Environmental profile of building elements details per variant

7. Pitched roof

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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)

Environmental profile of building elements: details per variant

7. Pitched roof

Table V 7: overview of the composition of the variants "pitched roof" (45°))

(27.2)+ pitched roof (45°): milieu-impact per m² horizontaal geprojecteerd dak, 13 types* *(van binnen naar buiten =>)*							
1	PR1_purlin_RW18_ clay roof tile	acrylic paint	plasterboard	purlins and jack rafters with 8 cm RW between jack rafters and 10 cm between purlins (U=0.2)	wood fibre board		clay tiles
2	PR2_FJI_RW24_ clay roof tile	acrylic paint	plasterboard	FJI 24 cm + RW	wood fibre board		clay tiles
3	PR3_FJI_RW36_ clay roof tile	acrylic paint	plasterboard	FJI 36 cm+RW	wood fibre board		clay tiles
4	PR4_FJI_celllulose24_ clay roof tile	acrylic paint	plasterboard	FJI 24 cm + cellulose	wood fibre board		clay tiles
5	PR5_rafters_RW18_ clay roof tile	acrylic paint	plasterboard	rafters	wood fibre board	RW (complete filling between rafters)	clay tiles
6	PR6_rafters _PUR08_ clay roof tile	acrylic paint	plasterboard	rafters	wood fibre board	PUR1 (sarking): 8 cm (U = 0.26)	clay tiles
7	PR7_rafters_PUR16_ clay roof tile	acrylic paint	plasterboard	rafters	wood fibre board	PUR2 (sarking): 16 (6+10) cm (U = 0.14)	clay tiles
8	PR8_rafters_RW18_ zinc	acrylic paint	plasterboard	rafters + RW (complete filling)	wood fibre board	substructure	zinc on PE studded foil
9	PR9_rafters_RW18_ fibre cement	acrylic paint	plasterboard	rafters	wood fibre board	RW (complete filling between rafters)	slates in fibre cement
10	PR10_steel_sandwich RW12_steel	acrylic paint	plasterboard	steel structure	metal sandwich panels filled with rock wool		
11	PR11_rafters_RW18_ wooden shingles	acrylic paint	plasterboard	rafters	wood fibre board	RW (complete filling between rafters)	cedar wood (shingles)
12	PR12_rafters_RW18_ concrete roof tile	acrylic paint	plasterboard	rafters	wood fibre board	RW (complete filling between rafters)	concrete roof tiles
13	PR13_rafters_sandwich panel PUR8_ clay roof tile	acrylic paint		rafters	prefab panels filled with PUR + laths		clay tiles

* vapour barriers and wind screens are added where necessary

Table CEN 7: overview of the individual CEN indicators for the variants 'pitched roof"

	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
Pitched roof							
PR1_purlin_RW18_clay roof tile	2,85E+02	2,24E-05	4,47E-01	1,75E-01	3,67E-02	8,24E-04	4,59E+03
PR2_FJI_RW24_clay roof tile	1,70E+02	1,39E-05	3,97E-01	1,56E-01	2,78E-02	7,80E-04	2,62E+03
PR3_FJI_RW36_clay roof tile	1,70E+02	1,40E-05	3,99E-01	1,57E-01	2,81E-02	7,82E-04	2,64E+03
PR4_FJI_celllulose24_clay roof tile	1,64E+02	1,39E-05	3,22E-01	1,46E-01	2,35E-02	1,08E-03	2,53E+03
PR5_rafters_RW18_clay roof tile	2,85E+02	2,21E-05	4,47E-01	1,74E-01	3,67E-02	1,09E-03	4,59E+03
PR6_rafters _PUR08_clay roof tile	3,26E+02	2,39E-05	4,49E-01	1,78E-01	4,21E-02	1,11E-03	5,21E+03
PR7_rafters_PUR16_clay roof tile	2,55E+02	1,77E-05	4,85E-01	1,87E-01	4,25E-02	1,13E-03	3,89E+03
PR8_rafters_RW18_zinc	3,47E+02	2,44E-05	1,38E+00	5,96E-01	7,37E-02	2,39E-02	5,42E+03
PR9_rafters_RW18_fibre cement	3,34E+02	2,86E-05	5,93E-01	2,74E-01	4,60E-02	1,37E-03	5,14E+03
PR10_steel_sandwich RW12_steel	3,72E+02	2,56E-05	6,34E-01	2,93E-01	6,94E-02	1,06E-03	5,96E+03
PR11_rafters_RW18_wooden shingles	3,03E+02	2,46E-05	6,00E-01	2,70E-01	4,63E-02	1,30E-03	4,98E+03
PR12_rafters_RW18_concrete roof tile	2,76E+02	2,11E-05	4,27E-01	1,72E-01	3,44E-02	1,11E-03	4,45E+03
PR13_rafters_sandwich panel PUR8_clay roof tile	3,19E+02	2,21E-05	3,87E-01	1,34E-01	4,29E-02	7,16E-04	5,20E+03

Table CEN+ 7: overview of the individual CEN+ indicators for the variants 'pitched roof"

	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	m^3
Pitched roof											
PR1_purlin_RW18_clay roof tile	2,07E-05	2,22E-04	4,59E-07	3,15E-02	6,74E-01	7,83E-01	2,29E-02	5,56E-08	7,56E-08	6,50E-09	6,63E-01
PR2_FJI_RW24_clay roof tile	1,78E-05	2,12E-04	3,71E-07	2,28E-02	5,98E-01	6,51E-01	2,28E-02	3,41E-08	4,93E-08	5,69E-09	5,99E-01
PR3_FJI_RW36_clay roof tile	1,80E-05	2,13E-04	3,74E-07	2,36E-02	6,02E-01	6,55E-01	2,28E-02	3,43E-08	4,95E-08	5,69E-09	6,05E-01
PR4_FJI_celllulose24_ clay roof tile	1,72E-05	1,46E-04	3,39E-07	2,26E-02	5,78E-01	6,32E-01	2,28E-02	3,05E-08	4,14E-08	5,34E-09	5,06E-01
PR5_rafters_RW18_clay roof tile	2,13E-05	2,39E-04	4,52E-07	2,76E-02	9,91E-01	1,11E+00	2,29E-02	4,36E-08	6,49E-08	6,46E-09	6,60E-01
PR6_rafters _PUR08_ clay roof tile	2,14E-05	2,13E-04	4,41E-07	2,94E-02	1,09E+00	1,16E+00	2,29E-02	4,11E-08	6,09E-08	6,36E-09	8,55E-01
PR7_rafters_PUR16_ clay roof tile	2,24E-05	2,29E-04	4,00E-07	3,08E-02	1,22E+00	1,18E+00	2,29E-02	4,03E-08	5,22E-08	5,70E-09	1,10E+00
PR8_rafters_RW18_zinc	2,25E-04	5,21E-04	7,49E-07	1,66E-01	3,72E+00	5,45E+00	2,03E-01	9,05E-08	1,05E-07	7,02E-09	2,76E+00
PR9_rafters_RW18_ fibre cement	3,56E-05	3,02E-04	7,29E-07	3,37E-02	1,46E+00	1,60E+00	3,53E-02	6,03E-08	8,22E-08	1,01E-08	1,28E+00
PR10_steel_sandwich RW12_steel	4,02E-05	3,96E-04	6,47E-07	2,53E-02	1,51E+00	1,66E+00	1,01E-02	3,99E-08	7,18E-08	6,85E-09	1,54E+00
PR11_rafters_RW18_ wooden shingles	3,31E-05	3,20E-04	6,61E-07	5,83E-02	1,41E+00	1,54E+00	6,19E-02	1,35E-07	1,41E-07	6,83E-09	9,37E-01
PR12_rafters_RW18_ concrete roof tile	2,08E-05	2,32E-04	4,51E-07	2,74E-02	9,94E-01	1,12E+00	2,33E-02	4,42E-08	6,40E-08	6,65E-09	7,63E-01
PR13_rafters_sandwich panel PUR8_clay roof tile	1,85E-05	1,86E-04	3,33E-07	2,95E-02	1,07E+00	1,15E+00	1,55E-02	3,37E-08	5,36E-08	2,41E-09	7,61E-01

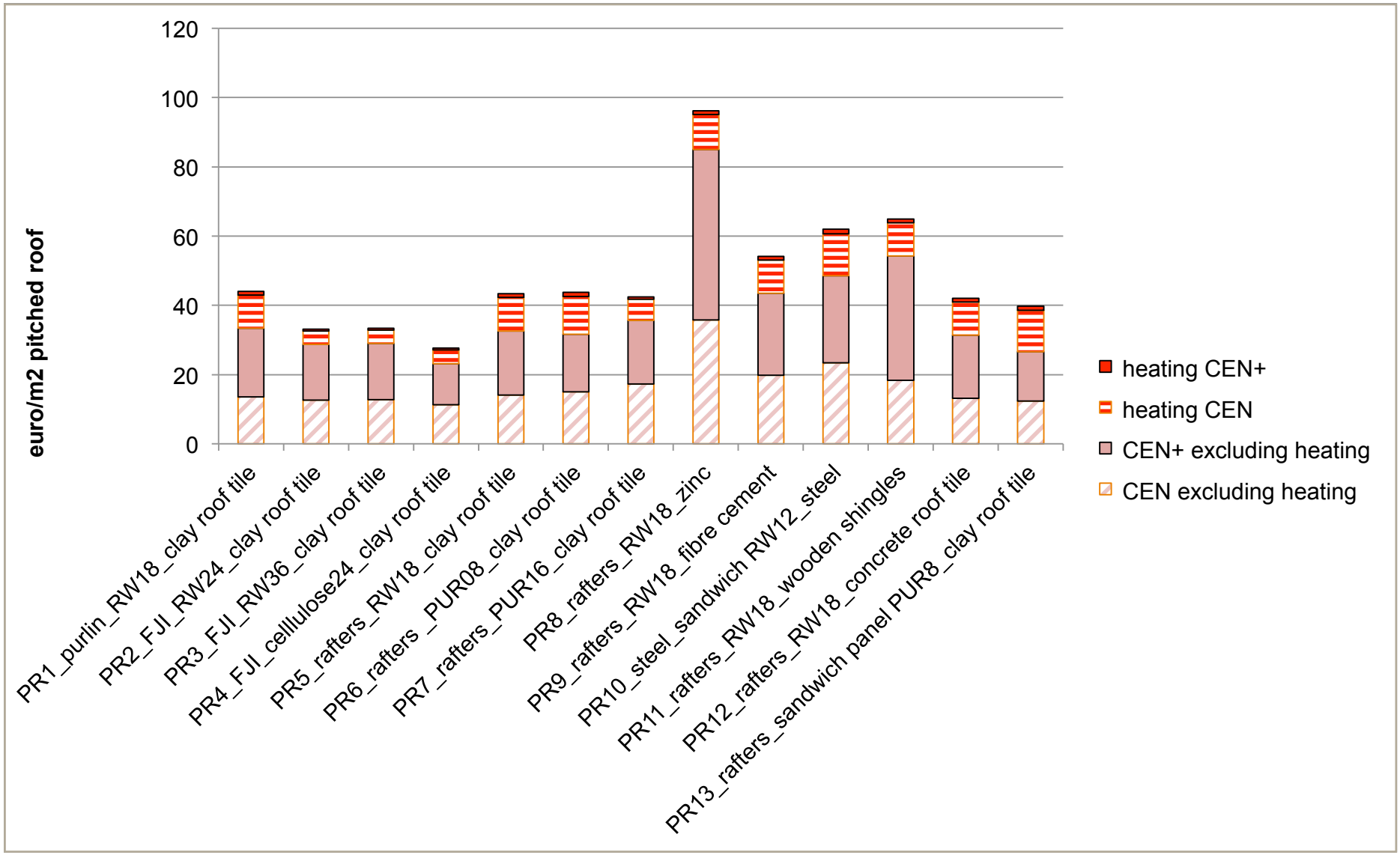

Figure E 7: Aggregated environmental profiles (split up into CEN and CEN+) of several building element variants "pitched roof', expressed in monetary units and distinguishing between purely materials-related and heat-transfer-related environmental impact.

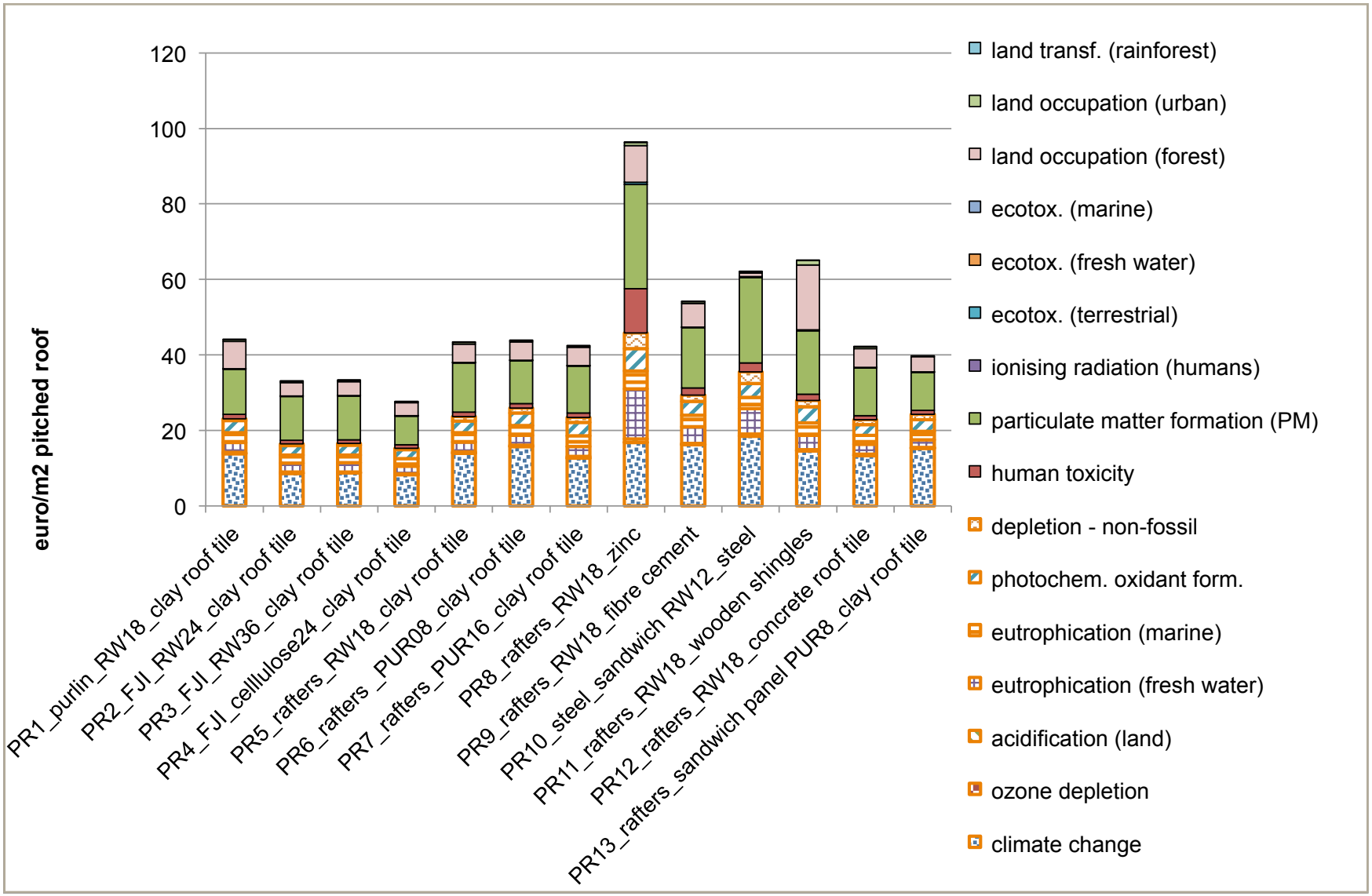

Figure I 7: Aggregated environmental profiles (split up into CEN and CEN+) for several building element variant 'pitched roof' per environmental indicator, expressed in monetary units.

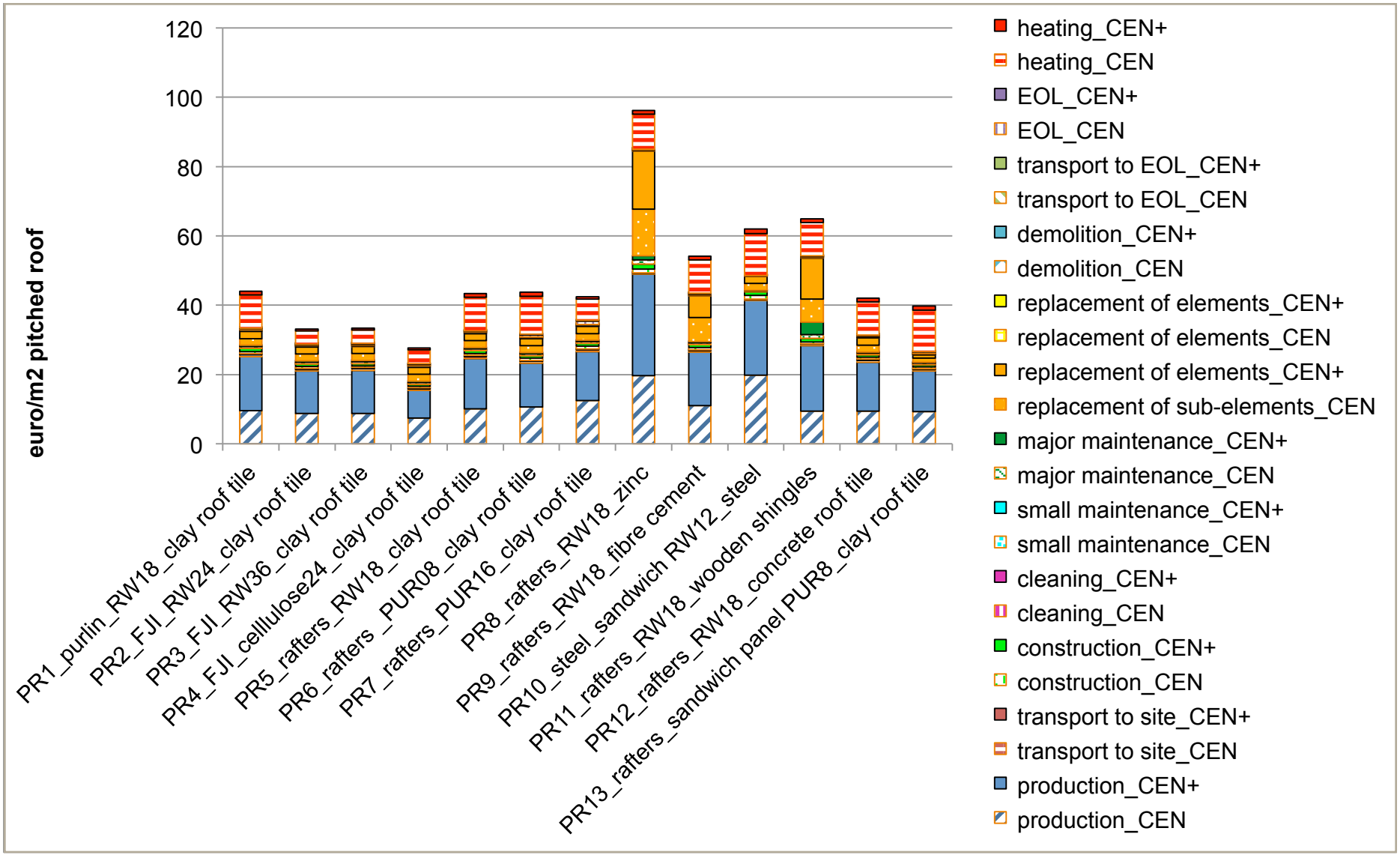

Figure L 7: Aggregated environmental profiles (split up into CEN and CEN+) for several building element variants 'pitched roof' per life cycle stage, expressed in monetary units.

7.1. PR1_purlin_RW18_clay roof tile

Table 7.1: overview of the detailed composition of variant 'PR1_purlin_RW18_clay roof tile'

Description	u	MiM	MaM	Repl	Repl Type	Ratio	t (m)	λ (W/m.K)	R (m².K/W)
PR1_purlin_RW18_clay roof tile									
Roofs - pitched - wood (inland) A roof framing - 2 rafters - surface 42.43 m²	m²		30	120	necessary	1,414	0,07	na	
Roofs - pitched - profiles - wood - inland - purlins 75 x 225 mm - 5 m (7 for 42.43 m²) - not for corrugated cement roof sheets	m²		30	120	necessary	1,414	0,23	na	
Roofs - pitched - profiles - wood - inland - jack rafters 63 x 72 mm - 4.243 m (2 x 12 for 42.43 m²) - not for roof slates	m²		30	120	necessary	1,414	0,06	na	
Pitched roof - profiles - wood - inland wood - structure for insulation - between perlings/between insulation, 38 x 100 mm	m²			120	necessary	1,414	0,1	na	
Pitched roof - thermal insulation between perlings (with extra battens in between) - blanket, batt - anorganic fibre - rock wool - medium hard (10 cm) - (for all finishings, except corrugated fibre cement roof sheets)	m²			120	necessary	1,414	0,1	0,048	2,070
Pitched roof - thermal insulation between arrises- blanket, batt - anorganic fibre - rock wool - medium hard (7,5 cm)	m²			120	necessary	1,414	0,08	0,051	1,470
Air cavity between wooden perlings (1,4 m h.o.h.) - 12,5 cm	m²			120	necessary	1,414	0,22	1,074	0,200
Ceiling finish - board - gypsum (1,25 cm), width 1,2 meter, screwed, inlcusive joint filler	m²		10	30	necessary	1,414	0,01	na	0,050
Ceiling finish - support structure for boards - profiles - wood	m²			30	necessary	1,414	0,02	na	0,160
Ceiling finish - paint - acrylic paint on gypsum plasterboard	m²		5	10	aesthetic	1,414		na	
Roof finishes - pitched surfaces - ceramic tiles (clay roof tiles) – high wind-resistant tile	m²		15	90	necessary	1,414	0,02	na	
Infrastructure for roof tiles - counter battens (20 x 30 mm) - native softwood - for ceramic roof tiles	m²		30	90	necessary	1,414	0,02	na	
Infrastructure for roof tiles - tile laths (25 x 30 mm) - native softwood - for ceramic roof tiles	m²		30	90	necessary	1,414	0,02	na	
Infrastructure for roof finish - subroof - board - wood fibre 22 mm, nailed - for ceramic & concrete tiles and natural slates	m²		30	90	necessary	1,414	0,02	0,055	0,400
Roof finishes - vapour felt - polyethylene (PE)	m²			120	necessary	1,414	0	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)

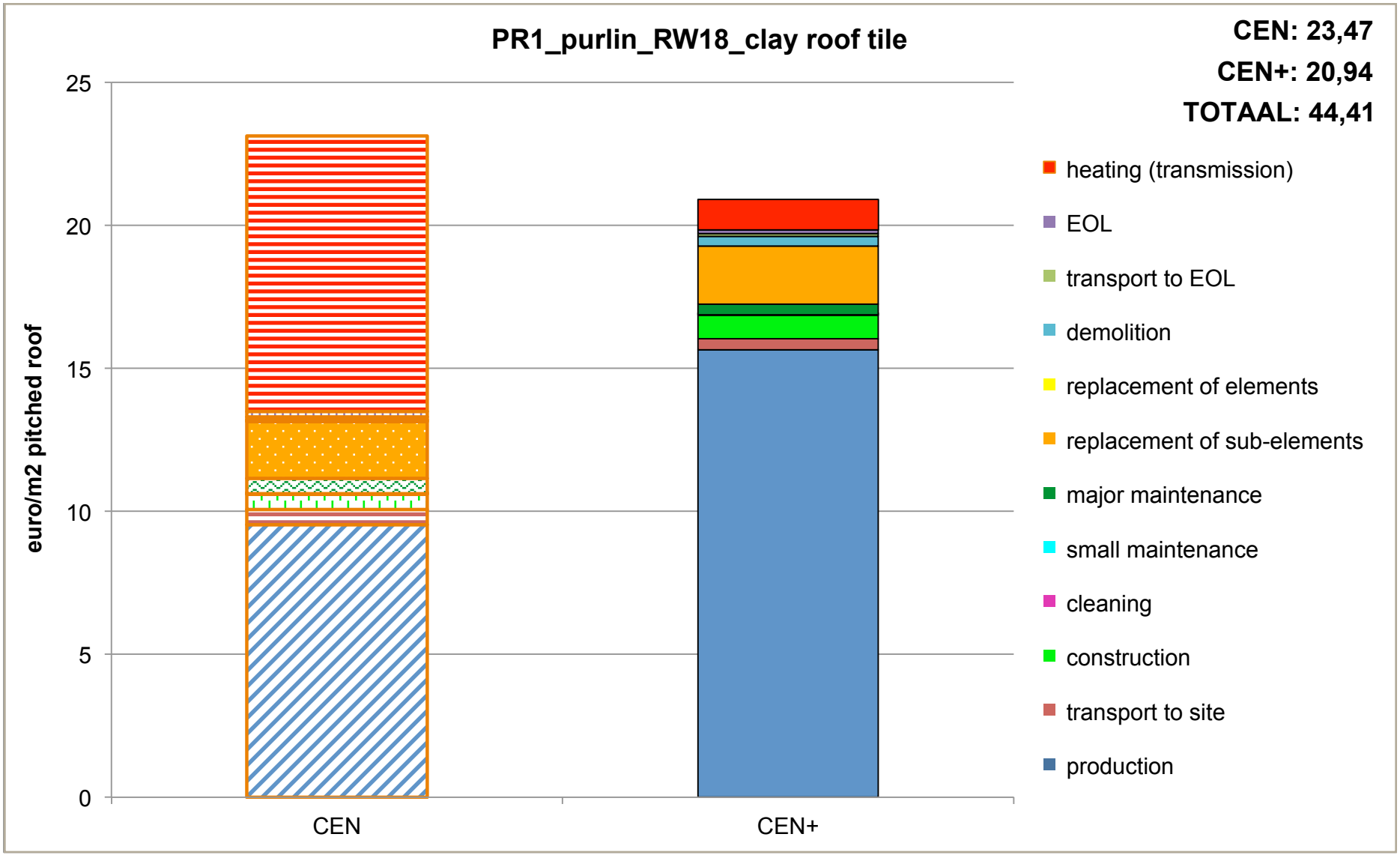

Figure pitched roof 7.1.1: Aggregated environmental profile (divided into CEN and CEN+) of variant 'PR1_purlin_RW18_clay roof tile' per life cycle stage, expressed in monetary units.

