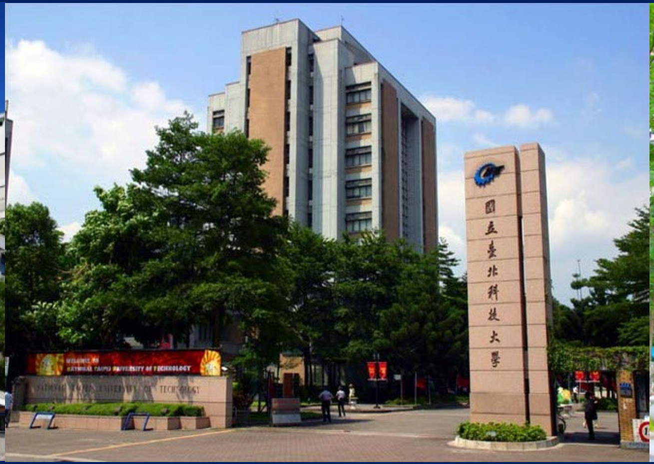
TAIPEI TECH 國立臺北科技大學
National Taipei University of Technology

Life Cycle Assessment for Clickshare Button Product






NTUT IEEM

Hu, Allen H. Professor Team

永續創新與評估中心
Sustainability, Innovation and Assessment Center (SIAC)

Project Description

Project Description

- **Project Objectives**

USI Green Product Lifecycle Assessment and Counseling – Clickshare Button Product Study

- **Project Implementation Framework**

The Green Product Lifecycle Assessment and Counseling Project is planned for one year, with the goal of promoting the establishment of product LCA, and at the same time, through counseling and training, strengthening the ability to implement product LCA, to fulfill the corporate social responsibility, to give full play to the influence of the semiconductor industry, and to improve the performance of international sustainability questionnaires (e.g., DJSI, CDP, etc.).

- **Anticipated Benefits**

1) Perform life cycle assessment on the target product to assist the investment control subsidiary to more comprehensively identify the environmental impacts associated with the product production process, as well as to identify improvement hotspots in the production process, and to fulfill its corporate social responsibility.
2) Through this year's project work program, not only can we achieve further exchanges between the industry and the academia, but we can also combine academic theories to meet the needs of the commissioning unit.

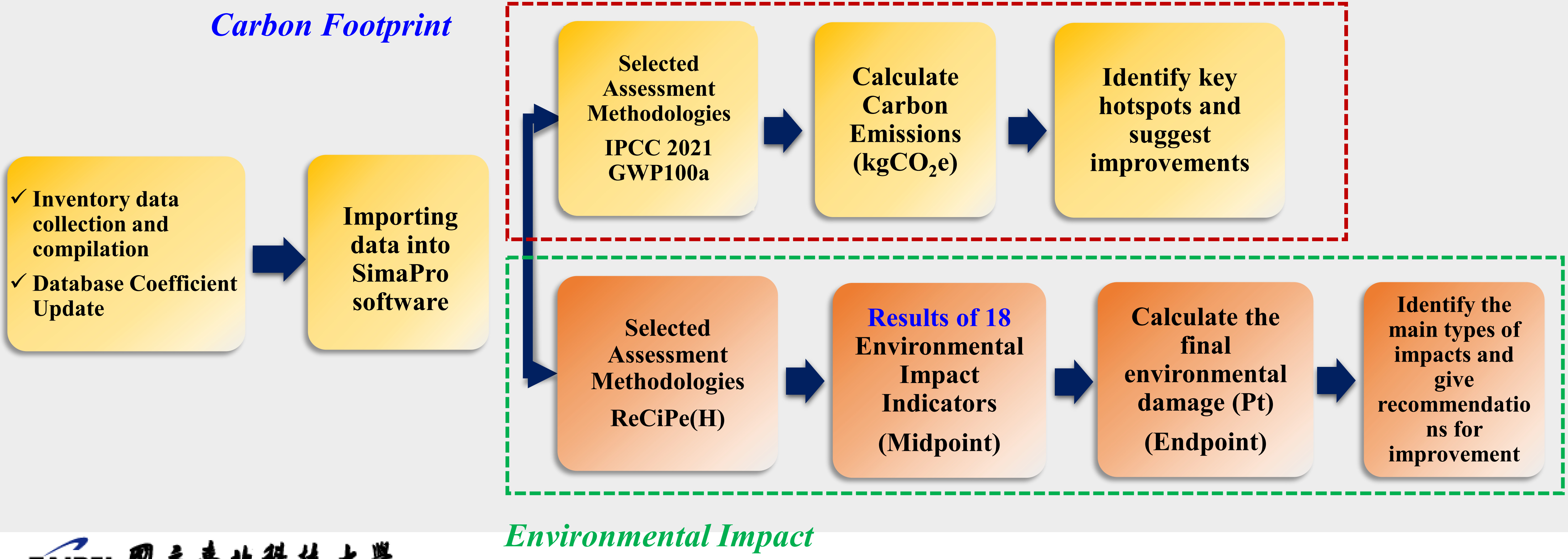
Clickshare Button Environmental impact implementation process

