# **E**nvironmental
# **P**roduct
# **D**eclaration

*Lightly*

**Crescent Linear Pendant**

According to
ISO 21930
ISO 14025

# 1. General Information

| | |
|---|---|
| **Manufacturer Name:** | Lightly – 7 Creek Parkway, Boothwyn PA, 19061 |
| **Program Operator:** | ASTM International<br>100 Barr Harbor Drive<br>West Conshohocken, PA 19428-2959, USA |
| **Declaration Number:** | EPD 992 |
| **Reference PCR:** | ISO 21930: 2017 with guidance from PEP ecopassport® Specific Rules for Luminaires PSR-0014-ed2.0-EN-2023 07 13 |
| **Date of Issuance:** | May 15, 2025 |
| **End of Validity:** | May 15, 2030 |
| **Product Name:** | Butterfly Linear Pendant |
| **EPD Owner:** | Lightly |
| **Functional Unit:** | One fixture providing lighting that delivers an outgoing artificial luminous flux of 1,000 lumens during a reference lifetime of 35,000 hours |
| **EPD Scope:** | Cradle-to-grave |
| **Verification:** | ISO 21930 serves as the core PCR. Independent verification of the declaration according to ISO 14025 and ISO 21930.<br>☐ internal ☒ external |
| **LCA Reviewer and EPD Verifier:** | Timothy S. Brooke<br>ASTM International |

# 2. Product Information

### 2.1 Company Description

Lightly is a collection of engineers and designers that are from Philadelphia, PA. Lightly works with teams and people around the world to design and manufacture LED light engines and luminaires.

### 2.2 Product Description

A luminaire as described in the functional unit consists of the following elements: a structure, a power supply equipment system, a light source (lamp), and if applicable a lighting management system. The specific luminaire in this EPD is called a Lightly Crescent Linear Pendant and is shown in Figure 1.

*Figure 1: Visual representation of lighting product.*

### 2.3 Technical Data

Table 1 provides technical data for the Crescent Linear Pendant. Table 2 provides fixture and packaging material information.

*Table 1. Technical Data*

| Parameter | Unit | Value |
|---|---|---|
| **Operating Voltage** | V | 120-277 |
| **Light Source Color Temperature** | K | 3,000 |
| **Protection Index for Water and Dust (IP)** | - | N/A |
| **Impact Resistance Index (IK, according to NF EN 62262:2004)** | - | N/A |
| **Luminous Efficacy** | lm/W | 175 |
| **Electrical Power** | W | 11.4 |
| **Assigned Lifetime** | h | 100,000 |

*Table 2. Fixture and Packaging Materials*

| Component | Unit | Value | Biogenic Carbon Content (kg C/kg) |
|---|---|---|---|
| **Materials** | | | |
| Maple plywood | kg | 0.998 | 0.500 |
| Glue | kg | 0.0635 | 0 |
| Stain | kg | 0.0453 | 0 |
| LED lens | kg | 0.0453 | 0 |
| SMD LED | kg | 0.0535 | 0 |
| LED driver | kg | 0.207 | 0 |
| Driver box | kg | 0.816 | 0 |
| Miscellaneous hardware | kg | 0.209 | 0 |
| **Packaging** | | | |
| Cardboard | kg | 0.680 | 0.430 |

The luminous flux of the Crescent linear pendant is 2,000 lumens with a color temp of 3,000 K. The luminous efficiency is 175 lumens/W and the power is 11.4 W. The operational lifetime is 100,000 hrs.

# 3. LCA Calculation Rules

### 3.1 Functional Unit

The functional unit for lightly's Crescent Linear Pendant is defined as "providing lighting that delivers an outgoing artificial luminous flux of 1,000 lumens during a reference lifetime of 35,000 hours".

The outgoing luminous flux of the fixture is 2,000 lumens and the operational lifetime is 100,000 hours.[1] This variation is considered to be the standard product.

