Course T307
"Innovation: designing for a sustainable future"

End-of-course Assessment (ECA)

Markus Albert Langer
V0140321

Design is the key intervention point for making radical improvements in the environmental performance of products.
(Edwin Datschefski)

If this contention is true, can designers solve the world's environmental problems?

Introduction

Every product has an impact on the environment during all stages of its life cycle from manufacturing, consumer use to ultimate disposal. Nowadays the need to reduce the possible adverse effects of a product is recognized around the world. Designers and technologists are called on to participate decisively in the creation of solutions for environmental problems on earth. However there are other groups like consumers, grassroots initiatives or environmental organisations that are involved in sustainable production and consumption. Furthermore governments set out policies and frameworks to ensure more sustainability.

Producing environmental problems or delivering sustainable solutions

Designers can contribute largely to the efforts to reduce environmental impacts and to achieve a sustainable world. The ecodesigner Edwin Datschefski is right when he says, "Products are the source of all environmental problems. Major issues such as pollution, deforestation, species loss, and global warming are all side-effects of the activities that provide consumers with food, transport, shelter, clothing and the endless array of consumer goods on the market today." (Datschefski, 2002, p. 41)
Datschefski points to the underlying "ugliness" of many beautiful-looking products. It is hidden to the consumer and is often invisible to the designer.

Key principles of sustainability

Edwin Datschefski requires sustainable products which are fully compatible with nature throughout their entire life cycle. They should not only be designed to minimise negative environmental but also social impacts. Sustainable products should be those products that are, what he calls, "the best for people, profits and the planet" (Datschefski, 2002, p. 41). Datschefski's concept of "total beauty of sustainable products" is based on five key principles: cyclic, solar, safe, efficient and social.

Like ecodesign strategies this concept of sustainable design focuses on the materials, energy and toxicity issues (Datschefski, 2009): The product should be made from recyclable or compostable organic materials or it should be produced with minerals that are continuously cycled in a closed loop. It uses only forms of renewable energy that are cyclic and safe, both during use and manufacture. The product is non-toxic in use and disposal, and its manufacture does not involve toxic releases or the disruption of ecosystems.

More than eco-efficiency

Datschefski argues that fully sustainability of a product means more than just designing and manufacturing a "green" product. He articulates two other requirements concerning the product's efficiency and its social impact respectively: "The product in its manufacture and use requires 90 per cent less materials, energy and water than products providing equivalent utility in 1990. The product and its components and raw materials are manufactured under fair and just operating conditions for the workers involved and the local communities." (Datschefski, 2002, p. 41)

For example, the Freeplay wind-up radio invented by Trevor Baylis fulfills the requirements of a sustainable product (Roy, 2006): Using a clockwork mechanism the radio does not rely on external electrical supply or batteries (environmental dimension). People in least developed countries do not have to spend their income on costly batteries (economic dimension) and the device provides them unlimited and inexpensive access to information and education (social dimension).

Design of sustainable systems

The goal of sustainable design is to make all products 100 per cent cyclic, solar and safe. It is a long way to redesign every product towards becoming completely sustainable. The question is if 100 per cent sustainability is even possible. Another question is: Can sustainable products become accepted in unsustainable systems? A wider application of the approach to system design seems to be necessary. This involves a shift from the design of individual products to the design of whole systems. Improvements to resource efficiency are an important part of addressing the environmental impacts of products, but increases in overall consumption mean that gains are often minimal or can even go to zero (rebound effect). Therefore the so-called sustainable innovation or green system innovation aims to foster the change of consumption patterns and the development of sustainable lifestyles (Roy, 2006).

Changing patterns of behaviour and consumption

SusHouse, a European research project, is attempting to identify scenarios and strategies through which households might become more sustainable. It focuses on household services of heating, cooling, lighting, shopping, cooking and eating, as well as clothing care (Green and Vergragt, 2002). The new solutions are radical in the sense that they are different from the present lifestyles. However they offer possibilities for future behaviour of consumers in a sustainable way (T307 DVD).
For example, instead of using domestic washing machines clean clothes are provided by a new type of laundry service (Roy, 2000). One of the scenarios is that clothes are not owned anymore but leased by clothing centres.

