

# Sustainability Insights FAQ

Sustainable product development and manufacturing strategies help product manufacturers and suppliers mitigate climate change, and can also position companies for a competitive advantage.

Read our frequently asked questions (FAQ) for details about our Manufacturing Insights solution, which can help to reduce a product's carbon footprint by analyzing product design, sourcing, manufacturing process, and factory location.

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## 1. General Product/Solution Questions

### Q 1. What is aPriori Sustainability Insights?

aPriori Sustainability Insights enables manufacturers to measure, reduce, and report on their products' carbon footprint during product design and production. aPriori calculates CO<sub>2</sub> equivalent greenhouse gas emissions (CO<sub>2</sub>e) for a given design's raw material extraction, processing, and manufacturing process. By adding CO<sub>2</sub>e emissions data analysis to its capabilities, aPriori provides the only manufacturing intelligence platform to optimize products for cost, manufacturability, and sustainability. aPriori Sustainability Insights is available via the cloud and on-premise.



## Q 2. What sustainability problems are manufacturers solving with aPriori?

Customers are using aPriori to address the following manufacturing challenges:

- Identify low cost/low carbon suppliers
- Evaluate alternate materials to reduce CO<sub>2</sub>e
- Investigate CO<sub>2</sub>e impacts by changing manufacturing processes
- Conduct “what if” scenarios to make product cost, carbon, and manufacturability decisions in real time

## Q 3. What sustainability challenges does aPriori Manufacturing Insights help address?

aPriori provides sustainability insights that enable manufacturing customers to answer a range of questions and issues. Examples include:

- How to evaluate CO<sub>2</sub>e alongside cost to improve sustainability without harming profitability
- How to identify the most significant contributors to CO<sub>2</sub>e emissions and product cost
- How to reach CO<sub>2</sub>e, cost, and manufacturability goals in minutes by:
  - » Making design changes and conducting trade-off analyses
  - » Simulating & optimizing manufacturing processes
  - » Assessing alternative materials
  - » Investigating the impact of using alternative suppliers
- How to gain full transparency and visibility regarding cost, sustainability, and manufacturability
- How to evaluate alternate manufacturing regions based on carbon, cost, and performance

## Q 4. Which departments and groups use aPriori Sustainability Insights?

Four primary manufacturing groups use our sustainability solution, including:

- Cost Engineers looking to establish baselines or collaborate with various stakeholders in engineering and procurement
- Design Engineers looking to assess CO<sub>2</sub>e when designing new or making updates to new products
- Sourcing Professionals looking to better understand suppliers and supply chain CO<sub>2</sub>e
- Sustainability teams focused on reducing carbon emissions and improving business performance

## Q 5. Which companies are using aPriori Sustainability Insights?

aPriori’s manufacturing sustainability technology is already commercially deployed. Additionally, leading manufacturers including Carrier, Grundfos, and Heliogen are participating in aPriori’s Sustainability Insights Early Adopter program.

## Q 6. Is the aPriori Sustainability Solution Certified?

Using aPriori solutions can help a company to become certified without the solution needing to be certified itself. Certifications are often about auditable processes, and due to our transparent, granular approach, we are well suited to helping companies achieve their goals in this area.

## Q 7. How does aPriori differ from other sustainability software tools?

aPriori takes a “bottom-up” approach to sustainability modeling to capture CO<sub>2</sub>e at a granular level (e.g., at the product component level and for each step of a manufacturing process). With our unparalleled understanding of the manufacturing process, we provide:

- A precise understanding of energy used during manufacturing, including:
  - » Factory machine cycle times
  - » Energy use
  - » Variances in the “green energy” mix by region (e.g., On average, China’s power grid generates more CO<sub>2</sub> per kWh than Western Europe)
- A precise analysis of material CO<sub>2</sub>e, including:
  - » Rough mass (the mass of material required to manufacture the product, not just the finish mass)
  - » Material waste generated, including the regrinding/remelt impact
- Real-world simulation, including the ability to calibrate and configure “digital factories” based on specific factory equipment and other specifications
- The ability to conduct “what if” scenarios to make product cost, carbon, and manufacturability decisions in real time

## Q 8. Which manufacturing process groups are currently available?

The most popular processes from the following process groups are included today:

- Plastic injection molding
- Pressure die casting
- Machining
- Sheet metal
- Two model machining
- Secondary treatments: surface and heat treatments

We will be regularly adding further manufacturing process groups for aPriori Sustainability Insights.

