Carbon Footprinting for Products

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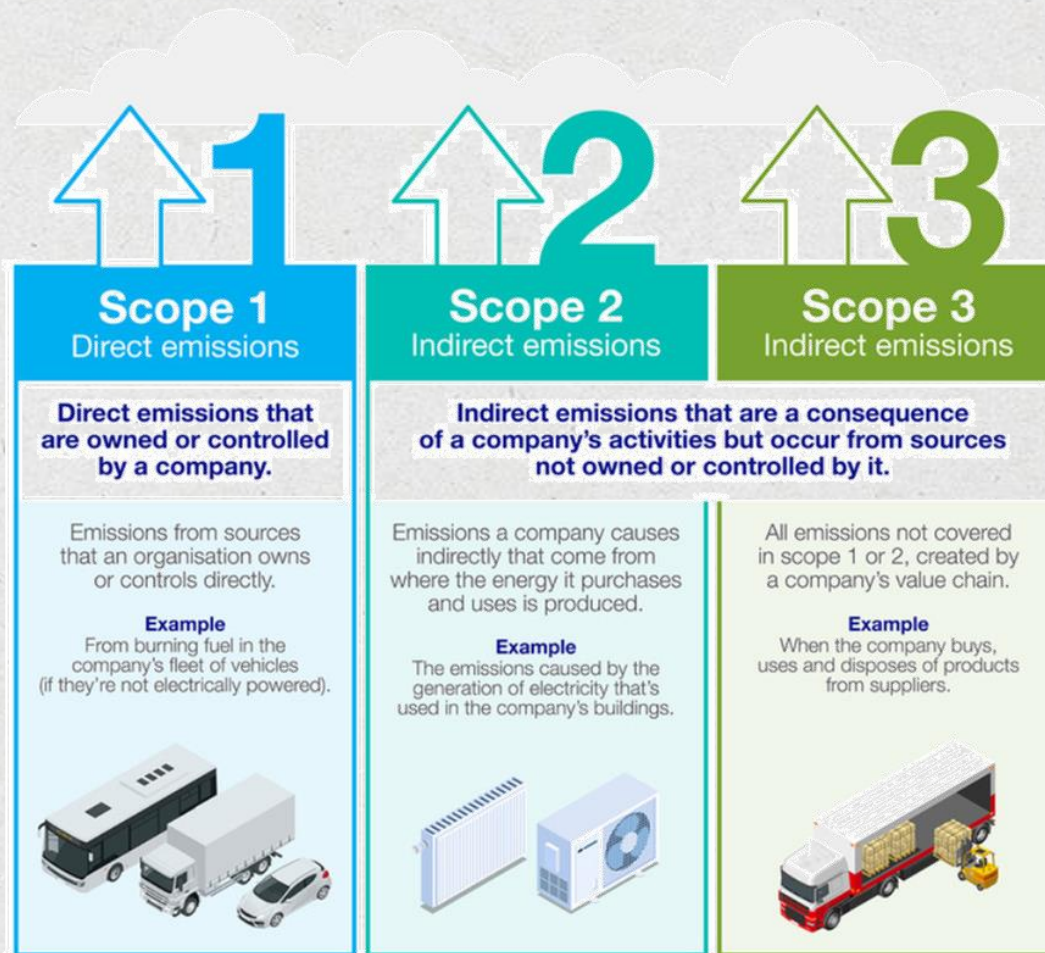
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What are GHG emissions scopes?

Scope 1
Direct emissions

Scope 2
Indirect emissions

Scope 3
Indirect emissions

Direct emissions that are owned or controlled by a company.

Emissions from sources that an organisation owns or controls directly.

Example
From burning fuel in the company's fleet of vehicles (if they're not electrically powered).

Indirect emissions that are a consequence of a company's activities but occur from sources not owned or controlled by it.

Emissions a company causes indirectly that come from where the energy it purchases and uses is produced.

Example
The emissions caused by the generation of electricity that's used in the company's buildings.

All emissions not covered in scope 1 or 2, created by a company's value chain.

Example
When the company buys, uses and disposes of products from suppliers.

nationalgrid

Emissions scopes examples

- Scope 1: Direct.
  - Boilers, furnaces, breakdown of carbonates, AC leaks.
  - Your equipment releases GHGs.
- Scope 2: Indirect.
  - Electricity, steam, hot water, compressed air.
  - You are supplied with an energy product from in pipes or wires, and the utility provider emits GHGs.
- Scope 3: Supply Chain.
  - Cardboard boxes, water, raw materials suppliers, staff commuting, logistics service providers.
  - You buy products from suppliers and they emit GHGs.
- Note that a company's Scope 1, Scope 2 and Scope 3 emissions, when attributed to the final product supplied, become the Scope 3 emissions for the end customers.

