Environmental product declaration

ABB Substation Automation Products and the environment

To guarantee structured and effective environmental work within the company, ABB Power Technologies AB has implemented the ISO 14001 environmental management system for Substation Automation Products. The system in itself is not a goal; it only provides guidelines for how environmental work shall be carried out. To show the results of our environmental work and to present the environmental performance of our products, the division for Substation Automation is introducing environmental product declarations for the product line.

At ABB, our products' environmental performance levels and environmental characteristics are determined by:

• *Life Cycle Assessment, LCA*, based on the International standards ISO 14040-43. LCA and its methods have been used to provide a comprehensive picture of how our products affect the environment.
• *Eco-efficient design,* primarily addresses the dismantling and recycling aspects that cannot be quantified with conventional LCAs. These environmental aspects have been evaluated by the concerned designers and product managers at the division.
• *Applicable law,* e.g. for hazardous substances where currently our products are exempt from the ROHS directive of the EU. However, all new designs are prepared to be compliant.

LCA and its general methodology

In accordance with the international standards, LCA is prepared with descriptions of goals and scopes, inventories, and environmental impact assessments. System boundaries, among other things, are established when describing goals and scopes. These limits define the areas to be measured and studied for any given type of environmental impact. Figure 1 shows the various life cycle phases for Substation Automation Products that are subject to environmental assessment. Based on the defined area of measurement, material and energy consumption, and waste and emission, amounts are inventoried and quantified.

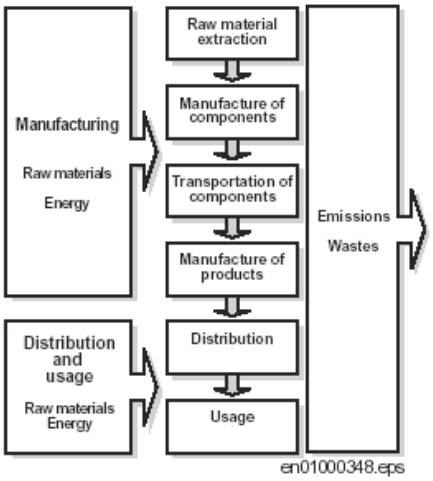

Figure 1: Studied life cycle for Substation Automation

In the following environmental impact assessment, information attained during inventorying is interpreted in terms that describe potential environmental impact. Environmental impact assessments are prepared through classification and characterization, where inventory data during classification is grouped with respect to

enivronmental impact . During the following characterization process, weighed appraisals are made of inventory data within the respective environmental impact categories. This is done because grouped inventory data influence the individual environmental impact categories to various extents.

Characterization results in inventory data within the respective environmental impact categories being converted into single numeric values, expressed as equivalents. In Figure 2, the various environmental impact categories considered for products are shown. Table 1 presents the units used for various environmental impact categories. For additional information on methodology see ISO 14040-43

