Environmental Fact Sheet

Wireless processor

The aim of this document is to provide relevant and reliable information on the environmental performance of the wireless processor. Results reported are based on a Life Cycle Assessment (LCA) carried out by an independent company (Sphera).

This environmental information sheet uses 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) as a reference, following the specific requirements for “other equipment”, and is based on a Life Cycle Assessment (LCA) study conducted according to DIN ISO 14040/44.

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 processor is a ceiling-mounted device that integrates Clear Connect – Type X devices (such as Ketra loads) with Lutron’s existing Clear Connect – Type A devices (such as Pico wireless controls and Radio Powr Savr sensors).

System description

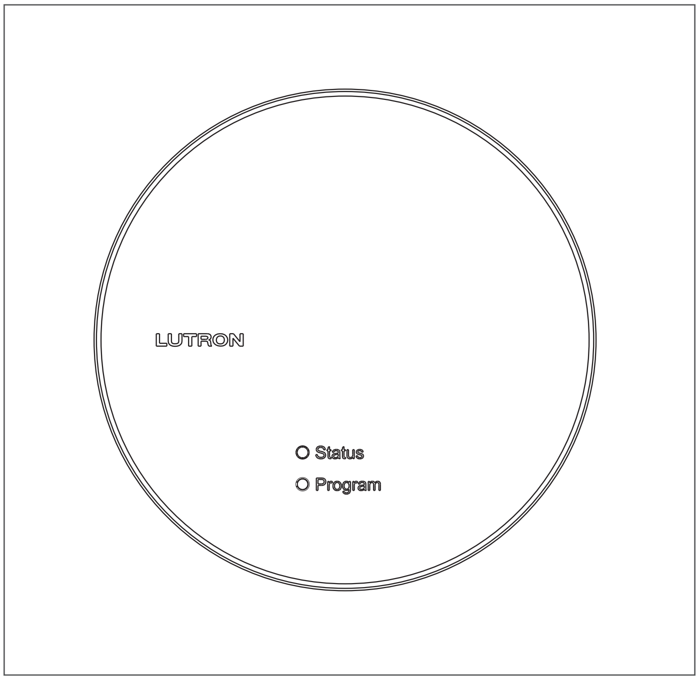
The functional unit is defined according to the PSR standard mentioned above, and the reference unit for this study is one wireless processor used over 10 years.

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, magnets, motor, 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

The functional unit as defined by the PSR meets specific standards for one piece of wireless processor:

“Ensure digital control of light fixtures using an ethernet connected device over a reference service life of 10 years”



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Material content

Total weight of reference product (incl. packaging) [g]	0.455	
Electronics	**mass [g]**	**% of total weight**
Electronics	0.016	3.5%
Metals	**mass [g]**	**% of total weight**
Metals	0.021	4.6%
Packaging	**mass [g]**	**% of total weight**
Packaging	0.324	71.2%
Plastics	**mass [g]**	**% of total weight**
Plastics	0.094	20.7%

Table 1: Weight and material content of the wireless processor

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 manufacturing site. The Use stage was considered in the US, and End-of-Life (EoL) as landfilling as base scenario.

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 wireless processor's life cycle

The following scenario was analyzed:

Scenario 1: Use scenarios: scenarios considering different locations of Power consumption of the AWN with processor 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 wireless processor is 88.7 kg CO_2 eq. The climate change results show that the Operational Energy Use (B6) in the Use Stage is the main contributor to the overall impact of the wireless processor, representing approximately 80% of potential impacts. In the Use Stage, 80% of impacts come from the the Processor and 20% from the PoE. For the electricity consumption, the electricity grid mix in the US was applied. The Use Stage is followed by the Product Stage (A1-A3) with approximately 12%, while the Transport (A4) and End of Life Stage (C1-D) have negligible impact. Assembly (A5) represents the impacts of the PoE in the Installation Stage, contributing to 9% of the total Carbon Footprint.

