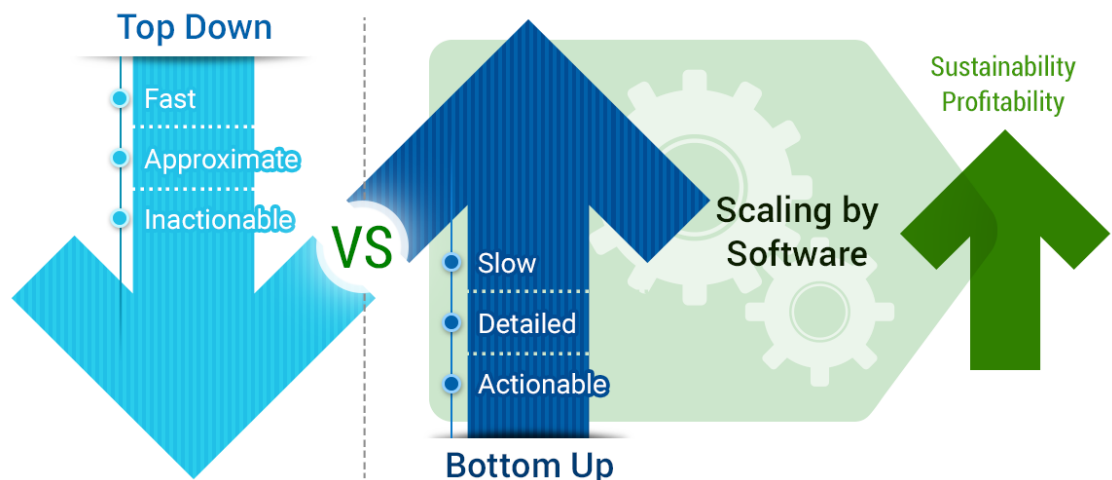


Product Carbon Footprint Teardown: If You Are Not Doing Bottom Up, You Are Leaving Value On The Table

Author: Pareekh Jain, CEO EIIRTrend

Product Carbon Footprint (PCF) Teardown is a critical component of corporate sustainability initiatives. There are two approaches to conducting a PCF teardown: top-down and bottom up. The top down approach is quicker but often lacks accuracy, missing out on valuable insights and opportunities for improvement. In contrast, the bottom up approach is more thorough, offering detailed insights and identifying opportunities for improvement, though it is time-consuming and challenging to scale, it can be effectively handled by automations, advancement of data analytics and integration with digital platforms like ERP/PLM. This PoV discusses strategies for scaling the bottom up PCF teardown by leveraging software, exemplified by HCLTech’s mypcm solution.

Exhibit 1: Product Carbon Footprint Teardown: Top Down vs Bottom Up



Source: EIIRTrend

Product Carbon Footprint Teardown: Current State & Challenges

A Product Carbon Footprint (PCF) teardown involves a comprehensive analysis of the carbon emissions throughout a product's lifecycle, covering everything from raw materials and manufacturing to transportation. The primary goal is to pinpoint the significant sources of emissions and identify potential reductions at each lifecycle stage.

This PCF process enables companies to grasp the environmental impact of their products better, guiding more sustainable decision-making. Additionally, it supports transparent communication of environmental impacts to all stakeholders and regulators, fostering trust and compliance. A further advantage of PCF analysis is the identification of cost-saving opportunities that also reduce the carbon footprint. Techniques employed in this analysis may include lifecycle assessment (LCA) tools, and collaborations with suppliers and experts to gather and analyze data.

The most common approach to PCF teardown is the top-down method. This starts with broad, aggregated data from an organizational or industry level, which is then allocated to specific products based on various criteria or assumptions. While faster and less resource-intensive, the top-down method comes with significant challenges:

- **Inaccuracy due to generalization:** A top-down approach that relies on industry averages or aggregated data can misrepresent the specific carbon footprint data of a particular product or company, leading to flawed analyses. Geographic and production process variations can significantly alter carbon intensity, and using outdated or irrelevant benchmarks might not reflect the true context of a specific enterprise or product.
- **Unreliable analysis can lead to unfair actions.** The top-down approach's dependency on the accuracy of initial data and assumptions means that even minor errors can cause substantial discrepancies in results. Decisions based on such unreliable analysis, like choosing suppliers or imposing penalties, may be unjust and detrimental.
- **Missing optimization and profitability opportunities.** Each product or process may have unique opportunities for efficiency improvements or emission reductions that cannot be revealed by generalized data and analysis not grounded in the detailed operational specifics of products. Consequently, this results in missed opportunities to identify specific emission reduction strategies. Additionally, since emission reductions are linked to operational improvements and profitability, overlooking these opportunities can also mean missing out on potential profit enhancements.

