ecolizer 2.0

ecodesign tool

Make the difference
with this guide
to ecodesign!

How · what · why

Make an inventory and limit the use of energy-intensive materials.

Avoid scarce materials.

Make a product as light as technically possible.

Give all components the same lifespan or make sure they can be replaced separately.

Simplify repairs and reuse.

Estimate the duration of the product warranty.

Make a sound analysis of the real need without considering the product as the answer to that need.

Perhaps the product can be used by various people; perhaps a service is a better solution for fulfilment of the need.

What you should know before you start... 00.01

This Ecolizer was developed for designers who wish to analyse the environmental impact of their product. It contains tens of sheets with hundreds of eco-indicators.

Eco-indicators are numbers that reflect the environmental burden of materials, processing procedures, transport, energy, recycling and waste treatment. The higher the score, the bigger the environmental impact.

The first Ecolizer was developed in 2005. Eco-indicators were then calculated using the "Eco-indicator '99 method". Four years later, an update is required. Not only have new data become available, the calculation method has improved as well. As a result, the Ecolizer 2.0 uses both recalculated eco-indicators and the most recent scientific method. This means that you can't use it for comparisons to, or for combining numbers with, data published earlier in the first Ecolizer version.

For calculation of the data, we opted for the "ReCiPe method", the logical and updated successor of the "Eco-indicator '99 method". Environmental impact categories (mid point) and damage categories (end point) were defined and weighed further into one single indicator. For more information on the Ecolizer please visit www.ovam.be/ecolizer.

The data in this Ecolizer are based on the Eco-invent 2.0 database. Using the software programme SimaPro, VITO performed the calculations at the end of 2009.
Although OVAM supports the work method used for the Ecolizer 2.0, not all results or indicators should be considered approved OVAM's point of view.

The Ecolizer 2.0 is meant for internal use, e.g. for product development; it is not intended for environmental marketing, for environmental labels or to publicly prove the advantages of product A over B, nor is it meant for use in the governmental issue of standards and directives.

What you should know before you start... 00.02

The Ecolizer 2.0 is primarily a tool for designers, helping them to assess environmental product impact and to choose the proper material for each individual application. It is a first step towards ecodesign, but not the only one. Defining a life cycle scenario and determining a functional unit of your product/design are particularly important when using the Ecolizer. For some, the Ecolizer will prove too complex and time-consuming, for others it may not be sophisticated enough. Alternatives are available to fulfil the needs of both types of users.

The Ecolizer 2.0 is particularly suitable for calculating the product's environmental impact. A few other ecodesign guidelines, such as nested packaging, modular construction, timeless design, etc., are not taken into account. The Ecolizer 2.0 uses European data only. This must be taken into consideration in case part of a product chain falls outside this scope.

To meet the broad range of materials included in your work as a designer, we also added materials and processes from other disciplines, such as a series of building materials for stand construction and exhibitions. Calculating the environmental impact of a building is, however, not the purpose of the Ecolizer 2.0. Other, more suitable instruments are available for that purpose.

Some materials, such as very specific metal alloys, plastics and textile products, are not included because they are not available in the European databases. In those cases, an estimate on the basis of comparable indicators has preference over omitting the indicator altogether.

Further research on the basis of designers' own findings and feedback will lead to more additions and improvements of the Ecolizer.

With the Ecolizer 2.0, OVAM offers you a scientifically well-founded tool that can help to increase the environmental safety of your design/product. We have tried to make the Ecolizer 2.0 as complete as possible, however, we call on designers and producers availing of more accurate data to have those incorporated in central databases such as Eco-invent and databases under construction in the EU.

Table of contents 00.03

Table of contents 00.04

Why?

The Ecolizer 2.0 allows designers to easily analyse which materials, processes, components or life cycle phases contribute most significantly to a product's environmental impact. Additionally, you can compare various material and product alternatives.

As a designer, while developing a product you will determine various parameters defining its environmental impact throughout its life cycle. Your decision to choose a specific material or process immediately affects the impact on the environment.

With this Ecolizer 2.0, OVAM hands you a basic tool that can help you to make expert decisions in that respect.

The OVAM considers ecodesign to be one of the most powerful strategies for its waste and materials policy. At the same time, product designers and companies are challenged to create better value with less impact by using scarce materials and energy sources more economically.

The OVAM is convinced that eco-design drives producers to a higher degree of innovation, and companies to engage in it.
Working with environmental indicators is one of several possibilities to apply ecodesign. Depending on the purpose or the assignment, other methods are available as well.

What?

Each product has an impact on the environment and their impact will vary. Raw materials need to be extracted; the product must be manufactured, distributed and packed. At the end of its life, it is disposed of.
In addition, environmental impact may occur during use as a result of the product's energy or material consumption. As a result, all phases of the life cycle need to be considered if we seek to establish the environmental impact of a product. An environmental analysis of all life phases is called a Life Cycle Analysis.

Eco-indicators of materials and processes have been established for the Ecolizer 2.0. An eco-indicator is a criterion for measuring the environmental impact of a material or process. The higher the indicator, the greater the environmental burden.

The eco-indicator is literally an indicator: it is merely indicative. As such, the absolute value of the Eco-indicator does not carry a lot of practical weight. It is the relative comparison of materials and processes that counts. One eco-indicator point corresponds to one thousandth of the total annual environmental burden caused by an average European. The unit used in Ecolizer 2.0 is a millipoint (Mpt) and hence corresponds to one millionth of that environmental burden.

The first Ecolizer was created in 2005. Eco-indicators were then calculated using the "Eco-indicator '99 method". Four years later, an update was required. Not only have new data become available, the calculation method has improved as well. As a result, the Ecolizer 2.0 uses both recalculated eco-indicators and the most recent scientific method. This means that you can't use it for comparisons to, or for combining numbers with, data published earlier in the first Ecolizer version.

For calculation of the data we chose the “ReCiPe method”, the logical and updated successor of the “Eco-indicator ’99 method”. It integrates environmental impact categories (mid point) and damage categories. ReCiPe includes no less than 19 environmental impact categories (such as ozone layer depletion, acidification and eutrophication, human and eco-toxicity, use of land and water and exhaustion of raw materials,...). These 19 environmental impact categories are further calculated into three environmentally damaging categories: impact on human health, impact on ecosystems and exhaustion of raw materials. As for weighing, ReCiPe uses the same principles as the Eco-Indicator ’99 method.

The following table shows the average weighing factors for impact:

Human health	400
Ecosystems	400
Raw materials	200

After calculation of the impact of a certain material on the individual environmental categories, that impact is translated into ‘damage’. Using the weighing factors from the table, the impact for each damage category is finally expressed in one single indicator. That indicator can be found in the sheets.

Please observe that these numbers have a relatively high uncertainty. Small differences between scores for two products must be treated with particular care.

How do you define a product's environmental impact?
In most cases, a simple approach, starting with a "rough" calculation is best.
Adding details and reviewing or including data can be done at a later stage.
You thus avoid losing too much time on the details.

For a correct application of the Ecolizer, you will always work through the following steps.

Step 1
Describe the product or product part under analysis or comparison and define the accuracy.

Step 2
Draw a diagram of the product's life cycle with equal attention for production, use and waste treatment. Depending on relevance, transport and recycling can be included as well.
Detailed examples are provided further down.
More information and a template for an overview matrix can be found on the website: www.ovam.be/ecolizer.

Step 3
Quantify and record the materials and processes, determine a functional unit and make estimates with regard to unavailable data.
Find the accompanying eco-indicator values and calculate the scores by multiplying quantities with indicator values.

Step 4
Make an interpretation of the results, check the estimates and uncertainties and draw conclusions.
The most important processes and phases in the life cycle or which alternative comes out best can be derived from the highest scores.
Always check the influence of estimates and uncertainties: how does a slightly changed estimate affect the result?
Does the main conclusion hold its ground or do priorities or product preferences change?
If that is the case, you will have to revise the estimate and search for additional information.

What to do when information is missing?
The calculation of the indicators depends on available, independent data. If no specific data are available, the Ecolizer will suggest a comparable indicator. These will be marked with a (!), to point out that this indicator is not specific for the material or process in question.

For example: the indicator available for polyethylene plastics, is the one that is specific for the treatment 'extrusion blow moulding (film)'. Since no specific data are available for polypropylene plastics, but both plastics are comparable, the polypropylene sheet also carries the indicator for 'extrusion blow moulding (film)'. To point out that the indicator is non-specific, a (!) is added. No mention of an indicator means that no generic or replaceable indicator was available.

The lack of an indicator value for any material or process can be dealt with as follows:

Check whether the missing indicator significantly contributes to the total environmental impact. Leaving out a material or process for lack of an indicator value is only allowed when the expected contribution of that particular part is clearly minimal.
Making an estimate or choosing a substitute usually has preference over leaving it out.

You can also replace the unknown indicator with a known indicator. Indicator values for one group mostly have the same order of magnitude, and often allow you to make an estimate of the same order of magnitude for the missing indicator.

Negative numbers for recycling and waste treatment
Recycling and waste scenarios often lead to negative numbers. For recycling, this is caused by deducting the primary material that has been saved; they occur for waste treatment when useful energy or material is released. The energy and materials that are taken back can be considered as profitable for the environment.

For instance: redemption of 1 kg of scrap material means that less iron ore needs to be extracted elsewhere. You can therefore deduct the environmental effects of the production of 1 kg raw iron from the environmental impact of the related product. In LCA jargon these are called “credits”. The Ecolizer 2.0 uses the term “primary material saved”. Designers who effectively realise this environmental profit by using recycled materials may count the corresponding credits accordingly. Use of materials that ‘might’ be suitable for recycling, may not be considered as ‘credit’. Credits for saved materials can only be settled once in the entire process.

What is included in a sheet?

Production
This area covers all production data on the following sheets for more information.

Processes
This area covers all treatment data on the following sheets for more information.

Recycling/waste treatment
This area covers all recycling and waste treatment data. Please refer to the concepts on the following sheets for more information.

Legend

Black indicator
The indicator is based on a large quantity of trustworthy production data relating to that specific material or process.

Grey indicator
The indicator is based on less trustworthy data, or the quantity of data used as a basis was limited.

