UNIVERSITÀ DI TRENTO
Dipartimento di Ingegneria Industriale

Master Degree in Materials and Production Engineering

FINAL DISSERTATION

Comparative Life Cycle Assessment of virgin and retreaded truck tyres

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Requisiti di Ecodesign

Lo pneumatico è elencato come prodotto prioritario nel piano di lavoro adottato dall'ESPR (Regolamento sulla progettazione ecocompatibile di prodotti sostenibili)

Il Regolamento EU sulla progettazione ecocompatibile di prodotti sostenibili (ESPR) mira a stabilire requisiti di circolarità per la progettazione degli pneumatici

2027

Adozione DA con requisiti di ecodesign specifici per la categoria pneumatici

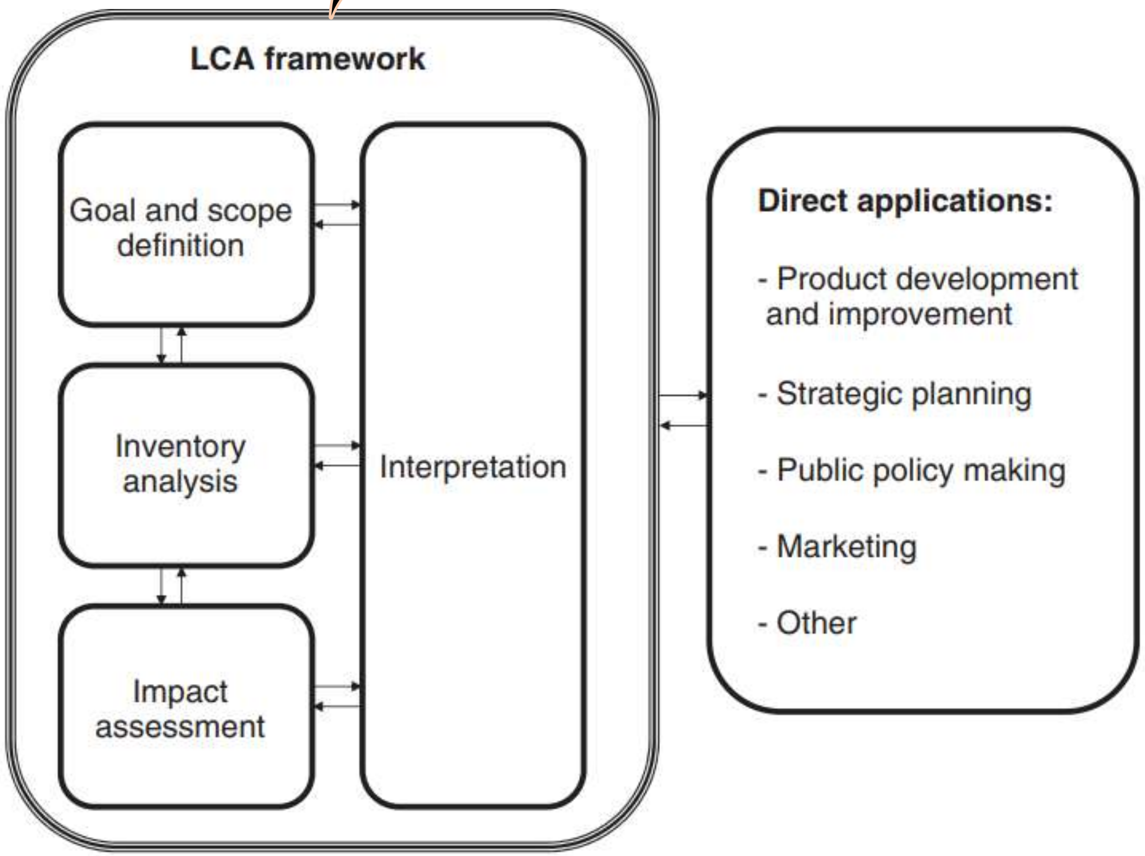
Aspetti per la futura legislazione in ambito ESPR

- **Riciclabilità**
- **Ricostruibilità**
- **Sostanze preoccupanti**
- **Deforestazione**
- **Microplastiche**
- **CFP / PEF**
- **Passaporto digitale**
- **Durabilità**

Life Cycle Assessment (LCA)

Descritta dalle
ISO 14040: Principles and Framework
ISO 14044: Requirements and Guidelines

Valutare **quantitativamente** gli aspetti ambientali e i potenziali impatti associati a un **sistema** di prodotto tangibile o intangibile durante il suo **intero** ciclo di vita



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Definizione dell’obiettivo

Committente

Azienda settore pneumatici

Applicazioni previste

(i) sviluppo di un'analisi sulla gomma naturale

(ii) confronto tra pneumatici per autocarro nuovi e ricostruiti

Pneumatico 385/65 R22.5

Massa: 80 kg

Definizione dell'ambito

Product Category Rule (PCR) of tyres UL 10006

Vita utile di riferimento

Nuovo
160,000 km

Ricostruito
320,000 km

N° ricostruzioni = 1

Nuovi e ricostruiti presentano le stesse prestazioni tecniche

Unità funzionale [km/FU]

