



Environmental
profile of building elements
details per variant

9. Staircase

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9. *Summary*
Building professionals and the government currently have to resort to foreign environmental classification systems to acquire an insight into the Environmental Performance of Materials used in Buildings and Building Elements (MMG: Milieugerelateerde Materiaalprestatie van Gebouw(element)en). However, often the tools and information involved are not transparent and/or not specifically related to the Flemish-Belgian building context. This publication proposes a database of environmental profiles of 115 variants of building elements, all of which are specific for the Flemish-Belgian building context. It offers an open and transparent presentation of the MMG method of determination that was used as the basis for the calculation of the environmental profiles. Although the resulting building materials methodology is far from final, it is a dynamic model (including a determination method) that will be fine-tuned and expanded in the future. In that context, this publication should be perceived as a communication tool to facilitate the dialogue with stakeholders in the future.

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12. *Other titles on this subject*
Milieugerelateerde Materiaalprestatie van Gebouwelementen (MMG report) (www.ovam.be/bouwmaterialenmethodiek)

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Environmental profile of building elements:
details per variant

9. Staircase

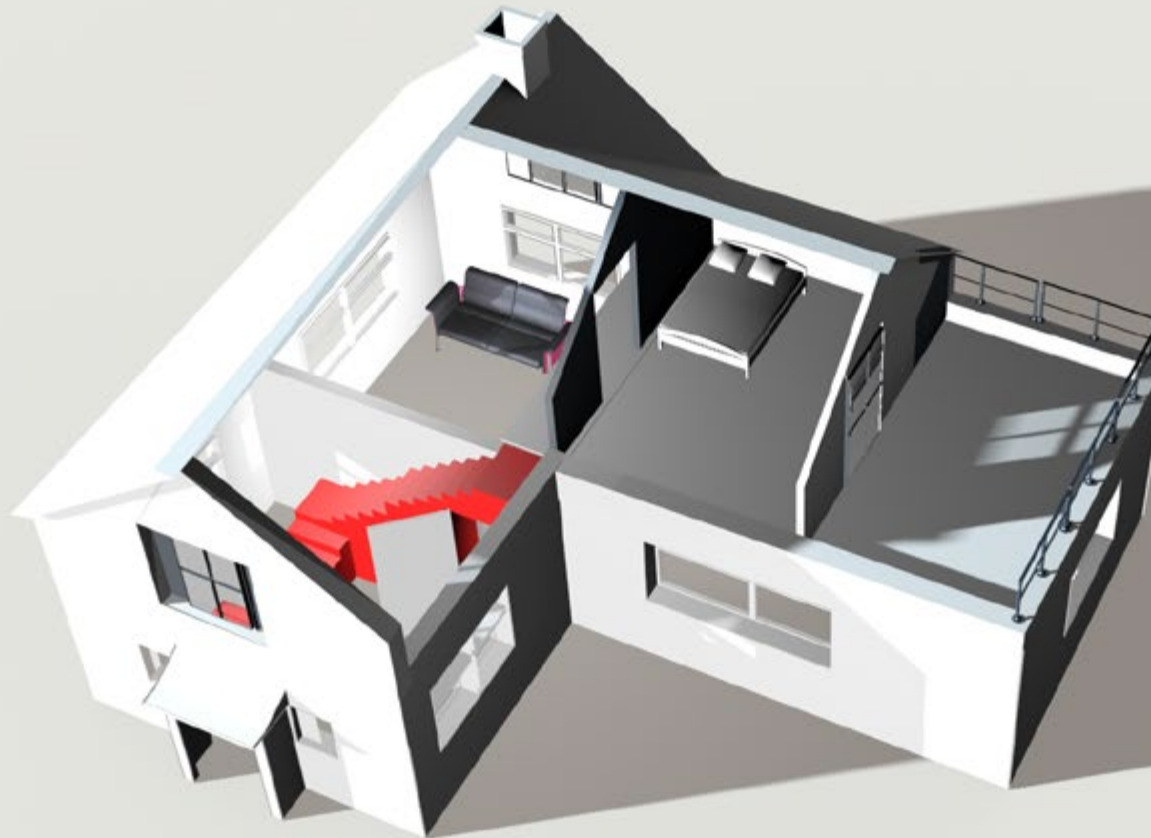


Table V 9: overview of the composition of the variants “staircase”

Staircase: 5 types				
1	staircase1_wood_open	wood open	varnish	wooden banister
2	staircase2_wood_closed	wood closed	varnish	wooden banister
3	staircase3_concrete	concrete	natural/polished	metal banister
4	staircase4_concrete_tiles	concrete	tiles	metal banister
5	staircase5_steel	steel	paint	steel banister

Table CEN 9: overview of the individual CEN indicators for the variants ‘staircases’

	climate change	ozone depletion	acidification (land)	eutrophication	photochem. oxidant form.	depletion non-fossil	depletion fossil
	kg CO2 eq	kg CFC-11 eq	kg SO2 eq	kg PO4--- eq	kg C2H4	kg Sb eq	MJ, net cal
Staircase							
staircase1_wood_open	3,66E+02	3,95E-05	1,63E+00	6,44E-01	8,22E-02	1,52E-03	4,95E+03
staircase2_wood_closed	4,82E+02	5,04E-05	1,98E+00	8,21E-01	1,04E-01	2,12E-03	6,60E+03
staircase3_concrete	1,46E+03	7,47E-05	4,51E+00	1,91E+00	3,75E-01	5,66E-03	2,50E+04
staircase4_concrete_tiles	1,73E+03	1,03E-04	5,50E+00	2,29E+00	4,75E-01	1,40E-02	3,02E+04
staircase5_steel	1,95E+03	1,10E-04	6,43E+00	4,24E+00	8,05E-01	7,66E-03	2,56E+04

Table CEN+ 9: overview of the individual CEN+ indicators for the variants 'staircases'

	human toxicity	particulate matter formation (PM)	Ionising radiation (humans)	ecotox. (terrestrial)	ecotox. (fresh water)	ecotox. (marine)	land occupation (forest)	land occupation (urban)	land transf. (nature)	land transf. (rainforest)	water
	DALY	DALY	DALY	kg 1,4-DB eq	kg 1,4-DB eq	kg 1,4-DB eq	species.yr	species.yr	species.yr	species.yr	m3
Staircase											
staircase1_wood_open	8,77E-05	1,65E-03	3,93E-06	2,06E-01	2,46E+00	2,55E+00	4,41E-05	5,08E-07	3,99E-07	3,99E-09	3,36E+00
staircase2_wood_closed	1,29E-04	1,49E-03	6,37E-06	3,66E-01	3,35E+00	3,48E+00	3,68E-05	4,78E-07	3,94E-07	4,32E-09	4,72E+00
staircase3_concrete	2,88E-04	2,33E-03	3,85E-06	9,20E-02	9,25E+00	9,58E+00	2,58E-07	2,22E-07	3,09E-07	8,64E-09	2,65E+01
staircase4_concrete_tiles	3,50E-04	5,68E-03	4,69E-06	1,16E-01	1,08E+01	1,11E+01	3,66E-07	3,09E-07	4,14E-07	1,20E-08	2,87E+01
staircase5_steel	6,36E-04	4,12E-03	1,23E-05	1,79E-01	2,36E+01	2,41E+01	5,20E-07	4,73E-07	5,33E-07	8,31E-09	2,37E+01

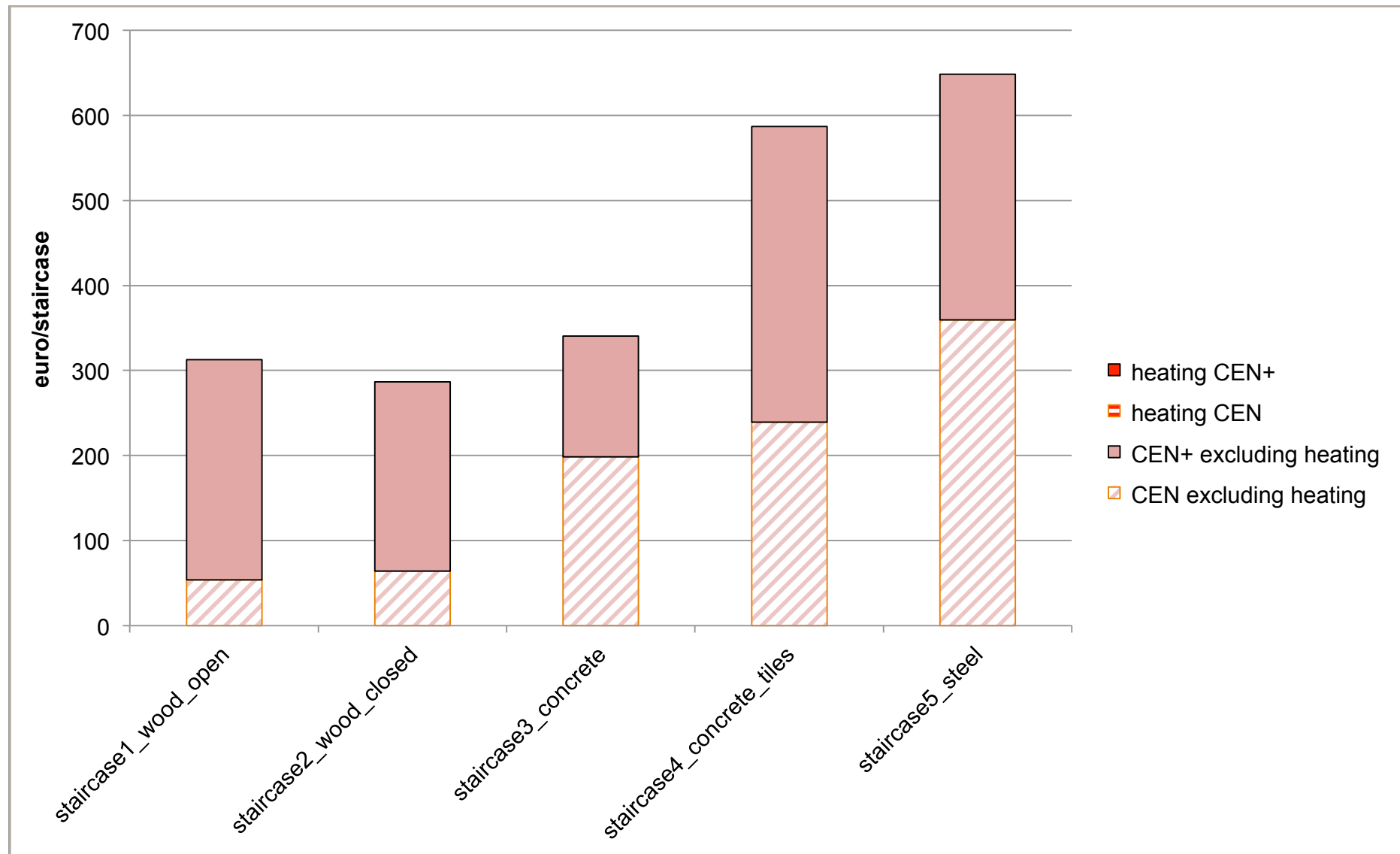


Figure E 9: Aggregated environmental profiles (split up into CEN and CEN+) of several building element variants 'staircase', expressed in monetary units and distinguishing between purely materials-related and heat-transfer-related environmental impact.

