14° September 2023

LIFE RESKIBOOT

MID-TERM SECTORIAL TECHNICAL WORKSHOP

Evaluation and monitoring of environmental and circularity impacts and benefits

Studio Fieschi & soci

Co-funded by the European Union

Performed activities

Activity	Performed activities
Definition of LCA methodological aspects	LCA Goal&Scope
Analysis of negative impacts	Analysis of possible negative impacts
LCI preparation	Preparation of checklists to collect inventory data
LCI	LCA data collection
LCA modelling	Comparison between skiboots
PCR Development	Draft and open consultation

ACTIVITY – WORK DONE

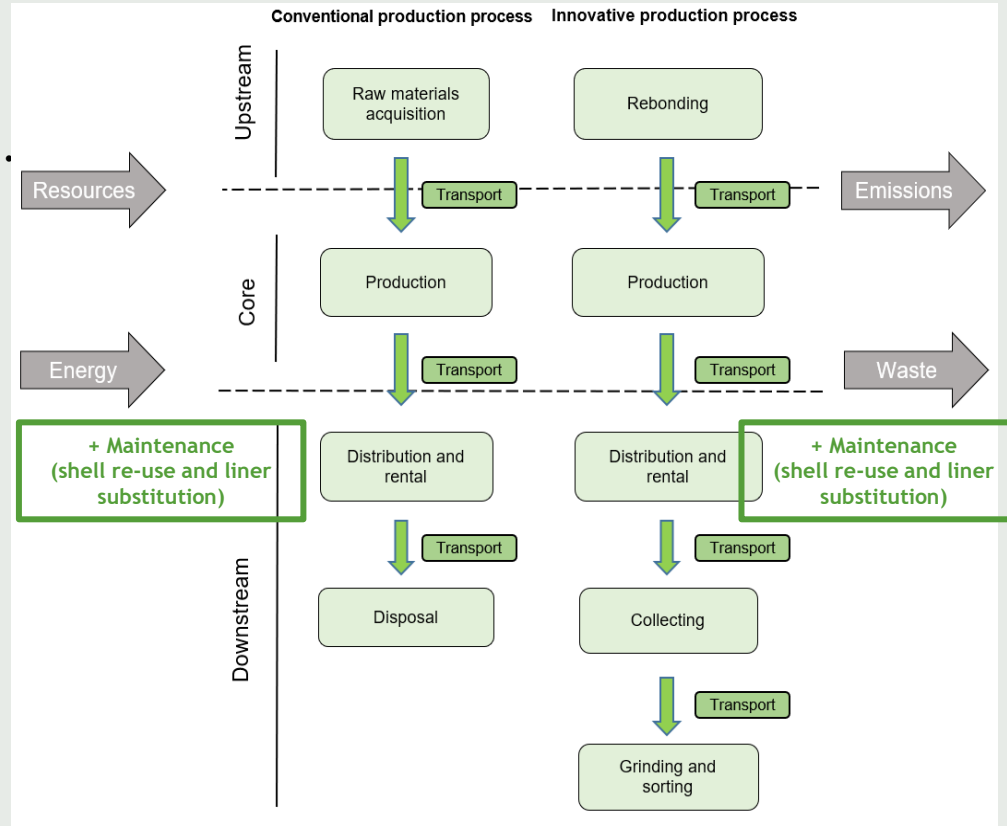
Goal&Scope

The **goal** of the LCA study is to assess the environmental performance of new Reskiboot process and make a comparison between the new and conventional system.