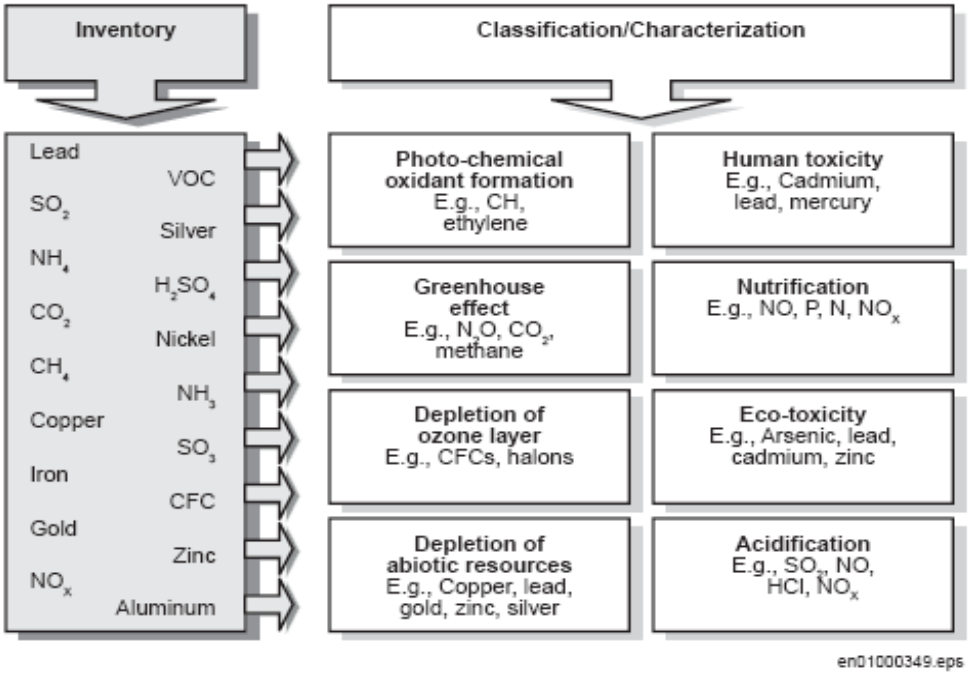

Figure 2: Classification and characterization of inventoried data

Table 1: Units for environmental impact categories

Environmental impact category	Units (Equivalents)
Greenhouse effect	kg carbon dioxide (GWP 100)
Acidification	kg sulfur dioxide (AP)
Abiotic depletion	kg silver
Nutrification	kg phosphate (NP)
Ozone depletion	kg CFC-11 (ODP)
Photochemical oxidant formation	kg ethylene (POCP)
Eco-toxicity (water)	m^3 water exposed to maximum acceptable limits (ECA)
Human toxicity (air)	kg of human body exposed to the maximum acceptable limit for intake of air pollution (HCA)
Human toxicity (water)	kg of human body exposed to the maximum acceptable limit for intake of water pollution

Environmental performance, LCA

Manufacturing

In Table 2 the environmental impact is shown for the manufacture of the products. The COMBIFLEX family products have been grouped, where the impact for the respective group is based on the products marked **bold**. The environmental impact for the 500-series and IED670 for a minimal and maximal configured product.

Table 2: Environmental impact for manufacturing

Product		Environmental impact category								
		Greenhouse effect	Acidification	Abiotic depletion	Nutrification	Ozone depletion	Photochemical oxidant formation	Eco-toxicity (water)	Human toxicity (air)	Human toxicity (water)
500-Series	**REX 5XX,** Minimal configured	67.2	0.4	0.3	2.3E-2	2.8E-5	7.1E-2	1.5E-3	0.7	2.0E-3
	REX 5XX, Maximum configured	94.0	0.5	0.5	3.4E-2	4.3E-5	0.1	2.1E-3	1.0	2.2E-3
IED670	**IED670**, Minimal configured	79.1	0.5	0.4	2.7E-2	3.3E-5	8.4E-2	1.8E-3	0.8	2.4E-3
	IED670, Maximal configured	121	0.6	0.5	4.4E-2	5.5E-5	0.13	2.7E-3	1.3	2.8E-3
Accessories	**Frame(4U)**	8.0	1.6E-2	3.6E-2	1.6E-3	3.8E-7	3.6E-3	5.8E-5	2.1E-2	3.7E-6
	Test switch witch case (RTXP24, RHGS6) 2	20.9	0.1	0.1	9.7E-3	2.5E-6	1.1E-2	4.1E-4	0.1	1.6E-5
	Apparatus bar (6C)	7.4E-2	1.1E-4	3.1E-4	1.1E-5	-	3.3E-5	9.9E-9	1.4E-4	3.4E-8
	Wire units (1 meter)	0.2	1.4E-3	1.8E-3	1.6E-4	9.6E-12	2.0E-4	6.4E-7	2.4E-3	1.4E-8

Table 2: Environmental impact for manufacturing (cont.)