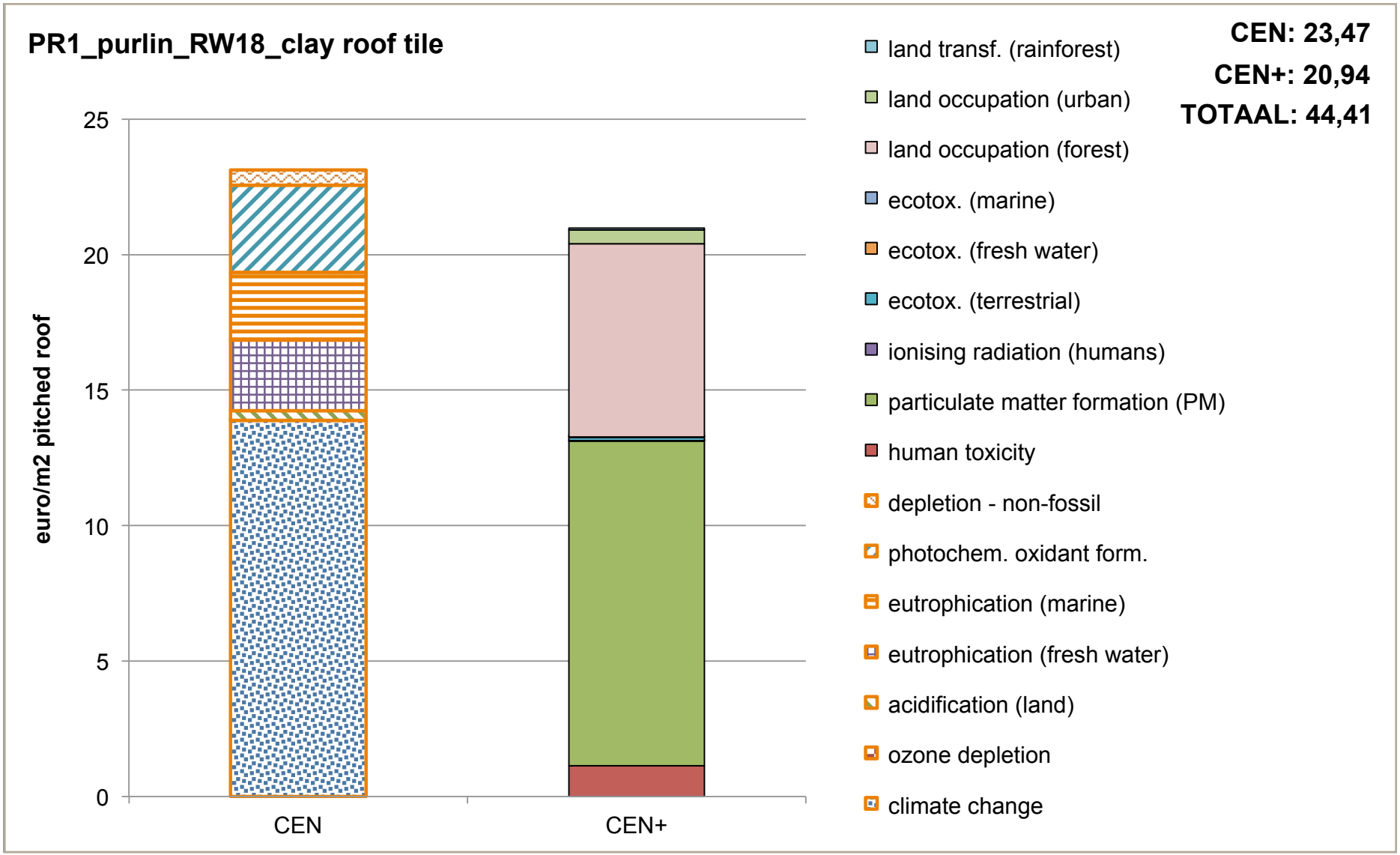

Figure pitched roof 7.1.2: Aggregated environmental profile (divided into CEN and CEN+) of variant 'PR1_purlin_RW18_clay roof tile' per environmental indicator, expressed in monetary units.

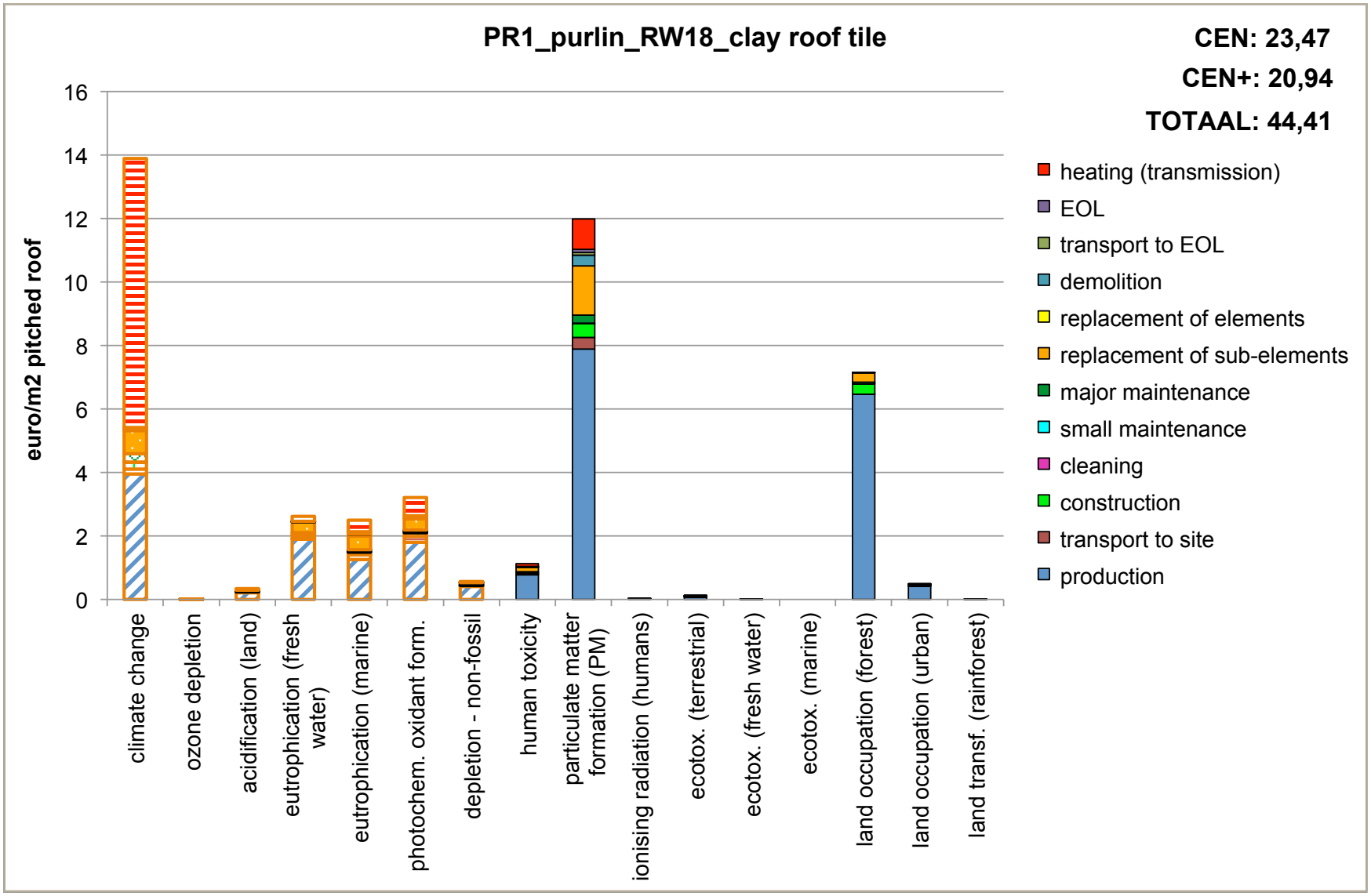

Figure pitched roof 7.1.3: Aggregated environmental profile (divided into CEN and CEN+) of variant 'PR1_purlin_RW18_clay roof tile' per life cycle stage and per individual environmental indicator, expressed in monetary units.

7.2. PR2_FJI_RW24_clay roof tile

Table 7.2: overview of the detailed composition of variant 'PR2_FJI_RW24_clay roof tile'

Description	u	MiM	MaM	Repl	Repl Type	Ratio	t (m)	λ (W/m.K)	R (m².K/W)
PR2_FJI_RW24_clay roof tile									
Roofs - pitched - wood (inland) A roof framing - 2 rafters - surface 42.43 m2	m²		30	120	necessary	1,414	0,07	na	
Roofs - inclined - profiles - FJI beam - type 350 - height 24 cm - h.o.h. 60 cm	m²		30	120	necessary	1,414	0,41	na	
Pitched roof - thermal insulation between FJI beams - rockwool - 24 cm	m²			120	necessary	1,414		na	10,560
Ceiling finish - board - gypsum (1,25 cm), width 1,2 meter, screwed, inlcusive joint filler	m²		10	30	necessary	1,414	0,01	na	0,050
Ceiling finish - support structure for boards - profiles - wood	m²			30	necessary	1,414	0,02	na	0,160
Ceiling finish - paint - acrylic paint on gypsum plasterboard	m²		5	10	aesthetic	1,414		na	
Roof finishes - pitched surfaces - ceramic tiles (clay roof tiles) - high wind-resistant tile	m²		15	90	necessary	1,414	0,02	na	
Infrastructure for roof tiles - counter battens (20 x 30 mm) - native softwood - for ceramic roof tiles	m²		30	90	necessary	1,414	0,02	na	
Infrastructure for roof tiles - tile laths (25 x 30 mm) - native softwood - for ceramic roof tiles	m²		30	90	necessary	1,414	0,02	na	
Infrastructure for roof finish - subroof - board - wood fibre 22 mm, nailed - for ceramic & concrete tiles and natural slates	m²		30	90	necessary	1,414	0,02	0,055	0,400
Roof finishes - vapour felt - polyethylene (PE)	m²			120	necessary	1,414	0	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)

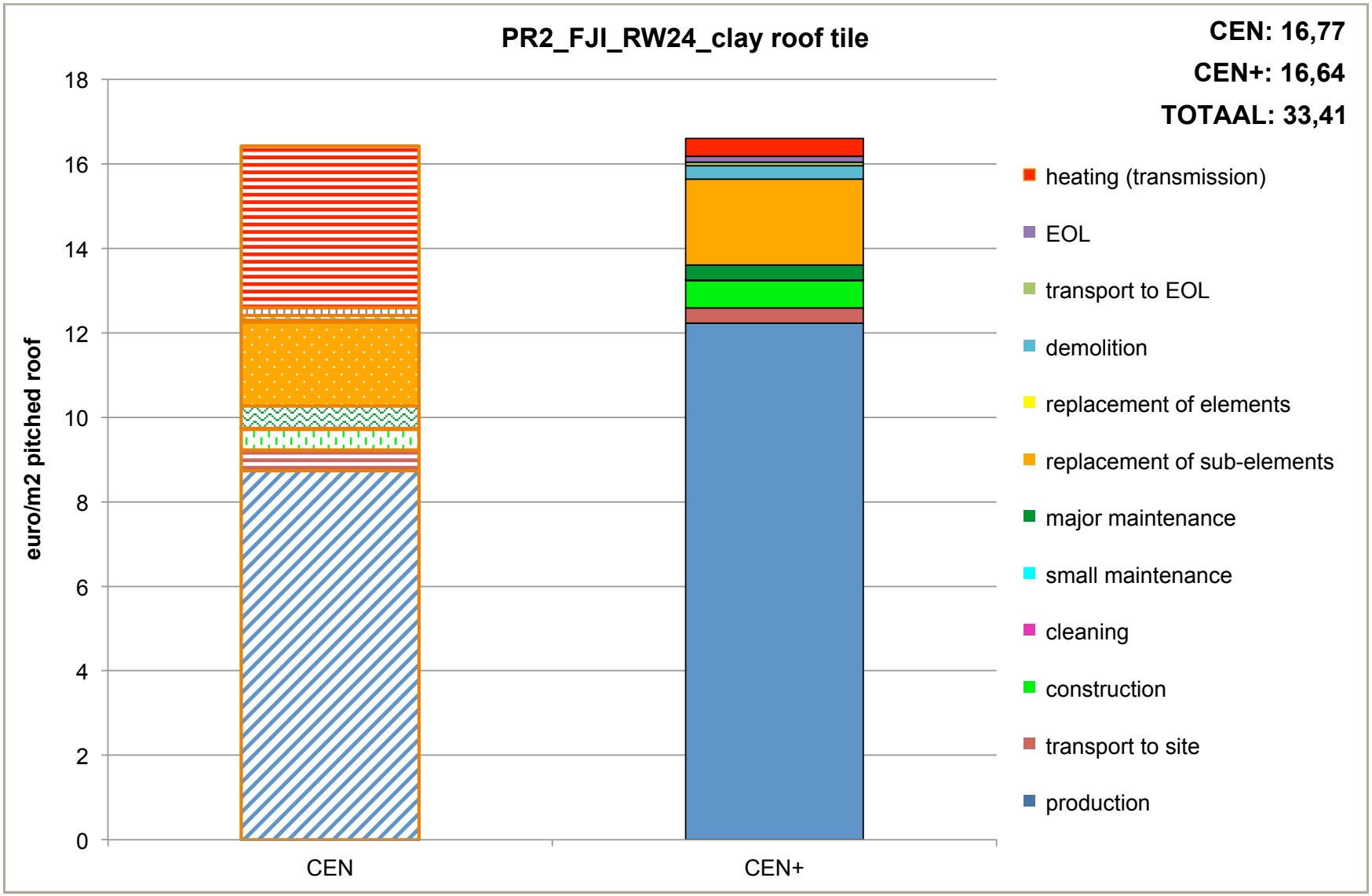

Figure pitched roof 7.2.1: Aggregated environmental profile (divided into CEN and CEN+) of variant 'PR2_FJI_RW24_clay roof tile' per life cycle stage, expressed in monetary units.

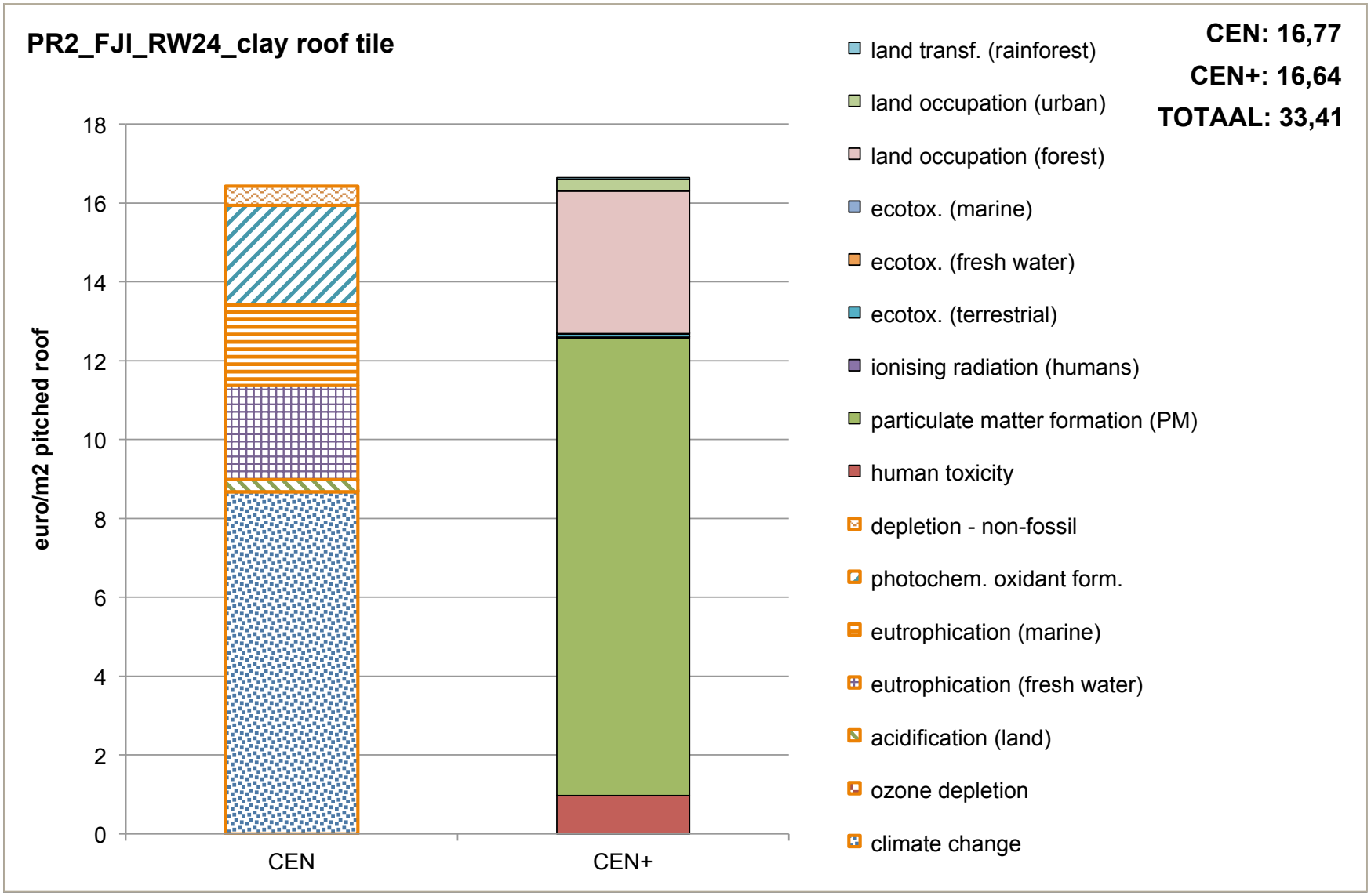

Figure pitched roof 7.2.2: Aggregated environmental profile (divided into CEN and CEN+) of variant 'PR2_FJI_RW24_clay roof tile' per environmental indicator, expressed in monetary units.

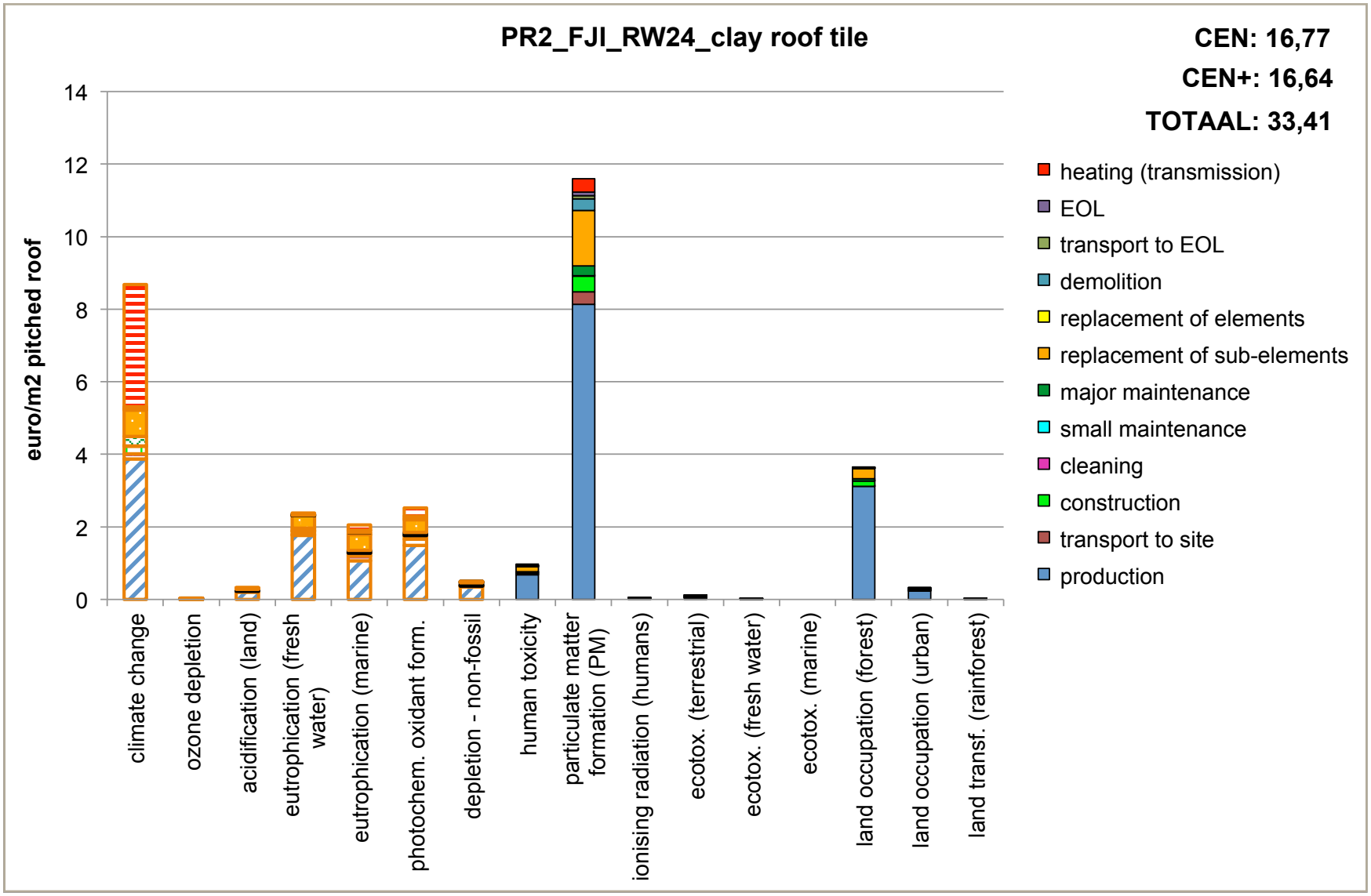

Figure pitched roof 7.2.3: Aggregated environmental profile (divided into CEN and CEN+) of variant 'PR2_FJI_RW24_clay roof tile' per life cycle stage and per individual environmental indicator, expressed in monetary units.

