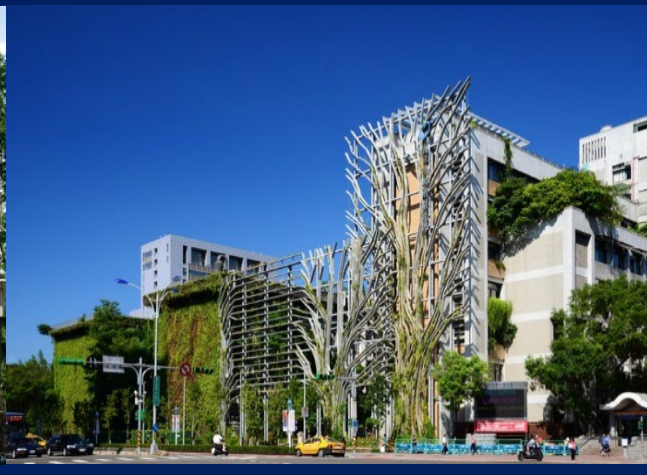
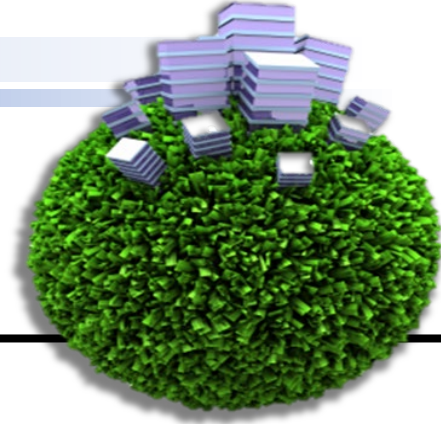


# Life Cycle Assessment for Charger for Hearing Aids Product



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



# Project Description

- **Project Objectives**

USI Green Product Lifecycle Assessment and Counseling – Charger for Hearing Aids 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.

# Charger for Hearing Aids Environmental impact implementation process

## Research Target

<b>Target Product</b>	Charger for Hearing Aids		
<b>Functional unit</b>	The production of one Charger for Hearing Aids product		
<b>System Boundary</b>	B2B(Raw materials, manufacturing, waste)		
<b>Software</b>	SimaPro 9.5.0.2		
<b>Database Use</b>	Ecoinvent 3.9		
<b>Inventory Data</b>	USI provides data on energy inputs, and the data collection period is one year.		
<b>Carbon Footprint</b>	IPCC 2021 GWP100a		
<b>Environmental impact</b>	ReCiPe Midpoint & Endpoint		