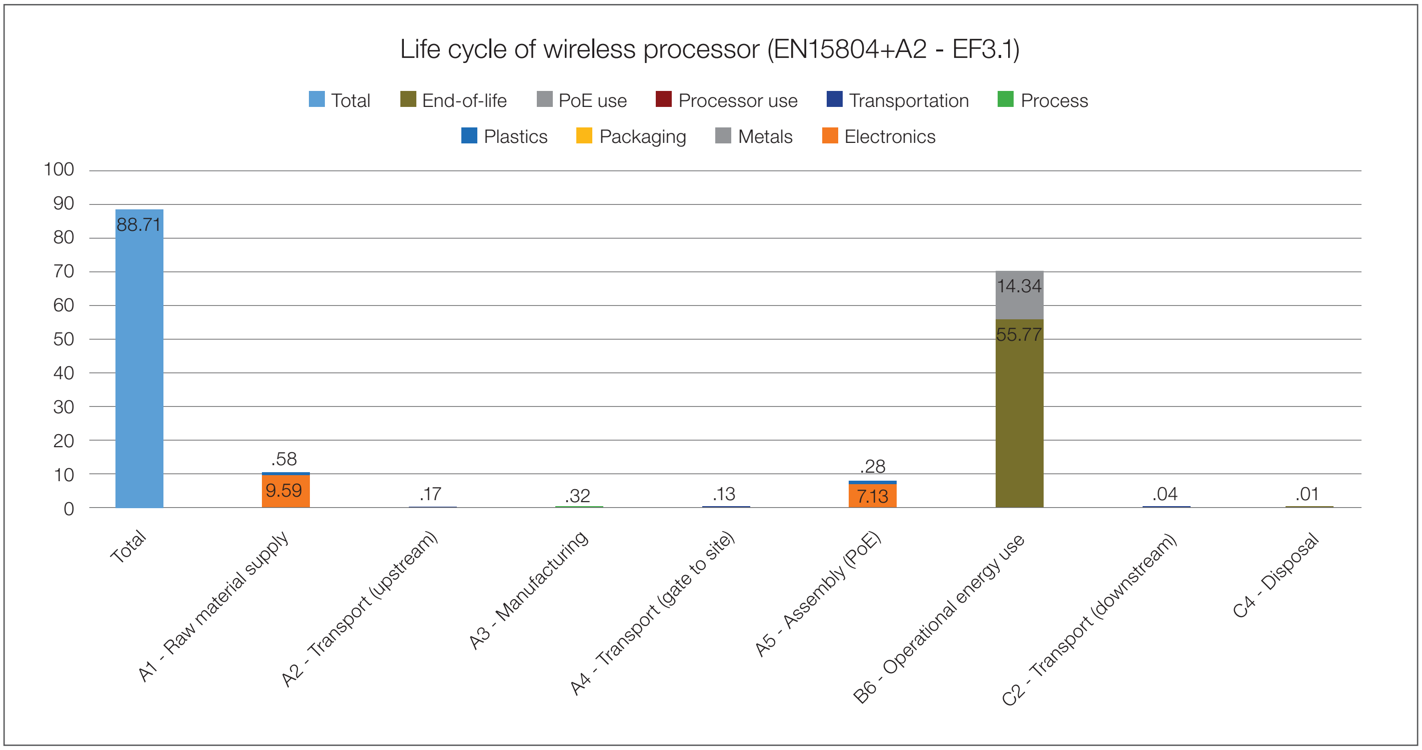

Figure 2: Climate change potential of one unit of wireless processor

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Climate change results for the base scenario

In the Product Stage (A1-A3), the main contributors to CO_2 emissions are the raw material supplies (A1) of electronics followed by plastic and metal parts. Upstream transportation (A2) contributes to almost 2% of the climate change results of the Product Stage, while the electricity used in the manufacturing process (A3) sums up to 3% of the Stage's results.