The ecovillage project "Beddington Zero Energy Development (BedZED)" demonstrates that a sustainable lifestyle can be achieved (BioRegional, 2009; T307 DVD). It shows a special approach towards sustainable transport and has taken the following measures to decrease car dependency for residents: offering alternatives to private car travel (car sharing or cycling), promoting

public transport (close vicinity to railway station and bus routes) and reducing the need to travel (mix of homes and workspace).

Consumers as pioneers and adopters of new forms of energy

Climate change is the greatest environmental challenge facing the world today. Consumers are increasingly committed to tackling climate change and looking for ways to minimise their impact. The ability to cut down on carbon dioxide and other greenhouse gases is very closely linked to the production and use of energy.

Energy efficiency

Many consumers have opted for more environmentally friendly ways of using energy. They invest in energy efficiency measures such as wall, loft and floor insulation, installing draught proofing around doors and windows or using energy saving double glazing windows and doors (Elliott, 2006). Insulating the external walls helps to reduce the energy loss and to heat the house more efficiently. Using less energy reduces carbon dioxide emissions, one of the biggest causes of climate change, and the consumers also save money at the same time.

Consumers can also minimise their environmental impact by buying energy efficient electrical equipment like washing machines and refrigerators (Elliott, 2006). Many electronic devices such as televisions, satellite receivers or DVD players incorporate standby features. Even when they are switched off, they consume power in the standby mode. The only way a consumer can be sure a device is not drawing power is to unplug it from the electrical outlet, then he or she can prevent unnecessary energy consumption.

Switching to renewable power

Energy efficiency is one important attempt to reduce emissions; another is the switch from fossil energy sources to renewable power. Consumers can support the development of renewable energy through installing and using of new energy technologies (Roy, 2006). Households, communities, businesses and farms are no longer simply energy consumers, but energy producers. People who do no want to install such technologies can sign up to green power schemes. Those enable electricity customers to pay a premium to have all or part of their electricity sourced from renewable energy.

Solar energy for heating and electricity

Solar water heating is the most common way of using solar energy and the easiest way of using renewable energy for the ordinary citizen or householder. The idea is to use roof-mounted solar systems to pre-heat cold mains water so that less gas, oil or electricity is needed to supply the hot water needs (Energy Saving Trust, 2009).
Householders interested in solar energy may join one of the several solar clubs in the United Kingdom. These community organisations provide local help and information on solar installations, benefitting from the knowledge of its members

(Elliott, 2006). Consumers learn from the experiences of the Austrian solar system self construction movement, the Association of Renewable Energy, how to develop new renewable technologies effectively (T307 DVD).
The usage of photovoltaic solar systems, solar cell modules on the roof of the homes, to generate electricity might still be a more expensive option for domestic-level energy generation. Nevertheless if the system is producing more electricity than a consumer need, the excess power can be exported to the electricity network.

Wind turbines

An additional or alternative device to solar systems could be micro-wind turbines for domestic use (Elliott, 2006). If the small wind system is connected to the National Grid then domestic users can make money by selling any generated electricity to an electricity supply company. If the turbine is not connected to the electricity grid then unused electricity can be stored in a battery for use when there is no wind.

Consumers can learn a lesson from Danish grass-roots-initiated wind projects which are owned by individuals or local co-operatives: The residents of the Danish island of Samsø generate almost all the energy they need from renewable resources. For electricity, they established on the island 11 one-megawatt wind turbines that produce what is equivalent to a yearly consumption of energy in Samsø (T307 DVD). 75 per cent of the heating demand also come from renewable energy as solar or biomass. An offshore wind farm comprising 10 turbines was completed, funded by the islanders. The turbines play a crucial role in reducing carbon emissions and giving the island a self-sufficient source of electrical energy. The offshore turbines export electricity to other parts of Denmark; the sale of electricity returns the cost of investment.

