

Smart ecoDesign

Eco-design Checklist

For Manufacturers of Passive Electronic Components

Issue 1 - 22nd December 2006

Author: Graham Adams, seeba co-ordinator

Checked and Approved by: Martin Charter, Director, CfSD



Asia Eco-Design Electronics (AEDE) is funded by the European Union as part of the Asia-Pro Eco Programme

This document has been produced with the financial assistance of European Union. The contents of this document are the sole responsibility of The Centre for Sustainable Design at the University College for the Creative Arts and can under no circumstances be regarded as reflecting the position of the European Union.

Contents

1. INTRODUCTION.....	3
2. LEGISLATION/CUSTOMER REQUIREMENTS.....	4
LEGISLATION/CUSTOMER REQUIREMENTS CHECKLIST	4
BACKGROUND	4
MONITORING LEGISLATION.....	5
LEGISLATION OVERVIEW	5
<i>Directive 2005/32/EC:</i>	5
<i>Directive 2002/96/EEC:</i>	8
<i>Directive 2002/95/EC:</i>	8
<i>Directive 76/769/EEC:</i>	8
<i>Directive 67/548/EEC:</i>	8
<i>REACH:</i>	8
3. ECO-DECLARATIONS CHECKLISTS.....	10
MINIMUM DECLARATION REQUIREMENTS CHECKLIST.....	10
RECOMMENDED LEVEL OF DECLARATION CHECKLIST.....	11
MARKET LEADER LEVEL OF DECLARATION CHECKLIST	12
MINIMUM DECLARATION REQUIREMENTS OVERVIEW	13
RECOMMENDED LEVEL OF DECLARATION OVERVIEW	13
MARKET LEADER LEVEL OF DECLARATION OVERVIEW.....	14
DECLARATION TOOLS	16
4. ECO-DESIGN CHECKLISTS FOR PASSIVE COMPONENT MANUFACTURERS	17
ECO-DESIGN REQUIREMENTS CHECKLIST.....	17
BACKGROUND	18
APPLYING ECO-DESIGN	19
ECO-DESIGN TOOLS	20
APPENDIX: DEFINITIONS OF EUP ENVIRONMENTAL INDICATORS.....	21
GROSS ENERGY REQUIREMENT (GER).....	21
HAZARDOUS AND NON-HAZARDOUS WASTE.....	21
WATER USE (PROCESS AND COOLING).....	22
WATER EMISSIONS (HEAVY METALS AND EUP)	22
AIR EMISSIONS (GWP, AD, VOC, POP, HM, PAH AND PM).....	22

1. Introduction

This document is intended to help manufacturers of passive electric components meet the ever increasing demand from customers for eco-friendly components. This demand is being fuelled by both legislation that is appearing in many countries of the world and increased consumer awareness of the negative impact products are having on the environment around them.

The document is split into three main sections:

1. Legislation/Customer Requirements Checklist.
2. Eco declarations Checklists.
3. Eco-design checklists for passive component manufacturers.

Each of the sections starts with a checklist. It is followed by background information and more detailed advice. If this is the first time you are reading this report then it is recommended that you read the information and advice first before going through the checklist. After this you will probably only have to refer to the checklists, which is why they have been put first.

Any feedback or comments on the checklist are welcomed.

2. Legislation/Customer Requirements

Legislation/Customer Requirements Checklist	
Checklist Item	Answer
Has the responsibility to collect and document customer and legislation responsibilities been assigned to an individual(s)	
Does that person(s) have clear reporting responsibilities to top management?	
Do you have a system/tool(s) to keep you up to date with the latest legislation	
Do you have a documented system in place to generate a single requirements document that covers all your customers and legislation requirements?	
Is there a system in place to regularly review the above document and keep it up to date?	
Where there are any non-conformances to legislation or customer requirements, is urgent action in place to rectify the situation?	
Has the customer been informed of any non-conformances and has it been documented?	
<i>If the answer to any of the above is no, put in place a documented plan to address the issue(s) with target completion dates.</i>	

Background

Passive component manufacturers in general work with very small profit margins. For that reason eco-design requirements have taken up to recently a very low priority. This has resulted in those companies not having any resources or in-house skills to address the increasing demand from their customers for product environmental information. This in turn has resulted in many companies giving inaccurate information. Some recent work has shown that a significant percent of components declared as RoHS compliant are not.

The need for good environmental data from suppliers is steadily increasing as more and more environmental product legislation is passed by different countries. Companies not able to address these needs are likely to lose significant market share. For this reason you should have a robust system in place that monitors new requirements and implements any changes needed to meet them.

