



# ANNUAL REPORT 2023

## PV CYCLE ITALIA



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Rosa Narcisi  
Country Manager Italy

## 1: INTRODUCTION

In 2023, PV CYCLE ITALIA continues to be a crucial reference point in the photovoltaic waste management industry.

PV CYCLE ITALIA is dedicated to ensuring that end-of-life PV Panels are collected, treated, and recycled efficiently and responsibly. This approach not only reduces environmental impact but also facilitates the recovery of secondary raw materials.

To comply with environmental impact regulations and sustainability report requirements, PV CYCLE ITALIA continues its dedication to improving environmental reporting, with the aim of building a more sustainable and responsible future.

We thank our members, partners, and customers for their trust and collaboration. We are proud of the achievements and challenges overcome together.

Rosa Narcisi  
Country Manager Italy

## 2: PV PANELS PUT ON THE ITALIAN MARKET IN 2023

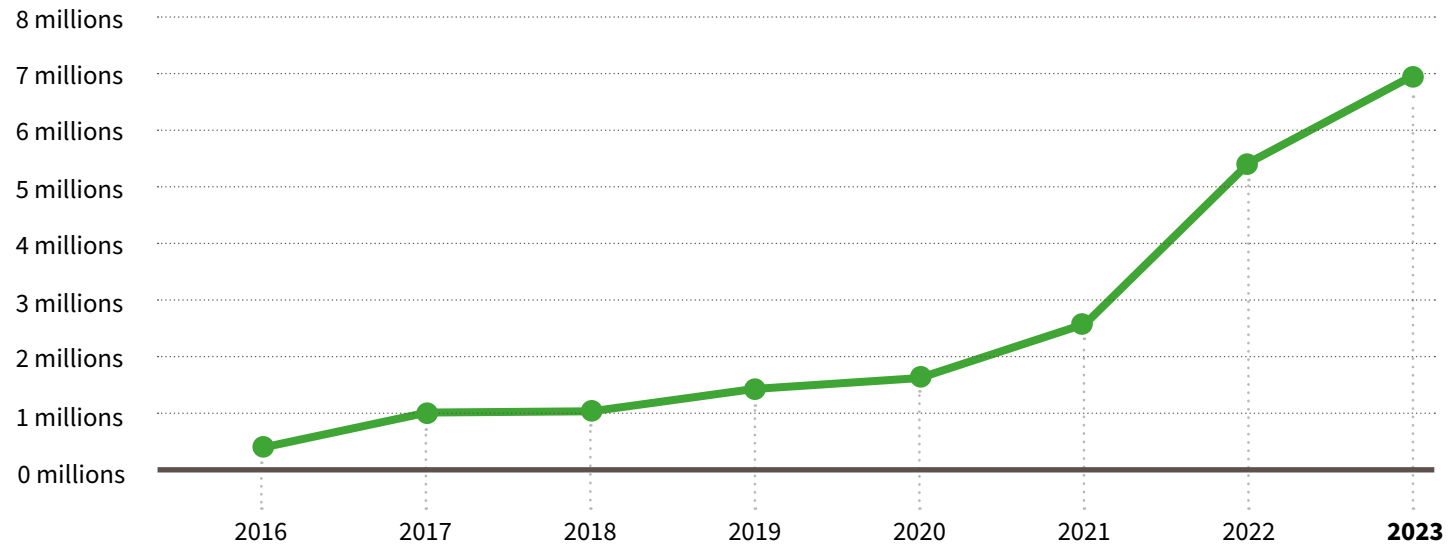
In 2023, the number of PV Panels put on the market by PV CYCLE ITALIA's member companies reached an important record of 7 million units.

Over the years, PV CYCLE ITALIA has seen a continuous growth in both its membership and the quantity of declared PV and EEE.

This growth shows the industry's dedication to sustainable practices and the correct and efficient management of WEEE, particularly PV Panels.

PV CYCLE ITALIA reaffirms itself as a leader in Italy's photovoltaic sector. This achievement highlights the importance of collaboration and mutual trust between its members and PV CYCLE ITALIA.