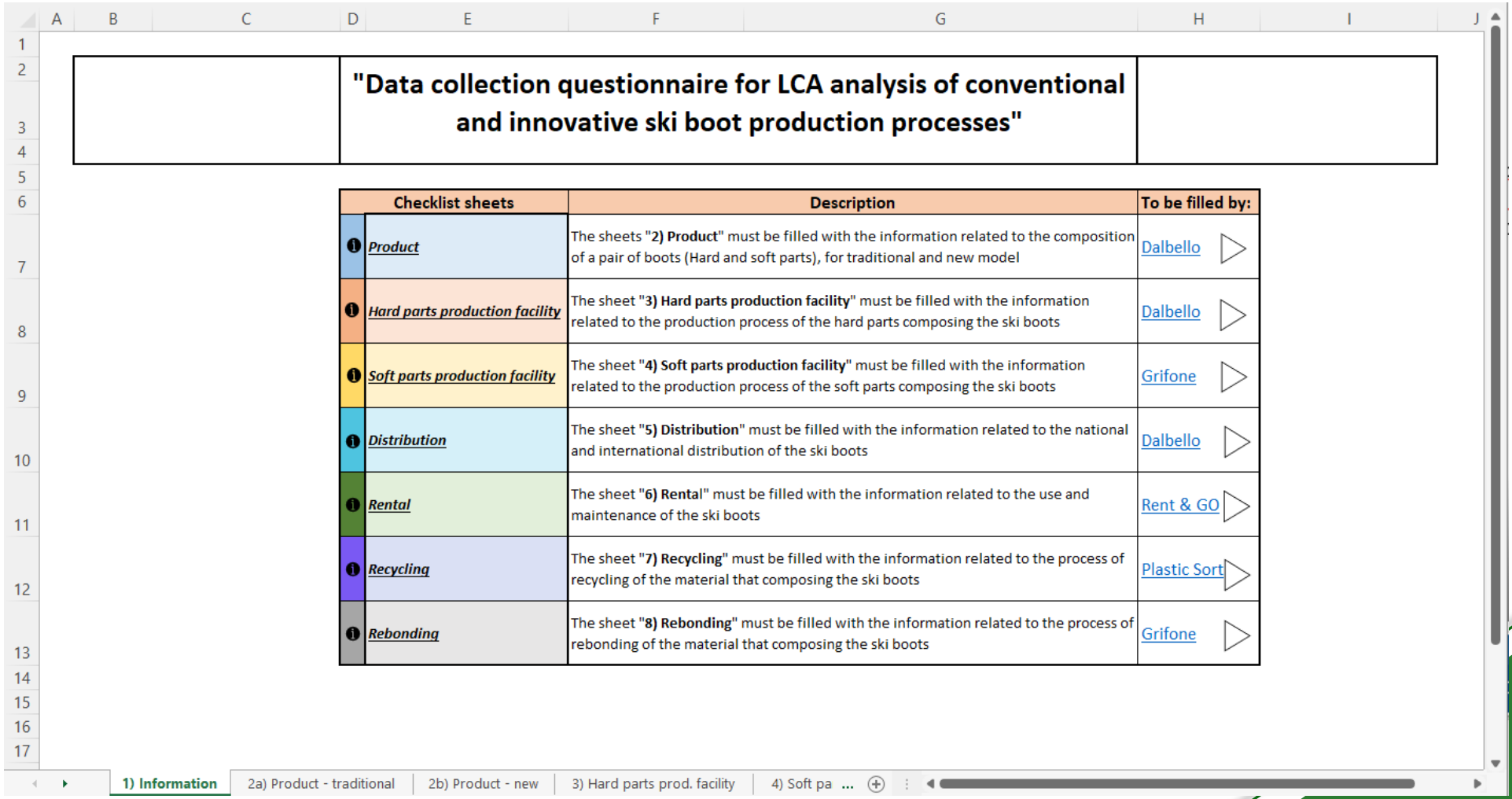
The **scope** of the LCA study is the production, use and recycling of a 100% recycled ski boot.

The **functional unit** is «a pair of ski boot for rental, used for 100 skiing days».

The LCA scope for Reskiboot is from **cradle to grave**, i.e., including all stages in the ski boots value chain: raw materials, manufacturing, sale and logistics, use and maintenance, end-of-life. The processes are grouped in three macro-stages, i.e. upstream, core and downstream.



ACTIVITY – WORK DONE



"Data collection questionnaire for LCA analysis of conventional and innovative ski boot production processes"

Checklist sheets	Description	To be filled by:
Product	The sheets "**2) Product**" must be filled with the information related to the composition of a pair of boots (Hard and soft parts), for traditional and new model	Dalbello
Hard parts production facility	The sheet "**3) Hard parts production facility**" must be filled with the information related to the production process of the hard parts composing the ski boots	Dalbello
Soft parts production facility	The sheet "**4) Soft parts production facility**" must be filled with the information related to the production process of the soft parts composing the ski boots	Grifone
Distribution	The sheet "**5) Distribution**" must be filled with the information related to the national and international distribution of the ski boots	Dalbello
Rental	The sheet "**6) Rental**" must be filled with the information related to the use and maintenance of the ski boots	Rent & GO
Recycling	The sheet "**7) Recycling**" must be filled with the information related to the process of recycling of the material that composing the ski boots	Plastic Sort
Rebonding	The sheet "**8) Rebonding**" must be filled with the information related to the process of rebonding of the material that composing the ski boots	Grifone

1) Information | 2a) Product - traditional | 2b) Product - new | 3) Hard parts prod. facility | 4) Soft pa ...

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ACTIVITY – WORK DONE

COMPANY DATA	
Name	DALBELLO S.R.L
Address	Via Frattalunga, 12, 31011 Asolo TV
Referent	Stefano Prosdocimo
Contact	
Reference year	2022
Date	19/12/2022

Traditional skiboot Materials (1/2)

Soft parts	Number of pairs produced	Total weight (g)
Liner	1	1082

Grifone ex-factory

Materials	Quantity (g)	Total scraps weight (g)	Note	Origin	Distance (km)	Mode of transport
TPO	380	11,4			1394	Road freight
PVC	114	22,8			879	Road freight
Schiuma PE (20%)	216	43,2			1135	Road freight
Schiuma PU (20%)	213	42,6			1135	Road freight
Schiuma Agglomerato (10%)	108	21,6			1168	Road freight
Mastice	20	/			959	Road freight
Attivatore	1	/			1181	Road freight
PE (fettuccia)	20				1749	Road freight
Nylon (filo)	10				1749	Road freight

Soft parts	Number of pairs produced	Total weight (g)
Belt	1	76,34

Materials	Supplier	Lenght (mm)	Total scraps weight (g)	Note	Origin	Distance (km)	Mode of transport
PVC		280				5	Road freight
Nylon		1340				5	Road freight
Velcro		930				5	Road freight