7.3. PR3_FJI_RW36_clay roof tile

Table 7.3: overview of the detailed composition of variant 'PR3_FJI_RW36_clay roof tile'

Description	u	MiM	MaM	Repl	Repl Type	Ratio	t (m)	λ (W/m.K)	R (m².K/W)
PR3_FJI_RW36_clay roof tile									
Roofs - pitched - wood (inland) A roof framing - 2 rafters - surface 42.43 m²	m²		30	120	necessary	1,414	0,07	na	
Roofs - inclined - profiles - FJI beam - type 350 - height 36 cm - h.o.h. 60 cm	m²		30	120	necessary	1,414	0,41	na	
Pitched roof - thermal insulation between FJI beams - rockwool - 36 cm	m²			120	necessary	1,414		na	10,560
Ceiling finish - board - gypsum (1,25 cm), width 1,2 meter, screwed, inlcusive joint filler	m²		10	30	necessary	1,414	0,01	na	0,050
Ceiling finish - support structure for boards - profiles - wood	m²			30	necessary	1,414	0,02	na	0,160
Ceiling finish - paint - acrylic paint on gypsum plasterboard	m²		5	10	aesthetic	1,414		na	
Roof finishes - pitched surfaces - ceramic tiles (clay roof tiles) - high wind-resistant tile	m²		15	90	necessary	1,414	0,02	na	
Infrastructure for roof tiles - counter battens (20 x 30 mm) - native softwood - for ceramic roof tiles	m²		30	90	necessary	1,414	0,02	na	
Infrastructure for roof tiles - tile laths (25 x 30 mm) - native softwood - for ceramic roof tiles	m²		30	90	necessary	1,414	0,02	na	
Infrastructure for roof finish - subroof - board - wood fibre 22 mm, nailed - for ceramic & concrete tiles and natural slates	m²		30	90	necessary	1,414	0,02	0,055	0,400
Roof finishes - vapour felt - polyethylene (PE)	m²			120	necessary	1,414	0	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)

overview overview CEN overview CEN+

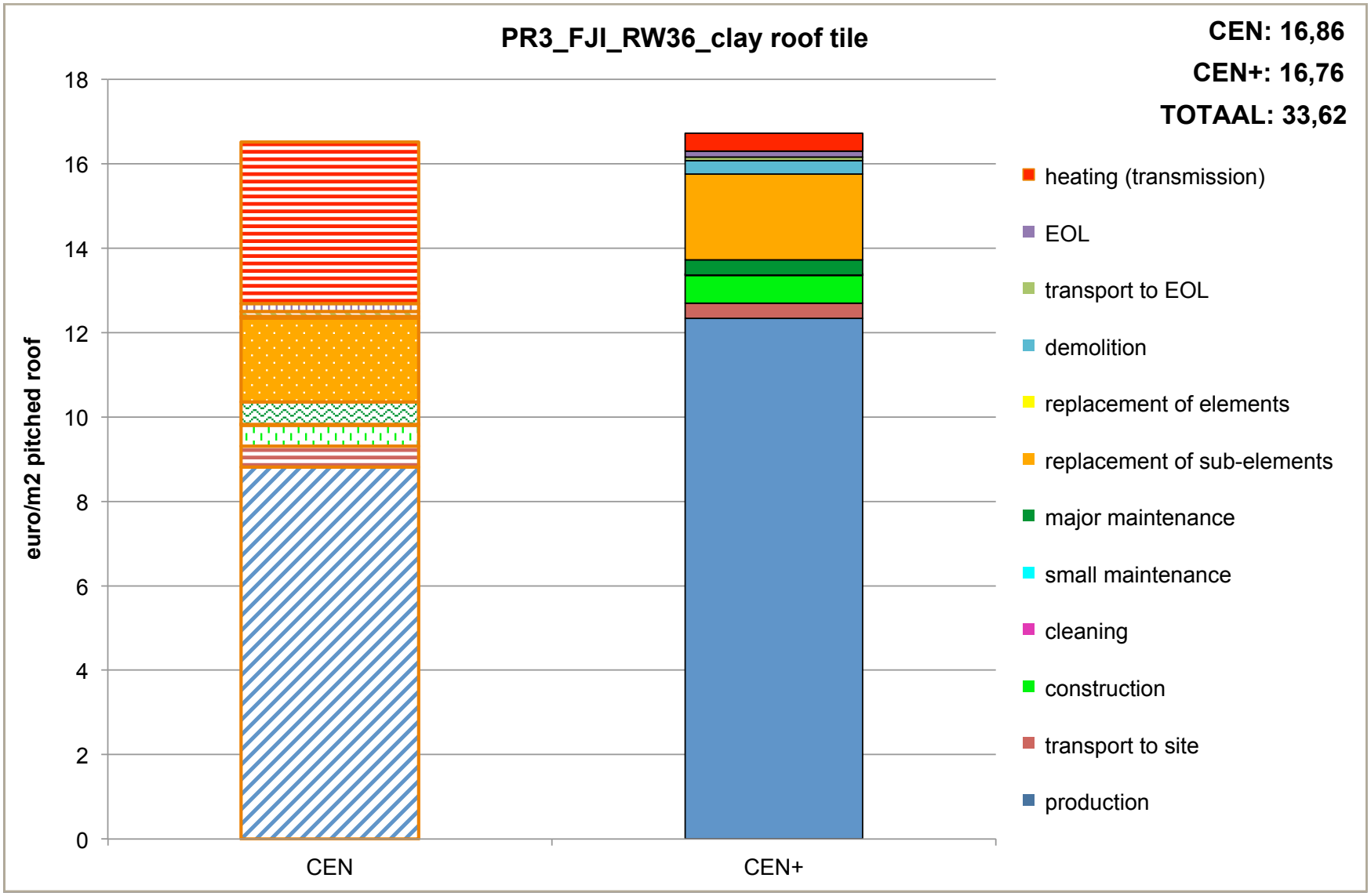

Figure pitched roof 7.3.1: Aggregated environmental profile (divided into CEN and CEN+) of variant 'PR3_FJI_RW36_clay roof tile' per life cycle stage, expressed in monetary units.

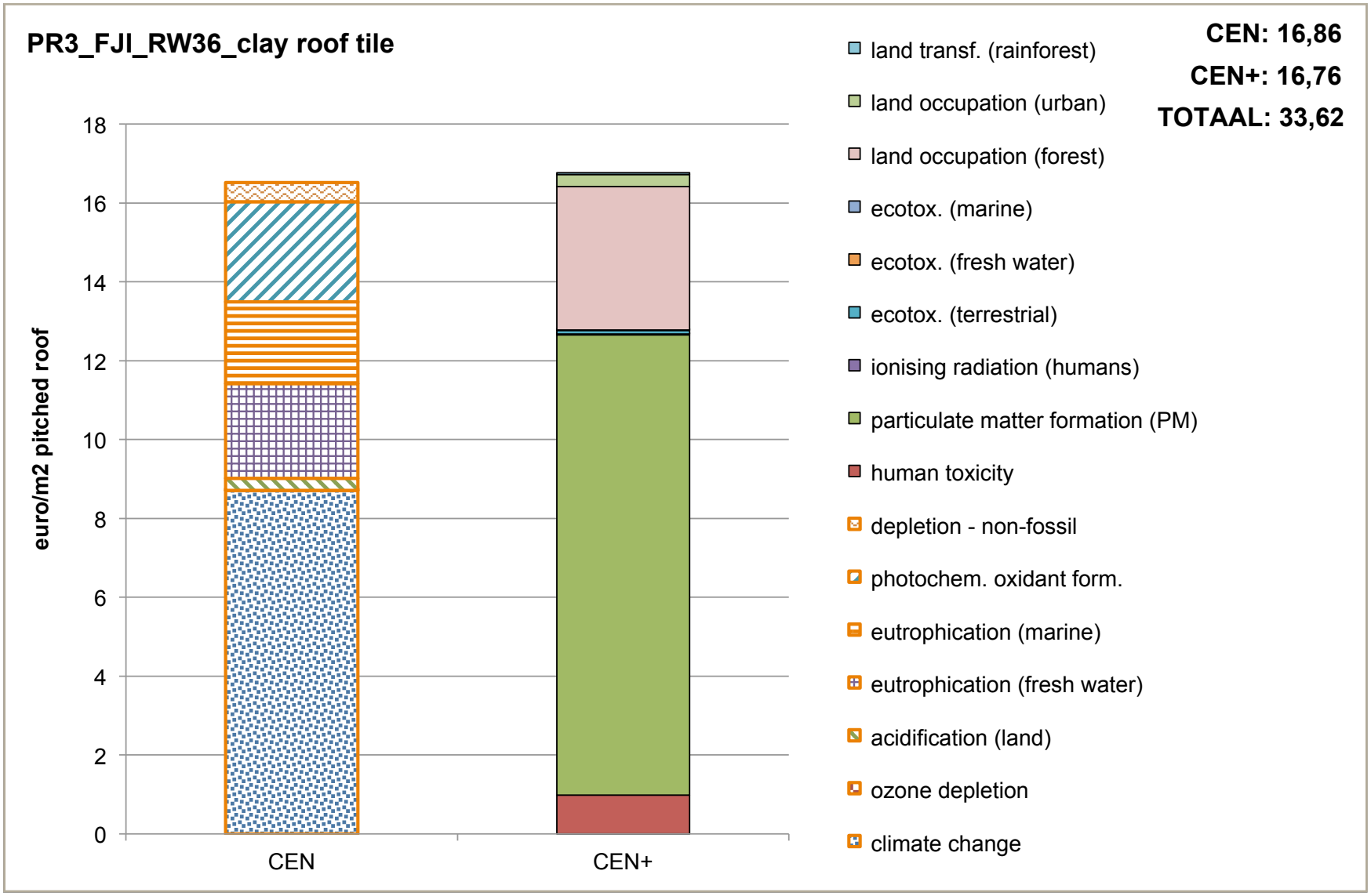

Figure pitched roof 7.3.2: Aggregated environmental profile (divided into CEN and CEN+) of variant 'PR3_FJI_RW36_clay roof tile' per environmental indicator, expressed in monetary units.

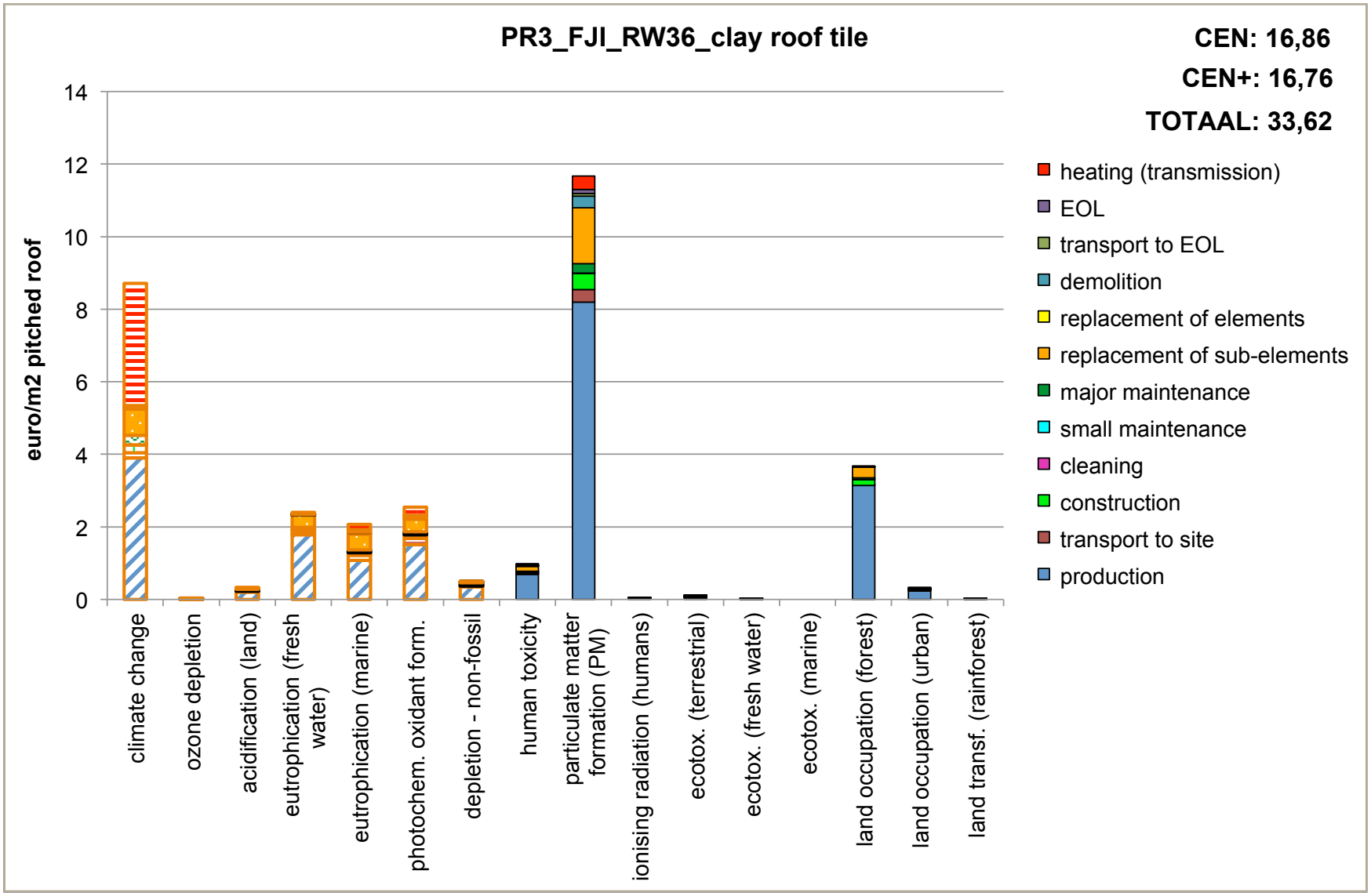

Figure pitched roof 7.3.3: Aggregated environmental profile (divided into CEN and CEN+) of variant 'PR3_FJI_RW36_clay roof tile' per life cycle stage and per individual environmental indicator, expressed in monetary units.

7.4. PR4_FJI_celllulose24_clay roof tile

Table 7.4: overview of the detailed composition of variant 'PR4_FJI_celllulose24_clay roof tile'

Description	u	MiM	MaM	Repl	Repl Type	Ratio	t (m)	λ (W/m.K)	R (m².K/W)
PR4_FJI_celllulose24_clay roof tile									
Roofs - pitched - wood (inland) A roof framing - 2 rafters - surface 42.43 m2	m²		30	120	necessary	1,414	0,07	na	
Roofs - inclined - profiles - FJI beam - type 350 - height 24 cm - h.o.h. 60 cm	m²		30	120	necessary	1,414	0,41	na	
Pitched roof - thermal insulation between FJI beams - cellulose flakes between - 24 cm	m²			120	necessary	1,414		na	10,030
Ceiling finish - board - gypsum (1,25 cm), width 1,2 meter, screwed, inlcusive joint filler	m²		10	30	necessary	1,414	0,01	na	0,050
Ceiling finish - support structure for boards - profiles - wood	m²			30	necessary	1,414	0,02	na	0,160
Ceiling finish - paint - acrylic paint on gypsum plasterboard	m²		5	10	aesthetic	1,414		na	
Roof finishes - pitched surfaces - ceramic tiles (clay roof tiles) - high wind-resistant tile	m²		15	90	necessary	1,414	0,02	na	
Infrastructure for roof tiles - counter battens (20 x 30 mm) - native softwood - for ceramic roof tiles	m²		30	90	necessary	1,414	0,02	na	
Infrastructure for roof tiles - tile laths (25 x 30 mm) - native softwood - for ceramic roof tiles	m²		30	90	necessary	1,414	0,02	na	
Infrastructure for roof finish - subroof - board - wood fibre 22 mm, nailed - for ceramic & concrete tiles and natural slates	m²		30	90	necessary	1,414	0,02	0,055	0,400
Roof finishes - vapour felt - polyethylene (PE)	m²			120	necessary	1,414	0	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)

overview overview CEN overview CEN+

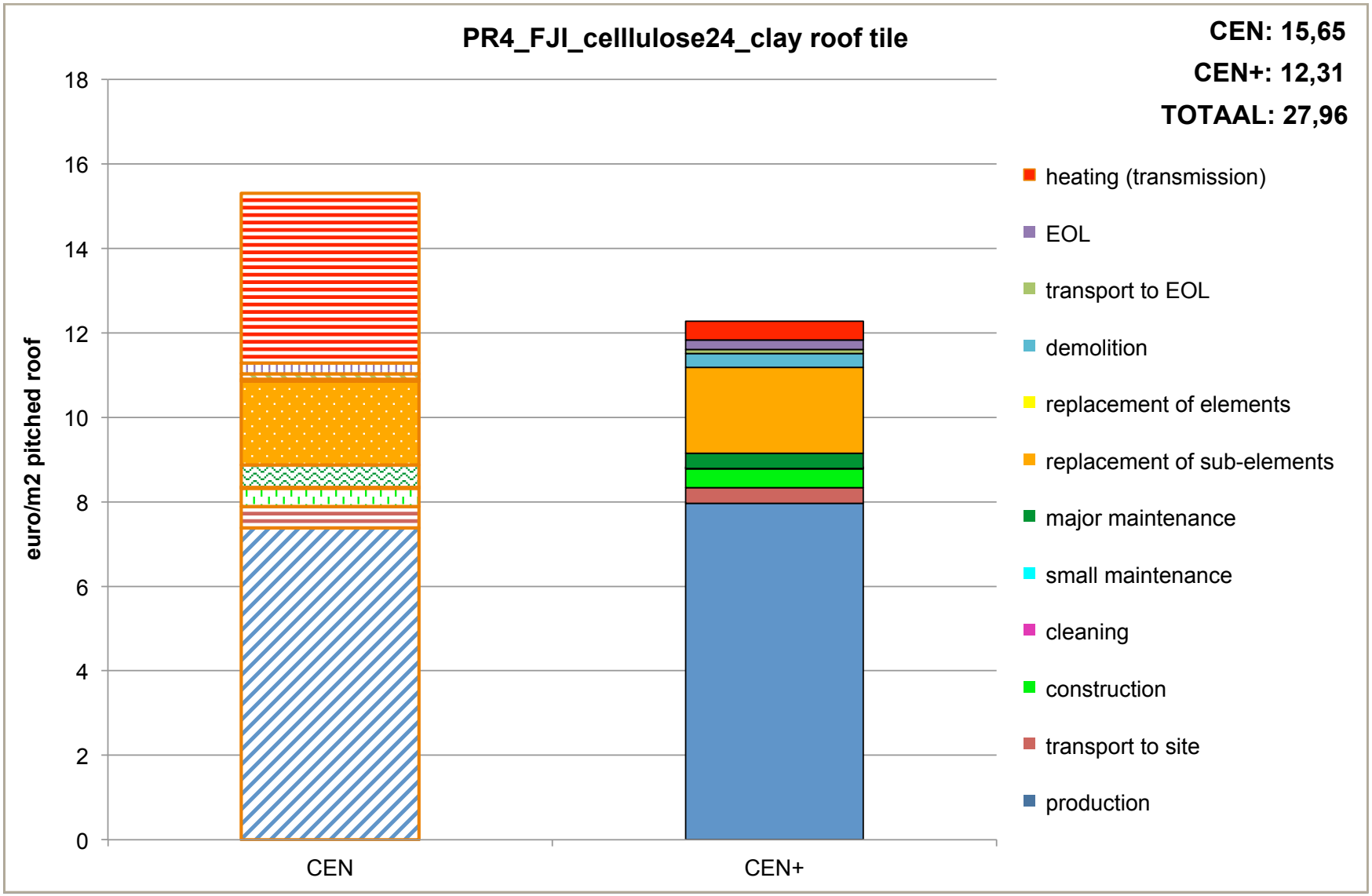

Figure pitched roof 7.4.1: Aggregated environmental profile (divided into CEN and CEN+) of variant 'PR4_FJI_celllulose24_clay roof tile' per life cycle stage, expressed in monetary units.

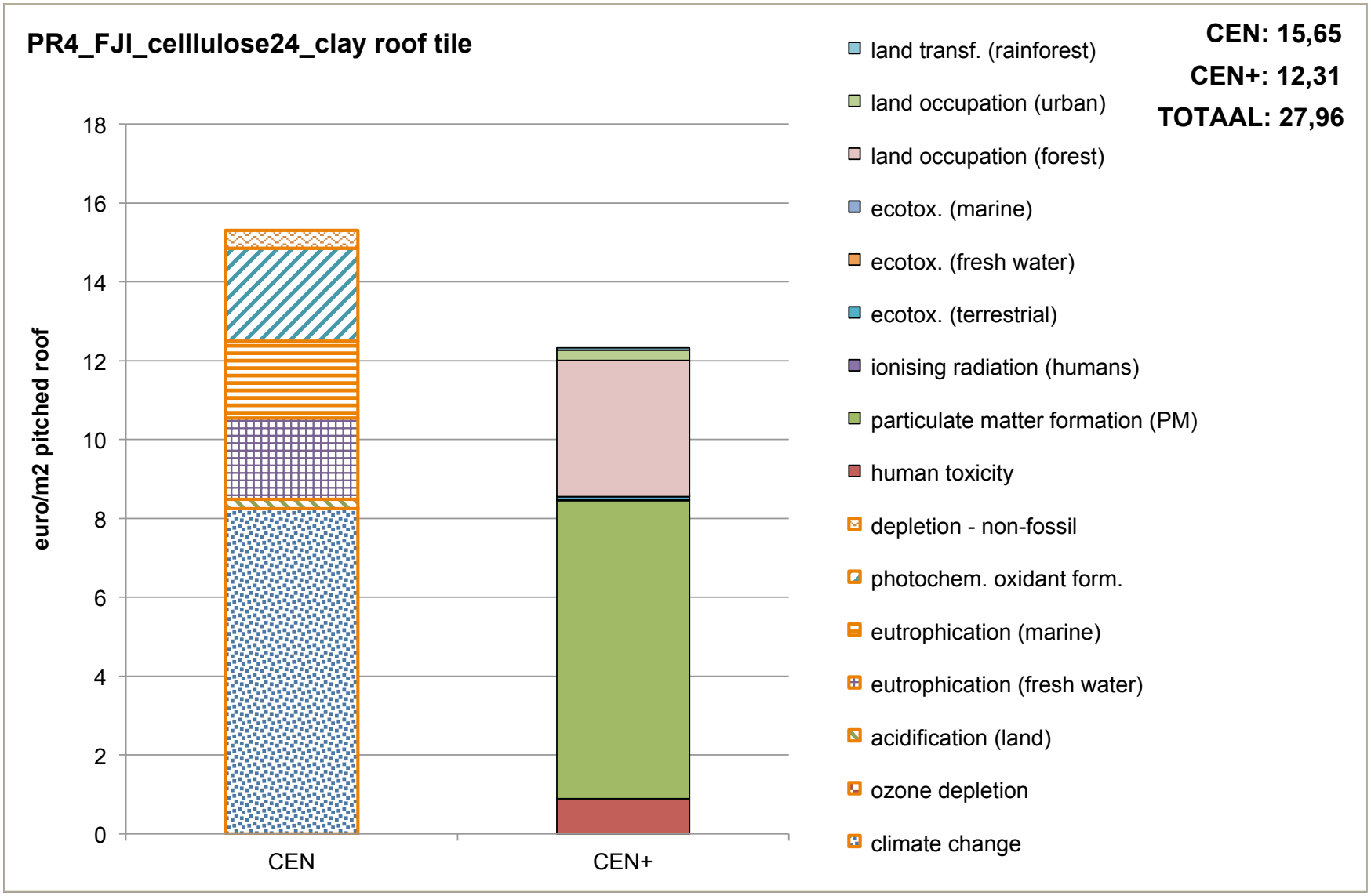

Figure pitched roof 7.4.2: Aggregated environmental profile (divided into CEN and CEN+) of variant 'PR4_FJI_celllulose24_clay roof tile' per environmental indicator, expressed in monetary units.

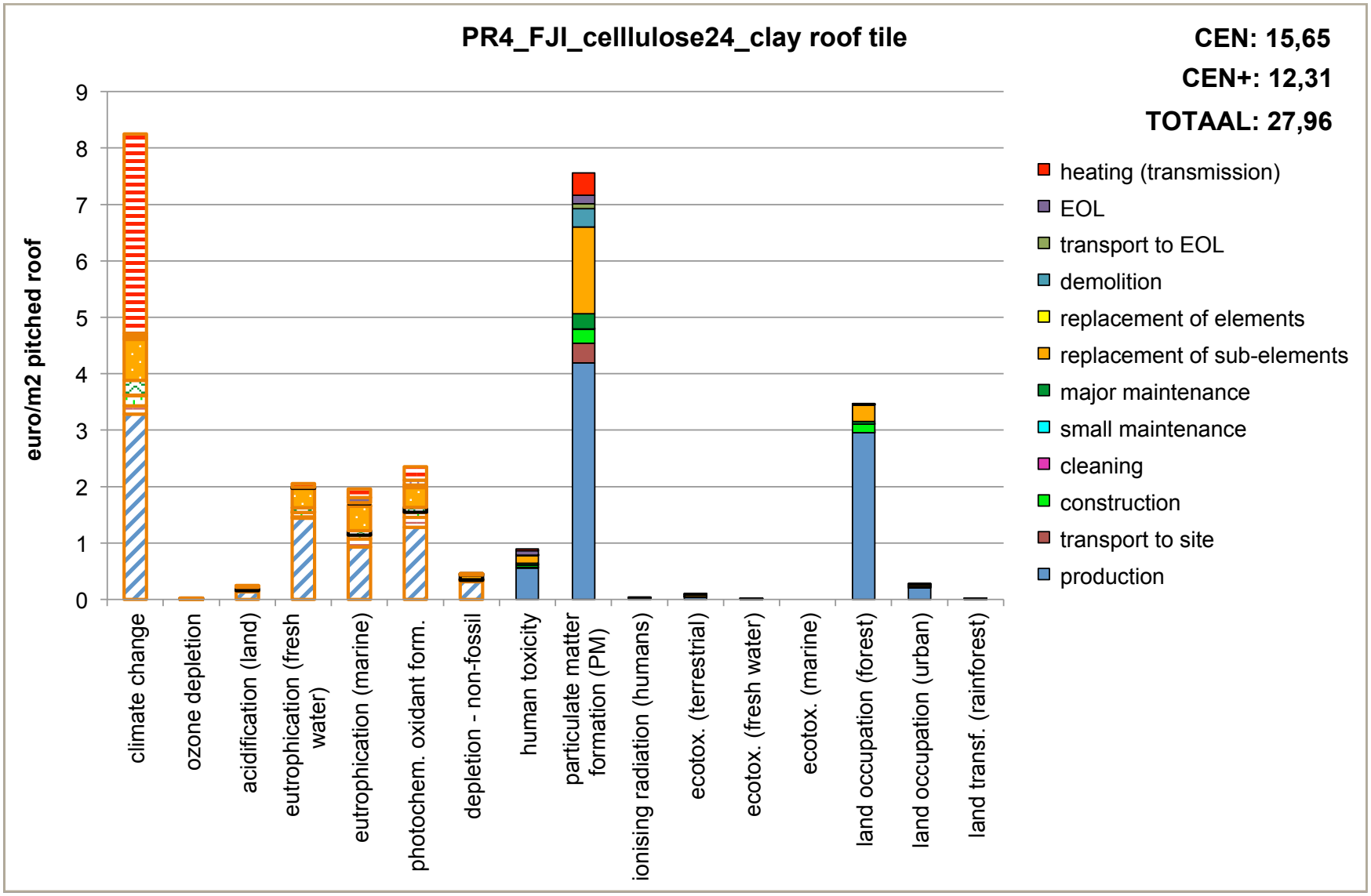

Figure pitched roof 7.4.3: Aggregated environmental profile (divided into CEN and CEN+) of variant 'PR4_FJI_celllulose24_clay roof tile' per life cycle stage and per individual environmental indicator, expressed in monetary units.

