabrück

Declared product / Declared unit

Sheets made of copper. The declared functional unit is 1 kg of copper sheets alloyed.

Scope:

The declaration applies to 1 kg copper sheet blank and surface treated.

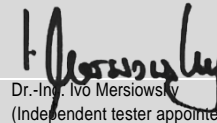
The Life Cycle Assessment is based on data from KME Germany GmbH & Co. KG in D-49074 Osnabrück. The location of the plant is Germany (Osnabrück). The data is based on the production year 2011.

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



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

2 Product

2.1 Product description

The alloy TECU® Bronze consists of Cu-DHP and Tin. It is produced according to DIN EN 1172 and with the material designation CuSn4 CW50K

The copper alloy TECU® Gold consists of CU-DHP, Aluminium, Zinc, Tin. It is produced according to DIN EN 1172 with the material designation CuAl5Zn5Sn1 WC309G.

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.

Structural Data

Designation	Value	Unit
Coefficient of thermal expansion	0,017	10 ⁻⁶ K ⁻¹
Tensile strength	290 - 390	N/mm ²
Yield strength	190	N/mm ²
Modulus of elasticity at 20°C	120	kN/mm ²
Melting point	950 - 1070	°C

Thermal conductivity at 20°C	100	W/(mK)
Electrical conductivity at 20°C	≥9 - 15	m/Wmm ²
Density	8,85	kg/m ³

Structural Data

Designation	Value	Unit
Coefficient of thermal expansion	0,017	10 ⁻⁶ K ⁻¹
Tensile strength	min 400	N/mm ²
Yield strength	180	N/mm ²
Modulus of elasticity at 20°C	113	kN/mm ²
Melting point	950 - 1080	°C
Thermal conductivity at 20°C	80	W/(mK)
Electrical conductivity at 20°C	≥7 - 8,5	m/Wmm ²
Density	8,18	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® Bronze

Thickness 0,7 – 1,0mm, Breiten 500 – 670mm
Ring - inside - Ø für Großcoil 500mm, 600mm
Panel lengths 2000mm, 3000mm

TECU® Gold

Thickness 0,5 – 1,0mm, Breiten 500 – 1000mm
Ring - inside - Ø für Großcoil 500mm, 600mm
Panel lengths 2000mm, 3000mm

2.6 Base materials / Ancillary materials

TECU® Bronze consists to 3,5-4,5 % of Tin and of Cu-DHP according to DIN EN 1172, i.e. oxygen-free phosphorus de-oxidised copper with limited residual phosphorus.

TECU® Gold consists to 4-6 % of Aluminium, 0,3 – 1,5 % tin, 4-6% zinc and Cu-DHP according to DIN EN 1172 .e. oxygen-free phosphorus de-oxidised copper with limited residual phosphorus.

Only internal and external scrap is used for TECU® alloys. Primary copper cathode is not used. Small amounts of Al, ZN and Sn are added.

Rolling oil-emulsion: 0.544 g/kg Cu

highly refined mineral oil, organic esters, polyhydrocarbons, antioxidants which are used for cooling or 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.

2.7 Manufacture

The manufacturing process consists of 12 steps:

- **Pouring:** the highly pure Cu-DHP is poured into slabs, i.e. extruded blocks.
- **Warming up:** 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 warming up 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 surfaces. In this process, several tenths of millimetres are removed from each side.
- **Cold roughing down:** on a reverse quartet (four high stand), the copper band is then cold roughed down with more passes, thereby becoming more solid as it becomes reshaped.
- **Intermediate annealing:** therefore, before further processing, the copper is sub-jected to heat treatment involving intermediate annealing, causing 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® alloys is achieved in the stability or condition rolling process.
- **Stretcher levelling:** on a stretch-levelling plant, the tolerances with regard to linearity and surface evenness are reduced even further.

- **Packing:** After the production, the products are packed.

2.8 Environment and health during manufacturing

Air: By means of adequate reduction of emissions (filter plants), the air is purified to below the limit values required by law (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.

During 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 (re-crystallisation 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 palletes, 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® Bronze and TECU® Gold.

Mechanical damage and scratches to the surface should be avoided. TECU® Bronze and TECU® Gold-sheets must be transported in original packaging units and stored in a dry place. Once individual sheets have been removed from the packaging unit, it must be closed again immediately.

Detailed information on transport, packaging and storage can be found in the KME-information leaflets.