Research Target

Target Product	**Clickshare Button**
Functional unit	**The production of one Clickshare Button product**
System Boundary	B2B (Raw materials, manufacturing, waste)
Software	SimaPro 9.4.0.1
Database Use	Ecoinvent 3.8
Inventory Data	USI provides data on energy inputs, and the data collection period is one year.
Carbon Footprint	IPCC 2021 GWP100a
Environmental Impact	ReCiPe (H) Midpoint、Endpoint

Clickshare Button Impact Assessment Execution Process

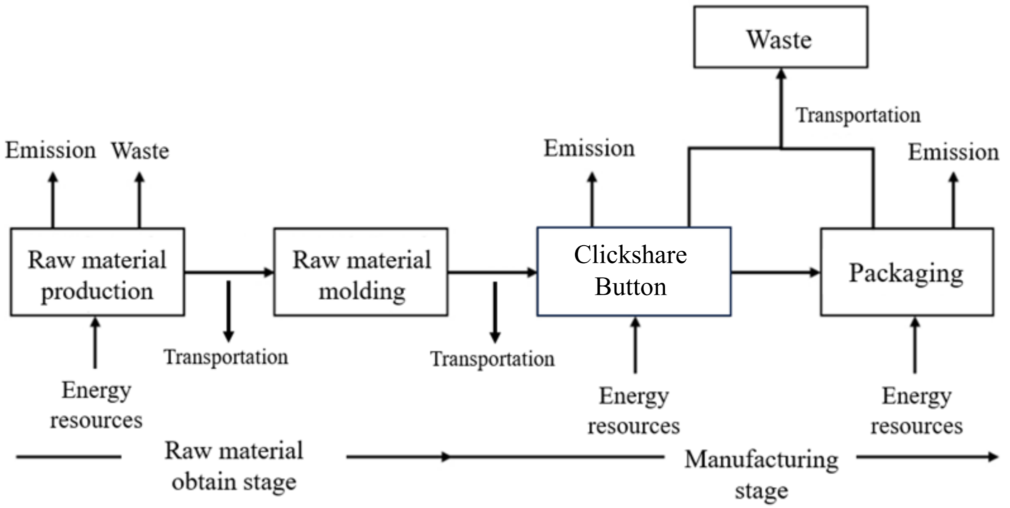
Carbon Footprint＆Environmental Impact



Clickshare Button Environmental Impact Implementation Process

System Boundary

- Includes wastes from the raw material stage, the manufacturing stage, and the production stage.



