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# Envisioning Ecodesign

Definitions, Case Studies and Best Practice

The European Network of Ecodesign Centres (ENEC) was founded in 2012.



**The five founding members are:**

- Ecodesign Centre (Wales)
- Effizienz-Agentur NRW (North Rhine-Westphalia)
- OVAM (Flanders/Belgium)
- Ihobe (Basque Country)
- Pôle Eco-Conception (Rhône-Alps, France)



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## 1. Introduction

**Our mission is to  
openly exchange knowledge, experience  
and best practice on all aspects of ecodesign  
to make good design, ecodesign happen.**

To deliver on this mission, ENEC partners require a shared vision of ecodesign and this document describes that vision.

This has been co-created by the partners, by sharing each partner's unique understanding of ecodesign. This co-creation process is supported by existing academic literature and criteria indicative of best-practice case studies of ecodesign. To support this each ENEC partner presents a best-practice example of ecodesign from their respective region.

The document is structured into the following sections: Defining Ecodesign; Distinguishing between Life Cycle Thinking and Environmental Burden-Shifting; Distinguishing between Ecodesign, Green Design and Related Areas; Criteria for Best Practice; Best Practice Case-Studies.



## 2. Defining Ecodesign

This section analyses 34 definitions of ecodesign including each partner's proposed definition as well as a selection from the literature. Two approaches to defining ecodesign can be identified: (1) strategic and (2) operational definitions. Table 1 presents a list of these definitions in chronological order.

- Definitions are classified according to: working; policy; academic; standard; encyclopedic.
- The most common characteristics of ecodesign definitions are:
  - (1) environmental impact reduction
  - (2) life cycle thinking and
  - (3) taking a product design focus.
- Traditionally ecodesign has been seen as applicable to products (including packaging), whereas more recently its field of application has broadened to include services and systems.
- A distinction between life cycle thinking and burden-shifting is also identified and discussed further in section 3.