Results of this study are presented in two ways: for the functional unit and for one fixture over its total lifetime. The full fixture is scaled to meet the requirements of the functional unit. The calculation and resulting scaling factor are shown below.

$$\frac{Luminous\ flux_{FU}}{Luminous\ flux_{fixture}} \times \frac{Lifetime_{FU}}{Lifetime_{fixture}} = \frac{1{,}000\ lumens}{2{,}000\ lumens} \times \frac{35{,}000\ hours}{100{,}000\ hours} = 0.18$$

### 3.2 System Boundary

The system boundary for this study is cradle to grave (see also Table 3):

- **A1 Extraction and upstream production:** This information module includes the cradle-to-gate production of material inputs. Secondary datasets were used for all extraction and upstream production.
- **A2 Transport to factory:** The mode of transport for materials is by trucking. Transportation distances were assumed to be 1,000 km based on the PSR. Secondary data were used for the road transport.
- **A3 Manufacturing**: The primary gate-to-gate LCI data is based on 2025 calendar year production and was collected by means of completed surveys of lightly's operations. For energy, packaging material and waste treatment, secondary datasets were used.
- **A4 Distribution:** The mode of transport for the fixture to the installation site is by trucking. The estimated distance from the manufacturing facility to the installation site is 2,900 km (1,800 mi) based on data provided by lightly. Secondary data were used for the road transport.
- **A5 Installation:** Installation of the fixture is manual. Packaging material is disposed of during the installation process. Secondary data were used for the waste treatment.
- **B1 Use:** There are no relevant impacts for use included in the scope of the LCA.
- **B2 Maintenance:** There are no relevant maintenance requirements included in the scope of the LCA.
- **B3 Repair:** There are no relevant repairs included in the scope of the LCA.

[1] https://lightly.com/products/crescent/

- **B4 Replacement:** The fixture lifetime is longer than the functional unit lifetime, therefore no replacements are included in the scope of the LCA.
- **B5 Refurbishment:** There is no relevant refurbishment included in the scope of the LCA.
- **B6 Operational Energy Use:** The lighting fixture requires electricity to operate. Electricity use over the fixture lifetime is based on a fixture efficacy of 175 lumens/watt. Secondary data were used for energy production.
- **B7 Operational Water Use:** There is not relevant water use included in the scope of the LCA.
- **C1 Deconstruction:** Deconstruction of the fixture is manual.
- **C2 Transport:** The mode of transport for the fixture to end-of-life disposal is by trucking. The distance to end-of-life disposal is assumed to be 100 km based on the PSR. Secondary data were used for the road transport.
- **C3 Waste Processing:** No waste processing occurs prior to disposal. The fixture is assumed to be 100% landfilled per the PSR.
- **C4 Disposal:** The fixture is assumed to be 100% landfilled per the PSR. Secondary data were used for waste treatment.

### 3.3 Estimates and Assumptions

All significant manufacturing foreground data was gathered from the manufacturer based on measured values. Foreground data for downstream life cycle stages was based on a combination of data provided by the manufacturer and default values included in the PSR.

### 3.4 Cut-off Criteria

The cut-off criteria for all activity stage flows considered within the system boundary conform with ISO 21930 Section 7.1.8. Specifically, the cut-off criteria were applied as follows:

- All inputs and outputs for which data are available are included in the calculated effects and no collected core process data are excluded.
- A 1% cut-off is considered for renewable and non-renewable primary energy consumption and the total mass of inputs within a unit process. The sum of the total neglected flows does not exceed 5% of all energy consumption and mass of inputs.
- All flows known to contribute a significant impact or to uncertainty are included.

No material or energy input or output was knowingly excluded from the system boundary.

Additionally, it is noted that EPDs are comparable only if they comply with this document, use the same sub-category PCR where applicable, include all relevant information modules and are based on equivalent scenarios with respect to the context of the construction works.

### 3.5 Data Sources

Primary data were collected by lightly personnel and were used for all manufacturing processes for 2025. Secondary data for raw material production and energy generation were utilized from

ecoinvent 3.10. Secondary data for plywood production were taken from the AWC/CWC EPD for North American Softwood Plywood, published July 1st, 2020. The electricity grid mix used for A3 is based on the location of the manufacturing facility and is modeled per the corresponding NERC region, which is RFC.

### 3.6 Data Quality

The geographical scope of the manufacturing portion of the life cycle is the United States. All primary data were collected from the manufacturer. The geographic coverage of primary data is considered very good. The primary data provided by the manufacturer represents manufacturing in 2025. Using this data meets the PCR requirements. Time coverage of this data is considered very good. Primary data provided by the manufacturer are specific to the technology that lightly uses to manufacture their product. They are site-specific and considered of very good quality.

### 3.7 Period under Review

Data was gathered for the primary material and energy inputs used in the production for calendar year 2025.

### 3.8 Allocation

Allocation is the method used to partition the environmental load of a process when several products or functions share the same process. The manufacturing data was provided for processing steps specific to the manufacturing of the Crescent fixture. As such, no allocation was required for the manufacturing data.

