Environmental Fact Sheet

Athena wireless node

The aim of this document is to provide relevant and reliable information on the environmental performance of the Athena wireless node. Results reported are based on a Life Cycle Assessment (LCA) carried out by an independent company (Sphera). This environmental information sheet is based on a LCA study conducted according to DIN ISO 14040/44 and in accordance with the requirements of the PSR0005 - Electrical Switchgear and Control Gear Solutions, "Contactors, Remote Control Switch" classification, from the PEP ecopassport® Program (PSR-0005-ed3-EN-2023 06 06, supplemented by the PCR PCR-4-ed4-EN-2021 09 06) and especially the specific requirements for "other equipment."

All relevant environmental data relating to climate change (carbon footprint) as well as an overview of other environmental impact categories applying EN 15804+A2 methodology are disclosed in this information sheet.

Manufacturer

Lutron Electronics Co., Inc.
7200 Suter Rd, Coopersburg, PA 18036

Study conducted by

Sphera Solutions GmbH
Hauptstraße 111-113, 70771 Leinfel-den-Echterdingen, Germany

Product description

The Athena wireless node is a radio frequency (RF) device that enables simple, digital control of individual light fixtures in an Athena control system. The small size and compatibility with a wide variety of drivers allow for seamless integration with common commercial lighting fixtures from any manufacturer.

- Enables individual, wireless control of each fixture in an Athena control system. Accommodates zone and control changes without rewiring.
- Typically installed at OEM factory – no wiring required on-site. Fixture is ready to communicate wirelessly once power is connected.
- Pairs with Lutron digital LED drivers (LD2) for either Tunable White or Static White control.
- DALI-2 and ANSI C137.1 compatible for simple interoperability with third-party LED drivers.
- All drivers on the link are controlled as a single zone.

System description

The product system for this study considers the Athena RF wireless node product as a baseline, that represents the product family due to its close similarities to other wireless nodes in Lutron's portfolio: Athena OCC wireless node.

Primary data for the analysis was collected by Lutron including electronics (populated printed wiring boards). Other relevant data, e.g., upstream processing of polymers, metals, electronic components, and others including relevant manufacturing processes according to the bill of materials information was taken from Sphera's 2023 Managed LCA Content, which is representative of the state-of-the-art processes.

Product reference

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The functional unit as defined by the PSR meets specific standards for one Athena wireless node:

"Ensure simple, digital control of individual light fixtures using a radio frequency device over a reference service life of 10 years."

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Material content

	RF Variant		OCC Variant	
Total weight of reference product (not incl. packaging) [g]	7.94		8.87	
Plastics	**mass [g]**	**% of total weight**	**mass [g]**	**% of total weight**
Polypropylene (PP)	1.13	14%	1.13	13%
Polyamide 6 (PA 6)	2.83	36%	2.83	32%
Total plastics	3.96	50%	3.96	45%
Printed circuit board assembly	**mass [g]**	**% of total weight**	**mass [g]**	**% of total weight**
Electronics	3.97	50%	4.9	55%
Packaging	**mass [g]**		**mass [g]**	
Packaging	29		29	
Cables	**mass [g]**		**mass [g]**	
Cables	111		111	

Table 1: Material content of Athena wireless node

Scope of the LCA

A cradle-to-grave LCA study was carried out according to DIN ISO 14040/44 using LCA for Experts software. The system boundary includes upstream raw material production and transportation to the assembly site. The Use stage was considered in US, and domestic End-of-Life (EoL) treatment as base scenarios.

Environmental impacts of the system were calculated following EN15804+A2 with a focus on climate change (kg CO_2 eq.), while also addressing other midpoint impact categories.

Figure 1: Schematic representation of the Athena wireless node's life cycle

Two scenarios were analyzed:

Scenario 1: Manufacturing scenarios: scenarios considering the Athena wireless node of different material content, reflecting the radio frequency (RF) and occupancy sensor (OCC) from Lutron's product portfolio. The differences between the two products are in the type of certain active and passive electronic components.