Inventory Data

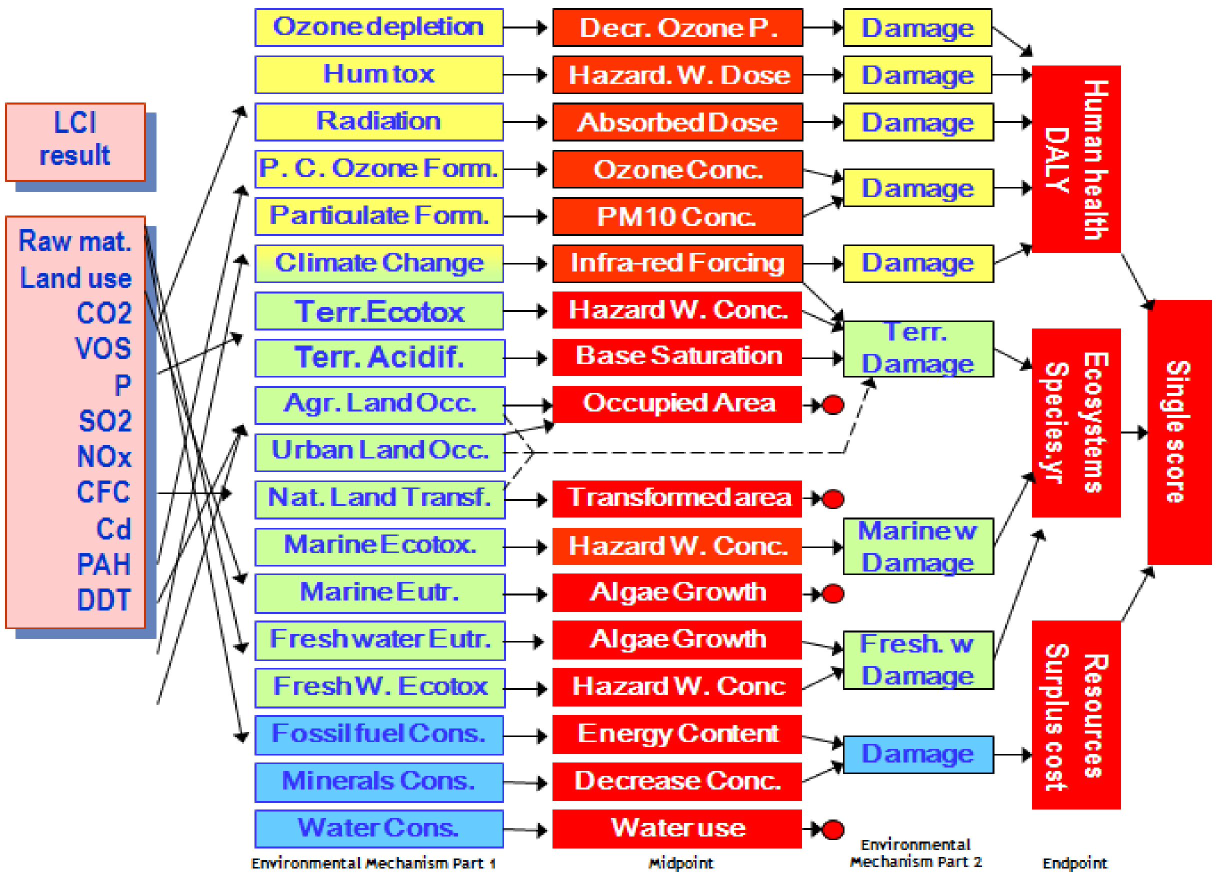
- **2022/01/01~2022/12/31**

Stages	Use of Information	資料來源	分配方式
Raw material stage	Raw Material Activity Data	SAP、OA、Replacement of Records	Clickshare Button Number of production/all products in production
	Transportation Distance, Vehicle Type	Supplier Information、Google Map、ELCD、ICAO	
Manufacturing stage	Resources	Electricity Bills, Greenhouse Gas Inventory Data, Meter Reading Records	SMT equipment man-hour allocation + SMT floor revenue allocation + Assembly and testing floor revenue allocation
Waste Stage	Waste	Statistical Tables, Weigh Bills, Coupons	Floor area of production line/floor area of the whole factory*product quantity distribution
	Transportation Distance, Vehicle Type	Supplier Information、Google Map	

Clickshare Button Selection of Environmental Impact Methods

ReCiPe methodologies

- ReCiPe is a methodology developed based on two existing methods, CML 2001 and Eco-indicator 99, making it one of the relatively newer environmental impact assessment methods (Goedkoop et al., 2013). ReCiPe encompasses the most extensive range of environmental impact categories among current existing methods (Heinonen et al., 2016) and can be used for comparative analyses of various environmental impact and damage categories (Korol et al., 2016).
- A significant feature of the ReCiPe methodology is that the normalization factors between midpoint and endpoint methods are consistent. Therefore, when evaluating damage results, the ReCiPe life cycle impact assessment method is recommended for use (Dong and Ng, 2014).