Figure 1 Visionary Ecodesign

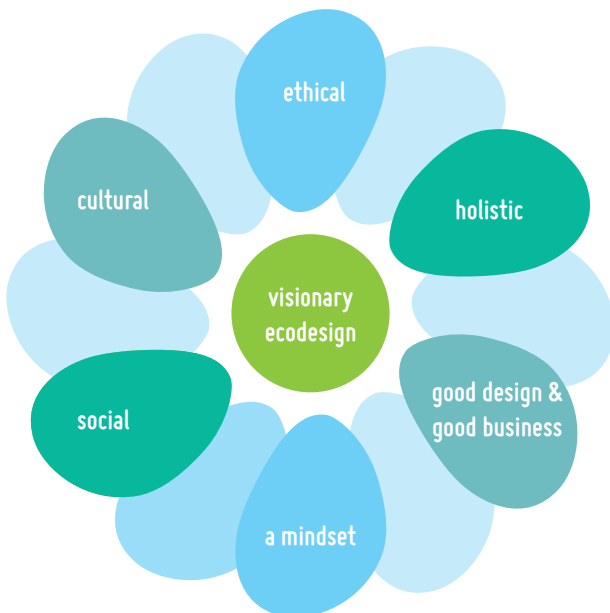


Figure 2 Operational Ecodesign



**Table 1 Definitions of Ecodesign**

	author	source	year	definition	type
1	Lindhal and Ekermann	academic	2013	Eco-Design is not a specific method or tool, but rather a way of better design through analyzing and synthesising in order to reduce environmental impacts throughout the product's life cycle.	Strategic
2	Sustainable minds	working/web	2013	Ecodesign systematically incorporates environmental decisions into the design process. Three key approaches shape the framework and practice of ecodesign: 1. Life cycle thinking; 2. Decrease environmental impact early in the design process; 3. Environment as an additional design requirement.	Operational
3	Dewulf	academic	2013	Ecodesign and Design for Environment (DfE) are terms for strategies that aim to integrate environmental considerations into product design and development.	Operational
4	European Commission	policy	2012	Ecodesign implies taking into account all the environmental impacts of a product right from the earliest stage of design. In particular, this avoids uncoordinated product planning (for example, eliminating a toxic substance should not lead to higher energy consumption, which on balance could have a negative impact on the environment).	Operational
5	Plouffe et al.	academic	2011	Ecodesign involves simultaneously taking into account the environmental impacts associated with the selection of materials, the manufacturing process, the storage and transportation phase, usage, and final disposal.	Operational
6	ISO 14006	standard	2011	Ecodesign is the integration of environmental aspects into product design and development with the aim of reducing adverse environmental impacts throughout a product's life cycle.	Operational
7	IHOBE	working	2011	Ecodesign is the integration of environmental aspects into product design and development with the aim of reducing adverse environmental impacts throughout a product's life cycle.	Operational
8	Borchardt et al.	academic	2011	Ecodesign is a set of project practices oriented to the creation of eco-efficient products and processes.	Operational
9	Zhao et al.	academic	2010	DfE is a practice by which environmental considerations are integrated into product and process engineering design procedures.	Operational
10	Pigosso et al.	academic	2010	Ecodesign is a proactive approach of environmental management that aims to reduce the total environmental impact of products.	Operational

11	Platchek	academic	2008	Ecodesign is a holistic view in that, starting from the moment we know the environmental problems and its causes, we begin to influence the conception, the materials selection, the production, the use, the reuse, the recycling and final disposition of industrial products.	Operational
12	Guelere Filho et al.	academic	2007	Ecodesign (Europe) or Design for Environment (US) implies a new way of developing products where environmental aspects are given the same status as functionality, durability, costs, time-to-market, aesthetics, ergonomics and quality. Ecodesign aims at improving the product's environmental performance and may be seen as a way of developing products in accordance with the sustainable development concept.	Operational
13	Bhamra and Lofthouse	Textbook (Design for Sustainability p.39)	2007	Environmental considerations are considered at each stage of the design process.	Operational
14	Karlsson and Luttrupp	academic	2006	Eco design is about Design in and for sustainable development.	Strategic
15	EDC	working	2006	Ecodesign is simply good design and good business practice. It's a way of thinking and doing.	Strategic
16	Alonso	academic	2006	Ecodesign integrates environmental criteria in the design of products and services, so as to get the reduction of environmental impacts they produce, taking into account all stages of their life cycle.	Operational
17	Ölundh	academic	2006	Modernising ecodesign means taking advantage of environmental benefits and the innovation potential when developing solutions rather than using ecodesign simply to ensure that legal requirements or customer demands are met.	Operational
18	Lexique	encyclopedia/web	2006	Ecodesign is a method of designing products that takes into account their impact on the environment at all stages of their life cycle. It may for example result in the choice of a recyclable or biodegradable material for packaging or the development of a washing powder effective in cold water to reduce the energy consumption of washing machines.	Operational
19	Interreg (learn ecodesign)	academic	2005	Ecodesign (also design for the environment, life cycle design, environmentally conscious design) is the systematic methodology that incorporates environmental considerations into the design process of products.	Operational

20	Manzini	academic	2005	The term “ecodesign” indicates a design activity aimed at connecting what is “technically possible” to what is “ecologically necessary” in order to formulate new socially and culturally acceptable proposals.	Strategic
21	Ecodesign Directive	policy	2005	Ecodesign is the integration of environmental aspects into product design with the aim of improving the environmental performance of the product throughout its whole life cycle.	Operational
22	Wimmer et al.	academic	2004	Ecodesign is how to integrate environmental considerations into product design and development.	Operational
23	Bhamra	academic	2004	Ecodesign is understood to be the systematic integration of environmental considerations into the design process across the product life cycle, from cradle to grave.	Operational
24	Pole Eco-conception	policy	2004	Eco-design helps reduce the negative environmental impacts throughout the life cycle of the product during the design phase.	Operational
25	EFA	standard	2003	Through the integration of Life Cycle Thinking and evaluation of environmental impacts new methods and tools will be needed in the product development process to develop environmentally preferable products. Ecodesign therefore will become an integrated part of the state of technology product development processes.	Operational
26	OVAM	policy	2003	Ecodesign assumes that the effect a product has on the environment should be considered and reduced at all stages along the product life cycle. These stages include the extraction of the raw materials, the manufacturing of the product, its marketing and distribution, the use and finally, the disposal of a product. The term product includes hardware as well as software respectively services. Ecodesign products are „flexible, reliable, durable, adaptable, modular, dematerialised and reusable“.	Operational
27	Dewulf	academic	2003	It comprises the systematic integration of environmental aspects into product design with the aim to reduce the overall environmental impact of the product throughout its whole life cycle.	Operational
28	ISO 14062	standard	2002	Doesn't define ecodesign but discussed integration of environmental considerations in product development.	Operational

