Will the power supply industry adopt the cradle-to-cradle business model?

Due to its very nature, the power supply industry has been on a never-ending quest searching for new technologies to improve energy efficiency, safety and miniaturization. In doing so, an admirable pioneering spirit has developed and grown within the power community. Moving from the plated germanium rectifiers of the old days to the latest gallium nitride or silicon carbide technology, time and time again power designers have proven their ability to optimize efficient energy conversion while complying with ever more demanding regulations. Step by step - sometimes small ones, sometimes big – the industry has created power architectures that reduce energy consumption and in many cases has discovered technical solutions to supposedly 'unsolvable' problems. Who, twenty years ago would have believed that we could produce power supplies with such high levels of efficiency that also comply with very stringent environmental regulations? All those achievements are great but are they enough to address the growing demand from the market to reduce - even further - the environmental impact?

Risks under control

Technology has helped us to perform 'magic' but at the same time the world has changed and environmental challenges have become more complex and global, requiring all industries to reconsider their ways of working, particularly with a higher regard and responsibility for environmental and social issues.

This is the latest challenge that the power industry is now facing, and despite the fact that the technologies brought to the market have helped reduce CO2 emissions,

companies' Corporate and Social Responsibility (CSR) policies aligned to international standards will require many adjustments in the way they are working. Not only that, but the issue of how their suppliers will comply with such environmental regulations and manage the related risks.

One example is the implementation of the global risk management ISO 31000 methodology. This was initially developed for decision and policy makers within governments and large corporations in order to minimize exposure to risk and to secure business integrity for stockholders, and is now adopted by many companies such as those in the medical industry.

ISO 31000 is becoming an important tool, helping companies to develop their environmental strategy and gain better control of risk, both internal and external. ISO 31000 is defined as 'a process that provides confidence that planned objectives will be achieved within an acceptable degree of residual risk'. Moving forwards, ISO 31000 will become an immense and increasingly important part of organizations.

Clearly, many power supply designers are used to dealing with risk management assessment (e.g. when designing a medical power supply to comply with the IEC 60601-1-3 Edition, or a power supply for demanding applications in other segments such as in gas and oil industry), though in coming years the demand from OEM customers on the power supply industry in term of risk management might become more global, including environmental impact and social responsibility down to a single supplier. That requires our industry to be prepared for new ways of working and even to consider revamping some of the business principles that we thought were engraved in stone!

Are we ready for that?

Medical drives trends!
Addressing a vast range of applications, from consumer to defense, the power supply industry has to comply with many standards and regulations. Some of these, originally developed for a specific segment are now rapidly being adopted by other industries. Regulation in the medical industry is a good example where a number of parameters specified in the IEC 60601-1-3 and -4 have now been adopted by industrial project managers involved in 'Industry 4.0' (e.g. higher isolation, lower leakage current, reduced and in-control EMI and documented risk assessment).

Designing power supplies and complying with safety regulations is for sure a vital obligation, but designing a product for the environment (DfE) is just as important. Here again, the medical industry is setting the scene and according to a market study released in 2014 by Johnson & Johnson, more than 80 percent of the hospitals around the world are expected to incorporate sustainability into their purchasing decisions and for many to follow ISO 31000's risk assessment process - including their suppliers.

That considered, one way or another the power supply industry will have to comply with environmental requirements demanded by the medical industry, and by other industries formulating the same demands on their suppliers and partners. Therefore it becomes very important for the power supply industry to adopt a way of working that includes environmental aspects at the very early stages of any project.

Designing for the environment has often been performed on a voluntary basis or used as a marketing/sales argument, though that is now changing. For many, a product with high efficiency and low standby power may seem to be DfE by nature, but that is not necessarily the case. DfE is much more than that and despite the existence of ISO 14062, the lack of a common definition or standard that is relevant to the electronics industry is making it difficult for customers and users to verify what is included under each company DfE definition and verification.

Being aware of the difficulties in assessing the different variables considered as part of DfE from their suppliers, the medical industry and regulatory bodies realized the need to define a standardized methodology that considers the overall life cycle, i.e. all stages, from the initial specification to end-of-life management.