## Q 9. Which aPriori apps will have Sustainability Data?

aPriori Sustainability Insights availability includes:

- aP Pro and aP Analytics: On-Prem/Cloud Q1 2023
- aP Design and aP Generate: later in 2023

## Q 10. What functionality/use cases will be available in aPriori’s sustainability application?

There are three main use cases that aPriori can support:

- Sustainable design
- Sustainable manufacturing
- Sustainable sourcing

## Q 11. What actions have the most significant impact on a product’s CO<sub>2</sub>e footprint?

Typically, the “in-use” phase of a product’s lifecycle has the most significant proportion of its environmental impact (think fuel/energy used by a car for its entire serviceable life or the power used by an electronic device). Making the product as lightweight and efficient as possible will determine this. However, the material selection and manufacturing phase is where we can help.

aPriori can assess how changes in the following drivers help stakeholders make the right decisions around their product design, manufacturing, and sourcing. aPriori conducts analysis based on the product geometry/ shape, product material selection, manufacturing process chosen, and carbon factor of the electricity used to manufacture the product.



## 2. Sustainability Data and aPriori Analysis

### Q 1. Where do you get your sustainability data? Can you use more than one database?

We use ecoinvent, a leading third-party data provider to give everyone a baseline of environmental data. However, the data can be configured using additional sources if required.

### Q 2. What is ecoinvent?

[ecoinvent](#) is leading third-party data provider. The non-profit organization provides a high-quality database for the sustainability assessments of products and processes worldwide.

Importantly, aPriori can configure and customize ecoinvent data to provide customers with an even greater level of precision.

### Q 3. Is the environmental data used “out of the box” or adapted?

We use the ecoinvent database. Additionally, some customers use GaBi Databases. For this application, we map the GaBi material and electricity carbon factors to our materials and digital factories.

### Q 4. How large is the ecoinvent database?

The ecoinvent database is quite extensive, and features more than 21,000 activities. Learn more about ecoinvent's database.

### Q 5. What database version is being used for the carbon footprint calculations?

ecoinvent database version 3.9

### Q 6. Which data and allocation methods do we use for our carbon factors?

We use the Intergovernmental Panel on Climate Change (IPCC 2021) CO<sub>2</sub>-equivalent (CO<sub>2</sub>-eq) using the Global Warming Potential with a time horizon of 100 years (GWP 100).

### Q 7. What allocation method is being used? (APOS, Consequential, Cut-off)

aPriori uses the system model “Allocation, cut-off by classification.” This cut-off system model is based on the recycled content, or cut-off, approach. In this system model waste is the producer’s responsibility (“polluter pays”). And there’s an incentive to use recyclable products burden free (cut-off). Read more about [ecoinvent’s system models \(including allocation\)](#) online.

### Q 8. Which effect categories are implemented? (GWP, EP, AP, TOX, etc.)

Currently, GWP (Global Warming Potential) is implemented. We will add more over time.

### Q 9. What is the workflow? e.g., do you have connectors (e.g., BOM import, results / report export)?

aPriori gathers most of our data directly from 3D CAD models and can automate integration with most PLM systems including Siemens Teamcenter, PTC Windchill, etc.

### Q 10. How do you achieve coupling of cost and sustainability results?

Cost and carbon are calculated at the same time with our 3D CAD analysis engine.