The reusable pallets can be reused. Not reused packing material is incinerated

2.11 Condition of use

TECU® Bonze is an alloy consisting of copper and tin. The ingredients are stated in 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: depending on the building geometry and the local climate, causes the formation of the green patina that is typical for copper.

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® Bronze and TECU® Gold copper is UV-resistant and does not rot. It is resistant to defrost water (hot water corrosion), to a rust film and to most of the chemical substances used in building construction. As rain begins, copper can be washed away in soluble or insoluble form. 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® copper alloys TECU® Bronze and TECU® Gold comply with DIN 4102, Part 1 the Requirements of Building Material Class A1 "non-combustible".

Meltingpoint of TECU® Gold is 950°C – 1080 °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 suggest that precipitation water running off TECU® alloys 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 bodies of water only releases as much copper as is required by the water

3 LCA: Calculation rules

3.1 Declared unit

The declaration applies to copper alloys. The declared unit is 1 kg copper sheet alloyed (TECU® Bronze, TECU® Gold).

3.2 System boundary

Type of EPD: cradle to gate - with options.

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

- The provision of resources, additives and energy
- Transport of resources and additives to the production site

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® alloys.

2.15 Re-use phase

The process and new scrap materials that occur in the manufacture and processing of TECU® alloys TECU® Bronze and TECU® Gold 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 recycling materials, copper and copper alloy scrap is characterised by its very high value. The scrap can be processed into new building products with relatively little expenditure and energy. The relationships shown, state that copper is a very sustainable product.

2.16 Disposal

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

Due to the effective recycling process, no copper alloys from roof cladding or façade cladding have 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); 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

- Production process of copper sheets on site including needed energy, production of additives, disposal of production residues, consideration of related emissions, recycling of production scrap ("looping back")
- Recycling of copper sheets in End-of-Life ("looping back").

3.3 Estimates and assumptions

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

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

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 page.

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 page.

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 **/Fehler! Verweisquelle konnte nicht gefunden werden./**. 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 **/Fehler! Verweisquelle konnte nicht gefunden werden./**.

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 reviewed 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 production 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 and the alloys contained. This loss of scrap, leads to a deficit 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 EN 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 tables show the results of the LCA Environmental Impact Assessment, the Resource 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 no information about end-points of the impact assessment, if threshold values are exceeded, safety margins or risks.

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

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES	
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	MND	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 kg Copper Sheet TECU® Bronze, TECU® Gold (alloyed)

		TECU® Bronze		TECU® Gold	
		Manufacturing	Credits	Manufacturing	Credits
Parameter	Unit	A1-3	D	A1-3	D
GWP	[kg CO ₂ -Äq.]	9,1E-01	3,2E-02	1,6E+00	3,4E-02
ODP	[kg CFC11-Äq.]	3,7E-09	4,1E-09	1,3E-08	4,4E-09
AP	[kg SO ₂ -Äq.]	1,4E-03	1,9E-04	3,9E-03	2,1E-04
EP	[kg PO ₄ ³⁻ -Äq.]	1,7E-04	2,7E-05	2,9E-04	2,9E-05
POCP	[kg Ethen Äq.]	1,2E-04	1,8E-05	2,6E-04	1,9E-05
ADPE	[kg Sb Äq.]	1,9E-07	6,7E-06	1,1E-04	7,3E-06
ADPF	[MJ]	9,3E+00	3,3E-01	1,7E+01	3,6E-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® Bronze, TECU® Gold (alloyed)

		TECU® Bronze		TECU® Gold	
		Manufacturing	Credits	Manufacturing	Credits
Parameter	Einheit	A1-3	D	A1-3	D
PERE	[MJ]	2,5E+00	2,5E-02	3,8E+00	2,7E-02
PERM	[MJ]	0	0	0	0
PERT	[MJ]	2,5E+00	2,5E-02	3,8E+00	2,7E-02
PENRE	[MJ]	1,2E+01	0,375-	2,1E+01	4,1E-01
PENRM	[MJ]	0	0	0	0
PENRT	[MJ]	1,2E+01	3,8E-01	2,1E+01	4,1E-01
SM	[kg]	1,2E+00	-	1,2E+00	-
RSF	[MJ]	1,8E-04	3,4E-05	3,8E-04	3,6E-05
NRSF	[MJ]	1,9E-03	2,8E-04	3,8E-03	3,0E-04
FW	[m³]	1,5E-03	2,7E-06	3,5E-03	3,0E-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® Bronze, TECU® Gold (legiert)