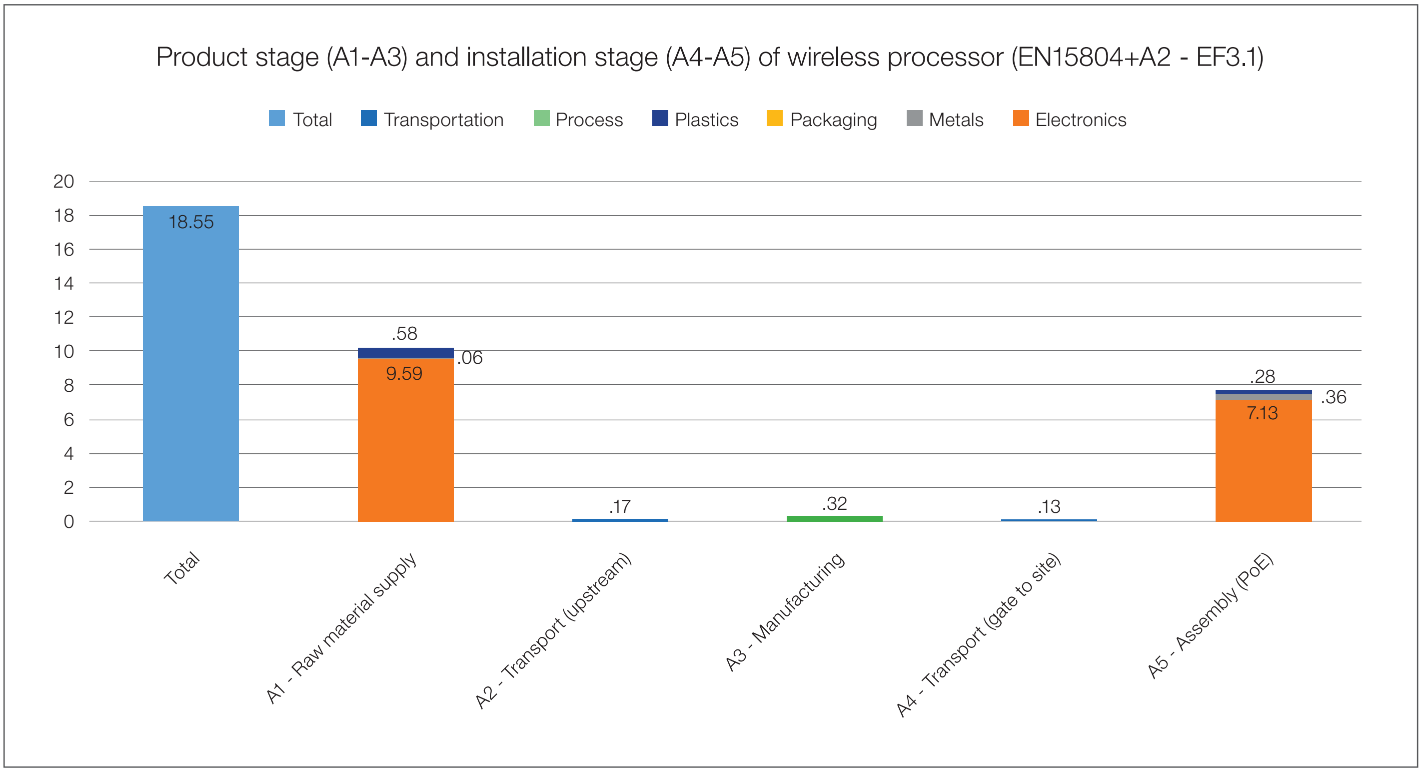

Figure 3: Climate change potential in the Product and Installation Stages of one unit of wireless processor

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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 other energy mixes as an alternative to the base scenario in the US during the Use Stage can decrease the total climate change results of the wireless processor by almost 50% (e.g.: scenario of users located in Canada), or reduce it by 30% (scenarios with users located in the UK and Europe).