29	Fuad-Luke	Textbook (Ecode- sign – The Sourcebook – glossary)	2002	A design process that considers the environmental impacts associated with a product throughout its entire life from acquisition of raw materials through production/ manufacturing and use to end of life. At the same time as reducing environmental impacts ecodesign seeks to improve the aesthetic and functional aspects of the product with due consideration to social and ethical needs. Eco- design is synonymous with the terms design for environment (DfE), often used by the engineering design profession, and lifecycle design (LCD) in North America.	Operational
30	Sherwin and Evans	academic	2000	The design of a product, service or system with the aim of minimising the overall impact on the environment.	Operational
31	Brezet and van Hemel	academic	1997	Eco-design considers environmental aspects at all stages of the product development process, striving for products which make the lowest possible environmental impact throughout the product life cycle.	Operational
32	Fiksel	academic	1996	Ecodesign is a process that develops a product that meets cost, performance, quality, as well as environmental attributes of a product by integrating environmental aspects into product design engineering process.	Operational
33	Ecodesign Platform	working / web	1996	Ecodesign assumes that the effect a product has on the environment should be considered and reduced at all stages along the product life cycle.	Operational
34	Wikipedia	encyclopedia / web	ND	Ecodesign is an approach to design of a product with special consideration for the environmental impacts of the product during its whole life cycle.	Operational

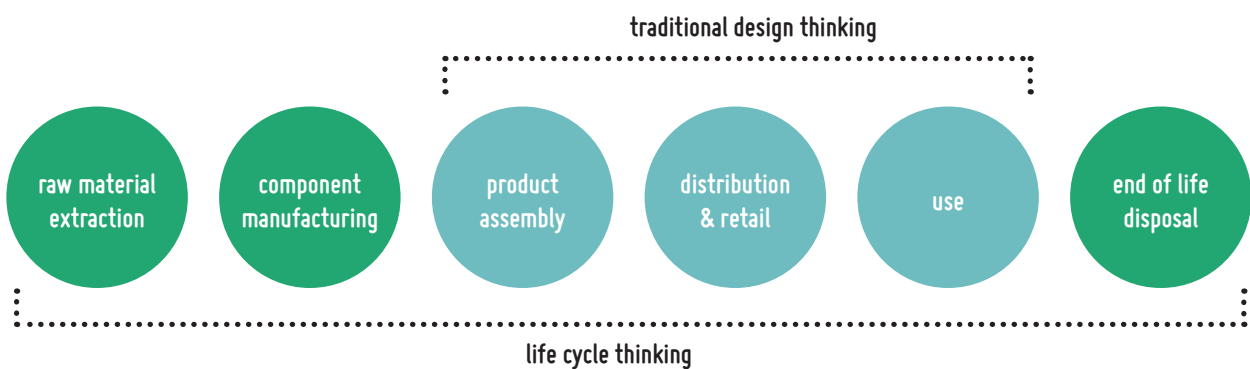




### 3. Distinguishing between Life Cycle Thinking and Environmental Burden-Shifting

Consideration of the whole life cycle is known as life cycle thinking and is fundamental to ecodesign. Life cycle thinking differs from traditional design thinking in that it expands the focus of designers from design and manufacturing stages to include additional upstream stages, downstream stages and transportation between each of these. The intention of life cycle thinking is to convey the risks of environmental burden shifting or trade-offs, along product life cycles.