As a default, secondary ecoinvent datasets use a physical basis for allocation.

### 3.9 Comparability

This LCA was created using industry average data for upstream materials. Data variation can result from differences in supplier locations, manufacturing processes, manufacturing efficiency and fuel types used.

# 4. LCA Results

Life cycle impact assessment (LCIA) is the phase in which the set of results of the inventory analysis – the inventory flow table – is further processed and interpreted in terms of environmental impacts and resource use inventory metrics.

*Table 3. LCA System Boundary (X = module included; ND = module not declared)*

| Production | | | Construction | | Use | | | | | | | End of Life | | | | Benefits & Loads Beyond System Boundary |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A1 | A2 | A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D |
| Raw Material Supply | Transport | Manufacturing | Transport to Site | Assembly/Install | Use | Maintenance | Repair | Replacement | Refurbishment | Operational Energy Use | Operational Water Use | Deconstruction | Transport | Waste Processing | Disposal | Reuse, Recovery, Recycling Potential |
| X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | ND |

Results are presented for the functional unit as well as for one fixture over its lifetime.

Note that all results for life cycle modules B1, B2, B3, B4, B5, B7, C1, and C3 are reported as zero and therefore they are excluded from the tables for readability.

### 4.1 Results for Functional Unit

*Table 4: LCIA results for Crescent, per functional unit*

| Impact | Unit | A1-A3 | A4 | A5 | B6 | C2 | C4 |
|---|---|---|---|---|---|---|---|
| ***IPCC AR6*** | | | | | | | |
| GWP, incl. bio C | kg $CO_2$ eq | 1.14E+00 | 2.40E-01 | 1.94E-01 | 9.62E+01 | 6.49E-03 | 3.91E-02 |
| GWP, excl. bio C | kg $CO_2$ eq | 1.31E+00 | 2.40E-01 | 5.80E-03 | 9.58E+01 | 6.48E-03 | 3.52E-02 |
| ***TRACI 2.1*** | | | | | | | |
| GWP, excl. bio C | kg $CO_2$ eq | 1.28E+00 | 2.37E-01 | 5.85E-03 | 9.49E+01 | 6.39E-03 | 3.08E-02 |
| ODP | kg CFC 11 eq | 3.59E-08 | 4.36E-09 | 9.09E-11 | 1.24E-06 | 1.18E-10 | 1.34E-10 |
| EP | kg N eq | 1.08E-03 | 8.12E-05 | 9.54E-06 | 5.43E-02 | 2.19E-06 | 3.36E-05 |
| AP | kg $SO_2$ eq | 7.07E-03 | 9.87E-04 | 3.76E-05 | 2.65E-01 | 2.66E-05 | 3.31E-05 |
| SFP | kg $O_3$ eq | 8.44E-02 | 2.59E-02 | 1.04E-03 | 2.71E+00 | 6.99E-04 | 8.12E-04 |

*Table 5: Carbon emissions and removals for Crescent, per functional unit*

| Impact | Unit | A1-A3 | A4 | A5 | B6 | C2 | C4 |
|---|---|---|---|---|---|---|---|
| BCRP | kg $CO_2$ | 1.83E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| BCEP | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 3.74E-03 |
| BCRK | kg $CO_2$ | 1.07E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| BCEK | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 1.07E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| BCEW | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CCE | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CCR | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CWNR | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |

*Table 6: Resource use, waste, and output flow results for Crescent, per functional unit*

| Impact | Unit | A1-A3 | A4 | A5 | B6 | C2 | C4 |
|---|---|---|---|---|---|---|---|
| ***Resource Use*** | | | | | | | |
| RPRE | MJ | 1.44E+00 | 4.79E-02 | 1.45E-03 | 2.17E+02 | 1.29E-03 | 1.59E-03 |
| RPRM | MJ | 2.05E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NRPRE | MJ | 1.56E+01 | 3.42E+00 | 5.41E-02 | 1.76E+03 | 9.24E-02 | 1.07E-01 |
| NRPRM | MJ | 1.23E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| SM | kg | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RSF | MJ | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NRSF | MJ | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RE | MJ | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| FW | $m^3$ | 1.17E-02 | 5.17E-04 | 1.43E-04 | 7.27E-01 | 1.39E-05 | -1.58E-03 |
| ***Waste / Outputs*** | | | | | | | |
| HWD | kg | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NHWD | kg | 1.79E-02 | 0.00E+00 | 1.19E-01 | 0.00E+00 | 0.00E+00 | 4.27E-01 |
| HLRW | $m^3$ | 1.03E-09 | 4.16E-11 | 1.04E-12 | 3.43E-07 | 1.12E-12 | 1.46E-12 |
| ILLRW | $m^3$ | 5.31E-09 | 2.20E-10 | 5.65E-12 | 2.63E-06 | 5.93E-12 | 7.83E-12 |
| CRU | kg | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MR | kg | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MER | kg | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| EE | MJ | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |

