Bromine- and Chlorine-Free Plastic Components

COMPANY PROFILE

DSM ENGINEERING PLASTICS

Manufacturer of engineering plastics used in a variety of industries, including electronics.

DSM Engineering Plastics is one of the world's leading suppliers of high-performance plastics, with a permanent focus on innovation. DSM EP delivers materials for customers who design or produce electronic equipment, cars, and barrier packaging films, as well as many electrical, mechanical, and extrusion applications.

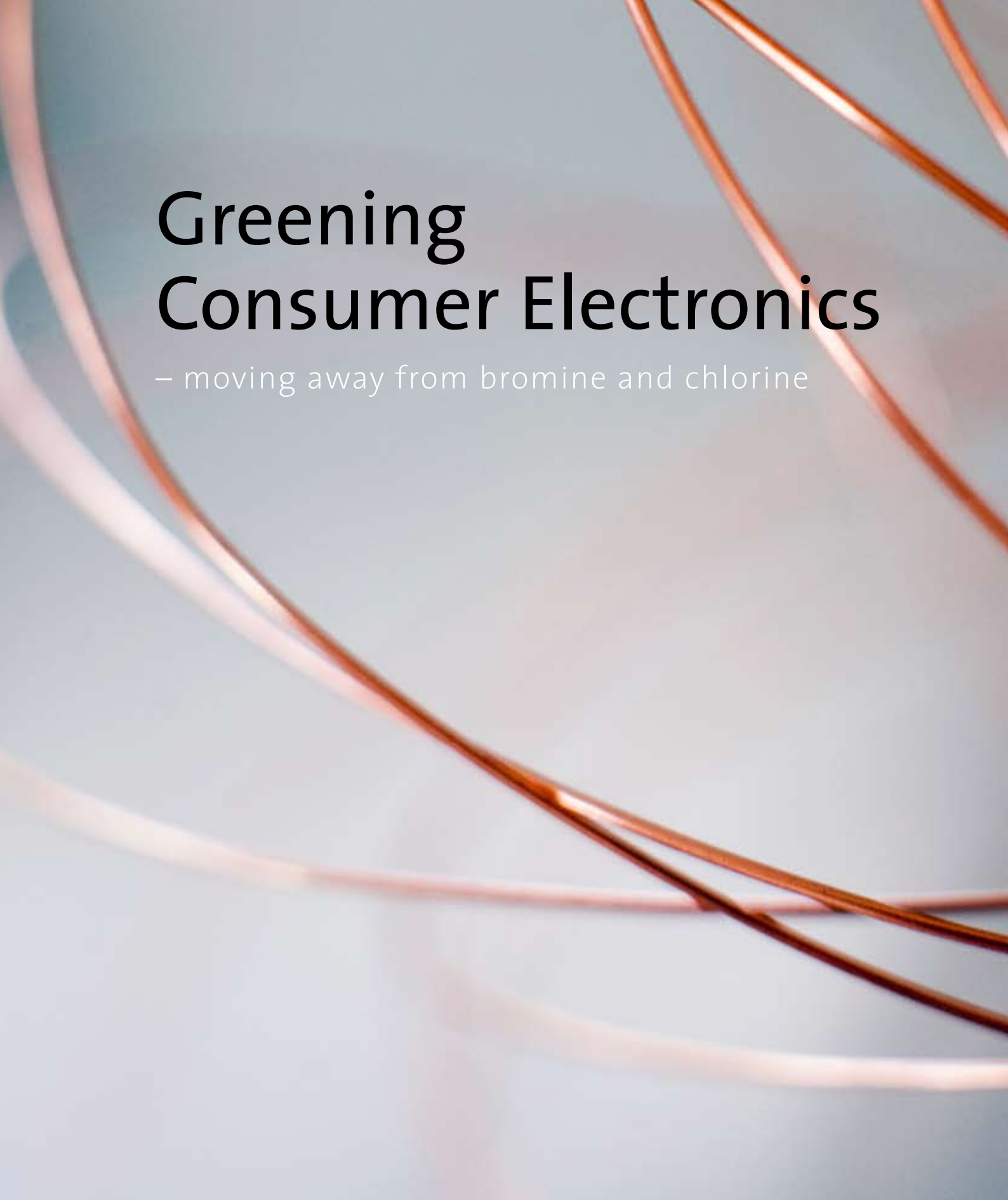
Headquarters: Sittard, The Netherlands
Sales: €760 million (Euros, 2008)
Employees: 1,500 worldwide

www.dsmep.com

"We cannot be successful,
nor can we call ourselves successful,
in a society that fails."

