



REIMAGINING SUSTAINABILITY: VIRTUAL TWINS AT THE WHEEL

Lifecycle Assessment and Eco-Design Unleashed

Curbing Climate Change
Without Sacrificing Business
Goals

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CURBING CLIMATE CHANGE WITHOUT SACRIFICING BUSINESS GOALS

The demand for more sustainable products is growing as temperatures rise and severe weather impacts communities worldwide. Consumers, governments, and even business partners are increasingly looking to manufacturers to minimize their environmental impact. Furthermore, these entities expect more than reassurances; they want credible evidence that products meet sustainability goals.

For product developers, these requirements present significant challenges. Companies must now invest extra resources into sourcing, manufacturing, and even the end of the product lifecycle. At the same time, these companies cannot sacrifice product performance or extend time to market. Keeping up in an era of ever-tightening competition requires more money and innovation.

Yet, manufacturers that pursue innovation and sustainability can enhance their credibility and industry standing. When new government regulations arise, these businesses are already often compliant.

So how can companies embrace sustainability without sacrificing business goals? The answer lies in integrating sustainability throughout the product development cycle. This e-book delves into the limitations of conventional processes for product developers and presents a compelling solution: the Eco-design approach. By leveraging the power of virtual twins, lifecycle assessments, and cloud technology, this innovative approach unlocks the potential for sustainable design without compromising business profitability.



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BREAKING FREE FROM TRADITION: WHY CONVENTIONAL METHODS FAIL SUSTAINABLE DEVELOPMENT

Product development has not changed much over the years. Designs are fleshed out via repeated physical prototyping cycles, during which teams create, test, and sometimes even discard mockups, adding to the waste stream. Other checks, such as assembly-line validation, focus on efficiency and quality but provide no input on environmental issues. Even in cases where companies try to minimize their environmental impact, efforts seem like an afterthought, disrupting development and stretching out timelines.

The problem is that 80% of a product's environmental impact is set during its design phase. The design engineer determines parameters such as material selection, manufacturing process, durability, longevity, energy efficiency, and even how easy it will be to recycle. But traditional development offers no tools to assess the impact of these decisions early on.



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Companies that want to embrace sustainability must look beyond traditional development practices. If design engineers considered environmental impacts while working, they could create more sustainable products and less ecological waste within a shorter time, all without delays or costly late design changes. In short, integrating sustainability into the earliest stages of design helps companies create sustainable products while still meeting their business goals.



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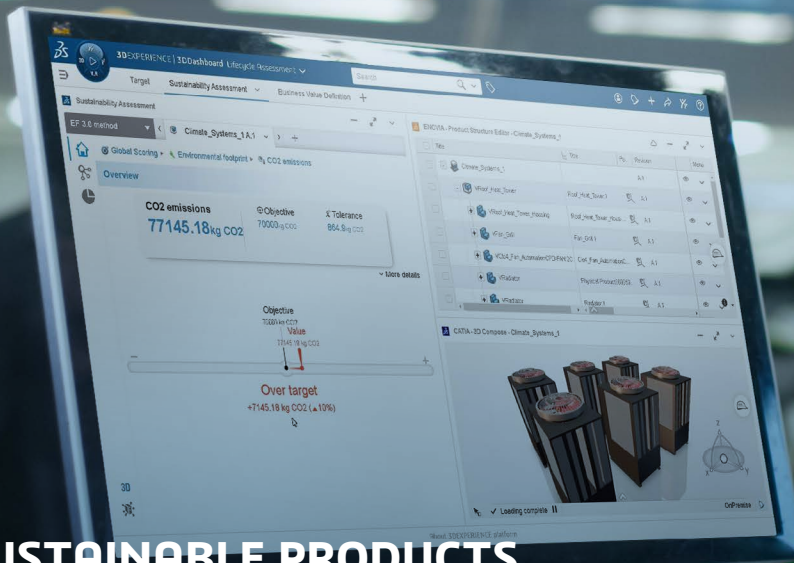
While traditional companies struggle to incorporate sustainability into their development cycles, Eco-design offers a way forward. Eco-design is a mindset towards product development that goes beyond form and function. It supports reduced resource consumption, utilization of renewable/recyclable materials, energy efficiency, waste reduction, and decreased emissions throughout the product lifecycle.

Having access to data is one of the biggest challenges, both inside a company and in the overall supply chain. Eco-design acts as a backbone for companies to manage and reduce their environmental footprint with real data. The approach touches on requirements, design, sourcing, manufacturing, procurement, use, servicing, end-of-life, and beyond.

Not least of all, Eco-design benefits a company's bottom lines.