Using fossil fuels efficiently

In addition to renewable technologies, the focus is on other types of domestic energy generation technologies which use common fuels more efficiently.
People have the possibility to heat their homes with a heat pump system that runs on electricity extracting heat from the ground and exhausting it to the building (Elliott, 2006).

Another option of self-generation at the domestic house level is a micro-combined heat and power unit running on natural gas. This system includes a Stirling engine and produces heat and electricity simultaneously. The electricity can be used for any household device, the heat produced for water heating and/or space heating (T307 DVD).

Sustainable energy policy

National governments and supranational institutions attach great importance to environmental protection and sustainable development. One focus lays on two targets of sustainable energy policy: energy efficiency and renewable energy.
Governments support individuals, communities and businesses to play their part in reducing carbon emissions. States have different tools to promote the

development of renewable energy technologies: information, taxes, regulations or subsidies.

Information about products

According to several different European Union Directives certain products like refrigerators, washing machines, light bulbs, dishwashers or cars must have a EU Energy Label clearly displayed when offered for sale. The labels provide information for consumers about the relative energy consumption and performance of domestic appliances (DEFRA, 2009). The market transformation programme, a UK government initiative, should help developing product policies and standards to encourage more sustainable and energy efficient products and materials.

Greenhouse gas reduction tax

The Climate Change Levy in the United Kingdom is a tax on the use of energy in industry, commerce and the public sector and gives additional support for energy efficiency schemes (DEFRA, 2008). The aim of the levy is to encourage users to improve energy efficiency and reduce emissions of greenhouse gases.

Regulations to limit emissions

Governments have introduced new regulations to limit greenhouse gas emissions in the last years. The European Union nations agreed to phase out sales of standard incandescent light bulbs by 2012 as part of their efforts to save energy and reduce global warming (European Commission, 2009).
Ninety percent of the energy that an incandescent light bulb burns is wasted as heat.
After 2012, consumers in Europe will have two choices: high-efficiency halogen lamps or compact fluorescent lamps.

Subsidies and grants

By providing subsidies for research and development programmes, state can influence technological development. Grants are measures for a more efficient use of energy and for a switch to sustainable energy sources. Thermal insulation is a key factor in Austria's climate protection strategy: In spring 2009 the Austrian Federal Government has allocated a budget of 100 millions euros for a support programme (GSTEC, 2009).
The UK Department of Energy and Climate Change (DECC) low carbon buildings programme offers grants for householders on microgeneration technologies including solar photovoltaics, solar water and space heating, wind turbines, small scale hydro systems, heat pumps and biomass (Energy Saving Trust, 2009).

Quota versus feed-in schemes

Another approach is the so-called market enablement, a way to help stimulate the market for renewables. For example, the Renewables Obligation (RO) is the main support scheme for renewable electricity projects in the United Kingdom (Johnston 2007). It places an obligation on UK suppliers of electricity to source

an increasing proportion of their electricity from renewable sources. The RO requires that renewables contribute 10 percent of electricity generation by 2010. Energy producers receive credits in form of certificates for the renewable electricity they generate. Companies that meet the specific annual quotas set by the government and have a surplus of certificates can trade them (Mendonça, 2007). Those who have a shortfall can build their own renewable capacity, buy electricity from other renewable plants or buy credits from other companies. This approach is focused on near-market technologies which are competitive and require temporary support to become commercially successful.

In contrast, feed-in or pricing systems like the Renewable Energy Feed in Tariff (REFIT) scheme in Germany provide guaranteed prices to renewable energy generators. The initially high prices are reduced in stages as the technology matures. The levels of support vary depending on the state of development of each renewable energy technology. The REFIT-type schemes have some advantages in comparison with the competitive-driven quota schemes: They can be used to ease new technologies into the market place and to support small co-operatives or communities businesses (Elliot, 2005).