An exclamation mark (!)
Indicates that generic data for this group of materials are included. Where specific data are unavailable, Ecolizer 2.0 suggests an indicator from a similar material or process.

Units and abbreviations

mPt
The indicator's value is entered as millipoints (mPt) per kg, per km, per m, etc.
Attention: this may lead to various materials carrying several units.

dna
data not available in the databases

na
not applicable

Production (of materials)

The whole of production processes, starting from the extraction of raw materials, on the basis of 1 kg of materials, unless otherwise stated. Transport processes are included as well, up until the last process in the production chain.

Transport processes

For transport processes, the calculation is made on the basis of the emission impact caused by extraction and production of fuel and by generating energy from fuel while driving.

Energy generating processes

Extracting and producing fuels and generating energy. The electricity score takes into account the various fuels used in Europe to generate electricity.
An eco-indicator has been defined for high voltage, meant for industrial processes. The low voltage eco-indicator is meant for household and small industrial electricity consumption. The difference is mainly in electricity loss and infrastructure such as high voltage cables.
The significant differences between countries originate from the various production techniques and fuels. Green power applications also have an environmental impact, since their production and infrastructure count as well.

Processes

Treatment and processing of various materials. Expressed per treatment in the unit which determines that process (e.g. square meters of rolled metal plate or per kg extruded plastics).

Reuse

Any product ending up in the disposal phase will be examined for partial or whole reuse. In principle, the environmental impact caused by offering the disposed product to a new user for reuse, is negligible. Reuse shops in Flanders are a good example of how reuse is being stimulated.

Recycling

Recycling entails closed loop collection of disposed products and their subsequent treatment for recovery of the used materials. Unfortunately, the term recycling is often applied to other treatments than recycling. Recycling is more than finding a useful purpose for certain materials.

By contrast, recycling does encompass all useful applications that reprocess waste into products and substances for the original or some other purpose. Hence reprocessing organic waste is included, but energy recovery is not, nor is reprocessing into materials intended to be used as fuel or as filling materials.

The Ecolizer limits the definition of recycling to those actions that ensure maximum retention of materials within a closed materials cycle. According to this definition, recycling does not include the treatment of waste into fuels. As a result of the incineration process, the major part is converted into emissions to the atmosphere; the material leaves the materials cycle. The energy gained from this process is obviously a positive thing, however the Ecolizer 2.0 does not consider it to be recycling.

High-grade recycling of materials for the original purpose is preferable because it produces materials that can be used for the application again. Low-grade recycling for a different purpose often involves a material stream that can no longer be used in the same application. This is also called down-cycling. Down-cycling is preferred over incineration or landfilling, however the material loses much of its value because it can no longer be used for the same purposes.

Recycling of materials is determined by the type of material and the purpose it had. In general, proper recycling cannot take place unless during its life cycle and particularly upon collection as waste, the material retains maximum purity. Applying eco-design principles can highly contribute to this. One of the major advantages of eco-design is that product design can allow for disassembly as well as recycling, or at least easier application thereof. A sophisticated design considers those issues from the start.

Recycling various materials

Metal and glass can and usually are submitted to high-grade recycling because their structure and purity are retained in most applications.

Provided its pollution is within limits, particularly solid wood can find new applications as timber sheets. Timber products such as MDF and chipboard on the other hand, are not or hardly recyclable. Sustained wood waste cannot be recycled either and undergoes an incineration and energy recovery procedure.

Plastics can only be recycled if they stay pure enough. The more plastics are polluted by colorants and other additives, the less likely their effective recyclability becomes. Although technology advances rapidly, plastics are currently seldom recycled for the same application. Applications with a mix of recycled plastics into a new raw material do exist, but a large part of the plastics is combusted with energy recovery. Plastic waste distinguishes between pre-consumer and post-consumer stream. Pre-consumer waste that is released during the production process can usually undergo high-grade recycling immediately and usually matches the primary raw material. It is much harder to assess a possible application for post-consumer waste. Much depends on market demand and economic profitability of the individual treatments (sorting, washing, grinding, etc.). As a result of quality loss from mixing plastics, this stream is more likely to be used for thick-walled applications or black foils.

The indicators for a waste scenario apply if recycling proves impossible. You will find indicators for European waste treatment. The indicator always contains a landfilling vs. incineration relation for this specific material.

The waste scenarios are based on the concept that 80% of European waste is being landfilled and 20% incinerated.
In the Flemish Region, household waste is collected by, or by order of the municipalities. Because a broad range of waste materials is offered for recycling, composting or reuse, the quantity of residual waste lies below the European average. 98% of Flemish residual waste is incinerated and 2% is being landfilled.

The recycling indicators are relevant only if you are positive that the product fully runs via the indicated waste treatment, or if you seek to estimate a mix of waste treatments, e.g. for electronic appliances.

In an average household in Flanders, materials such as glass, paper, PMD (plastic, metal and drink cartons) and GFT (vegetable, fruit and garden) waste are collected separately and subsequently recycled. The remaining is offered as residual waste. Residual waste is waste consisting of a mix of materials that can't be collected or selected separately.

Inclusion of the 'total' indicator for recycling is required if you wish to incorporate recycling into your calculations. If no indicator is provided, you can select an indicator for "primary materials saved". This value can be chosen from the indicators for "production" on top of the sheet.

Recycling prevents the production of new materials. The environmental impact from the process or the "primary materials saved" can vary considerably. The tables show both the environmental impact from the recycling process and the "profit" from the primary material saved.

Please consider the numbers reported here as an example of a possible situation and handle them with corresponding caution.

Template analysis matrix

00.16

Product component		**Project**	
Date		Author	
Remarks and conclusions			
Production			
Material or process	Quantity	Indicator	Result
In this section you can list all materials, processes, transport and additional energy required for the manufacture of your product.			
Total			
Transport			
Material or process	Quantity	Indicator	Result
Here you can list all transport required for your product.			
Use			
Process	Quantity	Indicator	Result
Here you can list all auxiliary materials, transport and energy required for normal use of your product.			
Total			
Disposal			
Material and type of processing	Quantity	Indicator	Result
List all recycling and/or disposal processes per material type here.			
Total [mPt]			
Total for all phases [mPt]			

For each alternative you can fill in an analysis matrix. It allows you to make a direct comparison of the environmental impact effects of various production methods.

Detailed example 1

Depending on demand, situation and relevance, phases like transport or recycling/waste treatment can be added to the calculation.

Coffee machine

Product or component: coffee machine	**Project: example 1**		
Date: 2009	Author		
Analysis based on 5-year use, twice a day, at medium capacity, kept warm for 30 minutes. The appliance follows the EU waste scenario in the disposal phase.			
Production			
Material or process	Quantity kg	Indicator	Result
ABS	1	431	431
Injection moulding ABS	1	126	126
Aluminium	0,1	1045	105
Extrusion al	0,1	75	8
Steelplate	0,3	195	59
Glass	0,4	91	36
Heat for glass production	4 Mj	7,1	28
		Total	**793**
Consumption			
Process	Quantity kg	Indicator	Result
Electricity LV	375 Kwh *	31	11625
Paper	7,3 Kg	261	1905
		Total	**13530**
** Deduced from measurements*			
Disposal			
Material and type of processing	Quantity kg	Indicator	Result
ABS scenario waste treatment in EU	1	45	45
Steel scenario waste treatment in EU	0,3	26	7,8
Aluminium scenario waste treatment in EU	0,1	26	2,6
Glass scenario waste treatment in EU	0,4	na	-
Paper scenario waste treatment in EU	7,3	9	66
		Total	**121**
		Total across all phases	**14444**

The next sheet contains the interpretation of the results of this sample analysis.

Interpretation of the results from the detailed example.

The results indicate that the user phase has the highest impact.

The score is much higher than the totals for the production phase and the waste phase.

Your aim as a designer should therefore be to
- cut down on energy consumption,
- reduce use of paper (filters) and
- reduce the environmental impact of the plastic compartment by saving material or by choosing an alternative material.

Check
The influence of assumptions is, in this case, negligible, except for those related to use and lifespan.

The measured electricity consumption is reasonably accurate, but the assumption that for a period of five years, coffee will be made twice a day that will be kept warm for 30 minutes, is not founded on concrete data. Even when assuming that the appliance will be used only once a week, the conclusion that energy consumption is the dominant factor still stands.

The indicator values of the assumptions relating to disposal of aluminium and paper do not give cause for other conclusions.

Even with the correct disposal figures, the contribution of the waste phase will remain only a fraction of the indicator for the consumption phase.

Improvements
Based on this eco-indicator calculation, you could consider designing a coffee machine with a thermos flask instead of a keep warm facility.

Furthermore, you could equip the machine with a permanent filter instead of single-use paper filters.

Detailed example 2

Chair

Product or component: chair	Project: example 2
Date: 2009	Author

A chair with a polypropylene (PP) seating and a plied stainless steel frame. The frame is connected to the seating by four stainless steel screws. The chair's life cycle is estimated at 15 years, but since it doesn't cause any impact during use, this is hardly relevant. There is no energy consumption involved and maintenance products are not required. Delivery per van to the customer averages out at 150 km. Recycling is always the preferred waste phase. We detailed both recycling and conventional waste treatment to show you the difference in environmental impact.

Data

Polypropylene seating 2 kg - injection moulding
Frame made from secondary stainless steel 3 kg - rolling - 20 cm bending
4 screws stainless steel 0.01 kg - milling
transport per van <3.5 tonnes

Production

Material or process	Quantity kg	Indicator	Result
PP seating	2	276	552
Injection moulding PP	2	126	252
Stainless steel primary	3,04	551	1675
Stainless steel plate rolling	3	59	177
Stainless steel bending	20 cm	2	40
Stainless steel milling	0,04	704	28
		Subtotal	**2724**

Transport

Process	Quantity kg	Indicator	Result
Total weight	5 Kg = 0,005 tonnes		
Van		186	
Transport distance	150 Km -> 0,75 tkm		
		subtotal	**140**

Disposal

Material and type disposal	Quantity kg	Indicator	Result
Recycling option			
Recycling polypropylene	2	-251	-502
Recycling stainless steel	3	-475	-1425
		Total for option 1: recycling	**937**
Waste treatment option			
PP scenario waste treatment in EU	2	36	72
Stainless steel scenario waste treatment in EU	3	26	78
Total for option 2: waste treatment in EU			**3014**

Conclusions and options for improvement

A first option is to decrease the weight of the chair. You might additionally consider substituting a different metal for stainless steel. Make sure of a design that is compatible with the available recycling system and check whether high-grade recycling is possible in reality.

