Guide to Sustainable Product Design

Introduction

Across the world, executives at manufacturing organisations are steadily making sustainability a priority key performance indicator (KPI). They are not doing this for fun. They are doing it to ensure they comply with legislation and because it offers commercial benefits ranging from cost savings to improved brand reputation.

In the manufacturing sector, the process of reducing the environmental impact of a company's products, processes and services originates with design. Every row, on every bill-of-materials is an opportunity to improve the company's overall sustainability.

To date, design briefs typically focus on product performance, cost, compliance, ergonomics etc. Adding sustainability changes the dynamics. This new guidance will particularly benefit those addressing sustainability for the first time but haven't had the opportunity to study the subject.

Beyond engineers, stakeholders benefiting from and contributing to this guidance include original equipment manufacturers, sustainability managers, institutes, universities, Government departments, consultants, lawyers and C-suite executives.

So, what is preventing every design and manufacturing engineer, at every OEM, starting that journey today? The questions putting the brakes on this process are simple: why start, where to start, what to ask, what to do and, underpinning all this, who to trust. This guidance is designed to answer these questions and provide inspiration and ideas to all those aiming to produce more sustainable products.

Chapters

1) What is sustainable design?

Sustainability means very different things to different people. At one end of the scale sustainability starts with offsetting greenhouse gasses by planting trees. At the other end of the scale, it means full product Life Cycle Assessments (LCAs) and certified Environmental Product Declarations (EPDs). This chapter offers a roadmap for a manufacturer's sustainability journey. Thought provoking topics include:

- Setting a benchmark and direction/rate of travel.
- Thinking differently by refusing to adhere to wasteful processes.
- Rethinking how products are made, owned, used and recovered.

2) Opportunities

Sustainable design brings six categories of opportunity, comprising one stick and five carrots. This chapter covers the following opportunities:

- Legislative compliance
- Cost reduction
- Business innovation
- Brand reputation
- Recruitment and retention
- ESG (environmental, social and governance)

3) Key challenges

This chapter investigates the reasons why design departments are yet to start their sustainability journey and the roadblocks slowing them down.

- Where, when and how to start.
- Working within existing safety compliance regimes.
- Securing buy-in from management and other departments.

4) Associated mega trends

Sustainable design is not taking place in isolation. It is one component in the move to Industry 5.0. This chapter unpacks the associated mega trends and how they dovetail with sustainable design including;

- Digitisation
- Product-as-a-service
- Additive manufacturing
- Circular economy

5) Legislation, standards and compliance

Design engineers already need to comply with environmental legislation such as WEEE, the Battery Directive, RoHS and REACH. However, a new generation of legislation, standards and compliance is evolving. This chapter covers key regulations and initiatives including.

- Corporate Sustainability Reporting Directive (CSRD)
- Ecodesign for Sustainable Products (ESPR)
- Digital Product Passports (DPPs)
- Right to Repair

6) Strategy

Successful sustainability strategies require buy-in from every department. This chapter focusses on the design department's interdepartmental relationships, including cooperation and communication during the development of a sustainability strategy. It will cover the following areas.

- Purchasing
- Manufacturing
- Marketing
- Sales
- Compliance
- Customer support

7) Tactics

Once a sustainable design strategy has been decided upon, how does the design department translate that decision into actionable results? Tactics include: reducing embodied carbon; improving efficiency; reducing weight; increased integration; improved durability; material minimisation; increased reliability; better maintainability; better repairability; upgradeability; ease of assembly; ease of disassembly; minimum packaging; minimum distance travelled. This chapter discusses all these tactics to provide actionable advice.

8) Measuring success

How does a design department know its sustainability initiatives are contributing to the company's success unless its actions are measurable? Manufacturers are now building sustainability into their key performance indicators (KPI), some up to 85%. This chapter looks at ways of measuring the benefits of sustainable design from minimised bills-of-materials to product lifecycle assessments. The contents will include coverage of:

- Frameworks and standards.
- Spend-based accounting.
- Product life cycle assessments.
- Environmental product declarations.

9) The business case

If the cost of reducing the environmental impact of engineered products out strips the financial gains, sustainability efforts will be self-extinguishing. This chapter will present real-world case studies confirming that sustainable product design can be done profitably.

10) Case studies

Progressive Tier 1 manufacturers with the financial and workforce resources to be pathfinders are already successfully deploying sustainable design across many different industry sectors. This chapter features illustrative case studies highlighting the strategies and tactics that led to success. A diversity of case studies will allow benchmarking and highlight different pathways according to different technology types and sectors.

Glossary

List of useful terms, abbreviations, acronyms etc.

References

List of reading resources: media platforms, textbooks, magazines, white papers, guides etc

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