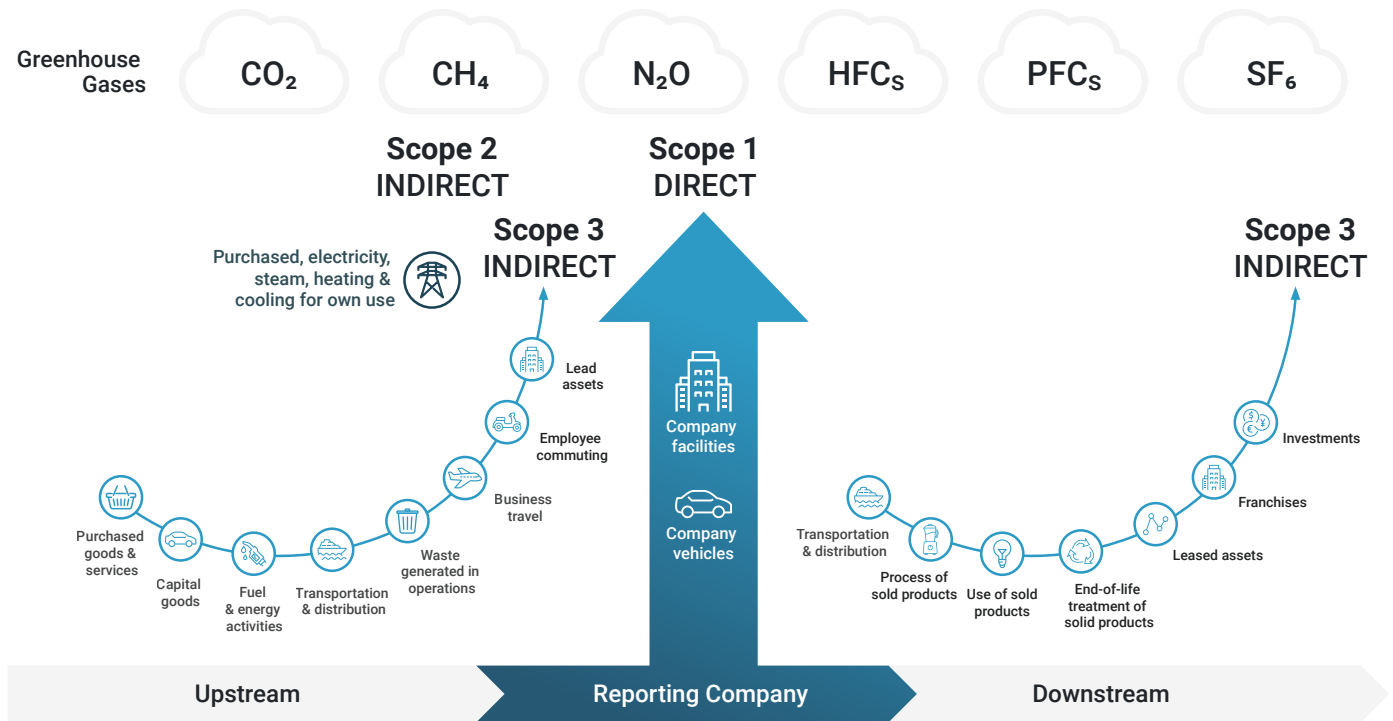
### 3. Technical Product Questions

#### Q 1. What does Scope 1, 2, and 3 refer to?

Emissions are categorized into three different levels of analysis, as provided by the Greenhouse Gas (GHG) Protocol:

- **Scope 1:** direct emissions from owned or controlled sources. aPriori supports Scope 1
- **Scope 2:** indirect emissions from the generation of purchased energy. aPriori supports Scope 2
- **Scope 3:** upstream and downstream emissions. aPriori supports product-level Scope 3 from a “cradle to gate” perspective (e.g., product design and manufacturing, not currently transportation and logistics)

The following figure provides additional background (adapted from the Greenhouse Gas Protocol):



#### Q 2. Do you perform cradle-to-gate or cradle-to-grave calculations?

Currently, we provide cradle-to-gate calculations, but we are looking to expand this over time.

#### Q 3. If a company recycles all of its scrap/waste from the manufacturing process, is that considered in the analysis?

Recycling waste is credited to the company using the recycled product in its process and not credited to the company that recycles the material. If both were considered, it would have a double-count effect, and both recycler and user of recycled material would benefit. But in reality, the CO<sub>2</sub>e is only saved once, and is generally credited in the use stage (end product).



**Q 4. Do you also calculate the transportation and in-use phases of the product lifecycle?**

No, not currently, but transportation in most cases is a tiny percentage of the overall CO<sub>2</sub>e footprint (unless using air transportation). The in-use phase data required is not usually part of the 3D CAD model but can be a relatively straightforward calculation. aPriori's strength is knowledge of the manufacturing process, which is where we are currently focused.