Emission scopes and control

- Where the emissions are released mainly determines the scope classification, but responsibility for the emissions also plays a part.

- For Scope 1 emissions, whoever has management control over an asset is liable for the emissions that the asset produces.

- Your Scope 2 emissions are the scope 1 emissions of the utility that supplies the energy product.

- Note that Scope 2 emissions could be classed as a sub-category of Scope 3.

- Scope 1 is fully under the control of the company, while Scope 2 is mainly under control, while Scope 3 emissions are outside the company's control.

- Scope 3 emissions may be influenced through purchase choices.

Why develop a footprint?

- Organisations can identify their emissions under the three scopes and report these publicly as their "carbon footprint".

- Carbon footprints are more properly known as "emissions inventories" – the concept of greenhouse gas accounting.

- They help a company to understand its emissions profile and which elements of their activities are most impactful.

- Within this they can sometimes identify reputational risks and opportunities.

- A key element is integrating this information into their overall corporate risk register and brand strategy.

What GHG issues do carbon footprints help with?

- Answering data requests and meeting customer needs.
- Being seen as a sophisticated supply chain partner.
- Promoting products that are not exposed to hidden climate liabilities.
- Understanding trends in customer expectations for data and product performance to maintain market position.
- Qualifying to supply blue chip customers.
- Providing shareholders with comprehensive risk management strategies and plans.

Where are GHGs Emissions from? (1)

LED bulb – 10W, 1600 lumens, 3g CO_2/hour

Incandescent Bulb - 100W, 1600 lumens, 30g CO_2/hour

Candle – 80W, 13 lumens, 20g CO_2/hour

Propane torch – 490g CO_2/hour

© Petar Milošević, Wikipedia, Sievert Ltd, Dorno Inc.

Where are GHGs Emissions from? (2)

Tesla 3 – 100km/h,
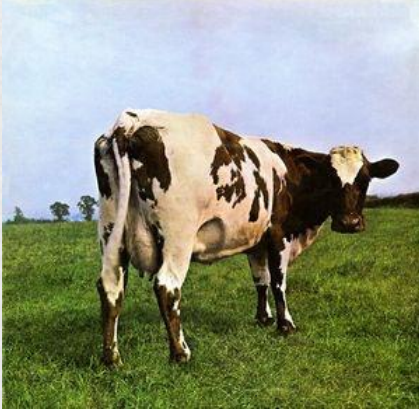4,700g CO_2e/hr

Land Cruiser V8 – 100km/h,
32,000g CO_2e/hour

Roll-Royce Trent 900 370kN full thrust,
64,300,000g CO_2e/hour

Coal Fired Power Station – 2,116MW,
1,813,714,286 gCO_2e/hour

© Tesla Inc, Toyota Motors, Airbus Ltd, Alan Murray-Rust

Where are GHGs Emissions from? (3)

Beef
60,000,000 gCO_2e/tonne

Aluminium cans
4,800,000g CO_2e/tonne

Office paper
7,950,000g CO_2e/tonne

Plastic
1,420,000g CO_2e/tonne

© US EPA WARM database 2015, Southern Packaging 2023, Guardian 2023, Ourworldindata.org 2023, Pink Floyd 1971.

# Footprinting gives consumers a number

One example:

CARBON TRUST CERTIFIED

Reduce your carbon footprint through everyday shopping

If you're looking to make more sustainable choices when you're shopping, look for the Carbon Trust's certified footprint label. It verifies that a brand is working to measure and reduce a product's carbon emissions.