		TECU® Bronze		TECU® Gold	
		Manufacturing	Credits	Manufacturing	Credits
Parameter	Einheit	A1-3	D	A1-3	D
HWD*	[kg]	-	-	-	-
NHWD*	[kg]	-	-	-	-
RWD	[kg]	1,01E-03-	1,32E-005-	1,64E-03	1,43E-005-
CRU	[kg]	-	0	-	0
MFR	[kg]	-	0	-	0
MER	[kg]	-	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

Modul D contains a burden for **TECU® Bronze** and **TECU® Gold**. This is caused by the additional need of primary material, because of the collection loss in the end-of-life phase.

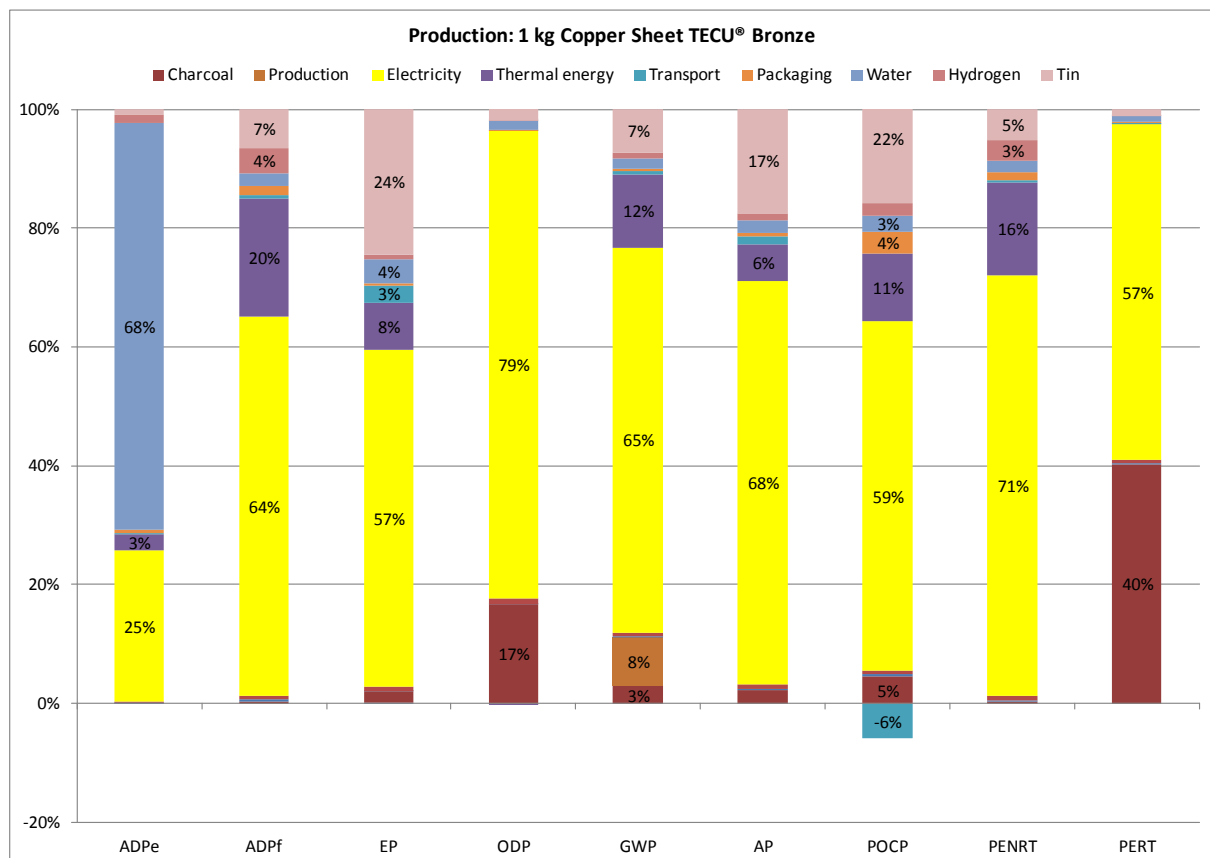
In case of the product **TECU® Bronze**, for almost all Impact categories the generation of Energy is the dominant process.