Detailed example 3

00.20

Built-in spotlight with LED or halogen

Product or component: built-in spot	Project: example 3
Date: 2009	Author

Built-in spotlight with aluminium compartment 0.3 kg - casting - powder coating.
Equipped with 20 LED lights with a life cycle of 50,000 hours under Flemish circumstances.
Production, consumption and waste phase are included in the calculation. After use, the spot ends up in a EU waste scenario. No data available for halogen and LED in the waste scenario.

Data

Casing 0.3 kg from secondary aluminium post consumer- high pressure casting - powder coating 0.25 m^2
20 LED lights with a total capacity of 5 watt and a lifespan of 50,000 hours and equipped with a 2 watt power supply.
The lamp can also be equipped with a 35 watt halogen spotlight with a 2,000 hour lifespan. For the same application we thus need 25 halogen lamps.

Production			
Material or process	Quantity	Indicator	Result
Secondary aluminium	0.3 Kg	134	40
Aluminium high pressure casting	0.3 Kg	382	115
Aluminium powder coating	0.25 M^2	337 84	84
20 LED 5 W	20 pieces	7	140
2 W power supply	per piece	2723	2723
Halogen lamps 35 watt	25 pieces	3	75
		Subtotal LED	**3102**
		Subtotal halogen	**314**

Consumption 50,000 hours			
Process	Quantity	Indicator	Result
20 LED 5 W	250 KWh	31/kWh	7750
Power supply: 2 W	100 KWh	31/kWh	3100
Halogen lamp 35 Watt	1750 KWH	31/kWh	54250
		Subtotal LED	**10850**
		Subtotal halogen	**54250**

Disposal			
Material and type disposal	Quantity	Indicator	Result
Aluminium	0,3 Kg	26	8
		Subtotal LED	**13960**
		Subtotal halogen	**54572**

Conclusions and options for improvement

Compared to other lamps, the energy consumed by this spot-light with LED is much lower, yet energy consumption remains the most dominant phase and has an impact three times higher than production. With respect to production, power supply is the heaviest weighing factor. So even for LEDs, the user phase remains an important point of attention, particularly because they have a long life span.
When compared to the halogen version, energy consumption becomes a predominant factor and despite a higher score for the production phase, the LED version gets better marks.

Ferrous metals

Minimise the number of components, materials and processes.

Use materials to maximum efficiency and minimise production waste.

Iron

01.01

PRODUCTION	*mPt/kg*
Cast iron/kg**	**173**
Iron scrap/kg	**dna**

PROCESSING	*mPt*
Zinc coating (coils)/m^2	**735** (!)
Drilling, CNC*/kg	311
Drilling, conventional/kg	293
Turning, CNC*/kg	357
Turning, conventional/kg	300
Enamelling/m^2	**841** (!)
Milling/kg	310
Zinc coating, pieces/m^2	**671** (!)
Casting, mechanical/kg	168
Casting (sand, mechanical)/kg	77

RECYCLING	*mPt/kg*
Proces	**76**
Primary material saved	**-173**
Total	**-97**

WASTE TREATMENT	*mPt/kg*
Waste treatment scenario in the EU	**26** (!)

* Computer Numerical Control.
** Cast iron, consisting of 35% secondary material.

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

Stainless Steel 01.02

PRODUCTION	mPt/kg
Stainless Steel 18/8 (converter, primary)/kg	**551**
Stainless electric Steel 18/8 (secundary)/kg	**511**

PROCESSING	mPt
Drilling, CNC*/kg	708
Drilling, conventional/kg	672
Bending/cm	2
Chemical staining	**dna**
Deep drawing, automode operation/kg	26 (!)
Deep drawing, 650 kN press, single stroke operation/kg	28 (!)
Deep drawing, 3500 kN press, single stroke operation/kg	30 (!)
Deep drawing, 10000 kN press, single stroke operation/kg	36 (!)
Deep drawing, 38000 kN press, single stroke operation/kg	38 (!)
Turning, CNC*/kg	789
Turning, conventional/kg	682
Electrolytic staining	**dna**
Elektrochemical polishing	**dna**
Enamelling/m^2	**841 (!)**
Milling/kg	704
Stamping/kg	40 (!)
Polishing	**dna**
Spot welding/pt	1 (!)
Abrade	**dna**
Punching/cutting/cm^2	0,0154
TIG welding	**dna**
Black chrome coating, plate/m^2 (only Cr3 tolerated)	58
Sheet rolling/kg	**59**

RECYCLING	mPt/kg
Proces	**76 (!)**
Primary material saved	**-551**
Total	**-475 (!)**

WASTE TREATMENT	mPt/kg
Waste treatment scenario in the EU	**26 (!)**

*Computer Numerical Control.

No data available of the processes: folding, orbital revetting, clinching, floating and profiling.

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

PRODUCTION	mPt/kg
Primary	
Low-alloyed (converter)**	**231**
Un- alloyed (converter)	**165**
High-alloyed	**dna**
High strength steel	**dna**
Secundary	
Low-alloyed (average)	**195**
Un-alloyed or low-alloyed (elektrosteal)	**61**

PROCESSING	mPt
Zinc coating, coils (continuous)/m²	**735** (!)
Welding/m	15
Drilling, CNC*/kg	340
Drilling, conventional/kg	311
Bending/cm	1,4
Deep drawing, automode operation/kg	26
Deep drawing, 650 kN press, single stroke operation/kg	28
Deep drawing, 3500 kN press, single stroke operation/kg	30
Deep drawing, 10000 kN press, single stroke operation/kg	36
Deep drawing, 38000 kN press, single stroke operation/kg	38
Wire drawing/kg	**40**
Turning, CNC*/kg	398
Turning, conventional/kg	318
Sheet rolling/kg	11 (!)
Enamelling/m²	**841** (!)
Milling/kg	337
Welding, gas (autogenous)/m	**dna**
Hardening/kg	9
Sheet rolling, steel/kg	35
Laser cutting/m (4 mm steel)	17
Stamping/kg	40 (!)
Plasma cutting	**dna**
Powder coating/m²	**424**
Section bar rolling/kg	**20**
Spot welding/pt	**1**
Forge	**dna**
Punching/cutting/cm²	0,0107
Drawing of pipes/kg	**44**
Ultrasonic welding/m	**dna**
Black chrome coating, plate/m²(only Cr3 tolerated)	**dna**
Zinc coating, pieces/m²	**671** (!)
Zinc coating (extra thickness)/m²	**dna**
Hot rolling/kg	**27**
Waterjet cutting	**dna**

RECYCLING	mPt/kg
Proces	**76** (!)
Primary material saved	**-231**
Total	**-155** (!)

WASTE TREATMENT	mPt/kg
Waste treatment scenario in the EU	**26** (!)

* Computer Numerical Control.
** Primary material + 1% Cr, 1% Mn, 1% Mo, 1% Ni.

No data available for tin-plate.

Ferrochromium 01.04

PRODUCTION	*mPt/kg*
Ferrochromium (primary)/kg	**379**

PROCESSING	*mPt*
Zinc coating, coils/m²	**735** (!)
Drilling, CNC*/kg	311 (!)
Drilling, conventional/kg	293 (!)
Turning, CNC*/kg	357 (!)
Turning, conventional/kg	300 (!)
Enamelling/m²	**841** (!)
Milling/kg	310 (!)
Industrial Casting/kg (casting, sand, mechanized)	77 (!)
Zinc coating, pieces/m²	**671** (!)
Casting (sand), mechanical/kg	168 (!)

RECYCLING	*mPt/kg*
Proces	**76** (!)
Primary material saved	**-379**
Total	**-303** (!)

WASTE TREATMENT	*mPt/kg*
Waste treatment scenario in the EU	**26** (!)

*Computer Numerical Control.

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

Ferronickel 01.05

PRODUCTION	
Ferronickel/kg	1105

PROCESSING	*mPt*
Zinc coating (coils)/m²	**735** (!)
Drilling, CNC*/kg	311 (!)
Drilling, conventional/kg	293 (!)
Turning, CNC/kg	357 (!)
Turning, conventional/kg	300 (!)
Enamelling/m²	**841** (!)
Milling/kg	310 (!)
Industrial Casting/kg (casting, sand, mechanized)	77 (!)
Zinc coating, pieces/m²	**671** (!)
Casting (sand)/kg	168 (!)

RECYCLING	*mPt/kg*
Proces	**76** (!)
Primary material saved	**-1105**
Total	**-1029** (!)

WASTE TREATMENT	*mPt/kg*
Waste treatment scenario in the EU	**26** (!)

*Computer Numerical Control.

Black indicator: trustworthy data
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dna: data not available
na: not applicable

Non-ferrous metals

Make an inventory and limit the use of energy-intensive materials.

Avoid scarce materials.

Make a product as light as technically possible.

Aluminium

PRODUCTION	mPt/kg
Aluminium, primary/kg	
Aluminium**	**1045**
Aluminium alloy EN AW5754, (AlMg3)/kg	439
100% recycled	
Secondary, from old scrap	**134**
Secondary, from new scrap	**45**

PROCESSING	mPt
Anodising/m²	338
Welding/m	18
Drilling, CNC*/kg	868
Drilling, conventional/kg	848
Bending/cm	0,8
Gravity die-casting	**dna**
Deep drawing, automode operation/kg	**26** (!)
Deep drawing, 650 kN press, single stroke operation/kg	28 (!)
Deep drawing, 3500 kN press, single stroke operation/kg	30 (!)
Deep drawing, 10000 kN press, single stroke operation/kg	36 (!)
Deep drawing, 38000 kN press, single stroke operation/kg	38 (!)
Turning, CNC*/kg	942
Turning, conventional/kg	861
Sheet rolling/kg	11 (!)
Enamelling/m²	**841** (!)
Milling/kg	874
Friction stir welding	**dna**
Casting, continuous casting/kg	382
Casting, sand, low pressure/kg	27
Pultrusion/kg	**dna**
Laser cutting/m (4 mm steel)	**dna**
Stamping/kg	40 (!)
Precipitation hardening	**dna**
Powder coating/m²	**337**
Section bar extrusion/kg	**92**
Spot welding/pt	4,7
Cold impact extrusion, 1 stroke/kg	75
Cold impact extrusion, every extra stroke/kg	27
Forge	**dna**
Selective coating of plate - nickle-aluminium oxide/m²	550
Punching/cutting/cm²	0,0064
Sheet rolling/kg	**53**
Ultrasonic welding/m	0,17 (!)
Contour	**dna**

RECYCLING	mPt/kg
Proces	**130**
Primary material saved	**-1045**
Total	**-915** (!)

