



Design for Environment WHITE PAPER (APRIL 2018)

This technical paper provides an overview of Dell's product design methodology with the complete lifecycle in mind.

Delivering environmentally responsible products and services

We actively pursue innovative design methodology for developing environmentally-responsible products

Recognized for sustainable product design and leadership

- Accenture Circular Economy Pioneer
- Keep America Beautiful - Vision for America Award
- ISRI's Design for Recycling Award
- US EPA's SMM Electronics Champion Awards
- CES Innovation Award for EcoDesign & Sustainable Technologies

“As we prepare for a future with 9.6 billion people in it, it’s imperative that we take a good, hard look at the impact we individually and collectively have on the earth we share.”

Michael Dell,
Chairman and CEO

At Dell, we are committed to putting our technology and expertise to work where it can do the most good for people and the planet. Our Environmental Policy commits us to deliver environmentally responsible products and services that prevent waste and pollution, demonstrate environmental responsibility, comply with the law and provides us tools to continually improve.

We consider environmental opportunities and challenges at every stage of the product lifecycle – 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 our performance.

Dell follows the ISO 14001 standard for managing environmental programs throughout the product lifecycle. Dell Product Design for Environment specifications are written in alignment with this model. The methodology encourages reduction of the most significant environmental aspects of the lifecycle without unnecessarily burdening the supply chain.

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.

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.

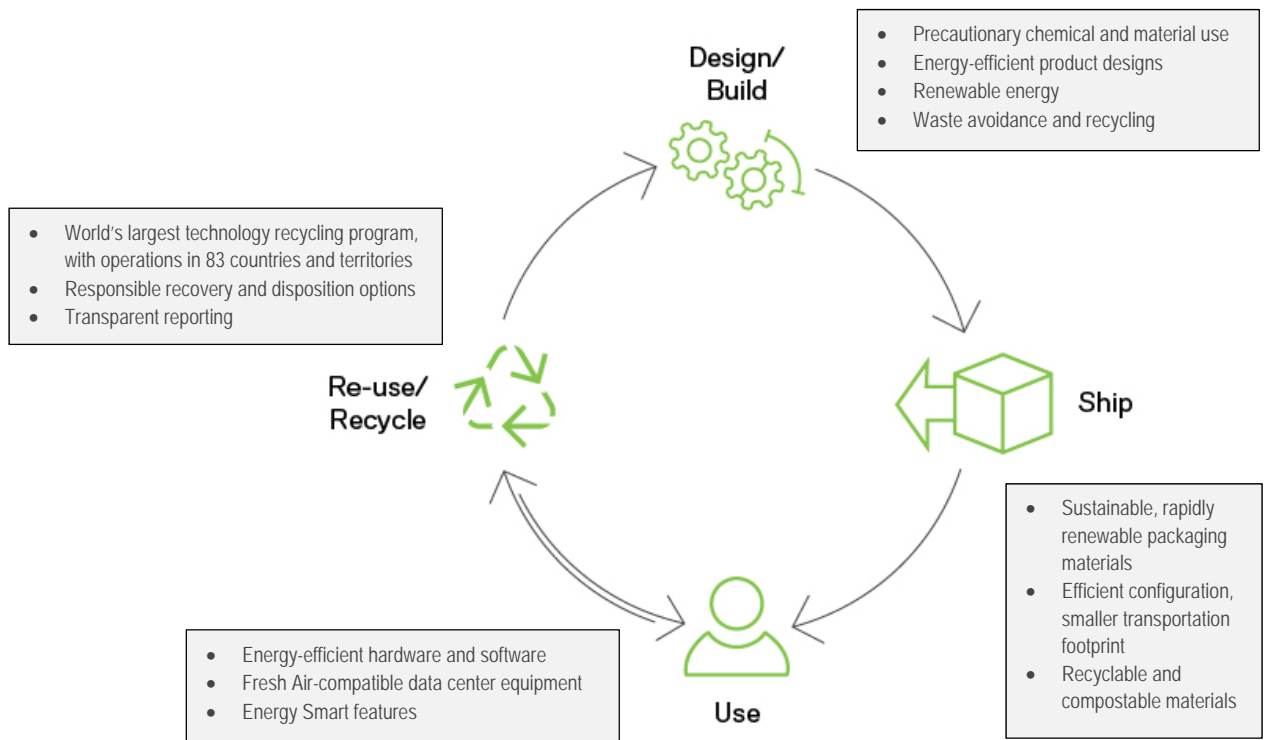


Figure 1: Dell's sustainable product lifecycle



A. Environmentally responsible material choices

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 we act responsibly and with caution. Material restrictions are based on consideration for legal requirements, international treaties and conventions, and specific market requirements. We work with our supply chain to develop substitutions, modify our specifications and verify compliance with these requirements.