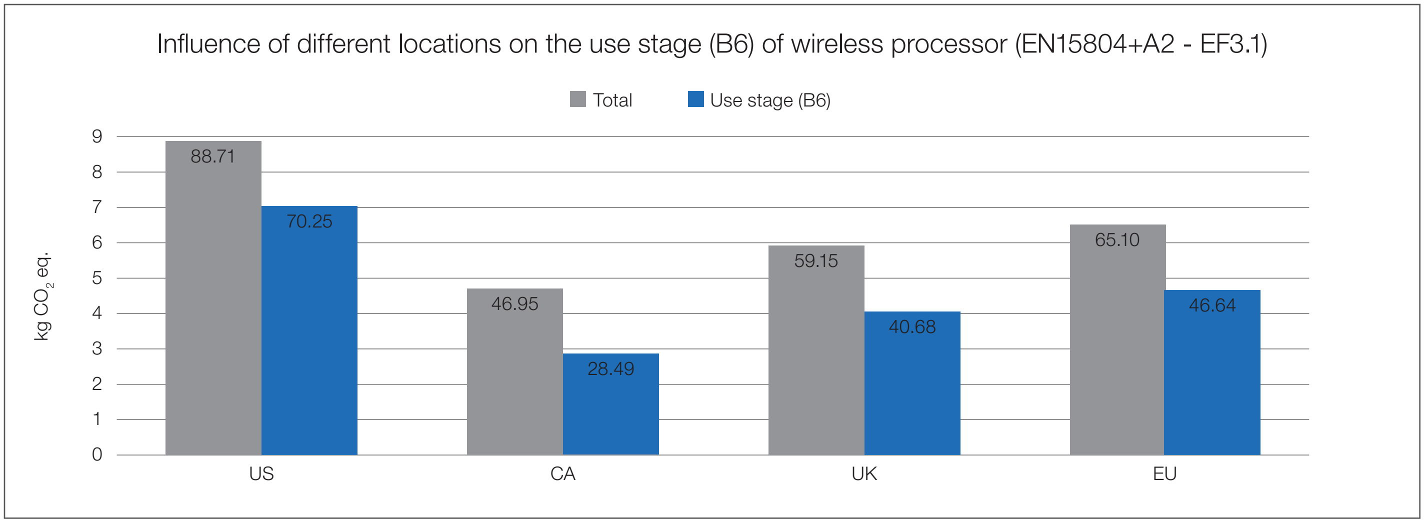

Figure 4: Climate change potential in the Use Stage of the wireless processor in different locations of use (different electricity grid mixes)

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Additional environmental impact indicators

	A1 - Raw Material Supply	A2 - Transport	A3 - Manuf.	A4 - Transport (gate to site)	A5 - Assembly	B6 - Operational energy use	C2 - Transport (downstream)	C3 - Waste Processing	C4 - Disposal	D - Reuse/ Recovery/ Recycling Potential
Climate change - total [kg CO_2 eq.]	1.0E+01	1.7E-01	3.2E-01	1.3E-01	7.8E+00	7.0E+01	3.7E-02	0.0E+00	6.5E-03	0.0E+00
Ozone depletion [kg CFC-11 eq.]	6.3E-11	2.2E-14	1.1E-12	1.7E-14	3.0E-11	4.6E-10	4.8E-15	0.0E+00	1.7E-14	0.0E+00
Acidification [Mole of H+ eq.]	5.6E-02	3.4E-04	3.1E-03	2.1E-04	5.7E-02	1.3E-01	6.1E-05	0.0E+00	4.8E-05	0.0E+00
Eutrophication, freshwater [kg P eq.]	4.8E-05	6.0E-07	1.4E-07	4.8E-07	2.8E-05	4.3E-05	1.4E-07	0.0E+00	1.4E-08	0.0E+00
Eutrophication, marine [kg N eq.]	9.0E-03	1.4E-04	3.0E-04	8.4E-05	6.3E-03	2.2E-02	2.4E-05	0.0E+00	1.3E-05	0.0E+00
Eutrophication, terrestrial [Mole of N eq.]	9.7E-02	1.5E-03	3.4E-03	9.6E-04	6.8E-02	2.4E-01	2.7E-04	0.0E+00	1.4E-04	0.0E+00
Photochemical ozone formation, human health [kg NMVOC eq.]	2.7E-02	3.2E-04	1.0E-03	1.9E-04	2.0E-02	6.4E-02	5.4E-05	0.0E+00	3.8E-05	0.0E+00
Resource use, mineral and metals [kg Sb eq.]	1.1E-03	1.1E-08	1.5E-08	8.6E-09	1.9E-03	5.3E-06	2.5E-09	0.0E+00	3.2E-10	0.0E+00
Resource use, fossils [MJ]	1.6E+02	2.3E+00	4.6E+00	1.8E+00	1.6E+02	1.2E+03	5.1E-01	0.0E+00	9.1E-02	0.0E+00
Water use [m^3 world equiv.]	2.3E+00	2.0E-03	2.2E-01	1.6E-03	2.3E+00	1.8E+01	4.5E-04	0.0E+00	7.5E-04	0.0E+00

Table 2: Life Cycle impact of one piece of wireless processor in EN 15804+A2 categories

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Additional environmental impact indicators