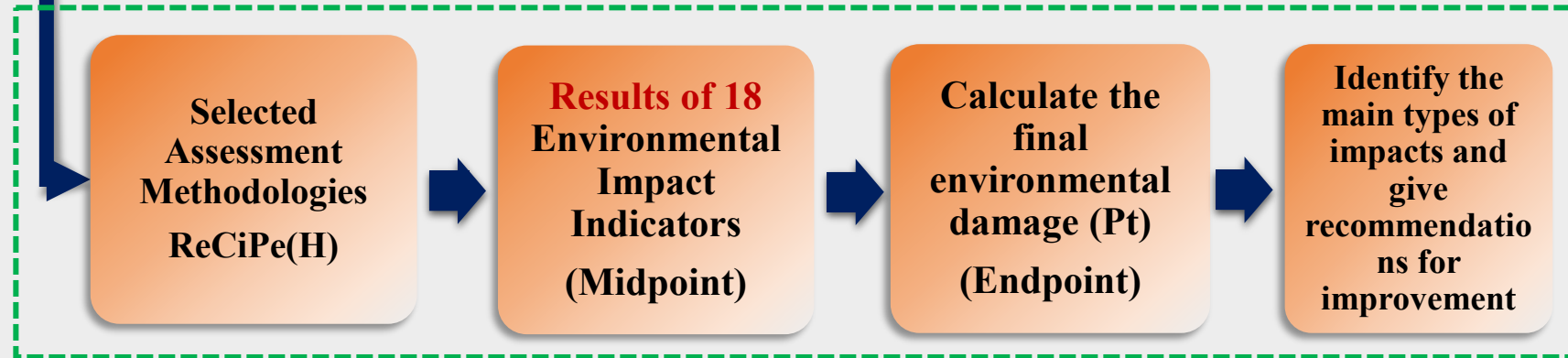
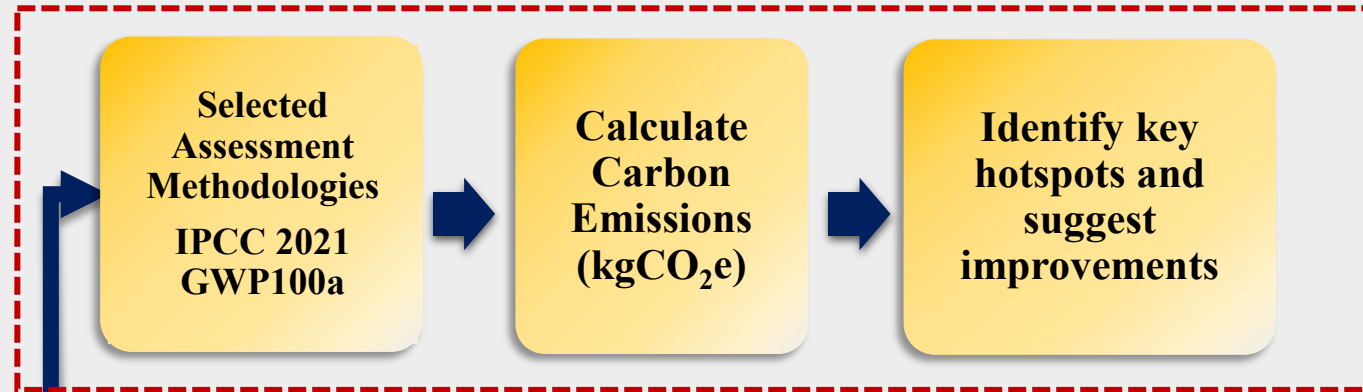
## Carbon Footprint & Environmental Impact