Through Eco-design, companies can:

- Save on material costs by designing products that use fewer resources or recycled materials.
- Increase customer loyalty and foster repeat business by developing more durable products.
- Avoid the expense and waste of engineering changes for products already at prototyping phase.
- Eliminate the need for costly rework when new regulations arise by ensuring products are sustainable throughout the lifecycle.



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LIFECYCLE ASSESSMENTS MAKE ECO-DESIGN MEASURABLE

A lifecycle assessment (LCA) is crucial to Eco-design. LCA is a rigorous method for systematically and objectively quantifying the environmental impact of a product design, from sourcing raw materials to end-of-life disposal or recycling.

LCA, which emerged in a limited form in the 1960s, is traditionally a manual effort that requires significant time and resources. As such, companies often use it to guide improvements for future product versions, and not the current design under production.

But today, with faster computers and more digital innovations, companies no longer need to wait to incorporate LCA into their development activities. With newer software tools, engineers have the data to quickly and easily apply LCA.

Then companies can:

- Identify the environmental impact of a product from its design.
- Measure the environmental footprint of their product by evaluating its environmental impact across multiple key performance indicators including but not limited to carbon emissions. Other crucial metrics can be monitored such as land use, fossil depletion, water use, freshwater ecotoxicity, marine eutrophication, and carcinogenic effects.
- Determine which materials offer the best environmental performances.
- Define a manufacturing strategy based on its carbon footprint.
- Experiment with design changes to find the most environmentally-friendly choices.
- Continuously improve designs as technology evolves and new opportunities arise.
- Communicate their sustainability efforts to stakeholders and customers.

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UNLEASHING THE POWER OF VIRTUAL TWINS FOR SUSTAINABLE PROGRESS

Virtual twins add significantly more power for effective Eco-design, primarily when the twin resides in the cloud.

What is a virtual twin?

A virtual twin is an exact digital copy of a physical asset that enhances visibility across ecosystems and helps to drive information flows, accelerate development, and streamline operations. Virtual twins are used today in areas from life sciences and healthcare to construction and retail.

Enhancing development with cloud technology

Virtual twins generally reside in the cloud, so stakeholders everywhere can easily access product data, which promotes collaboration and innovation. Plus, the cloud can act as a centralized data system, so everyone has the most recent information regardless of their location.

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Carrying out LCA with data from the virtual twin

When companies perform LCAs on a virtual twin, they can effectively bring Eco-design principles to the earliest stages of product development. The LCA no longer provides data just for future revisions but instead drives design decisions in the current project.

The virtual twin contains essential data such as manufacturing processes, materials, operations, and sourcing. The LCA can use that data to calculate energy consumption and environmental impact throughout the product's lifecycle. Engineers can understand the environmental impact of all components in their system. They can easily flag which components have the highest sustainability impact. They know the sustainability status of each component right from the product ideation stage. They can use this information to try out different design alternatives and finalize the design that has the least environmental impact.

With LCA integrated into the virtual twin, companies can:

- Connect to continuously updated datasets so design engineers can make optimized design choices for sourcing materials and manufacturing methods.
- Set sustainability goals and make sure designs stay within those targets.
- Perform trade-off studies to optimize their design decisions further.
- Continue to monitor impacts into each stage of the development cycle.
- Ensure digital continuity between the lifecycle assessment and the virtual twin.