7.5. PR5_rafters_RW18_clay roof tile

Table 7.5: overview of the detailed composition of variant 'PR5_rafters_RW18_clay roof tile'

Description	u	MiM	MaM	Repl	Repl Type	Ratio	t (m)	λ (W/m.K)	R (m².K/W)
PR5_rafters_RW18_clay roof tile									
Roofs - inclined - wood (inland) - "Dutch rafters" - rafters every 40 cm - surface 42,43 m²	m²		30	120	necessary	1,414	0,18	na	
Pitched roof - thermal insulation between "Dutch rafters" (each 40 cm) - blanket, batt - anorganic fibre - rock wool - medium hard (18 cm)	m²			120	necessary	1,414	0,18	0,048	3,760
Ceiling finish - board - gypsum (1,25 cm), width 1,2 meter, screwed, inlcusive joint filler	m²		10	30	necessary	1,414	0,01	na	0,050
Ceiling finish - support structure for boards - profiles - wood	m²			30	necessary	1,414	0,02	na	0,160
Ceiling finish - paint - acrylic paint on gypsum plasterboard	m²		5	10	aesthetic	1,414		na	
Roof finishes - pitched surfaces - ceramic tiles (clay roof tiles) - high wind-resistant tile	m²		15	90	necessary	1,414	0,02	na	
Infrastructure for roof tiles - counter battens (20 x 30 mm) - native softwood - for ceramic roof tiles	m²		30	90	necessary	1,414	0,02	na	
Infrastructure for roof tiles - tile laths (25 x 30 mm) - native softwood - for ceramic roof tiles	m²		30	90	necessary	1,414	0,02	na	
Infrastructure for roof finish - subroof - board - wood fibre 22 mm, nailed - for ceramic & concrete tiles and natural slates	m²		30	90	necessary	1,414	0,02	0,055	0,400
Roof finishes - vapour felt - polyethylene (PE)	m²			120	necessary	1,414	0	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)

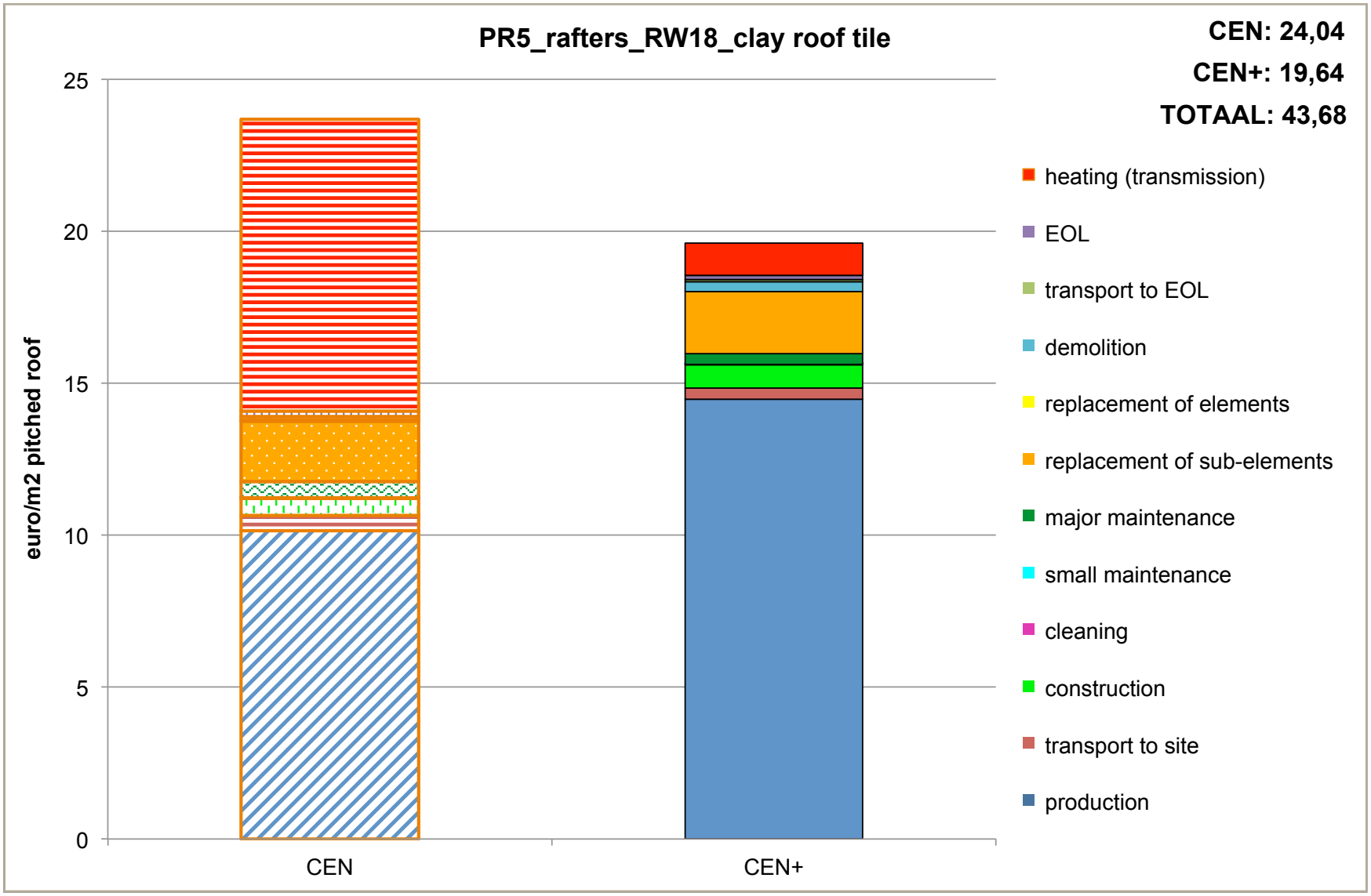

Figure pitched roof 7.5.1: Aggregated environmental profile (divided into CEN and CEN+) of variant 'PR5_rafters_RW18_clay roof tile' per life cycle stage, expressed in monetary units.

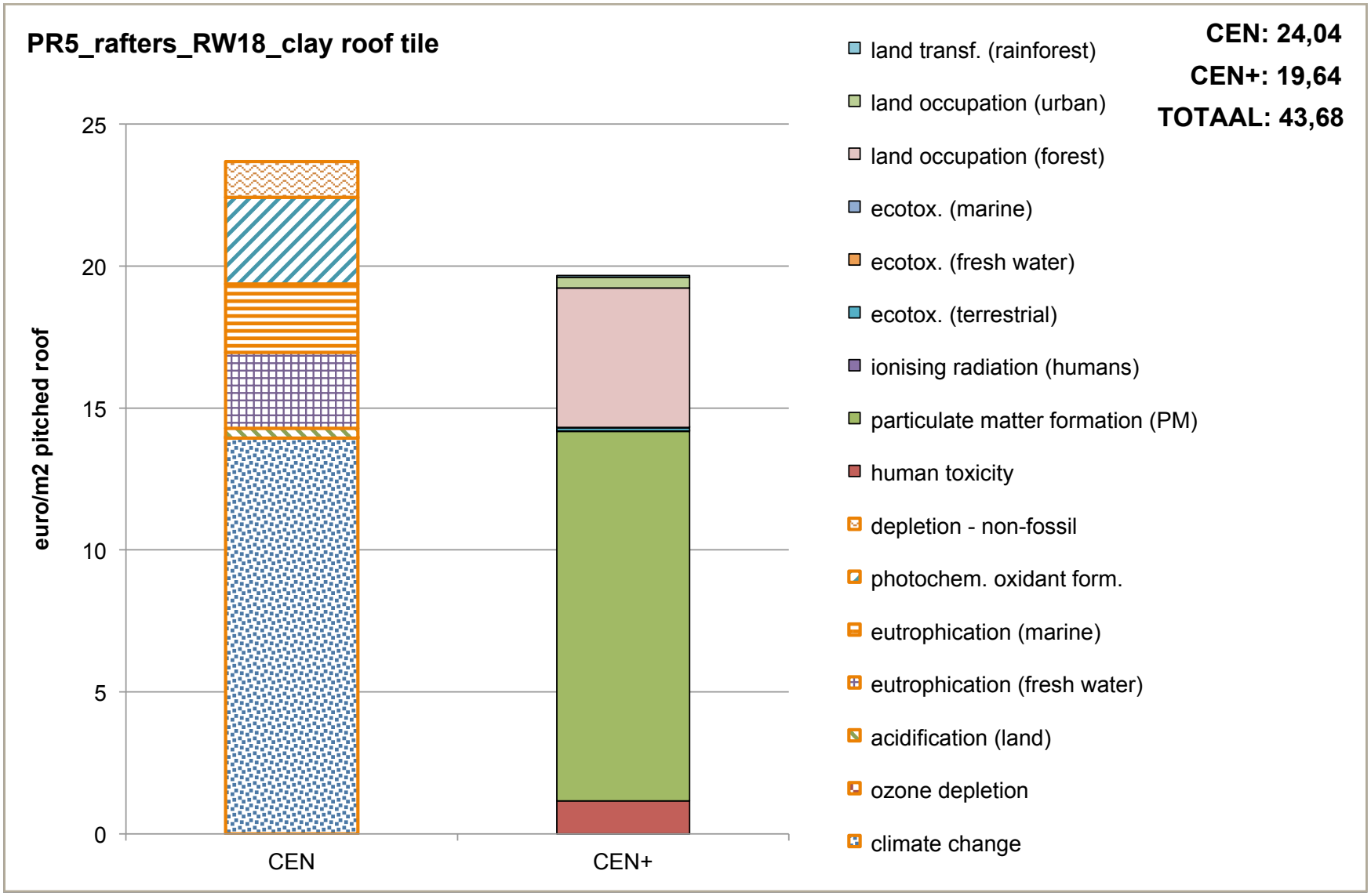

Figure pitched roof 7.5.2: Aggregated environmental profile (divided into CEN and CEN+) of variant 'PR5_rafters_RW18_clay roof tile' per environmental indicator, expressed in monetary units.

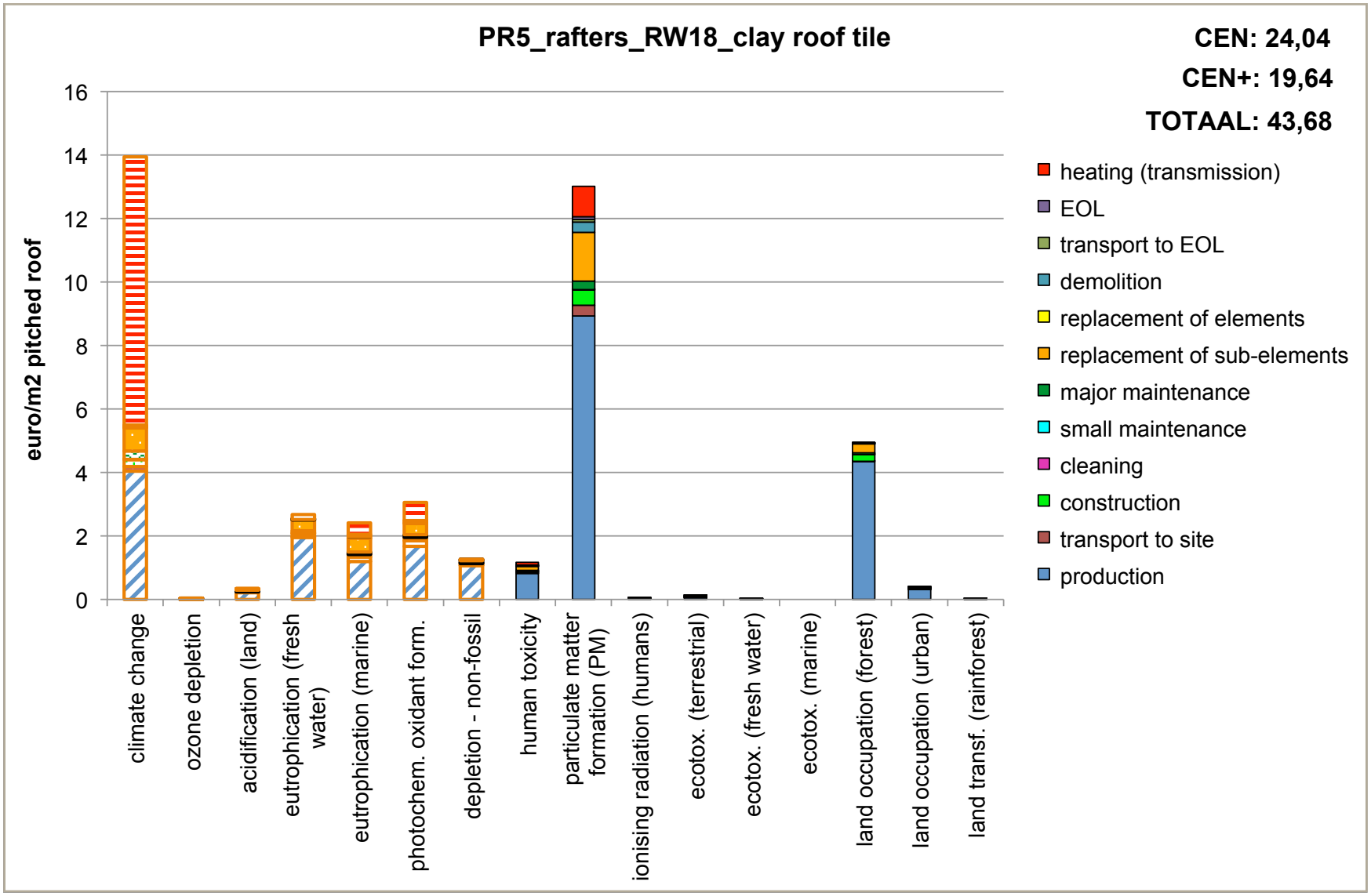

Figure pitched roof 7.5.3: Aggregated environmental profile (divided into CEN and CEN+) of variant 'PR5_rafters_RW18_clay roof tile' per life cycle stage and per individual environmental indicator, expressed in monetary units.

7.6. PR6_rafters_PUR08_clay roof tile

Table 7.6: overview of the detailed composition of variant 'PR6_rafters_PUR08_clay roof tile'

Description	u	MiM	MaM	Repl	Repl Type	Ratio	t (m)	λ (W/m.K)	R (m².K/W)
PR6_rafters_PUR08_clay roof tile									
Roofs - inclined - wood (inland) - "Dutch rafters" - rafters every 40 cm - surface 42,43 m²	m²		30	120	necessary	1,414	0,18	na	
Ceiling finish - board - gypsum (1,25 cm), width 1,2 meter, screwed, inlcusive joint filler	m²		10	30	necessary	1,414	0,01	na	0,050
Ceiling finish - support structure for boards - profiles - wood	m²			30	necessary	1,414	0,02	na	0,160
Ceiling finish - paint - acrylic paint on gypsum plasterboard	m²		5	10	aesthetic	1,414		na	
Roof finishes - pitched surfaces - ceramic tiles (clay roof tiles) - high wind-resistant tile	m²		15	90	necessary	1,414	0,02	na	
Infrastructure for roof tiles - counter battens (20 x 30 mm) - native softwood - for ceramic roof tiles	m²		30	90	necessary	1,414	0,02	na	
Infrastructure for roof tiles - tile laths (25 x 30 mm) - native softwood - for ceramic roof tiles	m²		30	90	necessary	1,414	0,02	na	
Infrastructure for roof finish - subroof - board - wood fibre 22 mm, nailed - for ceramic & concrete tiles and natural slates	m²		30	90	necessary	1,414	0,02	0,055	0,400
Pitched roof - thermal insulation - board - polyurethane 8 cm	m²			120	necessary	1,414	0,08	0,025	3,200
Roof finishes - vapour felt - polyethylene (PE)	m²			120	necessary	1,414	0	na	

- u: unit;
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- 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)

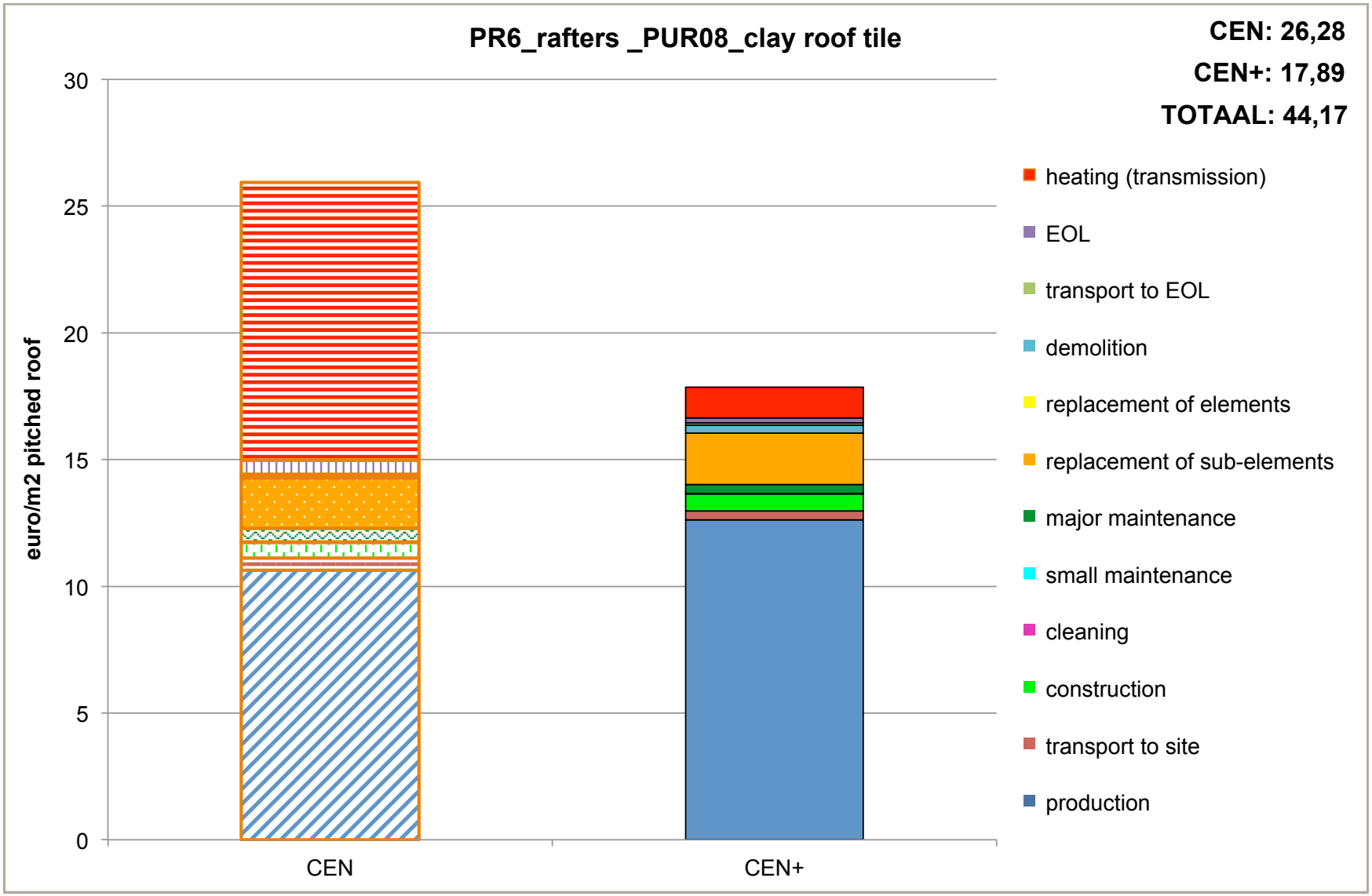

Figure pitched roof 7.6.1: Aggregated environmental profile (divided into CEN and CEN+) of variant 'PR6_rafters_PUR08_clay roof tile' per life cycle stage, expressed in monetary units.

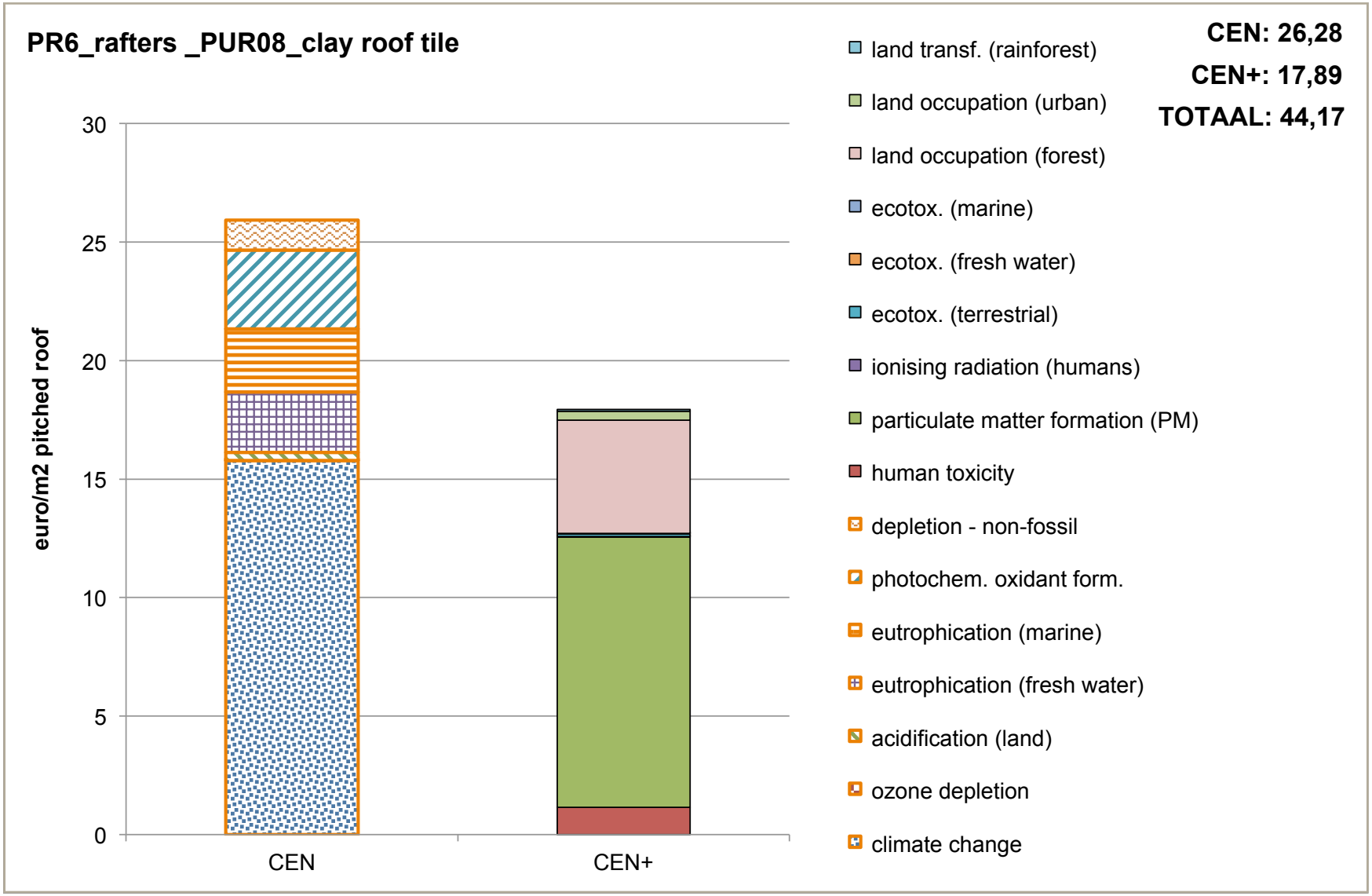

Figure pitched roof 7.6.2: Aggregated environmental profile (divided into CEN and CEN+) of variant 'PR6_rafters_PUR08_clay roof tile' per environmental indicator, expressed in monetary units.