Most component companies have at least ISO9000, and a substantial number also now have ISO14001 or EMAS. Use whatever management system you have to control the above monitoring system, with identified resources and responsibilities. Putting this system within a documented management system ensures it does not become a one off exercise

Monitoring Legislation

seeba Website

The seeba website (www.cfsd.org.uk/seeba) contains a lot of global legislation on electronics products. It is free to use. The resource centre on the website contains slide presentations on a number of the important pieces of legislation.

BuyUSA

This is a free US government website and contains a lot of information on environmental product legislation. (www.buyusa.gov/)

ERA Technologies

Subscription magazine. (<http://www.era.co.uk/news/pr0217.asp>) Updates on environmental product legislation.

PlesTech Ltd.,

Software/web and subscription. Substance database with legislation summaries and text, and minimum overall thresholds. (www.plestech.co.uk)

Raymond Communications

Subscription site, with overviews of most environmental product legislation, and reporting of new legislation. (www.raymond.com/)

Legislation Overview

Directive 2005/32/EC:

The EuP Directive was published in the European Union official journal on the 22nd July 2005. Member States are supposed to transpose it into national law by the 11th August 2007. It is based on article 95 so the requirements should be identical for all member countries. It creates a framework for the integration of various environmental aspects, such as energy efficiency, hazardous substances, water consumption or noise emissions, into the design of energy using products.

The EuP directive came about because it was estimated over 80% of all product-related environmental impacts are determined during the product design phase. The EuP directive states in the introduction:

'Action should be taken during the design phase of EuPs since it appears that the pollution caused during a product's life cycle is determined at that stage, and most of the costs involved are committed then.'

Energy using products account for a large proportion of the consumption of natural resources and energy used within the EU.

The directive applies to products that use electricity, fossil fuels or renewable energy sources during its use stage of the life cycle. It also applies to products used for generation, transfer or measurement of energy, and parts dependent on energy input supplied to end-users as individual parts if they can be assessed for environmental performance. Component and sub-assembly manufacturers may under the implementing legislation have to supply material composition and energy/material consumption data to the EuP producer.

There are some exemptions. They are:

- Transportation vehicles for people or goods. E.g. cars, trucks, ships, aeroplanes and rail.
- It is not clear whether the above includes agricultural and construction equipment that can move.

The EuP is a framework directive. The framework sets a template for legislation on specific product groups. The specific product groups will follow the parts of the template that are applicable to those groups. The framework will then allow the rapid implementation of legislation on products under the scope of the EuP in a standardised manner. It should be noted the EuP Directive will not directly create legal obligations and requirements for manufacturers. This will happen only when the implementing measures are adopted.

There will be 2 types of implementing measure requirements called specific and generic requirements. Specific requirements will have specific measurable targets set which companies will have to meet. This could be for example a value for maximum energy consumption on standby mode, or a maximum threshold set for a hazardous substance.

Generic requirements have no targets but a company is expected to demonstrate they have addressed it in their product launch process. These requirements will be taken from the complete list of generic requirements in the EuP.

A range of products have already been identified for priority action on introducing implementation measures. Preparatory study groups have been formed. The products impacted are:

- Heating and water heating equipment
- Electric motor systems
- Lighting
- Domestic appliances
- Office equipment
- Consumer electronics
- Heating ventilating air conditioning system (HVAC)

Separate implementation measure reducing stand-by energy use for a range of products will also be introduced. The target products have not yet been

specified. The commission will introduce implementing measures after consultation for the above listed products most probably in 2007.

The current preparatory study groups for the above list are using what is called [standardised data](#). For passive components there is a standardise data set which is multiplied by the component weight to give the environmental impact of passive components. This data set covers energy, emission to air and water, hazardous and non-hazardous waste, and water use.

The following lifecycle phases, where they relate to design will be required to look at:

- Raw material selection and use
- Manufacturing
- Packaging, transport and distribution
- Installation and maintenance
- Use
- End of life (e.g. end of its first use – reuse- recycling - until final disposal.)

Passive components manufacturers will be mainly impacted by only the first three items on the list where third item in this case refers to the packaging and transport of the components.

All EuPs covered by an implementing measure will require a documented ecological profile. It is a description with physical measurable values of the inputs and outputs as outlined in the implementing measure. It can include for example material content, energy, emissions and waste for those parts of the life cycle which have a significant environmental impact. The implementing measure may require the ecological profile to be made available to consumers along with the benefits of eco-design.

Each EuP covered by an implementing measure will require having a technical documentation file to demonstrate conformance. The file will cover the both the 'generic' and 'specific' eco-design requirements. Member States will assume an EuP bearing a CE marking conforms to any implementing measure on that EuP. This file will need to contain supplier part data either directly or as links to the relevant documents on the supplier's website.

