

# Dell Design for Environment White Paper

## I. SUSTAINABILITY MODEL IN PRODUCT DESIGN

At Dell, environmental opportunities and challenges are considered at every stage of the product life cycle from design and development, manufacturing and operations, to product use and recovery. Product design efforts are guided by corporate environmental policy and governance set to continuously improve the environmental performance. Dell follows the ISO 14001 standard for managing environmental programs throughout the product life cycle. Dell Product Design for Environment specifications is written in alignment with the life cycle model [Fig. 1.]

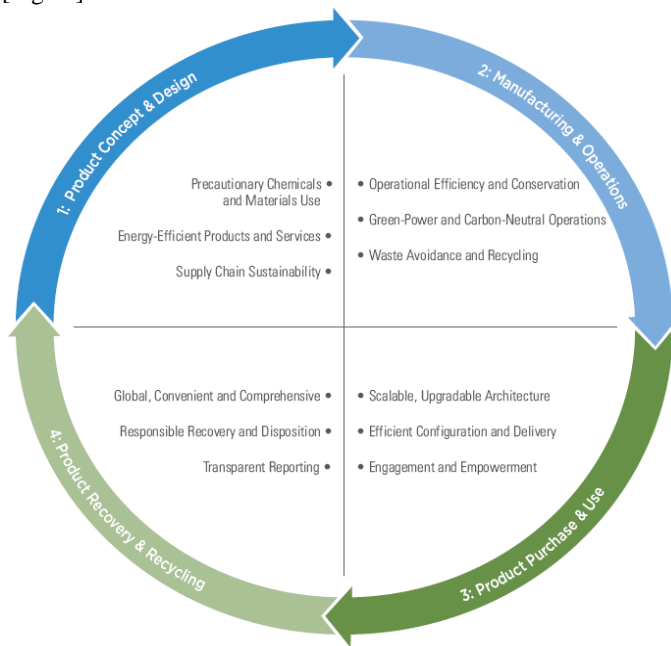


Fig. 1. Dell's Product Design Life Cycle.

Environmental specifications act as a guide to product designers for compliance to global regulations and standards, voluntary environmental initiatives and eco-label requirements. Products are designed to include environmentally-responsible materials, using efficient designs that require fewer materials and maximize reusability and recyclability. This methodology encourages reduction of the most significant environmental aspects of the life cycle without unnecessarily burdening the supply chain. At product end of life Dell offers consumers free take back and ensure that equipment is recycled in an environmentally-responsible manner using our stringent global recycling guidelines. More information on Dell disposition policy can be found [here](#).

## II. DESIGN GUIDELINES

Dell designers actively pursue innovative design methodology for developing environmentally-responsible products.

### A. Environmentally-responsible materials

Dell's vision is to avoid the use of substances in its products that could seriously harm the environment or human health and to

ensure that we act responsibly and with caution. Dell material restrictions are based on consideration for legal requirements, international treaties and conventions, and specific market requirements.

An example of Dell's leadership in this area is our commitment to transition Dell laptops to energy-efficient and mercury free LED displays by 2010. The transition from CRT to flat panel displays has already significantly reduced the use of lead. Dell also prohibits the use of PBBs and PBDEs (including Deca-BDE) for all applications, and the use of all other Brominated Flame Retardants (BFRs) (including TBBP-A and HBCDD) and PVC in mechanical plastic parts for desktops, notebook and server products as well as TCO certified displays and Blue Angel certified printers. In early 2009, Dell also launched G-series monitors which are free of PVC, BFR, CFR, arsenic and mercury. External chassis in these monitors is also made up of more than 25% post consumer recycled materials.

Dell recognizes the importance of material selection, with the goal of designing and manufacturing products so the resources needed to manufacture those products are minimized, the use of recycled and/or renewable materials is maximized and new material types (for example: renewable/biobased materials, nanomaterials) are thoroughly evaluated for health and environmental safety prior to use.

Designers also focus on dematerialization to make products smaller. Dell Studio Hybrid is about 80% smaller than standard desktops. Use of post consumer recycled content is driven by need to derive environmental benefit by reduction in extraction of virgin resources and associated green house gas impacts. Dell Optiplex 960 desktop contains 10 percent post-consumer recycled content plastics, several Dell displays contain 25 percent post-consumer recycled content plastic. Dell is also actively working to establish a closed loop process for plastics.

### B. Energy Efficiency

Dell is committed to leading the market in helping businesses achieve energy efficiency in their IT environment, from the client to the datacenter. For more than a decade, Dell has partnered with the U.S. Environmental Protection Agency (EPA) in support of ENERGY STAR. ENERGY STAR products reduce energy consumption, thereby reducing electricity costs for our customers. Dell currently leads the industry in energy efficiency with the inclusion of Dell Energy-Smart technologies across our PowerEdge portfolio. Dell Energy Smart combines the most relevant energy optimized hardware and software technology, energy-optimizing professional services and tools for customers, and partnerships with regulatory bodies and standards organizations to help drive future innovation around energy efficient products. For more information on Dell's energy efficiency efforts click [here](#)