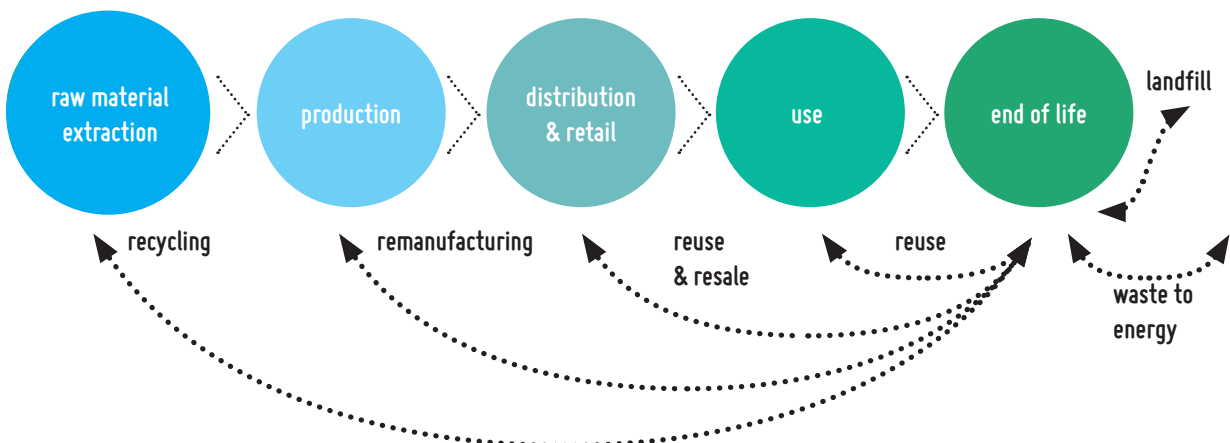
Figure 3 Life Cycle Thinking



Trade-offs arise when environmental improvements at one stage of a life cycle can have negative impacts further upstream or downstream in the life cycle. For example, material substitution may provide a less toxic solution but reduce the durability of a product. Such complex scenarios are common in ecodesign decision-making but poorly represented in the ecodesign literature. Of the numerous ecodesign definitions identified in Table 1 the European Commission's definition is potentially the most holistic as it integrates the risk of these trade-offs in applying ecodesign strategies.

The Joint Research Council (JRC) suggests that the 'key to life cycle thinking is burden-shifting' and the definitions identified tend to use both. Though these terms appear to be used interchangeably, they are not one and the same. Life cycle thinking may refer to, for example, designing for disassembly at the early stages of product development to foster easy recycling at the end of life. Whereas, burden-shifting may refer to designing for disassembly to support recycling at the end of life, where design for disassembly may require more complex materials which inhibits recyclability of that product.

Figure 4 Life Cycle Stages



Approaching ecodesign as an additional new product development constraint can potentially offer an easy entry-point into a company's traditional or standard processes. Integrating ecodesign within a company's processes translates into a business opportunity for innovation and competitive advantage. It has been suggested that integrating ecodesign in product development processes can reduce environmental impacts by up to 80% (Graedel and Allenby 1995). The further along the new product development process is, the more difficult it becomes to implement design changes or address environmental impacts. As such, environmental impacts can become locked-in. Reflecting this, Guelere Filho et al. (2007) define ecodesign as another one of the many constraints that drive innovation and creativity in new product development. Thus, companies need to be aware of potential impacts early in the design process (Bhamra, 2004; Sherwin and Evans, 2000). Ecodesign needs to be an integrated activity, considered early in the design process and represented in the brief alongside other constraints that a design team considers. Many authors stress the importance of this early stage action (Dewulf, 2013; Sherwin and Evans, 2000; Karlsson and Luttrupp, 2006). This is because it is also at this early stage of the new product development process that much of the costs are determined, making design changes expensive as new product development progresses.

Ecodesign is also a strategic approach to designing products to reduce environmental impacts across the whole product life cycle. The whole life cycle includes raw material extraction, production, transportation, use and end-of-life cycle stages. Depending on the product or sector one or many of these stages may become more important and represent, or carry, the key environmental impacts. This depends on many factors such as supply chain complexity and its global distribution, proximity to the end market and energy consumption during the use phase, amongst others. This concept is known as the occurrence of hot spots on the life cycle.