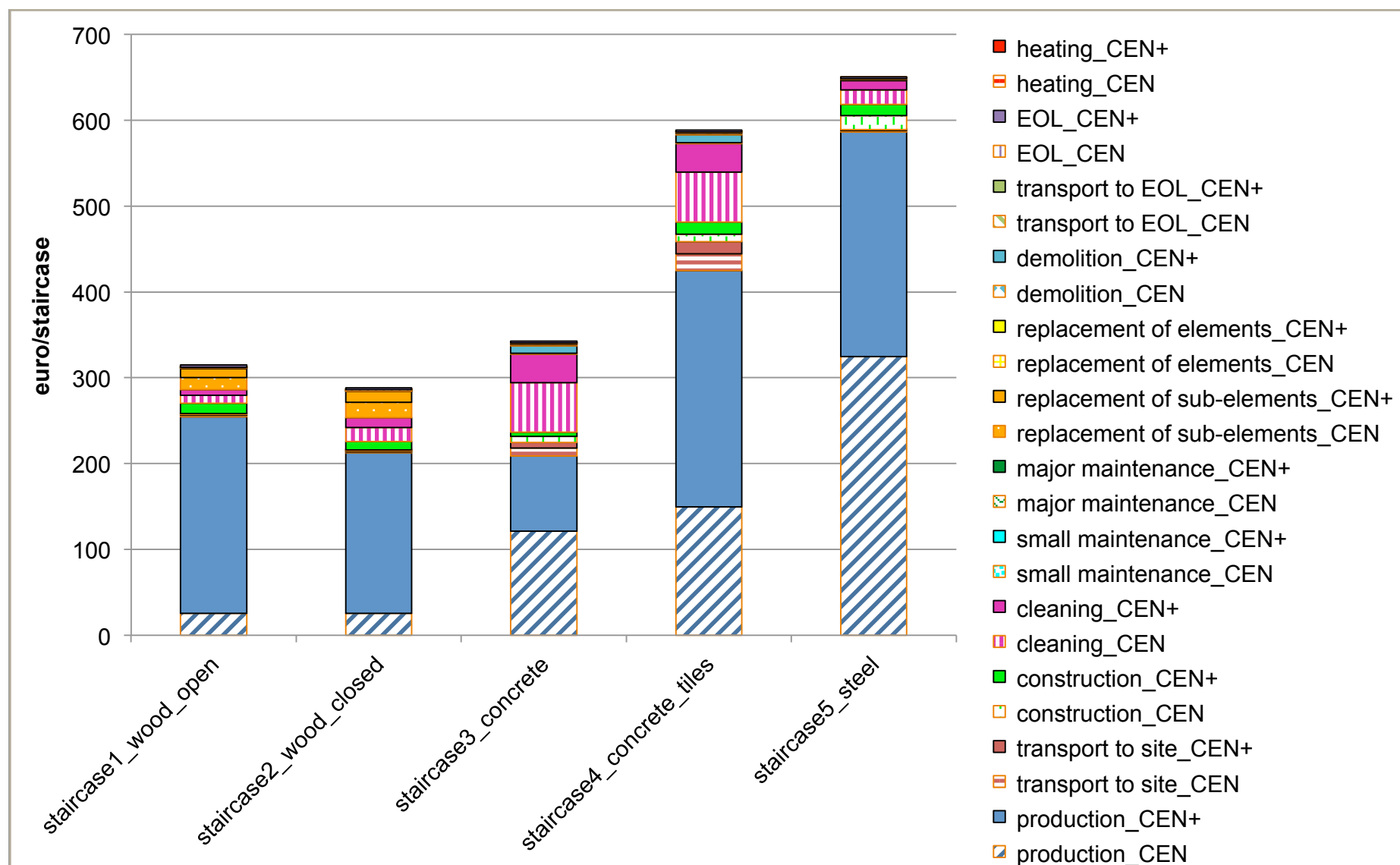


Figure I 9: Aggregated environmental profiles (split up into CEN and CEN+) for several building element variant 'staircase' per environmental indicator, expressed in monetary units.

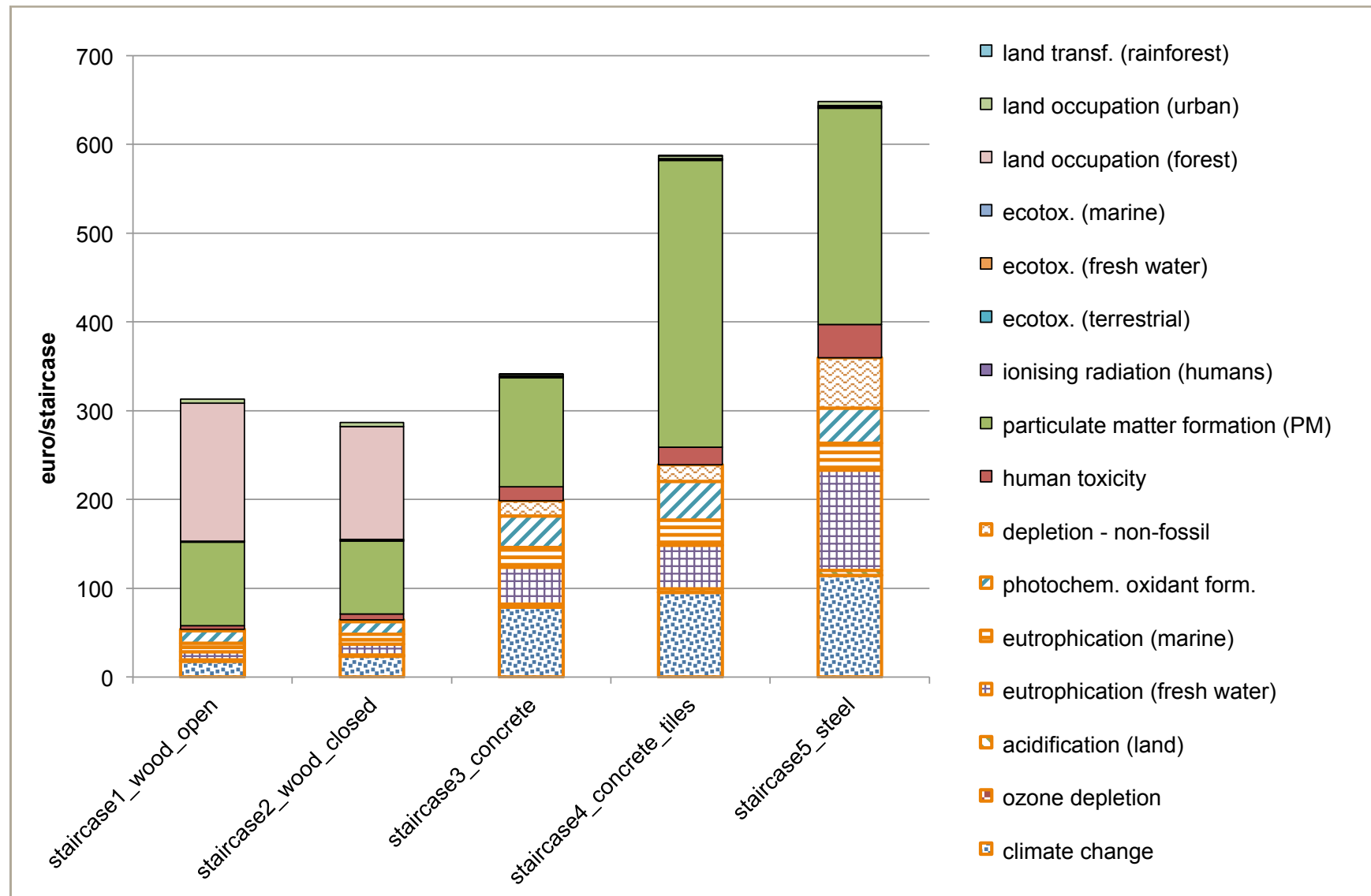


Figure L 9: Aggregated environmental profiles (split up into CEN and CEN+) for several building element variants 'staircase' per life cycle stage, expressed in monetary units.

9.1. staircase1_wood_open

Table 9.1: overview of the detailed composition of variant 'staircase1_wood_open'

Description	eh	KO	GO	VV	Type VV	Ratio	d (m)	λ (W/m.K)	R (m ² .K/W)
staircase1_wood_open									
staircase (open) - wood - in situ - step	step			120	necessary	17		na	na
staircase - wood - in situ - stair string	step			120	necessary	17		na	na
staircase - wood - in situ - wall string	step			120	necessary	17		na	na
wooden stair post (2) - open side (wooden newel)	stairs			120	aesthetic	1	1,2	na	na
wooden railing - open side (wooden railing)	step			60	aesthetic	17	0,86	na	na
wooden railing - open side (wooden railing) - varnish	step			10	aesthetic	17		na	na
wooden stair post (2) - open side (wooden newel) - varnish	stairs			10	aesthetic	1		na	na
Staircase (closed) finish - wood - varnish - step (24 cm)	step			10	aesthetic	17		na	na
Staircase (closed) finish - wood - varnish - timber string on open side (stair string)	step			10	aesthetic	17		na	na
Staircase (closed) finish - wood - varnish - timber string on wall side (wall string)	step			120	aesthetic	17		na	na

- u: unit;
- MiM: minor maintenance frequency;
- MaM: major maintenance frequency;

- Repl: replacement frequency;
- type Repl: type of replacement (necessary or aesthetic);
- ratio: quantity per m²;

- t: layer thickness (in m);
- λ : heat conduction coefficient (in W/m.K);
- R: thermal resistance = t/λ (in m².K/W)