Scenario 2: Use scenarios: scenarios considering different locations of power consumption of the Athena wireless node during the Use Stage: US, Canada, UK, and Europe. For all scenarios, a representative dataset for the country's electricity grid mix is considered.

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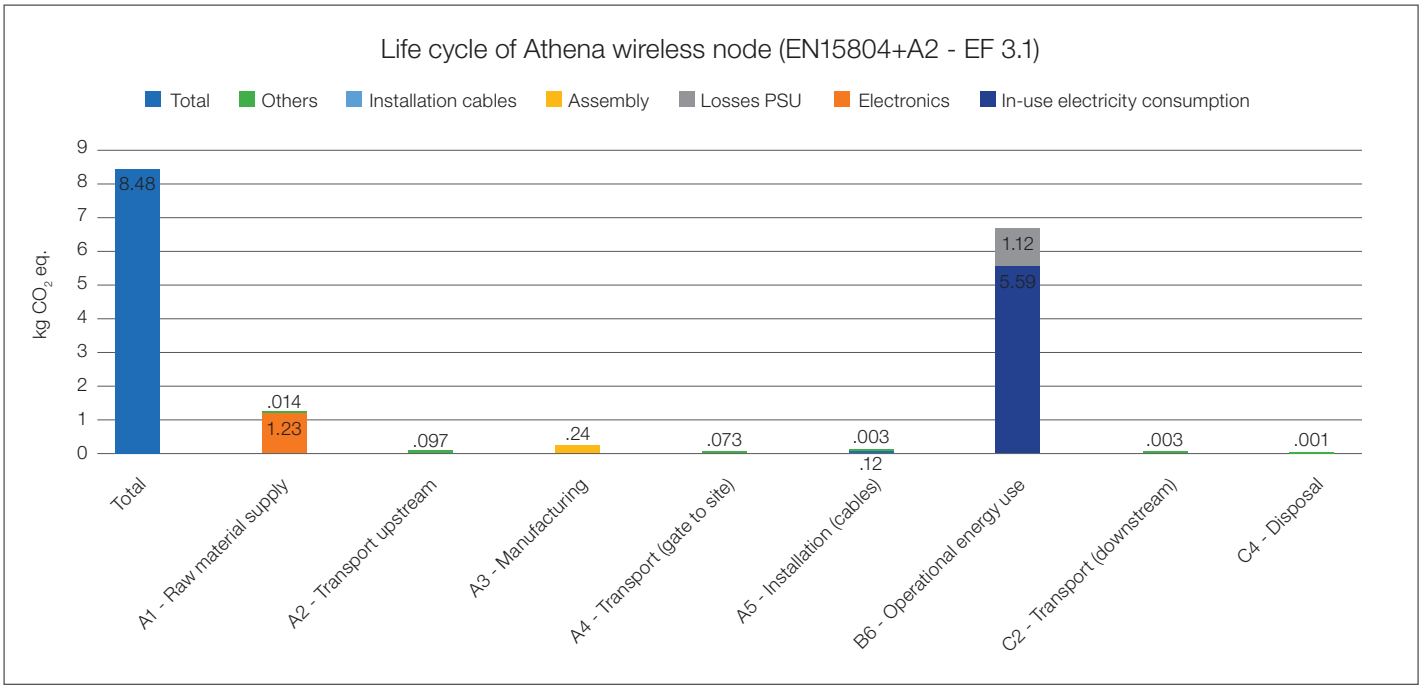
Climate change results for the base scenario

The carbon footprint of one Athena wireless node is 8.5 kg CO_2 eq. Use and manufacturing stages contribute to 79% and 18.6% of this value respectively, 98% together. The other life cycle stages contribute a negligible amount to the climate change. In particlular, EoL only contributes to 0.04% of the impact over the whole product lifecycle.



