Early cradle-to-gate carbon footprint simulation for e-mobility

Company profile
Tier-1 supplier headquartered in Central Europe producing power-train components (internal combustion, electric) for automotive, aerospace and industrial users.

Industry
Automotive, aerospace, industrial

Product Life-Cycle Phase
RfQ phase / supplier nomination

Revenue
15bn EUR

EBIT Margin
6%

Supply-Chain Status
Tier-1

Challenge

Automotive OEMs started to request detailed product carbon footprints as a new criterion for supplier nomination. Client needs to commit to CO_2 targets early in the product development cycle when their own supply chain is yet to be determined. First such disclosures have been generated ad-hoc in Excel with uncertainty of which values to communicate and how to prepare for future tightening of OEM requirements. The client now wants to establish a suitable process including a suitable software solution.

Approach

1. Set up a bottom-up calculation structure for the entire bill of material including all process steps and raw materials; supported with Tset Engine calculation modules, Tset master data and a modular set of golden sample calculations.
2. Define preliminary CO_2 premises for the most relevant raw materials and energy sources; apply them to the calculation structure.
3. Perform various scenario simulations.
4. Assess cost impact of CO_2 reduction measures.
5. Decide on a final scenario and submit the
6. OEM's product carbon footprint break-down forms.

	EAF	BF-BOF
Norway	0.86	4.31
Brazil	0.91	4.37
Germany	1.00	4.45
China	1.16	4.61

Values in kg CO_2e / kg
EAF: Electric arc furnace route with recycled material.
BF-BOF: Blast furnace – basic oxygen furnace route with virgin material.

The impact of different CO_2 scenarios can be enormous: emission estimates for 20MnCr5 (after bar peeling) vary across location and route by a factor of more than 5x.

Rotor shaft

- *20MnCr5 (EAF) from NO*
- *Cold extrusion, turning in CZ*
- *1.050 k pcs over 6 years*

	Cost	CO_2e
Material	9.91 €	9.62 kg
Manufacturing	4.08 €	5.43 kg
Overhead	1.16 €	1.20 kg

A bottom-up calculation structure allows to understand the cost impact of CO_2 reduction measures: rough breakdown of both cost and emissions for a specific rotor shaft supplier scenario created with Tset's calculation modules for cold extrusion and turning and supported with Tset's master data packages.

Sources of Potential

Stay in business

Several OEMs have stopped to accept offers without a product carbon footprint. Their supplier terms include the right to conduct audits on the provided numbers. If the supplier would not provide CO_2 values or submit low-quality data, they risk getting out of business.

Strengthen sales narrative

Compared to the conventional method of applying database emission factors to net weights in the bill of material, a more transparent understanding can be provided using Tset. For example, the client came up with a technical solution to reduce the margins on a forged semi-finished part. This now directly finds its way into the overall result and helps to build a strong narrative towards the OEM.

How did Tset support

- Set up product structure in Tset with an Excel-based BOM importer.
- Apply Tset Engine calculation modules for a broad set of commodities to derive a best-practice process chain based on just few input parameters for each part; this automatically translates into a bottom-up cost and emission calculation structure.
- Fill further positions of the bill of material from a database of golden sample calculations (e.g., power modules and EMV), process steps (e.g., rotor and end-of-line assembly).
- Where no detail calculation is necessary, apply CO_2 master data from Tset's materials master data (e.g., PEEK wires and small parts).
- Simulate different scenarios, e.g. shifting all casted parts to a best-practice country or increasing secondary aluminium.
- Once tier-2 suppliers open books on their as-is emission situation, supplier-specific master data entries allow to overhaul the calculation with few clicks.
- Mass data updates or permanent synchronisation with supply chain management tools can easily be set up via a public API.