WASTE TREATMENT	mPt/kg
Waste treatment scenario in the EU	**26** (!)

* Computer Numerical Control.
** Primary material + 1% Cr, 1% Mn, 1% Mo, 1% Ni.

Bronze

PRODUCTION	*mPt/kg*
Bronze/kg**	**938**

PROCESSING	*mPt*
Drilling, CNC*/kg	787 (!)
Drilling, conventional/kg	772 (!)
Turning, CNC*/kg	830 (!)
Turning, conventional/kg	780 (!)
Sheet rolling/kg	11 (!)
Enamelling/m^2	**841 (!)**
Milling/kg	dna
Casting/kg	**dna**
Stamping/kg	40 (!)
Contour/kg	**dna**
Ultrasonic welding/m	0,17 (!)

RECYCLING	*mPt/kg*
Proces	**76 (!)**
Primary material saved	**-938**
Total	**-862 (!)**

WASTE TREATMENT	*mPt/kg*
Waste treatment scenario in the EU	**26 (!)**

* Computer Numerical Control.
** Material consisting of 95% Cu and 5% Sn.

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

Copper

PRODUCTION	*mPt/kg*
Copper**	**774**

PROCESSING	*mPt*
Drilling, CNC*/kg	787 (!)
Drilling, conventional/kg	772 (!)
Selective coating of plate- titanium nitride oxide/m^2	69
Wire drawing/kg	**209**
Turning, CNC*/kg	830 (!)
Turning, conventional/kg	780 (!)
Sheet rolling/kg	11 (!)
Enamelling/m^2	**841 (!)**
Milling/kg	**dna**
Stamping/kg	40 (!)
Ultrasonic welding/m	0,17 (!)
Black chrome coating, plate/m^2	237
Sheet rolling/kg	**127**

RECYCLING	*mPt/kg*
Proces	**76 (!)**
Primary material saved	**-774**
Total	**-698 (!)**

WASTE TREATMENT	*mPt/kg*
Waste treatment scenario in the EU	**26 (!)**

* Computer Numerical Control.
** 44% secundary material.

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

Brass

02.04

PRODUCTION	mPt/kg
Brass**	**683**
Brazing solder, cadmium free***	**646**

PROCESSING	mPt
Drilling, CNC*/kg	787
Drilling, conventional/kg	772
Turning, CNC*/kg	830
Turning, conventional/kg	780
Sheet rolling/kg	11 (!)
Enamelling/m^2	**841 (!)**
Milling/kg	dna
Casting/kg	**dna**
Stamping/kg	40 (!)
Contour/kg	**dna**
Forging	**dna**
Ultrasonic welding/m	0,17 (!)

RECYCLING	
Proces	**76 (!)**
Primary material saved	**-683**
Total	**-607 (!)**

WASTE TREATMENT	mPt/kg
Waste treatment scenario in the EU	**26 (!)**

* Computer Numerical Control.
** 70% Cu and 30% Zn.
*** 60% Cu and 40% Zn.

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

Tin

PRODUCTION	mPt/kg
Soft solder/kg**	**3347**
Tin (primary)/kg	**dna**

PROCESSING	mPt
Drilling, CNC*/kg	**787** (!)
Drilling, conventional/kg	**772** (!)
Turning, CNC*/kg	**830** (!)
Turning, conventional/kg	**780** (!)
Sheet rolling/kg	**11** (!)
Enamelling/m^2	**841** (!)
Milling/kg	**dna**
Stamping/kg	**40** (!)
Ultrasonic welding/m	**0,17** (!)

RECYCLING	mPt/kg
Proces	**76** (!)
Primary material saved	**-3347**
Total	**-3271** (!)

WASTE TREATMENT	mPt/kg
Waste treatment scenario in the EU	**26** (!)

* Computer Numerical Control.
** 97% Sn, 3% Cu.

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

PRODUCTION	*mpt/kg*
Chromium (primary)	**dna**
Cobalt	**dna**
Coltan	**dna**
Mercury, liquid	1163775
Lead (primary)	**135**
Magnesium	**3768**
Manganese (primary)	**dna**
Nickel*	**2653**
Palladium primary (3% secundary)	**7119111**
Palladium (secondary)	**63054**
Platinum (5% secondary)	**4661326**
Platinum, secondary	**63042**
Rhodium (15% secundary)	**9558421**
Rhodium (secundary)	**63545**
Titanium zinc plate	**551**
Titanium dioxide	**466**
Zinc, for coating (primary)	**390** (!)

* Minimum 99,5% nickel.

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

Plastics

Use a limited number of various materials and choose materials that could get a new life in other products at a later stage.

Use plastics at maximum purity to enable recycling at a later stage.

Only combine plastics that don't render the recycling process impossible.

Ensure the material doesn't contain any toxic or "suspicious" substances.

Design in function of assembly and disassembly and mark the individual materials to enable easier recycling.

Use fastening techniques that allow for easy separation of the individual materials at a later stage.

ABS

Acrylonitrile-butadiene-styrene copolymer

03.01

PRODUCTION	mPt/kg
ABS/kg	431

PROCESSING	mPt
Revolving, milling, drilling/cm^3	0,01 (!)
Hot element welding (30sec) /welding	2 (!)
Hot element welding (45min) /welding	155 (!)
Extrusion, plastic film/kg	49 (!)
Extrusion, plastic pipes/kg	36 (!)
Stretch blow moulding/kg	131 (!)
Blow moulding/kg	123 (!)
Laser welding/m	0,46 (!)
Foaming/kg	60 (!)
Rotation Forming/kg	106 (!)
Injection moulding/kg	126 (!)
Ultrasonic welding (15kHz)/welding*	0,04 (!)
Ultrasonic welding (20kHz)/welding*	0,02 (!)
Ultrasonic welding (40kHz)/welding*	0,01 (!)

RECYCLING	mPt/kg
Plastics (packaging mix)** proces	25 (!)
Primary material saved	-431
Total	-406 (!)

WASTE TREATMENT	mPt/kg
Waste treatment scenario in the EU	45 (!)

* Per welding joint of appr. 2,5 cm^2 (0,5 seconds welding).
** If sufficiently pure.

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

EVA Ethylvinylacetate 03.02

PRODUCTION	mPt/kg
EVA/kg	**355**
EVA, foil/kg	345

PROCESSING	mPt
Revolving, milling, drilling/cm³	0,01 (!)
Extrusion, plastic film/kg	**49** (!)
Extrusion, plastic pipes/kg	**36** (!)
Stretch blow moulding/kg	**131** (!)
Blow moulding/kg	**123** (!)
Hot element welding (30sec)	2 (!)
Hot element welding (45min)	155 (!)
Laser welding/m	0,46 (!)
Foaming/kg	**60** (!)
Reaction injection moulding (RIM)/kg, large scale/kg	21 (!)
Rotation Forming/kg	106 (!)
Injection moulding/kg	**126** (!)
Ultrasonic welding (15kHz)/welding*	0,04 (!)
Ultrasonic welding (20kHz)/welding*	0,02 (!)
Ultrasonic welding (40kHz)/welding*	0,01 (!)

RECYCLING	mPt/kg
Plastics (packaging mix)** proces	**25** (!)
Primary material saved	**-355**
Total	**-330** (!)

WASTE TREATMENT	mPt/kg
Waste treatment scenario in the EU	**36** (!)

* Per welding joint of appr. 2,5 cm²
(0,5 seconds welding).
** If sufficiently pure.

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

PA Polyamide

03.03

PRODUCTION	mPt/kg
PA 6	**756**
PA 6.6	**715**
Glass-filled PA 6	**624**
Glass-filled PA 66	**612**

PROCESSING	mPt
Revolving, milling, drilling/cm³	0,01 (!)
Extrusion, plastic film/kg	**49 (!)**
Extrusion, plastic pipes/kg	**36 (!)**
Hot element welding (30sec)/welding	2 (!)
Hot element welding (45min)/welding	155 (!)
Laser welding/m	0,46 (!)
Foaming/kg	**60 (!)**
Reaction injection moulding (RIM), large scale/kg	21 (!)
Rotation Forming/kg	106 (!)
Injection moulding/kg	**126 (!)**
Ultrasonic welding (15kHz)/welding*	0,04 (!)
Ultrasonic welding (20kHz)/welding*	0,02 (!)
Ultrasonic welding (40kHz)/welding*	0,01 (!)
Vacuum forming/kg	16 (!)

RECYCLING	mPt/kg
Plastics (packaging mix)** proces	**25 (!)**
Primary material saved	**-756**
Total	**-731 (!)**

WASTE TREATMENT	mPt/kg
Waste treatment scenario in the EU	**38 (!)**

* Per welding joint of appr. 2,5 cm²
(0,5 seconds welding).
** If sufficiently pure.

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

PRODUCTION	*mPt/kg*
PC/kg	**672**

PROCESSING	*mPt*
Revolving, milling, drilling/cm^3	0,01 (!)
Extrusion, plastic pipes/kg	**36 (!)**
Hot element welding (30sec)/welding	2 (!)
Hot element welding (45min)/welding	155 (!)
Laser welding/m	0,46 (!)
Foaming/kg	**60 (!)**
Reaction injection moulding (RIM), large scale/kg	21 (!)
Rotation Forming/kg	106 (!)
Injection moulding/kg	**126 (!)**
Ultrasonic welding (15kHz)/welding*	0,04 (!)
Ultrasonic welding (20kHz)/welding*	0,02 (!)
Ultrasonic welding (40kHz)/welding*	0,01 (!)
Vacuum forming/kg	**dna**

RECYCLING	*mPt/kg*
Plastics (packaging mix)** proces	**25 (!)**
Primary material saved	**-672**
Total	**-647 (!)**

WASTE TREATMENT	*mPt/kg*
Waste treatment scenario in the EU	**33 (!)**

* Per welding joint of appr. 2,5 cm^2 (0,5 seconds welding).
** If sufficiently pure.