Following several years preparation, in 2007 as collateral to the IEC 60601 the International Electrotechnical Commission (IEC) published the so-called 'dash one nine'; IEC 60601-1-9. The objective of IEC 60601-1-9 is to reduce the environmental impact of the entire range of medical electrical equipment (ME equipment), taking into account all stages of the product life cycle, namely product specification, design, manufacturing, sales,

logistics, installation, commissioning, deployment, and end of life management.

The fundamental principle of the IEC 60601-1-9 is to protect the environment and human health from hazardous substances, to preserve raw materials and energy, minimize the generation of waste, and minimize the adverse environmental impact associated with waste. Without going into microscopic detail, the core requirements of IEC 60601-1-9 can be summarized as 'identification', 'instruction', and 'end-of-life management'. During this process, manufacturers will have to perform in accordance with existing processes (e.g. risk management performed in compliance with ISO 1497, life-cycle thinking, in line with ISO 14001 with particular emphasis on ISO 14062) and develop documentation demonstrating that all steps have been carried out with the highest consideration for the environment.

Since IEC 60601-1-9 was amended in 2013, the standard has been used to guide and help companies minimize products' and operational environmental impact and has been implemented on a voluntary basis. However in 2014 the Brazil National Health Surveillance Agency (ANVISA) took the lead, requiring that any medical electrical equipment sold into the country meets the standard by December 1, 2016 with special attention to three clauses: (4.1) Identification of Environmental Aspects, (4.5.2) Instructions for Minimizing Environmental Impact During Normal Use, and (4.5.3) Information for End of Life Management.

So Brazil is the first country to stipulate that medical electrical equipment formally complies with the standard, but other countries are also considering its implementation or national directives aimed at motivating medical equipment manufacturers to include parts of the standard to minimize impacts, and contribute to the development of a sustainable economy that preserves the environment.

Could the power industry adopt the cradle-to-cradle business model?

As engineers we enjoy challenges, solving problems, and to some extent we are used to breaking 'unbreakable' limits. The power supply history is awash with examples of 'that which will never be possible' eventually becoming a 'great innovation'. In terms of contributing to the environment, by permanently improving technical performance and reducing energy consumption, we have proven our ability to contribute to the reduction of environmental impact, but we can do more. Integrating the full life cycle stages and complying with standards such as ISO 60601-1-9 (or equivalent) are good, but looking forward can we rethink the way the power supply industry is working? Can we contribute even more to build a sustainable environment for future generations?

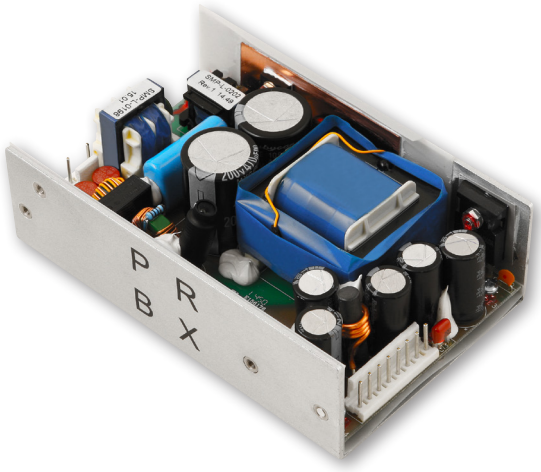

Figure 01 – Medical power supply OFM225 used as pilot case for C2C simulation (Source: Powerbox)

As part of an internal project, a group of engineers from different disciplines and companies were invited to project the complete life cycle of Powerbox's OFM225 power supply (Figure 1). The power supply had originally been designed for high efficiency and ease of manufacturing, and the group was asked to explore how, outside the established business model, could such a product/process not only have the lowest possible environmental impact, but also be able to optimize the positive impact (e.g. Supporting local economy).

Taking into consideration all aspects from initial design to end-of-life (and potential second life), the project followed the cradle-to-cradle (C2C) approach and identified areas to work on in order to minimize negative impacts and optimize positive ones (Figure 2).