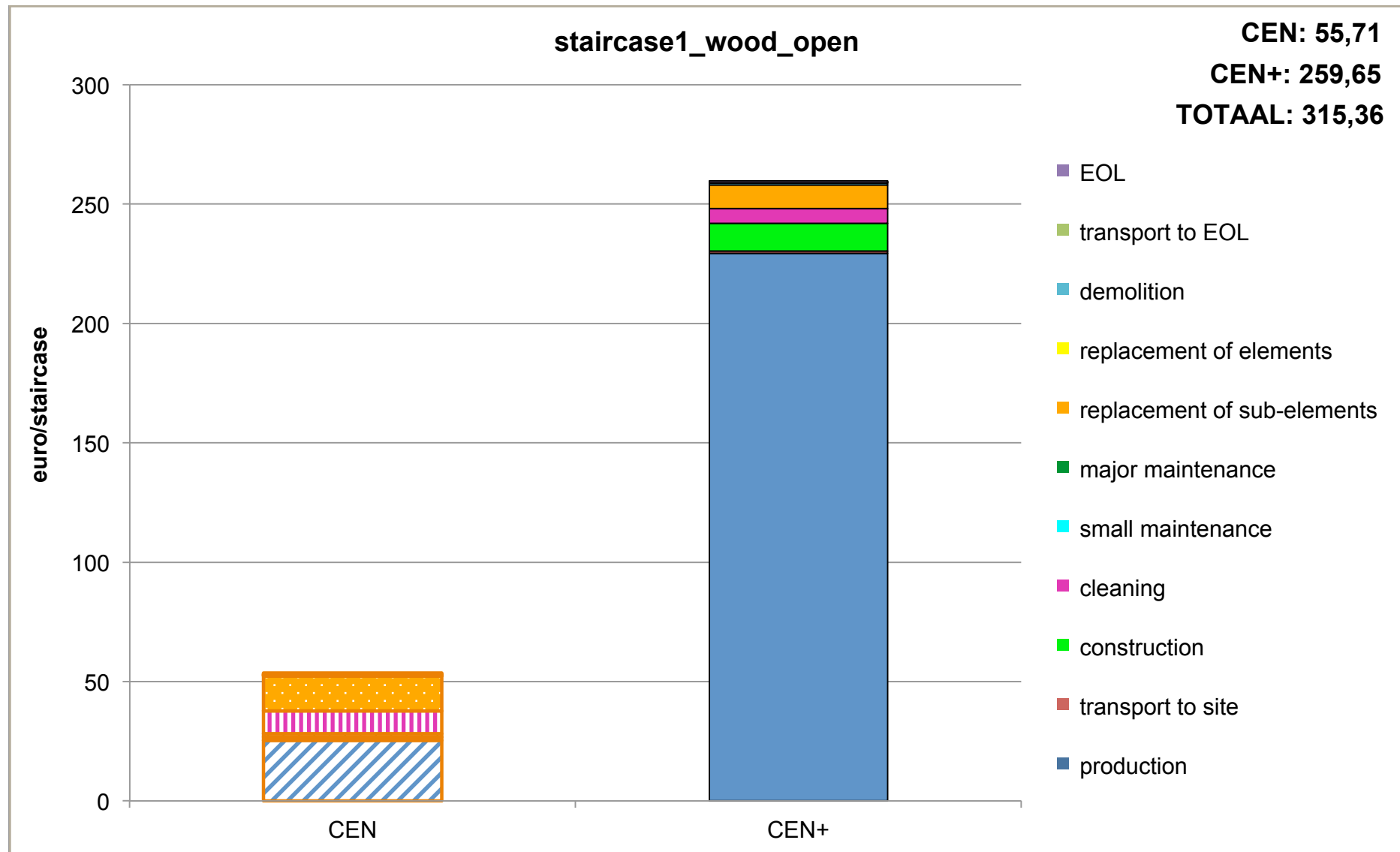


Figure staircase 9.1.1: Aggregated environmental profile (divided into CEN and CEN+) of variant 'staircase1_wood_open' per life cycle stage, expressed in monetary units.

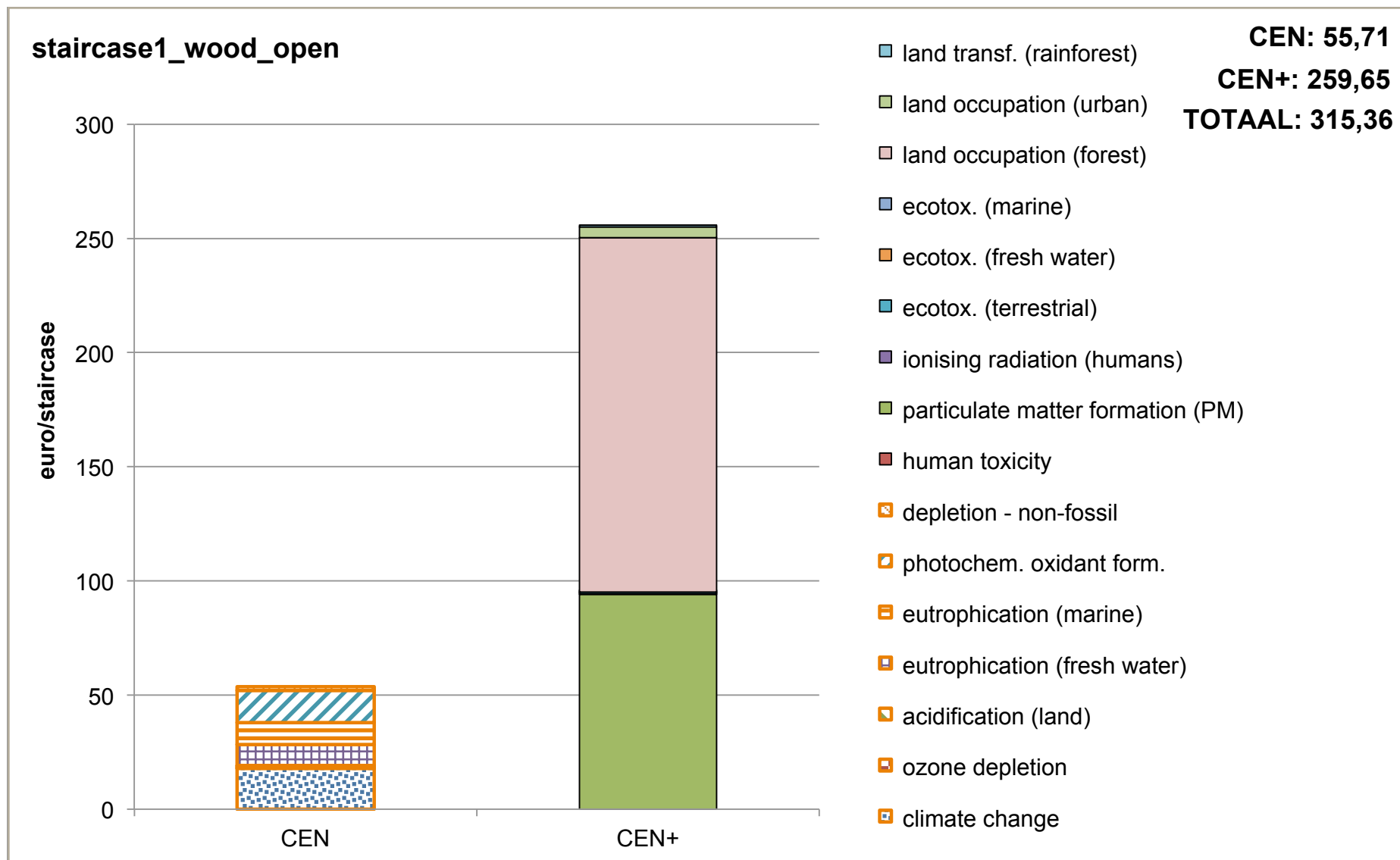


Figure staircase 9.1.2: Aggregated environmental profile (divided into CEN and CEN+) of variant 'staircase1_wood_open' per environmental indicator, expressed in monetary units.

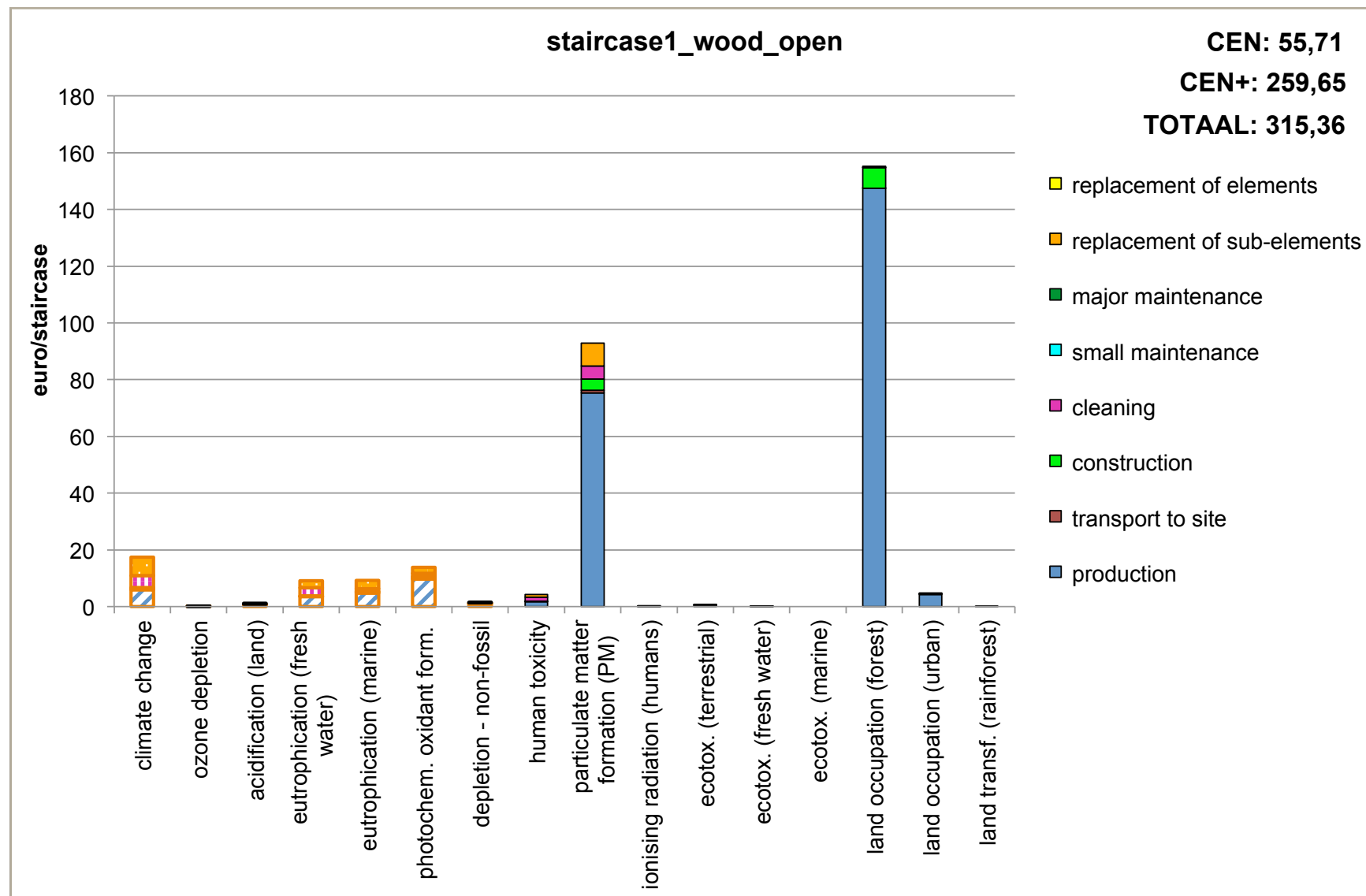


Figure staircase 9.1.3: Aggregated environmental profile (divided into CEN and CEN+) of variant 'staircase1_wood_open' per life cycle stage and per individual environmental indicator, expressed in monetary units.