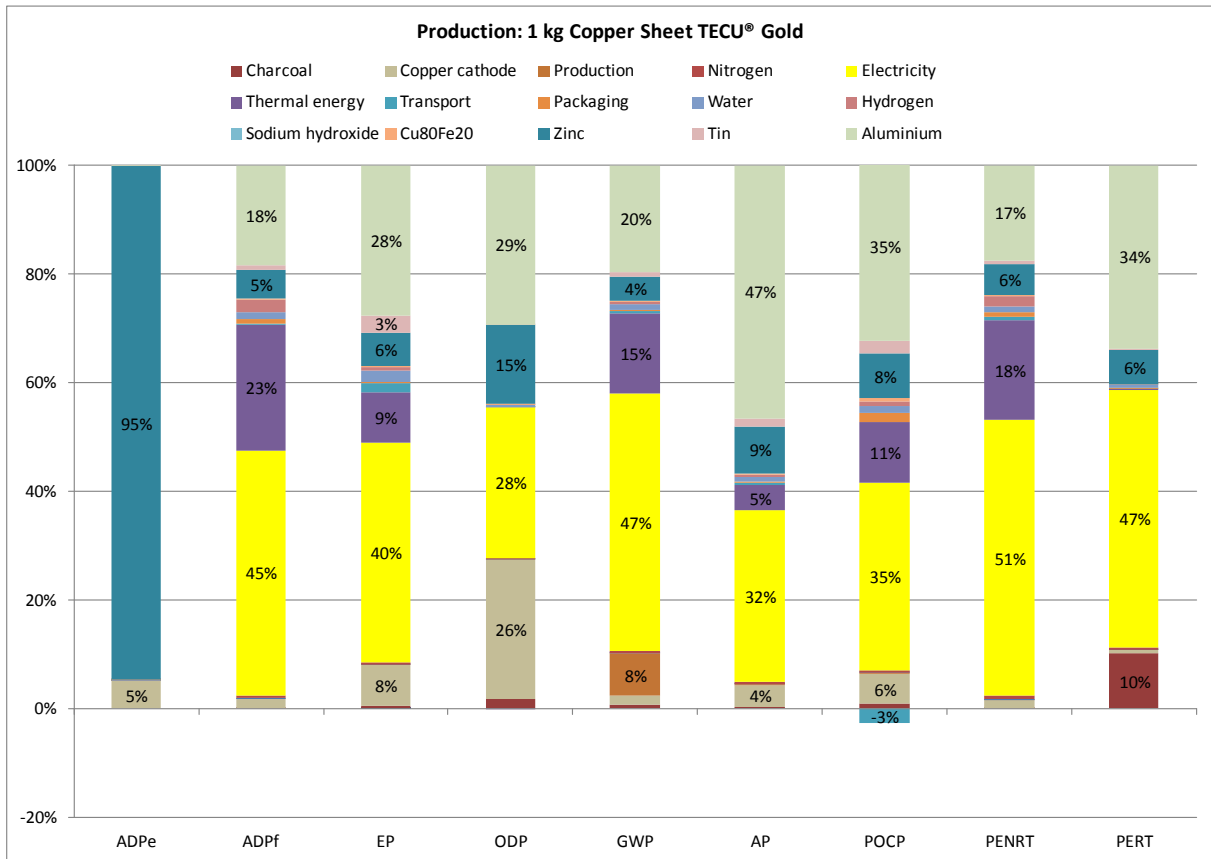
In all assessed Impact categories generation of energy has a significant contribution. To a lesser extent, the provision of thermal energy from natural gas and the provision of Tin have noticeable contribution to **Acidification**, **Eutrophication** and the **Photochemical Ozone Creating Potential**. **ADP-Elements** is dominated by the used deionized cooling water in the production process. However this value is very low and thereby neglectable.

The impact assessment for **TECU® Gold** shows, that in most of the cases the environmental impact

is dominated by the generation of electricity, the generation of thermal energy and the provision of aluminium (especially the electrolysis and the obtaining of Alumina). For the contribution to **Acidification Potential** and **POCP** the share of the aluminium production is 47% respectively 35%. **ADP-Elements** is dominated by the provision of Zinc. On the other hand; **PERT** is dominated by the provision of Aluminium (34%) and electricity (47%). **PENRT** is mainly influenced by their provision of electricity.