## 4. Distinguishing between Ecodesign, Green Design and Related Areas

Determining if an environmental impact reduction is purely on account of an ecodesign approach may be difficult. For example, some environmental impact reductions are driven by cost reductions achieved through resource efficiency measures, rather than a prioritisation of environmental impact reduction through ecodesign activities. To distinguish between ecodesign and other areas a number of definitions of closely related areas have been collated. Green design focuses on single environmental issues and sustainable design incorporates wider social and economic criteria. In 1998, the Wuppertal Institute developed the Material Input Per Service unit (MIPS), to address absolute decoupling of environmental impacts from economic growth. The Wuppertal Institute's perspective on resource efficiency does not include environmental impact reduction, whereas, the UNEP definition listed in Table 2 does. Recent research by Prendeville (2014) aligns with the perspective of the Wuppertal Institute. This study showed that certain resource efficiency measures taken by a specific company conflicted with longer-term environmental impact reduction.

**Table 2** Definitions of areas closely related to Ecodesign

SOURCE	YEAR	TYPE	DEFINITION
<b>Green Design</b>			
Bhamra and Lofthouse	2008	Text Book	Green design focuses on single issues, for example the inclusion of recycled or recyclable plastic, or consideration of energy consumption.
Fuad-Luke	2002	Textbook (Ecodesign – The Sourcebook – glossary)	A design process in which the focus is on assessing and dealing with individual environmental impacts of a product rather than on the product's entire lifecycle.
<b>Sustainable Design</b>			
Thorpe 2006 (Designers Atlas of Sustainability)	2006	Text book	Theories and practices for design that cultivate ecological, economic, and cultural conditions that will support human well-being indefinitely.
<b>Design for Environment</b>			
McGraw Hill Science and Technology Dictionary		Text book	A methodology for the design of products and systems that promotes pollution prevention and resource conservation by including within the design process the systematic consideration of the environmental implications of engineering designs. Abbreviated DFE.
Fuad-Luke (2002)	2002	Textbook (Ecodesign – The Sourcebook – glossary)	The analysis and optimization of the environmental, health and safety issues considered over the entire life of the product. DFE permits resource depletion, waste production and energy usage to be reduced or even eliminated during the manufacture, use and disposal or reuse of the product.
<b>Design for Sustainability</b>			
Bhamra and Lofthouse 2007	2007	Text Book	Design that considers the environment (for example resource use and end-of-life impact) and social impact of a product (for example usability, responsible use).

<b>Ecological Design</b>			
Van der Ryn and Cowan (as cited by The Sustainable Design Handbook p.14)		Text Book	Design that transforms matter and energy using processes that are compatible and synergistic with nature and modelled on natural systems.
<b>Sustainable Product Design</b>			
Fuad-Luke (2002)	2002	Textbook (Ecodesign - The Sourcebook - glossary)	A design philosophy and practice in which products contribute to social and economic well-being, have negligible impacts on the environment and can be produced from a sustainable resource base. It embodies the practice of eco-design, with due attention to environmental, ethical and social factors, but also includes economic considerations and assessments of resource availability in relation to sustainable production.
<b>Resource Efficiency</b>			
UNEP	Circa 2010	UNEP: Resource Efficiency	UNEP defines resource efficiency from a life cycle and value chain perspective. This means reducing the total environmental impact of the production and consumption of goods and services, from raw material extraction to final use and disposal.



## 5. Criteria for Best Practice

A set of typical product characteristics is evident in the ecodesign definitions that have been identified. Within these definitions there is few references to eco-innovation, which is stressed in the awards criteria. Also evident in the case study criteria is the need for ecodesign to be embedded within the organisation (more than a flagship product) and also the potential for product scalability. The following are the proposed criteria for an ENEC ecodesign case study.

1. Strategic vision, ecodesigned with intent and an organisational aspect
2. Operational integration during product development
  - Environmental impact reduction of products, processes and services
  - Life Cycle Thinking with additional consideration of burden-shifting
  - Competitive, innovative and scalable
  - Quality, functional and aesthetic