**Number of declared PV panels**



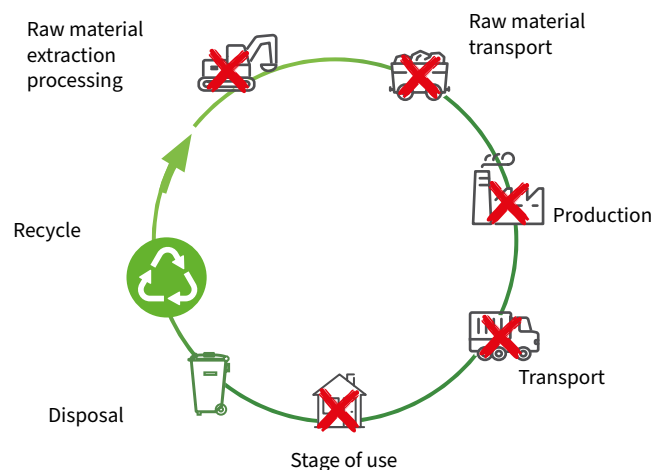
### 3: LIFE CYCLE ASSESSMENT (LCA)

Life Cycle Assessment<sup>1</sup> (LCA) refers to the collection and evaluation of inputs, outputs, and potential environmental impacts of a product, service, or organization throughout its life cycle: from raw material extraction to end-of-life management.

It analyses the life cycle of waste, thus the study begins not with the extraction of raw materials, but with the collection of waste, and ends with its final treatment, whether it be the recovery of secondary raw materials (such as MPS) or disposal.

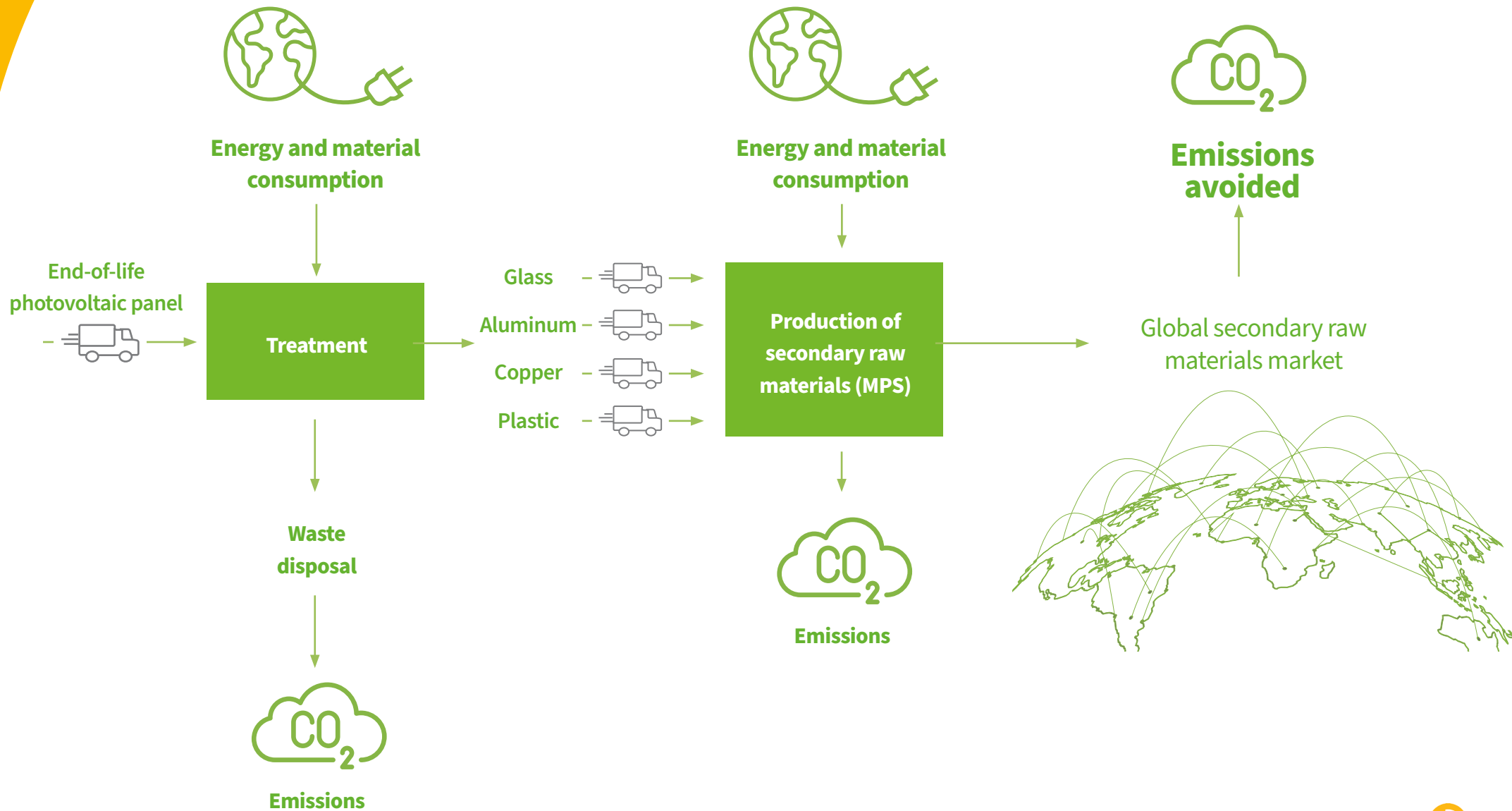
The end-of-life LCA analysis follows the “avoided product” method, which compares the net impacts of waste treatment and its fractions against the environmental benefits derived from material recovery achieved through recycling efficiencies at treatment plants.