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





7 Requisite evidence

7.1 Wheathering

Experimental setup: According to ISO 17752 experimental period 2007 – 2010, location Duisburg, TECU® Bronze 0,73 g/m²a und TECU® Gold 0,76

g/m². Measuring department: IUTA Institut for Energy and Environment, Mercator University Duisburg. <http://www.corrosionscience.se/runoff/>

8 References

Institut Bauen und Umwelt 2011,

General principles for the EPD range of Institut Bauen und Umwelt e.V. (IBU), 2011-09.

PCR Guidance-Texts for Building-Related Products and Services, Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Background Report. 2011-09.

PCR Guidance-Texts for Building-Related Products and Services, Part B: Requirements on the EPD for building metals. 2011-06.

www.bau-umwelt.de

DIN EN ISO 14025:2011-10, Environmental labels and declarations - Type III environmental declarations - Principles and procedures

DIN EN 15804:2012-04, Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction Products

DIN EN ISO 6507-1:2006-03, Metallic materials - Vickers hardness test - Part 1: Test method (ISO 6507-1:2005); German version EN ISO 6507-1:2005

DIN EN ISO 6507-2:2006-03, Metallic materials - Vickers hardness test - Part 2: Verification and calibration of testing machines (ISO 6507-2:2005); German version EN ISO 6507-2:2005

DIN EN ISO 6892-1:2009-12, Metallic materials - Tensile testing - Part 1: Method of test at room temperature (ISO 6892-1:2009); German version EN ISO 6892-1:2009

DIN EN 504:2000-01, Roofing products from metal sheet - Specification for fully supported roofing products from copper sheet; German version EN 504:1999

DIN EN 506:2009-07, Roofing products of metal sheet - Specification for self-supporting products of copper or zinc sheet; German version EN 506:2008

DIN EN 1172:2012-02, Copper and copper alloys - Sheet and strip for building purposes; German version EN 1172:2011

DIN EN 1462:2004-12, Brackets for eaves gutters - Requirements and testing; German version EN 1462:2004

DIN EN 1652:1998-03, Copper and copper alloys - Plate, sheet, strip and circles for general purposes; German version EN 1652:1997

DIN EN 14783:2006-12, Fully supported metal sheet and strip for roofing, external cladding and internal lining - Product specification and requirements; German version EN 14783:2006

ISO 1811-2:1988-10, Copper and copper alloys; selection and preparation of samples for chemical analysis; part 2: sampling of wrought products and castings

DIN EN 1976:1998-05, Copper and copper alloys - Cast unwrought copper products; German version EN 1976:1998

E DIN 17933-16:1997-07, Copper and copper alloys - Determination of residual stresses in the border area of slit strip

DIN 1402-1:1998-01, Fire behaviour of building materials and building components - Part 1: Building materials; concepts, requirements and tests

ISO 4739:1985-05, Wrought copper and copper alloy products; Selection and preparation of specimens and test pieces for mechanical testing

GaBi 5 Software

GaBi 5. Software and Databasis for Life Cycle Engineering. LBP, University of Stuttgart und PE International, 2011.

GaBi 5 Documentation

GaBi 5: Documentation of the GaBi 5-datasets for Life Cycle Engineering. LBP, University of Stuttgart and PE International, 2011.

<http://documentation.gabi-software.com>



Institut Bauen
und Umwelt e.V.

Publisher

Institut Bauen und Umwelt e.V.
Rheinufer 108
53639 Königswinter
Germany

Tel. +49 (0)2223 29 66 79- 0
Fax +49 (0)2223 2966 79- 0
E-mail info@bau-umwelt.com
Web www.bau-umwelt.com



Institut Bauen
und Umwelt e.V.

Programme holder

Institut Bauen und Umwelt e.V.
Rheinufer 108
53639 Königswinter
Germany

Tel. +49 (0)2223 2966 79- 0
Fax +49 (0)2223 2966 79- 0
E-mail info@bau-umwelt.com
Web www.bau-umwelt.com



Owner of the Declaration

KME Germany GmbH & Co. KG
Klosterstraße 29
49074 Osnabrück
Deutschland

Tel. +49 (0) 541321 4332– 200
Fax: +49 (0) 541321 4332– 2111
E-mail: info-tecu@kme.com
Web <http://www.kme.com>



Author of the Life Cycle Assessment

PE International AG
Hauptstraße 111 - 113
70771 Leinfelden-Echterdingen
Deutschland

Tel. +49 (0) 711 34 18 17-0
Fax: +49 (0) 711341817-25
E-mail: info@pe-international.com
Web: www.pe-international.com