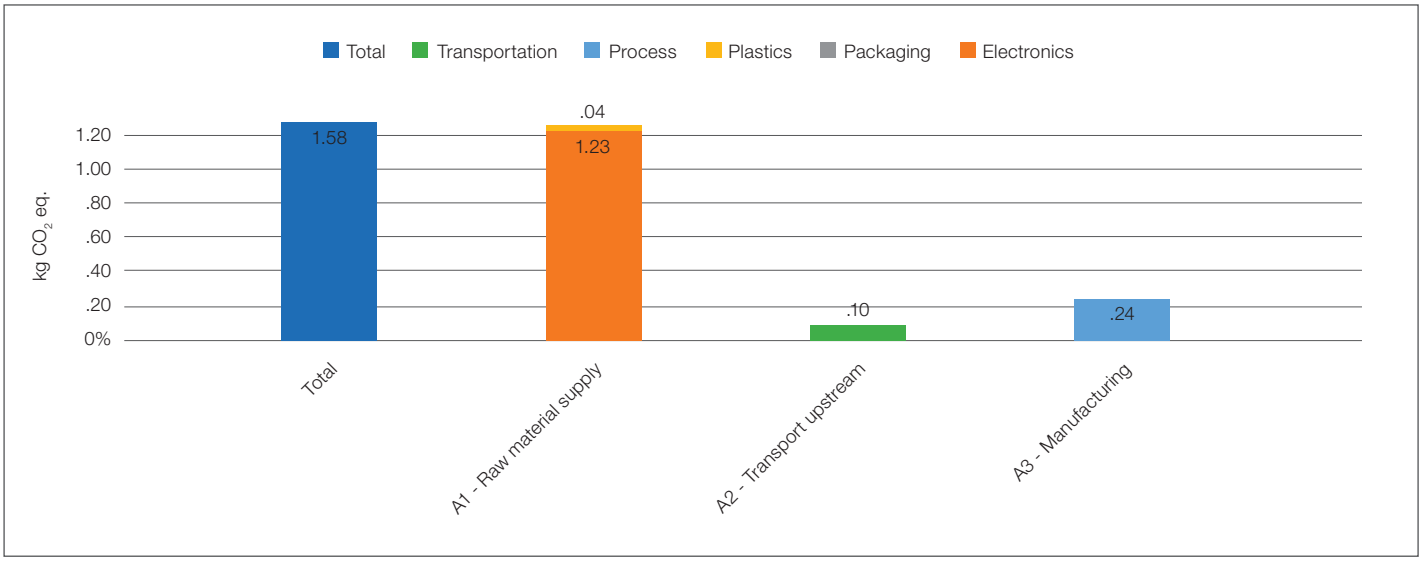


Figure 2: Climate change potential in the product state of one unit of Athena wireless node

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Climate change results comparing the base scenario with different Athena wireless node varients

Athena wireless nodes variants differ with regards to their Bill of Materials, all other aspects being equal. The OCC variant (with occupancy sensor) has a slightly larger impact (+2.5%) than the RF variant (base variant) as it embeds a few more components.