The study aimed to quantify the environmental impacts resulting from the end-of-life management of PV Panels and household WEEE managed by PV CYCLE ITALIA in 2023.



<sup>1</sup> The analysis is conducted by Interzero in accordance with ISO LCA 14040/14044, using SimaPro software version 9.4.0.2.

## 4: OVERVIEW OF CONSIDERED FLOWS

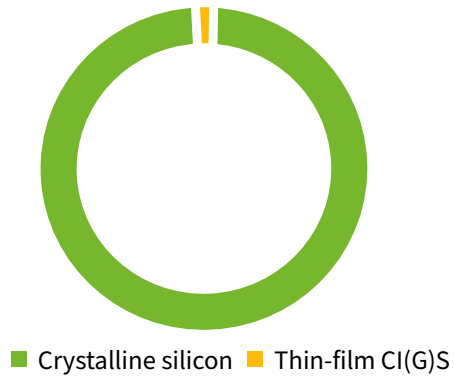




## 5: LCA ANALYSIS: COMPOSITION OF THE SAMPLE ANALYSED

In 2023, PV CYCLE ITALIA managed a total volume of photovoltaic panels amounting to **3,400 tons**: **98%** is attributable to crystalline **silicon technologies** (monocrystalline and polycrystalline); **2%** is attributable to **thin-film CI(G)S** technology;

Total PV Panel volume



PV Panel technology	KG processed by PV CYCLE ITALIA in 2023	Number of pieces	% on total PV Panels
Crystalline silicon	3 314 823	159 367	98,0%
Thin-film CI(G)S	74 680	4 649	2,0%
Total	3 391 383	164 016	100,0%

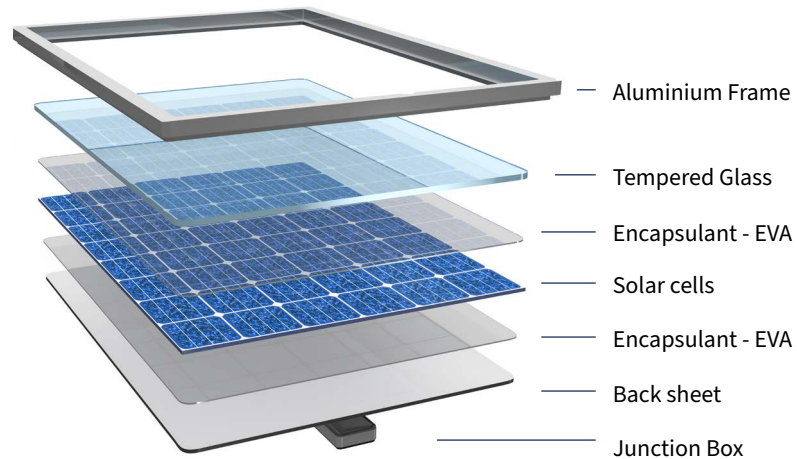


## 6: LCA ANALYSIS OF THE END-OF-LIFE FOR SILICON PHOTO-VOLTAIC PANELS

PV CYCLE ITALIA managed **3,400 tons** of silicon photovoltaic panels.