### C. Design for End-of-life, reuse.

Dell designs its products with a cradle to cradle approach. Product designers work closely with asset recovery partners and recyclers. Best practices and learning about product design for easy disassembly are shared and considered at an early stage of

product development. This partnership allows Dell to determine the most effective design features to facilitate product recycling. Designers at Dell continuously improve design of products to aid reuse and refurbishment of these components by making them modular and providing easy access and disassembly. Products, parts and components are designed to be upgraded extending the technological life of the product. To facilitate removal and easy upgrade parts are designed as sub-assemblies. Modular components and standardized parts are chosen where feasible. Choice of fasteners is equally important. Care is taken in selection of metal or plastics fasteners. Snap fits are preferred for fastening and joining plastic parts. Implementation of DfE guidelines assures that products use minimal amount of the most benign and recyclable materials and that they are constructed for easy disassembly, eliminate the use of glues and adhesives, less number of screws and provide easy access to the screws. The Plug-In To eCycling Guidelines for Materials Management are EPA's voluntary guidelines for sound reuse and recycling of e-waste. The guideline encourages recyclers to maximize reuse, refurbishment and recycling over disposal and incineration. Dell provides its customers a complete step-by-step instruction guide required to identify materials and components for disassembly. This instruction guide complies with the EU WEEE directive 2002/96/EC. These instructions can be found [here](#)

Most parts can be removed easily by hand. In some cases common household tools such as Philips and/or flat-head screw drivers may be necessary. To remove discrete components such as the electrolytic capacitors, needle-nose pliers may be helpful. Instructions for removing parts in each product can be found in the User Documentation originally provided with the product. This documentation can be found [here](#).

#### D. Design for Recycling

Design for recycling is essential and is important to be considered from very beginning. Adopting this premise helps to ensure an effective recycling chain, which goes well beyond the scrap processor to the mill, smelters and Aluminum and plastics recyclers. Historically products that utilized four, five, or more polymers effectively became non-recyclable, or at least the plastics fraction of that product was difficult to recycle. Today with research and technology much is known about mechanical recycling and other forms for material recovery as an alternative to land filling. Direct feedback from recycler's shows that HIPS, PC-ABS polymers more recyclable than PVC polymers by the recyclers that were surveyed. Among metals Aluminum and Steel are regarded as highly recyclable. Designers also use Thermoplastic elastomers (TPE) and Thermoplastics polyurethanes (TPU) as an alternative to PVC in cable insulation and jacketing.

##### i) Restriction on Paints and Coating

Apart from sorting plastics into different categories, recyclers also find it challenging while dealing with the variety of paints and coatings used within the industry. Paint and coatings, if not removed, can cause property reductions from stress concentrations. Degradation of coatings can also lead to chemical degradation of certain plastics during reprocessing. Dell designers when needed use compatible paint and promote Integral (molded-in) finishes are preferred over exterior coating, paints whenever possible. Per Dell's DfE specification, the following restrictions apply to the use of paints or coatings:

- Plastic parts over 100 grams may not contain paints or coatings that are not compatible with recycling or reuse. If parts over 100 grams are painted, suppliers must provide documentation showing the paint does not inhibit recycling or reuse of the plastic.

- Metallic paint (e.g. epoxy primer with metallic pigments, non conductive) shall not be used

- Galvanic coating (conductive, e.g. EMC shielding) shall not be used

- Plastic parts <25 g may be painted if required for functional reasons only (cosmetic and ID are NOT functional reasons)

E.g. buttons, op panel

- Galvanic coating (conductive, e.g. EMC shielding) shall not be used.

##### ii) Marking on products to promote recycling

All Dell Inc. branded-products meet the Dell environmental marking requirements to promote efficient recycling of products. Dell products globally comply with all worldwide certificates and label requirement to promote recycling. Most importantly, all plastics parts greater than 25 grams are marked as per ISO 11469:2000(E). The marking system is intended to help identify plastic types for subsequent decisions concerning handling, recycling, waste recovery or disposal.

##### iii) Use of recycled content

Dell works with recycling partners and resin manufacturers to identify environmentally preferable, post-consumer recycled (PCR) content plastics for use in Dell products. The optimal balance of environmental compliance and engineering performance for a given design must be defined to determine the targeted PCR content range for each plastic component. All new OptiPlex 960 systems are built using at least 10% post-consumer recycled chassis plastic Dell has launched multiple displays E207WFP,E1909W,E1909WDD,E2209W,E2009W, G2210 and G2410) that contain 25 percent post-consumer recycled chassis plastic. Our EPEAT Gold displays contain this level of post-consumer recycled content. In 2008, Dell shipped more than 1.1 million pounds of post-consumer recycled plastics. All Dell EPEAT Gold registered products contain at least 25% post-consumer recycled content in corrugate packaging.

### III. CONCLUSION

Electronic products have an effect on the environment, which may occur at any or all stages of its life cycle – raw material acquisition, manufacture, distribution, use and disposal. Design for the environment is a systematic way of considering the entire life or life cycle of a product up front, and during design.

Designers have to evenly balance the environmental aspects of a product against other factors such as its intended use, performance, safety and health, cost, marketability, quality and regulatory requirements. At Dell, environmental aspects are integrated early into product during the design stage. A collaborative team including product designers work with downstream partners in assessing impact of product design, materials use, recycling technology to develop environmentally sound products.. Dell designers also engage with recycling trade organizations, perform site visits and audits and also use international standards in making environmentally conscious design decisions to meet its commitment of developing more environmentally-responsible products.