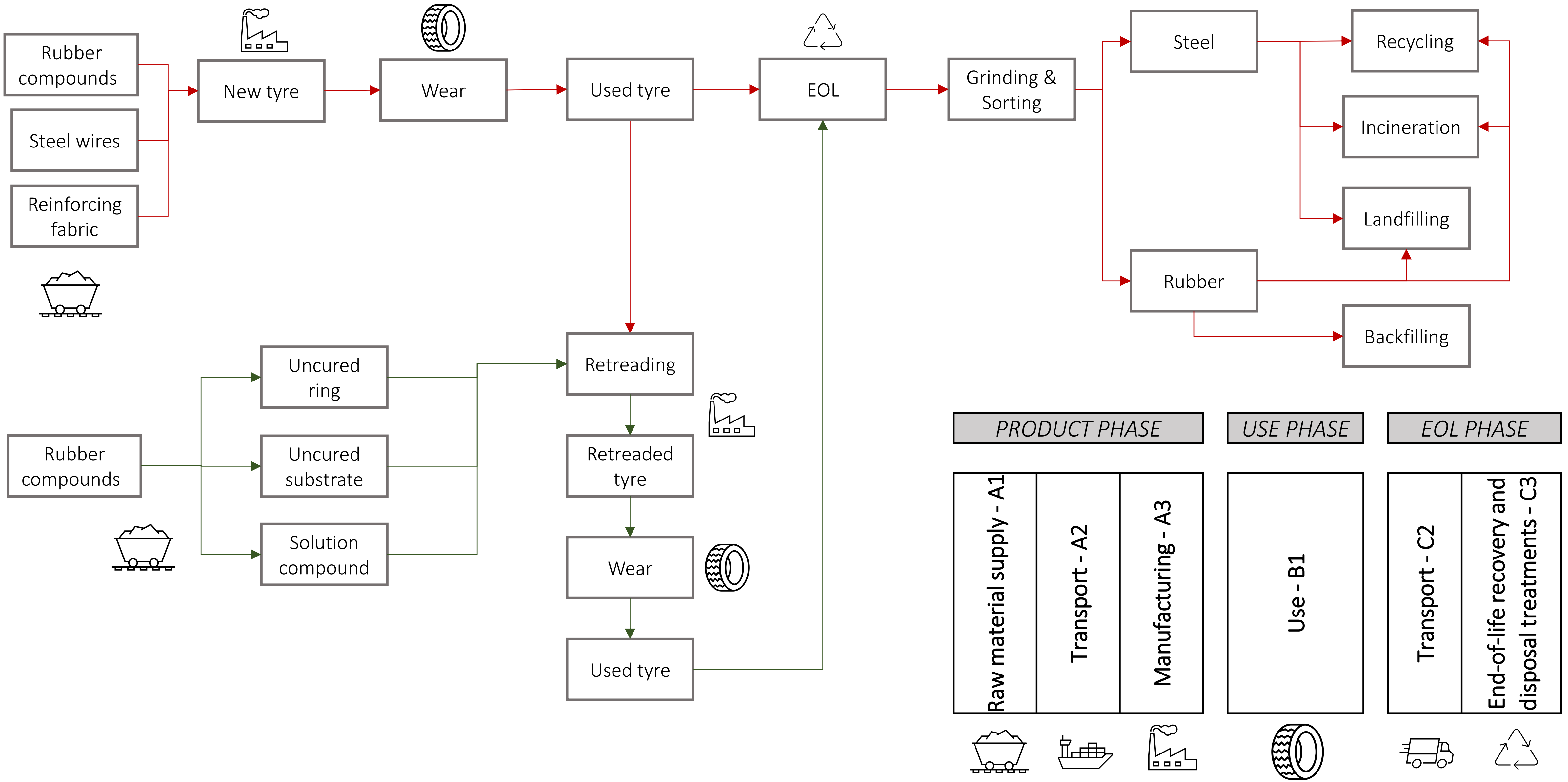
Uno pneumatico per 1,000 km

Flusso riferimento [unit/FU]