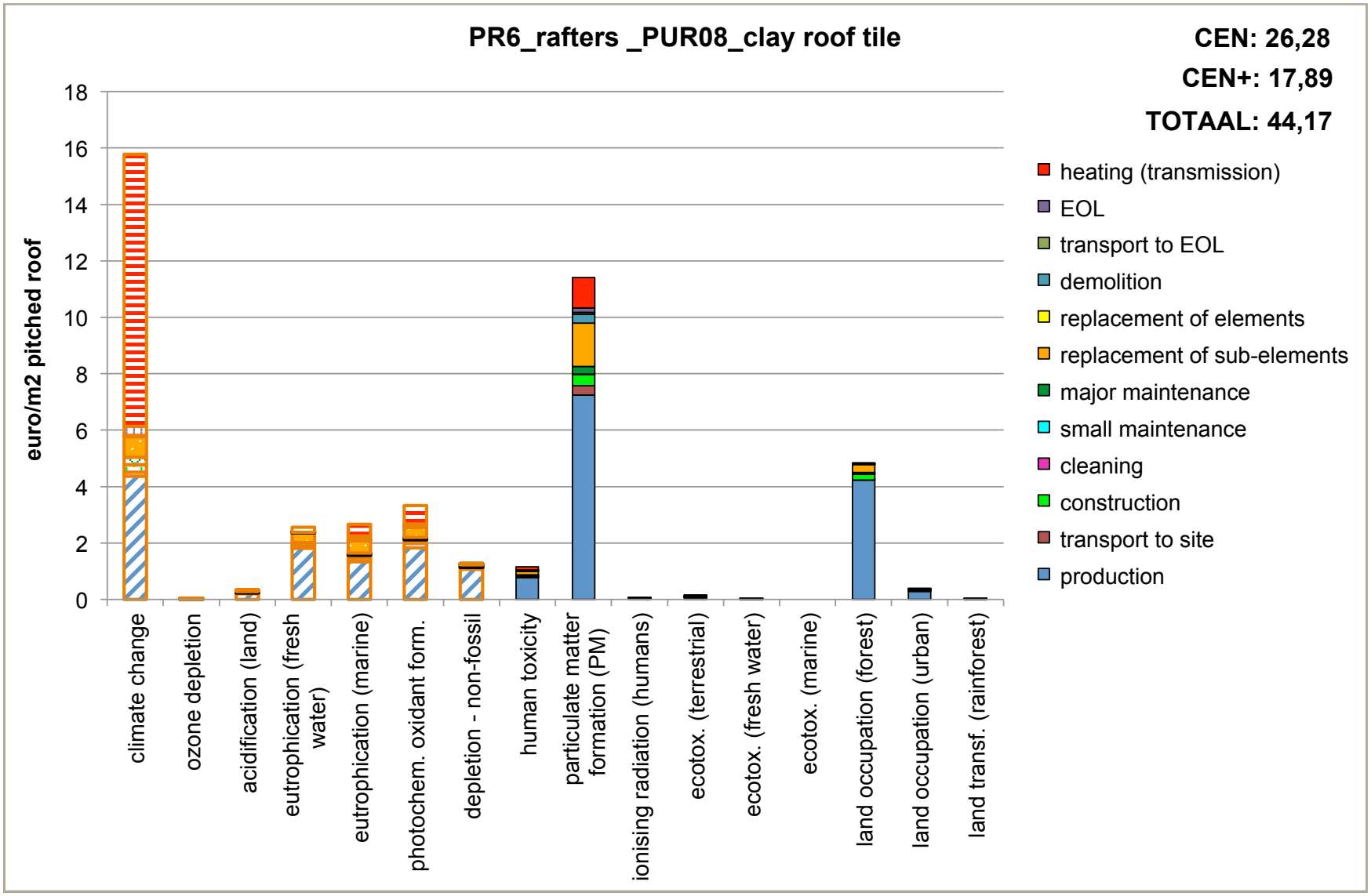

Figure pitched roof 7.6.3: Aggregated environmental profile (divided into CEN and CEN+) of variant 'PR6_rafters_PUR08_clay roof tile' per life cycle stage and per individual environmental indicator, expressed in monetary units.

7.7. PR7_rafters_PUR16_clay roof tile

Table 7.7: overview of the detailed composition of variant 'PR7_rafters_PUR16_clay roof tile'

Description	u	MiM	MaM	Repl	Repl Type	Ratio	t (m)	λ (W/m.K)	R (m².K/W)
PR7_rafters_PUR16_clay roof tile									
Roofs - inclined - wood (inland) - "Dutch rafters" - rafters every 40 cm - surface 42,43 m²	m²		30	120	necessary	1,414	0,18	na	
Ceiling finish - board - gypsum (1,25 cm), width 1,2 meter, screwed, inlcusive joint filler	m²		10	30	necessary	1,414	0,01	na	0,050
Ceiling finish - support structure for boards - profiles - wood	m²			30	necessary	1,414	0,02	na	0,160
Ceiling finish - paint - acrylic paint on gypsum plasterboard	m²		5	10	aesthetic	1,414		na	
Roof finishes - pitched surfaces - ceramic tiles (clay roof tiles) - high wind-resistant tile	m²		15	90	necessary	1,414	0,02	na	
Infrastructure for roof tiles - counter battens (20 x 30 mm) - native softwood - for ceramic roof tiles	m²		30	90	necessary	1,414	0,02	na	
Infrastructure for roof tiles - tile laths (25 x 30 mm) - native softwood - for ceramic roof tiles	m²		30	90	necessary	1,414	0,02	na	
Infrastructure for roof finish - subroof - board - wood fibre 22 mm, nailed - for ceramic & concrete tiles and natural slates	m²		30	90	necessary	1,414	0,02	0,055	0,400
Pitched roof - thermal insulation - board - polyurethane 6 cm	m²			120	necessary	1,414	0,06	0,025	2,400
Pitched roof - thermal insulation - board - polyurethane 10 cm	m²			120	necessary	1,414	0,1	0,025	4,000
Roof finishes - vapour felt - polyethylene (PE)	m²			120	necessary	1,414	0	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)

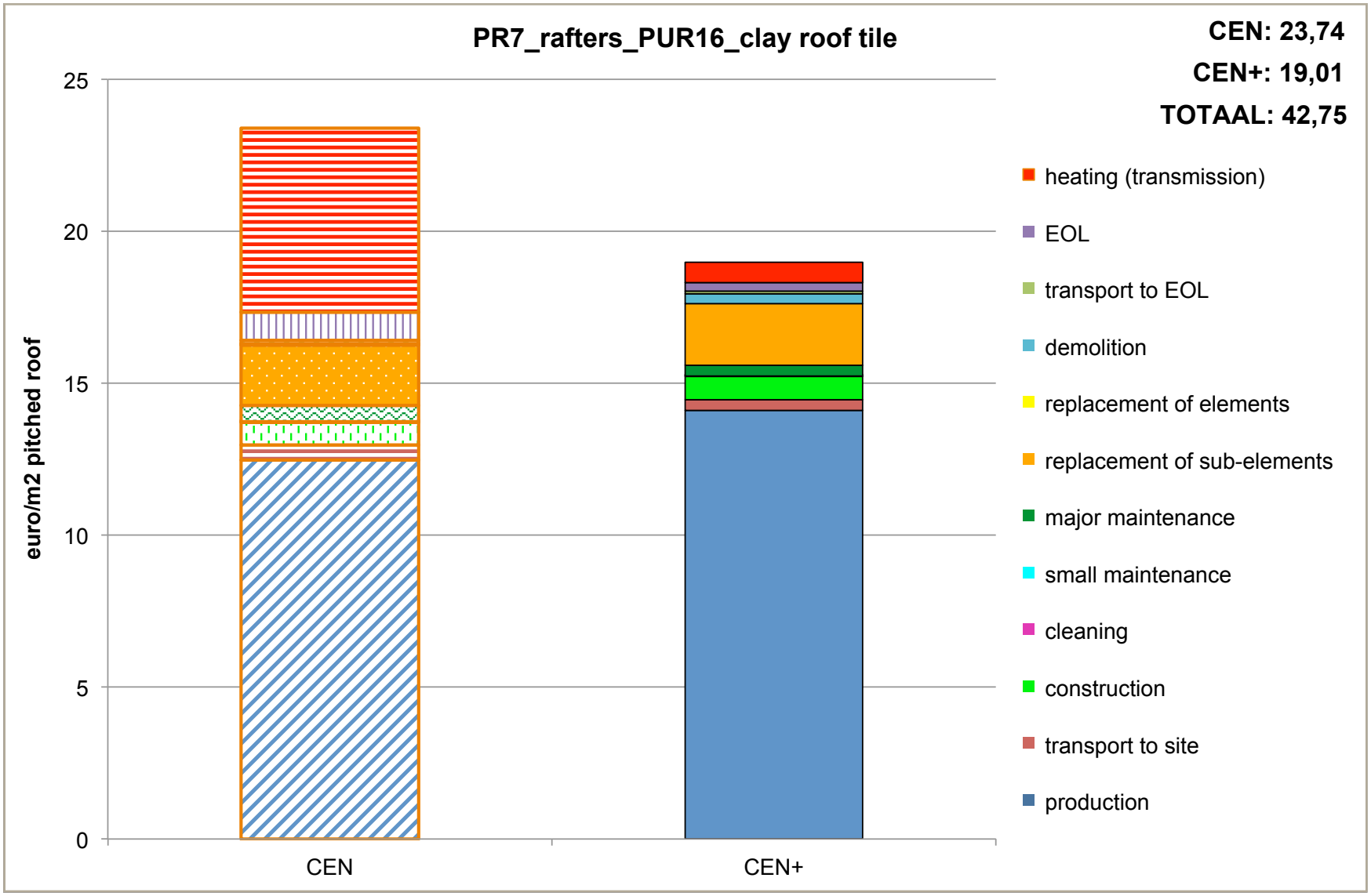

Figure pitched roof 7.7.1: Aggregated environmental profile (divided into CEN and CEN+) of variant 'PR7_rafters_PUR16_clay roof tile' per life cycle stage, expressed in monetary units.

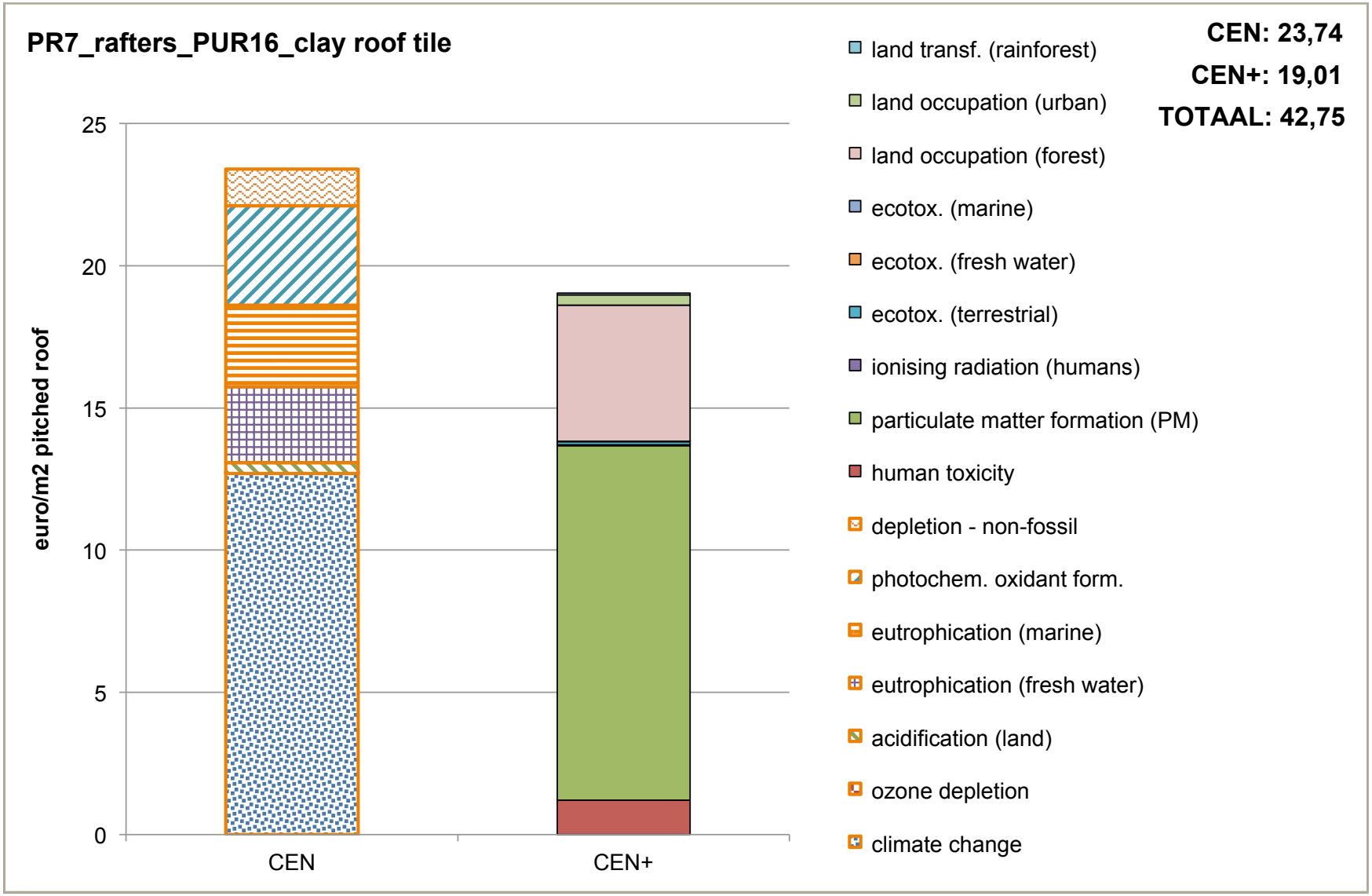

Figure pitched roof 7.7.2: Aggregated environmental profile (divided into CEN and CEN+) of variant 'PR7_rafters_PUR16_clay roof tile' per environmental indicator, expressed in monetary units.

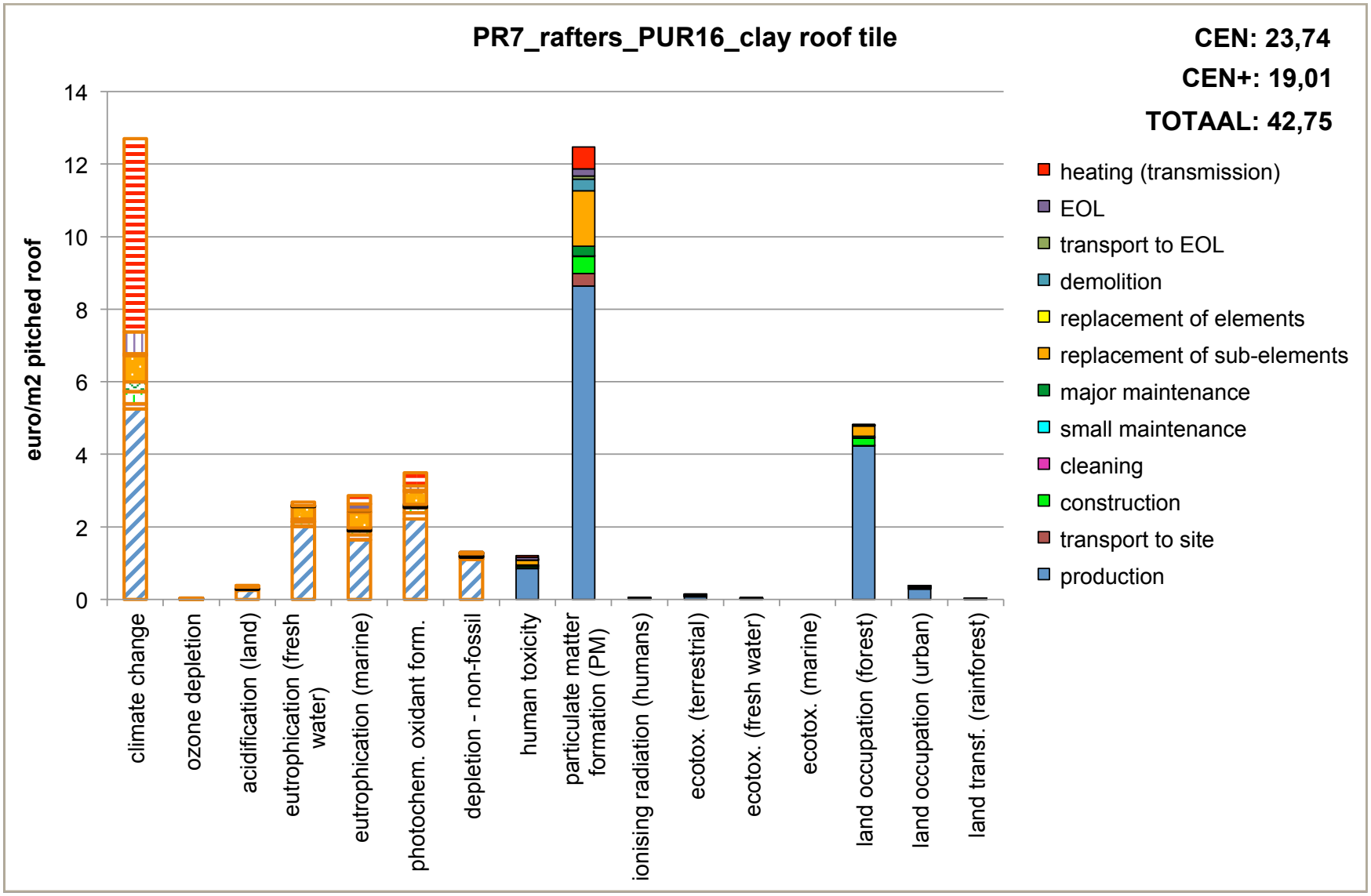

Figure pitched roof 7.7.3: Aggregated environmental profile (divided into CEN and CEN+) of variant 'PR7_rafters_PUR16_clay roof tile' per life cycle stage and per individual environmental indicator, expressed in monetary units.

7.8. PR8_rafters_RW18_zink

Table 7.8: overview of the detailed composition of variant 'PR8_rafters_RW18_zink'

Description	u	MiM	MaM	Repl	Repl Type	Ratio	t (m)	λ (W/m.K)	R (m².K/W)
PR8_rafters_RW18_zink									
Roofs - inclined - wood (inland) - "Dutch rafters" - rafters every 40 cm - surface 42,43 m²	m²		30	120	necessary	1,414	0,18	na	
Pitched roof - thermal insulation between "Dutch rafters" (each 40 cm) - blanket, batt - anorganic fibre - rock wool - medium hard (18 cm)	m²			120	necessary	1,414	0,18	0,048	3,760
Ceiling finish - board - gypsum (1,25 cm), width 1,2 meter, screwed, inlcusive joint filler	m²		10	30	necessary	1,414	0,01	na	0,050
Ceiling finish - support structure for boards - profiles - wood	m²			30	necessary	1,414	0,02	na	0,160
Ceiling finish - paint - acrylic paint on gypsum plasterboard	m²		5	10	aesthetic	1,414		na	
Roof finishes - inclined surfaces - profielplaten - zinc (geprepatineerd) - thickness 8/10	m²		15	30	necessary	1,414	0	na	
Infrastructure for roof finish - board - wood - 24 mm - for zinc tiles, zinc roof plate and copper roof plate	m²			30	necessary	1,414	0,02	0,130	0,180
Infrastructure for roof finish - flexible board for metal finishing (ventilation) - nailed (PE button foil)	m²			30	necessary	1,414	0	0,500	0,000
Roof finishes - vapour felt - polyethylene (PE)	m²			120	necessary	1,414	0	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)

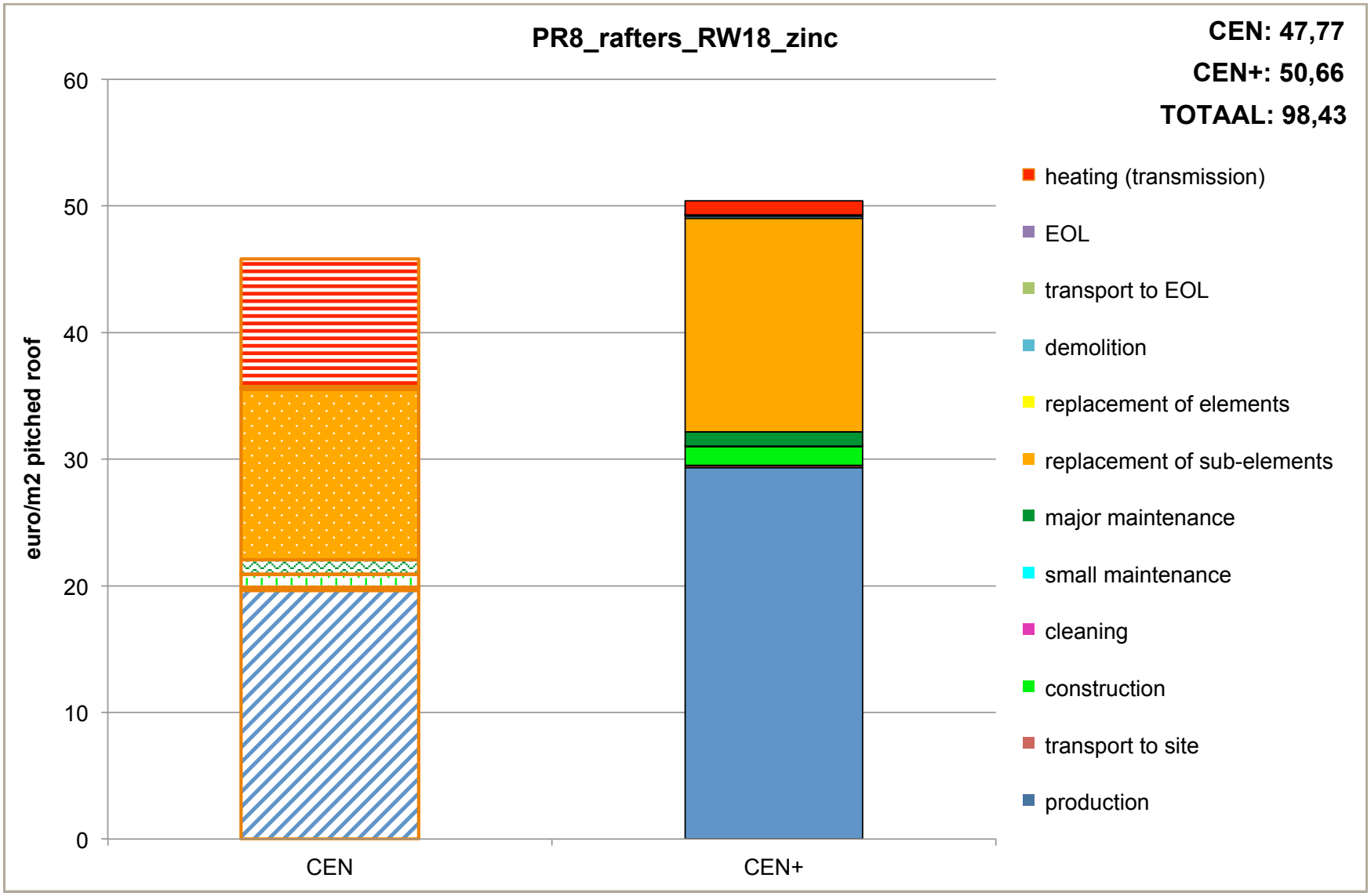

Figure pitched roof 7.8.1: Aggregated environmental profile (divided into CEN and CEN+) of variant 'PR8_rafters_RW18_zink' per life cycle stage, expressed in monetary units.