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

PE Polyethylene 03.05

PRODUCTION	mPt/kg
Low Density Polyethylene, LDPE/kg	285
High Density Polyethylene, HDPE/kg (products)	277
Linear Low Density Polyethylene, LLDPE/kg	272
EPE (expanded PE)	dna

PROCESSING	mPt
Revolving, milling, drilling/cm³	0,01 (!)
Extrusion, plastic film/kg	49
Extrusion, plastic pipes/kg	36 (!)
Stretch blow moulding/kg	131 (!)
Hot element welding (30sec)/welding	2 (!)
Hot element welding (45min)/welding	155 (!)
Blow moulding/kg	123 (!)
Laser welding/m	0,46 (!)
Foaming/kg	60 (!)
Reaction injection moulding (RIM)/kg, large scale/kg	21 (!)
Rotation Forming/kg	106 (!)
Mirror-welding	dna
Injection moulding/kg	126 (!)
Ultrasonic welding (15kHz)/welding*	0,04 (!)
Ultrasonic welding (20kHz)/welding*	0,02 (!)
Ultrasonic welding (40kHz)/welding*	0,01 (!)
Vacuum forming/kg	dna

RECYCLING**	mPt/kg
Proces	25 (!)
Primary material saved	-285
Total	-260 (!)

WASTE TREATMENT	mPt/kg
Waste treatment scenario in the EU	39 (!)

* Per welding joint of appr. 2,5 cm²
(0,5 seconds welding).
** If sufficiently pure.

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

PET
Polyethylene terephthalate

03.06

PRODUCTION	*mPt/kg*
PET/kg	327
PET (bottle grade)/kg	347

PROCESSING	*mPt*
Revolving, milling, drilling/cm³	0,01 (!)
Extrusion, plastic film/kg	**49** (!)
Extrusion, plastic pipes/kg	**36** (!)
Hot element welding (30sec)/welding	2 (!)
Hot element welding (45min)/welding	155 (!)
Blow moulding	**123** (!)
Laser welding/m	0,46 (!)
Reaction injection moulding (RIM)/kg, large scale/kg	21 (!)
Rotation Forming/kg	106 (!)
Injection moulding/kg	**126** (!)
Ultrasonic welding (15kHz)/welding*	0,04 (!)
Ultrasonic welding (20kHz)/welding*	0,02 (!)
Ultrasonic welding (40kHz)/welding*	0,01 (!)
Vacuum forming/kg	**dna**

*RECYCLING***	*mPt/kg*
Proces	**25** (!)
Primary material saved	-327
Total	**-302** (!)

WASTE TREATMENT	*mPt/kg*
Waste treatment scenario in the EU	**38** (!)

* Per welding joint of appr. 2,5 cm²
(0,5 seconds welding).
** If sufficiently pure.

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

PMMA
Polymethyl methacrylate

03.07

PRODUCTION	mPt/kg
PMMA (beads)/kg	676
PMMA (sheet) - casted semi-finished product/kg	768

PROCESSING	mPt
Revolving, milling, drilling/cm^3	0,01 (!)
Extrusion, plastic film/kg	**49 (!)**
Extrusion, plastic pipes/kg	**36 (!)**
Hot element welding (30sec)/welding	2 (!)
Hot element welding (45min)/welding	155 (!)
Laser welding/m	0,46 (!)
Foaming/kg	**60 (!)**
Reaction injection moulding (RIM)/kg, large scale/kg	21 (!)
Rotation Forming/kg	106 (!)
Injection moulding/kg	**126 (!)**
Ultrasonic welding (15kHz)/welding*	0,04 (!)
Ultrasonic welding (20kHz)/welding*	0,02 (!)
Ultrasonic welding (40kHz)/welding*	0,01 (!)
Vacuum forming/kg	**dna**

RECYCLING	mPt/kg
Plastics (packaging mix)** proces	**25 (!)**
Primary material saved	-676
Total	-651 (!)

WASTE TREATMENT	mPt/kg
Waste treatment scenario in the EU	**36 (!)**

* Per welding joint of appr. 2,5 cm^2 (0,5 seconds welding).
** If sufficiently pure.

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

PP Polypropylene 03.08

PRODUCTION	mPt/kg
PP/kg	276
EPP/kg	dna

PROCESSING	mPt
Revolving, milling, drilling/cm³	0,01 (!)
Extrusion, plastic film/kg	**49 (!)**
Extrusion, plastic pipes/kg	**36 (!)**
Stretch blow moulding/kg	**131 (!)**
Hot element welding (30sec)/welding	2 (!)
Hot element welding (45min)/welding	155 (!)
Blow moulding/kg	**123 (!)**
Laser welding/m	0,46 (!)
Reaction injection moulding (RIM)/kg, large scale/kg	21 (!)
Rotation Forming/kg	106 (!)
Mirror-welding	dna
Injection moulding/kg	**126 (!)**
Ultrasonic welding (15kHz)/welding*	0,04 (!)
Ultrasonic welding (20kHz)/welding*	0,02 (!)
Ultrasonic welding (40kHz)/welding*	0,01 (!)
Vacuum forming/kg	16 (!)

RECYCLING**	mPt/kg
Proces	**25 (!)**
Primary material saved	-276
Total	-251 (!)

WASTE TREATMENT	mPt/kg
Waste treatment scenario in the EU	**36 (!)**

* Per welding joint of appr. 2,5 cm² (0,5 seconds welding).
** If sufficiently pure.

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

PS Polystyrene

PRODUCTION	mPt/kg
Polystyrene, general purpose, GPPS/kg	388
Polystyrene, PS, expandable/kg	384
Polystyrene, high impact, HIPS/kg	**389**

PROCESSING	mPt
Revolving, milling, drilling/cm³	0,01 (!)
Extrusion, plastic pipes/kg	**36 (!)**
Hot element welding (30sec)/welding	2 (!)
Hot element welding (45min)/welding	155 (!)
Blow moulding/kg	**123 (!)**
Laser welding/m	0,46 (!)
Reaction injection moulding (RIM)/kg, large scale/kg	21 (!)
Rotation Forming/kg	106 (!)
Injection moulding/kg	**126 (!)**
Ultrasonic welding (15kHz)/welding*	0,04 (!)
Ultrasonic welding (20kHz)/welding*	0,02 (!)
Ultrasonic welding (40kHz)/welding*	0,01 (!)
Vacuum forming/kg	16 (!)

RECYCLING**	mPt/kg
Proces	**25 (!)**
Primary material saved	-388
Total	-363 (!)

WASTE TREATMENT	mPt/kg
Waste treatment scenario in the EU	**40 (!)**

* Per welding joint of appr. 2,5 cm²
(0,5 seconds welding).
** If sufficiently pure.

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

PUR Polyurethane 03.10

PRODUCTION	mPt/kg
Polyurethane, rigid foam, PUR/kg**	459
Polyurethane, flexible foam, PUR/kg***	484
PUR (no foam)/kg	dna

PROCESSING	mPt
Revolving, milling, drilling/cm³	0,01 (!)
Reaction injection moulding (RIM)/kg	21
Injection moulding/kg	126 (!)
Ultrasonic welding (15kHz)/welding*	0,04 (!)
Ultrasonic welding (20kHz)/welding*	0,02 (!)
Ultrasonic welding (40kHz)/welding*	0,01 (!)

WASTE TREATMENT	mPt/kg
Waste treatment scenario in the EU	36 (!)

Thermosetting compounds and rubbers cannot be recycled.

* Per welding joint of appr. 2,5 cm²
(0,5 seconds welding).
** For white goods, insulation, building material.
*** For furniture, mattresses, clothing.

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

PVC Polyvinylchloride 03.11

PRODUCTION	mPt/kg
PVC/kg***	220
PVDC (Polyvinylidenchloride), granulate/kg****	451
Softened PVC	dna

PROCESSING	mPt
High frequency welding	dna
Extrusion blow molding, pipes/kg	36 (!)
Stretch blow moulding/kg	131 (!)
Hot element welding (30sec)/welding	2 (!)
Hot element (45min)/welding	155 (!)
Blow moulding/kg	123 (!)
Laser welding/m	0,46 (!)
Reaction injection moulding (RIM)/kg, large scale/kg	21 (!)
Rotation Forming/kg	106 (!)
Injection moulding/kg	126 (!)
Ultrasonic welding (15kHz)/welding*	0,04 (!)
Ultrasonic welding (20kHz)/welding*	0,02 (!)
Ultrasonic welding (40kHz)/welding*	0,01 (!)
Vacuum forming/kg	16 (!)
Calendering, rigid sheets/kg- only for weak PVC	37 (!)

RECYCLING**	mPt/kg
Proces	25 (!)
Primary material saved	-220
Total	-195 (!)

WASTE TREATMENT	mPt/kg
Waste treatment scenario in the EU	34 (!)

* Per welding joint of appr. 2,5 cm^2 (0,5 seconds welding).
** If sufficiently pure.
*** Average European use of PVC from bulk, suspension and emulsion.
**** For thin coatings.

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

SAN
Styrene-acrylonitrile copolymer

03.12

PRODUCTION	mPt/kg
SAN/kg	**403**

PROCESSING	mPt
Revolving, milling, drilling/cm³	0,01 (!)
Extrusion, pipes/kg	**36 (!)**
Hot element welding (30sec)/welding	2 (!)
Hot element welding (45min)/welding	155 (!)
Laser welding/m	0,46 (!)
Reaction injection moulding (RIM), large scale/kg	21 (!)
Rotation Forming/kg	106 (!)
Injection moulding/kg	**126 (!)**
Ultrasonic welding (15kHz)/welding*	0,04 (!)
Ultrasonic welding (20kHz)/welding*	0,02 (!)
Ultrasonic welding (40kHz)/welding*	0,01 (!)
Vacuum forming/kg	16 (!)