– Feike Sijbesma, CEO of DSM EP.

DSM



Greening Consumer Electronics

– moving away from bromine and chlorine

CHEMSEC – FOR A TOXIC FREE WORLD

ChemSec (the International Chemical Secretariat) is a non-profit organisation working for a toxic-free environment. Our focus is to highlight the risks of hazardous substances and to influence and speed up legislative processes. We act as a catalyst for open dialogue between authorities, business, and NGOs and collaborate with companies committed to taking the lead. All of our work is geared to stimulating public debate and action on the necessary steps towards a toxic-free world.

CPA – STRATEGIC SOLUTIONS FOR GREEN CHEMICALS

Clean Production Action, CPA, designs and delivers strategic solutions for green chemicals, sustainable materials, and environmentally preferable products for a closed-loop material economy.

CPA engages with businesses and NGO leaders to hasten the transition to an economy without harm. We coordinate the US-based Business NGO Working Group for Safer Chemicals and Sustainable Materials and we research and promote companies' efforts to transform the toxic chemical economy.

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Companies highlighted in this report have kindly contributed to the information provided in the substitution case studies. ChemSec and Clean Production Action are solely responsible for all other texts in this report.

Photo: Niklas Maupoix

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ABSTRACT

DSM Engineering Plastics was one of the first chemical companies to offer a range of halogen-free products that can be used in electronics. DSM Engineering Plastics overcame technical, performance, and cost challenges to produce its new bromine- and chlorine-free high-temperature plastics. These new products can be used as PVC replacements for electronic wires and cables as well as internal and external electronic connectors.

DSM Engineering Plastics's long history of and commitment to product stewship has guided its journey in developing new bromine- and chlorine- free materials for electronic products. DSM EP's Living Solutions approach to sustainable product and process design includes four key tenets: reducing the use of hazardous substances; improving overall eco-efficiency; promoting recycling; and developing bio-based polymers. By keeping abreast of market trends, DSM EP became one of the first companies to recognize the value of developing solutions to replace bromine and chlorine in electronic connectors and cables. Over the past five years, growing demand for bromine- and chlorine-free products justified the investment required to develop a range of new halogen-free products, including polyamides (46, 6, and 66) and polyesters (TPC, PET, and PBT).

Until recently, the electronics industry generally considered brominated flame retardants and PVC plastic to have an ideal performance/safety balance. However, the inappropriate incineration of end-of-life electronics equipment via informal recycling has led to a growing concern that these materials can have risks to human health and to the environment. DSM EP recognized this concern as the result of several OEMs bringing it to the company's attention.

By working together with partners throughout its entire value chain, including OEMs and suppliers, DSM EP developed and now produces new bromine- and chlorine-free engineering plastics that meet high technical and environmental performance standards. These solutions enforce the competitive advantage for the emerging market demand for BFR- and PVC-free products in the electronics sector. DSM EP was among the first chemical companies to offer a complete portfolio of engineering plastics that are free of these substances.

Two key bromine- and chlorine-free DSM EP products with desirable qualities for electronic connectors and cables are:

- **Arnitel XG (www.arnitel.com)** is a high-performing thermoplastic co-polyester that contains no BFRs, PVC, halogens, or plasticizers. The product has been successfully commercialized for PVC replacement and approved for use with electronic wires and cables by the Underwriters Laboratories (UL), the world's largest, not-for-profit product safety testing and certification organization.

- **Stanyl ForTii (PA4T, www.fortii.com)** is a bromine-, chlorine-, and halogen-free polyamide resin that can be used for internal and external electronic connectors. Stanyl ForTii has the optimal balance of qualities desired in high-temperature polyamides: high stiffness, high melting temperature, and high glass-transition temperature. The material retains its mechanical and thermal performance throughout its lifecycle, from production to operation, to the recycling process of OEMs.

Re-tooling or specialized equipment is not required to use these new plastics to produce connectors and cable products. This significantly reduces the costs for electronic manufacturers using these products. DSM EP is now able to produce its halogen-free plastic resins in high volume to meet the increasing demand projected to arise as more customers move away from the use of BFRs, PVC, and other halogens.