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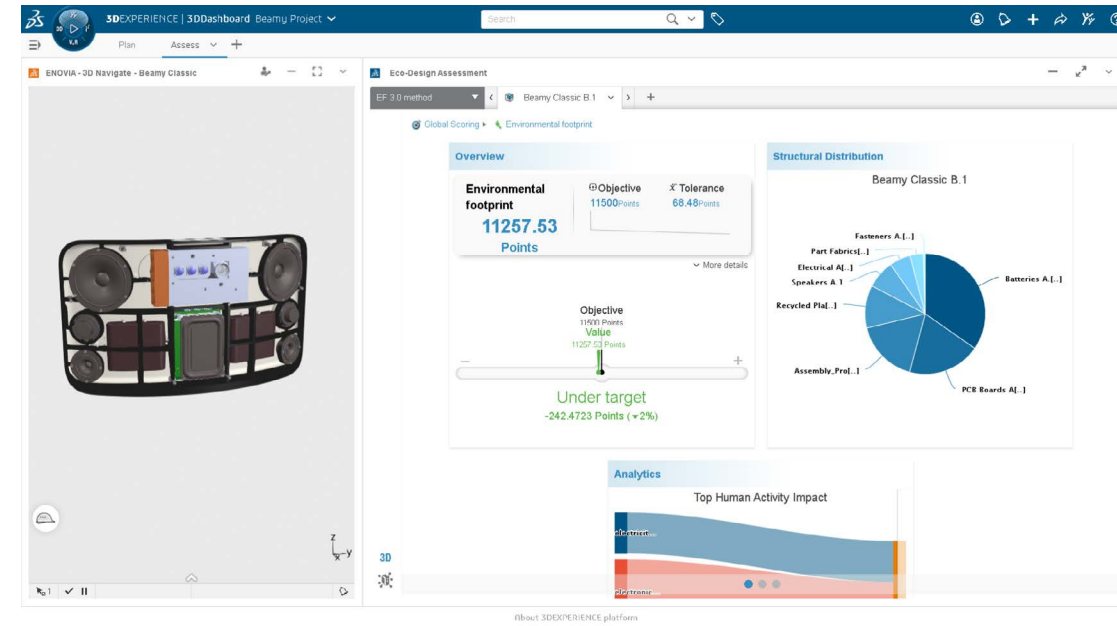
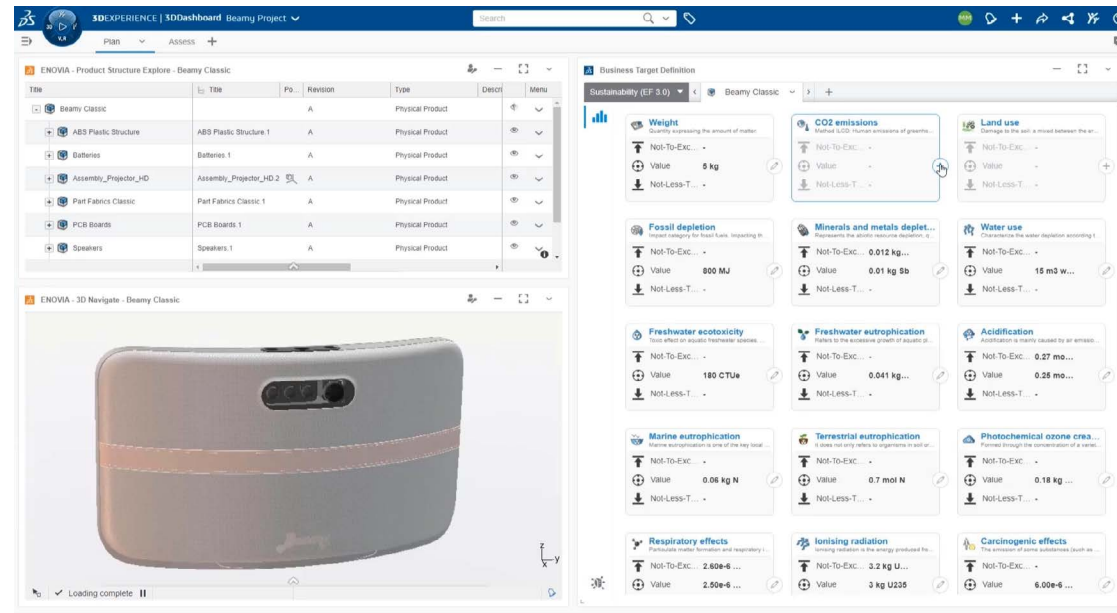
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EMBRACING SUSTAINABLE INNOVATION WITH 3DEXPERIENCE

Delving into the transformative power of Lifecycle Assessment (LCA) and its pivotal role in fostering responsible innovation and eco design practices, the forefront of this sustainable revolution features Dassault Systèmes and the visionary 3DEXPERIENCE platform on the cloud. Empowering organizations to seamlessly integrate sustainability into product development, the 3DEXPERIENCE platform's built-in LCA capabilities accurately measure the complete environmental impact of products, encompassing 16 key metrics including carbon emissions, freshwater ecotoxicity, and more. Drawing data from diverse sources this comprehensive approach enables informed decision-making, identifying key areas for sustainability improvements right from product inception.



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Empowering Sustainable Decision-Making Across the Lifecycle

Dassault Systèmes goes beyond using LCA merely for declaration purposes, elevating it to an integral part of the entire product lifecycle. Through the power of Virtual Twin technology, from engineering and manufacturing to operational usage, the platform enables users to create scenarios based on LCA results. This approach empowers organizations to act proactively and leverage LCA data within the context of Virtual Twins, optimizing asset performance in multiple domains. The result: a paradigm shift towards sustainable practices throughout a product's lifecycle.