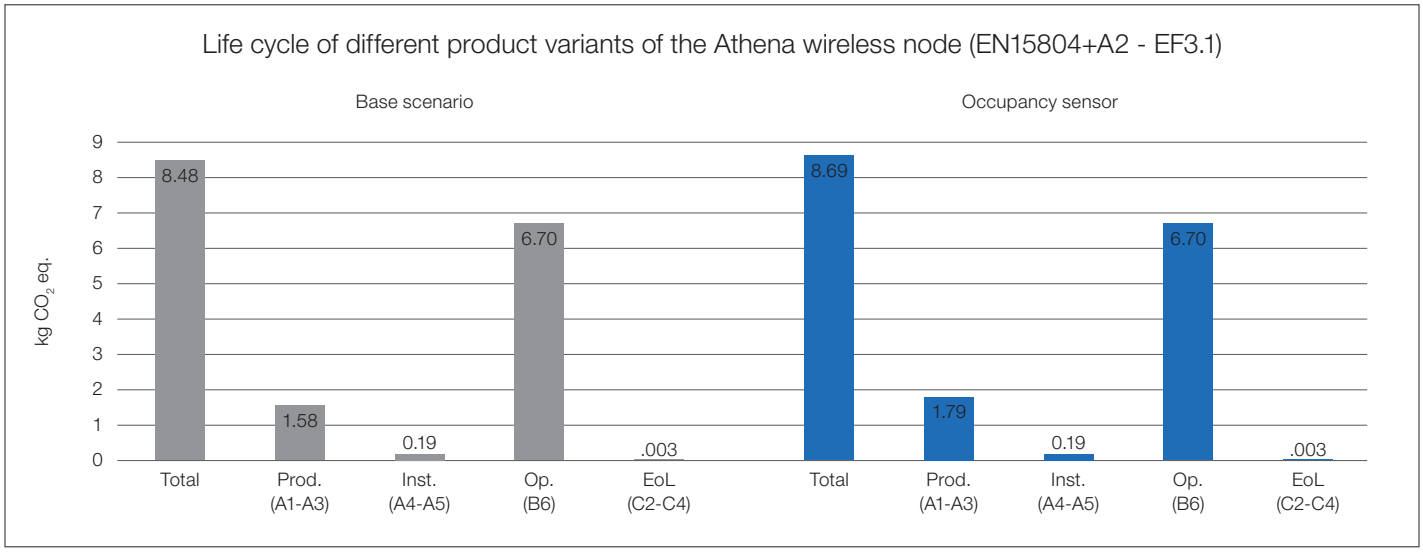

Figure 3: Climate change potential in the life cycle of different Athena wireless node variants

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Climate change results comparing the base scenario with different locations of use in the Operational Use Stage

The carbon intensity of the electricity mix at the point of use influences greatly the impacts. Utilizing Canadian, British, and European energy mixes as an alternative to the base scenario in the US during the Use Stage can decrease the total climate change results over the life cycle of 56%, 40%, and 28%, respectively.

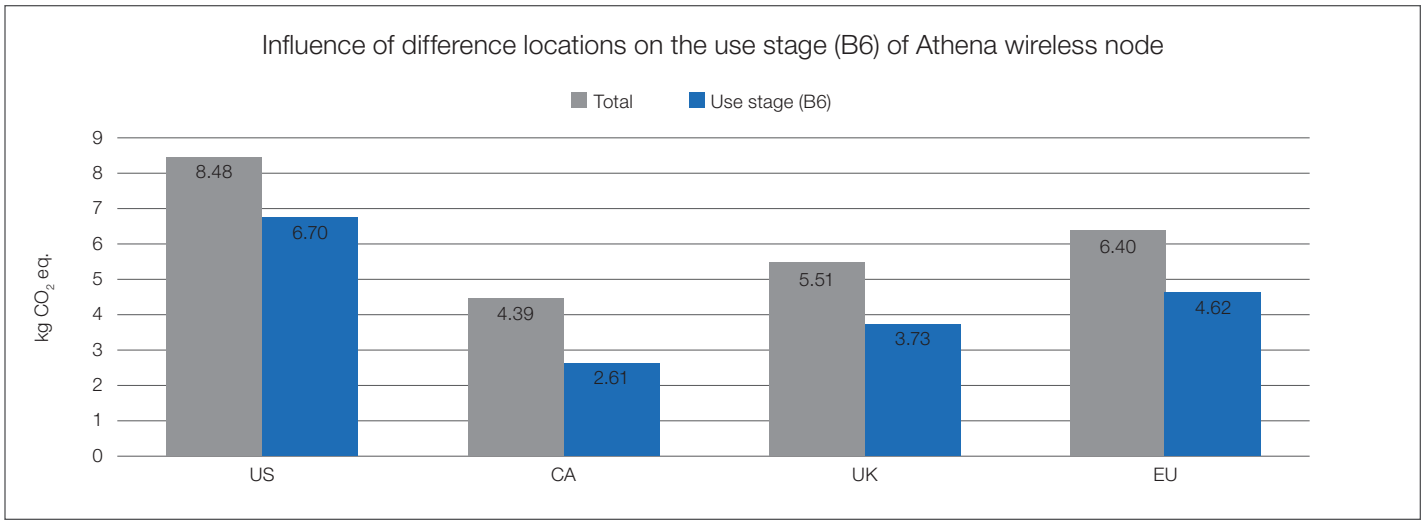

Figure 4: Climate change potential in the Use Stage of the Athena wireless node in different locations of use