EuPs will come under CE marking and companies will have to make a declaration of conformity before their products can be put on the market. Checks on compliance will be required by member states, with samples of products subjected to compliance checks. Member states must provide a means for other interested parties to submit observations on non-compliance of products. This could result in competitors reporting on each other. Manufacturers will have to re-call any non-compliant product from the market. Member states must state the grounds on which non-compliance is based.

Under the EuP legislation, component manufacturers for the first time in any legislation will have a legal obligation to supply data to the manufacturers of EuPs so that manufacturer can meet the requirements of the EuP. At the

minimum this will be the component weight and the inclusion of any hazardous substances. This is likely to meet the requirements if standardised part data is used, but some manufacturers may wish to use more accurate data to meet the requirements set out in the implementation measure on their product. This will be covered more fully under the next section.

Directive 2002/96/EEC:

The 'Waste from Electrical and Electronic Equipment' (WEEE) directive calls for information to be given to treatment centres on the location of hazardous substances, and for manufacturers to give information to users on how to dispose of the product. Documented evidence to demonstrate this is likely to be required for relevant products in the technical documentation file. Component manufacturers will need to provide information so this can be achieved.

Directive 2002/95/EC:

The 'Restriction of the Use of Certain Hazardous Substances in EEE' (RoHS) Directive bans with some exemptions the use of cadmium above a threshold 0.01% of homogeneous material and above 0.1% of homogeneous material for lead, mercury, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE). For impacted products the technical documentation file will probably need to demonstrate that these requirements have been met. Information is required from passive component suppliers to meet these requirements.

Directive 76/769/EEC:

The directive 'Restrictions on marketing and use of certain dangerous substances and preparations' contains a large number of restricted or banned components. The technical documentation file will almost certainly require data to show these requirements have been met. This directive along with its many daughter directives is often overlooked by many companies. However this is not likely to last long once the technical documentation file comes into general use.

Directive 67/548/EEC:

The directive on the 'Classification, Packaging and Labelling of Dangerous Substances' will need to be taken into account when selecting materials and their use reduced to a minimum. This will need to be documented in the technical documentation file.

REACH:

REACH is the acronym for Registration, Evaluation and Authorisation of CHemicals. The REACH proposal requires industry to register all existing and future new substances with a new European Chemicals Agency. This legislation which will come into force in 2007 and will considerably impact the passive components industry. It will require downstream users to report on the uses of different substances, and authorisation will be required to use substances of very high concern

Management Methods for Controlling Pollution by Electronic

Information Products Order No. 39 China: Bans same substances as RoHS plus labeling on recyclability and safe working life. All products put on the market that are in the catalogue will have to be tested by licensed laboratories

Californian Bills Numbers: SB 20, SB50 and Bill 2202 USA: The first 2 bills Ban the same substances as RoHS on video devices greater than 4 inches diagonally. They also require data and improvement targets for recycle use and designing for recycling. New bill going through extending scope to the same products as RoHS.

Bill 2202 which was passed in June 2006 extends the scope of the first 2 bills to the same scope covered by the EU RoHS directive.

Japanese J-Moss

Requires a label to be put on the product and packaging, plus details on the web if cadmium above a threshold 0.01% of homogeneous material and above 0.1% of homogeneous material for lead, mercury, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE). Some but not all the exemptions listed under the European RoHS are allowed.

3. Eco-declarations Checklists

<i>Minimum Declaration Requirements Checklist</i>	
Checklist Item	Answer
Do you publish the weight of your products?	
Do your products meet the RoHS requirements, and do you have documented evidence: <ul style="list-style-type: none"> • Less than 0.01% cadmium of homogeneous material • Less than 0.1% lead of homogeneous material • Less than 0.1% mercury of homogeneous material • Less than 0.1% hexavalent chromium of homogeneous material. • Less than 0.1% PBB of homogeneous material • Less than 0.1% PBDE of homogeneous material 	
Do you declare to your customers that you meet the RoHS requirements?	
Do you document and declare quantity and location of any occurrences of the above substances that are exempt under RoHS?	
Do you monitor whether you have any other substances in the product that are banned or restricted by other applicable legislation, and report occurrences to your customers?	
Have you colligated all the customer reporting requirements and are you reporting them?	
<i>If the answer to any of the above is no, put in place a documented action plan to address the issue(s) with target completion dates.</i>	

The above declaration is considered the minimum declaration a component manufacturer should give so their customers can satisfy current legislation and their internal needs.