Product		Environmental impact category								
		Greenhouse effect	Acidification	Abiotic depletion	Nutrification	Ozone depletion	Photochemical oxidant formation	Eco-toxicity (water)	Human toxicity (air)	Human toxicity (water)
COMBIFLEX[1]	**RXKL** RXKA1 RXMB1 RXMC1 RXMD1 RXIK1 RXMT1	1.9	1.0E-2	1.2E-2	9.3E-4	8.0E-7	1.5E-3	7.4E-5	1.8E-2	7.2E-6
	RXME1 RXMA1 RXMM1 RXSF1	2.3	1.2E-2	1.6E-2	1.2E-3	4.2E-7	1.1E-3	6.8E-5	1.7E-2	4.1E-6
	RXEDA1 RXETB1	2.5	1.4E-2	1.6E-2	1.2E-3	1.2E-6	2.5E-3	9.0E-5	2.7E-2	1.2E-5
	RXMS1	3.1	1.6E-2	1.7E-2	1.2E-3	5.0E-7	1.3E-3	1.1E-4	2.4E-2	1.6E-5
	RTXP8	3.1	1.7E-2	2.3E-2	1.8E-3	6.3E-7	1.6E-3	9.7E-5	2.5E-2	2.0E-6
	RXKM2H RXMB2 RXMD2	3.6	2.0E-2	2.3E-2	1.8E-3	1.6E-6	3.1E-3	1.4E-4	3.5E-2	1.5E-5
	RXIDK2H RXIDG21H RXEDK2H RXFK2H RXLK2H RXVK2H RXTUG22H	4.2	2.2E-2	2.7E-2	2.0E-3	1.6E-6	3.4E-3	1.4E-4	3.8E-2	1.4E-5
	RXMVB2 RXMA2 RXMH2	4.6	2.2E-2	3.0E-2	2.2E-3	8.4E-7	2.1E-3	1.9E-4	3.2E-2	1.2E-5
	RXPDK2H RXISK2H RXPPK2H RXZK2H	5.9	3.2E-2	3.5E-2	2.6E-3	2.4E-6	5.2E-3	1.8E-4	5.9E-2	2.8E-5
	RTXP18	7.0	3.9E-2	5.2E-2	4.0E-3	1.4E-6	3.6E-3	2.2E-4	5.7E-2	4.4E-6
	RXMBB4	8.5	4.2E-2	5.3E-2	4.4E-3	1.2E-6	3.6E-3	2.2E-4	6.6E-2	1.9E-5
	RTXP24	9.4	5.1E-2	6.9E-2	5.3E-3	1.9E-6	4.8E-3	2.9E-4	7.6E-2	5.9E-6
	RXHL4 RXIDK4 RXIIK4	13.0	7.5E-2	7.6E-2	5.8E-3	7.3E-6	1.6E-2	3.8E-4	1.5E-1	7.4E-5

1) The environmental impact for COMBIFLEX includes terminal bases
2) The environmental impact includes wire units

Distribution and Usage

In contrast to product manufacture, environmental impact from transportation to customers is dependent on where customer operations are situated. Usage is dependent on which energy sources are used for electrical production. In Table 3, environmental impact is shown for two means of distribution for the company's products (average values), as well as environmental impact for electricity production (average European values).

Table 3: Environmental impact for distribution and usage

Product distribution/use	Environmental impact category								
	Greenhouse effect	Acidification	Abiotic depletion	Nutrification	Ozone depletion	Photochemical oxidant formation	Eco-toxicity (water)	Human toxicity (air)	Human toxicity (water)
Truck (tonkm)	0.2	1.4E-3	1.4E-3	2.6E-4	-	6.0E-5	1.2E-7	1.9E-3	1.4E-9
Air (tonkm)	1.8	6.5E-3	1.3E-2	1.0E-3	-	3.5E-4	1.1E-6	8.8E-3	1.3E-8
Electrical Power (MJ)	0.1	8.8E-4	4.9E-4	3.8E-9	8.7E-9	3.1E-5	3.1E-6	1.2E-3	1.3E-6

In Table 4 power consumption is presented for a typical configuration for the various application areas within Substation Automation. Power consumption, during active operation is presented for the COMBIFLEX family, when relevant.