### Carbon Footprint

- ✓ Inventory data collection and compilation
- ✓ Database Coefficient Update



Importing data into SimaPro software



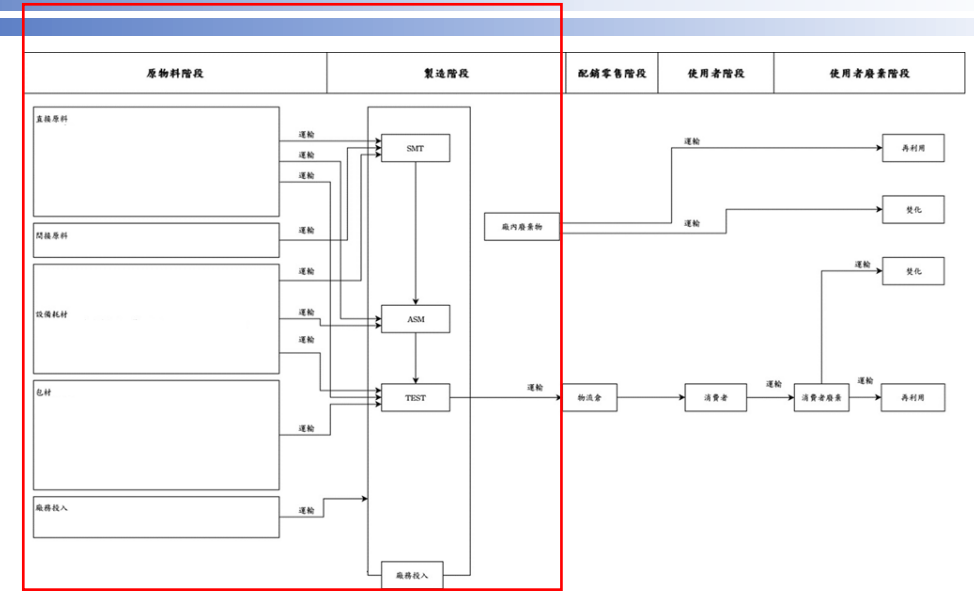
### Environmental Impact

## System Boundary

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

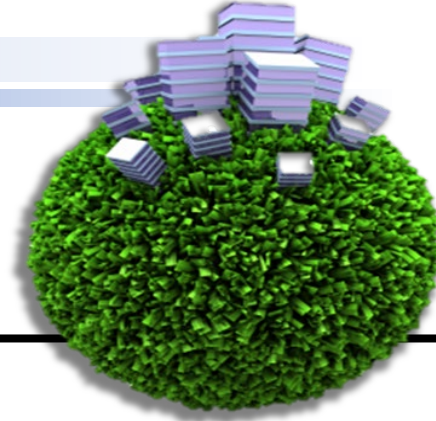
## Inventory Data

- 2023/01/01~2023/12/31



Stages	Use of Information	Source	Allocation
Raw material stage	Raw Material Activity Data	SAP、OA、Replacement of Records	1. Unallocated
	Transportation Distance, Vehicle Type	Supplier Information、Google Map、ELCD、ICAO	2. Allocation by production volume 3. Allocation by workshop production volume 4. Allocation by factory production volume
Manufacturing stage	Resources	Electricity Bills, Greenhouse Gas Inventory Data, Meter Reading Records	Product output/Total output of factory
Waste Stage	Waste	Statistical Tables, Weigh Bills, Coupons	Product quantity allocation
	Transportation Distance, Vehicle Type	Supplier Information、Google Map	





# Charger for Hearing Aids Carbon Footprint Assessment Results

## Carbon Footprint Assessment Results

- ✓ Using the life cycle assessment software SimaPro and the IPCC 2021 100a methodology, we examined the carbon emissions of Charger for Hearing Aids products and found that the total carbon emissions were 9.00 kgCO<sub>2</sub>e/pcs.
- ✓ The raw material stage (8.50 kgCO<sub>2</sub>e/pcs) has a higher carbon footprint than the manufacturing stage (0.281 kgCO<sub>2</sub>e/pcs).



## Critical Material

✓ CABLE used in Raw materials processes is a major hotspot for carbon emissions.

### ➤ Top five hot spots for products

Categorization	Name	Carbon footprint (kgCO <sub>2</sub> e/pcs)
<b>Manufacturing</b>	Electricity	2.77E-01
Raw materials	PCB	2.98E-01
Raw materials	IC MCU	3.53E-01
Raw materials	CABLE	6.51E+00
Raw materials	Metal Part	1.69E-01

### ➤ Raw materials

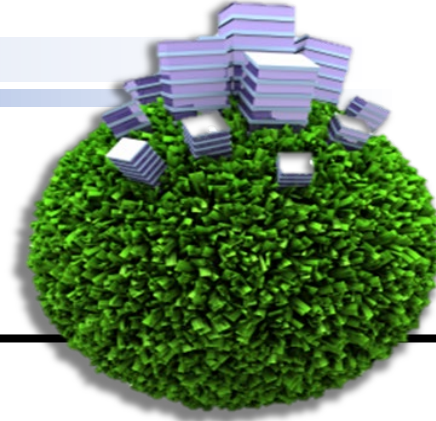
Categorization	Name	Carbon footprint (kgCO <sub>2</sub> e/pcs)
Raw materials	PCB	2.98E-01
Raw materials	IC MCU	3.53E-01
Raw materials	CABLE	6.51E+00

### ➤ Manufacturing

Categorization	Name	Carbon footprint (kgCO <sub>2</sub> e/pcs)
Manufacturing	Electricity	2.77E-01
Manufacturing	Septic tank	2.72E-03
Manufacturing	Official vehicle	5.42E-04