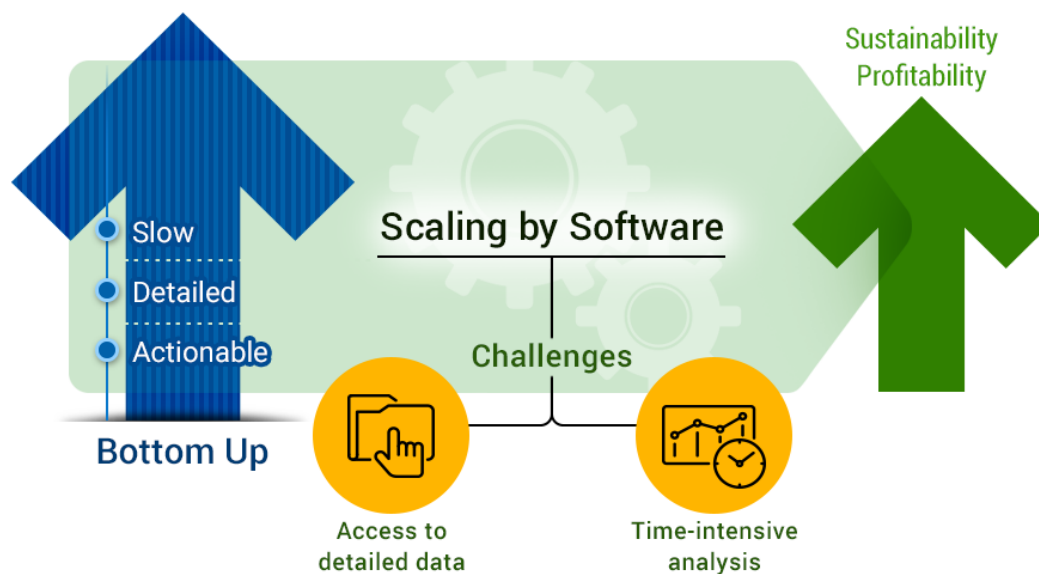
Leveraging Software Platforms for Effective Bottom Up Product Carbon Footprint Teardown

The bottom up approach to Product Carbon Footprint (PCF) teardown is meticulous, starting at the product or component level. This method compiles detailed data from each phase of a product's lifecycle, using Lifecycle Analysis (LCA) tools to calculate the direct and indirect emissions associated with each component or process. Factors such as energy consumption rates, material types, manufacturing processes, and transportation distances—which vary by geography—are integral to this analysis. This comprehensive aggregation provides a full view of the product's total carbon footprint.

However, scaling this detailed bottom up approach presents several challenges:

- **Access to detailed data:** The bottom-up method requires extensive data from every stage of the product lifecycle, which can be difficult to obtain, especially for products within a global supply chain.
- **Time-intensive analysis:** Thoroughly analyzing every component in multiple products continuously demands significant labor and time, which can be overwhelming for companies with diverse product lines. Each product may need a slightly different analysis approach, adding layers of complexity.

Exhibit 2: PCF Bottom Up Teardown: Scaling By Software



Source: EIIRTrend

A software or platform-based solution can address these challenges effectively. Sophisticated PCF teardown software equipped with industry benchmarks and detailed data, capable of spanning the entire product value chain, is crucial. Such platforms must handle large datasets, complex calculations, and generate multiple "what-if" scenarios. Ideally, the PCF teardown software should also integrate with product cost teardown or value engineering activities to maximize efficiency and alignment.

This software-driven strategy not only streamlines the process but also enhances the scalability and accuracy of bottom up PCF teardowns, making it a viable solution for comprehensive carbon footprint assessments.

HCLTech's mypcm Platform: Elevating Product Carbon Footprint and Cost Analysis

HCLTech's mypcm platform is a cloud-based digital solution designed for precise product carbon footprint with bottom up analysis and product cost calculations. It facilitates real-time collaboration and reporting, offers streamlined version control, and allows for project-specific configurations. Here are its key features:

- **Detailed Product Carbon Footprint Analysis:** Enables the generation of detailed product carbon footprint estimates at granular levels, including at specific plants or suppliers.
- **Rapid 'What-If' Scenarios:** Assesses product emissions along the value chain, identifies emission hotspots, and conducts scenario analyses for emission reductions.
- **Cost and Emissions Optimization:** Identifies strategies for simultaneously reducing product costs and emissions.
- **Comprehensive Data Integration:** Incorporates various factors affecting the Product Carbon Footprint, such as geography, electricity sources, process/equipment efficiency, material utilization, and logistics.

mypcm builds upon basic PCF analysis to enable more sophisticated use cases:

- **EcoDesign/DFS:** Utilizes a Life Cycle Assessment (LCA) approach to calculate the PCF of existing designs, explore alternative materials or processes, and assess the CO₂e impact of new designs.
- **Sustainable Procurement:** Integrates product Bills of Material, assigns specific emission factors to suppliers or plants, and calculates detailed product carbon footprints to guide sustainable procurement decisions.
- **Value Chain Emissions:** Gathers data across the entire product value chain, simulates manufacturing processes, calculates emissions for all lifecycle phases from cradle to grave, and identifies key areas for CO₂e reduction.
- **Product CO₂ Benchmarking:** Conducts physical teardowns of products to identify manufacturing processes and materials used, benchmarks CO₂e emissions by material/module/commodity, and generates ideas for CO₂e reduction based on best-of-best analysis.