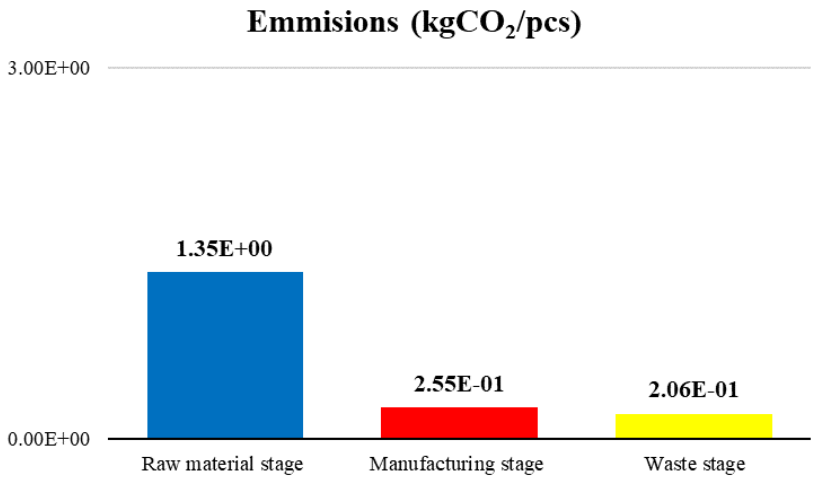


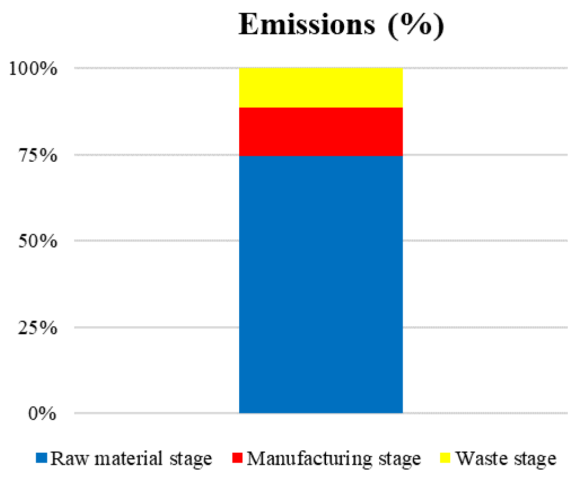
Clickshare Button Carbon Footprint Assessment Results

Clickshare Button Carbon Footprint Assessment Results

Carbon Footprint Assessment Results

- ✓ Using the life cycle assessment software SimaPro and the IPCC 2021 GWP100a methodology, we examined the carbon emissions of Clickshare Button products and found that the total carbon emissions were 1.81 $kgCO_2e/pcs$.
- ✓ The raw material stage (1.35 $kgCO_2e/pcs$) has a higher carbon footprint than the manufacturing stage (0.255 $kgCO_2e/pcs$).





Critical Material

- ✓ Electricity used in manufacturing processes is a major hotspot for carbon emissions.