The total impact avoided thanks to the treatment efficiencies of the plants amounts to **-6,596,498 kg CO<sub>2</sub>eq.**

This reduction is equivalent to the life cycle emissions of **130 medium-sized gasoline cars.**



The process recovers several materials: aluminum, copper, glass, and plastic.

Fraction	Silicon PV
Copper	1,9%
Aluminum	17,5%
Plastic	14,4%
Glass	66,2%

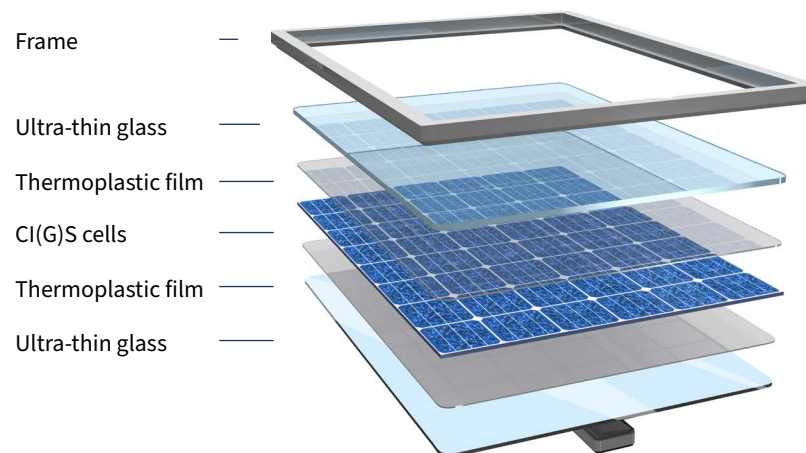


## 7: LCA ANALYSIS OF THE END-OF-LIFE FOR THIN-FILM PHOTOVOLTAIC PANELS

PV CYCLE ITALIA managed **75 tons** of thin-film photovoltaic panels.

The total impact avoided thanks to the treatment efficiencies of the plants amounts to **-27,632 kg CO<sub>2</sub>eq.**

This reduction is equivalent to the emissions of **3 medium-sized gasoline cars traveling 46,000 km.**

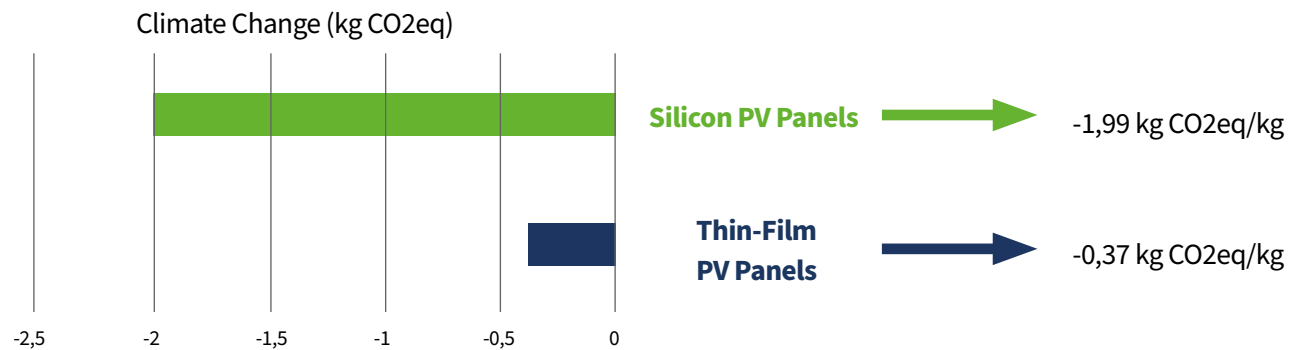


The thin-film photovoltaic panel is primarily composed of glass (87% by mass).