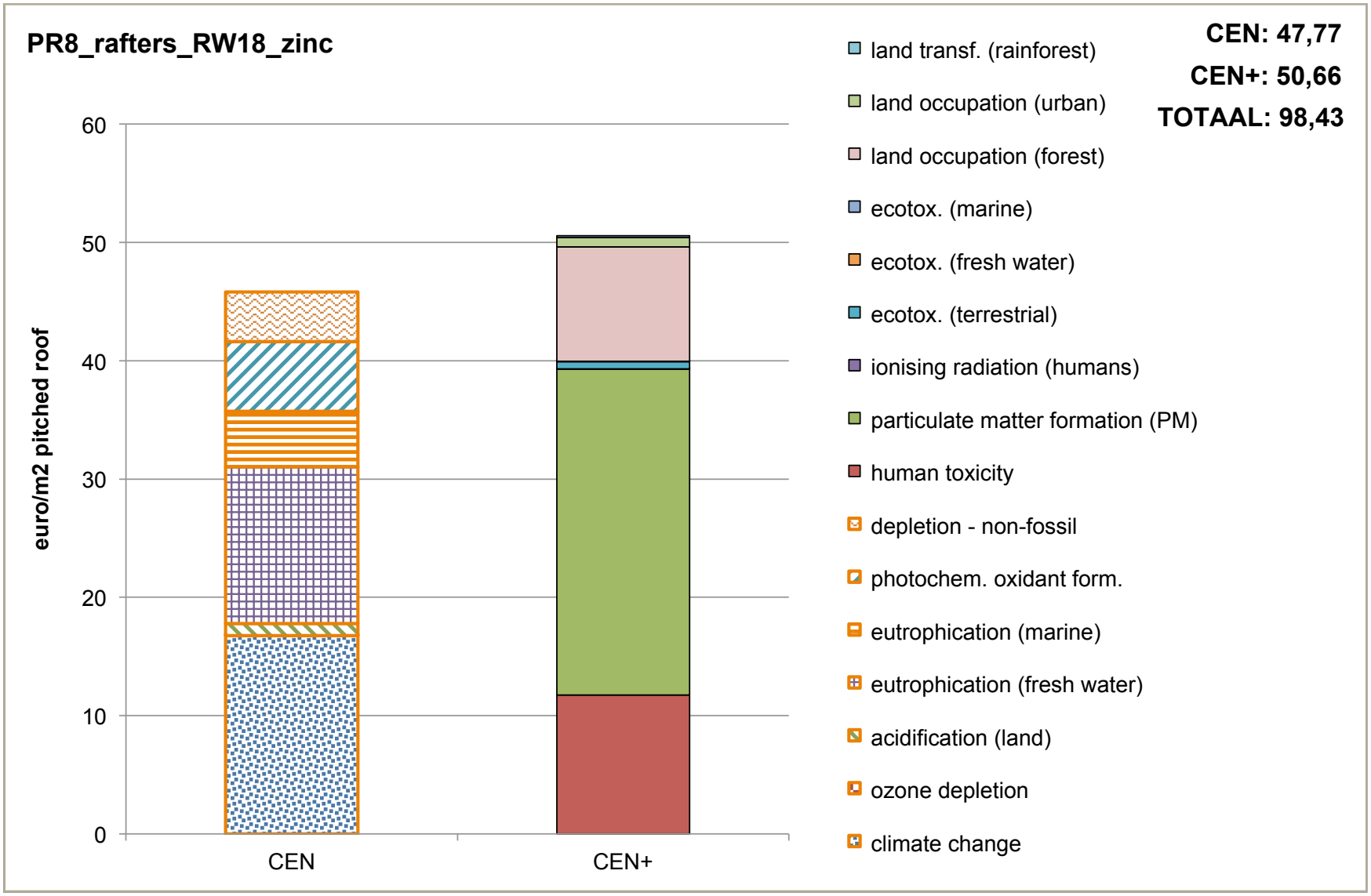

Figure pitched roof 7.8.2: Aggregated environmental profile (divided into CEN and CEN+) of variant 'PR8_rafters_RW18_zink' per environmental indicator, expressed in monetary units.

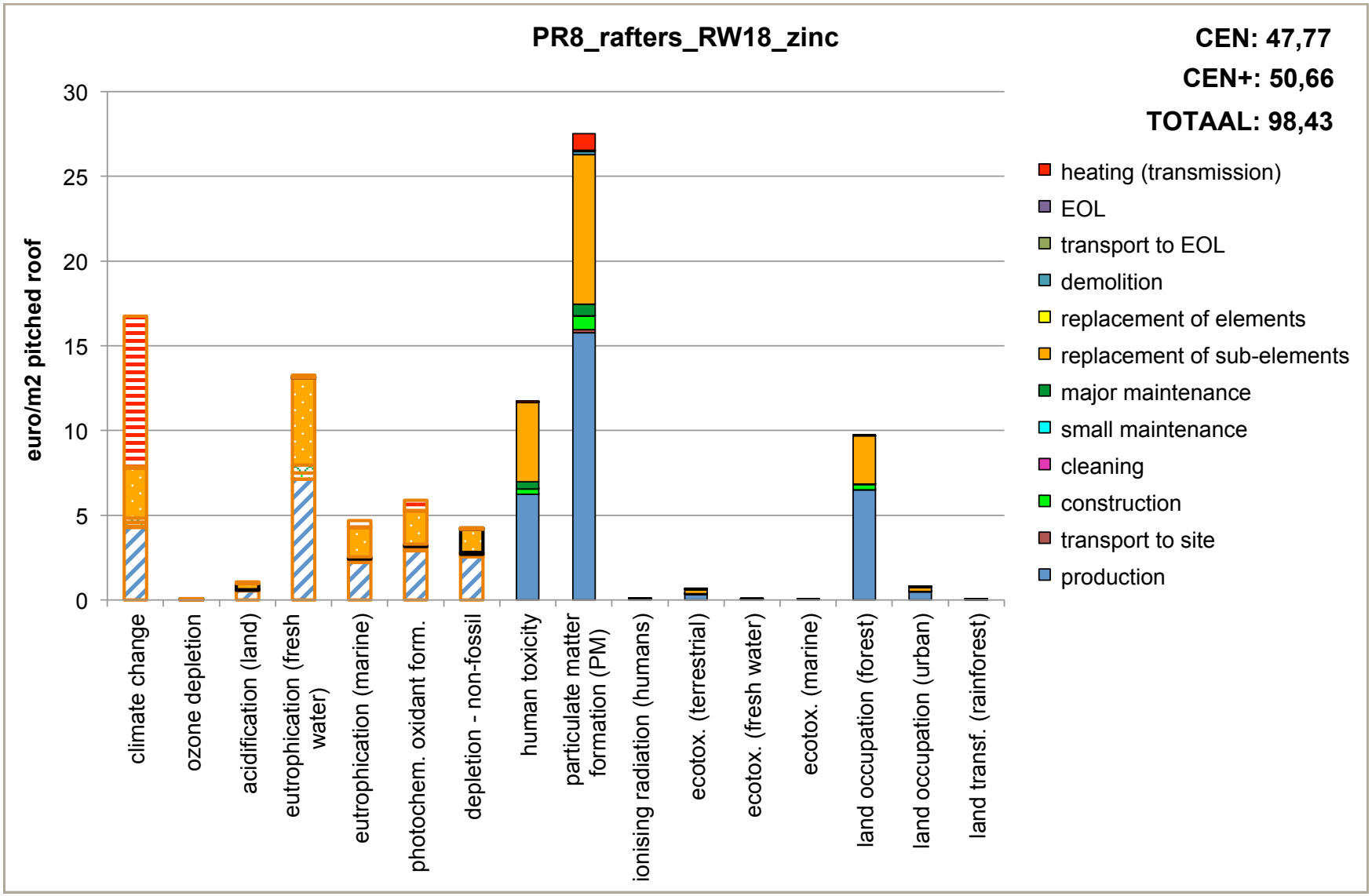

Figure pitched roof 7.8.3: Aggregated environmental profile (divided into CEN and CEN+) of variant 'PR8_rafters_RW18_zink' per life cycle stage and per individual environmental indicator, expressed in monetary units.

7.9. PR9_rafters_RW18_fibre cement

Table 7.9: overview of the detailed composition of variant 'PR9_rafters_RW18_fibre cement'

Description	u	MiM	MaM	Repl	Repl Type	Ratio	t (m)	λ (W/m.K)	R (m².K/W)
PR9_rafters_RW18_fibre cement									
Roofs - inclined - wood (inland) - "Dutch rafters" - rafters every 40 cm - surface 42,43 m²	m²		30	120	necessary	1,414	0,18	na	
Pitched roof - thermal insulation between "Dutch rafters" (each 40 cm) - blanket, batt - anorganic fibre - rock wool - medium hard (18 cm)	m²			120	necessary	1,414	0,18	0,048	3,760
Ceiling finish - board - gypsum (1,25 cm), width 1,2 meter, screwed, inlcusive joint filler	m²		10	30	necessary	1,414	0,01	na	0,050
Ceiling finish - support structure for boards - profiles - wood	m²			30	necessary	1,414	0,02	na	0,160
Ceiling finish - paint - acrylic paint on gypsum plasterboard	m²		5	10	aesthetic	1,414		na	
Roof finishes - inclined surfaces - slate - fibre cement - 60 x 30 cm	m²		15	30	necessary	1,414	0	na	
Infrastructure for roof tiles - counter battens (20 x 30 mm) - native softwood - for glass roof tiles and fibre cement roof slates	m²			30	necessary	1,414	0,02	na	
Infrastructure for roof tiles - tile laths (27 x 36 mm) - native softwood - for fibre cement roof slates	m²			30	necessary	1,414	0,03	na	
Infrastructure for roof finish - subroof - board - wood fibre 22 mm, nailed - not for ceramic & concrete tiles or natural slates	m²			30	necessary	1,414	0,02	0,055	0,400
Roof finishes - vapour felt - polyethylene (PE)	m²			120	necessary	1,414	0	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)

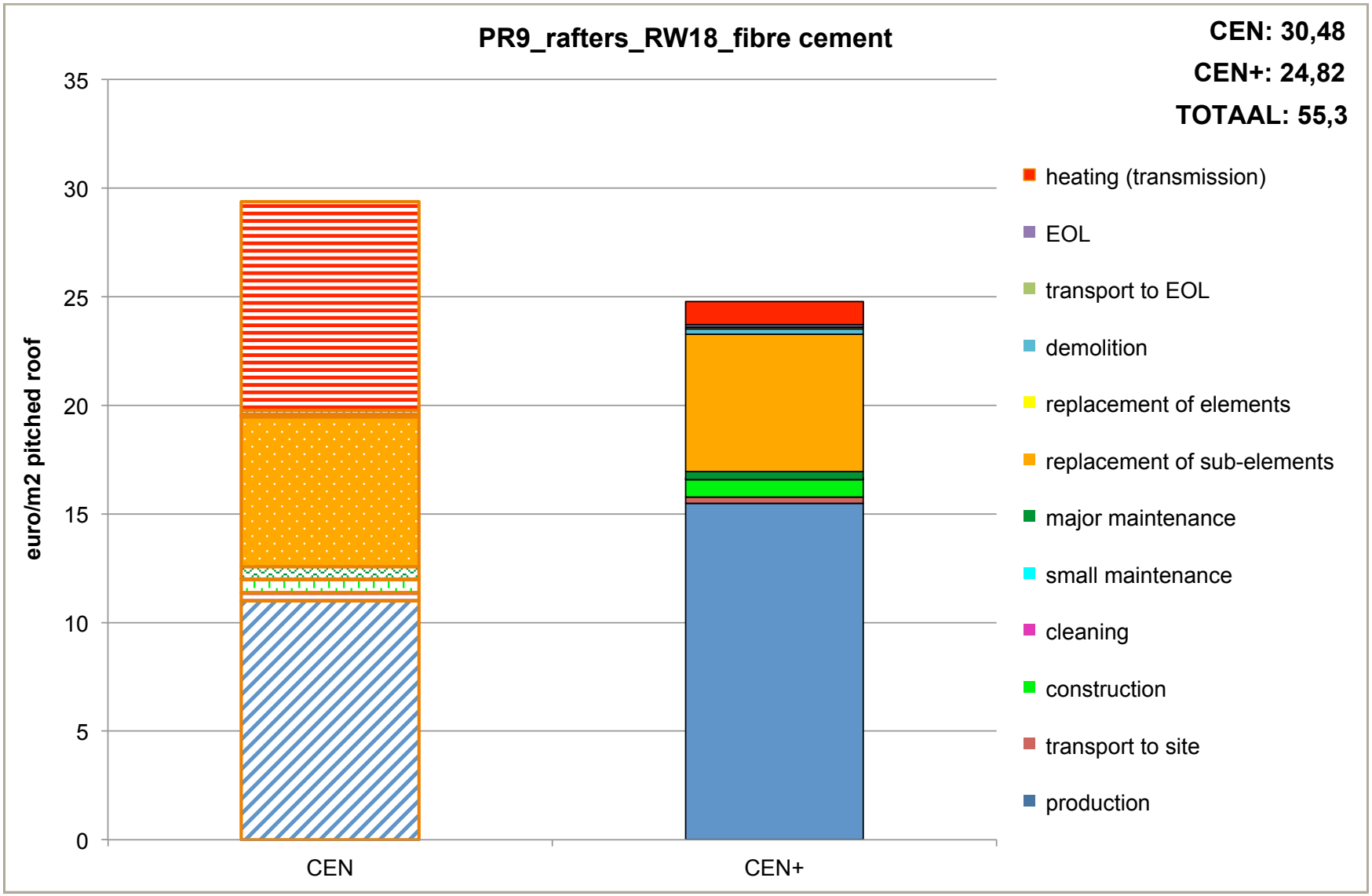

Figure pitched roof 7.9.1: Aggregated environmental profile (divided into CEN and CEN+) of variant 'PR9_rafters_RW18_fibre cement' per life cycle stage, expressed in monetary units.

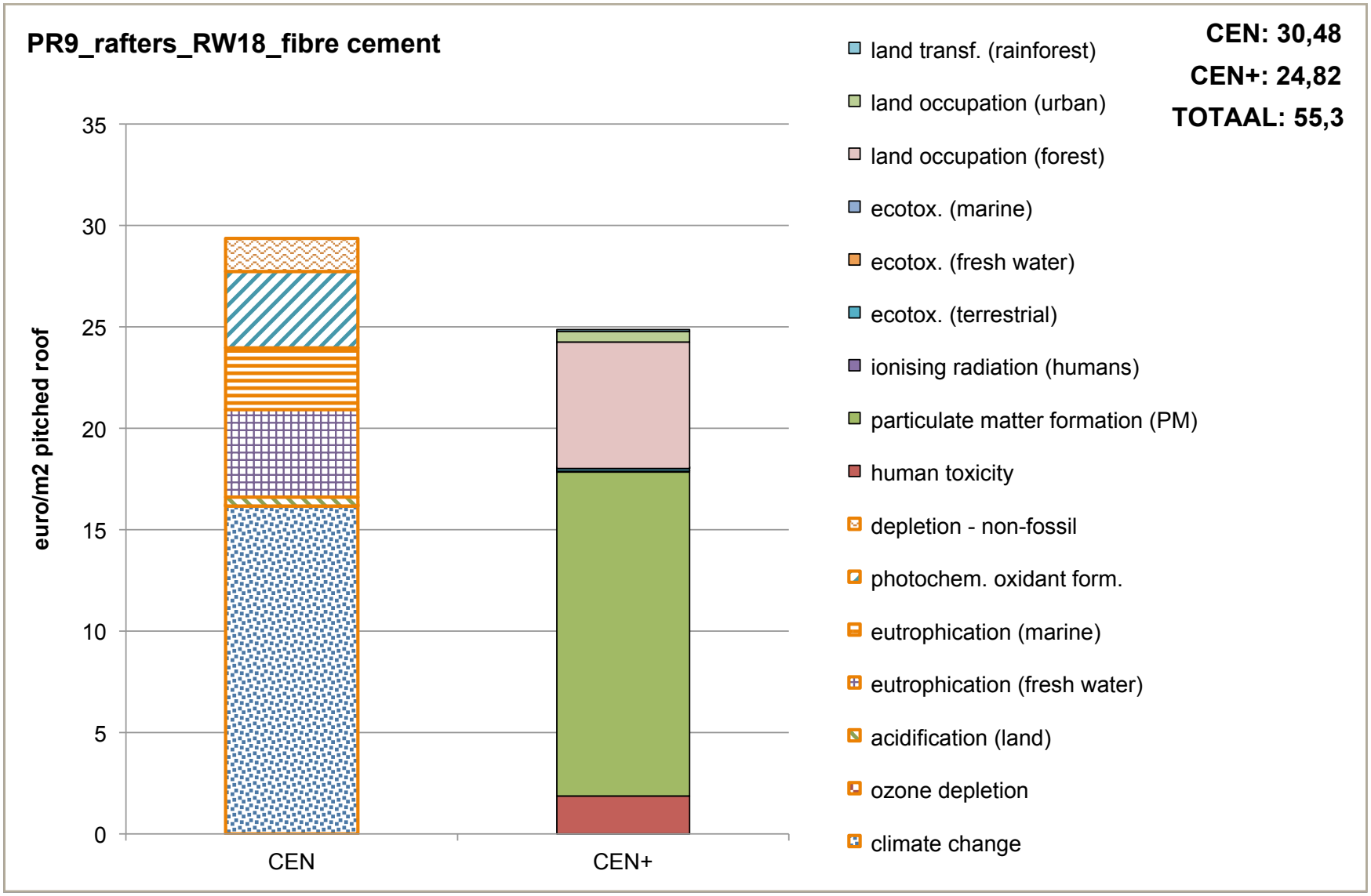

Figure pitched roof 7.9.2: Aggregated environmental profile (divided into CEN and CEN+) of variant 'PR9_rafters_RW18_fibre cement' per environmental indicator, expressed in monetary units.

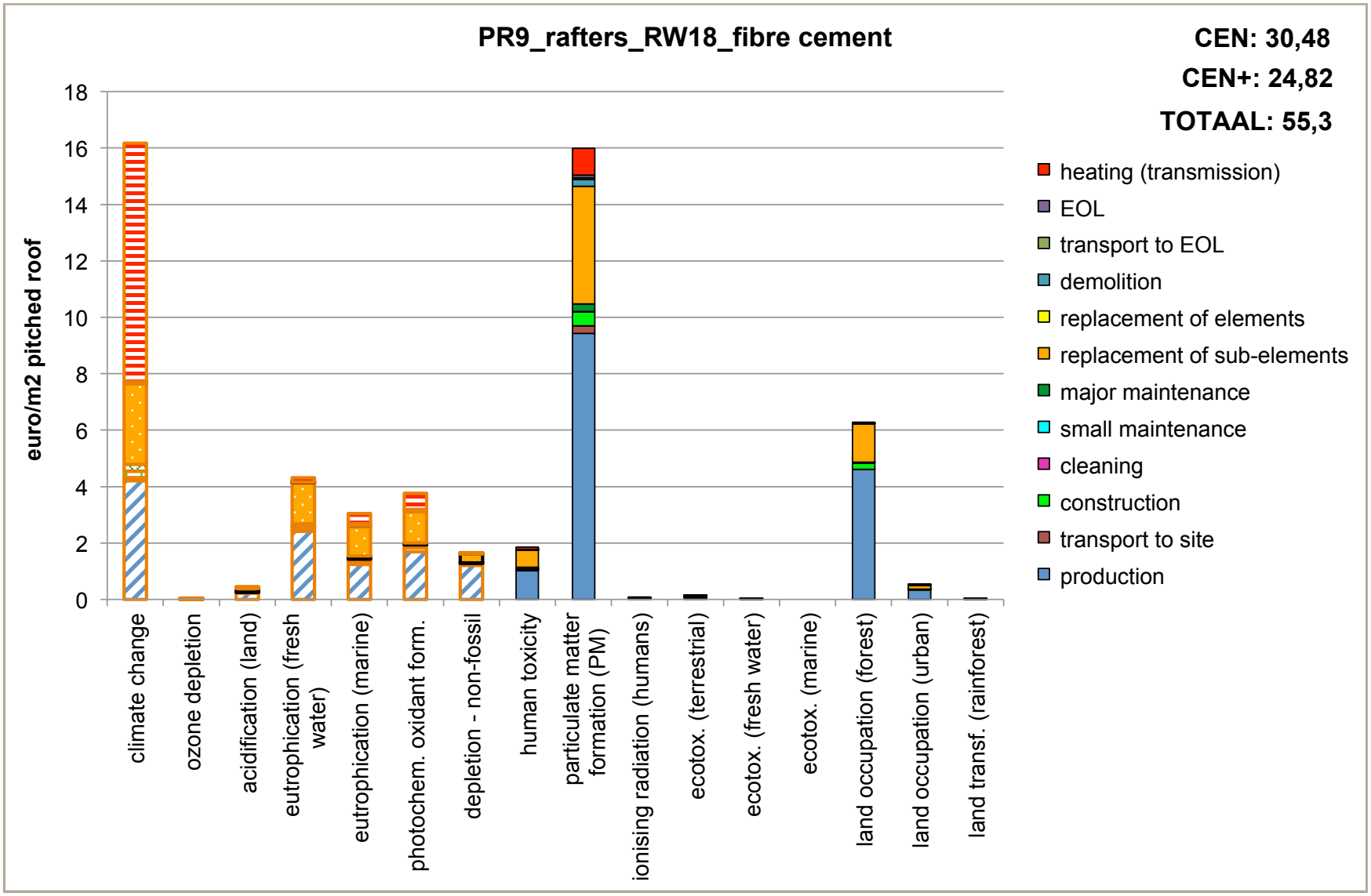

Figure pitched roof 7.9.3: Aggregated environmental profile (divided into CEN and CEN+) of variant 'PR9_rafters_RW18_fibre cement' per life cycle stage and per individual environmental indicator, expressed in monetary units.

7.10. PR10_steel_sandwich RW12_steel

Table 7.10: overview of the detailed composition of variant 'PR10_steel_sandwich RW12_steel'

Description	u	MiM	MaM	Repl	Repl Type	Ratio	t (m)	λ (W/m.K)	R (m².K/W)
PR10_steel_sandwich RW12_steel									
Roofs - inclined - sandwich roof panel – profiled steel plate + rockwool (12 cm) + steel plate	m²		30	60	necessary	1,414	0,12	0,037	3,210
Roofs - inclined - stainless steel prefab A roof framing - only to be used with open roof or sandwich panels - 2 frames - surface 42,43 m2	m²			120	necessary	1,414	0,14	na	
Roofs - inclined - profiles - steel - purlins IPE 140 - (2 for 42,43 m2)	m²			120	necessary	1,414	0	na	
Ceiling finish - board - gypsum (1,25 cm), width 1,2 meter, screwed, inlcusive joint filler	m²		10	30	necessary	1,414	0,01	na	0,050
Ceiling finish - support structure for boards - profiles - wood	m²			30	necessary	1,414	0,02	na	0,160
Ceiling finish - paint - acrylic paint on gypsum plasterboard	m²		5	10	aesthetic	1,414		na	

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- 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)

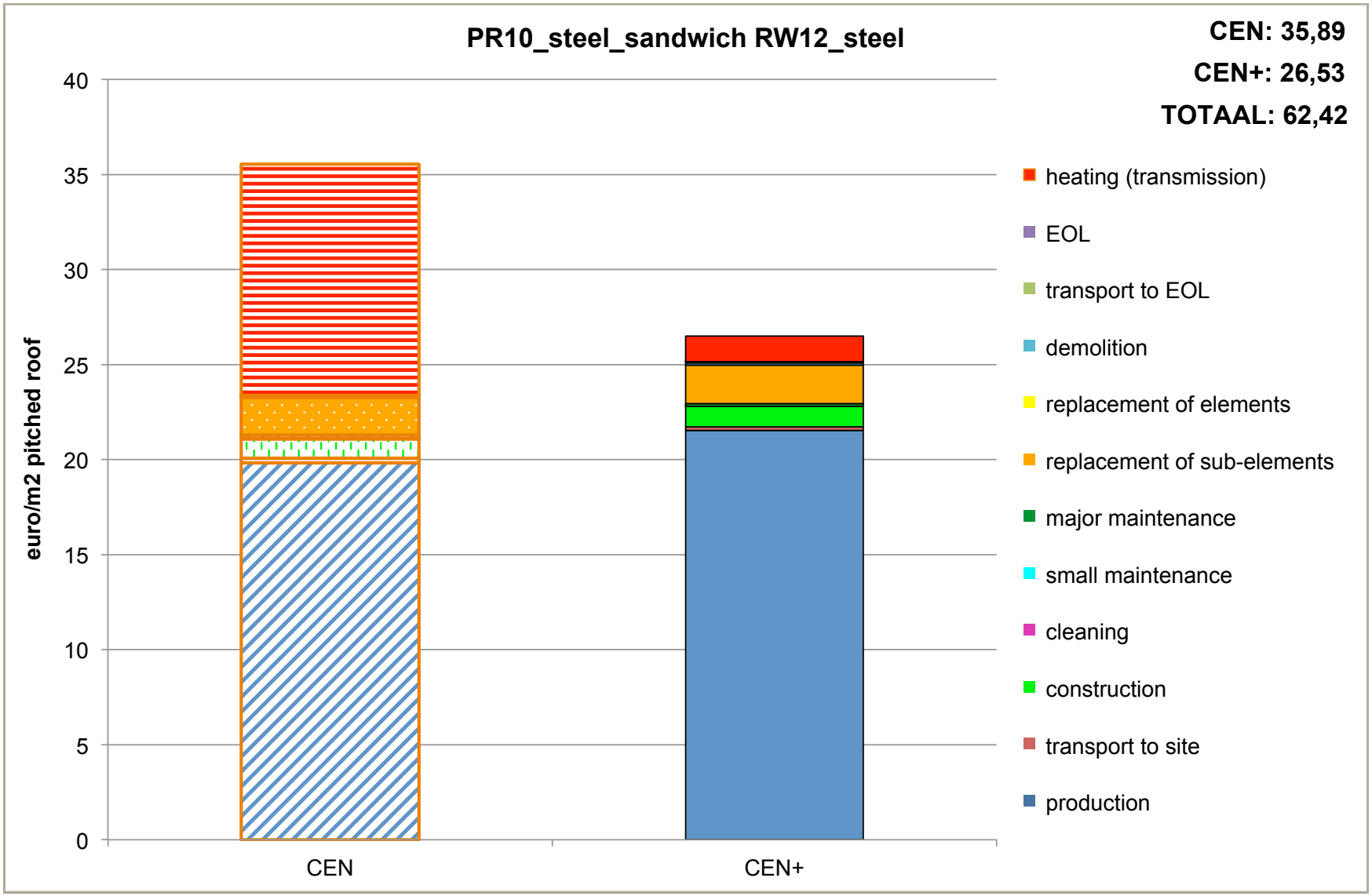

Figure pitched roof 7.10.1: Aggregated environmental profile (divided into CEN and CEN+) of variant 'PR10_steel_sandwich RW12_steel' per life cycle stage, expressed in monetary units.