RECYCLING	mPt/kg
Plastics (packaging mix)** proces	**25 (!)**
Primary material saved	**-403**
Total	**-378 (!)**

WASTE TREATMENT	mPt/kg
Waste treatment scenario in the EU	**40 (!)**

* Per welding joint of appr. 2,5 cm²
(0,5 seconds welding).
** If sufficiently pure.

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

Recycled plastics 03.13

PRODUCTION	mPt/kg
Agglomerate from	
Industrial mix of plastics	62
Household mix of plastics	93
Grinding product from	
Industrial mix of plastics	64
Household mix of plastics	95
Regranulate from	
Industrial mix of plastics	70
household mix of plastics	87

The environmental impact of the collection and recycling process itself is hardly linked to material type, but much more dependent on efficiency of logistics and the impact of separation and purification. When empty bottles are transported, for instance, the transported material consists mainly of air, unless the bottles are squeezed at the collection point. Separation of mixed plastics requires additional machinery.

The specifications consider the environmental impact for several secondary products without taking into account the profit that could be made from recycling.

Those calculated processes and products are:

Agglomerate
The granule forms as a result of foil heating and shrinkage. It is generally used for thick-walled products. Size of the granule and their variance are key elements.

Grinding product
A sorted, washed stream of plastics, sometimes made dustfree. The material has been milled to reach a certain particle size.

Regranulate
Regranulate is material cleaned by melt purification. In this process, the secondary raw material is melted by extrusion and forced through a fine sieve pack.

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

The size of the sieve pack (expressed in mesh) determines the volume of pollution. Additives may be added during production of regranulate. Special equipment is required if this is done in large amounts during the last phase, and the process is then called compounding. There are three types of regranulate.

Besides the environmental impact, you can also calculate the advantages of recycling. This is easiest when a material is used in a closed cycle and is thus kept within the product system. The disposed product is then used for new products. The profit of recycling manifests itself both on the production side and on the waste side, but doesn't count as double profit.

It doesn't occur often in practice; the recycled product will sooner find an application in a next product life cycle. There is a risk of double counting at this stage, since the designer can enter a profit both from the application of secondary materials for production, and from ensuring proper recycling. In those situations we recommend to assume a closed cycle for the quantity of secondary material, at the start and at the end. You subsequently calculate the environmental impact of that cycle only once on the basis of the given recycling processes.

The indicators provided here are those for the recycling process of a certain type of recycled plastics. When using recycled plastics, have a look at the type of recycled plastics that can be considered first. From this indicator, deduct the indicator of the primary plastics that you can avoid using.

These indicators apply only to thermoplastics because (composites of) thermosetting plastics are usually unrecyclable due to their irreversible condition.

An example: You are making a product from HDPE. If you want to make this product from recycled plastics and it allows for less technical properties, you can choose, for instance, indicator 62: 'Agglomerate from industrial mix of plastics'.

The original plastic you are replacing is HDPE, indicator 277. To get the total indicator, you deduct the avoided product 277 from process 25, resulting in indicator -252.

If 50% of the product already consists of secondary materials, you are allowed to deduct only 50% of 277. Use of secondary materials now seems less beneficial, however you need only include half the environmental impact for manufacture of the product; the recycling process supplies the other half if you assume a closed cycle.

PRODUCTION	mPt/kg
Modified starch/kg	275
Polylactide (PLA)/kg	**312**

PROCESSING	mPt
Revolving, milling, drilling/cm³	0,01 (!)
Extrusion, plastic film/kg	**49**
Extrusion, plastic pipes/kg	**36 (!)**
Hot element welding (30sec)/welding	2 (!)
Hot element welding (45min)/welding	155 (!)
Blow moulding/kg	**123 (!)**
Laser welding/m	0,46 (!)
Foaming/kg	**60 (!)**
Reaction injection moulding (RIM), large scale/kg	21 (!)
Rotation Forming/kg	106 (!)
Mirror-welding	**dna**
Injection moulding/kg	**126 (!)**
Ultrasonic welding (15kHz)/welding*	0,04 (!)
Ultrasonic welding (20kHz)/welding*	0,02 (!)
Ultrasonic welding (40kHz)/welding*	0,01 (!)
Vacuum forming/kg	**dna**

RECYCLING	mPt/kg
Proces	**dna**
Primary material saved	**dna**
Total	**dna**

WASTE TREATMENT	mPt/kg
Waste treatment scenario in the EU	**dna**

* Per welding joint of appr. 2,5 cm²
(0,5 seconds welding).

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

PRODUCTION	mPt/kg
Glass fibre reinforced plastic, polyester resin/kg	455
Glass fibre reinforced polypropylene/kg	359
Wood plastic composite (WPC)	dna
Kevlarfibre reinforced epoxy/kg	1249
Carbon fibre reinforced polypropylene/kg	620
Carbon fibre reinforced epoxy/kg	883
Flaxfibres reinforced polypropylene/kg	383
Epoxy resin (liquid)/kg	**734**
Polyester resin, unsaturated/kg	644
Glass fibre/kg	**264**
Kevlarfibre	dna
Carbon fibre /kg	833
Polyester fibres/kg	660
Flaxfibres/kg	350

PROCESSING	mPt
Revolving, milling, drilling/cm³	0,01 (!)
Sheet rolling/kg	dna
Hand-layup/kg	**69 (!)**
Cold press/kg	43 (!)
Laser cutting/m	17 (!)
Preformed matched die/kg	37 (!)
Pultrusion (extrusion together with fibres)/kg	11 (!)
Resin Transfer Moulding (RTM)/kg	46 (!)
Sheet Moulding Compound (SMC)/kg	13 (!)
Injecting/kg	54 (!)
Vacuum forming/kg	16 (!)
Vacuum assited resin infusion (VARI)/(kg)	**37 (!)**
Winding (of glass or fibres)/kg	9 (!)

WASTE TREATMENT	mPt/kg
Waste treatment scenario in the EU	**39 (!)**

Thermosetting compounds, composites and rubbers cannot be recycled.

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

Rubber

03.16

PRODUCTION	mPt/kg
Vulcanised EPDM (ethylene propylene diene Monomer)/kg	**355**
Latex/kg	230
Natural Rubber/kg	599
Polybutadiene rubber/kg	**444**
SBR (Styrene Butadiene rubber)/kg	453
Silicones/kg	274
Thermoplastic elastomer (TPE)	**dna**
Thermoplastic olefine (TPO)	**dna**
Thermoplastic PUR	**dna**
Thermoplastic urethane (TPU)	**dna**

PROCESSING	mPt
Revolving, milling, drilling/cm³	**dna**
Sheet rolling/kg	**dna**
Calender, plate	**dna**
Injection moulding/kg	**dna**
Vulcanize	**dna**

WASTE TREATMENT	mPt/kg
Waste treatment scenario in the EU	**50** (!)

Thermosetting compounds, composites and rubbers cannot be recycled.

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

Teflon

PRODUCTION	*mPt/kg*
Teflon PTFE/kg	16089
Teflon PTFE, on glass/kg	16929

PROCESSING	*mPt/m²*
Teflon coating (30min)/m²	157
Teflon coating (3min)/m²	16
Sintering	**dna**

WASTE TREATMENT	*mPt/kg*
Waste treatment scenario in the EU	**49** (!)

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

Wood

Opt for renewable materials.

Use wood from sustainably managed forests.

Try to avoid polluting the wood too much by applying harmful coatings.

Wood (untreated)* 04.01

PRODUCTION (excl. transportation)	mPt/kg
Azobe, Sawn timber (SFM), planed, air dried (u=15%)/kg**	558
Hardwood, Sawn timber, raw, air/ kiln dried (u=10%)/kg***	236
Hardwood, Sawn timber, planed, air/ kiln dried (u=10%)/kg***	271
Hardwood, Sawn timber, raw, air dried (u=20%)/kg***	234
Hardwood, Sawn timber, raw, kiln dried (u=10%)/kg***	239
Sawn timber, hardwood, planed, kiln dried (u=10%)/kg***	275
Cork slab/kg	**257**
Softwood, Sawn timber, raw, air dried, u=20%/kg*****	149
Softwood, Sawn timber, planed, air dried/kg*****	173
Softwood, Sawn timber, raw, kiln dried, u=10%/kg*****	154
Softwood, sawn timber, raw, kiln dried, u=20%/kg*****	152
Softwood, Sawn timber, planed, kiln dried/kg*****	179

PROCESSING	mPt/m³
Impregnating wood (beam)/m³******	**630**
Impregnating wood (pole)/m³******	**362**
Folding	**dna**
Sawing	**dna**

RECYCLING	
See machined wood	

WASTE TREATMENT	mPt/kg
Waste treatment scenario in the EU	**19** (!)

* For all wood types, the renewable CO2 (uptake during growth) considered neutral.
** Density azobe: 1000 kg/m³.
*** Density hardwood: 700 kg/m³.
**** Density parana pine: 500 kg/m³. Incl. transport naar Europese haven.
***** Density softwood: 450 kg/m³.
****** Only the impregnation process, production of wood must be added. See “Production of paint” for impregnation product.

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

Wood (layered)* 04.02

PRODUCTION	mPt/m³
Laminated board, three layered/m³	175806
GLT (Glued laminated timber) /m³	105085
Plywood (indoor use) /m³	299627
Plywood (outdoor use) /m³	314255

WASTE TREATMENT	mPt/kg
Waste treatment scenario in the EU	**19** (!)

* For all wood types, the renewable CO2 (uptake during growth) is considered neutral.

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

Wood (chipped)* 04.03

PRODUCTION	mPt/m³
MDF- board/m³	63809
OSB- board/m³	40633
Particle board/m³	38079
Fibreboard soft/m³	23129

WASTE TREATMENT	mPt/kg
Waste treatment scenario in the EU	**20** (!)

* For all wood types, the renewable CO2 (uptake during growth) is considered neutral.