Sustainability-Driven Design from Inception

Discover sustainability-driven design at the heart of the approach. Our complete and powerful solution equips companies with data on 16 key metrics, enabling them to assess environmental impacts upfront. Integrate LCA from the start, gaining insights to optimize materials, reduce pollutants, and make eco-conscious decisions early on. Embracing the eco-design mindset empowers businesses to create a greener future. Moreover, we take it a step further by harnessing the ecoinvent database, which significantly enhances basic LCA solutions. Boasting an extensive collection of 18,000 dependable lifecycle datasets across diverse sectors on a global and regional scale, this reputable resource ensures continuous updates for accuracy. With ecoinvent, LCA assessments gain credibility, enabling businesses to conduct robust and reliable sustainability evaluations.

"LCA brings the metrics needed to evaluate environmental impacts across the product lifecycle. Integrating that with virtual twin technology opens new possibilities to address those impacts very early on."

Emilia Moreno Ruiz, CTO, ecoinvent

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The EPFL Racing Team's collaboration with Dassault Systèmes exemplifies the practical application of LCA in Formula Student. By demonstrating how sustainability and performance can harmoniously coexist, the partnership sets a benchmark for integrating eco-design practices in motorsports. As the team embraces LCA and strives to reduce environmental impact throughout the vehicle's lifecycle, they inspire professionals across industries to follow suit.

Collaboration and Transparency for Collective Impact

A hallmark of the **3DEXPERIENCE** platform on the cloud is its emphasis on collaboration and transparency. The integrated LCA data is accessible to all stakeholders, fostering seamless teamwork among designers, engineers, logistics experts, and business planners. By sharing standardized sustainability data, organizations can collectively make informed decisions that positively influence their environmental footprint. This shared knowledge facilitates deeper insights and collective impact for a greener, more sustainable future.

Paving the Path to a Greener Tomorrow

Dassault Systèmes' visionary approach to LCA and its integration into the **3DEXPERIENCE** platform exemplify a transformative paradigm in eco design and sustainability. By enabling organizations to make informed, sustainable decisions from product inception to end-of-life considerations, the platform fosters responsible innovation and a greener future. Embracing sustainable practices and fostering collaboration across industries, Dassault Systèmes leads the charge towards a more sustainable and eco-conscious world.

"Each year is a new chance to improve the car. LCA guides us to design a vehicle that is truly sustainable without compromising on performance. Eco-design is a mindset. In less than a year, we put in place a system to perform an LCA and develop a sustainability strategy. If we can do it, then what are you waiting for?"

Hugo Fenoli-Rebellato, Team Leader Sustainability, EPFL Racing Team

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CONCLUSIONS AND RECOMMENDATIONS

Climate change creates new challenges for companies as their customers, governments, and business partners increasingly expect more sustainable practices. Unfortunately, the changes necessary to improve sustainability can lead to longer lead times and higher costs in traditional product development. The good news is that companies can overcome these challenges with newer progressive methods of development by adopting the following:

- **Eco-design:** This is an approach to design that incorporates sustainability into every phase of a product's lifecycle. This results in more environmentally friendly products while optimizing business benefits.
- **LCA:** LCA is a tool for carrying out Eco-design that systematically and objectively quantifies the impact of design decisions.
- **Virtual twins:** These are digital representations of products that teams can test and assess well before physical prototyping and manufacturing begin.
- **Cloud technology:** Cloud technology can host virtual twins, keeping development data up to date and accessible for all stakeholders, which promotes collaboration and innovation.

Our **3DEXPERIENCE**® platform powers our brand applications, serving 12 industries, and provides a rich portfolio of industry solution experiences.

Dassault Systèmes, the **3DEXPERIENCE** Company, is a catalyst for human progress. We provide business and people with collaborative virtual environments to imagine sustainable innovations. By creating virtual twin experiences of the real world with our **3DEXPERIENCE** platform and applications, our customers can redefine the creation, production and life-cycle-management processes of their offer and thus have a meaningful impact to make the world more sustainable. The beauty of the Experience Economy is that it is a human-centered economy for the benefit of all –consumers, patients and citizens.

Dassault Systèmes brings value to more than 300,000 customers of all sizes, in all industries, in more than 150 countries. For more information, visit www.3ds.com.

Together, these technologies help companies build sustainability into the entire product lifecycle, creating a more significant impact earlier in development while maximizing profitability for their businesses.

RECOMMENDATIONS

To assess how and whether they can profit from progressive approaches to sustainability and product design, companies should:

- Clearly define corporate sustainability goals.
- Estimate cost, timeline, and competitive benefits of incorporating sustainability early in product development.
- Attend a webinar on sustainability and design, available from dassault systèmes.
- Talk to a solution expert from dassault systèmes to understand how eco-design functions in the lca of your products and services.



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