Recommended Level of Declaration Checklist	
Checklist Item	Answer
Do you publish the weight of your products?	
Do your products meet the RoHS requirements, and do you have documented evidence: <ul style="list-style-type: none"> • Less than 0.01% cadmium of homogeneous material • Less than 0.1% lead of homogeneous material • Less than 0.1% mercury of homogeneous material • Less than 0.1% hexavalent chromium of homogeneous material. • Less than 0.1% PBB of homogeneous material • Less than 0.1% PBDE of homogeneous material 	
Do you declare the materials and substances for families of components in percentage (or ppm) of the part weight?	
Do you monitor whether you have any other substances in the product that are banned or restricted and taking action to eliminate any occurrences?	
For components containing substances listed in Annex I to Directive 67/548/EEC on Classification and Labelling of Dangerous Substances do you produce a Materials Safety Data Sheet	
Have you colligated all the customer reporting requirements and are you reporting them?	
<i>If the answer to any of the above is no, put in place a documented action plan to address the issue(s) with target completion dates.</i>	

Following the above checklist should satisfy most customer requirements and supply sufficient information for companies to meet the requirements of the new environmental legislation that are coming into force around the world. An excellent example is the declaration made by STMicroelectronics (<http://www.stmicroelectronics.com/stonline/company/environm/report03/envi03.pdf#search=%22stmicroelectronics%20materials%20declaration%22>)

Market Leader Level of Declaration Checklist

Checklist Item	Answer
Do you publish the weight of your products?	
Do your products meet the RoHS requirements, and do you have documented evidence: <ul style="list-style-type: none"> • Less than 0.01% cadmium of homogeneous material • Less than 0.1% lead of homogeneous material • Less than 0.1% mercury of homogeneous material • Less than 0.1% hexavalent chromium of homogeneous material. • Less than 0.1% PBB of homogeneous material • Less than 0.1% PBDE of homogeneous material 	
Do you declare the following for families of components in percentage (or ppm) of the part weight? <ul style="list-style-type: none"> • Materials and substances composition • Energy GER, feedstock, and electricity • Air emissions in GWP, AD, VOC, POP, HM, PAH, and PM • Water emissions of heavy metals and EUP. • Hazardous and non-hazardous waste generation • Water use for process and cooling 	
Do you monitor whether you have any other substances in the product that are banned or restricted and taking action to eliminate any occurrences?	
For components containing substances listed in Annex I to Directive 67/548/EEC on Classification and Labelling of Dangerous Substances do you produce a Materials Safety Data Sheet	
Have you started preparing for REACH by gathering data on how substances are used as recommended by cefic	
Have you colligated all the customer reporting requirements and are you reporting them?	
<p><i>If the answer to any of the above is no, put in place a documented action plan to address the issue(s) with target completion dates.</i></p>	

Minimum Declaration Requirements Overview

Many component companies are just making a statement that they are RoHS compliant. However most countries in the EU require readily available documented evidence to show a manufacturer has practiced due diligence under RoHS. If this is not available then there are risks that customers will be lost.

In China it looks like their version of RoHS, which covers not only products but also components as well, will require reporting of all substances over the thresholds, even those that are exempt. If you also consider REACH will probably require these chemicals to be tracked and reported then reporting the presence and location of these substances within a part becomes essential.

It is often overlooked by companies that RoHS is not the only legislation restricting the use of substances. Component manufacturers should ensure their products meet all the legislation. In many cases failure to meet legislation can result in a product having to be withdrawn from a market, and in some cases it can even go as far as imprisonment of company personnel. Most, but not all, of these substances are in the Level A list in the Joint Industry Guide which can be obtained from http://www.eia.org/new_policy/jig_download.phtml This guide however should not be used as a means of keeping up to date on legislation since a few substances are missing that are banned in Germany and also because changes have to be agreed by many companies making up the associations, and new legislation on substances will take its time to get into the guide.

Many multinational companies have their own reporting requirements. If retention of this customer is important, their requirements should be included in the declarations made.

Recommended Level of Declaration Overview

Companies have been reluctant to make full material declarations. The reasons given are:

- It gives away information to the competitors.
- There are too many types components for materials declaration to be practical.

The first on the list does not stand up to careful scrutiny. If a competitor wants to know the material content he will just carry out a material analysis on the product.

The second on the list is a more understandable concern because often component manufacturers will make 100s if not 1000s of different components. The trick to overcome this is to report by families of products in

percent of product weight for materials and percent of homogeneous material for substances. Try to split them into groups so the error never exceeds +/- 10% and for hazardous substances the maximum is reported. As an example the format for the declaration of a chip resistor would be?