ACTIVITY – WORK DONE

Traditional skiboot Materials (2/2)

Hard parts	Number of pairs produced	Total weight (g)
Shell	1	2767,377

Materials	Supplier	Weight (g)	Total scraps weight (g)	Note	Origin	Distance (km)	Mode of transport
Cuff							
TPU Elastollan		926,668	120,9 (13%)			280	Road freight
Master		18,752	/			290	Road freight
Lower							
TPU Elastollan		1785,575	145,756 (8%)			280	Road freight
Master		36,382	/			290	Road freight

Hard parts	Number of pairs produced	Total weight (g)
Footboard	1	114,282

Materials	Supplier	Weight (g)	Total scraps weight (g)	Note	Origin	Distance (km)	Mode of transport
PP Copolymer							
Grinded plastics		112	2,285 (2%)			39	Road freight
Master		2,282	/			290	Road freight

Clamping elements
General clamping

Materials	Supplier	Weight (g)	Total scraps weight (g)	Note	Origin	Distance (km)	Mode of transport
Toe							
TPU Elastollan		90,8	1,854 (2%)	*[Declare recycled content]*		280	Road freight
Master		1,9	/	*[Declare recycled content]*		290	Road freight
Heel							
TPU Elastollan		108,4	2,212 (2%)	*[Declare recycled content]*		280	Road freight
Master		2,2	/	*[Declare recycled content]*		290	Road freight
Water protection plates							
Sofpreme		22,54	0,46 (2%)	*[Declare recycled content]*		128	Road freight
Master		0,46	/	*[Declare recycled content]*		290	Road freight
Levers (L/R) + Racks							
Aluminium		249,82		*[Declare recycled content]*		45	Road freight
Steel		305,28		*[Declare recycled content]*		45	Road freight

ACTIVITY – WORK DONE

Reskiboot materials (1/2)

COMPANY DATA	
Name	DALBELLO S.R.L
Address	Via Frattalunga, 12, 31011 Asolo TV
Referent	Stefano Prosdocimo
Contact	[illegible]
Reference year	2022
Date	16/12/2022

Soft parts	**Number of pairs produced**	**Total weight (g)**
Liner	1	1082

Grifone ex-factory

Materials	**Supplier**	**Quantity**	**Total scraps weight (g)**	**Note**	**Origin**	**Distance (km)**	**Mode of transport**
Grinded TPO	DALBELLO	380	11,4			1190	Road freight
Schiuma PU	[illegible]	160	32			1191	Road freight
Schiuma Agglomerato	PLASTIC SORT SRL	127	25,4			1390	Road freight
Schiuma Agglomerato acquistata		304	60,8			1487	Road freight
Mastice		20	/			959	Road freight
Attivatore		1	/			959	Road freight
PE (fettuccia)		20				1749	Road freight
Recycled nylon		60	3,5			879	Road freight
Nylon		10				1749	Road freight

ACTIVITY – WORK DONE

Reskiboot materials (2/2)

Hard parts	Number of pairs produced	Total weight (g)
Shell	1	2767,377

Materials	Supplier	Weight (g)	Total scraps weight (g)	Note	Origin	Distance (km)	Mode of transport
Cuff							
Recycled TPU	PLASTIC SORT SRL	926,668	120,9 (13%)			200	Road freight
Master	[illegible]	18,752	/			290	Road freight
Lower							
Recycled TPU	PLASTIC SORT SRL	1785,575	145,756 (8%)			200	Road freight
Master	[illegible]	36,382	/			290	Road freight

Hard parts	Number of pairs produced	Total weight (g)
Footboard	1	114,282

Materials	Supplier	Weight (g)	Total scraps weight (g)	Note	Origin	Distance (km)	Mode of transport
PP Copolymer							
Grinded plastics	PLASTIC SORT SRL	112	2,285 (2%)	Recycled material		200	Road freight
Master	[illegible]	2,282	/			290	Road freight

Clamping elements
General clamping

Materials	Supplier	Weight (g)	Total scraps weight (g)	Note	Origin	Distance	Mode of transport
Toe				*[Declare recycled content]*			
Recycled TPU	PLASTIC SORT SRL	90,8	1,854 (2%)	*[Declare recycled content]*		200	Road freight
Master	[illegible]	1,9	/	*[Declare recycled content]*		290	Road freight
Heel				*[Declare recycled content]*			
Recycled TPU	PLASTIC SORT SRL	108,4	2,212 (2%)	*[Declare recycled content]*		200	Road freight
Master	[illegible]	2,2	/	*[Declare recycled content]*		290	Road freight
Water protection plates							
Grinded TPU	DALBELLO	22,54	0,46 (2%)	*[Declare recycled content]*		0	Road freight
Master	[illegible]	0,46	/	*[Declare recycled content]*		290	Road freight
Levers (L/R) + Racks							
Aluminium		249,82		*[Declare recycled content]*		15	Road freight
Steel		305,28		*[Declare recycled content]*		15	Road freight