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Additional environmental impact indicators

Impact category	A1 - Raw material supply	A2 - Transport	A3 - Manuf.	A4 - Transport (gate to site)	A5 - Assembly	B6 - Operational energy use	C2 - Transport (downstream)	C3 - Waste proc.	C4 - Disposal	D - Reuse/ Recovery/ Recycling potential
GWP - Climate change - total [kg CO_2 eq.]	1.2E+00	9.7E-02	2.4E-01	7.3E-02	1.2E-01	6.7E+00	2.8E-03	0.0E+00	6.3E-04	0.0E+00
ODP - Ozone depletion [kg CFC-11 eq.]	6.9E-12	5.6E-15	1.1E-12	4.7E-15	5.5E-13	3.3E-11	4.1E-16	0.0E+00	1.7E-15	0.0E+00
AP - Acidification [Mole of H+ eq.]	7.9E-03	4.9E-04	1.6E-03	2.7E-04	7.0E-04	9.5E-03	3.9E-06	0.0E+00	4.7E-06	0.0E+00
EPf - Eutrophication, freshwater [kg P eq.]	5.3E-06	2.8E-08	2.4E-07	4.1E-08	2.0E-07	4.0E-06	1.1E-08	0.0E+00	1.3E-09	0.0E+00
EPm - Eutrophication, marine [kg N eq.]	1.1E-03	2.2E-04	1.3E-04	1.2E-04	7.9E-05	2.1E-03	1.4E-06	0.0E+00	1.2E-06	0.0E+00
EPt - Eutrophication, terrestrial [Mole of N eq.]	1.1E-02	2.4E-03	1.4E-03	1.3E-03	8.5E-04	2.3E-02	1.6E-05	0.0E+00	1.3E-05	0.0E+00
POCP - Photochemical ozone formation, human health [kg NMVOC eq.]	3.3E-03	6.0E-04	4.6E-04	3.3E-04	2.5E-04	6.1E-03	3.5E-06	0.0E+00	3.7E-06	0.0E+00
ADPm - Resource use, mineral and metals [kg Sb eq.]	4.3E-05	1.2E-09	1.0E-08	1.2E-09	2.8E-05	4.3E-07	2.1E-10	0.0E+00	3.1E-11	0.0E+00
ADPe - Resource use, fossils [MJ]	1.9E+01	1.3E+00	2.9E+00	1.0E+00	1.4E+00	1.1E+02	4.3E-02	0.0E+00	8.8E-03	0.0E+00
W - Water use [m^3 world equiv.]	2.5E-01	1.8E-04	4.3E-02	1.9E-04	2.4E-02	1.5E+00	3.8E-05	0.0E+00	7.3E-05	0.0E+00

Table 2: Relative life cycle impact of one Athena wireless node in EN 15804+A2 categories

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Additional environmental impact indicators