Figure 5 Criteria for Best Practice





## 6. Best Practice Case-Studies

**Company: Orangebox**

**Product: Do Chair**



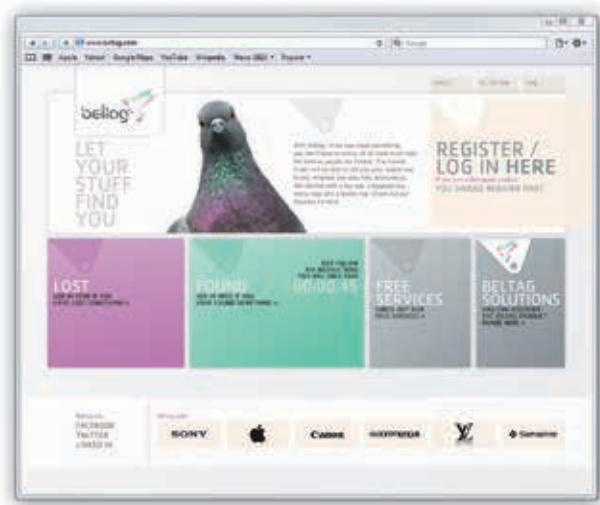
Ecodesign  
Centre Wales  
Canolfan  
Ecodaylunio  
Cymru

### This is ecodesign because

- It is designed in collaboration with local Welsh suppliers and manufactured in Wales, reducing environmental impacts at the transport stage.
- It has a reduced part count, streamlined Bill of Materials (BOM) and lighter weight (25% lighter than its market predecessor).
- The reduced part count and simplified design mean it is efficient to assemble, reducing production costs and energy consumption during the manufacturing stage.
- It is designed for easy disassembly and Orangebox offer a product take-back service for the product at the end of life.

»» Website: [www.orangebox.com](http://www.orangebox.com)

## Company: Pars Pro Toto Product: Beltag



### This is ecodesign because

- Beltag is a combined product-service that provides tags (such as key tags, luggage labels, stickers and clothes labels) and covers every step needed to return lost property to its rightful owner.
- This service tackles a very real problem. A tremendous number of items are lost every day. It is often very difficult, if not impossible to trace the owner.
- For the owner, it is unpleasant, annoying and even traumatic to lose something of value. Because of this many found items are discarded or unused, while their owner has to purchase a new product in its place.
- This system lengthens the lifespan of a product and does away with the need to find a replacement.
- Beltag also bolsters a number of other (social) values, such as peace of mind, satisfaction, product attachment and a feeling of security.

Pars Pro Toto won a cash prize of EUR 4,000 and a trophy for its design.

»» Website: [www.beltag.com](http://www.beltag.com)

## Company: Studio Segers for The Heating Company

### Product: C2C Aluminium radiators



#### This is ecodesign because

- The radiator produces optimal heat due to the radiated heat at the front and the convected heat at the back
- The Aluminium extruded profiles contain two water channels
- It's made of 100% recycled Aluminium
- The product has three important energy-saving properties:
  - the radiator uses less water, which provides a high speed response
  - Aluminium is a good heat conductor and therefore a better option because a low water temperature is sufficient
  - optimal heat is achieved by radiating heat from the front and preventing any loss of heat through the wall
- Furthermore, the radiator is three times lighter than a steel one. This benefits transport, assembly and possible applications.

Studio Segers receives a cash prize of EUR 4,000 and a trophy.

»» Website: [www.studiosegers.be](http://www.studiosegers.be)



**Company: Reinhard Krückemeyer GmbH & Co. KG**  
**Product: RK Coil Protect**



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NRW

**eFa+**

**This is ecodesign because**

- It uses nearly 100% recycled material (scrap tires)
- It can be re-used several times whereas alternative products are single-use
- It reduces the steel scrap and protects the coil from damage during transportation
- It is almost 100% recyclable
- It is applied to the coil in half the time of conventional protection systems

»» Website: [www.krueckemeyer.de](http://www.krueckemeyer.de)

Company: A&B Laboratorios

Product: DD 474 – Machine Eco-Detergent



#### This is ecodesign because

- It has received a European Ecolabel and has been independently audited through the process of ISO 14001 ecodesign certification.
- It is an innovative biotechnology-based product that is less hazardous than traditional products.
- It is 29% more efficient than any other leading chemical cleaner in the market, and is also competitively priced.
- It has an improved chemical make-up with no phosphates, biocides, dyes and perfumes, or Volatile Organic Compounds (VOCs).