ACTIVITY – WORK DONE

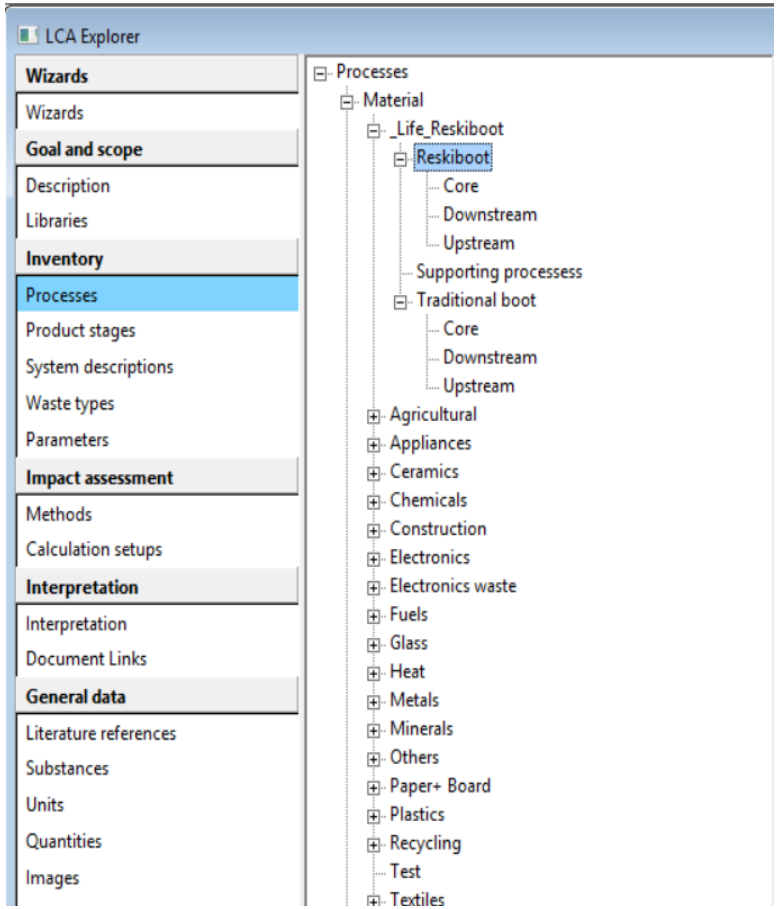
LCIA

The impact assessment is calculated with the LCA software Simapro with the database Ecoinvent v3.9.

A LCA model has been created for each product divided in life cycle stages.

- **Upstream**
- **Core**
- **Downstream**

for each life cycle stage all the data collected in the inventory phase have been input and associated with an appropriate dataset.



ACTIVITY – WORK DONE

LCA Modelling

UPSTREAM

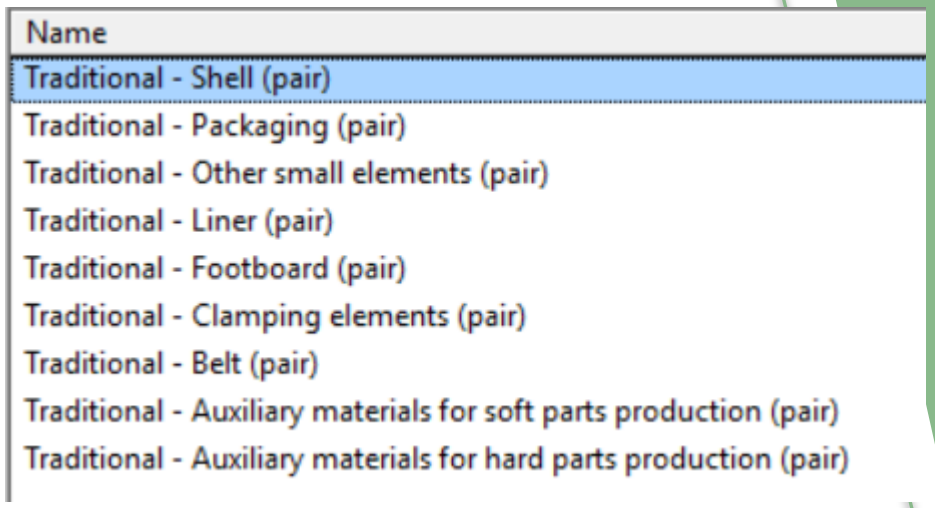
The Upstream phase is characterized by the production of raw materials and the manufacturing of semi-finished products and packaging used in the production of ski boot components

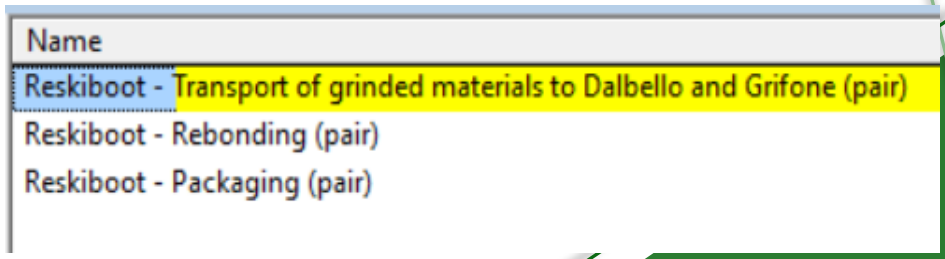
Traditional ski boot:

- Production of raw materials
- Production of packaging
- Production of semi-finished products