At this moment there are no data avalable of the following materials and processes

Materials:
veneered boards - laminated boards - HPL coated boards - paper foil coated boards - PVC foil coated boards - water resistant boards - flame retardant boards - sandwichboards - honeycomb structures - solid cores

Machine processes:
planing - drilling- sawing - CNC operations - drift drilling - veneers - milling - wood drying - profiling
Wood carvings: CNC cutting - 3D cutting - other cutting

Wood bending

Connection:
physical connection - gluing

Surface treatments:
pickling - high gloss spraying - paint spraying - paint rolling - UV paint rolling and drying, varnishing - treating with lye

Coating application:
application veneer - application melamine - application HPL - application paper foil - application PVC foil - side gluing - softforming - postforming - profile paneling

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

Paper + packaging

Use less burdensome materials and minimise volume and weight of transport packaging.

Opt for reusable (transport) packaging.

Paper

05.01

PRODUCTION	mPt/kg
Recycled, with deinking/kg*	**262**
Recycled, no deinking/kg*	**76**
Woodfree, coated/kg	**258**
Woodfree, uncoated/kg	**309**
Wood-containing, light weight coated (LWC)/kg	**261**
Wood-containing, supercalendred (SC) /kg	**258**

RECYCLING	
Proces	**176** (!)
Primary material saved	**dna**
Total	**dna**

WASTE TREATMENT	mPt/kg
Waste treatment scenario in the EU	**9** (!)

* Including paper waste as input flow.

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

Newsprint 05.02

PRODUCTION	*mPt/kg*
New fibre/kg	**207**
DIP containing/kg	**164**
European average/kg*	**174** (!)

RECYCLING	*mPt/kg*
Proces	**176** (!)
Primary material saved	**dna**
Total	**dna**

WASTE TREATMENT	*mPt/kg*
Waste treatment scenario in the EU	**19** (!)

* European average, consists of 77% recycled paper.

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

Cardboard* 05.03

PRODUCTION	mPt/kg
Mixed fibre, single wall/kg	147
Recycling fibre, single wall/kg	95
Recycling fibre, double wall/kg	125
Fresh fibre, single wall/kg	261

PROCESSING	mPt/kg
Carton board boxes, gravure printing/kg**	39
Carton board boxes, offset printing/kg**	68
Folding boxboard, Folding Box Board/kg***	260

RECYCLING	mPt/kg
Proces	95 (!)
Primary material saved	dna
Total	dna

WASTE TREATMENT	mPt/kg
Waste treatment scenario in the EU	20 (!)

* Cardboard class C.
** Only process, excluding production of cardboard
*** Including production of cardboard.

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

Glass (packaging) 05.04

PRODUCTION	mPt/kg
Brown (53,1% recycled) /kg	**97**
Green (80% recycled) /kg	**95**
White (58% recycled) /kg	**91**

RECYCLING	mPt/kg
Proces	**58** (!)
Primary material saved	**dna**
Total	**dna**

WASTE TREATMENT	mPt/kg
Waste treatment scenario in the EU	**na**

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

Liquid packaging board containers

05.05

PRODUCTION	*mPt/kg*
Production of liquid packaging board containers/kg	**347**

RECYCLING	*mpt/kg*
Proces	**dna**

WASTE TREATMENT	*mPt/kg*
Waste treatment scenario in the EU	**17** (!)

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

Energy

Design products that don't depend on energy or minimise their energy consumption.

Use renewable energy or human power.

Do not use a high-grade energy source for a low-grade application.

Avoid the use of single-use batteries; use rechargeable batteries.

Make sure internal batteries can be easily removed in the disposal phase.

Raise the user's awareness of energy consumption, sleep power consumption and consumption in stand-by.

Electricity
according to voltage

06.01

*PRODUCTION**	*mPt/kWh*
High voltage (HV) (> 24 kVolt)	
Electricity, high voltage Europe (UCTE)	**44**
Electricity, high voltage Belgium	**28**
Medium voltage (1 tot 24 kVolt)	
Electricity, medium voltage Europe (UCTE)	**45**
Electricity, medium voltage Belgium	**29**
Low voltage (< 1 kVolt)	
Electricity, low voltage Europe (UCTE)	**51**
Electricity, low voltage Belgium	**31**
Electricity, low voltage, CENTREL**	**88**
Electricity, low voltage Germany	**59**
Electricity, low voltage France	**10**
Electricity, low voltage Greece	**113**
Electricity, low voltage United Kingdom	**60**
Electricity, low voltage Ireland	**78**
Electricity, low voltage Italy	**63**
Electricity, low voltage Luxembourg	**53**
Electricity, low voltage the Netherlands	**64**
Electricity, low voltage NORDEL***	**18**
Electricity, low voltage Austria	**31**
Electricity, low voltage Portugal	**66**
Electricity, low voltage Spain	**56**
Electricity, low voltage Switzerland	**3**

* Including production of fuels.
** Slovakia, Hungary, Poland, Czech Republic.
*** Norway, Denmark, Sweden, Finland.

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

Electricity
according to extraction

06.02

PRODUCTION	*mPt/kWh*
Electricity, from nuclear power*	**1,2**
Electricity, from hard coal	**89**
Electricity, from oil	**85**
From bagasse, sugarcane, at sugar refinery	**1,66**
From bagasse, sweat sorghum, at distillation	**3,77**
Electricity, from hydropower	**0,35**
Electricity, from wind energy	**1,2**
From solar-energy **	
Facade, single-Si (laminated, integrated)	**9,6**
Facade, multi-Si (laminated, integrated)	**8,7**
Flat roof installation, single-Si	**7**
Flat roof installation, multi-Si	**6,5**
Slanted-roof, a-Si (panel, mounted)	**6,4**
Slanted-roof, a-Si (laminated, integrated)	**5,3**

* No consideration of calamities.

** Photovoltaic electricity produced in a small installation (3kwp). Different indicators depending on the position of the installation in the building (outer wall, flat roof, pitched roof).

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

PRODUCTION FROM:*	*mPt/MJ*
Anthracite	
At stove (5-15kW)	**11**
Lignite briquette	
At stove (5-15kW)	**16**
Diesel	
Boiler (10kW)	**7,7**
Industrial (1MW)	**8**
Natural gas	
At boiler atm. low-NOx condensing non-modulating <100kW	**6,7**
At boiler fan burner low-NOx non-modulating <100kW	**7,6**
At industrial furnace low-NOx >100kW	**7,1**
Wood	**3,9**
Hard coal	
At stove 5-15kW	**15**
Industrial furnace 1-10MW	**11**
Heat pump 30kW	**3,5**
Heavy fuel oil	
At industrial furnace (1MW)	**9,2**
Solar-energy	
Flat plate collector	
For combined system	**0,84**
Solar+gas heating	**5,2**
One-family house, for hot water	**1,1**
Hot water tank	
Solar+electric, flat plate, multiple dwelling**	**2,8**
Solar+gas heating, one-family house***	**5,2**

* Including production of fuels.
** Hot water system with use of electricity for control and post-heating.
*** Hot water system with use of natural gas for control and post-heating.

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

Transport

Stack the product to maximum compactness, if necessary through different or partial assembly.

Optimise distribution plans and limit transport distances: choose suppliers that are closest to the manufacturing location; assure transportation in large quantities rather than small ones, …

Opt for the least burdensome means of transport.

Transport* 07.01

	mPt
Road	
Van <3.5t/tkm	**186**
Lorry >16t(Eur4)/tkm	**15**
Lorry >32t(Eur4)/tkm	**12**
Railroad	
Train (freight)/tkm	**3,9**
Water	
Barge tanker (inland)/tkm	**4,4**
Barge (inland)/tkm	**4,7**
Transoceanic tanker (ocean)/tkm	**0,6**
Transoceanic freight ship/tkm	**1,3**
Air	
Aircraft, freight, Europe/tkm	**181**
Helicopter, LTO cycle (takeoff and landing)/piece	**14637**
Helicopter (flying time)/hour	**8601**
Aircraft, freight, intercontinental/tkm	**99**

* Including production of fuels.
Indicators per tkm (ton kilometer, transport of one tonne over one kilometer).

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

Lighting and electronic components

Make your design with universally available components.

Avoid designs using disposable batteries.

Make sure that the consumer does not pay for functions he never uses. Integrate an “off” button to shut off all energy consumption next to the “stand-by” button.

LIGHTING	*mPt*
Light bulb 60 Watt/piece*	11
Halogen lamp/piece	3
Candle	**dna**
LED lamp (incl. PCB) (0,35g) /kg	20691
LED lamp (incl. PCB) (0,35g)/piece	7
OLED	**dna**
Light bulb SL11 (E-saving)/piece**	136
T5 (16 mm) fluorescent lamp/piece	25
T8 (26 mm) fluorescent lamp	**dna**
T12 (38 mm) fluorescent lamp	**dna**

As regards lighting you must consider the lamp's application and lifespan. A type A lamp can have a high score for production, yet in the long run achieve better marks than type B due to lower energy consumption. Also take into account the lighting application that requires, for instance, one single type A lamp against five type B lamps for equal functional lighting.

* Life span of 1000 hours.
** Life span of 8000 hours.

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

ELECTRONIC COMPONENTS	*mPt*
CRT screen, 17 inches	**30487**
LCD screen, 17 inches	**209610**
Desktop computer, without screen	**24809**
Electrode, negative, LiC6/kg	**290**
Electrode, negative, Ni/kg	**8185**
Electrode, positive, LiMn2O4/kg	**1728**
HDD, desktop computer/piece	**1080**
HDD, laptop computer/piece	**300**
Laptop computer	**35639**
Rechargeable battery, Li-ion, prismatic/kg	**7720**
Rechargeable battery, NiMH, prismatic/kg	**6119**
Mouse device, optical, with cable	**473**
Power supply unit/piece	**2723**
Printer, laser jet, colour	**5642**
Printer, laser jet, b/w	**5631**
Keyboard, standard version	**2440**
Toner module, laser jet, colour/piece	**900**
Toner module, laser jet, b/w/piece	**889**
Fan, for electronics/kg	**1190**
PCB's	
Printed wiring board, surface mounted, Pb containing/kg	**22345**
Printed wiring board, surface mounted, Pb free/kg	**22360**
Naked printed wiring board, surface mount, lead-containing surface/m^2	**24531**
Naked printed wiring board, surface mount, lead-free surface/m^2	**24430**
Printed wiring board, through-hole mounted, Pb containing/kg	**5275**
Printed wiring board, through-hole mounted, Pb free/kg	**5120**
Naked printed wiring board, through-hole, lead-containing surface/m^2	**9586**
Printed wiring board, through-hole, lead-free surface/m^2	**9243**

Give preference to an application without batteries and use more environmentally safe energy resources. If use of a battery is unavoidable, opt for rechargeable batteries. Rechargeable batteries (e.g. NiMH, LI-ion, etc.) can be recharged up to 1,000 times and thus save a considerable amount of raw materials and energy in the production and waste treatment phases.

