



DIGITAL INDUSTRIES SOFTWARE

Product Carbon Footprint Calculator

Accelerating your transition to net-zero while operating profitably

Benefits

- Operate profitably while accelerating transition to net-zero
- Identify cost and CO₂e emission reduction potential
- Take early eco design decisions with a focus on value and cost
- Increase efficiency by re-using the same bottom-up model to roll up cost and CO₂e emissions along the value chain
- Increase transparency into supplier cost and CO₂e emissions to incentivize carbon-conscious production methods
- Accelerate cross-functional processes between cost engineering, purchasing, supply chain, sales and management

Summary

The pressure is growing on manufacturing companies to respond to the threat of global warming. To meet the 2015 Paris Agreement's global-warming cap, emissions must be reduced to reach net-zero by 2050. Manufacturing companies struggle to make trade-offs between driving down carbon dioxide equivalent (CO₂e) emissions, reducing product costs and addressing customer value demands. But how can companies advance their carbon-reduction goals while operating profitably?

Driving decarbonization by making product carbon footprints transparent

Today 80 percent of the environmental impact associated with a product can be avoided in the development and design phase. The Product Carbon Footprint calculator, which is part of the Teamcenter® product cost management solution, enables organizations to measure, simulate, reduce and track their product carbon footprint early in the development phase. Teamcenter is part of the Xcelerator portfolio, the comprehensive and integrated portfolio of software and services from Siemens Digital Industries Software. This approach capitalizes on the transparency and optimization that bottom-up target costing provides. It allows companies to calculate product carbon footprints in the same detailed way. Because the analysis is done at a granular level, companies can set eco-design strategies such as: design for resource

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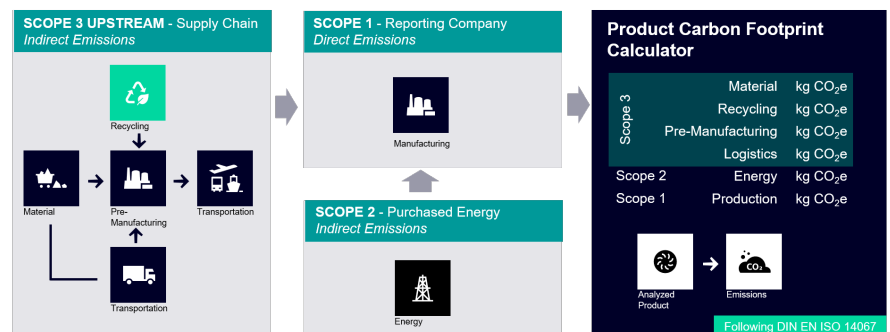
Features

- Link cost and CO₂e emissions along the value chain
- Identify cost and CO₂e emission drivers and dependencies
- Use benchmark data for cost and CO₂e emissions to perform what-if simulations
- Get accurate cost results using integrated carbon taxes
- Lead calculations based on international standards (DIN EN ISO 14067, GHG Protocol)
- Share cost and CO₂e emission breakdowns via Xcelerator Share

efficiency or design for recycling by using a systematic approach that integrates ecological aspects from the product planning, development and design process through the entire product lifecycle.

The Product Carbon Footprint solution considers all the processes from extracting raw or recycled materials and manufacturing of precursors through production of the final product and when it leaves the company gate (cradle-to-gate).

The Product Carbon Footprint module follows the same bottom-up analysis workflow for CO₂e emissions, where all relevant emission factors of the product along the value chain are summarized. This means data is collected on all emissions corresponding to direct costs (raw material, semifinished parts, machine type, energy type, tools and devices), including upstream activities for purchased parts, energy consumption, transportation and waste. It also means data is collected on emissions associated with indirect costs embedded in the product, such as plant overhead and transportation. Finally, emissions from downstream activities, such as recycling and disposal, can be factored in. Users can then classify the detailed data on product emissions into the established Greenhouse Gas (GHG) Protocol classifications of scopes 1, 2 and 3.



Classification of detailed data on product emissions into the established GHG Protocol classifications of scopes 1, 2 and 3.

Scope 1 includes direct GHG emissions from company-owned and controlled resources. Scope 2 is comprised of indirect GHG emissions from the generation of energy purchased from a utility provider. In other words, all GHG emissions released in the atmosphere, including the consumption of purchased electricity, steam, heat and cooling. Scope 3 is comprised of all indirect GHG emissions not included in scope 2 that occur in the value chain of the reporting company, including both upstream and downstream emissions.