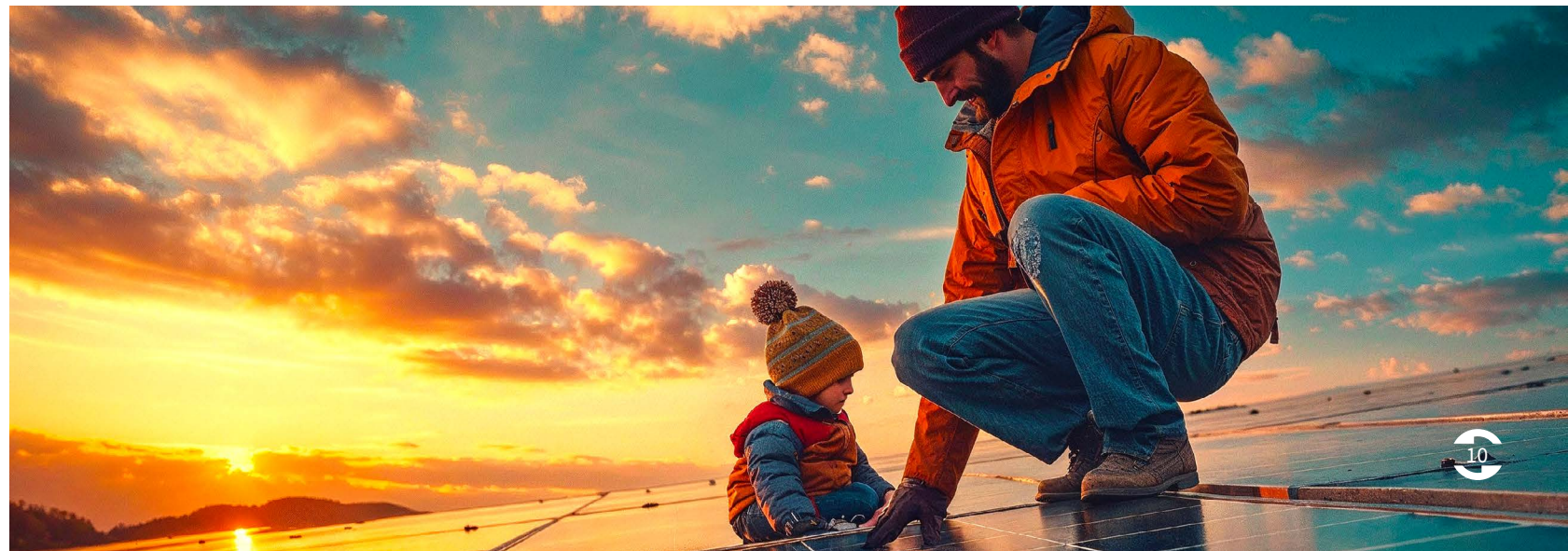
Fraction	Thin-film PV Cl(G)S
Copper	0,1%
Aluminum	0,3%
Plastic	12,0%
Glass	87,0%
Indium-gallium-selenium	0,1%

## 8: ANALYSIS RESULTS: CLIMATE CHANGE

The comparative analysis highlights how end-of-life treatment of crystalline silicon panels generates greater environmental benefits compared to CI(G)S Panels.



**Specifically, the total CO<sub>2</sub>eq saved is equivalent to the lifecycle emissions of 130 gasoline cars.**



## 9: OVERVIEW OF HOUSEHOLD WEEE GROUPS

Household WEEE is divided into five Groups in order to facilitate its proper treatment:

- R1: Refrigeration appliances (refrigerators, freezers, air conditioners, etc.)
- R2: Large household appliances (washing machines, dishwashers, ovens, hobs, etc.)
- R3: TVs (Monitors and screens)
- R4: Various electronic products (small appliances, consumer electronics, IT and telecommunications, etc.)
- R5: Light sources

The quantities of household WEEE managed by PV CYCLE ITALIA in 2023 are displayed in the following table

WEEE Groups	KG processed by PV CYCLE ITALIA in 2023	% on total PV Panels	KG CO2eq saved by recycling	GJ energy saved through recycling
R1	66 920	1,16%	73 600	630
R2	150 675	2,61%	144 600	1 217
R3	11 825	0,20%	2 909	57
R4	5 548 710	96,00%	8 128 196	56 042
R5	1549	0,03%	449	-

## Household WEEE Group R1: Refrigeration appliances

PV CYCLE ITALIA managed **67 tons** of **Household WEEE Group R1**.

The total impact avoided thanks to the treatment efficiencies of the plants amounts to **-73,600 kg CO<sub>2</sub>eq**.

This value corresponds to the life cycle emissions of **1 EURO4 gasoline car**.