Reskiboot:

- Production and of virgin raw materials
- Production and of packaging
- Transport of grinded materials from Plasticsort to Dalbello and Grifone
- Rebonding process





ACTIVITY – WORK DONE

LCA Modelling

CORE

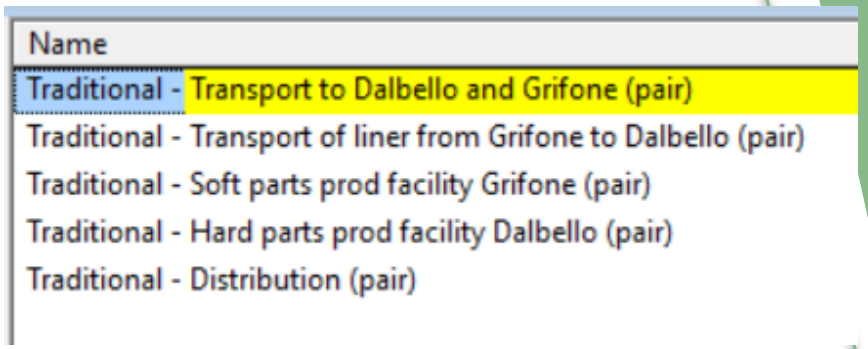
The Core phase is characterized by the transport of raw materials and semi-finished products from the supplier to the production site, as well as the resource consumption related to the production of the finished product and its assembly, and also from the distribution of the ski boot to the rental points.

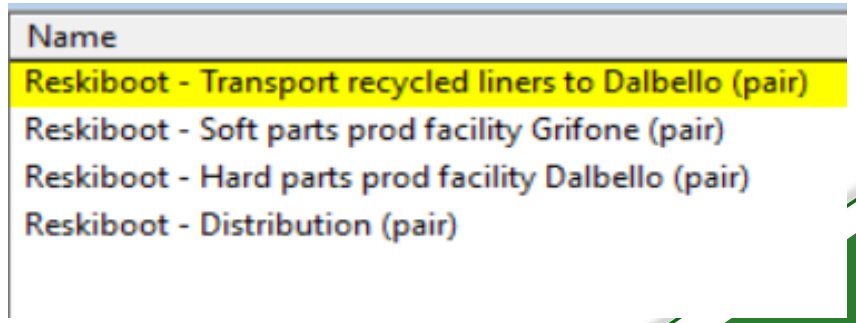
Traditional ski boot:

- Transport of raw materials and semif. products to Dalbello and Grifone
- Dalbello and Grifone manufacturing
- Distribution to the Rent & Go rental points

Reskiboot:

- Transport of recycled liners from Grifone to Dalbello
- Dalbello and Grifone manufacturing
- Distribution to the Rent & Go rental points





ACTIVITY – WORK DONE

LCA Modelling

DOWNSTREAM

The Downstream phase is characterized by the maintenance of ski boots throughout their useful life and their end-of-life management.

Traditional ski boot:

- Production and supply of component that need to be replaced during the ski boot lifetime (liners, hooks and heels)
- Ski boot sanitizing
- End of life

Reskiboot:

- Production and supply of component that need to be replaced during the ski boot lifetime (liners, hooks and heels)
- Ski boot sanitizing
- Transport to recycling
- Recycling

Name
Traditional - sanitizing products (pair)
Traditional - Liners substituted (pair)
Traditional - Heel and Hooks substituted (pair)
Traditional - End of life (pair) - Sensitivity analysis
Traditional - End of life (pair)

Name
Reskiboot - Transport to recycling (pair)
Reskiboot - transport and recycling (Plasticsort)
Reskiboot - Sanitizing products (pair)
Reskiboot - Liners substituted (pair)
Reskiboot - Heel and Hooks substituted (pair)

ACTIVITY – WORK DONE

LCA Modelling

The analysis has been carried out on the **materials** used to produce a **traditional Skiboot** and a **new Skiboot** (made of >70%w/w recycled materials).

The functional unit used for the analysis is the **pair of boots**.

The results of this analysis were obtained using the Simapro software and Ecoinvent database.

The calculation method and the impact categories are those defined by **PEF** standard.