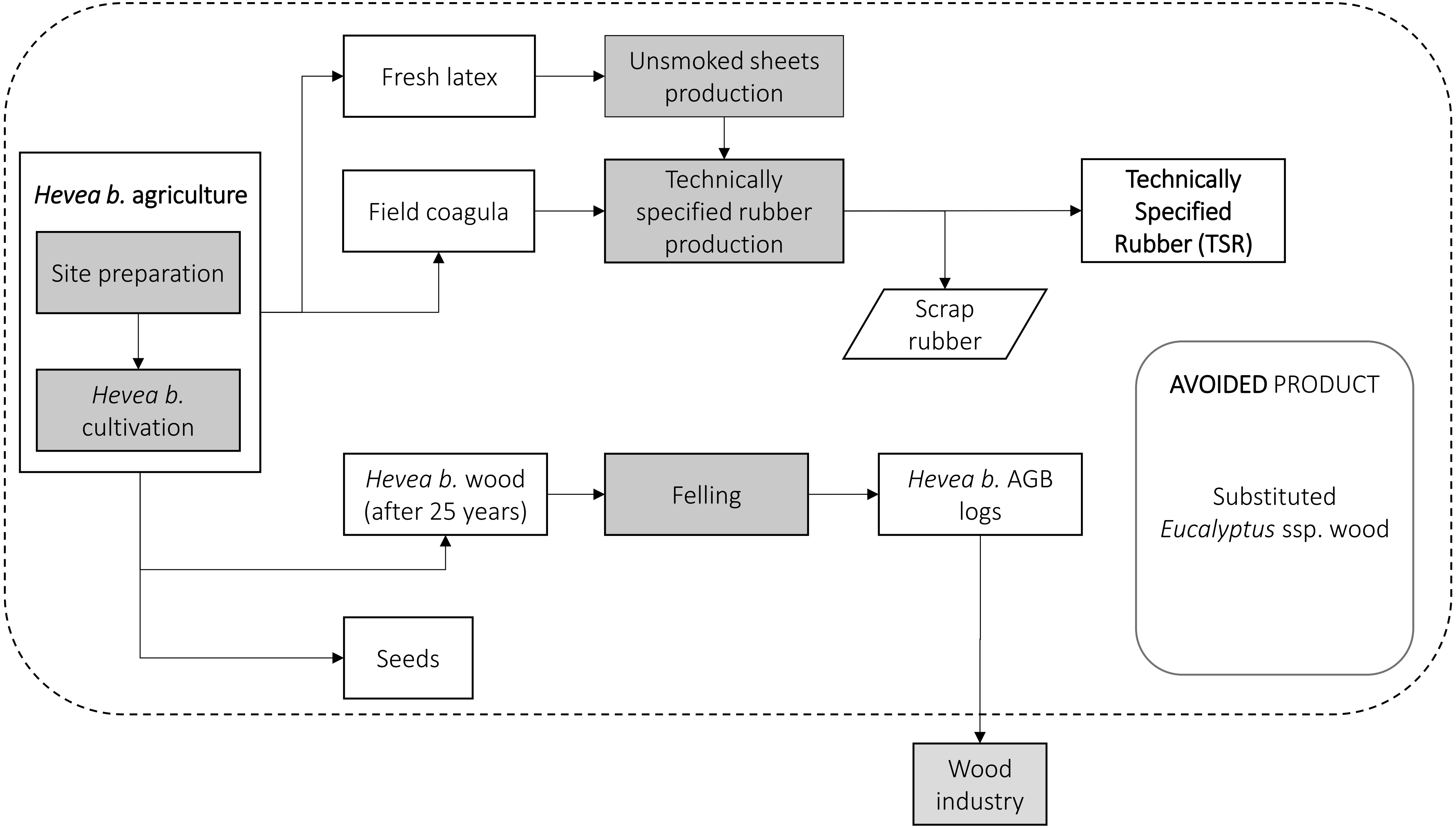
Nuovo	6.25E-03
Ricostruito	3.13E-03

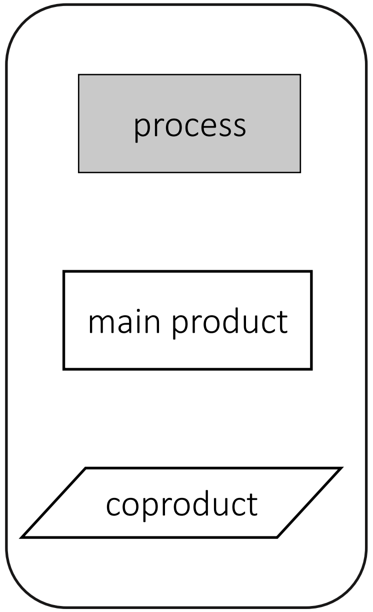
Il confronto deve essere effettuato sulla base dei flussi di riferimento del sistema!