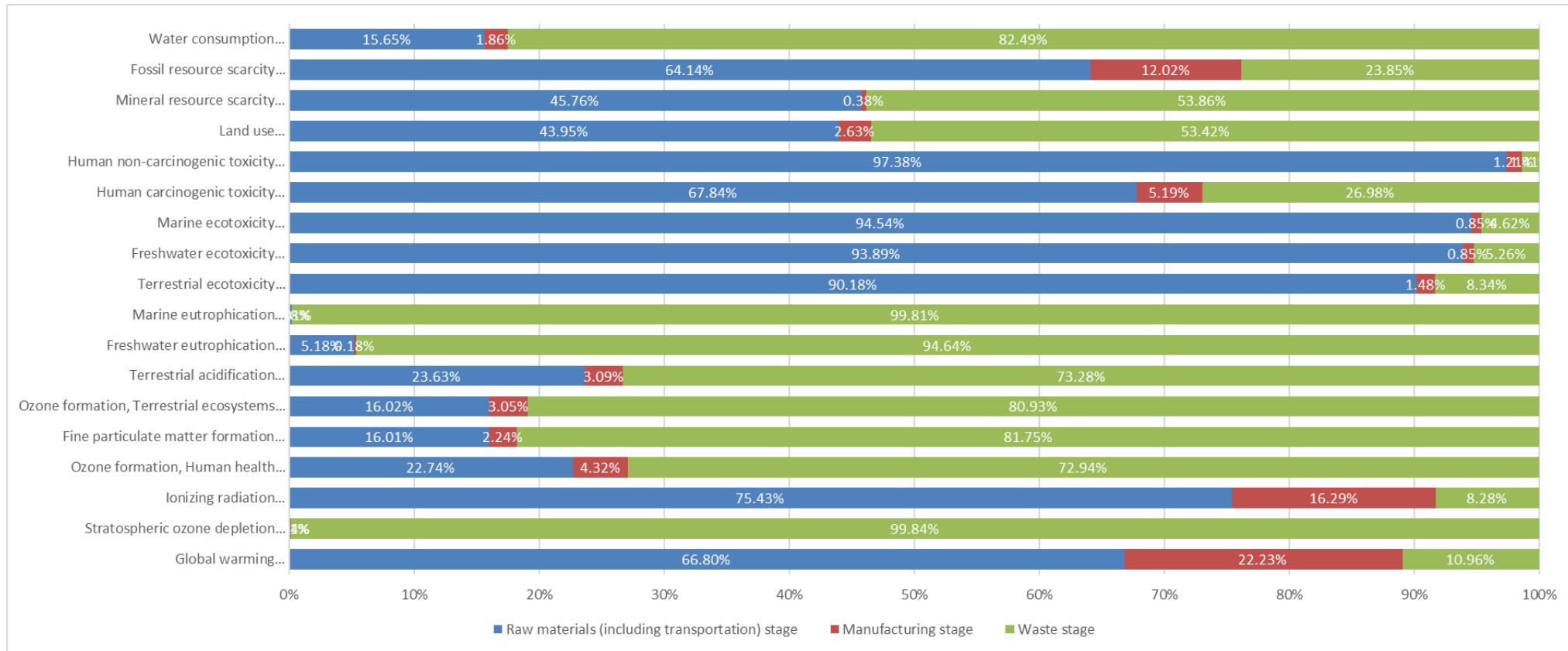
### ➤ Waste

Categorization	Name	Carbon footprint (kgCO <sub>2</sub> e/pcs)
Waste	Waste activated carbon	7.94E-05
Waste	Valueless materials	1.40E-03
Waste	Industrial waste	2.30E-03