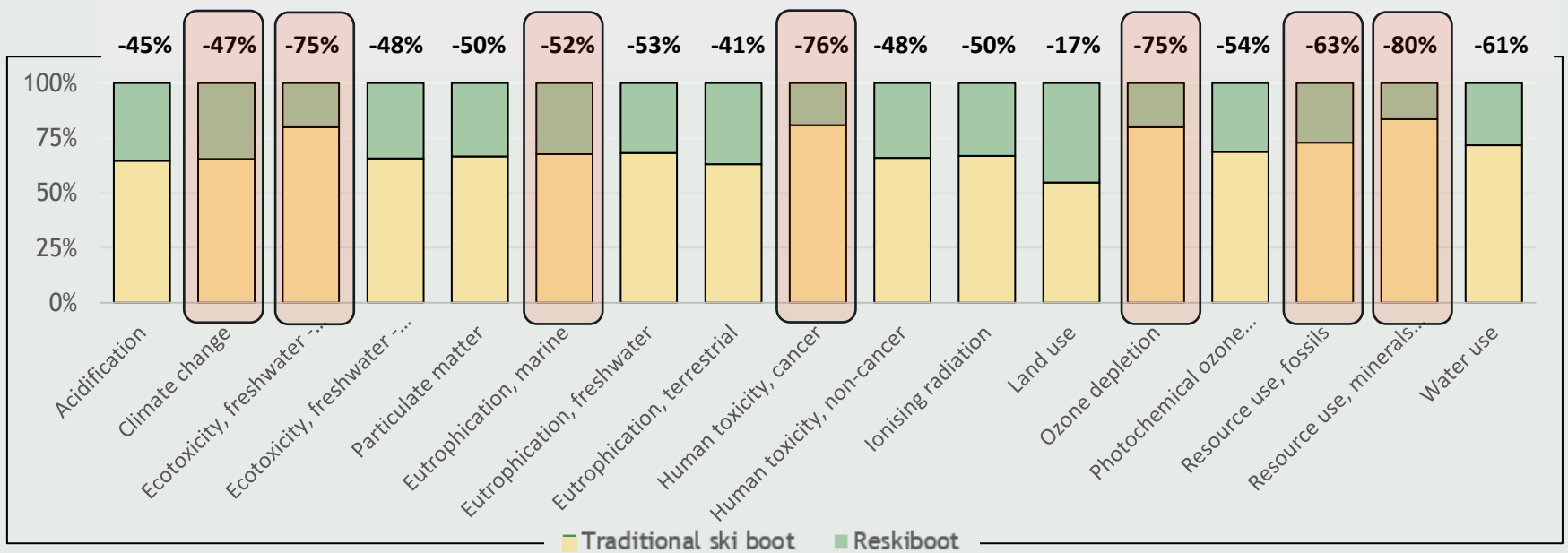
The results presented below are preliminary and do not constitute the final outcomes of the study

KEY RESULTS

LCIA

Comparison between Traditional ski boot and Reskiboot – Life Cycle impacts

Comparing **traditional ski boots** and **Reskiboot**, a substantial **reduction** in impacts has been observed for each indicator. This reduction is primarily attributed **to the use of entirely recycled plastics**, as well as the reduction in **energy and resource consumption** compared to traditional processes for manufacturing the individual components



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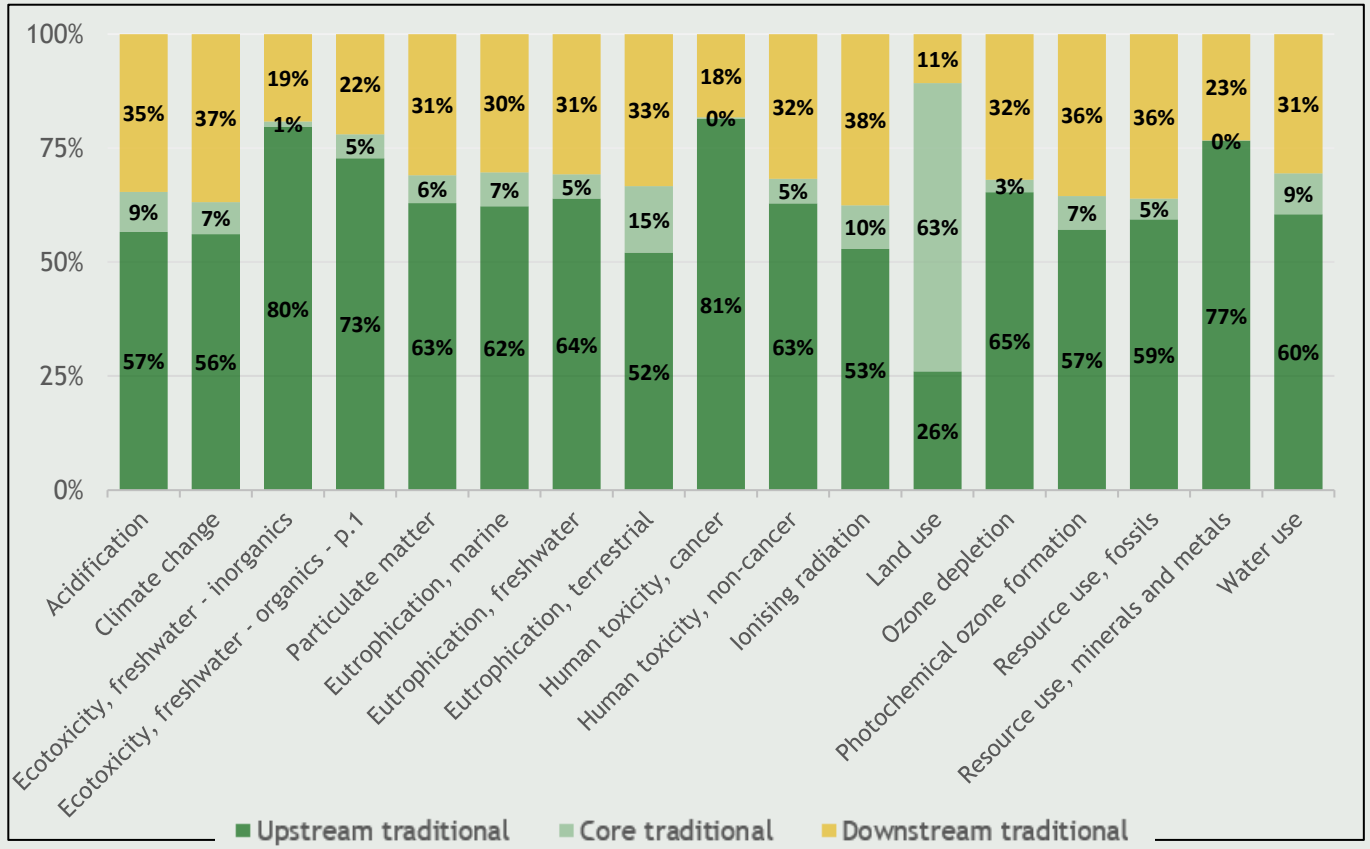
KEY RESULTS