Note that the European Batteries Directive prohibits the use of rechargeable NiCd batteries (except for a few applications) due to the harmful, poisoning and carcinogenic properties of cadmium.

Make sure to design appliances that allow for easy removal of disposed batteries and accumulators. Provide a manual for appliances with built-in batteries that explains their easy removal and informs the user about the type of built-in batteries or accumulators used.

Used up batteries fall under Small Hazardous Waste and must therefore always be collected and treated separately.

Flanders applies a take-back obligation for electronic appliances.

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

Construction materials

Opt for local raw materials and energy sources.

Make designs using recycled materials, particularly for invisible parts and use their specific properties.

Concrete- and cement products

09.01

PRODUCTION	mPt
Concrete (exacting)/m^3*	**20575**
Poor concrete/m^3**	**8585**
Concrete (normal)/m^3***	**16759**
Concrete (sole plate and foundation)/m^3***	**11110**
Autoclaved aerated concrete block/kg	**28**
Cement/kg (Portland)	**49**
Blast furnace slag cement/kg	**27**
Fibre cement roof slate/kg	**61**
Wall plate from cementfibre/kg	**dna**

RECYCLING	mPt/kg
Gravel replacement	**-0,67** (!)

WASTE TREATMENT	mPt/kg
Waste treatment scenario in the EU	**na**

Non combustible building materials usually go to landfill or are re-used as road embankment or as coarse fraction in concrete.

* Ready-for-use concrete with density of 2440 kg/m^3.
** Ready-for-use concrete with density of 2190 kg/m^3.
*** Ready-for-use concrete with density of 2380 kg/m^3.

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

Plaster- and limeproducts

09.02

PRODUCTION	*mPt/kg*
Gypsum (CaSO4*2H2O)/kg	**2,7**
Gypsum plaster board/kg	**35**
Gypsum fibre board/kg	**28**
Lime, hydrated/kg	48
Quicklime, milled, packed/kg	**62**
Stucco/kg	**10**

RECYCLING	*mPt/kg*
Proces	**dna**

WASTE TREATMENT	*mPt/kg*
Waste treatment scenario in the EU	**na**

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

Brick and ceramic 09.03

PRODUCTION	*mPt/kg*
Brick/kg	**18**
Ceramic (porcelain)/kg	**dna**
Ceramic tiles/kg	124
Roof tile/kg	**27**
Light clay brick/kg*	17

RECYCLING	*mpt/kg*
Proces	**dna**

WASTE TREATMENT	*mPt/kg*
Waste treatment scenario in the EU	**na**

Non combustible building materials usually go to landfill or are re-used as road embankment or as coarse fraction in concrete.

* Consists of clay and straw.

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

PRODUCTION	mPt/kg
Basalt/kg	44
Bentonite/kg	13
Refractory/kg	**195**
Dolomite/kg	**dna**
Gravel (round) /kg	**0,6**
Gravel (crushed) /kg	**dna**
Limestone/kg	3,5
Sand-lime brick/kg	**10**
Clay/kg	**0,3**
Perlite/kg	1,6
Silica sand/kg	2,2
Feldspar/kg	**3,6**
Vermiculite/kg	**0,77**
Sand/kg	**0,6**

RECYCLING	mPt/kg
Sand replacement	**-0,598** (!)

WASTE TREATMENT	mPt/kg
Waste treatment scenario in the EU	**na**

Non combustible building materials usually go to landfill or are re-used as road embankment or as coarse fraction in concrete.

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

PRODUCTION	mPt/kg
Mineral isolation	
Cellulose fibres/kg	50
Glass wool mat/kg	158
Rock wool/kg*	169
Vermiculite/kg	**0,77**
Plastic isolation	
Tube insulation (elastomere) /kg**	530
Polystyrene foam slab/kg***	**460**
Urea formaldehyde foam slab, hard/kg****	337
PUR/kg	459

RECYCLING	mPt/kg
Mineral isolation proces	**dna**
Plastic isolation proces	**na**

WASTE TREATMENT	mPt/kg
Waste treatment scenario in the EU	**36** (!)

The production of insulation materials is usually small compared to the environmental benefits.

* Density: 100 kg/m^3.
** For different technical applications. Density: 75 kg/m^3.
*** Density: 30 kg/m^3.
**** Density: 10-30 kg/m^3.

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

PRODUCTION	mPt/kg
Flat glass, coated/kg*	82
Flat glass, uncoated/kg	70
Tempering, flat glass (proces)/kg**	19
Glass fibre/kg	264
Triple glazing (U<0,5W/m² K)m²	6389

RECYCLING	mPt/kg
Proces	58 (!)
Primary material saved	-82
Total	-24 (!)

WASTE TREATMENT	mPt/kg
Waste treatment scenario in the EU	na

* Tin, silver, nickel coating (77 g/m^2).
** Process, only and including loss of glass.
Excluding the input of glass.

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

Melamine laminate 20mm/m²*	10177
Solid surface (PMMA) 3mm/m²	2948
Solid surface (PMMA en Al(OH)3) 12 mm (flexible)/m²**	3418
Solid surface (PMMA en Al(OH)3) 6mm (flexible)/m²***	6664
High Pressure Laminate (chipboard core), 20mm/m²	1040
High Pressure Laminate (paper core), 10mm/m²	4406

WASTE TREATMENT	*mPt/kg*
Waste treatment scenario in the EU	**20** (!)

Furniture panels are not recyclable.

* Both sides of plate are covered with decorative layer.
** For horizontal use.
*** For vertical use.

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

	mPt/kg
Fleece, PET	401
Refining of textile, coton	502
Spinning of fibres, bast fibre	130
Spinning of fibres, coton fibre	884
Weaving of bast fibres (e.g. flax)	35
Weaving of coton	1036

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

Chemicals

Avoid harmful substances in a product as well as harmful processing substances.

Use production techniques with a low environmental impact.

Painting and inks 10.01

PRODUCTION	mPt/kg
Acrylic varnish, 87.5% in H2O/kg	205
Alkyd paint, white, 60% in H2O/kg	309
Alkyd paint, white, 60% in solvent/kg	393
Printing colour, offset, 47.5% solvent/kg	498
Printing colour, rotogravure, 55% toluene/kg	381

WASTE TREATMENT	mPt/kg
Waste treatment scenario in the EU	**22** (!)

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Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

Anorganic

10.02

PRODUCTION	mPt/kg
Ammonia (NH3), liquid/kg	218
Argon, liquid/kg	dna
Bentonite/kg	69
Chemicals (inorganic) /kg*	170
Chlorine (Cl2), liquid/kg	99
Fluoride	dna
Phosphoric acid (industrial grade, 85% in water) /kg	220
Phosphoric acid (fertiliser grade, 70% in water) /kg	167
Iron sulphate FeSO4/kg	18
Sodium chloride NaCl/kg	19
Caustic soda NaOH/kg	dna
Sodium perborate, monohydrate (NaBO3 · H2O) powder/kg	355
Sodium perborate, tetrahydrate (NaBO3 · 4 H2O) powder/kg	159
Nitric acid, HNO3/kg	197
Silicate (water glass) /kg	102
Hydrochloric acid, mannheim process powder/kg	41
Nitrogen (N2), liquid/kg	37
Decarbonised water/kg	0,001
Water (demineralized)/kg	dna
Tap water/kg	0,03
Hydrogen, liquid/kg	253
Zeolite/kg	425
Hydrochloric acid HCl (Mannheim)/kg	dna
Hydrochloric acid HCl/kg	dna
Oxygen, liquid/kg	35
Sulphuric acid/kg	27

WASTE TREATMENT	mPt/kg
Waste treatment scenario in the EU	22 (!)

* Average value for production of anorganic chemicals.

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

PRODUCTION	mPt/kg
Chemicals (organic)/kg*	249
Diesel (fuel)/kg*	174
Ethylene oxide/kg	245
Ethylene glycol/kg	203
Petrol, unleaded (fuel) /kg**	190
Heavy fuel oil/kg**	166
Propylene glycol/kg	446
Urea/kg	350
Soap/kg	5306

WASTE TREATMENT	mPt/kg
Waste treatment scenario in the EU	22 (!)

* Average value for production of organic chemicals.
** Only production of fuel, excluding combustion emissions.

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

Glues

PRODUCTION	*mPt/kg*
Wood glue/kg	280
PVC glue/kg	159
EVA hot melt glue/kg*	320
Flooring glue/kg	94

USE	*mPt/m²*
PVC glue (solvent)/m²	26
Hotmelt glue/m²	21

WASTE TREATMENT	*mPt/kg*
Waste treatment scenario in the EU	**22** (!)

* Glue consumption per m² and energy use for 2 minutes.

Black indicator: trustworthy data
Grey indicator: less trustworthy data/ limited data
(!): generic data for this group of materials
dna: data not available
na: not applicable

Colophon

This Ecolizer 2.0 was created in collaboration with VITO (Flemish Institute for Technological Research).

The calculations were done on the basis of the ReCiPe method.

The indicators were constructed on the basis of the following available sources and data.

1. “National Life Cycle Inventory Database Ecoinvent 2009” www.ecoinvent.ch
2. ESU-ETH database “Ökoinentare für Energiesystemen”, 1996 3rd edition, ETH Zürich. [1996]

Please let us know if other or more recent data are available.

Want to know more?
More information and other detailed examples of Ecolizer applications can be found on www.ovam.be/ecolizer
For questions, comments and additional information, please write to ecodesign@ovam.be

Although OVAM supports the method used in Ecolizer 2.0, results or indicators should not be considered approved OVAM’s point of view.

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