Fraction	kg CO <sub>2</sub> -eq	% benefits	% impacts
ABS plastic	-0,0010	0,1%	
Aluminum	-0,2120	18,9%	
Copper	-0,0434	3,9%	
Glass	-0,1200	0,3%	
PS Plastic	-0,0119	10,7%	
PP Plastic	-0,0121	1,1%	
PU	-0,7130	1,1%	
Iron	-0,0001	63,7%	
Wood	-0,0031	0,0%	
Steel	-0,0031	0,3%	
CFC gas	0,0103		58,1%
Oil	0,0074		41,9%
<b>Total</b>	<b>-1,1</b>	<b>100,0%</b>	<b>100,0%</b>

## Household WEEE Group R2: Large household appliances

PV CYCLE ITALIA managed **151 tons** of **Household WEEE Group R2**.

The total impact avoided thanks to the treatment efficiencies of the plants amounts to **-144,600 kg CO<sub>2</sub>eq**.

This value corresponds to the life cycle emissions of **3 EURO4 gasoline car**.

Fraction	kg CO <sub>2</sub> -eq	% benefits	% impacts
Aluminum	-0,102	10,2%	
Copper	-0,0394	3,9%	
PP Plastic	-0,00274	0,3%	
Iron	-0,782	78,2%	
Steel	-0,0741	7,4%	
Wood	-0,000215	0,0%	
ABS plastic	0,0108		29,5%
Cement	0,0101		27,6%
Glass	0,00107		2,9%
PA Plastic	0,00292		8,0%
PS Plastic	0,0117		32,0%
<b>Total</b>	<b>-0,96</b>	<b>100,0%</b>	<b>100%</b>



## Household WEEE Group R3: TVs

PV CYCLE ITALIA managed **12 tons** of **Household WEEE Group R3**.

The total impact avoided thanks to the treatment efficiencies of the plants amounts to **-2,909 kg CO<sub>2</sub>eq**.

This value corresponds to the life cycle emissions of **1 EURO4 gasoline car**.

Fraction	kg CO <sub>2</sub> -eq	% benefits	% impacts
Aluminum	-0,0752	12%	
Copper	-0,213	33%	
PMMA Plastic	-0,133	20%	
Iron and Steel	-0,230	36%	
Wood	-0,00023	0%	
ABS-PC Plastic	0,104		26%
ABS Plastic	0,247		61%
Glass	0,0441		11%
PCB	0,01		2%
PS Plastic	0,00074		0%
<b>Total</b>	<b>-0,246</b>	<b>100,0%</b>	<b>100,0%</b>

## Household WEEE Group R4: Various electronic products

PV CYCLE ITALIA managed **5,600 tons** of **Household WEEE Group R4**.

The total impact avoided thanks to the treatment efficiencies of the plants amounts to **-8,128,196 kg CO<sub>2</sub>eq**.

This value corresponds to the life cycle emissions of **160 EURO4 gasoline cars**.

Fraction	kg CO <sub>2</sub> -eq	% benefits	% impacts
Copper	-0,161	14,8%	
PP Plastic	-0,0307	2,8%	
PS Plastic	-0,0462	4,2%	
Iron	-0,539	49,5%	
Steel	-0,0719	6,6%	
Aluminum	-0,24	22,0%	
ABS-PC Plastic	0,106		26,5%
ABS Plastic	0,29		72,4%
Glass	0,0004		0,1%
Wood	0,0043		1,1%
<b>Total</b>	<b>-0,688</b>	<b>100,0%</b>	<b>100,0%</b>

## Household WEEE Group R5: Light sources

PV CYCLE ITALIA managed **1,50 tons** of **Household WEEE Group R5**.

The total impact avoided thanks to the treatment efficiencies of the plants amounts to **-449 kg CO<sub>2</sub>eq.**

This value corresponds to the life cycle emissions of **1 EURO4 gasoline car.**

Fraction	kg CO <sub>2</sub> -eq	% benefits	% impacts
Aluminum	-0,237	65%	
Copper	-0,0329	9%	
Glass	-0,05	14%	
Iron & Steel	-0,022	6%	
PC Plastic	-0,022	6%	
Fluorescent powders	0,0135		17%
Plastics	0,0662		83%
<b>Total</b>	<b>-0,28</b>	<b>100%</b>	<b>100%</b>



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