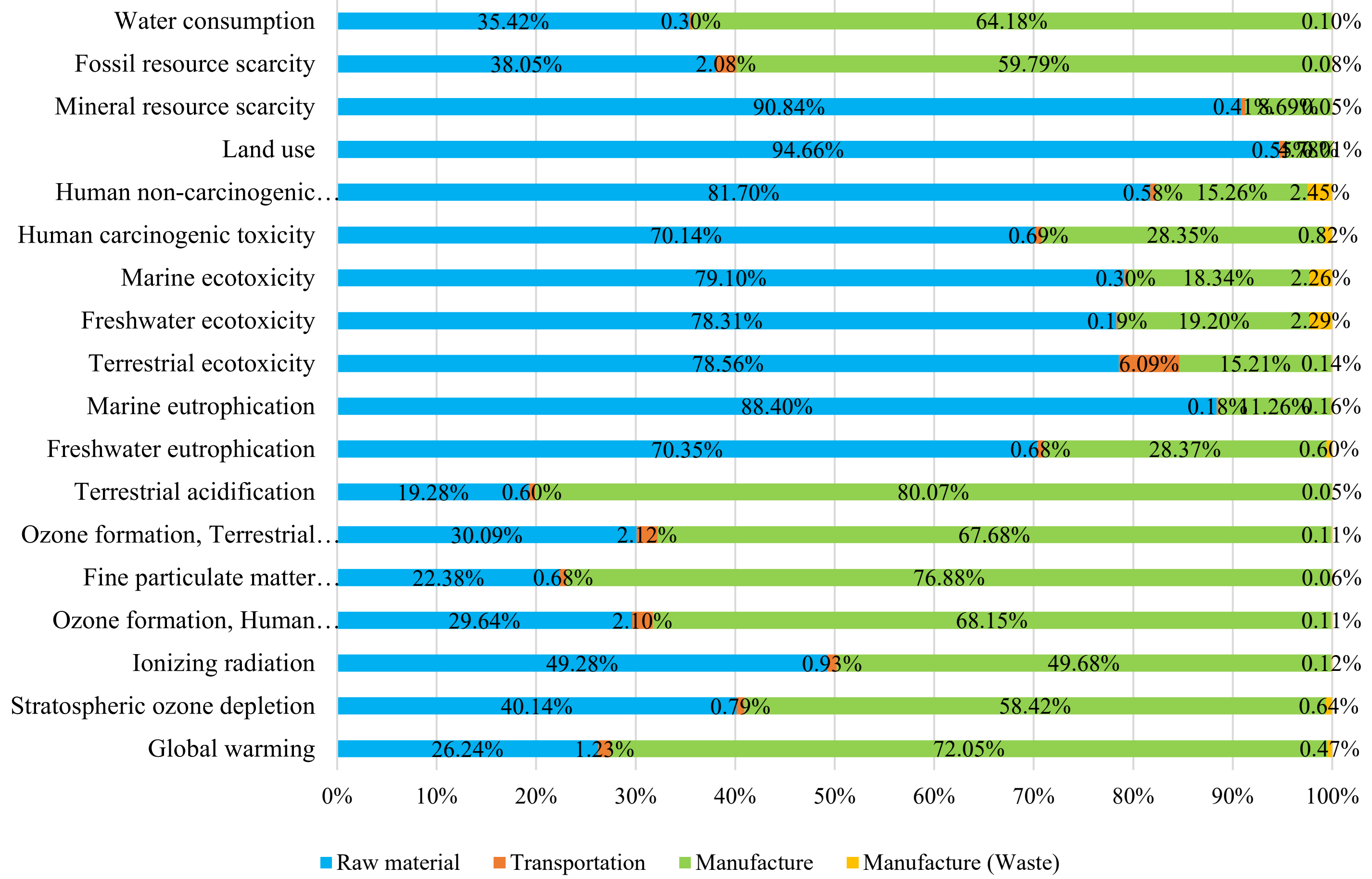
Number	Categorization	Name	Carbon footprint ($kgCO_2e/pcs$)	Percentage
Manufacturing stage		**Electricity**	**2.55E-01**	**14.05%**
M1	Raw materials	PCB	3.03E-01	16.72%
M77	Raw materials	USB	3.17E-01	17.48%
M43	Raw materials	IC PROCESSOR	6.62E-02	3.65%
M50	Raw materials	IC VOLTAGE MONITORS	6.61E-02	3.65%

Clickshare Button Environmental Impact Assessment Results

Clickshare Button Environmental Impact Assessment Results

Lifecycle Assessment Results (Midpoint)

Using the life cycle assessment software SimaPro and the ReCiPe 2016 Midpoint (H) methodology, the impacts of Clickshare Button's products on 18 environmental indicators were examined, and the results showed that the raw material stage had a more significant impact on most of the indicators, followed by the manufacturing stage.