HCLTech has successfully deployed mypcm across various engineering firms, achieving significant outcomes. Here are some examples:

Exhibit 2: HCLTech's mypcm Examples

Customer/ Context	HCLTech Solution	Business Impact Delivered
<p>Customer 1: Design for Sustainability – PCF Study of Motor Plate</p> <ul style="list-style-type: none"> • Leading Global industrial manufacturer of HVAC equipment was looking for support on Eco-Design to develop an Environmentally friendly Residential HVAC unit. • As part of Green Building certifications like LEED & BREEAM Environmental Impact assessment contributes to achieving a higher level of certification. • Customer approached HCLTech to run a detailed Cradle-to-Grave PCF for residential HVAC unit and identify the impact hotspots to reduce the environmental impact. 	<ul style="list-style-type: none"> • A detailed PCF was done for HVAC unit by adopting Cradle-to-Grave approach by considering ISO 14067 standards. • Design aspects like form, fit & function was assessed along with Cost Vs CO₂ impact at sub-system levels. E.g., Blower motor plate assembly. • HCLTech' s Eco-Design solution architects have developed 12+ concept designs and carefully selected the top 3 concept designs after weighted average technique. • A detailed impact assessment was done for top 3 concepts using mypcm platform to assess the impact of Raw material, manufacturing process, energy impact, and logistics. 	<ul style="list-style-type: none"> • 16% less Raw material • 36% less Cycle Time • 48% less Power • 35% less CO₂ Emission • \$1Mn+ Cost Savings • Per UnitGWP Emission Saved 3.49kg CO₂e

Customer/ Context	HCLTech Solution	Business Impact Delivered
<p>Customer 2: Product Benchmarking for Main Circuit Breaker</p> <ul style="list-style-type: none"> For Global Electrical OEM, detailed carbon impact for product and elimination of impact hotspots through product redesign without compromising product pricing 	<ul style="list-style-type: none"> Detailed Benchmarking of carbon footprint along with cost Cradle-to-Grave approach considering ISO 14067 standards Assessment of design aspects (form, fit & function) along with Cost Vs CO₂ impact at sub-system levels mypcm platform leveraged to run detailed assessment of impact of Raw material, manufacturing process, energy impact, and logistics for all make parts. Additional Value: Value Engineering Ideation resulted in 54 Cost/CO₂ reduction ideas, 30 of which were taken up for implementation. 	<ul style="list-style-type: none"> 55.1 kg CO₂e Reduction(22%) per product 4410 Ton CO₂e annual savings 12% Product Cost Savings per product

Customer 3:**Product Co2 Benchmarking for Consumer Products**

- Leading global Consumer Products manufacturer with an intent to gain market leadership from sustainable product perspective, was exploring methods to gain competitive intelligence.
- Customer approached HCLTech to run a detailed carbon footprint benchmarking for the product, redesign the product to eliminate the impact hotspots without compromising the products competitive pricing in the market.
- A detailed carbon footprint benchmarking was done for their products by adopting Cradle-to-Grave approach by considering ISO 14067 standards.
- Design aspects like form, fit & function was assessed along with Cost Vs Co2 impact at sub-system levels.
- HCLTech's Eco-Design solution architects used mypcm to run a detailed assessment of the impact of raw material, manufacturing process, energy impact, and logistics for all make parts.
- A Best of Best approach was adopted to arrive at the least possible footprint design.
- 34.1 kg Co2e Reduction(17%) per product
- 1943.7 Ton Co2e Savings in a Year

Source: HCLTech, EIIRTrend

Strategic Advice for Enterprises on Scaling Product Carbon Footprint Teardown

Here are our recommendations for enterprises looking to start or accelerate their sustainability product teardown initiatives:

- **Adopt a Bottom Up Approach:** Conduct a comprehensive analysis of your product's carbon footprint. Focus on identifying key metrics and uncovering both sustainability and profitability levers that can enhance sustainability efforts profitably.
- **Leverage Software Solutions:** Utilize software solutions to efficiently scale the bottom up approach to product carbon footprint teardown.
- **Choose Partners Diligently:** Select partners that not only offer robust software solutions but also have a proven track record in sustainability and value engineering. Ensure they have demonstrated results in delivering both sustainability and profitability.
- **Proactively Monitor Key KPIs:** Keep an eye on key sustainability and profitability KPIs, and continually refine your approach. Recognize that sustainability and profitability are dynamic goals, influenced by evolving trends and technological advancements. Regular monitoring and adjustment of processes are essential to stay on target.

Conclusion

Sustainability product teardown presents an opportunity not only addressing Compliance Stewardship but achieving Sustainable Product Stewardship while managing cost structure and boost profitability. While enterprises have a choice between a quicker, simpler approach and a more time-consuming, meticulous one, the latter—the bottom up approach—often yields more substantial results in the medium to long term. Solutions like HCLTech's mypcm solution can facilitate and scale this journey, making the bottom up approach more feasible. Forward-thinking enterprises should embrace this bottom up strategy to implement sustainability, which is comprehensive and profitable.