»» Website: [www.ab-laboratorios.com](http://www.ab-laboratorios.com)



Company: VICINAY CADENAS

Product: Eco-friendly Mooring Lines



**This is ecodesign because**

- It has an 11.61% reduction in environmental impact for each 1000 Kg of mooring line due to a reduction in the chain's diameter (reduction equivalent to 156 Kg CO<sub>2</sub>/T of chain).
- It has an optimised lifecycle using recycled raw material inputs and a 100% recyclable product.
- The chain's weight is decreased by 35% in comparison with previous models.
- It has achieved a market share of more than 60% for all mooring line products.

»» Website: [vicinaycadenas.net](http://vicinaycadenas.net)



**Company: Altinnova**  
**Product: ALTA0® Pump**



**This is ecodesign because**

- It has a compact form, and weight reduction of approximately 15%
- It uses recyclable materials: steel, HDPE, EPDM
- It is manufactured in France which limits the transport distance
- It uses a primary corrosion Zero Zinc (Irritant free and not harmful to the environment)
- The polyester powder paint uses no solvents or VOCs, and doesn't require additional thinner or water to apply
- Stock control is improved and is based on an estimated one year's manufacturing, resulting in transportation savings
- The reduction in transport costs is high and the cumulative savings can reach 60%
- The Alta0,®Pump is efficiently installed in 30 minutes and does not require power or a concrete base
- The product is made of 99% recyclable materials
- The end of life is managed by the municipality and components are easily separated into the appropriate recycling streams
- Altinnova participated in the developmental phase of a diagnostic tool (called Socio-Eco-Design) developed by Pôle Eco-Conception as part of a thesis on the subject



## 7. References

- Anon, 2006. Archive Lexique. Available at: [http://archives.universcience.fr/francais/ala\\_cite/expo/tempo/defis/lexique/pop\\_definition\\_print.php?iddef=1017](http://archives.universcience.fr/francais/ala_cite/expo/tempo/defis/lexique/pop_definition_print.php?iddef=1017) [Accessed February 11, 2014].
- Anon, McGraw Hill Dictionary of Scientific and Technical Terms Sixth Edit., McGraw-Hill Professional.
- Anon, Sustainable Minds. Available at: <http://www.sustainableminds.com/> [Accessed February 11, 2014b].
- Anon, Wikipedia Page. Available at: <http://en.wikipedia.org/wiki/Ecodesign> [Accessed February 11, 2014c].
- Bhamra, T. & Lofthouse, V., 2008. Design for Sustainability: A Practical Approach,
- Bhamra, T.A., 2004. Ecodesign: the search for new strategies in product development. *Journal of Engineering Manufacture*, 218 B, pp.557–569.
- Borchardt, M. et al., 2011. Redesign of a component based on ecodesign practices: environmental impact and cost reduction achievements. *Journal of Cleaner Production*, 19(1), pp.49–57.
- Brezet, H. & van Hemel, C., 1997. Ecodesign — A Promising Approach to Sustainable Production and Consumption, Paris.
- Dewulf, K., 2013. Sustainable Product Innovation: The Importance of the Front- End Stage in the Innovation Process. In P. D. Coelho, ed. *Advances in Industrial Design Engineering*.
- Dewulf, W., 2003. A pro-active approach to ecodesign: Framework and tools. Leuven, Belgium. Available at: <http://citeseerx.ist.psu.edu/viewdoc/download;jsessionid=DDEF09FB9BE696307CFCC488DE29546C?doi=10.1.1.124.9684&rep=rep1&type=pdf>.
- Effizienz Agentur NRW, 2013. Effizienz Preis NRW: Das Ressourceneffiziente Produkt, Available at: [www.ressourceneffizienz.de](http://www.ressourceneffizienz.de).
- Engineering Design at the Technical University of Vienna, 1996. Ecodesign Information. Available at: <http://www.ecodesign.at/> [Accessed February 11, 2014].
- European Commission, 2012. Ecodesign your Future: How Ecodesign can help the environment by making products smarter, Available at: [http://ec.europa.eu/enterprise/policies/sustainable-business/ecodesign/files/brochure\\_ecodesign\\_en.pdf](http://ec.europa.eu/enterprise/policies/sustainable-business/ecodesign/files/brochure_ecodesign_en.pdf).
- Fiksel, J.R., 1996. Design for environment: Creating ecoefficient products and processes., New York: McGraw-Hill Publication.
- Fraunhofer Institute for Reliability and Microintegration IZM, 2005. Learn-Ecodesign. Available at: <http://www.ecodesignarc.info/servlet/is/218/> [Accessed February 11, 2014].
- Fuad-Luke, A., 2006. ecoDesign: The Sourcebook Revised Edition,
- Graedel, T.E. & Allenby, B.R., 1995. *Industrial Ecology*, Englewood Cliffs, NJ: Prentice Hall.
- Guelere filho, A. et al., 2007. Improving Environmental Performance of Products by Integrating Ecodesign Methods and Tools into a Reference Model for New Product Development. *Complex Systems Concurrent En*, 55(16), pp.1–8.
- International Standards Institute (ISO), 2010. ISO 14006:2011 Environmental management systems — Guidelines for incorporating ecodesign.
- International Standards Institute (ISO), 2002. ISO/TR 14062:2002 Environmental management -- Integrating environmental aspects into product design and development.
- Karlsson, R. & Luttrupp, C., 2006. EcoDesign: what's happening? An overview of the subject area of EcoDesign and of the papers in this special issue. *Journal of Cleaner Production*, 14(15–16), pp.1291–1298.
- Kibert, C.J., 2012. *Sustainable Construction: Green Building Design and Delivery Third.*,
- Lindahl, M. & Ekermann, S., 2013. Structure for Categorization of EcoDesign Methods and Tools. In A. Y. C. Nee, B. Song, & S.-K. Ong, eds. *Re-engineering Manufacturing for Sustainability SE - 19*. Springer Singapore, pp. 117–122. Available at: [http://dx.doi.org/10.1007/978-981-4451-48-2\\_19](http://dx.doi.org/10.1007/978-981-4451-48-2_19).
- Manzini, E., 1992. Limits and Possibilities of EcoDesign; From the “ecological re-design” of products to the suggestion of “new environmental scenarios.”