Element: body

Material ceramic, 94% of part weight
Substance ceramic, 92% of material
Substance Silver, 8% of material

Element: Lead

Material plating, 6% of part weight
Substance, tin 50% of material
Substance, nickel 50% of material

The inclusion of the above information is likely to become a valuable market advantage for a component manufacturer. This information will also need to be given on Material Safety Data Sheets when they are required under REACH. These should be generated if the part contains any of the substances listed under 67/548/EEC on Classification and Labelling of Dangerous Substances.

http://ec.europa.eu/environment/dansub/home_en.htm

Market Leader Level of Declaration Overview

The indications are at the moment that for the EuP, standardised data will be used to analyse products. For passive components this means that a standard sets of data can be used for these components. The data covers:

- Primary gross energy requirement (GER) , feedstock (energy from incineration), and electricity usage of the total energy.
- Air emissions:
 - Greenhouse gases (GWP)
 - Acidifying agents (AD)
 - Volatile organic compounds (VOC)
 - Persistent organic pollutants (POP)
 - Heavy metals (HM)
 - Polycyclic Aromatic Hydrocarbons (PAH)
 - Particulate matter (PM)
- Water emissions of heavy metals and Eutrophication (EUP).
- Hazardous and non-hazardous waste generation
- Water use for process and cooling

In principle the above would mean that passive component manufacturers would only have to supply the component weight to their customers. However some of the multinational companies may wish to gather real data from their suppliers so they can use it to help meet EU set targets for their products. In addition some suppliers may wish to drive performance improvements to help them get a larger market share. All the above parameters can be declared for

families of products as per material content. (See appendix 1 for detail definition of parameters)

Table . Life Cycle Impact (per unit) of Products										
Nr	Life cycle Impact per product:					Date	Author			
0	Products					0	vhk			
Life Cycle phases -->										
Resources Use and Emissions		PRODUCTION			DISTRI- BUTION	USE	END-OF-LIFE*		TOTAL	
		Material	Manuf.	Total			Disposal	Recycl.	Total	
Materials		unit								
1	Bulk Plastics	g			0		0	0	0	
2	TecPlastics	g			0		0	0	0	
3	Ferro	g			0		0	0	0	
4	Non-ferro	g			0		0	0	0	
5	Coating	g			0		0	0	0	
6	Electronics	g			0		0	0	0	
7	Misc.	g			0		0	0	0	
	Total weight	g			0		0	0	0	
<i>see note!</i>										
Other Resources & Waste							debit	credit		
8	Total Energy (GER)	MJ	0	0	0	0	0	0	0	
9	of which, electricity (in primary MJ)	MJ	0	0	0	0	0	0	0	
10	Water (process)	ltr	0	0	0	0	0	0	0	
11	Water (cooling)	ltr	0	0	0	0	0	0	0	
12	Waste, non-haz./landfill	g	0	0	0	0	0	0	0	
13	Waste, hazardous/ incinerated	g	0	0	0	0	0	0	0	
Emissions (Air)										
14	Greenhouse Gases in GWP100	kg CO2 eq.	0	0	0	0	0	0	0	
15	Ozone Depletion, emissions	mg R-11 eq.	negligible							
16	Acidification, emissions	g SO2 eq.	0	0	0	0	0	0	0	
17	Volatile Organic Compounds (VOC)	g	0	0	0	0	0	0	0	
18	Persistent Organic Pollutants (POP)	ng I-Teq	0	0	0	0	0	0	0	
19	Heavy Metals	mg Ni eq.	0	0	0	0	0	0	0	
	PAHs	mg Ni eq.	0	0	0	0	0	0	0	
20	Particulate Matter (PM, dust)	g	0	0	0	0	0	0	0	
Emissions (Water)										
21	Heavy Metals	mg Hg/20	0	0	0	0	0	0	0	
22	Eutrophication	g PO4	0	0	0	0	0	0	0	
23	Persistent Organic Pollutants (POP)	ng i-Teq	negligible							
*-Note: Recycling credits only relate to recycling of plastics and electronics (excl. LCD/CRT). Recycling credits for metals and other fractions are already taken into account in the production phase.										

Standardised data being used by the preparatory study groups.

REACH Industry Preparation Letter No 3 from cefic states for both manufacturers/Importers (Registrants) and downstream Users they should start preparing now the following:

- Produce your own company inventory of individual chemical substances and preparations.
- Define for each substance or preparation your own status from the perspective of REACH (M/I, distributor, DU, legal entity) and your "position" in the supply chain.
- Define for each substance or preparation your own status from the perspective of REACH (M/I, distributor, DU, legal entity) and your "position" in the supply chain.