Embodied energy in primary materials
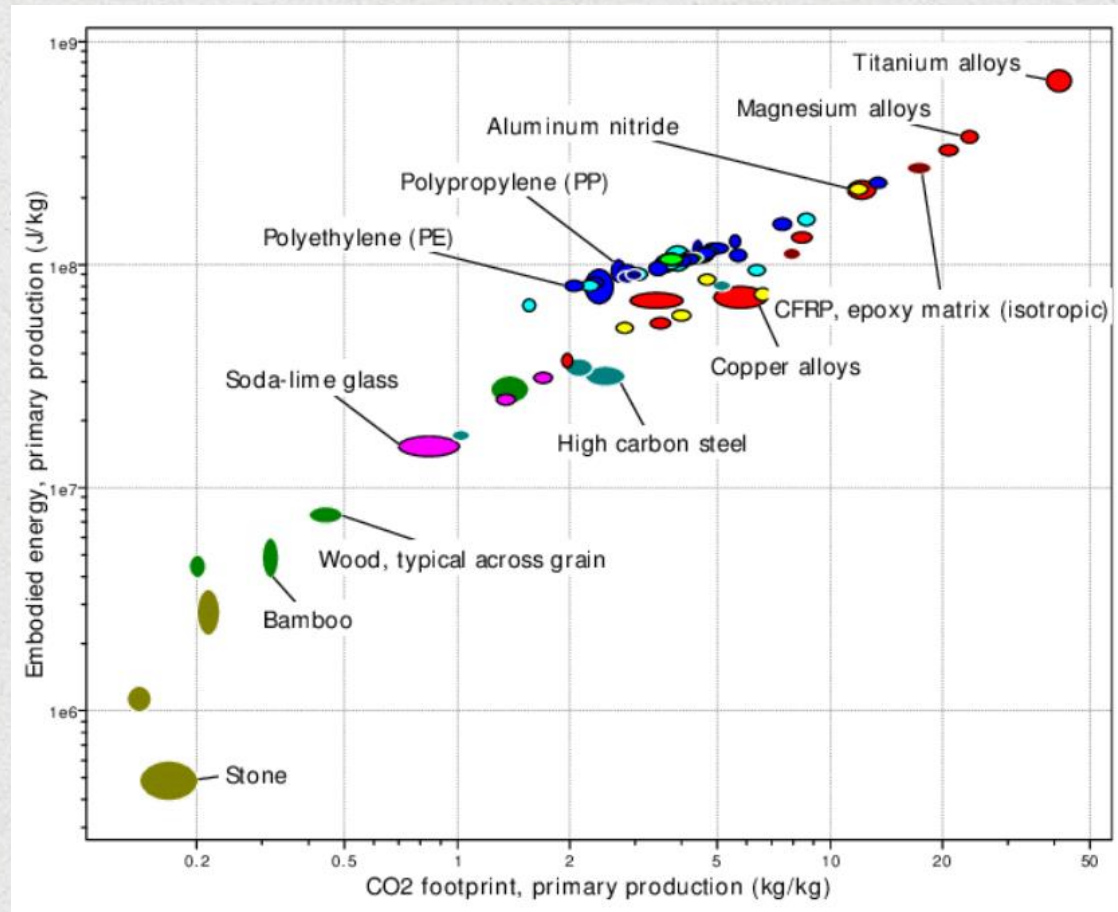
Embodied emissions in a new car
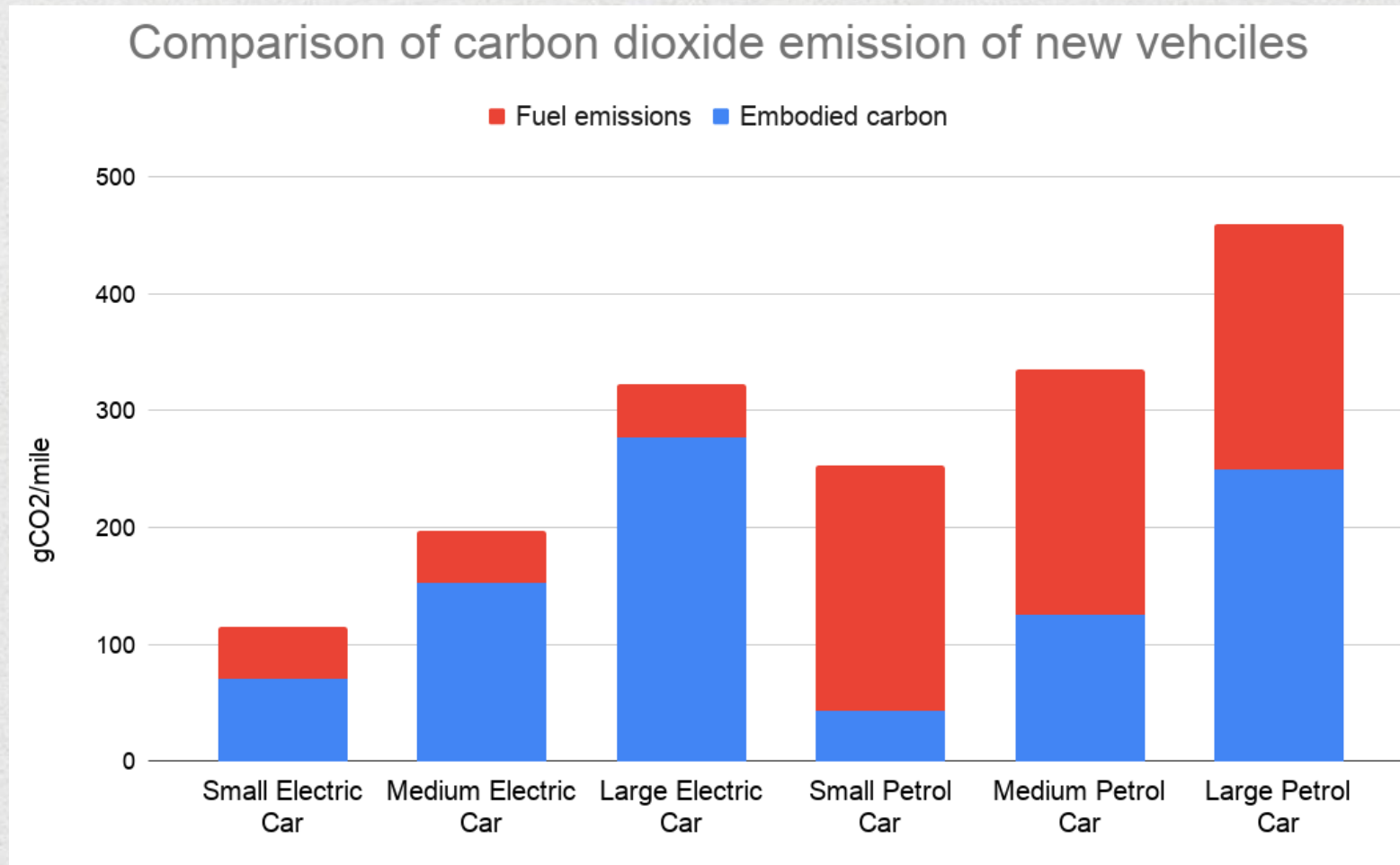
Courtesy of Zero Carbon Guildford