Clickshare Button Environmental Impact Assessment Results

Midpoint			Normalization			Weighting			
Impact category	Unit	Characterization	Unit	Weighting	Standardization	Unit	Weighting	Damage	Percentage
Global warming, Human health	DALY	**1.30E-05**	Pt	**41.7**	**5.43E-04**	Pt	300	**1.63E-01**	29.16%
Stratospheric ozone depletion	DALY	4.92E-09	Pt	41.7	2.05E-07	Pt	300	6.16E-05	0.01%
Ionizing radiation	DALY	3.28E-09	Pt	41.7	1.37E-07	Pt	300	4.10E-05	0.01%
Ozone formation, Human health	DALY	3.93E-08	Pt	41.7	1.64E-06	Pt	300	4.92E-04	0.09%
Fine particulate matter formation	DALY	**2.24E-05**	Pt	**41.7**	**9.34E-04**	Pt	300	**2.80E-01**	50.09%
Human carcinogenic toxicity	DALY	1.73E-06	Pt	41.7	7.20E-05	Pt	300	2.16E-02	3.86%
Human non-carcinogenic toxicity	DALY	**4.86E-06**	Pt	**41.7**	**2.03E-04**	Pt	300	**6.08E-02**	10.88%
Water consumption, Human health	DALY	2.85E-07	Pt	41.7	1.19E-05	Pt	300	3.56E-03	0.64%
Global warming, Terrestrial ecosystems	species.yr	3.93E-08	Pt	676	2.66E-05	Pt	400	1.06E-02	1.90%
Global warming, Freshwater ecosystems	species.yr	1.07E-12	Pt	676	7.26E-10	Pt	400	2.90E-07	0.00%
Ozone formation, Terrestrial ecosystems	species.yr	5.62E-09	Pt	676	3.80E-06	Pt	400	1.52E-03	0.27%
Terrestrial acidification	species.yr	2.00E-08	Pt	676	1.35E-05	Pt	400	5.40E-03	0.97%
Freshwater eutrophication	species.yr	3.36E-09	Pt	676	2.27E-06	Pt	400	9.09E-04	0.16%
Marine eutrophication	species.yr	1.41E-12	Pt	676	9.51E-10	Pt	400	3.80E-07	0.00%
Terrestrial ecotoxicity	species.yr	5.83E-10	Pt	676	3.94E-07	Pt	400	1.58E-04	0.03%
Freshwater ecotoxicity	species.yr	8.93E-10	Pt	676	6.04E-07	Pt	400	2.42E-04	0.04%
Marine ecotoxicity	species.yr	1.79E-10	Pt	676	1.21E-07	Pt	400	4.84E-05	0.01%
Land use	species.yr	1.73E-08	Pt	676	1.17E-05	Pt	400	4.69E-03	0.84%
Water consumption, Terrestrial ecosystem	species.yr	1.78E-09	Pt	676	1.20E-06	Pt	400	4.81E-04	0.09%
Water consumption, Aquatic ecosystems	species.yr	2.11E-13	Pt	676	1.42E-10	Pt	400	5.70E-08	0.00%
Mineral resource scarcity	$	1.71E-02	Pt	3.57E-05	6.09E-07	Pt	300	1.83E-04	0.03%
Fossil resource scarcity	$	5.29E-01	Pt	3.57E-05	1.89E-05	Pt	300	5.66E-03	1.01%

Endpoint

Endpoint	
Human health	5.30E-01
Ecosystems	2.40E-02
Resources	5.84E-03
Single score	5.59E-01

Environmental Impact & Critical Material Sequencing

Environmental Impact

ReCiPe(H)- Lifecycle Assessment Results	
Environmental Impact (Percentage of damage)	Priority Clickshare Button
Fine particulate matter formation	1 2.80E-01 Pt (50.06%)
Global warming, Human health	2 1.63E-01 Pt (29.12%)
Human non-carcinogenic toxicity	3 6.08E-02 Pt (10.87%)

Critical Material

Number	Categorization	Name	Damage	Percentage
M1	Raw material	PCB FR4 8L 9P	1.34E-03	16.72%
M77	Raw material	USB Cable ASSY	1.28E-03	17.48%
Process	Process input	Electricity	3.60E-01	14.05%

- ✓ In Clickshare Button's environmental impact assessment, the key materials at the raw material stage are PCB and USB Cable, which come from M1 and M77.
- ✓ The critical material at the manufacturing stage is electricity.

Conclusion and Recommendation

Conclusion and Recommendation

- ✓ From the results of Clickshare Button's Carbon Footprint and Environmental Impact Critical Raw Materials, power input in the manufacturing process is one of the hotspots, with a share of 14.05% and 20.11% respectively.
- ✓ →It is recommended to reduce the proportion of traditional electricity input and increase the use of electricity (purchased green energy) in the manufacturing process to improve the damaging effects.

- ✓ In the ranking of critical raw materials (except for the process stage), PCB, USB Cable ASSY, and IC PROCESSOR used in the raw material stage are the hotspots that affect carbon emissions.
- ✓ →It is recommended to optimize the ratio of inputs of these critical raw materials to strengthen raw material management and avoid unnecessary consumption, thus improving the environmental impact.

Thank you for your attention