Table 4: Power consumption

Product		Power consumption, normal operation (W)[1]	Power consumption, active operation (W)[2]
IED670 & 500-series	**IED670, REX 5XX** Minimum configured	20	
	IED670, REX 5XX Maximum configured	60	
COMBIFLEX	**RXMB1**	0[3]	2.0
	RXMD1	0[3]	1.4
	RXMH2	0[3]	4.6
	RXKL1	0[3]	2.5
	RXMS1	0[3]	7
	RXKA1	0[3]	2.4
	RXMA1, RXMA2, RXMB2, RXMC1, RXMD2, RXME1, RXKM2H, RXMM1, RXMT1, RXMVB4, RXSF1	0[3]	
	RXMVB2	0[3]	3.0
	RXEDA1	0.4-2.5	3.1
	RXEDK2H	1.3-2.3	
	RXETB1	1.2	
	RXFK2H, RXLK2H	2.0-2.3	
	RXHL4	3.0-3.5	6
	RXIDG21H	1.3-1.4	
	RXIDK2H	1.3-2.1	2
	RXVK2H	1.3-2.1	
	RXIDK4, RXIIK4	3.5-4.0	
	RXIK1	0.7	
	RXISK2H, RXPPK2H, RXZK2H	3.0-3.4	
	RXPDK2H	3.0-3.4	
	RXTUG22H	3.5	

1) The lowest value in the interval for COMBIFLEX that presents in the table refers to auxiliary voltage only. The highest value refers to auxiliary voltage including power when measuring input feeds with rated current and/or rated voltage.
2) Power consumption, maximal operation (Watts).
3) In some applications these relays will be continuously energized. The power will be within the range 1-3 W.

Figures 3, 5 and 4 show how environmental impact is distributed over the studied life cycle phases for a typical product for a COMBIFLEX product and for a 500-series/IED670-product, where the environmental impact from the operation shows the energy consumption. For those products, which do not consume power during normal operation, the environmental impact will be missing.