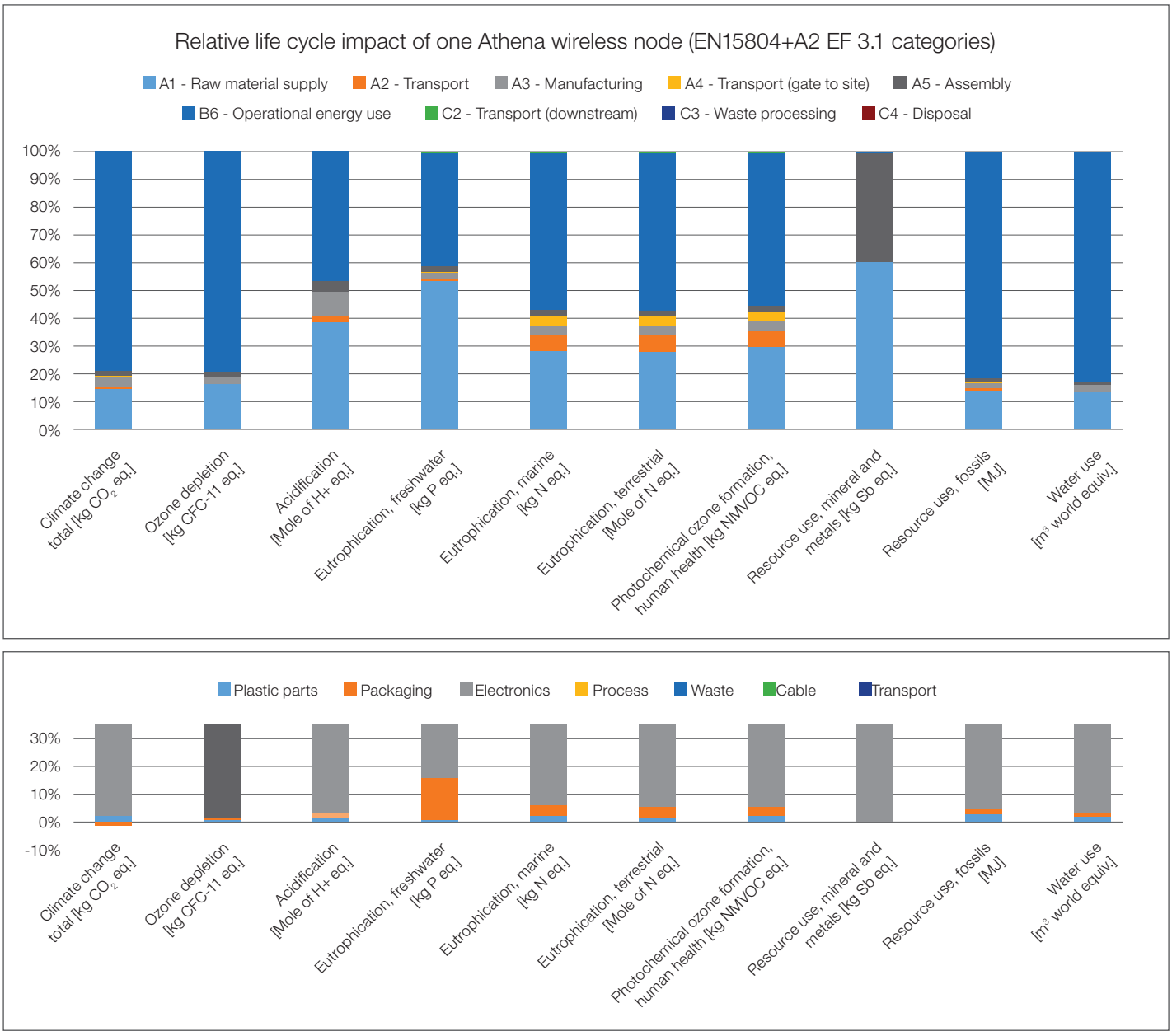

Figure 5: Relative impact of the Product Stage of one Athena wireless node in EN 15804+A2 categories

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Summary and conclusion

With the aim to assess the environmental impact of the Athena wireless node family produced by Lutron, climate change potential was used as a reference indicator in this study due to its stability and global importance.

The results on all impact categories show that climate change can be used as a good proxy to estimate the environmental impacts of this product and identifying its impacts. Exception to this rule of thumb is the impact category “resource use, minerals and metals”, which is specifically influenced by metal contents and hence behaves differently from the other impact categories.

Within the Cradle-to-Grave system boundary of the device, the LCA study shows electricity consumption during the Use Stage as the main hotspot for climate change, followed by the production of electronic components. The observation of the hotspot is seen as a trend in most other environmental categories as well.

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