**Q 5. Do you also provide additional sustainability insights beyond CO<sub>2</sub>e? Such as water use and other environmental impact categories such as ecotoxicity?**

Not currently. We are looking to add other categories of impacts soon and potentially transportation, but this will be based on customer demand.

**Q 6. Can we set CO<sub>2</sub>e targets during the early design phase to provide early warnings if CO<sub>2</sub>e targets have been surpassed?**

Yes, just like cost, we can attach targets for CO<sub>2</sub>e values.

**Q 7. Do I need to be upgraded to aPriori 23.1 or later to use aPriori Sustainability Insights?**

Yes – unless you are a new customer and therefore starting on 23.1 or later, there will need to be an upgrade of any customized cost/process models.

**Q 8. As a part of aPriori's calculations, is the rough mass used to account for the additional mass over the actual mass of the product (scrap rate)?**

Yes, rough mass = finish mass + scrap mass

## 4. How aPriori Complements LCAs

### Q 1. What is LCA (Life Cycle Assessment), and how does aPriori differ?

LCA covers from cradle to grave of a product and assesses CO<sub>2</sub>e emissions, water and air pollution, transportation, in-use, and end-of-life in terms of environmental impact. In other words, LCAs measure CO<sub>2</sub>e emissions of a product's life cycle once the product is designed and produced.

But LCAs don't provide the rapid sustainability analysis that product development teams require during the early design stage. aPriori focuses on the material and processing of the manufacturing process (Cradle to Gate). This is typically the area when product developers and manufacturers can influence the most.

### Q 2. How does aPriori analyze carbon compared to an LCA?

Unlike aPriori, the LCA data on finish mass misses most of the material CO<sub>2</sub>e created for a product – and does not identify opportunities to increase material utilizations to save carbon. Here's how aPriori works:

- aPriori takes a bottom-up approach to calculating carbon emissions based on rough mass and energy used during the manufacturing process. The rough mass is used and determined by the manufacturing process, material regrind opportunities, and material utilization.
- aPriori calculates the amount of raw rough mass required to make the selected part. This approach provides more precise CO<sub>2</sub>e analysis than the finished mass calculations that LCA tools provide.



### Q 3. How does aPriori's rough mass analysis provide more precise CO<sub>2</sub>e calculations than LCA alternatives?

Process CO<sub>2</sub>e in aPriori's platform utilizes our knowledge and model of manufacturing cycle time and energy used to create the specified part. In our method, cycle time and energy used during the cycle time drive the process CO<sub>2</sub>e calculation. The geometry, wall thickness, and mass drive the cycle time.

Because cycle time drives the process CO<sub>2</sub>e calculation, two parts with very different masses can have similar cycle times and similar process CO<sub>2</sub>e emissions. Also, two parts with similar cycle times can run on different-sized machines with different energy use.