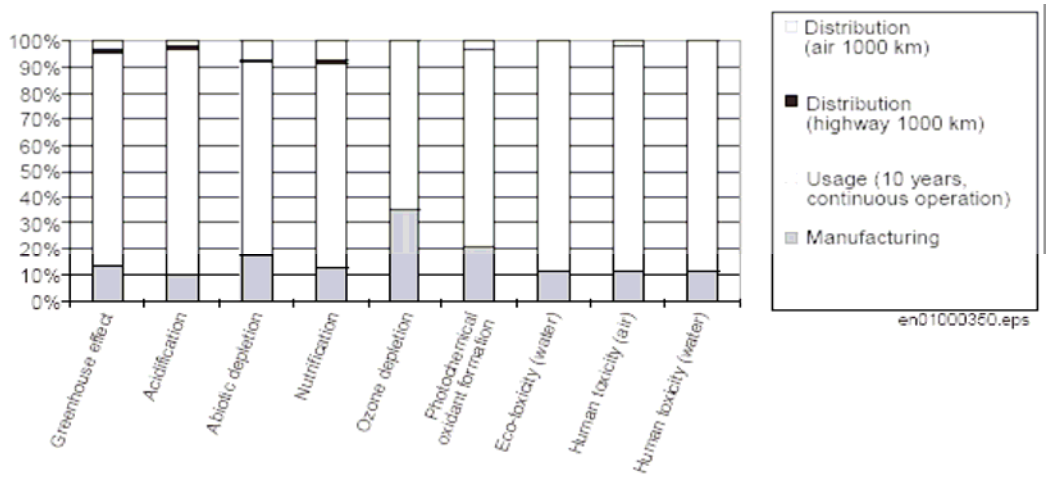

Figure 3: Environmental impact from the life cycle of a typical product

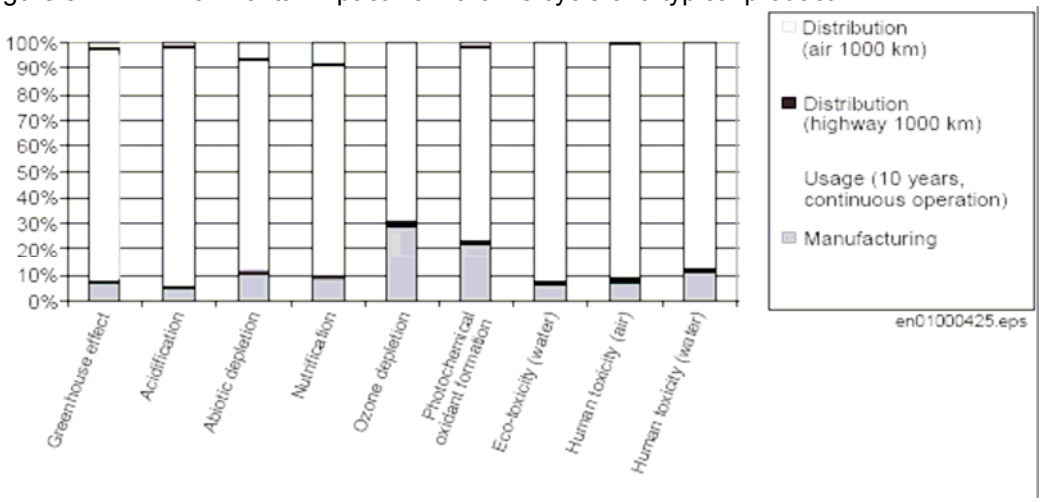

Figure 4: Environmental impact from the life cycle of a 500-series/IED670 product

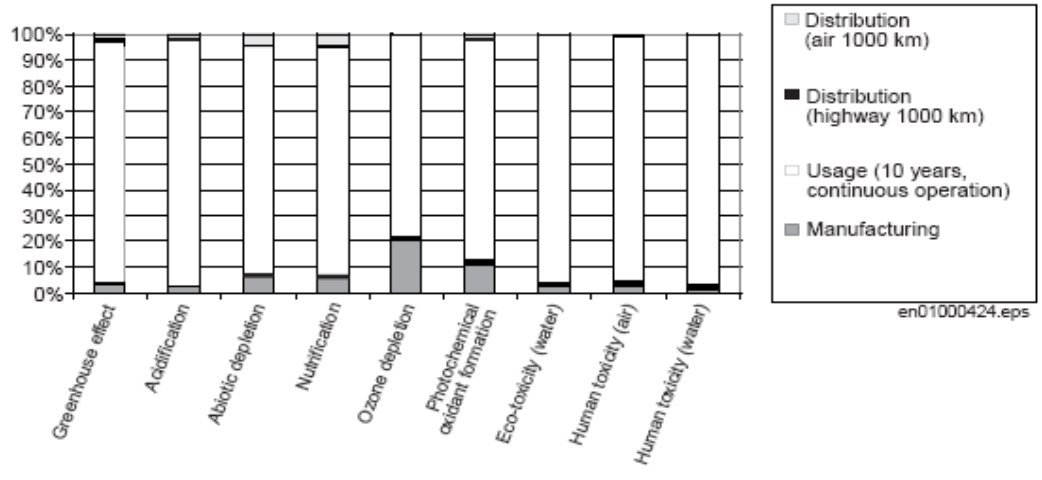

Figure 5: Environmental impact from the life cycle of a Combiflex product

Eco-efficient design

In Table 5 "Electronics" environmental aspects are presented that cannot be examined (quantified) with a conventional LCA.