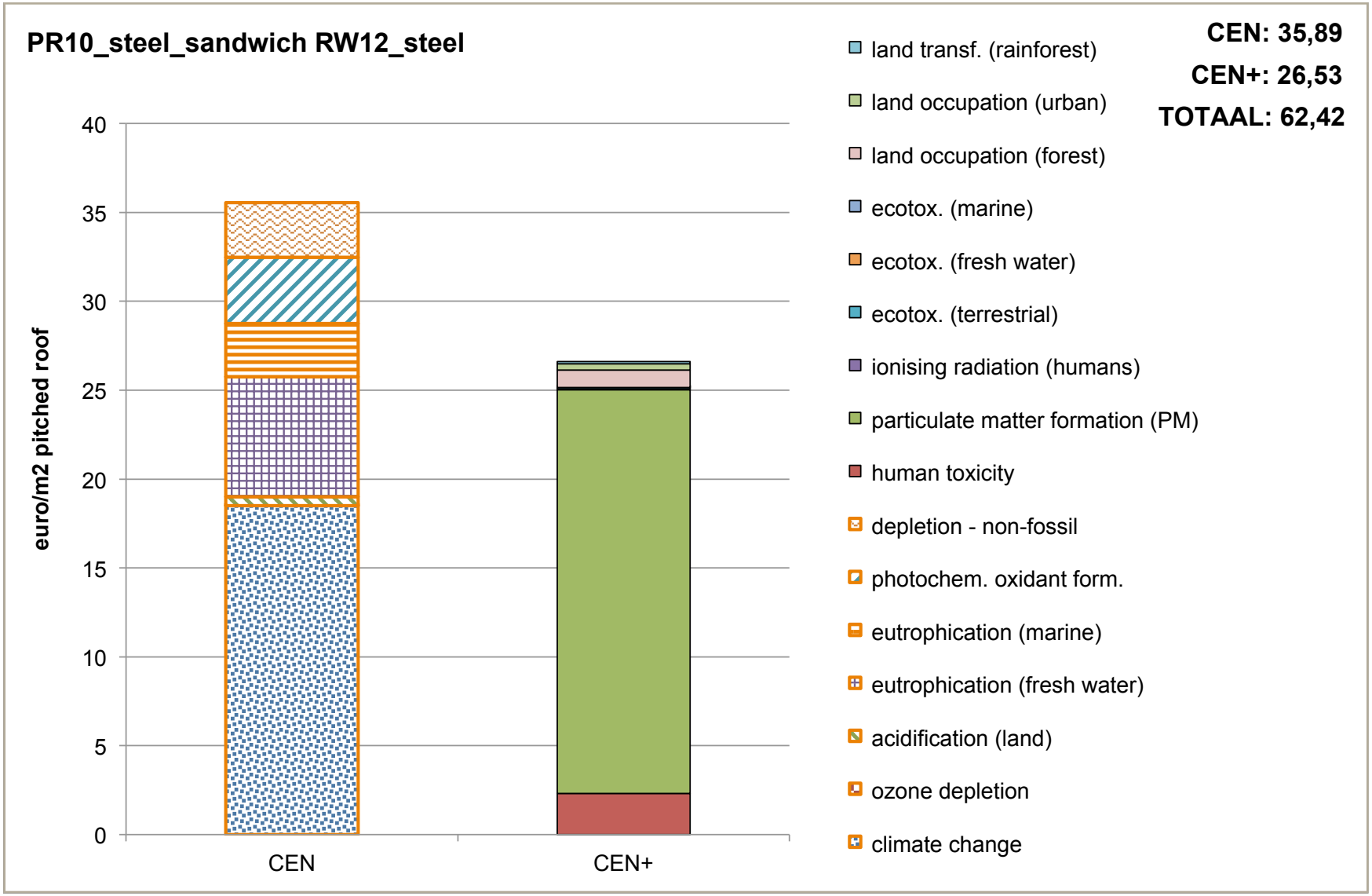

Figure pitched roof 7.10.2: Aggregated environmental profile (divided into CEN and CEN+) of variant 'PR10_steel_sandwich RW12_steel' per environmental indicator, expressed in monetary units.

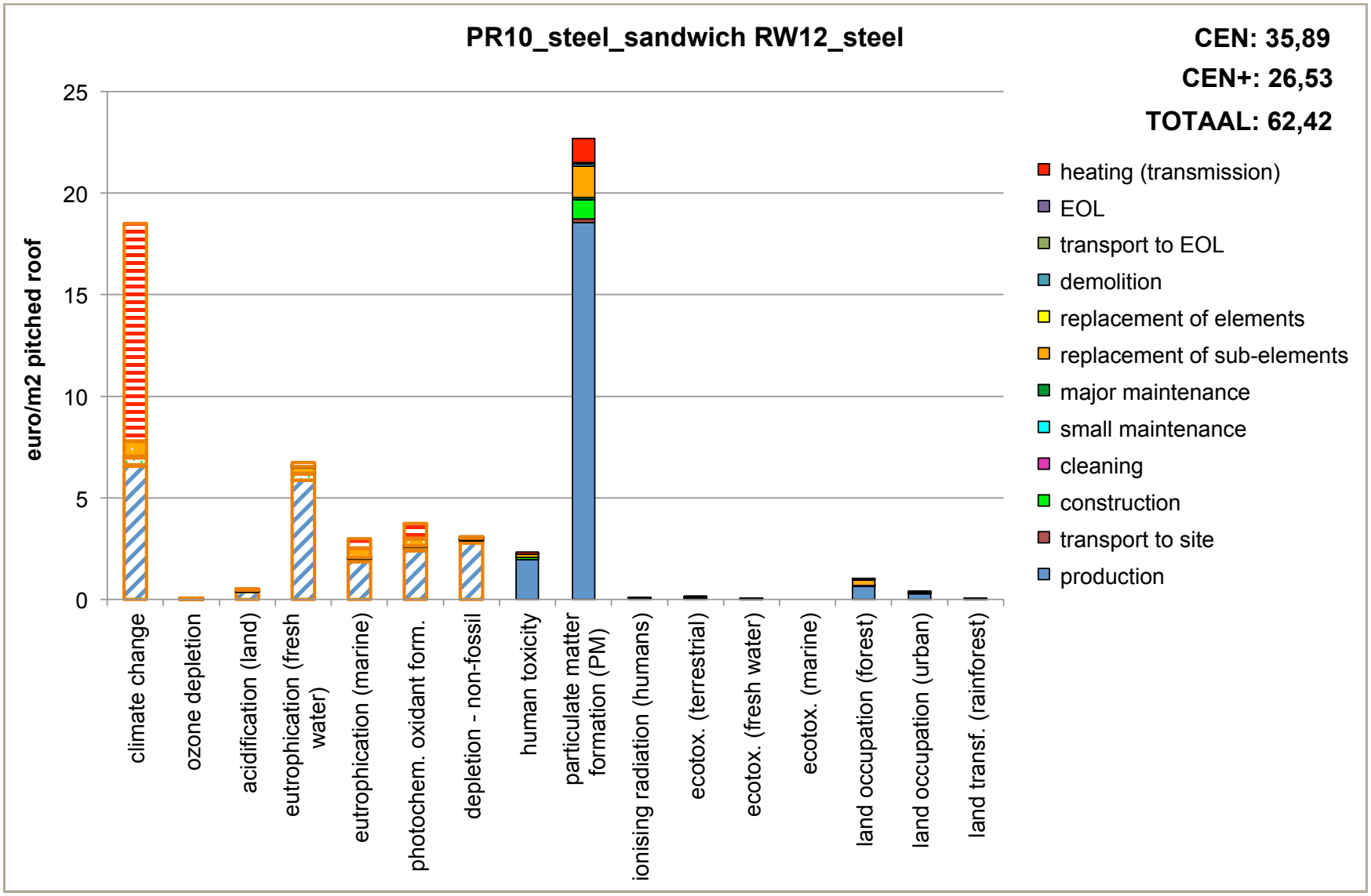

Figure pitched roof 7.10.3: Aggregated environmental profile (divided into CEN and CEN+) of variant 'PR10_steel_sandwich RW12_steel' per life cycle stage and per individual environmental indicator, expressed in monetary units.

7.11. PR11_rafters_RW18_wooden shingles

Table 7.11: overview of the detailed composition of variant 'PR11_rafters_RW18_wooden shingles'

Description	u	MiM	MaM	Repl	Repl Type	Ratio	t (m)	λ (W/m.K)	R (m².K/W)
PR11_rafters_RW18_wooden shingles									
Roofs - inclined - wood (inland) - "Dutch rafters" - rafters every 40 cm - surface 42,43 m²	m²		30	120	necessary	1,414	0,18	na	
Pitched roof - thermal insulation between "Dutch rafters" (each 40 cm) - blanket, batt - anorganic fibre - rock wool - medium hard (18 cm)	m²			120	necessary	1,414	0,18	0,048	3,760
Ceiling finish - board - gypsum (1,25 cm), width 1,2 meter, screwed, inlcusive joint filler	m²		10	30	necessary	1,414	0,01	na	0,050
Ceiling finish - support structure for boards - profiles - wood	m²			30	necessary	1,414	0,02	na	0,160
Ceiling finish - paint - acrylic paint on gypsum plasterboard	m²		5	10	aesthetic	1,414		na	
Roof finishes - inclined surfaces - shingles - wood (western red cedar) 45 x 14 cm	m²		15	30	necessary	1,414	0,02	na	
Infrastructure for wooden roof shingles - counter battens (20 x 30 mm) - native softwood - 4.243m - 72 for 42.43 m²	m²			15	necessary	1,414	0,02	na	
Infrastructure for wooden roof shingles - tile laths (20 x 30 mm) - native softwood - 5 m - 60 for 42,43 m2	m²			15	necessary	1,414	0,02	na	
Infrastructure for roof finish - subroof - board - wood fibre 22 mm, nailed - not for ceramic & concrete tiles or natural slates	m²			30	necessary	1,414	0,02	0,055	0,400
Roof finishes - vapour felt - polyethylene (PE)	m²			120	necessary	1,414	0	na	

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- 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)

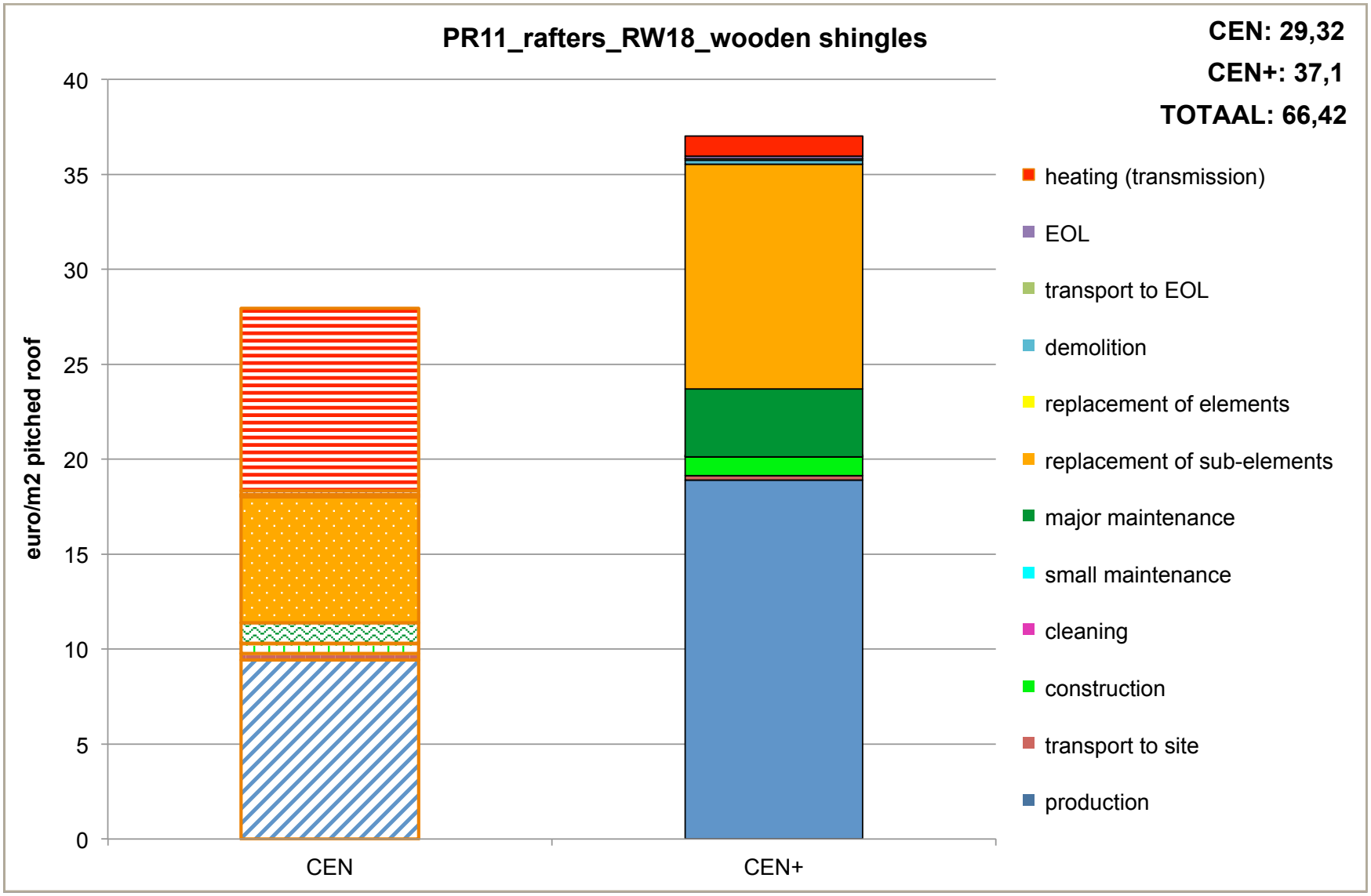

Figure pitched roof 7.11.1: Aggregated environmental profile (divided into CEN and CEN+) of variant 'PR11_rafters_RW18_wooden shingles' per life cycle stage, expressed in monetary units.

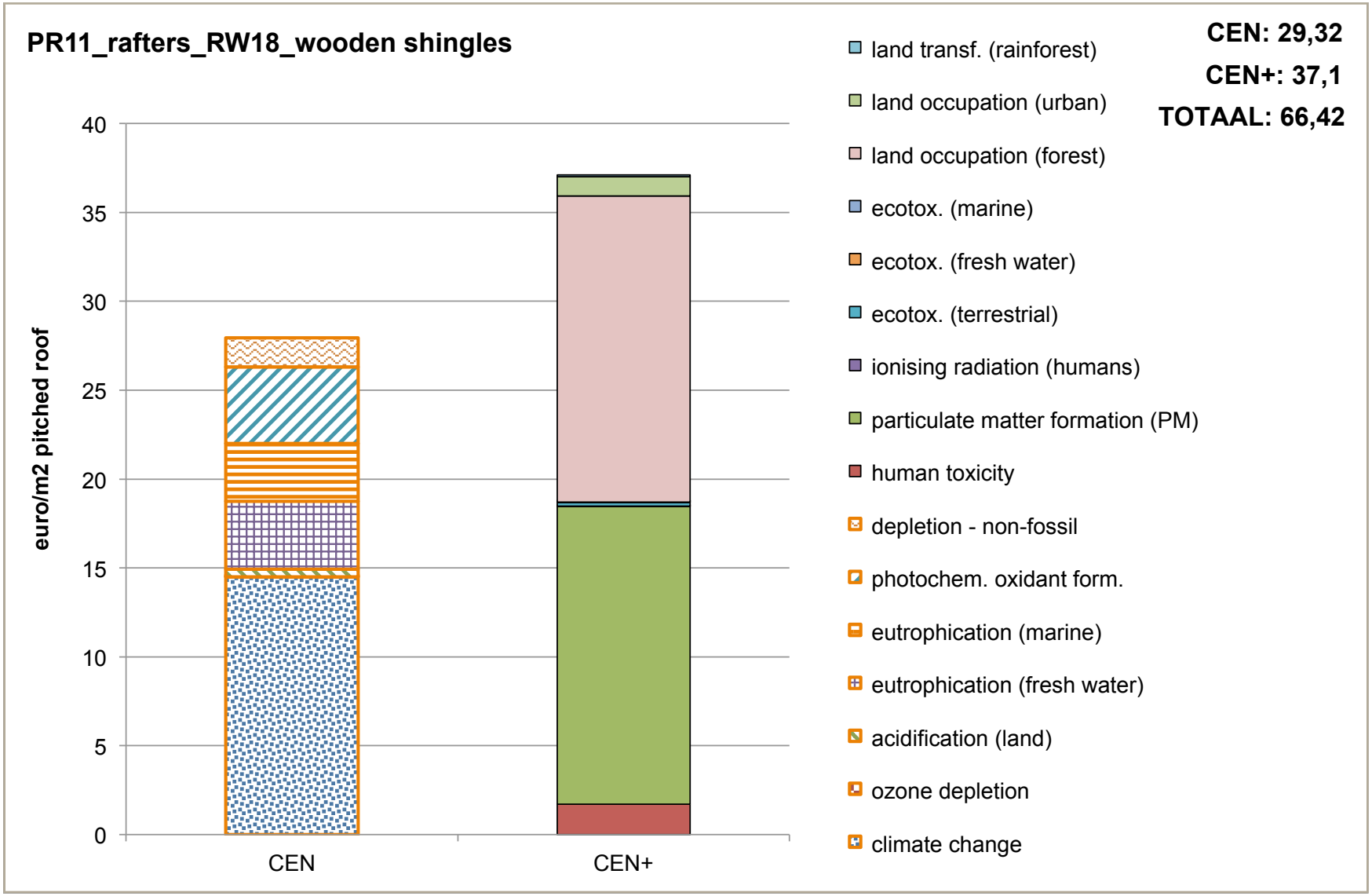

Figure pitched roof 7.11.2: Aggregated environmental profile (divided into CEN and CEN+) of variant 'PR11_rafters_RW18_wooden shingles' per environmental indicator, expressed in monetary units.

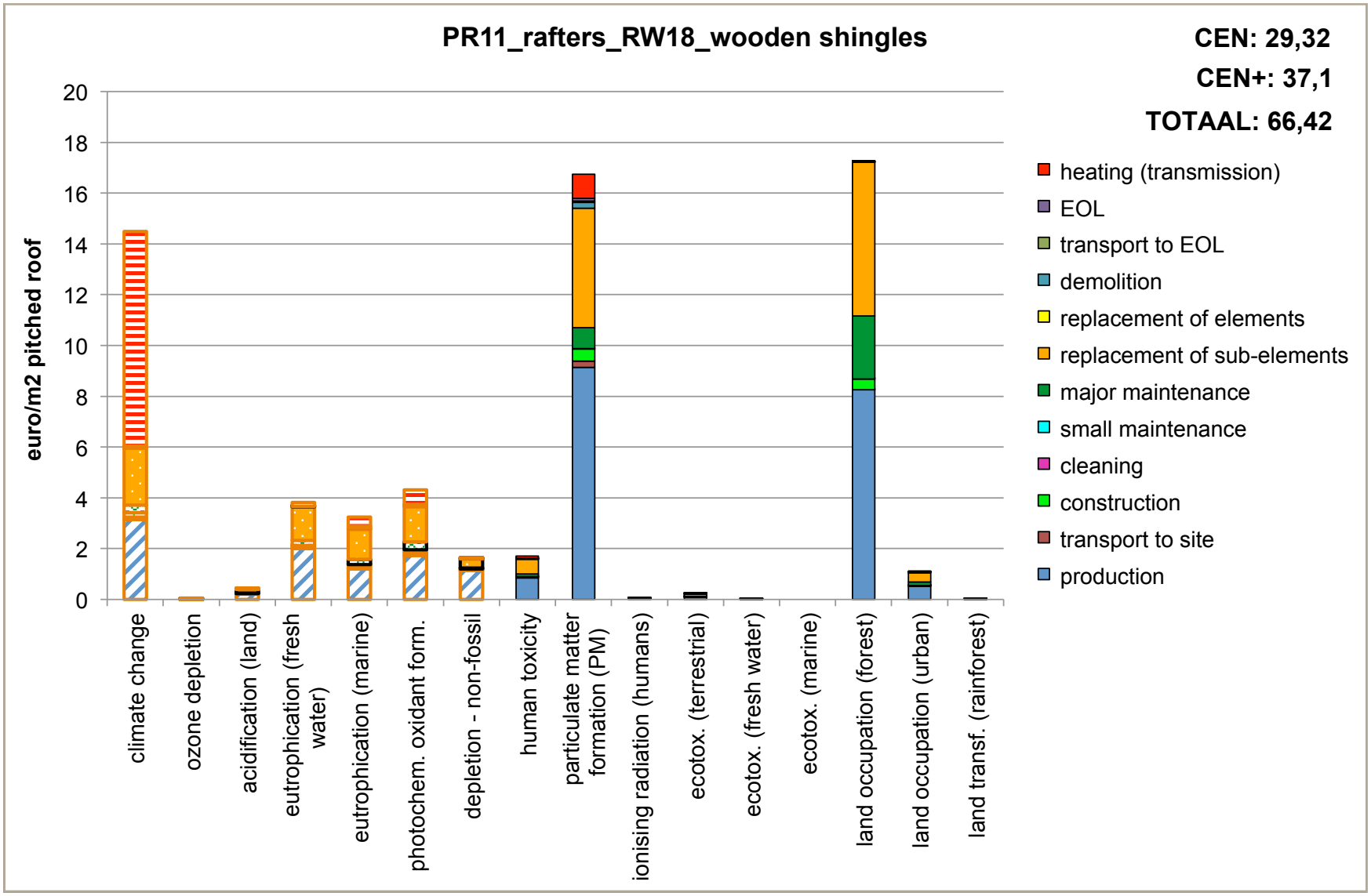

Figure pitched roof 7.11.3: Aggregated environmental profile (divided into CEN and CEN+) of variant 'PR11_rafters_RW18_wooden shingles' per life cycle stage and per individual environmental indicator, expressed in monetary units.