Description of the results

Contribution analysis of Traditional boot – Life Cycle impacts

Most of the impacts for each environmental indicator are driven by the **Upstream phase**, and in particularly characterized from the **production of fossil-origin plastic components**.

The plastic components represent more than the **80%** of the weight of a pair of ski boot.



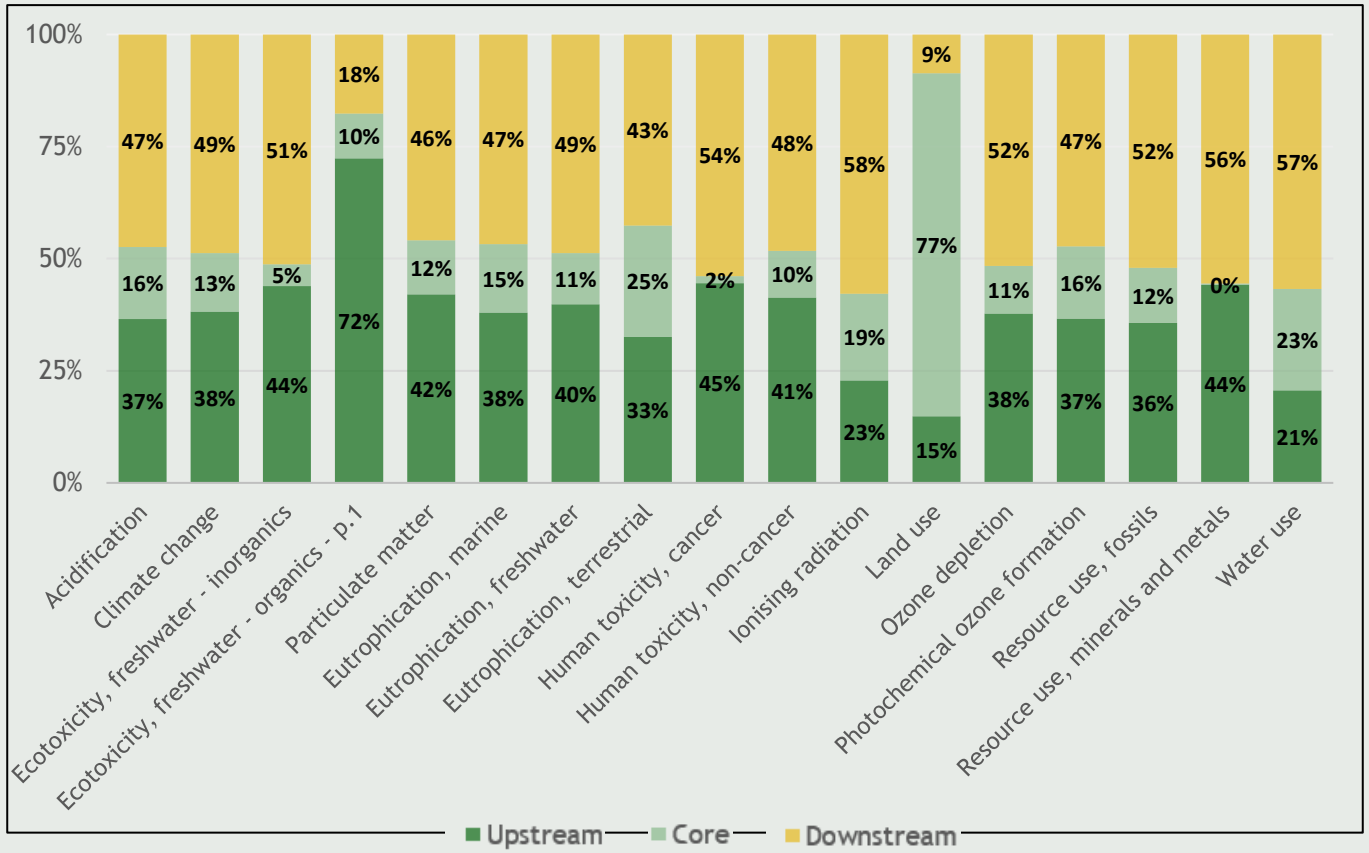
KEY RESULTS

Description of the results

Contribution analysis of Reskiboot boot – Life Cycle impacts

In **Reskiboot**, most of the plastic used in the boot production comes from recycling.