9.2. staircase2_wood_closed

Table 9.2: overview of the detailed composition of variant 'staircase2_wood_closed'

Description	eh	KO	GO	VV	Type VV	Ratio	d (m)	λ (W/m.K)	R (m ² .K/W)
staircase2_wood_closed									
staircase (closed) - wood - in situ - step + riseboard	step			120	necessary	17		na	na
staircase - wood - in situ - stair string	step			120	necessary	17		na	na
staircase - wood - in situ - wall string	step			120	necessary	17		na	na
wooden stair post (2) - open side (wooden newel)	stairs			120	aesthetic	1	1,2	na	na
wooden railing - open side (wooden railing)	step			60	aesthetic	17	0,86	na	na
wooden railing - open side (wooden railing) - varnish	step			10	aesthetic	17		na	na
wooden stair post (2) - open side (wooden newel) - varnish	stairs			10	aesthetic	1		na	na
Staircase (closed) finish - wood - varnish - step (24 cm)	step			10	aesthetic	17		na	na
Staircase (closed) finish - wood - varnish - riseboard (18 cm)	step			10	aesthetic	17		na	na
Staircase (closed) finish - wood - varnish - timber string on open side (stair string)	step			10	aesthetic	17		na	na
Staircase (closed) finish - wood - varnish - timber string on wall side (wall string)	step			120	aesthetic	17		na	na

- u: unit;
- MiM: minor maintenance frequency;
- MaM: major maintenance frequency;

- Repl: replacement frequency;
- type Repl: type of replacement (necessary or aesthetic);
- ratio: quantity per m²;

- t: layer thickness (in m);
- λ : heat conduction coefficient (in W/m.K);
- R: thermal resistance = t/λ (in m².K/W)

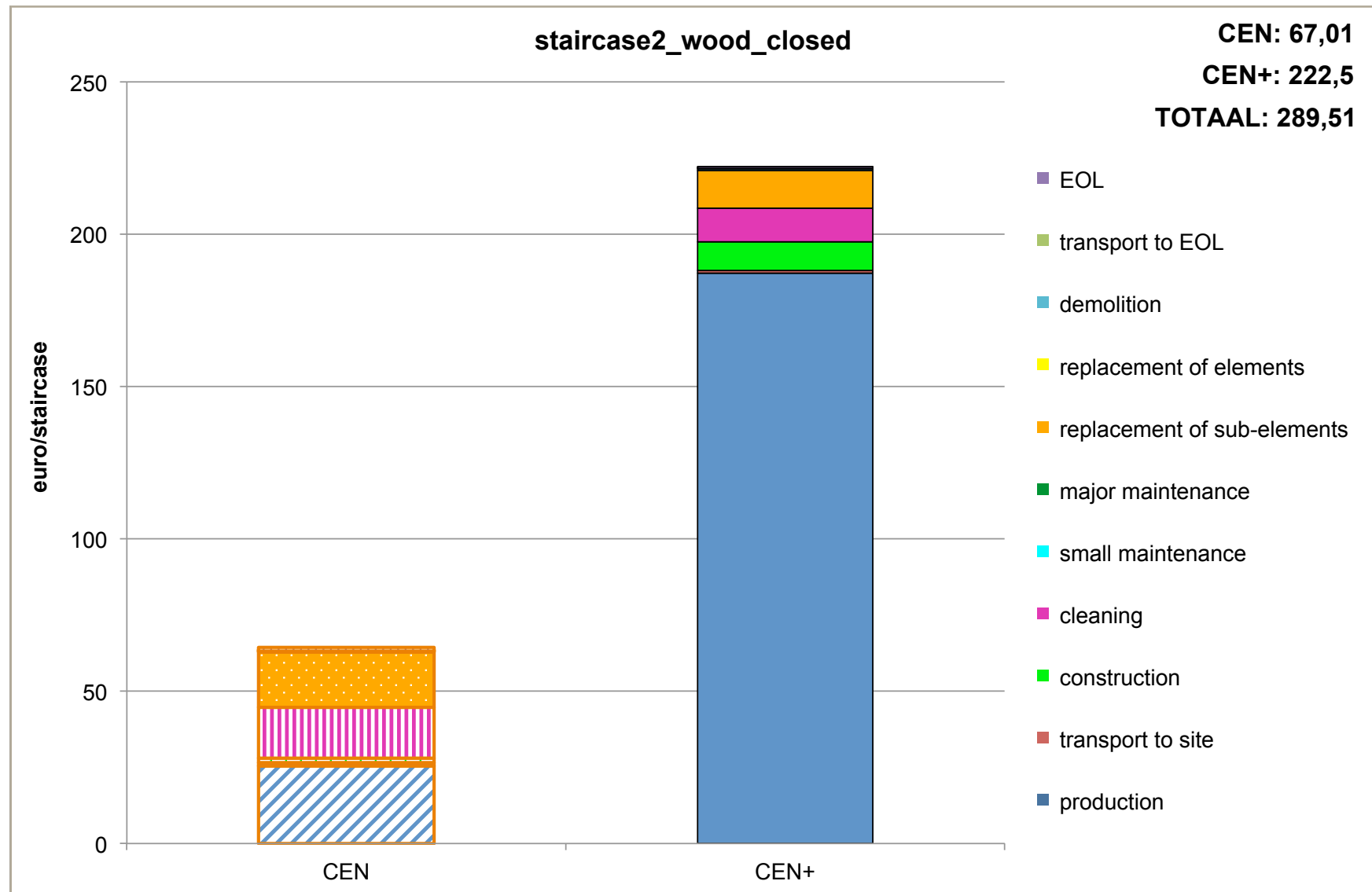


Figure staircase 9.2.1: Aggregated environmental profile (divided into CEN and CEN+) of variant 'staircase2_wood_closed' per life cycle stage, expressed in monetary units.

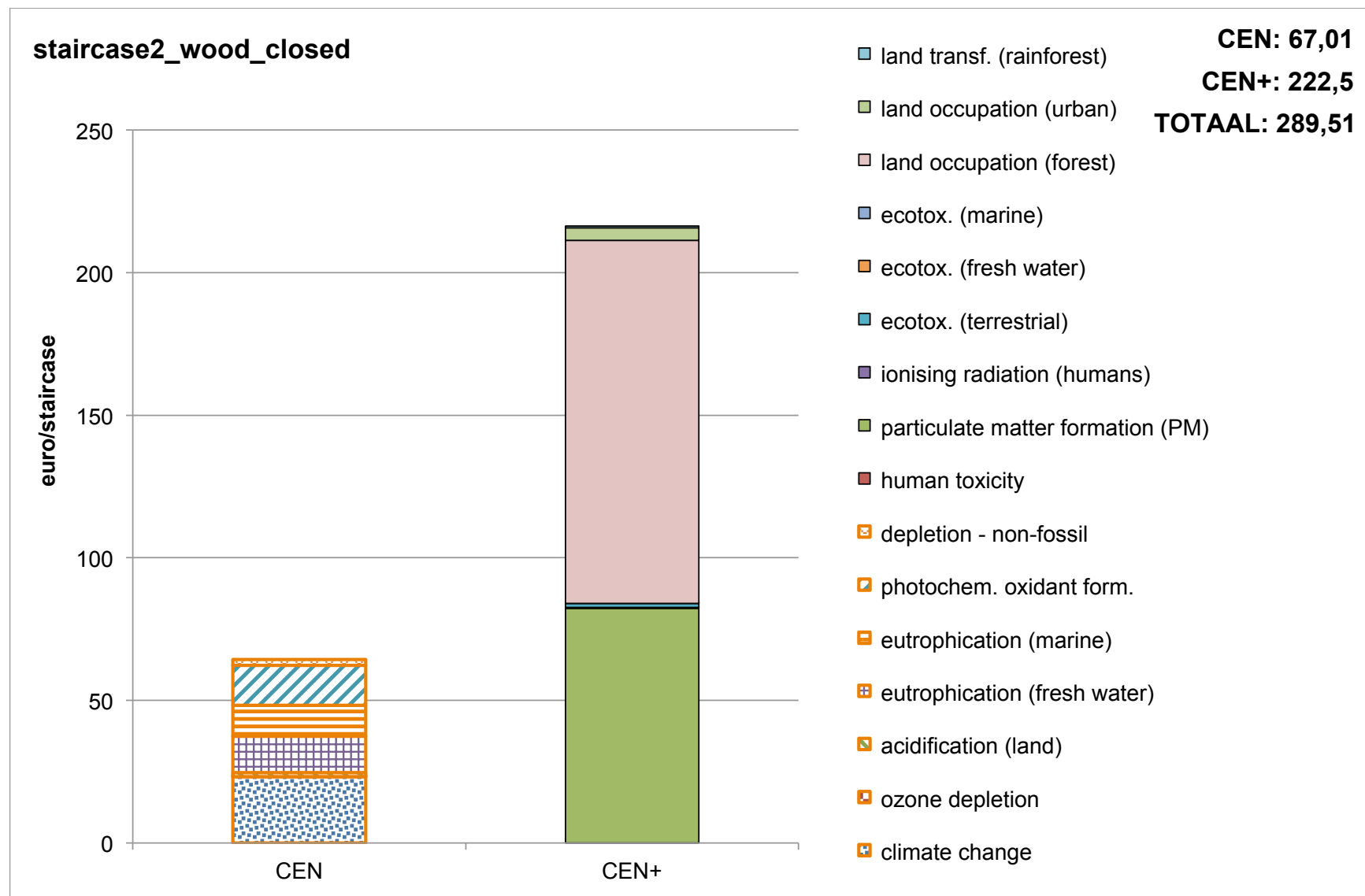


Figure staircase 9.2.2: Aggregated environmental profile (divided into CEN and CEN+) of variant 'staircase2_wood_closed' per environmental indicator, expressed in monetary units.