# Charger for Hearing Aids Environmental damage assessment results

## Charger for Hearing Aids Life cycle assessment results (Midpoint)



# Charger for Hearing Aids-Endpoint

Midpoint			Normalization			Weighting				Endpoint	
Impact category	Unit	Characterization	Unit	Weight	standardization	Unit	Weight	Damage	Proportion		
Global warming, Human health	DALY	1.94E-06	Pt	41.7	8.10E-05	Pt	300	2.43E-02	18.47%	Human health	1.26E-01
Stratospheric ozone depletion	DALY	4.25E-09	Pt	41.7	1.77E-07	Pt	300	5.31E-05	0.04%		
Ionizing radiation	DALY	1.44E-09	Pt	41.7	6.00E-08	Pt	300	1.80E-05	0.01%		
Ozone formation, Human health	DALY	6.63E-09	Pt	41.7	2.76E-07	Pt	300	8.29E-05	0.06%		
Fine particulate matter formation	DALY	3.09E-06	Pt	41.7	1.29E-04	Pt	300	3.87E-02	29.40%		
Human carcinogenic toxicity	DALY	6.12E-07	Pt	41.7	2.55E-05	Pt	300	7.66E-03	5.82%		
Human non-carcinogenic toxicity	DALY	4.39E-06	Pt	41.7	1.83E-04	Pt	300	5.49E-02	41.74%		
Water consumption, Human health	DALY	2.72E-08	Pt	41.7	1.13E-06	Pt	300	3.40E-04	0.26%	Ecosystems	3.56E-03
Global warming, Terrestrial ecosystems	species.yr	5.86E-09	Pt	676	3.96E-06	Pt	400	1.59E-03	1.20%		
Global warming, Freshwater ecosystems	species.yr	1.60E-13	Pt	676	1.08E-10	Pt	400	4.33E-08	0.00%		
Ozone formation, Terrestrial ecosystems	species.yr	9.65E-10	Pt	676	6.52E-07	Pt	400	2.61E-04	0.20%		
Terrestrial acidification	species.yr	2.57E-09	Pt	676	1.74E-06	Pt	400	6.95E-04	0.53%		
Freshwater eutrophication	species.yr	1.37E-09	Pt	676	9.23E-07	Pt	400	3.69E-04	0.28%		
Marine eutrophication	species.yr	1.36E-13	Pt	676	9.21E-11	Pt	400	3.68E-08	0.00%		
Terrestrial ecotoxicity	species.yr	5.96E-10	Pt	676	4.03E-07	Pt	400	1.61E-04	0.12%		
Freshwater ecotoxicity	species.yr	7.04E-10	Pt	676	4.76E-07	Pt	400	1.90E-04	0.14%		
Marine ecotoxicity	species.yr	1.43E-10	Pt	676	9.68E-08	Pt	400	3.87E-05	0.03%		
Land use	species.yr	7.87E-10	Pt	676	5.32E-07	Pt	400	2.13E-04	0.16%		
Water consumption, Terrestrial ecosystem	species.yr	1.78E-10	Pt	676	1.20E-07	Pt	400	4.80E-05	0.04%		
Water consumption, Aquatic ecosystems	species.yr	1.97E-14	Pt	676	1.33E-11	Pt	400	5.34E-09	0.00%		
Mineral resource scarcity	\$	1.53E-02	Pt	3.57E-05	5.45E-07	Pt	300	1.64E-04	0.12%	Resources	1.96E-03
Fossil resource scarcity	\$	1.67E-01	Pt	3.57E-05	5.98E-06	Pt	300	1.79E-03	1.36%		

**Single score**  
1.32E-01

# Charger for Hearing Aids Environmental impact sequence & key raw material sequence at each stage

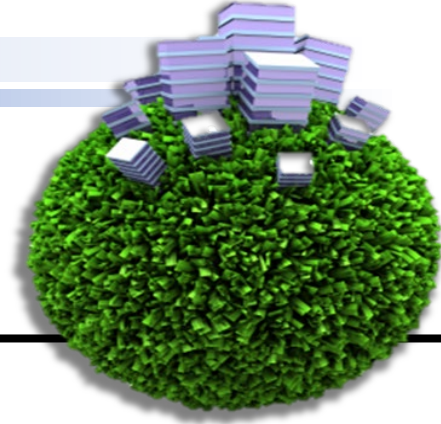
## ➤ Environmental impact sequence

ReCiPe(H)-Full life cycle stage	
Environmental impact (Percentage of damage)	Priority
	<b>Charger for Hearing Aids</b>
Fine particulate matter formation	<b>2</b> 3.87E-02 Pt (29.40%)
Global warming, Human health	<b>3</b> 2.43E-02 Pt (18.47%)
Human non-carcinogenic toxicity	<b>1</b> 5.49E-02 Pt (41.74%)
Human carcinogenic toxicity	<b>4</b> 7.66E-03 Pt (5.82%)

## ➤ Sequencing of key raw materials at each stage

Charger for Hearing Aids		Raw material name	Final damage value	Proportion
number	classification			
Process	Process investment	Electricity	7.54E-03	99.62%
M50	Direct raw materials	TR NPN	2.27E-02	16.97%
M1	Direct raw materials	PCB	1.83E-02	13.68%
M72	Direct raw materials	Connector	1.64E-02	12.29%

✓ The key raw materials of Charger for Hearing Aids are mainly PCB, TR NPN and the electricity used in the process.



# Conclusion and Recommendation

## ➤ Carbon Footprint

- ✓ From the results of Charger for Hearing Aids's Carbon Footprint Critical Raw Materials, power input in the manufacturing process is one of the hotspots.
- ✓ →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, IC MCU, and CABLE 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.

## ➤ Environmental damage assessment

- ✓ The results show that PCB is the reason for the high environmental hazard value, so we can consider whether there are alternative materials to effectively reduce the environmental impact.
- ✓ Secondly, during the manufacturing stage of the production of packaged products, it is observed that the power supply has a soft multi-faceted environmental impact, and power supply optimization should be carried out step by step. Energy-saving technologies or equipment can be adopted, as well as green power policies.

*Thank you  
for your attention*