For many it may seem an odd approach for a power supply company to consider revamping a conventional way of working to adopt such a model, but considering that C2C takes the whole lifecycle of an item into account, including sourcing and end-of-life disposal, it becomes

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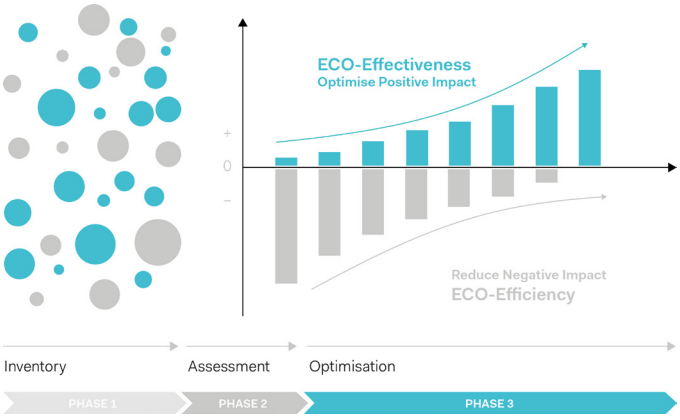

Figure 02 – Cradle-to-Cradle three phases methodology for continuous improvements strategy (Source: Powerbox)

Figure 03 – Cradle-to-Cradle Quality categories addressed for certification (source: The Cradle to Cradle Products Innovation Institute/ Powerbox)

synchronous with existing and forthcoming regulations, with customers, end-users and stakeholders expectations, and a way forward for the power supply industry to help create a better world.

Integrating the C2C five goals (Figure 3) at the beginning of a project will contribute to the development of power supplies with the lowest environmental impact while increasing the positive ones (e.g. selecting a components supplier engaged in sustainable development, working with CEM partners to reduce water consumption and to use renewable energies, designing products with end-of-life or second life in mind), contributing to make the power supply industry, not only able to provide products with best in class technology, but to contribute to local economies and the development of a new way of working, paving the way for future generations.

Recent climate and ecological events remind us daily of how fragile our environment is, and we all have to contribute to its protection. The cradle-to-cradle business model within the power industry may not be a utopia, but it will eventually become part of our daily way of working. So to the question: “Will the power supply industry adopt the cradle-to-cradle business model?” The answer is a resounding, “Yes!”

Material Health
Knowing the chemical ingredients of every material in a product, and optimizing towards safer materials. Identify materials as either biological or technical nutrients. Understand how chemical hazards combine with likely exposures to determine potential negative impacts to human health and the environment.

Material Reutilization
Designing products made with materials that come from and can safely return to nature or industry. Maximize the percentage of rapidly renewable materials or recycled content used in a product. Maximize the percentage of materials that can be safely reused, recycled, or composted at the product’s end of use. Designate your product as technical (can safely return to industry) and/or biological (can safely return to nature).

Renewable Energy & Carbon Management
Envisioning a future in which all manufacturing is powered by 100% clean renewable energy. Source renewable electricity and offset carbon emissions for the product’s final manufacturing stage.

Water Stewardship
Manage clean water as a precious resource and an essential human right. Address local geographic and industry water impacts at each manufacturing facility. Identify, assess, and optimize any industrial chemicals in a facility’s effluent.

Social Fairness
Design operations to honor all people and natural systems affected by the creation, use, disposal or reuse of a product. Use globally recognized resources to conduct self-assessments to identify local and supply chain issues and third party audits to assure optimal conditions. Make a positive difference in the lives of employees, and the local community.

About Powerbox
Founded in 1974, with headquarters in Sweden and operations in 15 countries across four continents, Powerbox serves customers all around the globe. The company focuses on four major markets - industrial, medical, transportation/railway and defense - for which it designs and markets premium quality power conversion systems for demanding applications. Powerbox's mission is to use its expertise to increase customers' competitiveness by meeting all of their power needs. Every aspect of the company's business is focused on that goal, from the design of advanced components that go into products, through to high levels of customer service. Powerbox is recognized for technical innovations that reduce energy consumption and its ability to manage full product lifecycles while minimizing environmental impact.

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