Dell's footprint for Latitude 5510 laptop

For this product, the estimate has a mean of 348 kg of CO_2e and standard deviation (margin of uncertainty) of 67 kg of CO_2e. Therefore, 348 kg of CO_2e is what we refer to as the Products Carbon Footprint (PCF).

This product's estimated carbon footprint:

348 kgCO2e +/- 67 kgCO2e

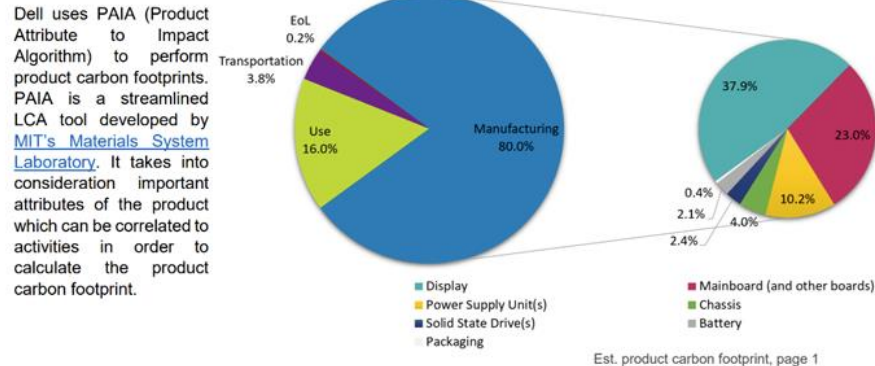Estimated impact by lifecycle stage with breakout for manufacturing by component:

Dell uses PAIA (Product Attribute to Impact Algorithm) to perform product carbon footprints. PAIA is a streamlined LCA tool developed by MIT's Materials System Laboratory. It takes into consideration important attributes of the product which can be correlated to activities in order to calculate the product carbon footprint.