Ölundh, G., 2006. Modernising Ecodesign: Ecodesign for Innovative Solutions. Royal Institute of Technology. Available at: <http://kth.diva-portal.org/smash/get/diva2:9846/FULLTEXT01>.

Pigosso, D.C.A. et al., 2010. Ecodesign methods focused on remanufacturing. *Journal of Cleaner Production*, 18(1), pp.21–31.

Platchek, E.R. et al., 2008. Methodology of ecodesign for the development of more sustainable electro-electronic equipments. *Journal of Cleaner Production*, 16(1), pp.75–86.

Plouffe, S. et al., 2011. Economic benefits tied to ecodesign. *Journal of Cleaner Production*, 19(6-7), pp.573–579.

Prendeville, S., 2014. Ecodesign and Material Selection for Eco-Innovation in Office Furniture. Cardiff Metropolitan University.

Sherwin, C. & Evans, S., 2000. Ecodesign innovation: is “early” always “best”? In *International Symposium on Electronics and the Environment*. pp. 112–117.

Schmidt-Bleek, Friedrich. *Das MIPS Konzept. Weniger Naturverbrauch, mehr Lebensqualität durch Faktor 10.* Droemer Knauer, München 1998

THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION, 2009. DIRECTIVE 2009/125/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products (recast), Available at: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:285:0010:0035:EN:PDF>.

Thorpe, A., 2007. *The Designer's Atlas of Sustainability*, Island Press, Suite 300, 1718 Connecticut Ave., NW, Washington, DC.

United Nations Environment Programme (UNEP), 2010. *Resource efficiency*, Available at: <http://www.unep.org/pdf/brochures/ResourceEfficiency.pdf>.

Wimmer, W., Züst, R. & Lee, K.-M., 2004. *Ecodesign Implementation: A Systematic Guidance on Integrating Environmental Considerations into Product Development*, Springer-Netherlands.

Zhao, F. et al., 2010. Integrated Sustainable Life Cycle Design: A Review. *Journal of Mechanical Design*, 132(9), p.15.





»» [www.ecodesign-centres.org/projects.htm](http://www.ecodesign-centres.org/projects.htm)