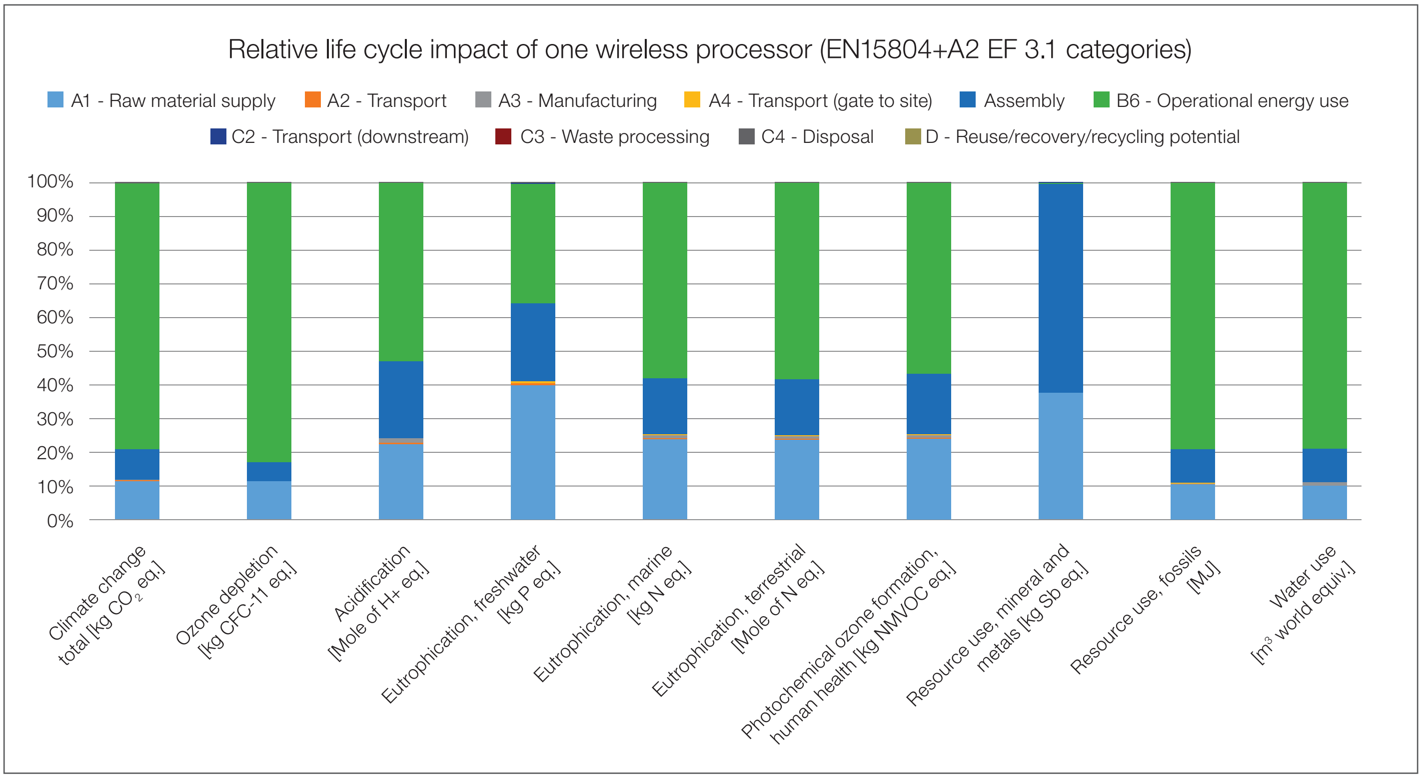

Figure 5: Relative Life Cycle Impact of wireless processor in EN 15804+A2 categories

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Additional environmental impact indicators