Following international standards and rules

Product carbon footprints are calculated following general standards for products as stipulated in German Institute for Standardization (DIN), European Standard (EN) and International Organization for Standardization (ISO) 14067, as well as the Greenhouse Gas Protocol Product Standard. Furthermore, the calculations are constantly updated to comply with new standards.

Considering carbon taxes

Another factor being considered for the cost calculation is carbon taxation, which is pushing companies to make the carbon footprint of their products transparent. Carbon tax sets a price on each ton of emitted GHG, which sends a price signal that gradually causes a market response across an entire economy, creating incentives for emitters to shift to less GHG-intensive ways of production, ultimately resulting in reduced emissions. The upshot is companies have to show environmental taxes not only for combustion processes like oil and gas, but also for their products, depending on the country. Thus, the Product Carbon Footprint calculator can be used to factor in carbon taxation.

Simulating options for reducing the product carbon footprint

Simulations can be performed on material substitution, weight savings, higher material recycling ratios, manufacturing process optimization, etc., by using the integrated database with CO₂e emission values for material data such as: metals, polymers, composites, powder materials and the energy mix from various countries and regions. The data sets of covered areas will be continuously extended.

A123.168.65.34 (Driver Door Panel Switch - Germany)						Fixed	Current	Difference	
Driver Door Panel Switch						€/100 pcs	378,29	378,29	0,00 %
						kg CO ₂ e/100 pcs	37,14	37,14	0,00 %
Symbol	Designation	Item number	Region	Date of calculation	Carbon Footprint	Carbon Footprint L	Master Data Quali	Net sales price	Net sales price Un
	Driver Door Panel Switch	A123.168.65.34	Germany	19.07.2021			Manual		
	Moulded lead frame	X-1001	Germany	19.07.2021	14,46 kg CO ₂ e/100 pcs		Manual	17,46 €/100 pcs	
	Lead frame	X-1002	Germany	19.07.2021	6,98 kg CO ₂ e/100 pcs		Manual	9,36 €/100 pcs	
	DCD1	R-1003	Germany	19.07.2021	6,48 kg CO ₂ e/100 pcs		Full match	5,44 €/100 pcs	
	Steel scrap	RS-1001	Germany	19.07.2021	0,00 kg CO ₂ e/100 pcs		Full match	0,56 €/100 pcs	
	Stamping lead frame		Germany		0,43 kg CO ₂ e/100 pcs			3,33 €/100 pcs	
	CPI-25	CPI-25			0,08 kg CO ₂ e/100 pcs		Fallback match	0,09 €/100 pcs	
	Coiler				0,04 kg CO ₂ e/100 pcs		Manual	0,58 €/100 pcs	
	1 - 4mm				0,21 kg CO ₂ e/100 pcs		Manual	1,10 €/100 pcs	
	Roll feed				0,06 kg CO ₂ e/100 pcs		Manual	0,38 €/100 pcs	
	Peripheral equipment				0,00 kg CO ₂ e/100 pcs		Manual	0,12 €/100 pcs	
	Worker							0,34 €/100 pcs	
					0,03			0,30 €/100 pcs	
	PBT 30GF	R-1004	Germany	19.07.2021	4,23 kg CO ₂ e/100 pcs		Fallback match	3,20 €/100 pcs	
	PBT 30GF		Germany	19.07.2021	0,00 kg CO ₂ e/100 pcs		Manual	0,00 €/100 pcs	
	Injection molding lead fr		Germany		3,22 kg CO ₂ e/100 pcs			4,86 €/100 pcs	
	Plug	N-1005	Germany	19.07.2021	2,30 kg CO ₂ e/100 pcs		Full match	21,00 €/100 pcs	
	Switch	N-1006	Germany	19.07.2021	4,45 kg CO ₂ e/100 pcs		Fallback match	120,18 €/100 pcs	
	Resistor	N-1007	Germany	19.07.2021	4,00 kg CO ₂ e/100 pcs		Fallback match	0,80 €/100 pcs	
	Epoxy resin	C-1008	Germany	19.07.2021	0,00 kg CO ₂ e/100 pcs		Fallback match	2,45 €/100 pcs	
	Assemble moulded lead		Germany		0,00 kg CO ₂ e/100 pcs			45,86 €/100 pcs	
	Solder plug, switch and		Germany		0,02 kg CO ₂ e/100 pcs			6,50 €/100 pcs	
	Seal soldered areas with		Germany		0,00 kg CO ₂ e/100 pcs			35,20 €/100 pcs	
	Testing		Germany		0,92 kg CO ₂ e/100 pcs			5,75 €/100 pcs	

Simulation and optimization of a driver door panel switch.