Schema di flusso



Schema di flusso gomma naturale





Valutazione del C stock e analisi del cambiamento d’uso del suolo (LUC)

32,151 ha/y

41,665 ha/y

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Valutazione dell’impatto: gomma TSR

Network **flow chart** of the **Technically Specified Rubber (TSR)**

- Impact category **climate change**
- *Cut-off value of 2 %*

1 Raw material supply (93 %)

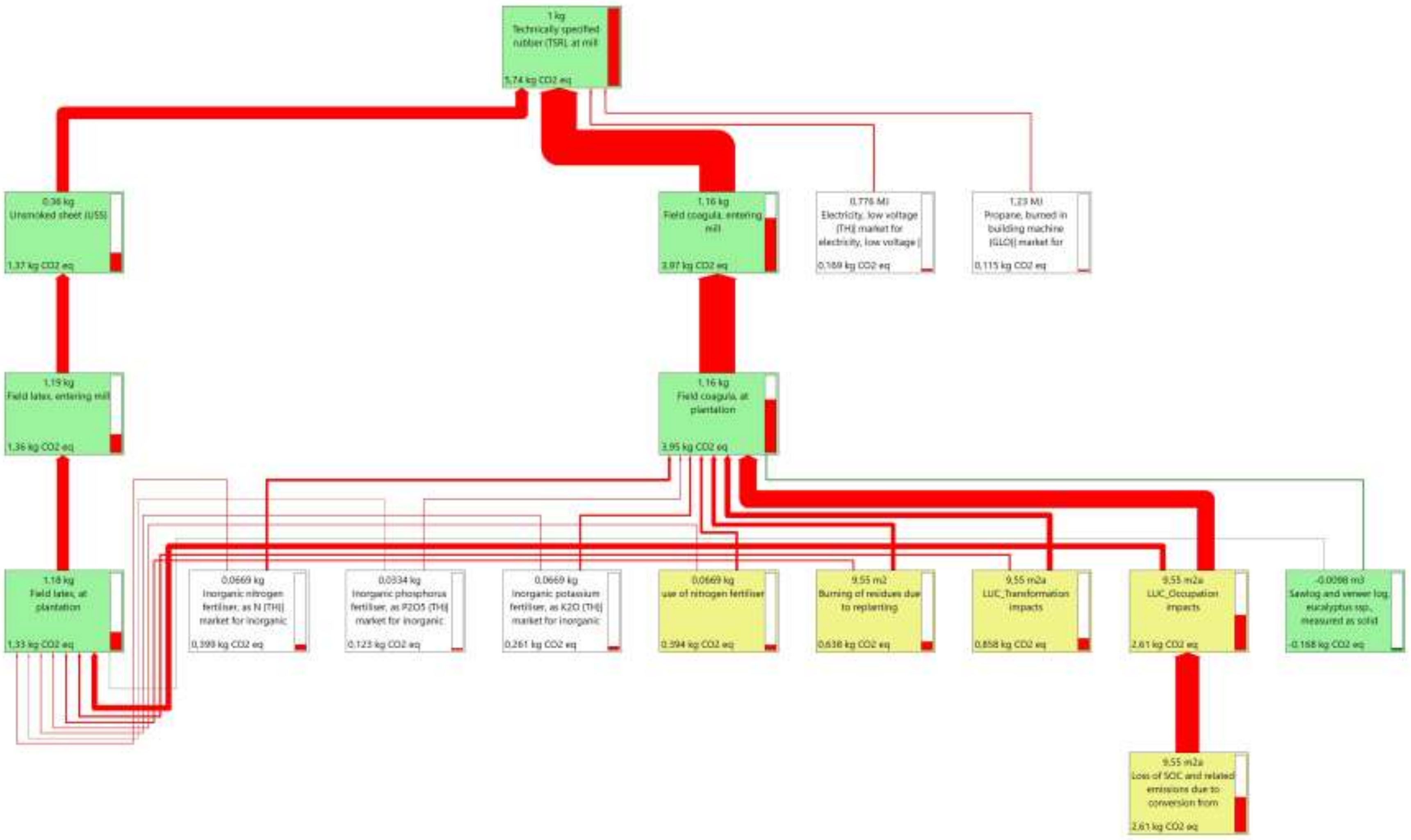
field coagula (69%) and USS (24%)

2 Manufacturing (6.7 %)

electricity (2.9%), diesel & propane (3.8%)