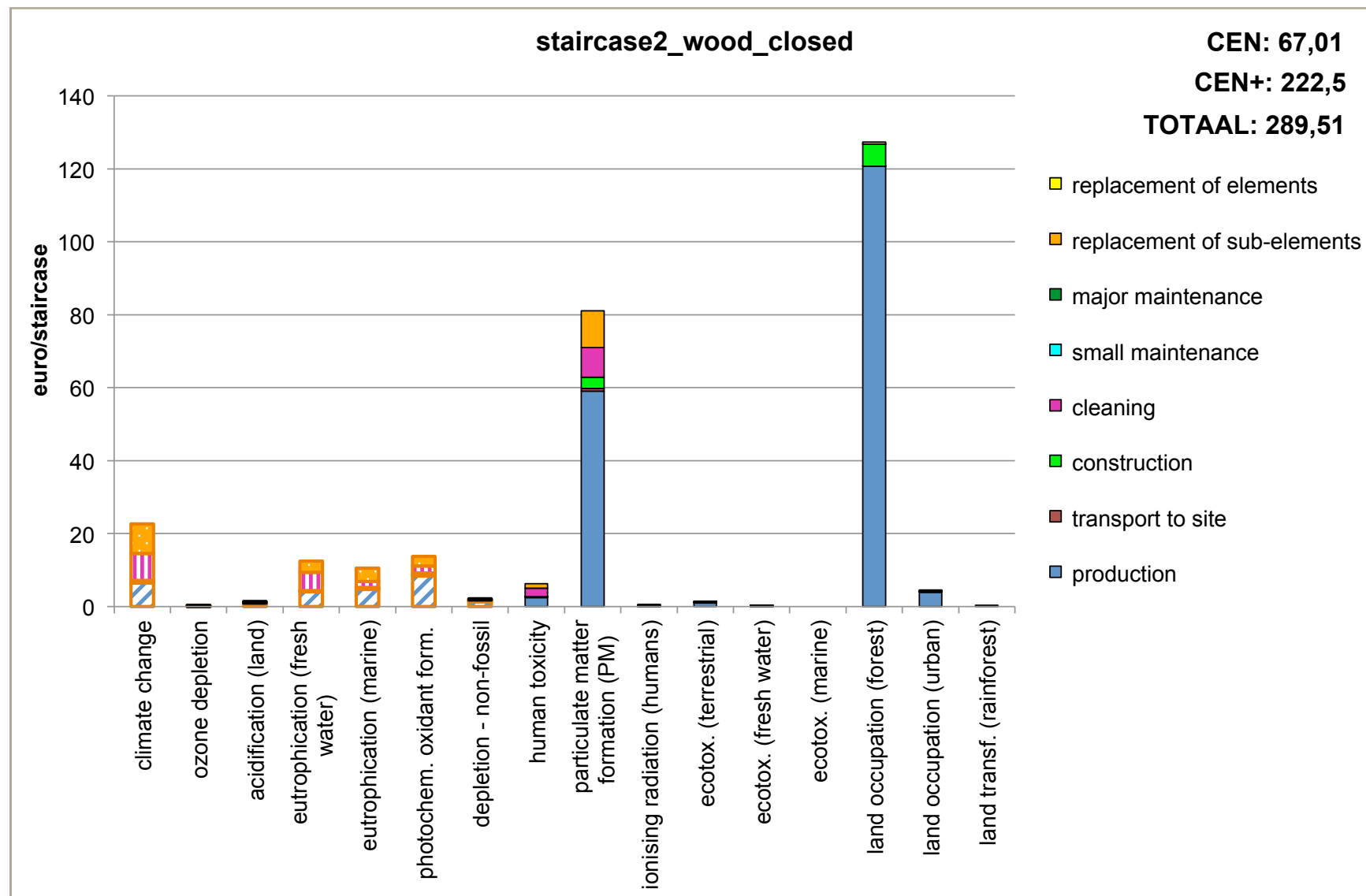


Figure staircase 9.2.3: Aggregated environmental profile (divided into CEN and CEN+) of variant 'staircase2_wood_closed' per life cycle stage and per individual environmental indicator, expressed in monetary units.

9.3. staircase3_concrete

Table 9.3: overview of the detailed composition of variant 'staircase3_concrete'

Description	u	MiM	MaM	Repl	Repl Type	Ratio	t (m)	λ (W/m.K)	R (m ² .K/W)
staircase3_concrete									
staircase - reinforced concrete - prefab - step + riseboard - not covered or to be covered with tiles or paint	step			120	necessary	17		na	na
metallic railing - open side (metal railing)	step			60	aesthetic	17	0,84	na	na

- u: unit;
- MiM: minor maintenance frequency;
- MaM: major maintenance frequency;

- Repl: replacement frequency;
- type Repl: type of replacement (necessary or aesthetic);
- ratio: quantity per m²;

- t: layer thickness (in m);
- λ : heat conduction coefficient (in W/m.K);
- R: thermal resistance = t/λ (in m².K/W)

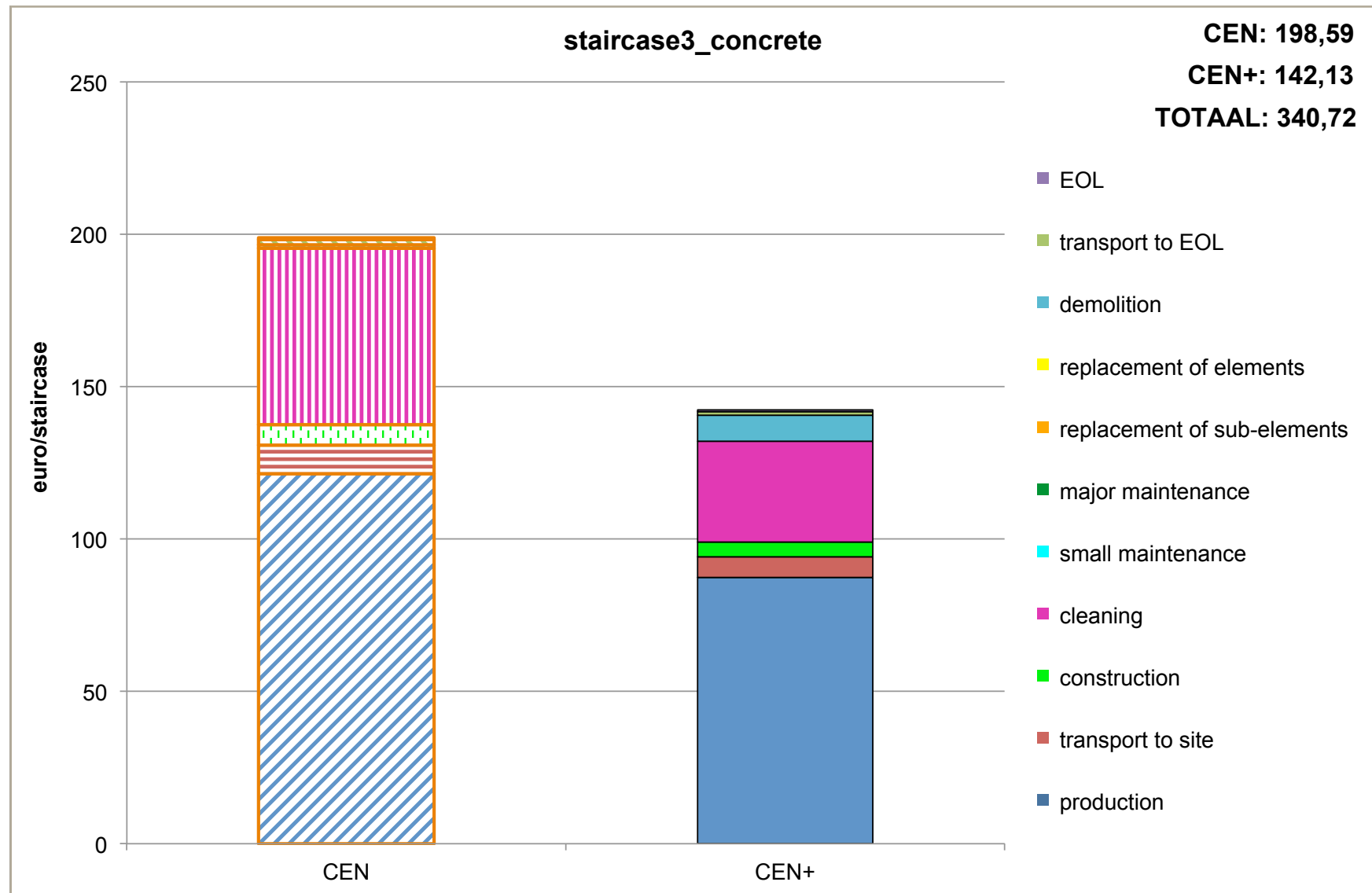


Figure staircase 9.3.1: Aggregated environmental profile (divided into CEN and CEN+) of variant 'staircase3_concrete' per life cycle stage, expressed in monetary units.