### 4.2 Results for One Fixture

*Table 7: LCIA results for Crescent, per fixture*

| Impact | Unit | A1-A3 | A4 | A5 | B6 | C2 | C4 |
|---|---|---|---|---|---|---|---|
| ***IPCC AR6*** | | | | | | | |
| GWP, incl. bio C | kg $CO_2$ eq | 6.54E+00 | 1.37E+00 | 1.11E+00 | 1.68E+01 | 3.71E-02 | 2.23E-01 |
| GWP, excl. bio C | kg $CO_2$ eq | 7.47E+00 | 1.37E+00 | 3.31E-02 | 1.68E+01 | 3.70E-02 | 2.01E-01 |
| ***TRACI 2.1*** | | | | | | | |
| GWP, excl. bio C | kg $CO_2$ eq | 7.32E+00 | 1.35E+00 | 3.34E-02 | 1.66E+01 | 3.65E-02 | 1.76E-01 |
| ODP | kg CFC 11 eq | 2.05E-07 | 2.49E-08 | 5.19E-10 | 2.17E-07 | 6.73E-10 | 7.67E-10 |
| EP | kg N eq | 6.16E-03 | 4.64E-04 | 5.45E-05 | 9.50E-03 | 1.25E-05 | 1.92E-04 |
| AP | kg $SO_2$ eq | 4.04E-02 | 5.64E-03 | 2.15E-04 | 4.63E-02 | 1.52E-04 | 1.89E-04 |
| SFP | kg $O_3$ eq | 4.82E-01 | 1.48E-01 | 5.96E-03 | 4.75E-01 | 4.00E-03 | 4.64E-03 |

*Table 8: Carbon emissions and removals for Crescent, per fixture*

| Impact | Unit | A1-A3 | A4 | A5 | B6 | C2 | C4 |
|---|---|---|---|---|---|---|---|
| BCRP | kg $CO_2$ | 1.05E+01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| BCEP | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 2.14E-02 |
| BCRK | kg $CO_2$ | 6.13E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| BCEK | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 6.13E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| BCEW | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CCE | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CCR | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| CWNR | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |

*Table 9: Resource use, waste, and output flow results for Crescent, per fixture*

| Impact | Unit | A1-A3 | A4 | A5 | B6 | C2 | C4 |
|---|---|---|---|---|---|---|---|
| ***Resource Use*** | | | | | | | |
| RPRE | MJ | 8.20E+00 | 2.74E-01 | 8.26E-03 | 3.79E+01 | 7.38E-03 | 9.08E-03 |
| RPRM | MJ | 1.17E+01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NRPRE | MJ | 8.92E+01 | 1.96E+01 | 3.09E-01 | 3.08E+02 | 5.28E-01 | 6.10E-01 |
| NRPRM | MJ | 7.03E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| SM | kg | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RSF | MJ | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NRSF | MJ | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RE | MJ | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| FW | $m^3$ | 6.69E-02 | 2.95E-03 | 8.18E-04 | 1.27E-01 | 7.97E-05 | -9.01E-03 |
| ***Waste / Outputs*** | | | | | | | |
| HWD | kg | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NHWD | kg | 1.02E-01 | 0.00E+00 | 6.80E-01 | 0.00E+00 | 0.00E+00 | 2.44E+00 |
| HLRW | $m^3$ | 5.91E-09 | 2.38E-10 | 5.96E-12 | 6.00E-08 | 6.42E-12 | 8.32E-12 |
| ILLRW | $m^3$ | 3.03E-08 | 1.26E-09 | 3.23E-11 | 4.60E-07 | 3.39E-11 | 4.47E-11 |
| CRU | kg | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MR | kg | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| MER | kg | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| EE | MJ | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |

# 5. Interpretation

Figure 2 shows the relative contribution to the cumulative impacts of the cradle-to-grave life cycle and Figure 3 shows the relative contribution of stages A1, A2, and A3 to the cradle-to-gate cumulative impacts. Across the full life cycle of the product, the electricity use required for operation of the lighting fixture (B6) dominates results across LCIA indicators. Within the production of the fixture itself, raw materials (A1) are the most significant contributor to impacts across indicators, specifically the LED driver in the fixture. Within manufacturing (A3), electricity use is the main driver of impacts across indicators.