- Establish whether individual substances and preparations fall into the following categories:
 - Manufactured by your company within the EU
 - Imported by your company into the EU
 - Purchased by your company from a supplier established within the EU

Component manufacturers use a lot of substances and starting preparation now will make the whole task more manageable.

Declaration Tools

RosettaNet

RosettaNet (www.rosettanet.org/) have established a standard for the electronic exchange of materials and substance data between companies that uses XML.

IPC 1752

IPC have developed a PDF electronic form for materials declaration. It can handle a full materials and substance declaration. It is XML based so could be automatically populated. (http://members.ipc.org/committee/drafts/2-18_d_MaterialsDeclarationRequest.asp)

The GoodBye Chain Group

Material Declaration Wizard 3.0 is a software package for declaring materials to the 'Joint Industry Guide' levels A, B, and C.
(www.smta.org/declaration_software.html)

Synapsis

web-based Environmental Material Aggregation and Reporting System for WEEE, RoHS and ELV.
(www.synapsistech.com/Products_Environmental_Compliance.asp)

PlesTech

Materials, REACH and EuP declarations. Software/database with web based documentation, and database updates (www.plestech.co.uk)

4. Eco-design checklists for passive component manufacturers

The following checklist does not include items already covered in previous lists, and should be used in conjunction with those lists.

<i>Eco-design Requirements Checklist</i>	
Checklist Item	Answer
Do you have sufficient person(s) that have received training in eco-design?	
Is eco-design an integral part of the management system for product launch?	
Are their company metrics and targets for eco-design, which are reviewed by top management?	
Is eco-design included in design and product launch reviews together with price, quality, milestones etc?	
Does the corrective action system include product environmental issues?	
<p>When choosing materials for components do you consider alongside price and quality the environmental impacts of producing the components for:</p> <ul style="list-style-type: none"> • Hazardous material content? • Energy use? • Waste generation (hazardous and non-hazardous)? • Water use? • Water emissions? • Air emissions? 	
<p>Where applicable and can be influenced by design do you consider and try to reduce the environmental impact of the part on:</p> <ul style="list-style-type: none"> • Product assembly? • Product Use? • End-of-life disposal/recycling of the product? 	
Where applicable have you compared the environmental impact of using different technologies for producing the part?	
Does marketing use your strengths in eco-design in a similar manner to those in cost and quality?	

Checklist Item	Answer
Have you investigated the overall environmental impact and associated costs of using reusable packaging with selected customers?	
Have you designed the component packaging for minimal environmental impact including: <ul style="list-style-type: none"> • Absence of hazardous substances? • Minimal weight? • Minimal volume? • Economical to recycle at end-of-life? • Least number of different materials? 	
<i>If the answer to any of the above is no, put in place a documented plan to address the issue(s) with target completion dates.</i>	

Background

Eco-design is in the process of making the same sort of step change that was seen in the 1970/80s with the establishment by the Japanese of integrated quality control and in 1986 by the Six Sigma methodology pioneered by Bill Smith at Motorola. The latter manages process variations that cause defects, defined as unacceptable deviation from the mean or target; and to systematically work towards managing variation to eliminate those defects. Many companies not embracing these changes went out of business or lost market share. Prior to these changes quality was considered peripheral to the main business activity just as eco-design is for many companies today.

What is causing this change? It is the fast growing public awareness of the environmental damage being done by products to their quality of life and that of their children plus the growing body of legislation emerging in many countries to try and limit that damage. As an example a poll carried out by [Zogby International](#) in the US (A country not generally seen as strong on environmental issues) stated: “*Nearly three of every four (general public) – 74% – are more convinced today that global warming is a reality than they were two years ago*” In addition “*The survey also indicated there is strong support for measures to require major industries to reduce their greenhouse gas emissions to improve the environment without harming the economy – 72% of likely voters agreed such measures should be taken.*”

As a result of the above passive component manufacturers can expect to see the following trends coming very quickly from their customers:

- Request for more environmental information.

- Demonstration of capability to integrate eco-design into product launch
- Reduction in environmental Impacts from components used in their products.
- Product redesigns resulting in changes to types of components used in products.

Applying Eco-design

When starting with eco-design either hire or train an individual to take overall control of its implementation. That person should then be overall responsible for:

- Constructing an implementation plan with dates and costs.
- Getting top management buy in for the implementation plan
- Establishing measurable and appropriate metrics.
- Putting in place the resources, and organisation.
- Training of staff
- Documented procedures and auditing of them.