Companies can do all sorts of what-if simulations in the product development phase, looking at the different levers to evaluate trade-offs. For instance, they can see what happens when switching between plant locations with different levels of automation. It can compare the effects of switching to higher efficiency production equipment with optimizing designs by substituting materials, using higher material recycling ratios or thinning out a component. This supports companies in their eco-design strategies by enabling them to efficiently use materials in production through better product design or optimized manufacturing processes and avoiding re-use of production waste.

Procurement teams can analyze the impact of buying parts from a supplier in a developing economy versus one in a developed economy. They can weigh the trade-offs between using a higher-cost supplier with old machinery and using a lower-cost supplier with new equipment.

Sharing product cost and carbon footprint breakdowns via Xcelerator Share

Our solution not only equips companies with the insights to reduce product cost and CO₂e emission across their value chain, but can also enable cloud-based data exchange with customers, suppliers and business partners to accelerate quotation processes. Product cost and carbon footprint breakdowns, 3D data or other project data can be shared directly from Teamcenter product cost management via Xcelerator Share. You can realize the value of Xcelerator Share in Teamcenter product cost management due to seamless integration and secure data that is accessible across sites and the supply chain. This flexible collaboration allows original equipment manufacturers (OEMs) and suppliers to gain agility, accelerating quotation processes that ensure consistency of work and enable fast decision-making.

SIEMENS		Breakdown of Costs and CO ₂ e Emissions				Summary	
Powered by Siemens Teamcenter Product Cost Management		Supplier	Field	Project	Version 6.8		
Contact person	Manufacturer	Part number	A123.146.65.34		Language English		
E-Mail	Supplier	Part name	Silver Door Panel Switch				
Telephone	Calculator	Quotation date					
Premises		Costs		Carbon footprint			
Project time (years) 5		€ / 100 pcs	Fraction	kg CO ₂ e / 100 pcs	Fraction		
Average annual quantity 437,500		1 Raw materials 9.30	2.43%	10.72	28.86%		
Manufacturing lot size 25		2 Purchased parts 142.78	37.74%	10.75	28.94%		
Production site Germany		3 Direct material 151.98	40.18%	21.47	57.80%		
Quotation currency Euro		4 Material scrap 3.00	0.79%	0.09	0.23%		
Quotation unit 100pcs		5 Material overhead 1.91	0.50%	0.00	0.00%		
Date of calculation (DDP) 19.07.2021		6 Interest on material stock 0.00	0.00%				
Specific		7 Material 156.89	41.47%	21.56	58.04%		
Special agreements		12 Machine 60.23	15.92%	4.52	12.16%		
		11 Set-up 0.84	0.22%				
		19 Direct labor 40.99	10.83%				
		14 Tools / device maintenance 0.70	0.18%				
		15 Process manufacturing step 0.00	0.00%	0.00	0.00%		
		16 Manufacturing I 162.75	27.16%	4.52	12.16%		
		17 Res. Manufacturing overhead 13.72	3.63%				
		18 Manufacturing scrap 2.34	0.62%	0.02	0.05%		
		19 Tools / devices allocation 2.08	0.55%	0.05	0.14%		
		20 Direct manufacturing 0.00	0.00%				
		21 Interest on work in progress 0.00	0.00%				
		22 Manufacturing II + III 120.89	31.96%	4.59	12.35%		
		23 Production I 277.78	73.43%	26.14	70.39%		
		24 Special direct 9.71	2.57%				
		24 Overheads after PC 33.30	8.80%	1.00	2.69%		
		25 Prime 320.79	84.80%				
		26 Profit 16.14	4.27%				
		27 Terms of payment 0.00	0.00%				
		28 Incolorms 60.43	16.59%	10.00	26.92%		
		29 Carbon tax 0.93	0.25%				
		30 Net sales price / Carbon footprint 378.29	100.00%	37.14	100.00%		

This breakdown reveals opportunities for CO₂e and product costs reduction.

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