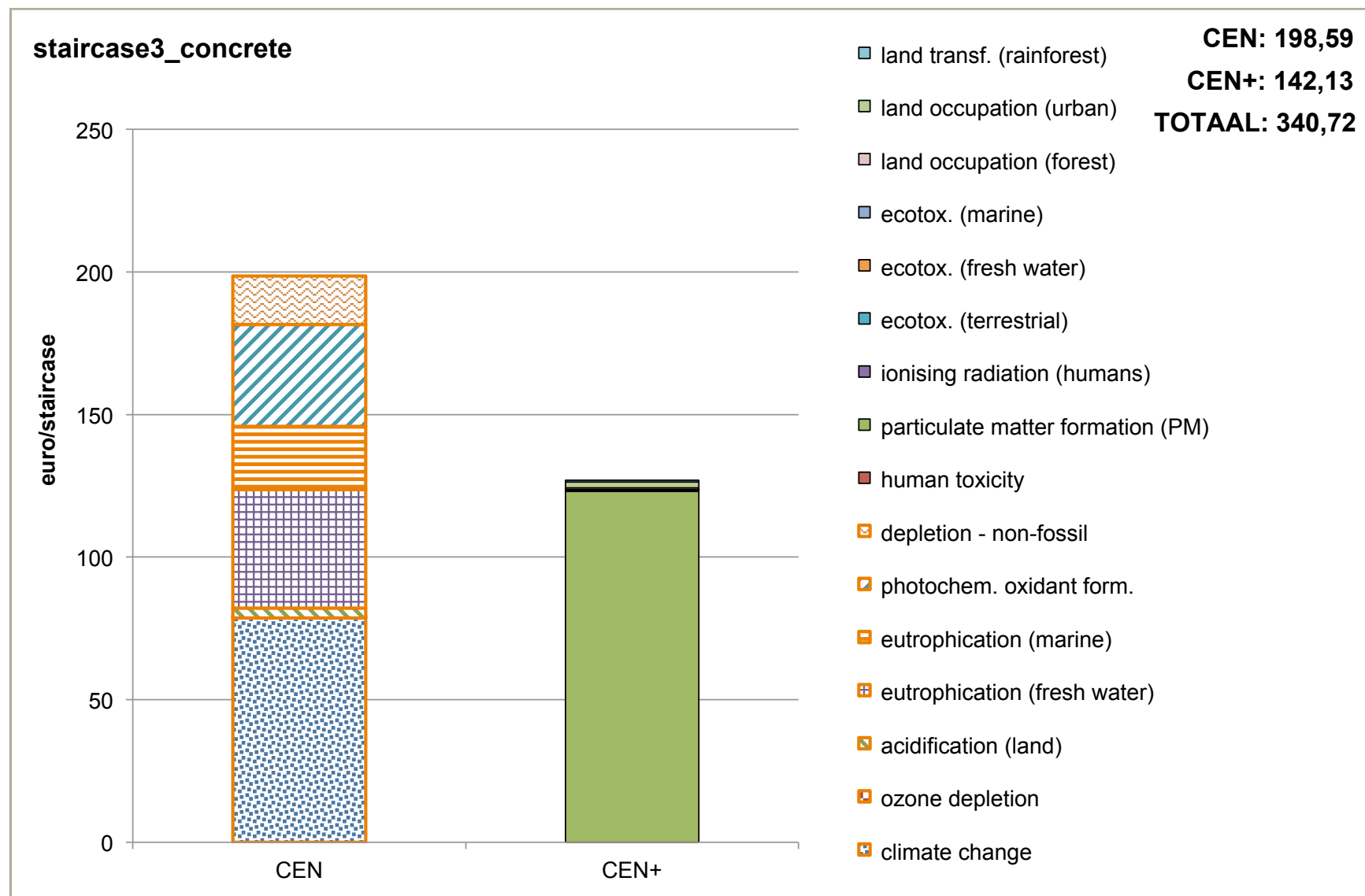


Figure staircase 9.3.2: Aggregated environmental profile (divided into CEN and CEN+) of variant 'staircase3_concrete' per environmental indicator, expressed in monetary units.

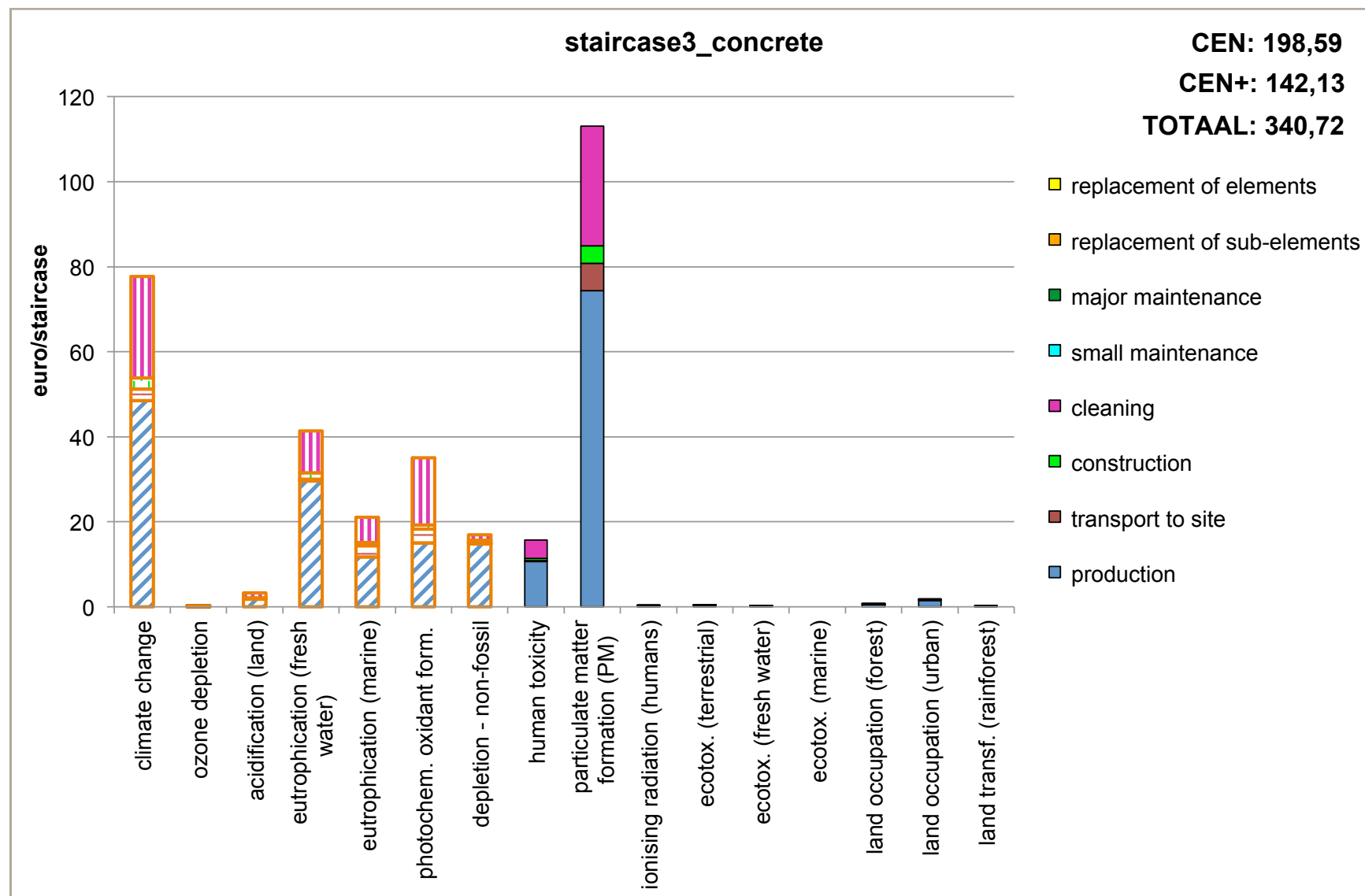


Figure staircase 9.3.3: Aggregated environmental profile (divided into CEN and CEN+) of variant 'staircase3_concrete' per life cycle stage and per individual environmental indicator, expressed in monetary units.

9.4. staircase4_concrete_tiles

Table 9.4: overview of the detailed composition of variant 'staircase4_concrete_tiles'

Description	u	MiM	MaM	Repl	Repl Type	Ratio	t (m)	λ (W/m.K)	R (m ² .K/W)
staircase4_concrete_tiles									
staircase - reinforced concrete - prefab - step + riseboard - not covered or to be covered with tiles or paint	step			120	necessary	17		na	na
metallic railing - open side (metal railing)	step			60	aesthetic	17	0,84	na	na
Staircase (closed) finish - tiles - ceramic (extruded, glazed stoneware) 30 x 30cm - glued	step		60	120	aesthetic	17	0,01	na	na

- u: unit;
- MiM: minor maintenance frequency;
- MaM: major maintenance frequency;

- Repl: replacement frequency;
- type Repl: type of replacement (necessary or aesthetic);
- ratio: quantity per m²;

- t: layer thickness (in m);
- λ : heat conduction coefficient (in W/m.K);
- R: thermal resistance = t/λ (in m².K/W)

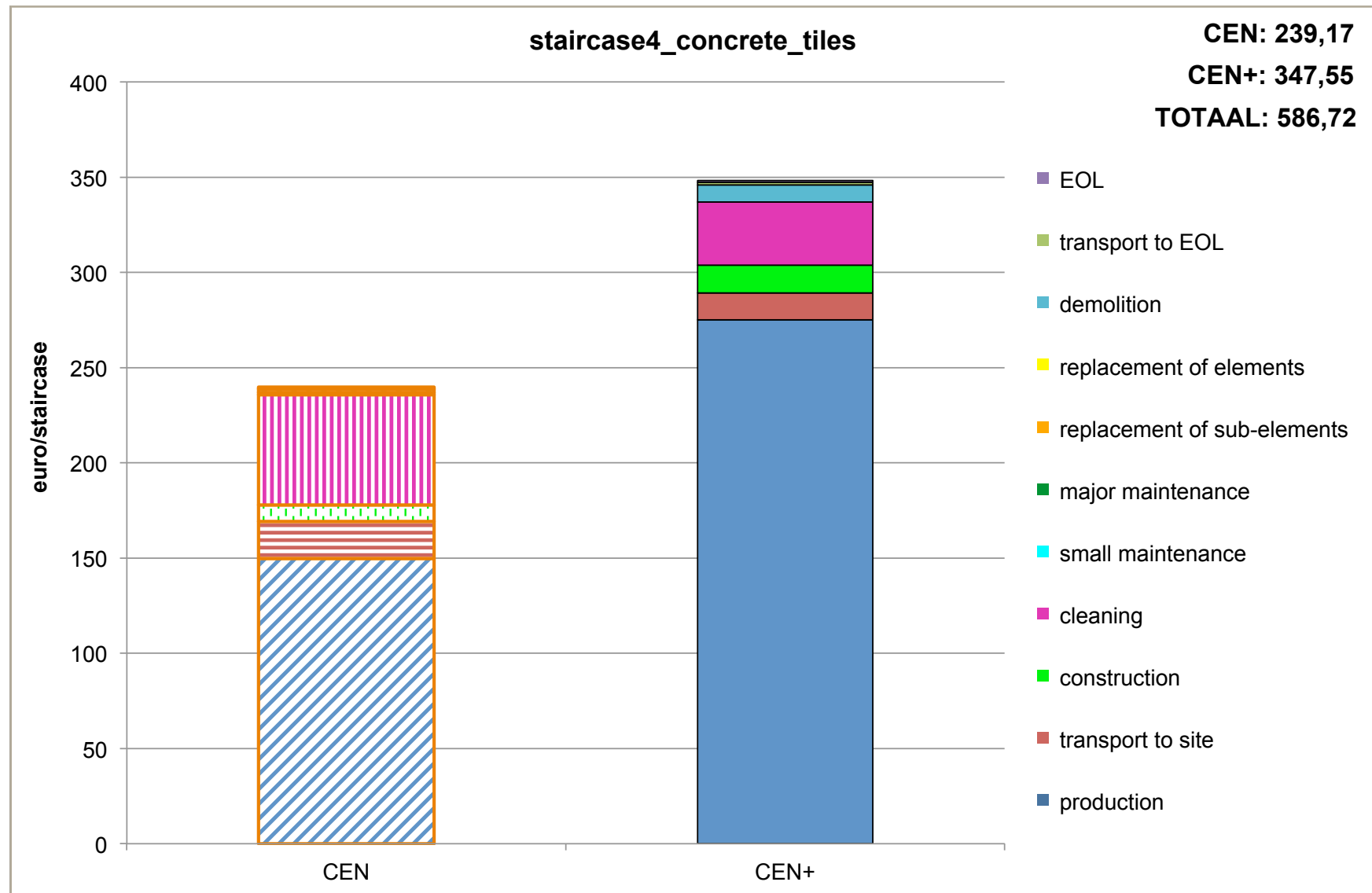


Figure staircase 9.4.1: Aggregated environmental profile (divided into CEN and CEN+) of variant 'staircase4_concrete_tiles' per life cycle stage, expressed in monetary units.