Once the organisation is in place, determine for the company products, what environmental impacts can be influenced by component design. For instance a manufacturer of chip resistors can not impact the energy used by the products during the use phase so that should be ignored. However part weight, choice of materials, part packaging and data declarations are all very important.

The environmental performance of parts is likely to become much more important in the marketing of products, since it is an area a company can demonstrate it is better than its competitors, and something that customers will increasingly want as the EuP and other legislation comes into force. For this reason ensure the marketing/sales departments are fully involved and environmental data required by the customer base is easily available from the web.

What is the first thing a company should do once the system is in place? Understand what is currently being sold. This includes:

- Part and packaging weights
- Material composition and identification of hazardous substances in parts and packaging.
- Energy used to produce products and packaging including idle time energy. Include overheads (offices)
- Waste and hazardous waste generated.
- Any emissions to air and water during production.
- Recyclability of packaging including any return and reuse activities.

The above can be used as a starting point to drive future improvements. One of the things many companies are surprised over is that often by doing this exercise they can make substantial cost savings. Few companies know exactly where the energy is being consumed and often most of it is consumed

doing nothing (Sometimes up to 90%). If a company has multiple factories it is not unusual to find large variations in energy use between them. In addition to the above further saving can often be made by reductions in the use of materials especially packaging. In summary a well planned exercise with improvements implemented can result in:

- Reduced costs
- More environmentally friendly products.
- Good customer satisfaction
- A clear marketing advantage.

Eco-Design Tools

There are many eco-design tools available, however check that they will do at least the following before investing in one:

- It uses a database to store the parts. Most component manufacturers deal with 100s or thousands of different part numbers and a database system is essential for handling them.
- Ensure similar parts can be generated so that only a few fields have to be changed for each part.
- Can import and export records in at least XML, ODBC, and Excel.
- Handle EuP standardised data, and the EuP standardised data records are kept up to date.
- Can generate materials composition, EuP data and RoHS compliance reports
- Can it handle both product and packaging.
- Can the tool be used by current staff of the company, or is expertise not in the company required?
- Does it fit in well with how products are launched by the company?
- Is the tool user friendly?
- Does the tool also address other environmental product legislation requirements such as REACH?
- Is it affordable for the company?

The following links can be used as a starting point.

Product Eco-design Tools:

- Eco Scan <http://www.ind.tno.nl/en/product/ecoscan/>
- EDT <http://www.plestech.co.uk>
- Idemat <http://www.io.tudelft.nl/research/dfs/idemat/index.htm>

Life Cycle Analysis:

- Boustead <http://www.boustead-consulting.co.uk/>
- GaBi <http://www.gabi-software.com/>
- Sima Pro <http://www.pre.nl/simapro/default.htm>
- TEAM http://www.ecobilan.com/uk_team03.php

Appendix: Definitions of EuP Environmental Indicators

Gross Energy Requirement (GER)

Gross energy requirement (GER) which is defined by IFIAS (1974) as: "... the amount of energy source which is sequestered by the process of making a good or service ...". The GER of a product is the sum of all energy sources which are required for the making of the product or service.

The EuP values given per gram of common passive components are:

Big capacitors and coils	SMD components and LEDs
0.38 MJ	2.97 MJ

Whilst SMD components are very light (Typical 1206 chip is about 0.01gm) a product can use 100s or even thousands of them, and the total energy used to produce them becomes substantial.

Hazardous and Non-hazardous Waste

Waste has been defined as the solid waste that is not reused or recycled. Hazardous waste refers to the substances listed in RoHS plus others non-defined. For the Excel ecodata spreadsheet of standardised values the definitions given in the waste directive 75/442/EEC appear to have been used. For the 2 types of passive components considered above the waste generated in grams per gram of components are:

	Big capacitors and coils	SMD components and LEDs
Hazardous	0.02 grams	0.13 grams
Non-hazardous	0.6 grams	2.8 grams

Besides reducing component weight, the choice of materials and the plating process are the largest influence on these figures. Nickel plating produces for example 20 grams of waste for every gram of plating. Precious metals such as gold, produce 26 grams of hazardous and 187,500 grams of non-hazardous waste, for every gram of gold. Luckily the amount normally used in components is very small. However when you take the total product into account the overall hazardous and non-hazardous waste generated can still be fairly large.

Water Use (Process and Cooling)

Process water usage is the one of primary importance between the two indicators. It is the water used in the process of the material or part that is then normally disposed of into the sewage system. A secondary indicator is cooling water which can be taken from a river or lake then returned to them slightly warmer. Only the first is really normally of any concern. The process water usage for the 2 types of passive components per gram of components is:

Big capacitors and coils	SMD components and LEDs
0.035 litres	0.9 litres

Metal plating, plastics, ceramics and paper all use a lot of process water.