OVERCOMING TECHNICAL CHALLENGES

When DSM EP began its quest to develop halogen-free versions of the high-temperature plastics used in electronics connectors and cable insulation, the viability of such formulations was in question due to reliability issues, such as brittleness, blooming, and corrosion. The company formed a large multidisciplinary team to conduct its own in-house research and development effort to find better solutions. The company's material scientists and engineering teams credit some of their success in solving many of the reliability issues to working relationships they established with some of the other manufacturers in the large and diverse electronics supply chain who were also grappling with some of the same challenges in their efforts to remove bromine and chlorine from their products.

These efforts included large OEM clients who were attempting to convert complete product lines, as well as "Tier 1" connector and cable manufacturers who needed viable engineering plastics. These companies collaborated to set up a feedback system whereby customers could report on the performance characteristics of new compounds. The information gleaned through this system allowed DSM EP's engineering teams to quickly address problems and incorporate changes into new versions of their products. The company also worked closely with suppliers to identify environmentally preferable flame retardants. DSM EP's engineering teams conducted both internal and external "Safety, Health and Environment (SHE)" studies to ensure that the new compounds met high environmental standards.

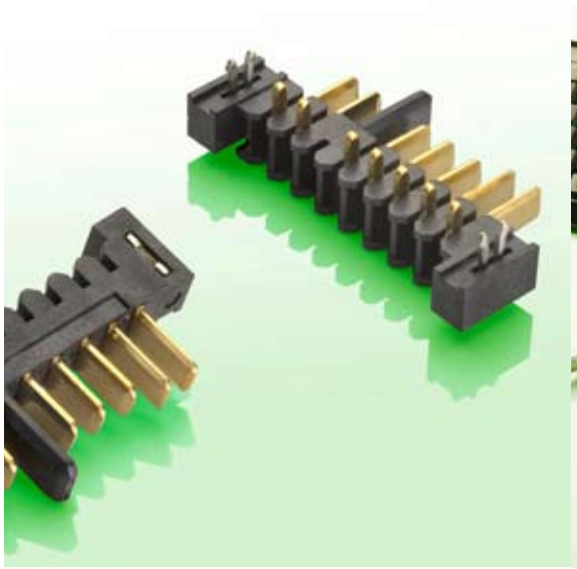
In addition to overcoming the technical, performance, and cost challenges that previously inhibited commercialization of new bromine- and chlorine-free high-temperature plastics, DSM EP also helped facilitate the development of new flame retardency standards. For the past decade, electronics suppliers and manufacturers only used plastic materials that conformed to the Underwriters Laboratories UL94-V0 flammability standard. This blanket approach to fire safety did not provide incentive for innovative designs. In some cases, it even encouraged the use of flame retardants in applications where the risk of fire was low.

DSM EP developed green design strategies based on a new fire safety standard (IEC 62368) being proposed by the International Electrotechnical Commission (IEC). The new standard would allow designers to address fire-safety by either preventing ignition (distancing the placement of flammable materials and heat sources) or controlling the spread of fire (using flame retardants and or fire barriers).