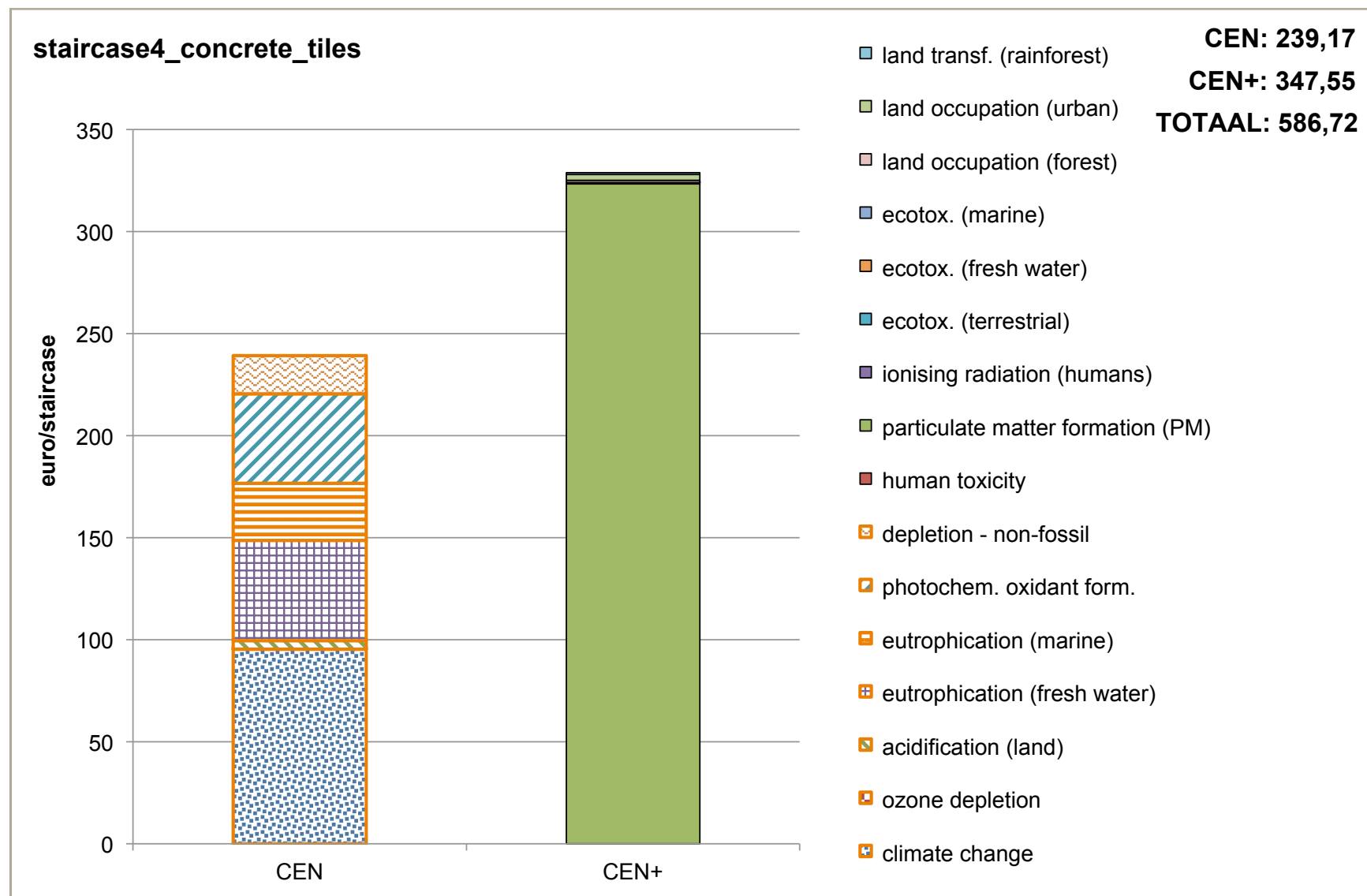


Figure staircase 9.4.2: Aggregated environmental profile (divided into CEN and CEN+) of variant 'staircase4_concrete_tiles' per environmental indicator, expressed in monetary units.

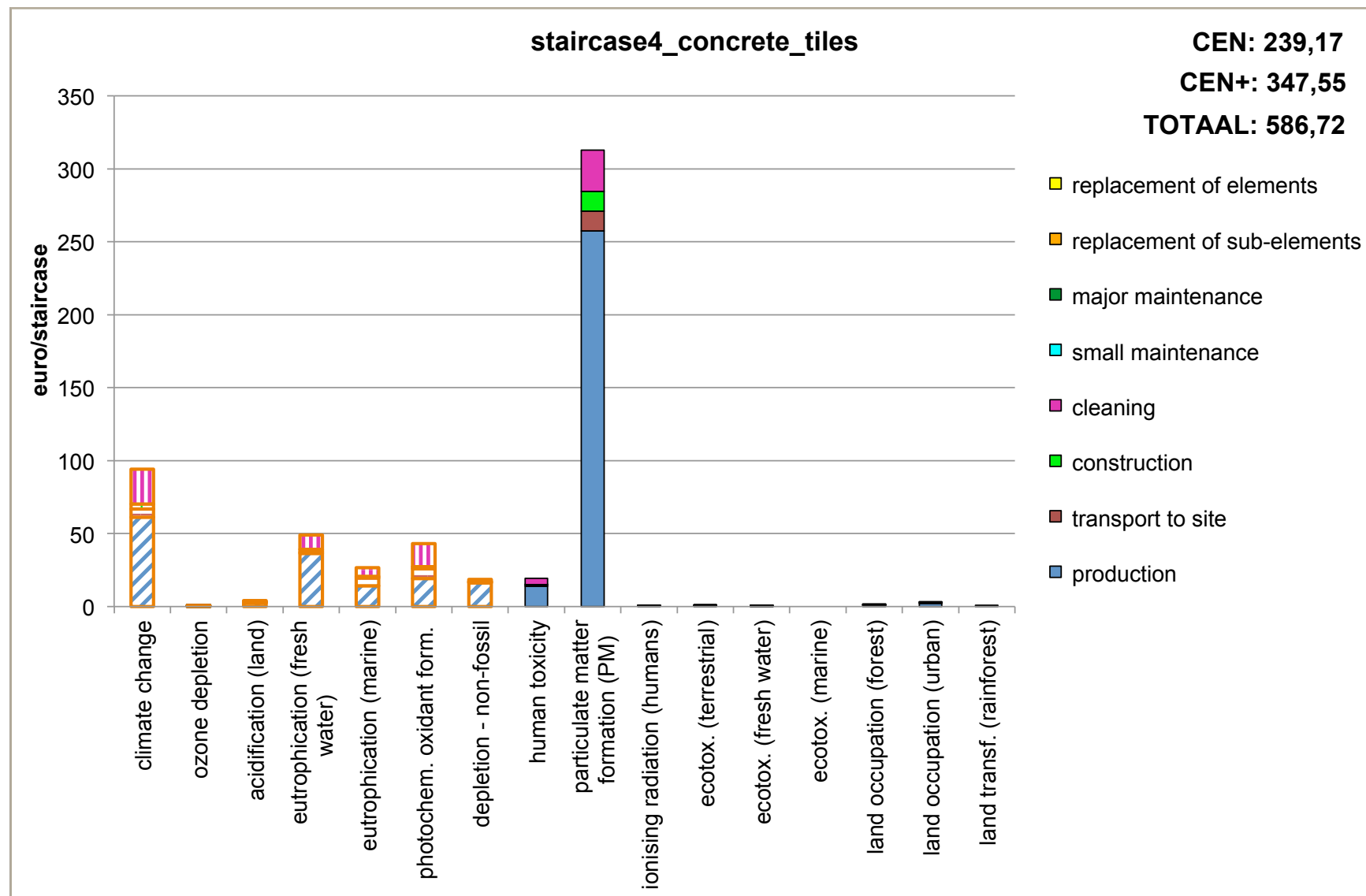


Figure staircase 9.4.3: Aggregated environmental profile (divided into CEN and CEN+) of variant 'staircase4_concrete_tiles' per life cycle stage and per individual environmental indicator, expressed in monetary units.

9.5. staircase5_steel

Table 9.5: overview of the detailed composition of variant 'staircase5_steel'

Description	u	MiM	MaM	Repl	Repl Type	Ratio	t (m)	λ (W/m.K)	R (m ² .K/W)
staircase5_steel									
staircase - steel - step + riseboard	step			120	necessary	17		na	na
metallic railing - open side (metal railing)	step			60	aesthetic	17	0,84	na	na

- u: unit;
- MiM: minor maintenance frequency;
- MaM: major maintenance frequency;

- Repl: replacement frequency;
- type Repl: type of replacement (necessary or aesthetic);
- ratio: quantity per m²;

- t: layer thickness (in m);
- λ : heat conduction coefficient (in W/m.K);
- R: thermal resistance = t/λ (in m².K/W)