Table 5: Electronics

Product	Environmental aspects Dismantling/Recycling	Yes	No	Comments
500-Series/IED670	Components containing hazardous materials are easy to identify		X	Materials with known environmentally hazardous properties are used on circuit boards. They are not actively marked
	Components containing hazardous materials are easy to remove	X		Circuit boards and cables are easy to remove.
	Mechanic plastic details are marked according to ISO 11469		X	
	Gluing and/or welding of mechanical details exists		X	
	Metallizing and metal inserts in mechanical details exist			
	Plating, painting and other coating exist on mechanical details	X		
	Dismantling can be carried out using just a few basic standard tools.	X		
	Fastening elements are easily accessible for dismantling products	X		
	Employs fastening elements that enable non-destructive dismantling	X		
COMBIFLEX	Components containing hazardous material are easy to identify.		X	Materials with known environmentally hazardous properties are circuit board, contacts (lead), socket and locking clip (beryllium). These components are not actively marked.
	Components containing hazardous material can easily be removed	X		Circuit boards, cables, contacts, socket and locking clips can easily be removed.
	Mechanical plastic details are marked according to ISO11469.	X		The standard marking consists of a letter and number code to inform which type and content of plastic (plastpolymer), filling substance and softener.
	Mechanical plastic details contain brominated flame retardant.		X	
	Gluing and/or welding of mechanical details exist.		X	Are used in test switch and in terminal bases
	Metallizing and metal inserts in mechanical details exist.	X		
	Dismantling can be carried out using just a few basic standard tools.	X		A standard tool is defined as a tool that is commercially available
	Fastening elements are easily accessible for dismantling products.	X		
	Employs fastening elements that enable nondestructive dismantling.	X		The separated units should be intact in the product structure.
Accessories	Components containing hazardous materials are easy to identify		X	Materials with known environmentally hazardous properties are used on wiring (PVC and beryllium in sockets).
	Components containing hazardous materials are easy to remove.	X		Wirings are easy to remove.
	Dismantling can be carried out using just a few basic standard tools.	(X)		In COMBIFLEX a special tool is needed to remove wirings from terminal bases.
	Fastening elements are easily accessible for dismantling products.	X		
	Employs fastening elements that enable nondestructive dismantling.	X		

Other Environmental Aspects

Material Content

The figures 7, 6 and 8 show the material for a typical product within the COMBIFLEX family, the 500-Series/IED670 and the test system COMBITEST.