Water Emissions (Heavy metals and EUP)

The 2 main pollutants to water by energy using products are heavy metals and eutrophication (EUP). The first are metals such as lead and mercury and the amount is expressed as mg of equivalent mercury/20.

The second is eutrophication, which is a process whereby water bodies, such as lakes, estuaries, or slow-moving streams receive excess nutrients that stimulate excessive plant growth such as algae. This enhanced plant growth, often called an algal bloom, reduces dissolved oxygen in the water when dead plant material decomposes and can cause other organisms to die. This can be caused by pollutants and in particular phosphorus, nitrogen, and carbon. This is expressed as one value in terms of mg of phosphorus (PO₄) equivalent. The metal and EUP impact for the 2 types of passive components per gram of components are:

	Big capacitors and coils	SMD components and LEDs
Metal (mg Hg/20eq)	0.074	0.015
EUP (mg PO ₄ eq.)	0.007	2.2

Metal plating is a large source of both metal and EUP emissions. In addition plastics and paper can generate high levels of EUP.

Air Emissions (GWP, AD, VOC, POP, HM, PAH and PM)

The following are definitions of the different air emissions included under the EuP standardised data:

- **GWP:** Is the 'Global Warming Potential' from gas emissions, or sometimes call greenhouse gases. It is a relative scale which compares the gas in question to that of the same mass of carbon dioxide (whose GWP is by definition 1). The standardised data is expressed in terms of equivalent kilograms of carbon dioxide (CO₂).
- **AD:** These are 'Acidifying Agents' that cause what is commonly known as acid rain. They mainly form during fossil fuel combustion. When emissions of sulphur dioxide and nitrogen oxides come in contact with water, they become sulphuric acid and nitric acid. The standardised data is expressed in terms of equivalent grams of sulphur dioxide (SO₂).
- **VOC:** These are 'Volatile Organic Compounds' which are emitted as gases from certain solids or liquids. Many organic compounds are known to cause cancer in animals; some are suspected of causing, or are known to cause, cancer in humans. The main sources of VOC for passive components are paints, lacquers and adhesives. The standardised data is expressed in terms of mg of VOC.
- **POP:** These are 'Persistent Organic Pollutants' which are a set of chemicals that are toxic, persist in the environment for long periods of time, and bio-magnify as they move up through the food chain. They include polychlorinated biphenyls (PCBs), which were used as plasticizers in paints, plastics, and rubber products and dioxins and furans, which are produced unintentionally from most forms of combustion. Dioxins comprise of polychlorinated dibenzo-para-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs). The standardised data is expressed in terms of ng I-TEq. This is a rather complex measurement which is the summation of individual (Toxicity Equivalents) TEQs for a mixture of PCDDs and PCDFs and is termed the International Toxicity Equivalent or I-TEq of the mixture.
- **HM:** Stands for heavy metals. The 3 particularly harmful metals are cadmium, lead and mercury, which are covered by the 1998 Heavy Metals Protocol. Parties agreed to reduce their emissions for these three metals below their levels in 1990. The main cause from passive components now mercury switches have been banned is from paint. The standardised data is expressed in terms of mg of equivalent nickel.
- **PAH:** These are 'Polycyclic aromatic hydrocarbons' and are chemical compounds that consist of fused aromatic rings. Some of them are known or suspected carcinogens. They are formed by incomplete combustion of carbon-containing fuels. PAHs have been grouped with the heavy metals under directive 2004/107/EC so under the standardised data it is expressed in terms of mg of equivalent nickel as above.
- **PM:** Stands for particulate matter. It is a complex mixture of extremely small particles and liquid droplets made up of a number of components, including acids (such as nitrates and sulphates), organic chemicals, metals, and soil or dust particles. The standardised data it is expressed in terms of grams of PM.

The air emissions impact for the 2 types of passive components per gram of components are:

	Big capacitors and coils	SMD components and LEDs
GWP (kgCO ₂ eq)	0.022	0.167
AD (g SO ₂ eq)	0.14	1.62
VOC (mg)	0.0001	0.0075
POP (ng I-Teq)	0.002	0.015
HM (mg Ni eq)	0.008	0.422
PAH (mg Ni eq)	0.204	0.004
PM (g)	0.035	0.051

Except for the last 2 lines the environmental impact of SMDs and LEDs per gram of components is much higher than for big capacitors and coils. Again as per some of the previous sections metal plating can have a big impact particularly on HM, POP, and AD emissions. The use of precious metals such as gold have a large impact on GWP.