EoL 0.2%
Transportation 3.8%
Use 16.0%
Manufacturing 80.0%

37.9%
23.0%
0.4%
2.1%
10.2%
4.0%
2.4%

- Display
- Power Supply Unit(s)
- Solid State Drive(s)
- Packaging
- Mainboard (and other boards)
- Chassis
- Battery

Est. product carbon footprint, page 1

Figure 2: PCF estimate of a Latitude 5510

Click here to view Dell's Product Carbon Footprint Datasheets

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How common are product carbon footprints?

- Carbon footprints are still quite rare for actual consumer products, as they are complex and expensive to produce.

- This is because once they are released into the public domain they are subject to intensive scrutiny. The quality assurance required to produce them and eliminate risks is costly.

- Footprints are much more common for commodity and intermediate products.

- In these cases they are used by OEMs for calculating their overall corporate carbon footprint, which is then reported.

Breaking Down Emissions into "Scopes"

- Emissions are related to all activities and break down into three main categories:
  - Scope 1: Emissions from your own equipment that combusts fuel or releases GHGs due to leaks or chemical changes.
  - Scope 2: Emissions from other entities who combust fuel or generate GHGs to supply you with wired or piped energy commodities.
  - Scope 3: Emissions from other entities who supply you with goods and services.
- Note that Scope 2 emissions could be classed as a sub-category of Scope 3.
- Scope 1 is fully under the control of the company, while Scope 2 is mainly under control, while Scope 3 emissions are outside the company's control.

Calculating carbon footprints

- Emissions are calculated by matching the volume of an activity performed against intensity factors and summing the results for the different scopes.

- Volumes of activities are best based out of accounting records to give traceability.

- GHG emissions factors in the build-up of calculations must be linked to a documented source and the justification for their choice must also be provided.

- The footprint must be accompanied by a methodology statement.

Emissions Factors Examples

https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2021

Activity	Fuel	Unit	kg CO_2e	kg CO_2	kg CH_4	kg N_2O
Gaseous fuels	Butane	tonnes	3033.32	3029.26	2.25	1.80
		litres	1.75	1.74	0.00	0.00
		kWh (Net CV)	0.24	0.24	0.00	0.00
		kWh (Gross CV)	0.22	0.22	0.00	0.00
	CNG	tonnes	2538.48	2533.69	3.44	1.34
		litres	0.44423	0.44340	0.00060	0.00023
		kWh (Net CV)	0.20297	0.20258	0.00028	0.00011
		kWh (Gross CV)	0.18316	0.18282	0.00025	0.00010
	LNG	tonnes	2555.28	2550.49	3.44	1.34
		litres	1.15623	1.15407	0.00156	0.00061
		kWh (Net CV)	0.20431	0.20393	0.00028	0.00011
		kWh (Gross CV)	0.18438	0.18403	0.00025	0.00010
	LPG	tonnes	2939.29	2935.18	2.28	1.83
		litres	1.55709	1.55491	0.00121	0.00097
		kWh (Net CV)	0.23031	0.22999	0.00018	0.00014
		kWh (Gross CV)	0.21449	0.21419	0.00017	0.00013
	Natural gas	tonnes	2538.48	2533.69	3.44	1.34
		cubic metres	2.02135	2.01754	0.00274	0.00107
		kWh (Net CV)	0.20297	0.20258	0.00028	0.00011
		kWh (Gross CV)	0.18316	0.18282	0.00025	0.00010
	Natural gas (100% mineral blend)	tonnes	2555.28	2550.49	3.44	1.34
		cubic metres	2.03473	2.03092	0.00274	0.00107
		kWh (Net CV)	0.20431	0.20393	0.00028	0.00011
		kWh (Gross CV)	0.18438	0.18403	0.00025	0.00010
	Other petroleum gas	tonnes	2578.25	2575.70	1.17	1.39
		litres	0.94441	0.94348	0.00043	0.00051
		kWh (Net CV)	0.19917	0.19897	0.00009	0.00011
		kWh (Gross CV)	0.18324	0.18305	0.00008	0.00010
	Propane	tonnes	2997.55000	2993.40000	2.31000	1.85000
		litres	1.54354	1.54140	0.00119	0.00095
		kWh (Net CV)	0.23257	0.23225	0.00018	0.00014
		kWh (Gross CV)	0.21411	0.21381	0.00016	0.00013

Example of calculation schematic for footprint

tarsheedAD.com

Example of detailed buildup of footprint

tarsheedAD.com

GHG Protocol Process for Scope 3

For direct assistance on footprinting

- Contact the ADDC Industrial Energy Efficiency Team.
- ETIPTECHNICAL@ADDC.AE

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