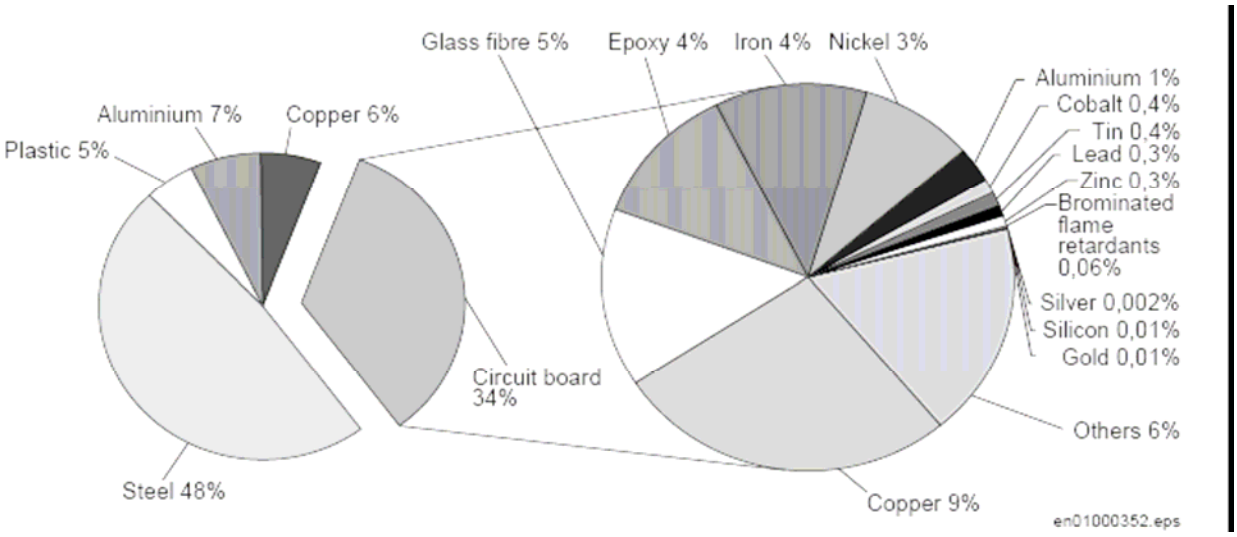

Figure 6: Material content, 500-Series/IED670

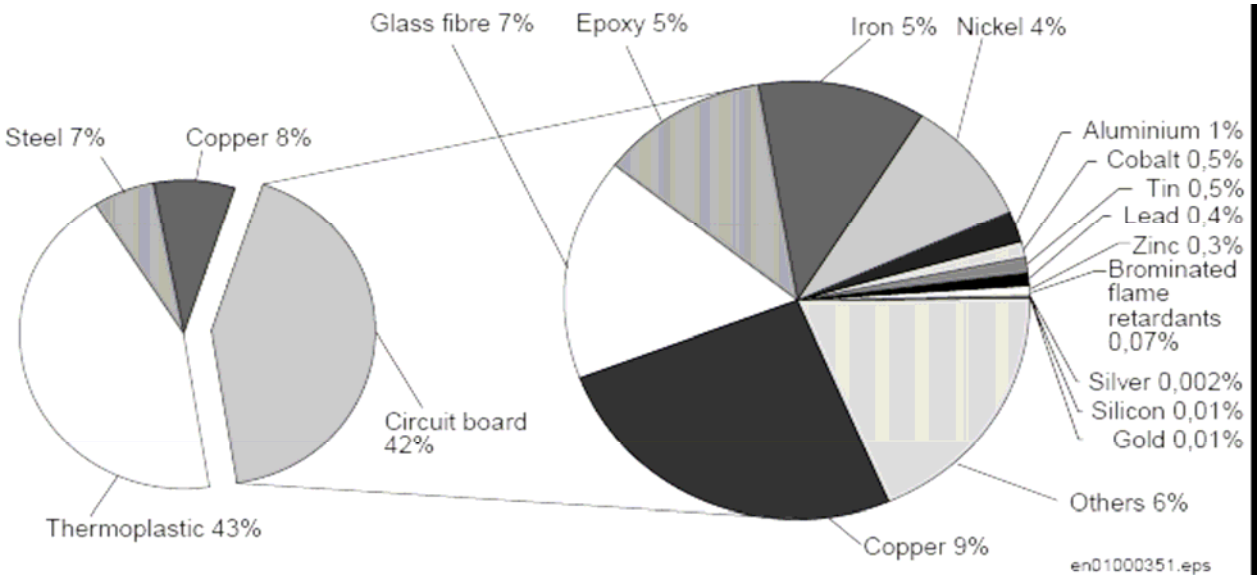

Figure 7: Material content, COMBIFLEX

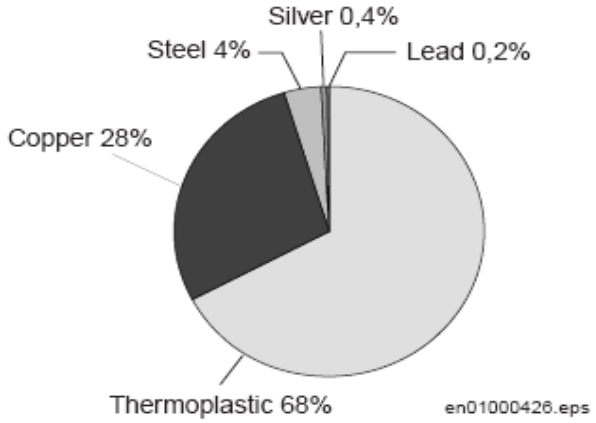

Figure 8: Material content, COMBITEST

Discharged products

While substation automation products are primarily constructed of steel and plastic, circuit boards and wiring are also extensively used. These components contain materials of considerable value, from the environmental perspective. For this reason, worn-out products shall be sent to a recycling facility. At the recycling facility, materials that can be used as raw materials for new products are recycled, and hazardous materials are processed in an environmentally correct manner

.

Manufacturer

ABB Power Technologies AB

Power Systems Division
Substation Automation Products

SE-72159 Västerås
Sweden
Tel: + 46(0) 21 34 20 00
Fax: +46(0) 21 14 69 18