Dell has phased out the use of several sensitive materials such as Arsenic, Medium Chained Chlorinated Paraffins (MCCPs) and certain Phthalates and Polycyclic Aromatic Hydrocarbons (PAHs).

Dell continues to make progress towards our commitment to eliminate BFR & PVC from PC products, as acceptable alternatives are identified. For example, we eliminated all polybrominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDEs), including decabromodiphenyl ether (decaBDE), from all Dell products four years before the EU RoHS directive took effect. As for PVC, we have been restricted in our products since 2002 – and also banned its use in our packaging that year. See our publicly available [Dell Material Restricted for Use](#) document.

B. Dell's Efforts to Advance Circular Economy

Dell recognizes the importance of material selection as part of an ongoing shift to a circular economy, with the goal of designing and manufacturing products so the resources needed to manufacture those products are minimized while the use of recycled and/or renewable materials is maximized.

Dell has a history of using innovation to advance this shift. We have used post-consumer recycled content plastics in our products and packaging. We have also developed packaging solutions that take

advantage of rapidly renewable materials (like bamboo) and waste products (such as ocean plastics).

With the launch of the OptiPlex 3030 All-in-One in 2014, Dell became the first in the industry to offer a computer made with third party-certified closed-loop recycled plastics. For more information visit www.dell.com/closedloop. In 2015, Dell launched the first laptop containing [post-industrial recycled \(PIR\) carbon-filled polycarbonate](#) developed by SABIC.

In 2018, Dell announced another first for the circular economy, launching the Latitude 5285 2-in-1 convertible notebook with motherboards made of closed-loop gold harvested from our computer recycling efforts. With this announcement Dell introduced a closed-loop recycling supply chain for precious metals and demonstrated its successful integration. We chose to work with gold because tiny gold electronic components add up to a surprisingly big impact.

In the U.S. alone, consumers throw away \$60 million in gold and silver annually by not recycling their phones. This treasure trove is even larger when considering that global e-waste recycling rates are still at about 15 percent. What's more, the gold recycling process we use does 99 percent less environmental damage than virgin mining operations. For more information visit www.dell.com/gold.

C. 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. Since the early 1990s, 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

Dell's Circular Economy Initiatives Innovation and Leadership

Closed-Loop Recycled Plastics

- Used over 24 millions pounds of Closed loop plastics from 2014
- Used in over 100 different products such as displays, Desktop, All-in-One.

Reclaimed Carbon Fiber

- Prevented 2 million pounds of carbon fiber from entering in landfill from 2015
- Reclaimed carbon fiber has 67% lower carbon footprint

Closed-Loop Gold

- Launched in Jan 2018 in Latitude 5285 2-in-1 with closed loop gold in motherboard.
- Closed loop gold is 99 percent efficient than virgin mining operations and avoiding \$1.6M per kilo in natural capital costs.



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, visit Dell's [energy efficiency page](#).

For further information
regulatory_compliance@dell.com

More information
[Dell's Legacy of Good Plan](#)
[Dell's latest CSR Report](#)

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Authors: Puneet Shrivastava, Stephanie Schafer

D. Design for End-of-life, Reuse

Dell designs products with a cradle-to-cradle approach. Product designers use best practices and learnings from recyclers and repair professionals about product design for easy disassembly. These considerations are made at an early stage of product development to ensure effective design features that will facilitate product recycling. Some of the key design guidelines built into products include:

Modular design: providing easy access and disassembly.

Upgradeability: products, parts and components are upgradeable to extend the technological life of the product.

Standardized fasteners: along with snapfit assemblies when necessary provide ease of access for easy removal.

Single-access service door: provides ease-of-accessibility for repair and recycling.

Eliminate the use of glues and adhesives

Documentation: Disassembly instructions are provided in user documentation. For details, visit Dell's support site at support.dell.com.

E. Design for Recycling

Today with research and technology much is known about mechanical recycling and other forms for material. We use ABS, PC-ABS polymer over other polymers as these are much widely recycled. All plastics parts greater than 25 grams are marked as per ISO 11469:2016(E) to aid recovery and sorting.

Designers also use Thermoplastic elastomers (TPE) and Thermoplastics polyurethanes (TPU) as an alternative to PVC in cable insulation and jacketing. Dell designers when needed use compatible paint and promote integral (molded-in) finishes are preferred over exterior coating, paints whenever possible.

Among metals, aluminum and steel are regarded as highly recyclable. Dell products such as laptops, tablets and servers have been evaluated for recyclability per the IEC 62635 standard by an independent lab and are found to be highly recyclable.



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.

At Dell, environmental aspects are integrated early into product during the design stage. This is a collaborative effort and involves assessing impact of product design, materials use, recycling technology etc. to develop environmentally sound products.

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