Stimulating development of new technologies

Environmental nongovernmental organisations and pressure groups want to change the world into a sustainable one. They are aiming to stimulate development and demand of environmentally friendly products (Elliott, 2006). The international pressure group Greenpeace, for instance, has mounted a campaign focussing on renewable energy technologies like solar photovoltaic and offshore wind power. These environmental organisations can also play an important role in supporting technical innovation and widespread diffusion. In 1992, Greenpeace launched a new domestic refrigerator "Greenfreeze'" with the help of two scientists who pointed out how to replace chlorofluorocarbons for refrigeration. Greenfreeze refrigerators use hydrocarbons like propane and butane and are entirely free of ozone destroying and global warming chemicals (Greenpeace, 1997).

Conclusion

Not only designers, but also consumers, grassroots initiatives, local communities, environmental organisations and governments make their contribution to the reduction of environmental impacts and the development of a sustainable world. Designers aim to create products that are highly sustainable. Governments and nongovernmental organisations want to stimulate the development and demand of environmentally friendly products. Consumers use conventional energy more efficiently or switch to renewable energy technologies. Grassroots initiatives and local communities seek to practice alternative forms of sustainable development and try to find new solutions that respond to their needs.

References:

BioRegional Development Group (2009) *BedZED*. Available from: http://www.bioregional.com/what-we-do/our-work/bedzed/ [accessed September17, 2009].

Datschefski, E. (2002) *Designing Products as if the Earth Really Mattered*. Earth Island Journal, Summer 2002, Vol. 17 Issue 2, p. 41, Berkeley, California.

Datschefski, E. (2009) *Total Beauty of Sustainable Products*. Available from: http://www.biothinking.com/btintro.htm [accessed September 17, 2009].

Department for Environment, Food and Rural Affairs, DEFRA (2008) *Climate change agreements: the Climate Change Levy*. Available from: http://www.defra.gov.uk/environment/climatechange/uk/business/cca/levy.htm [accessed July 13, 2009].

Department for Environment, Food and Rural Affairs, DEFRA (2009) *Energy Labels - helping you make the right choice*. Available from: http://www.defra.gov.uk/environment/business/pdf/energylabel.pdf [accessed July 15, 2009].

Elliott, D. (2005) *Feed-in or quota? Is REFIT better than the RO?* Refocus, Volume 6, Issue 6, November-December 2005, pp. 53-54.

Elliott, D. (2006) *T307 Innovation: designing for a sustainable future, Block 4 Diffusion: consumers and innovation*, Milton Keynes, The Open University.

Energy Saving Trust (2009) *Generate your own energy*. Available from: http://www.energysavingtrust.org.uk [accessed July 17, 2009].

European Commission (2009) *FAQ: phasing out conventional incandescent bulbs*. Available from: http://europa.eu/rapid/pressReleasesAction.do?reference=MEMO/09/113&format=HTML&aged=0&language=EN&guiLanguage=en [accessed September 30, 2009]

Global Solar Thermal Energy Council, GSTEC (2009) *Austria: Incentives for solar thermal installations in old buildings*. Available from: http://www.solarthermalworld.org/node/651 [accessed July 17, 2009].

Green, K. and Vergragt, P. (2002) *Towards sustainable households: a methodology for developing sustainable technological and social innovations*. Futures, Volume 34, Issue 5, June 2002, pp. 381-400.

Greenpeace (1997) *Greenfreeze - A Revolution in Domestic Refrigeration.* Available from: http://archive.greenpeace.org/ozone/greenfreeze/may1997/index.html [accessed September 17, 2009].

Johnston, A.; Kavali , A. and Neuhoff, K. (2007) *Take-or-Pay Contracts for Renewables Deployment*. Available from:

http://www.electricitypolicy.org.uk/pubs/wp/eprg0707.pdf [accessed July 14, 2009].

Mendonça, M. (2007) *Feed-in tariffs: accelerating the deployment of renewable energy*. London, Earthscan.

Roy, R. (2000) *Sustainable product-service systems*. Futures, Volume 32, Issues 3-4, April 2000, pp. 289-299.

Roy, R. (2006) T307 *Innovation: designing for a sustainable future*, Block 3 Markets: Products: new product development and sustainable design, Milton Keynes, The Open University.

The Open University (2009) T307 *Innovation: designing for a sustainable future*, DVD, Milton Keynes, The Open University.