3 Wastewater (0.2 %)

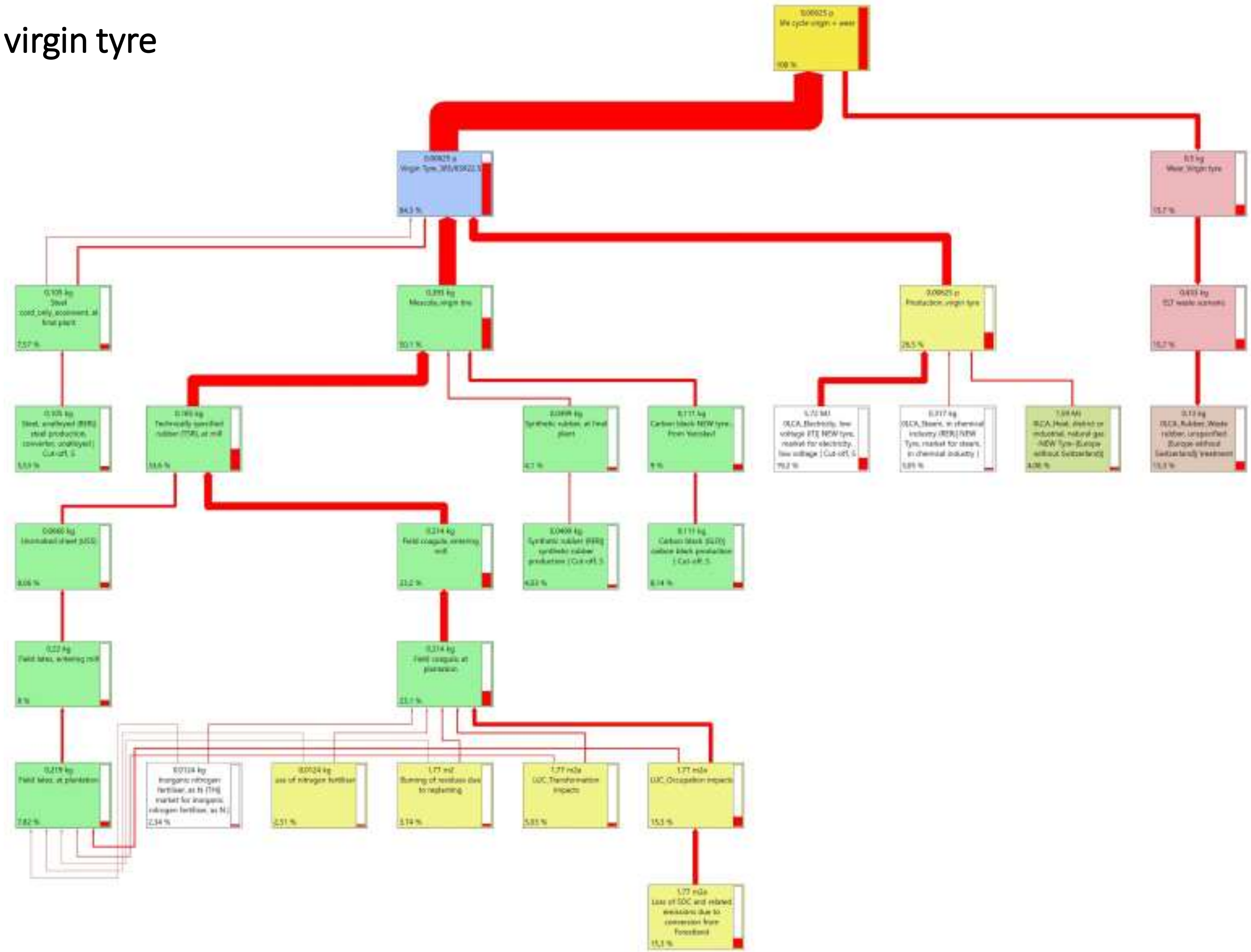
treatment



Valutazione dell’impatto: pneumatico nuovo

Network **flow chart** of the **life cycle of the virgin tyre**

- Impact category **climate change**
- *Cut-off value of 2 %*



1 Raw material supply (58 %)

involves modules A1 (57 %) and A2 (1 %)

2 Manufacturing (26 %)

entails module A3

3 End of life (16 %)

covers modules C2 (1 %) and C3 (15 %)