## Q 4. Show how aPriori evaluates cycle time and energy use for each part.

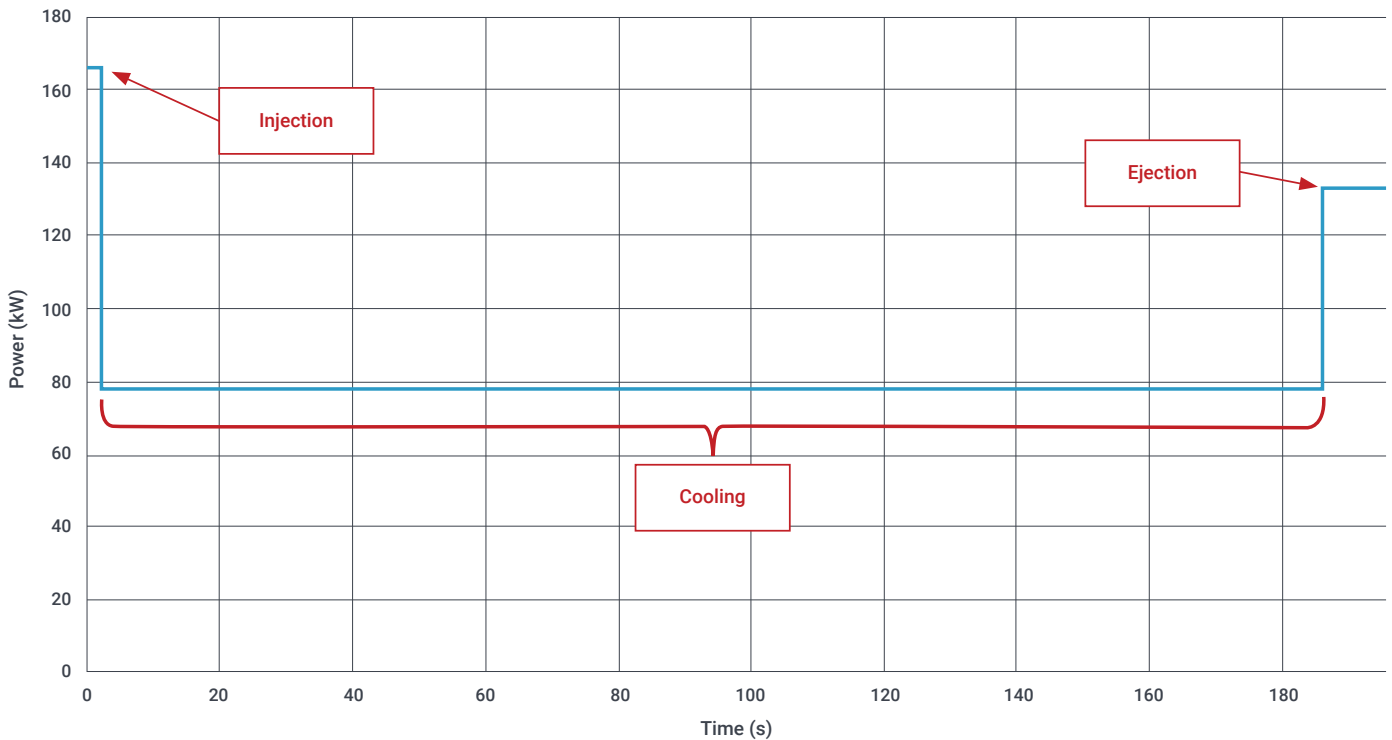
Here's how aPriori calculates cycle time and energy use for each part, along with additional process background.

- **Cost and Carbon Tradeoffs:** aPriori allows users to calculate cost and carbon at the same time to see cost and carbon trade-offs in real-time. LCA does not generate costs.
- **Time to Calculate:** LCA range in time to complete and are highly customized. Tracking assumptions is challenging. The time to complete for LCA can be three weeks to months depending on the availability of the LCA team and the complexity of the product.

### LCA vs aPriori Difference in Calculations:

	LCA	APRIORI
<b>MATERIAL CARBON</b>	Finish Mass (Does not account for carbon for material utilization, Regrind/Remelt)	Rough mass = finish mass + scrap mass
<b>PROCESS CARBON</b>	Finish Mass (Can't track design changes that impact cycle time and carbon)	Calculates cycle time and energy use

Power Time Injection Molding



Based on Injection Molder 30,000kN Clamp Force 302.6 kW Machine

This graphic shows energy used throughout one injection mold cycle. The machine uses high energy as the molten polymer is forced into the mold; then the energy level drops during the cooling phase. Next the mold is pulled apart, which triggers the release of the cooled/solidified part at the same time. This movement uses more energy and so it goes up again. There is always energy used as the plastic is heated and then forced into the mold.





**Q 5. Why do I need aPriori Sustainability Insights if I already have an LCA solution which covers more aspects of environmental impact i.e. water, logistics, etc.?**

aPriori can improve the precision that an LCA tool reports on, and we can deliver results in minutes, rather than weeks to help you to mitigate CO<sub>2</sub>e emissions earlier, and compare different product development options to help you make the right decision, rather than report on it once it is done.

We complement LCA tools, and we can help you make decisions to reduce CO<sub>2</sub>e during the product development cycle.

## WANT TO LEARN MORE?

[CLICK HERE](#) to schedule a demo of aPriori Manufacturing Insights.

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