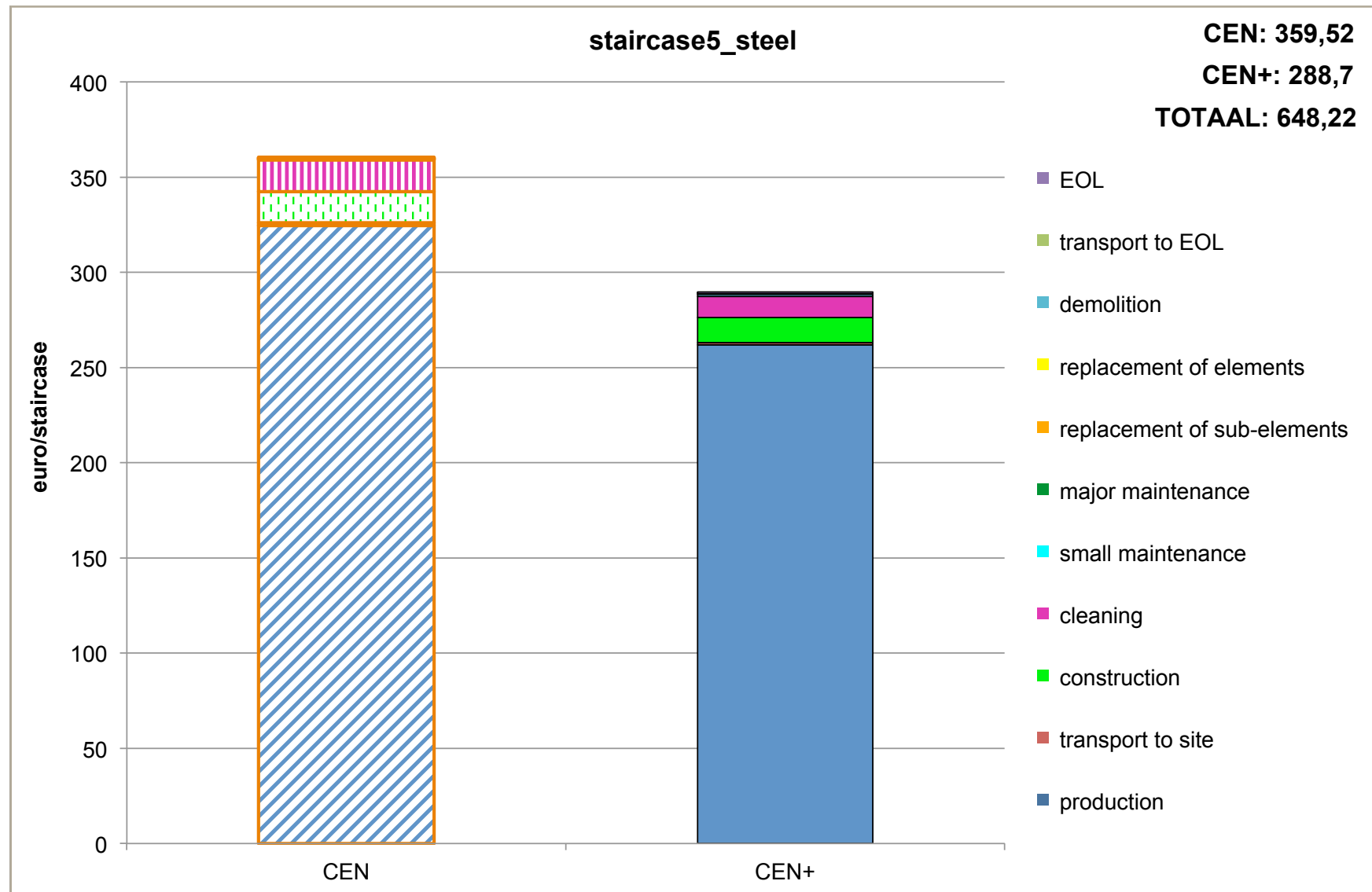


Figure staircase 9.5.1: Aggregated environmental profile (divided into CEN and CEN+) of variant 'staircase5_steel' per life cycle stage, expressed in monetary units.

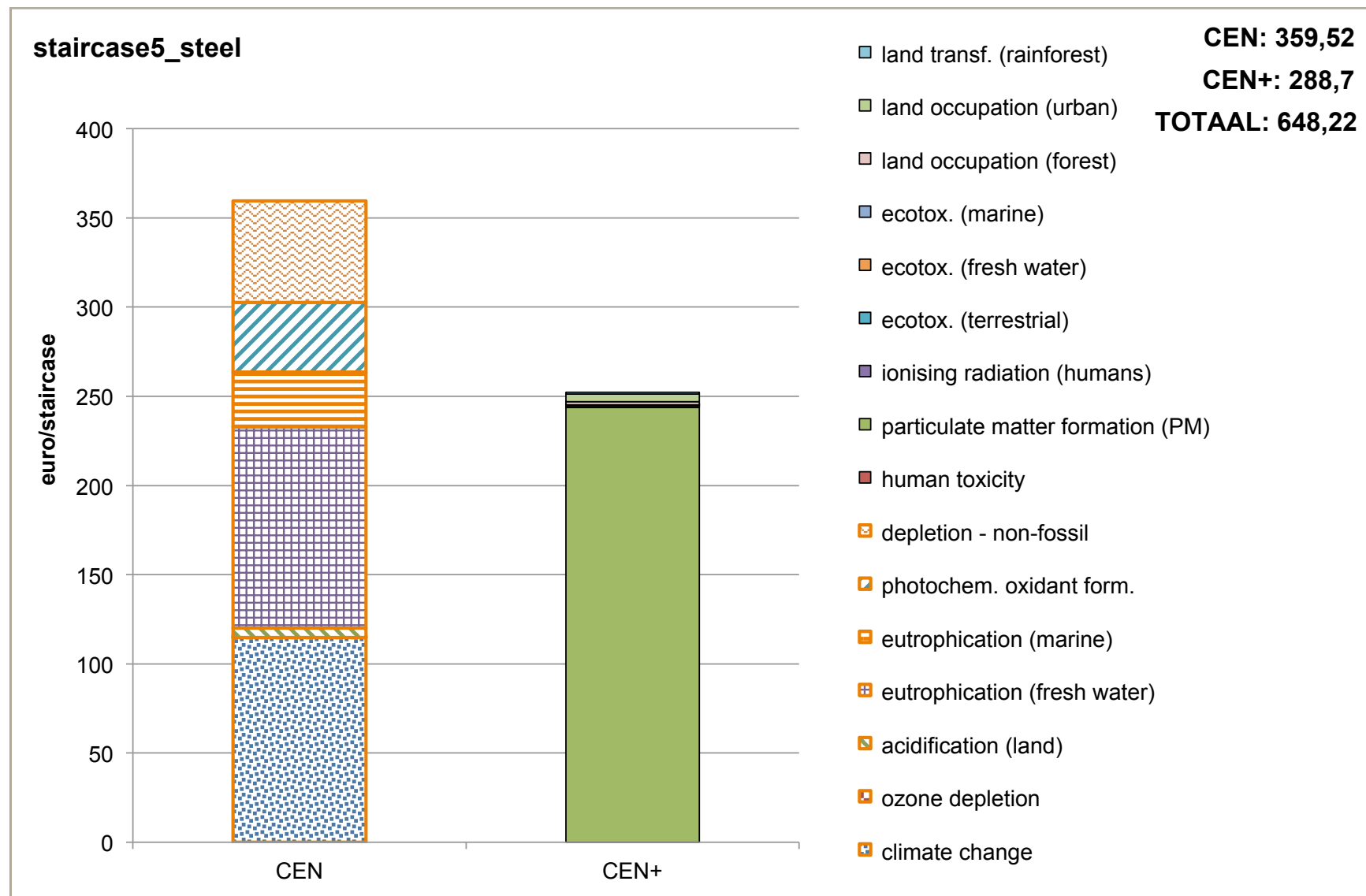


Figure staircase 9.5.2: Aggregated environmental profile (divided into CEN and CEN+) of variant 'staircase5_steel' per environmental indicator, expressed in monetary units.

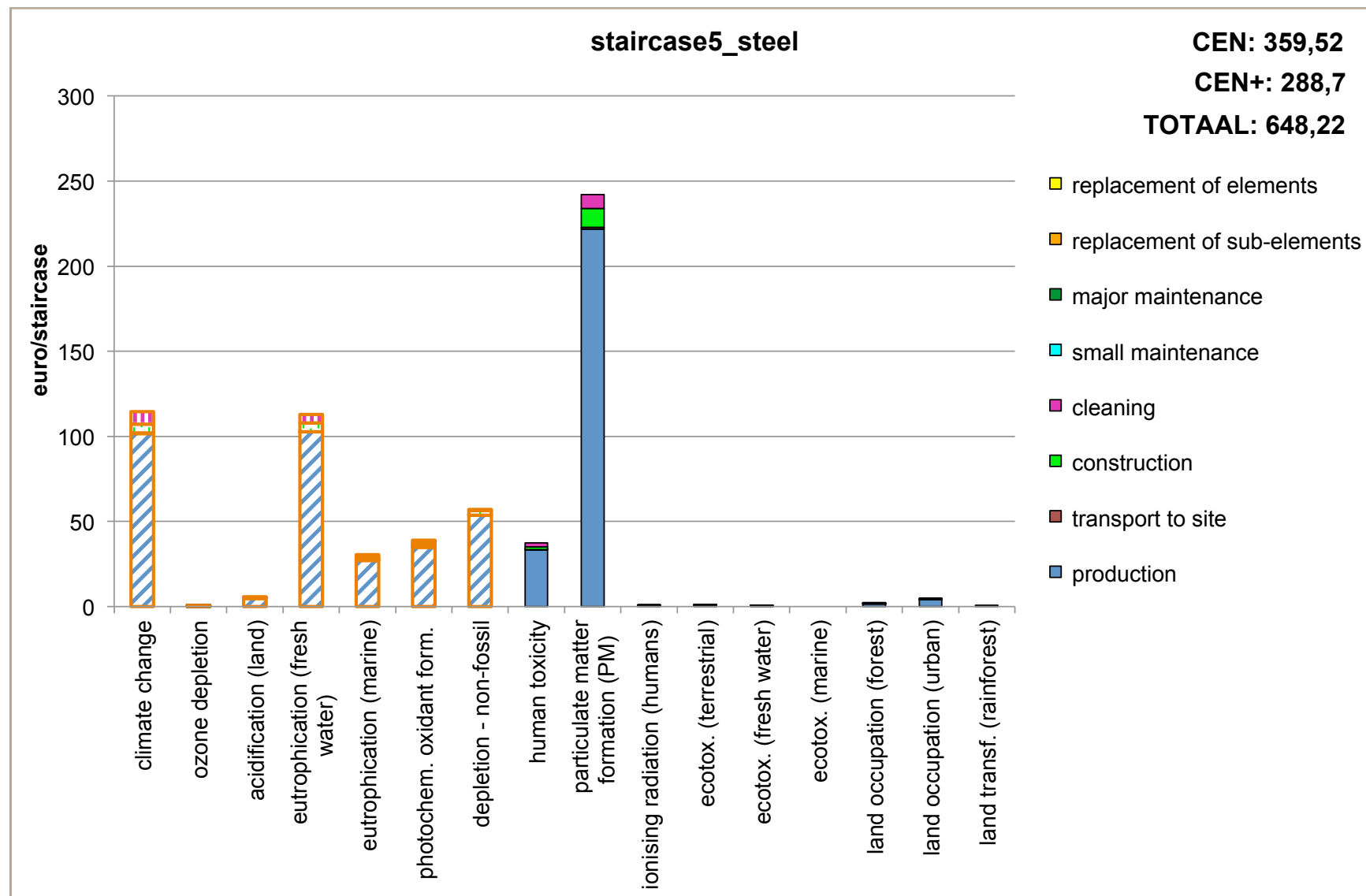


Figure staircase 9.5.3: Aggregated environmental profile (divided into CEN and CEN+) of variant 'staircase5_steel' per life cycle stage and per individual environmental indicator, expressed in monetary units.

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