Valutazione dell’impatto: pneumatico ricostruito

Network **flow chart** of the **life cycle of the retreaded tyre**

- Impact category **climate change**
- *Cut-off value of 2 %*

1 LC of new tyre (82 %)

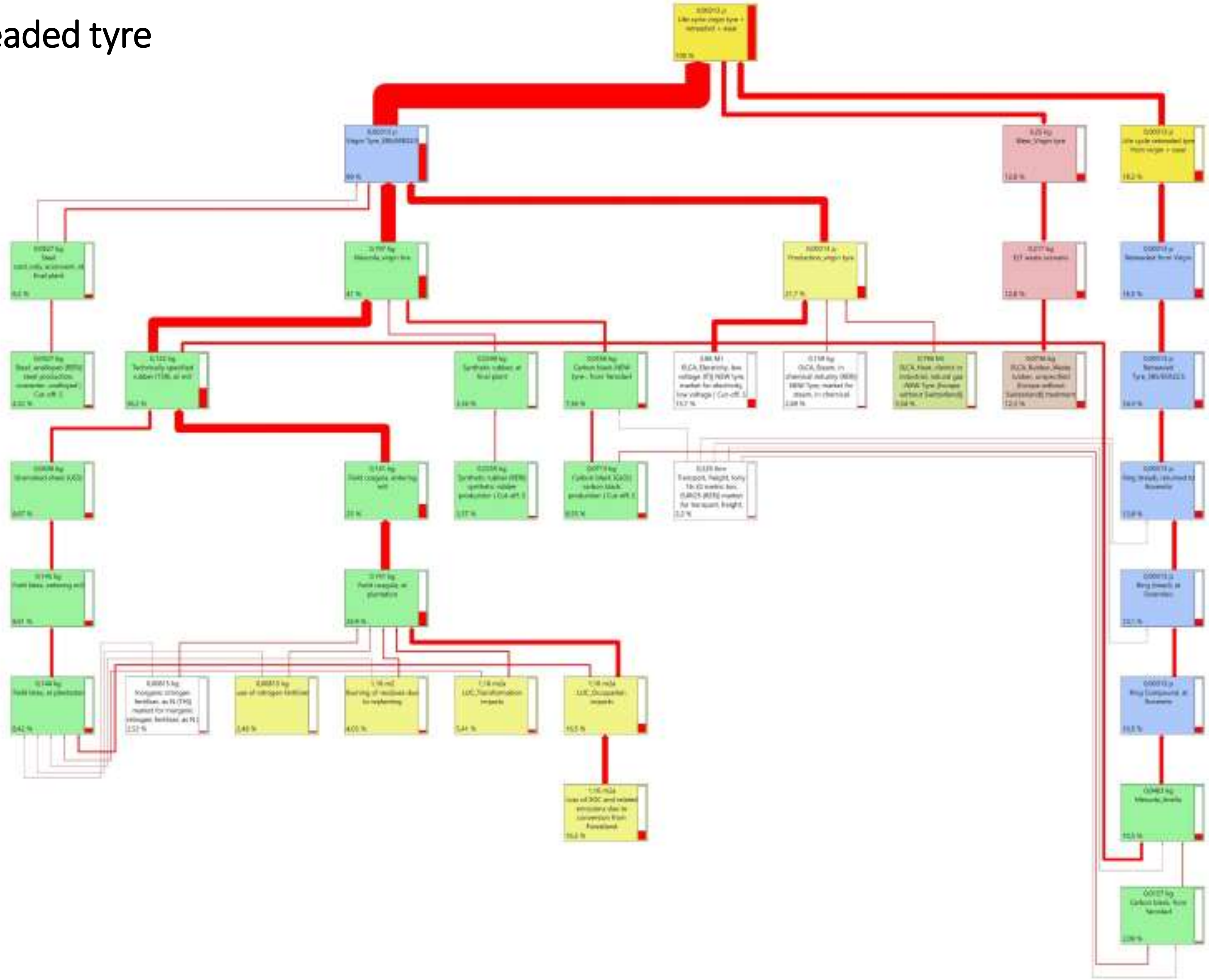
life cycle of the tyre before reuse

2 Raw material supply (12 %)

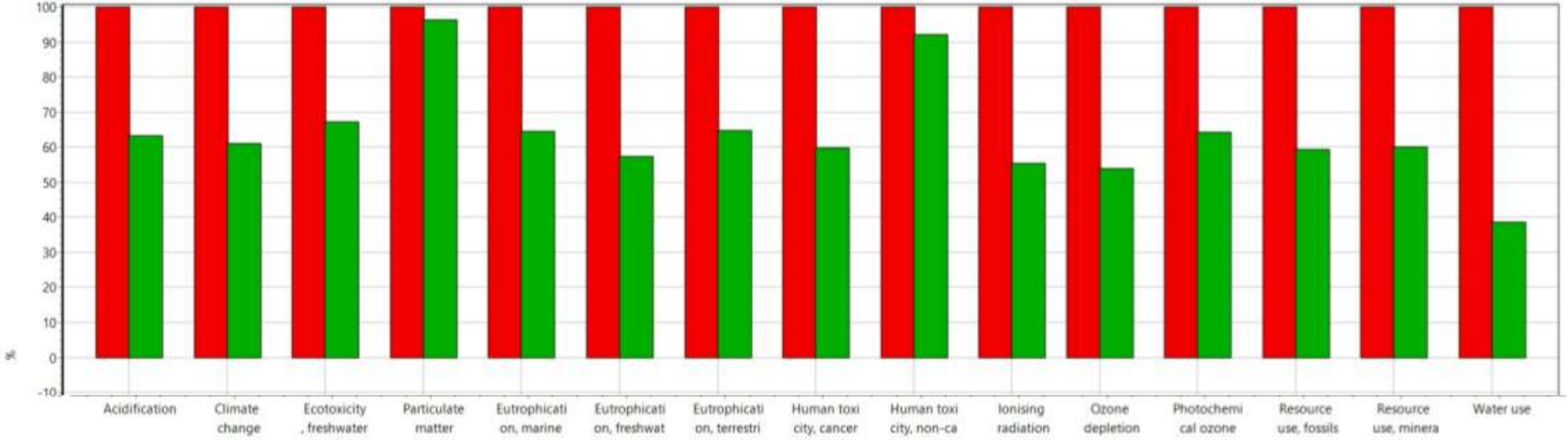
entails modules A1 – A2

3 Manufacturing (5 %)

covers module A3



Valutazione dell'impatto: confronto



- 37% **- 39%** **- 33%** **- 4%** **- 36%** **- 43%** **- 35%** **- 40%** **- 8%** **- 45%** **- 61%** **- 46%** **- 36%** **- 41%** **- 40%**