7.12. PR12_rafters_RW18_concrete roof tile

Table 7.12: overview of the detailed composition of variant 'PR12_rafters_RW18_concrete roof tile'

Description	u	MiM	MaM	Repl	Repl Type	Ratio	t (m)	λ (W/m.K)	R (m².K/W)
PR12_rafters_RW18_concrete roof tile									
Roofs - inclined - wood (inland) - "Dutch rafters" - rafters every 40 cm - surface 42,43 m²	m²		30	120	necessary	1,414	0,175	na	
Pitched roof - thermal insulation between "Dutch rafters" (each 40 cm) - blanket, batt - anorganic fibre - rock wool - medium hard (18 cm)	m²			120	necessary	1,414	0,18	0,048	3,759
Ceiling finish - board - gypsum (1,25 cm), width 1,2 meter, screwed, inlcusive joint filler	m²		10	30	necessary	1,414	0,0125	na	0,050
Ceiling finish - support structure for boards - profiles - wood	m²			30	necessary	1,414	0,022	na	0,160
Ceiling finish - paint - acrylic paint on gypsum plasterboard	m²		5	10	aesthetic	1,414		na	
Roof finishes - inclined surfaces - concrete roof tiles - high wind-resistant tile	m²		15	90	necessary	1,414	0,012	na	
Infrastructure for roof tiles - counter battens (20 x 30 mm) - native softwood - for concrete roof tiles and natural roof slates	m²		30	90	necessary	1,414	0,02	na	
Infrastructure for roof tiles - tile laths (26 x 40 mm) - native softwood - for concrete roof tiles	m²		30	90	necessary	1,414	0,026	na	
Infrastructure for roof finish - subroof - board - wood fibre 22 mm, nailed - for ceramic & concrete tiles and natural slates	m²		30	90	necessary	1,414	0,022	0,055	0,400
Roof finishes - vapour felt - polyethylene (PE)	m²			120	necessary	1,414	0,0002	na	

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- 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)

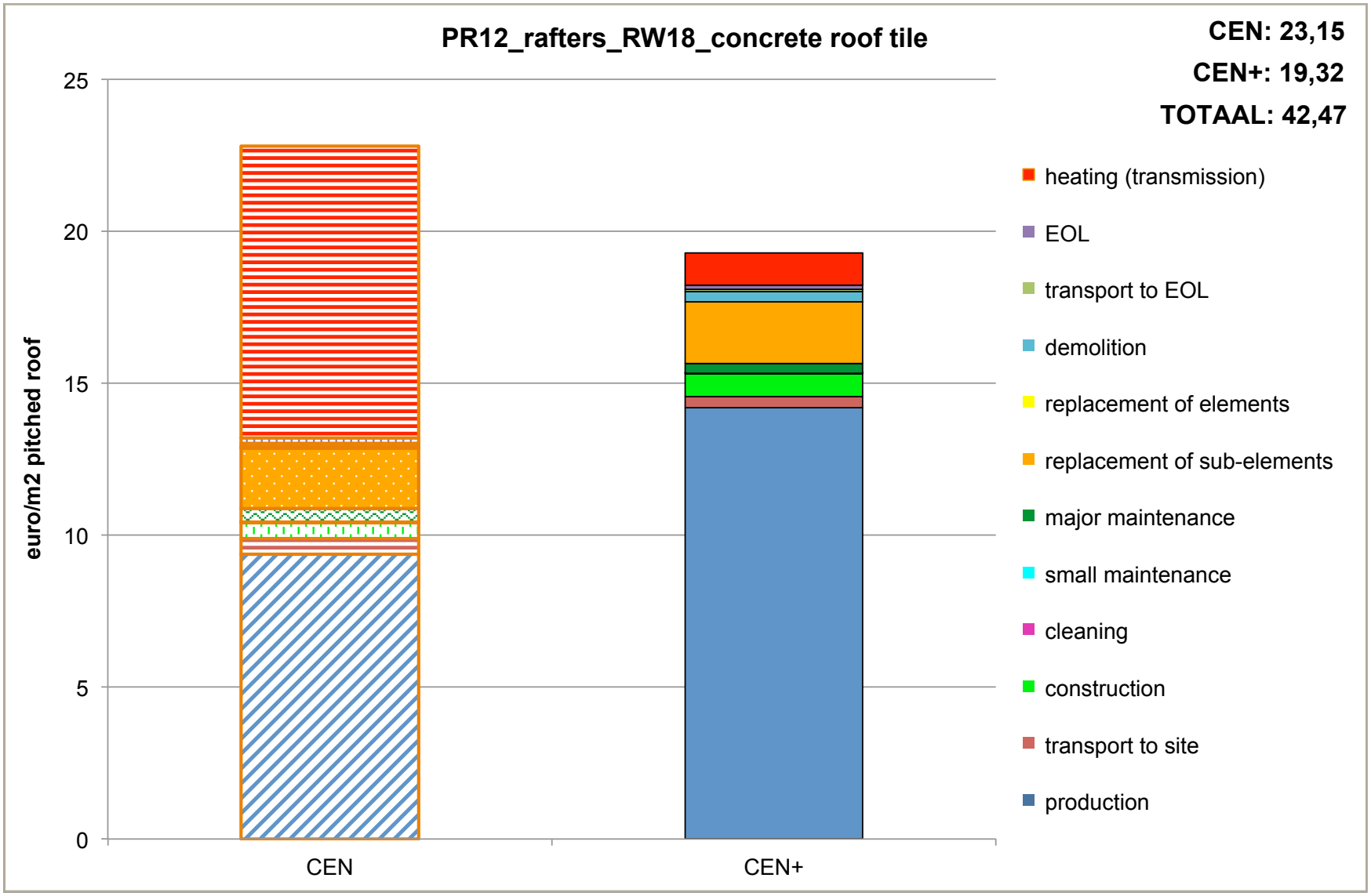

Figure pitched roof 7.12.1: Aggregated environmental profile (divided into CEN and CEN+) of variant 'PR12_rafters_RW18_concrete roof tile' per life cycle stage, expressed in monetary units.

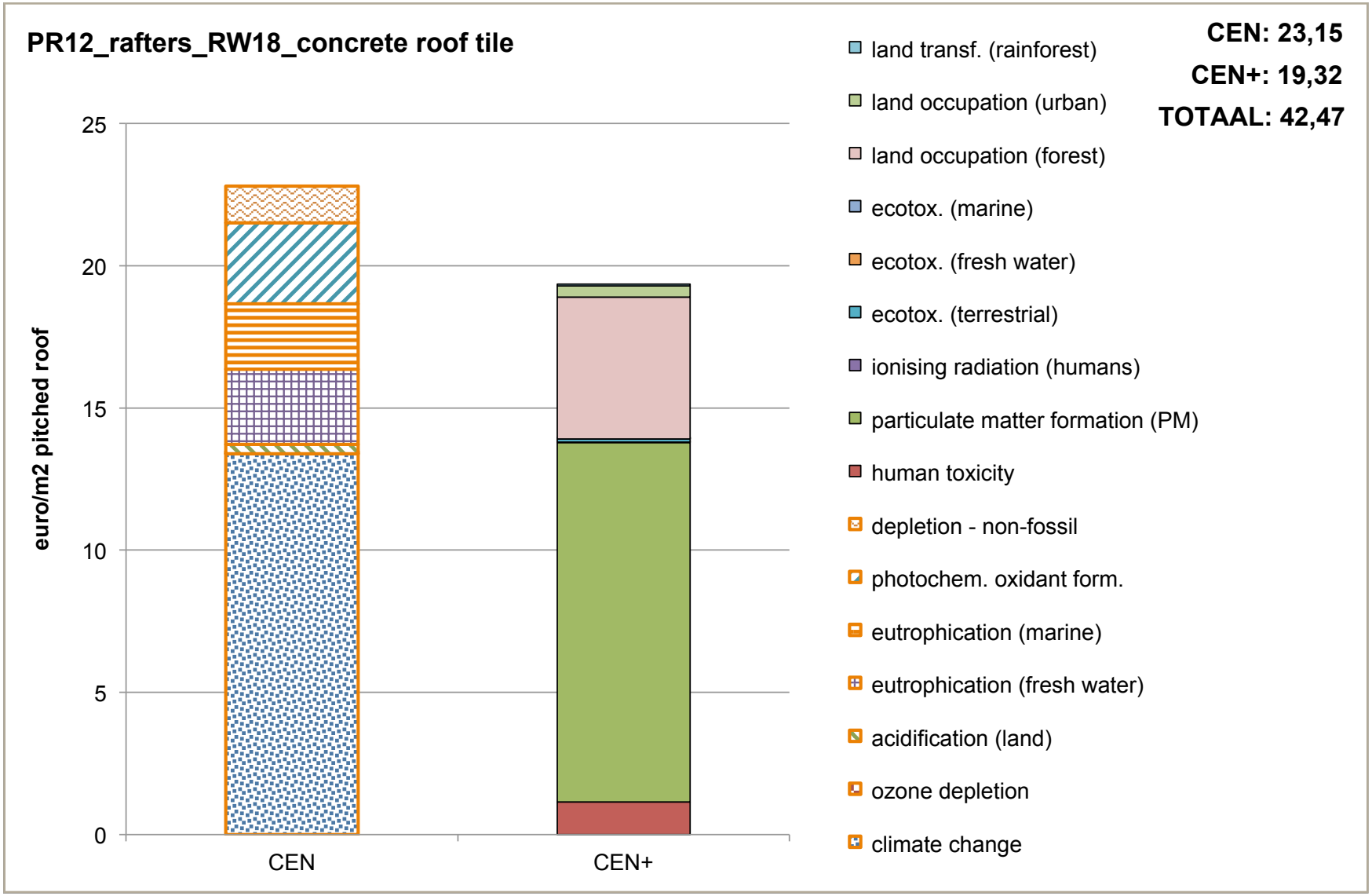

Figure pitched roof 7.12.2: Aggregated environmental profile (divided into CEN and CEN+) of variant 'PR12_rafters_RW18_concrete roof tile' per environmental indicator, expressed in monetary units.

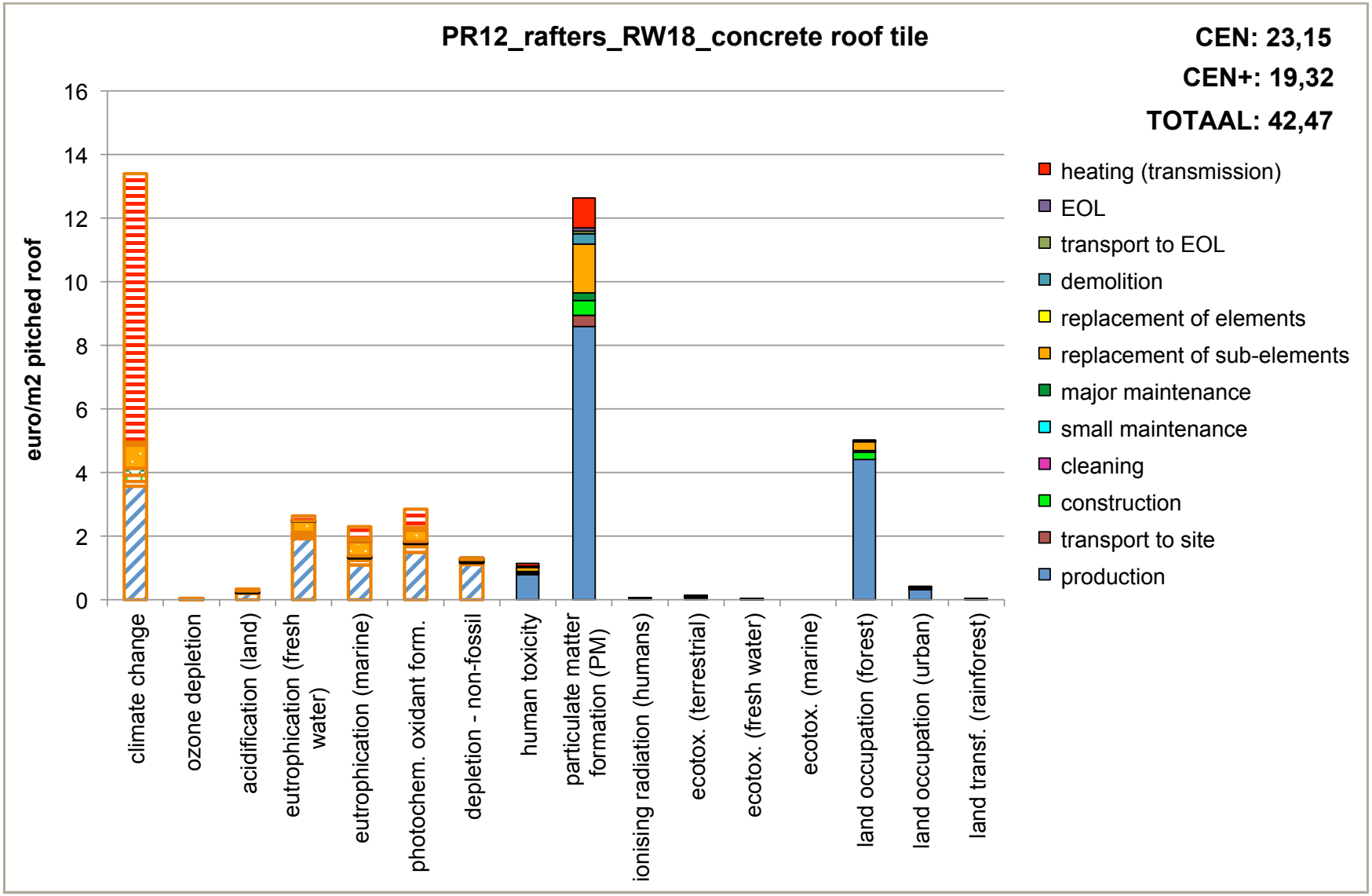

Figure pitched roof 7.12.3: Aggregated environmental profile (divided into CEN and CEN+) of variant 'PR12_rafters_RW18_concrete roof tile' per life cycle stage and per individual environmental indicator, expressed in monetary units.

7.13. PR13_rafters_sandwich panel PUR8_clay roof tile

Table 7.13: overview of the detailed composition of variant 'PR13_rafters_sandwich panel PUR8_clay roof tile'

Description	u	MiM	MaM	Repl	Repl Type	Ratio	t (m)	λ (W/m.K)	R (m².K/W)
PR13_rafters_sandwich panel PUR8_clay roof tile									
Roofs - inclined - sandwich - chipboard (white, 7 mm) + PUR (8 cm) + chipboard (7 mm) + counter battens	m²			60	necessary	1,414	0,114	na	3,500
Roofs - inclined - wood (inland) - "Dutch rafters" - rafters every 40 cm - surface 42,43 m²	m²		30	120	necessary	1,414	0,175	na	
Ceiling finish - paint - acrylic paint on gypsum plasterboard	m²		5	10	aesthetic	1,414		na	
Roof finishes - pitched surfaces - ceramic tiles (clay roof tiles) - high wind-resistant tile	m²		15	90	necessary	1,414	0,015	na	
Infrastructure for roof tiles - tile laths (25 x 30 mm) - native softwood - for ceramic roof tiles	m²		30	90	necessary	1,414	0,024	na	

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- 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)

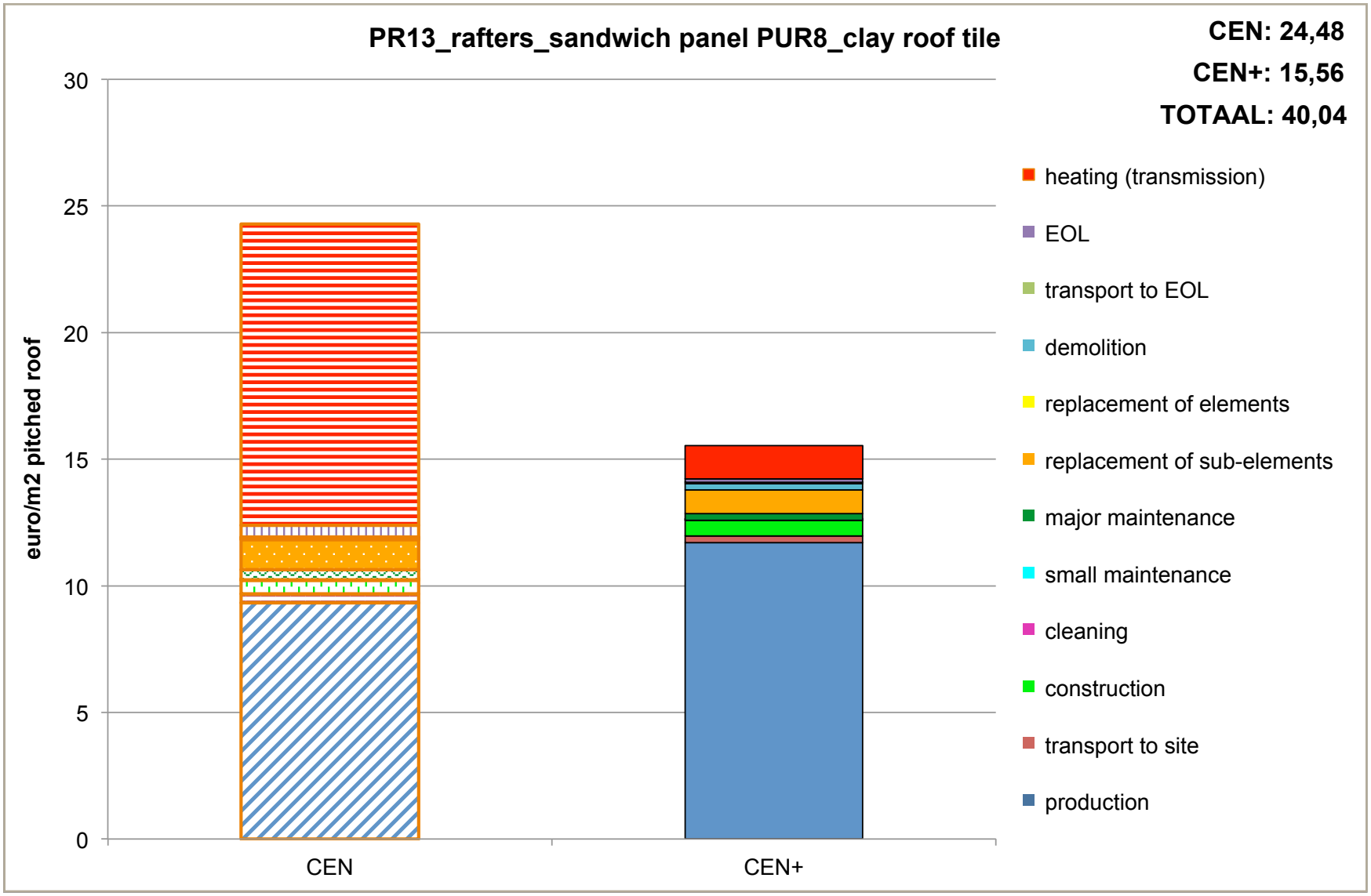

Figure pitched roof 7.13.1: Aggregated environmental profile (divided into CEN and CEN+) of variant 'PR13_rafters_sandwich panel PUR8_clay roof tile' per life cycle stage, expressed in monetary units.

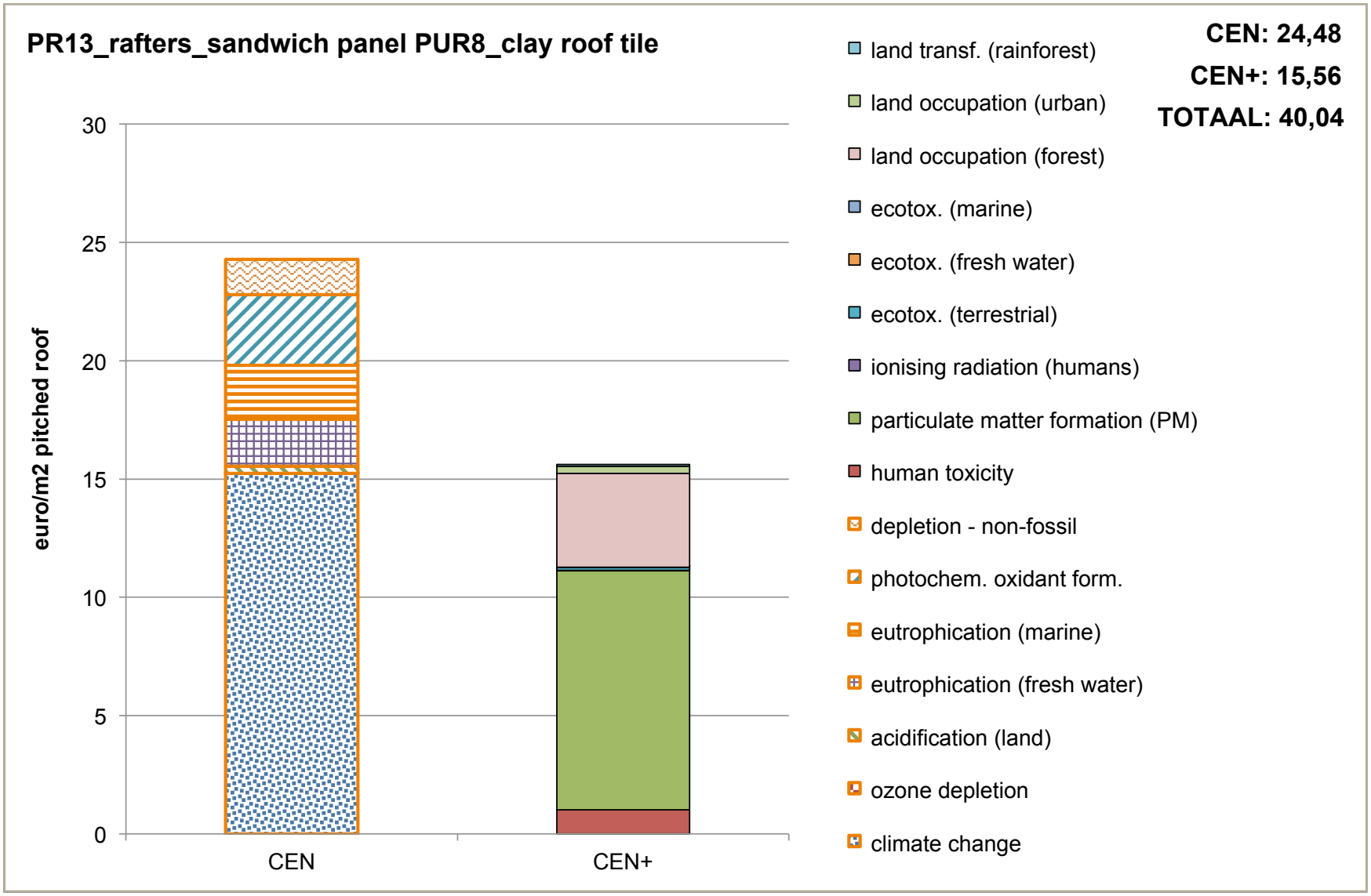

Figure pitched roof 7.13.2: Aggregated environmental profile (divided into CEN and CEN+) of variant 'PR13_rafters_sandwich panel PUR8_clay roof tile' per environmental indicator, expressed in monetary units.

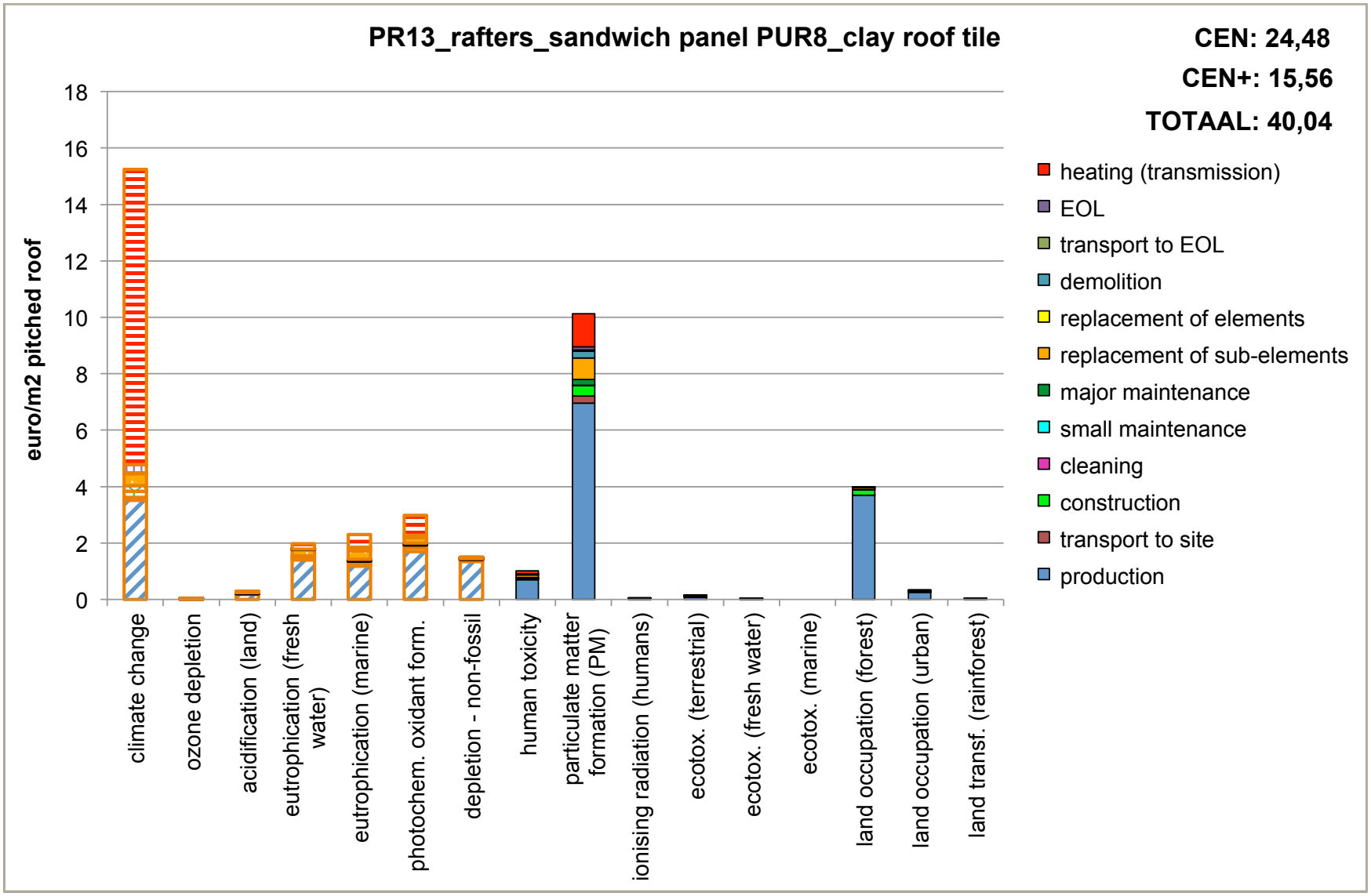

Figure pitched roof 7.13.3: Aggregated environmental profile (divided into CEN and CEN+) of variant 'PR13_rafters_sandwich panel PUR8_clay roof tile' per life cycle stage and per individual environmental indicator, expressed in monetary units.

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