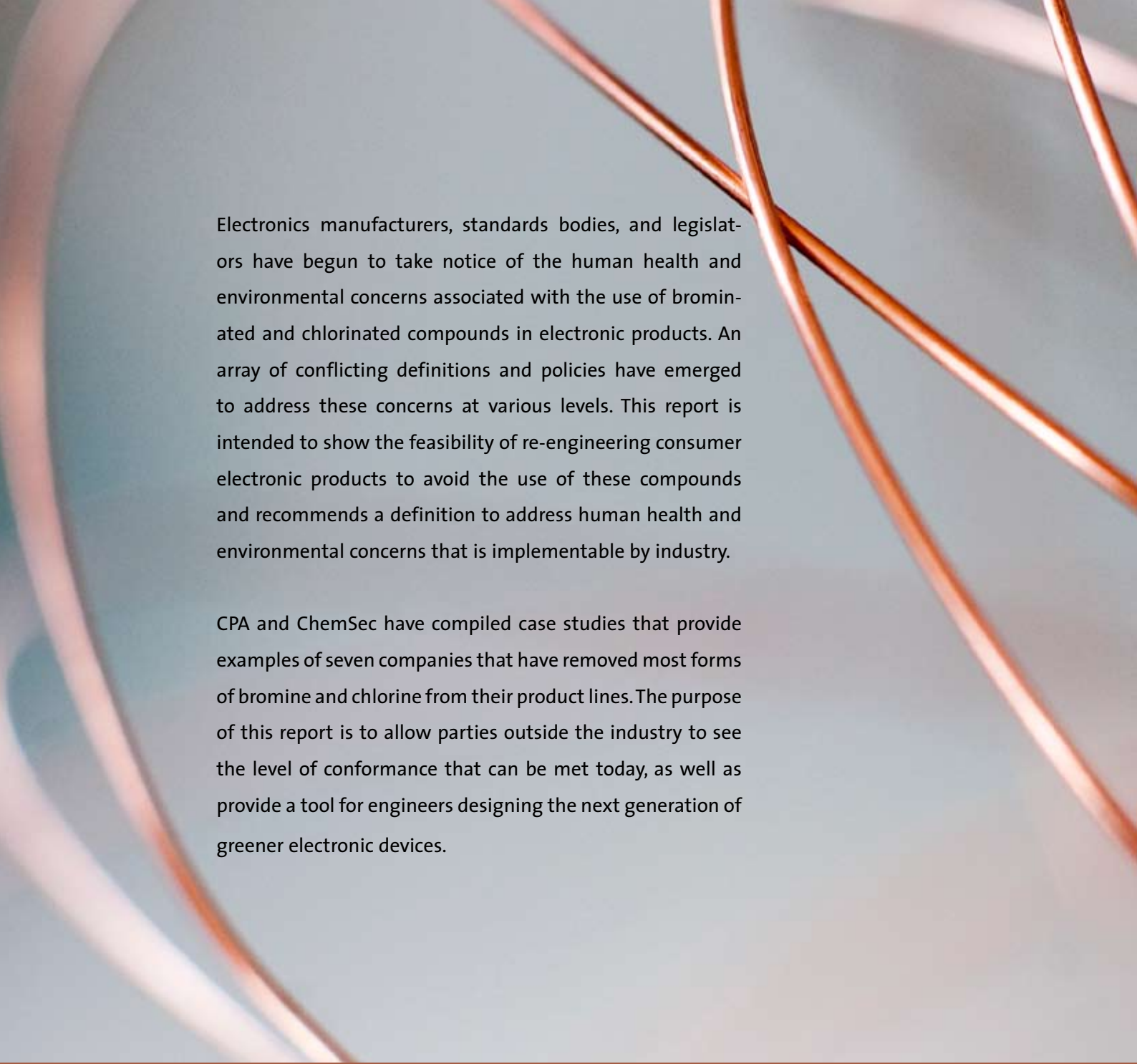
MOVING FORWARD

DSM EP's achievements would not have been possible without a forward-thinking management team who supported this work even through the economic downturn, when many other companies were cutting research and development expenses. By actively driving the development of halogen-free plastics components for the electronics sector, DSM EP was able to achieve breakthroughs that enabled the company to sprint ahead of its competitors.

DSM EP fully intends to continue developing sustainable solutions that meet the emerging market demands for eco-friendly products. In keeping with its corporate motto, the company expects to continuously improve the quality of its halogen-free portfolio. DSM EP is also active in developing bio-based plastic polymers that avoid or reduce the use of petroleum, as well as improve the recyclability and eco-efficiency of its engineering plastics.



Over the past five years, growing demand for bromine- and chlorine-free products justified the investment required to develop a range of new halogen-free products, including polyamides (46, 6, and 66, 4T) and polyesters (TPC, PET, and PBT).



Electronics manufacturers, standards bodies, and legislators have begun to take notice of the human health and environmental concerns associated with the use of brominated and chlorinated compounds in electronic products. An array of conflicting definitions and policies have emerged to address these concerns at various levels. This report is intended to show the feasibility of re-engineering consumer electronic products to avoid the use of these compounds and recommends a definition to address human health and environmental concerns that is implementable by industry.

CPA and ChemSec have compiled case studies that provide examples of seven companies that have removed most forms of bromine and chlorine from their product lines. The purpose of this report is to allow parties outside the industry to see the level of conformance that can be met today, as well as provide a tool for engineers designing the next generation of greener electronic devices.

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