LC vergine

LC ricostruito

Indice

Conclusioni

La **gomma naturale** rappresenta la materia prima più importante dal punto di vista della massa

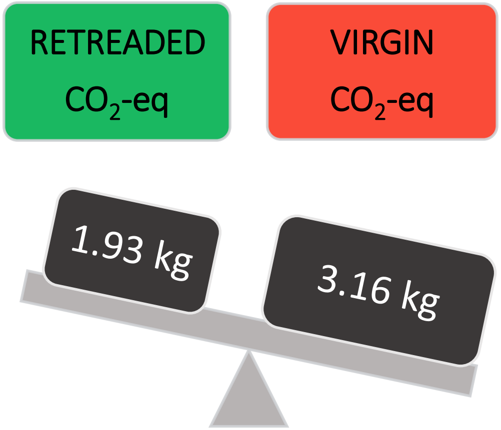
➔ emerge come il principale responsabile degli impatti causati dalle materie prime e rappresenta oltre il 20% degli impatti totali del ciclo di vita di uno pneumatico vergine in 10 su 16 categorie

Lo **pneumatico ricostruito** costituisce una valida opzione di riutilizzo caratterizzata da minori impatti ambientali

➔ riduzione del consumo di materiali e della domanda energetica

Considerando il chilometraggio totale annuo del trasporto merci su strada nell'UE, sarebbe possibile ottenere

➔ un risparmio annuo totale di circa (205 · *n*) migliaia di tonnellate di CO_2 eq, se tutti gli *n* pneumatici fossero ricostruiti una sola volta

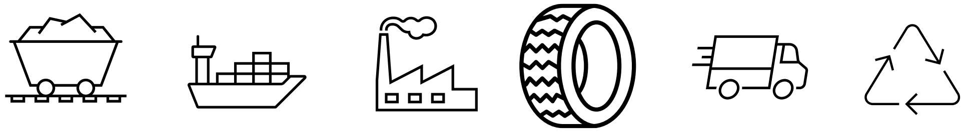


GRAZIE
PER L’ATTENZIONE

18 Aprile 2026

Scope definition (supplementary)

Technical system boundaries

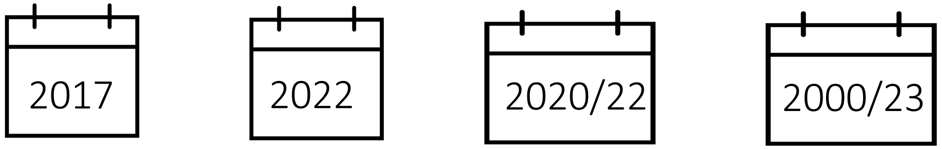


Raw materials | Transport | Manufacturing | Use | Transport | End of life

Geographical system boundaries

Americas | Europe & Africa | Asia

Temporal system boundaries



Data on new tyre production

Data from Marangoni S.p.A. and on mass composition

Data on EOL

Data on Natural Rubber

Raw material	Mass ratio [phr]	Mass ratio [%]	Mass composition (new tyre) [kg]
Natural rubber	78.8	37.08	29.64
Synthetic rubber	21.2	9.98	7.98
(thus, new rubber is)	100	47.06	37.62
Carbon black	47.3	22.26	17.79
Process oil	1.8	0.85	0.68
Total of organic rubber chemicals	8.3	3.91	3.12
Zinc oxide	4.4	2.07	1.66
Sulphur	2.7	1.27	1.02
Silica	2.8	1.32	1.05
Total of fibres	0.4	0.19	0.15
Steel cord	31.5	14.82	11.85
Bead wire	13.3	6.26	5.00
Total	212.5	100	79.94

Scope definition (supp.2)

- Among the most common rubber chemicals reported in the literature, the ones utilised also for the retreaded tyre, are here selected. For example, N-1,3-dimethylbutyl-N'-phenyl-p-phenylenediamine (i.e., 6PPD) and 2,2,4-Trimethyl-1,2-dihydroquinoline (i.e., TMQ), employed for producing the ring compound in the retreaded tyre system (primary data from Marangoni), are assumed to be used also as chemicals in the production of the compound for the new tyre, since both are the most used antioxidants/antiozonants in the tyre industry. This ensures further coherency between the studied systems, which improves their comparison.

- A wear rate equal to 13.1 %, with respect to the total mass of the tyre, is reported by Marangoni S.p.A. and therefore used during the service of the retreaded tyre. The same tread wear rate proper of the retreaded tyre is fairly assumed and employed for the new tyre use phase.