Resulting in a shift of impacts for nearly every indicator from the **Upstream** to the **Downstream phase.**

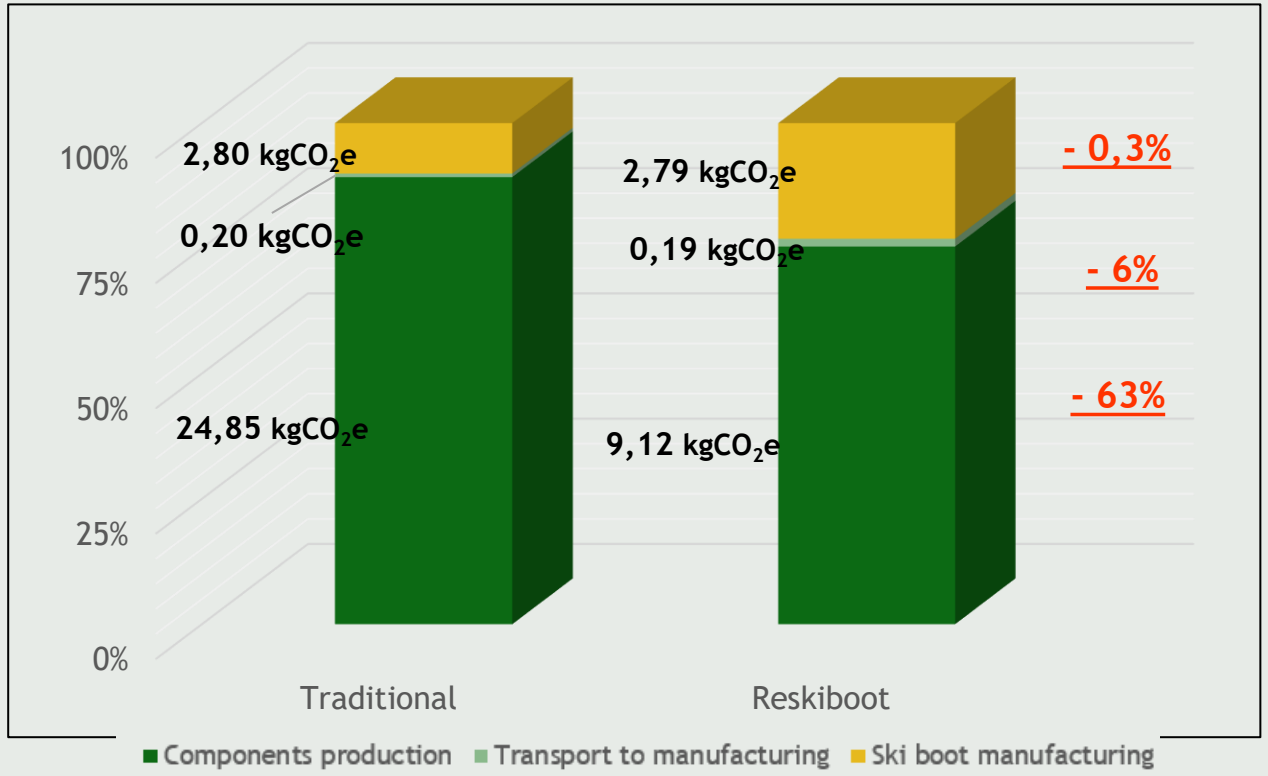


KEY RESULTS

Description of the results

Contribution analysis on components production – GWP indicator

The impact in terms of **GWP** generated by the ski boot components experiences a significant reduction between the **two scenarios** being compared



CONCLUSION

Life Cycle Assessment

In summary, the **Life Cycle Assessment (LCA)** provided valuable insights into the environmental impact of traditional versus recycled ski boots.

Results clearly highlight distinction between the two lies in the upstream phase, encompassing production and distribution

- In the traditional ski boots **Upstream** phase, the use of virgin materials, resources and energy during production, significantly contributing to their environmental impacts
- Instead, Reskiboot exhibit a considerably lower impacts during his **Upstream** phase, thanks to the use of recycled materials
- The **Core** phase is similar for both boots, due to the same production processes for both hard and soft components.
- The **Downstream** phase has a greater impact on traditional boots, as it involves distributing the boots to other European cities for reuse. In contrast, Reskiboot implements a **recycling process** that is environmentally virtuous in terms of **energy consumption** and resource utilization.

CONCLUSION

Description of the work performed

While the Reskiboot production process has significantly lower impacts compared to traditional boots, there is still considerable potential for further **reducing the environmental impacts** of this product, for example:

- Using metal components (steel and aluminum) with a high recycled content
- Further reducing the distances of raw material suppliers
- Separating and recycling/reusing the metal components before the recycling process would contribute to increase the recycling efficiency and reducing the waste generated during the process
- If each organization participating in the product life cycle used only renewable energy, the emissions associated with the production and recycling of Reskiboot components would experience a substantial reduction

THANK YOU FOR THE ATTENTION!

Co-funded by the European Union
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GRIFONE
DALBELLO
rent and go
SPORT YOURSELF
Plastic Sort
ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA
DEPARTMENT OF CIVIL, CHEMICAL, ENVIRONMENTAL AND MATERIALS ENGINEERING
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