	Electronics	Metals	Packaging	Plastics	Process	Transportation
Climate change - total [kg CO_2 eq.]	1.0E+01	1.7E-01	3.2E-01	1.3E-01	7.8E+00	7.0E+01
Ozone depletion [kg CFC-11 eq.]	6.3E-11	2.2E-14	1.1E-12	1.7E-14	3.0E-11	4.6E-10
Acidification [Mole of H+ eq.]	5.6E-02	3.4E-04	3.1E-03	2.1E-04	5.7E-02	1.3E-01
Eutrophication, freshwater [kg P eq.]	4.8E-05	6.0E-07	1.4E-07	4.8E-07	2.8E-05	4.3E-05
Eutrophication, marine [kg N eq.]	9.0E-03	1.4E-04	3.0E-04	8.4E-05	6.3E-03	2.2E-02
Eutrophication, terrestrial [Mole of N eq.]	9.7E-02	1.5E-03	3.4E-03	9.6E-04	6.8E-02	2.4E-01
Photochemical ozone formation, human health [kg NMVOC eq.]	2.7E-02	3.2E-04	1.0E-03	1.9E-04	2.0E-02	6.4E-02
Resource use, mineral and metals [kg Sb eq.]	1.1E-03	1.1E-08	1.5E-08	8.6E-09	1.9E-03	5.3E-06
Resource use, fossils [MJ]	1.6E+02	2.3E+00	4.6E+00	1.8E+00	1.6E+02	1.2E+03
Water use [m^3 world equiv.]	2.3E+00	2.0E-03	2.2E-01	1.6E-03	2.3E+00	1.8E+01

Table 3: Impact of the Product Stage of one piece of wireless processor in EN 15804+A2 categories

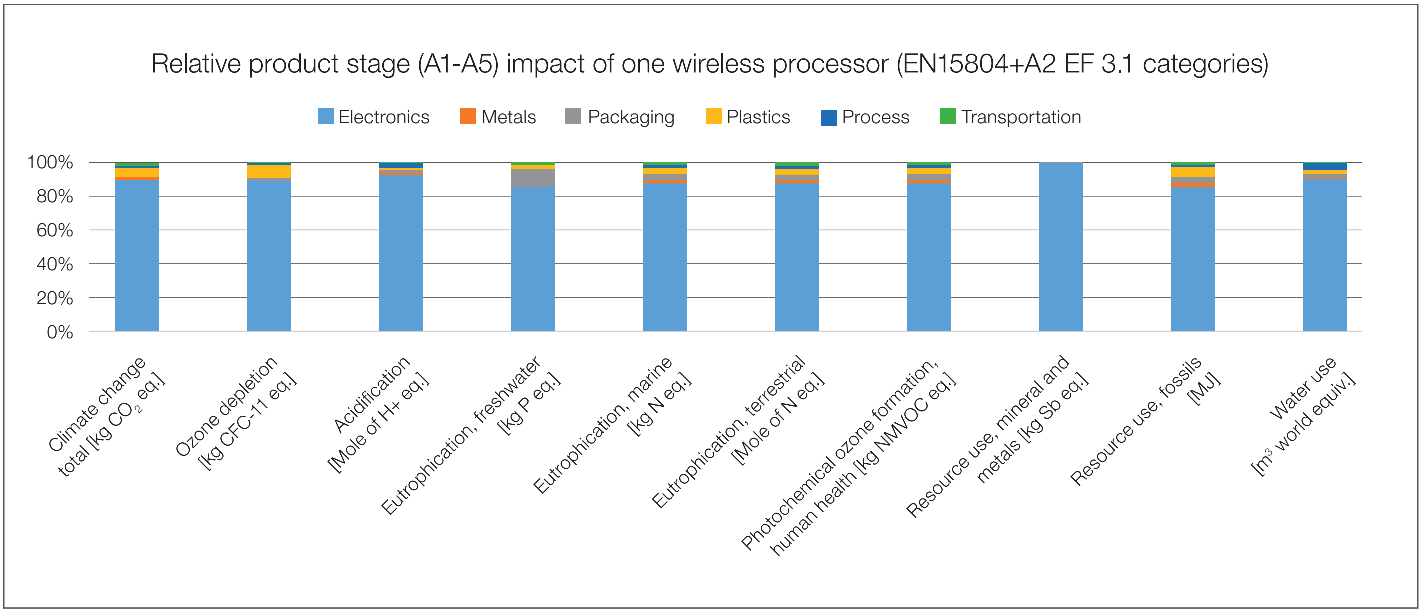

Figure 6: Relative impact of the Product Stage of one wireless processor in EN 15804+A2 categories

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Summary and conclusion

Climate change was used as a reference indicator to assess the environmental impact of the wireless processor produced by Lutron. 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 behave 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. The observation of the hotspot is seen as a trend in most other environmental categories as well.

The scenario analysis shows that when varying the electricity source (eg.: more or less renewable energy in the grid mixes) the impact over the device’s life cycle changes significantly.