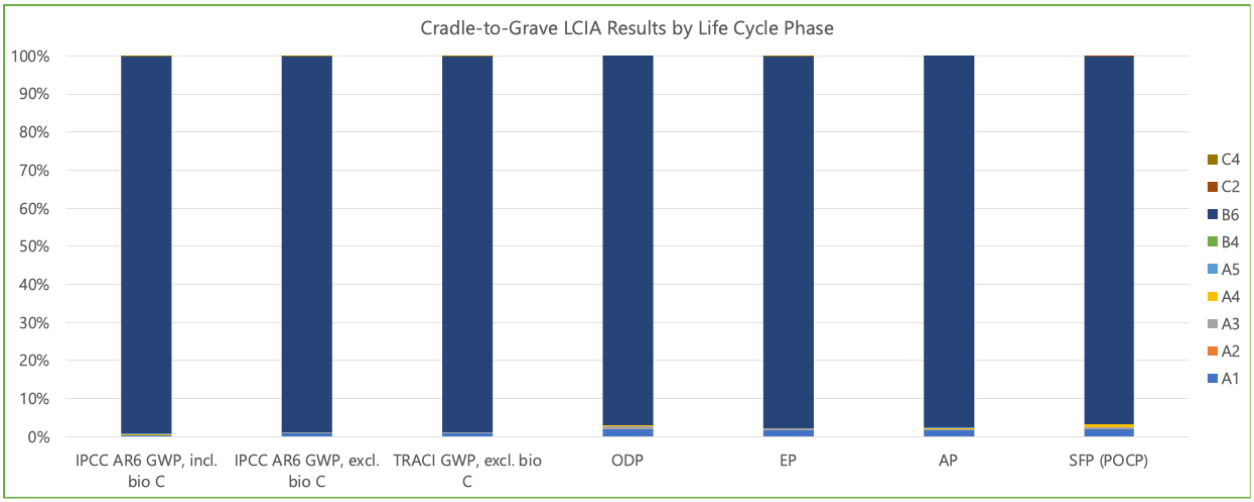


*Figure 2: Contribution by life cycle stage to LCIA results for functional unit, cradle-to-grave*

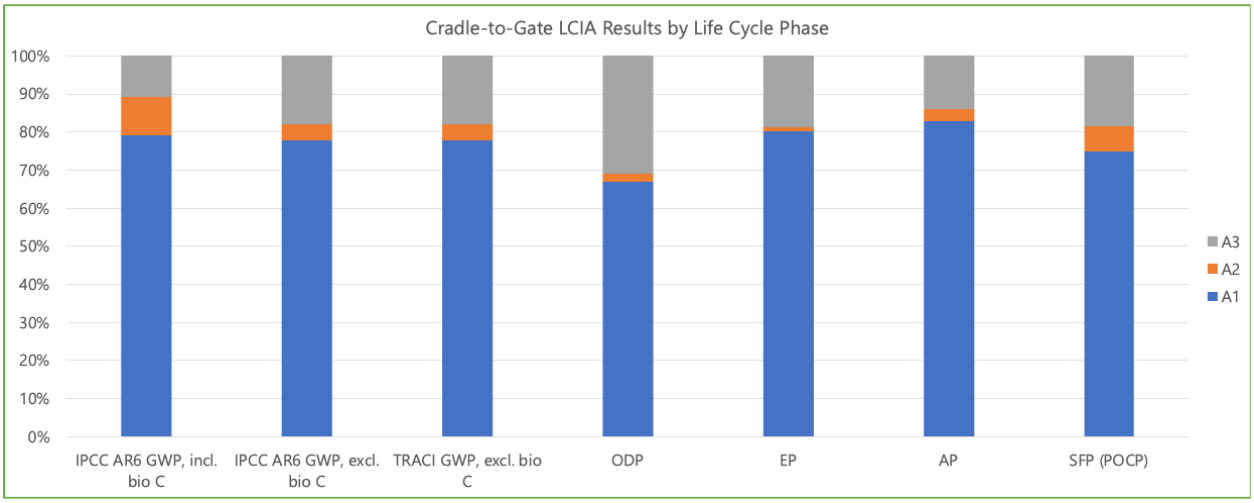


*Figure 3: Contribution by life cycle stage to LCIA results for functional unit, cradle-to-gate*

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