- End of life scenario employed for both the tyres →

	[%]				
	Rubber (tyre)	Plastic packaging	Paper and Cardboard	Steel	Pallet wood
Reused	-	-	-	-	12.3
Recycled	52.4	45.5	71.6	90.0	80.0
Incinerated	39.8	37.2	28.4	5.7	5.7
Landfilled	4.3	17.3	-	2.0	2.0
Backfilled	3.6	-	-	-	-

It must be noted that, the information about the waste generated during the new tyre manufacturing, retrieved from the literature, is general, so not distinguishing between waste types, but referring to a total mass of scraps. Therefore, this waste mass disposal pathway is modelled as a mix of treatment according to Ecoinvent database: landfilling (55.22 % of the total mass), incineration (44.11 %) and open burning (0.67 %). The EOL of the waste (cured) rubber obtained during the retreading process is instead modelled according to the assumed scenario.

Natural rubber (supp.)

- **Thailand** is the first world producer and first **EU** natural rubber supplier.
- Data **quality requirements** for the acquisition of the information required for the NR system

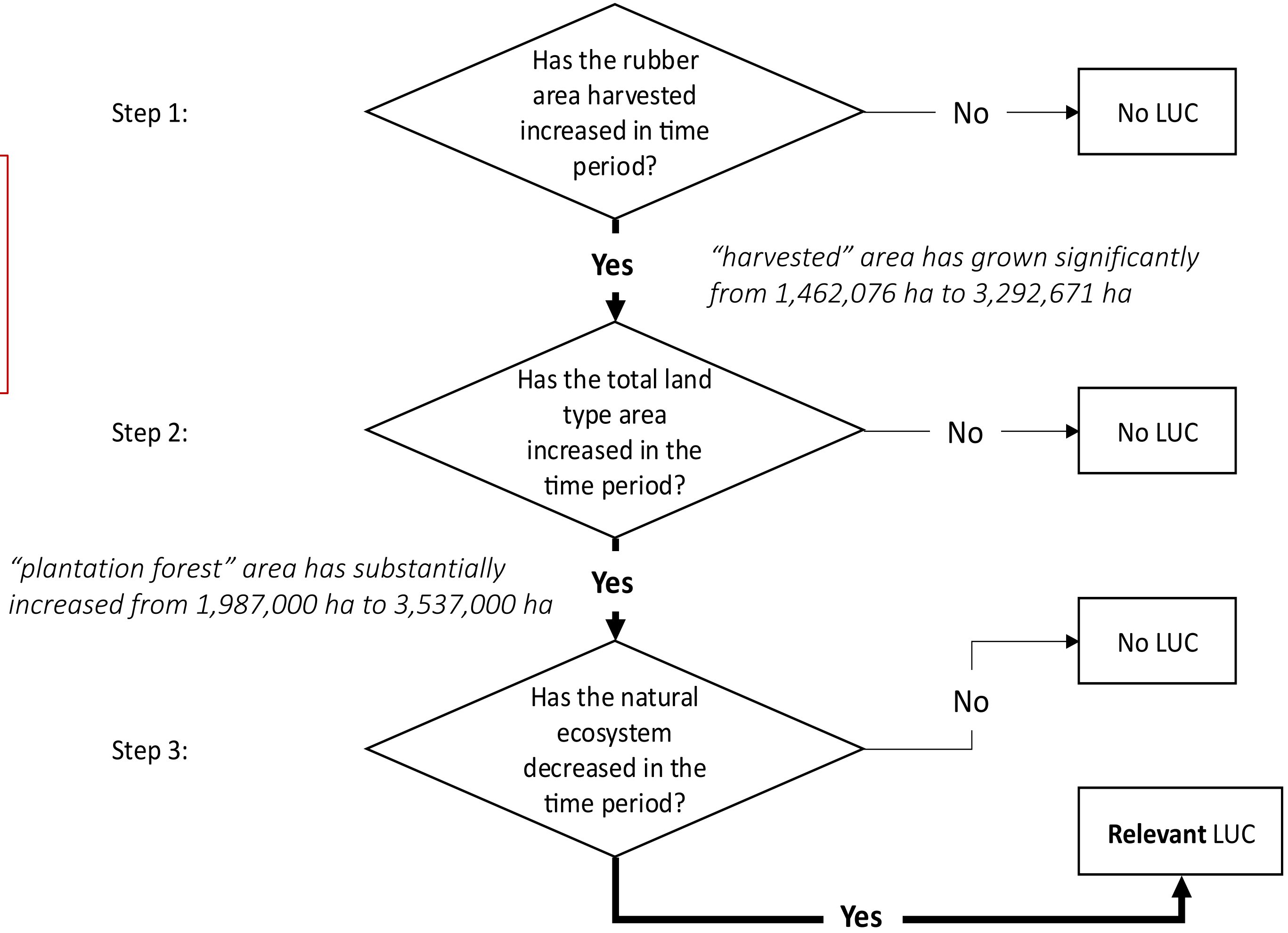
Data quality category	Requirement
Geospatial	Country-specific data (Thailand)
Temporal	Recent data; data from 2000 – 2020 period for land use change topics
Technological	Most common practices

- When secondary data were not found, **estimations** were performed.

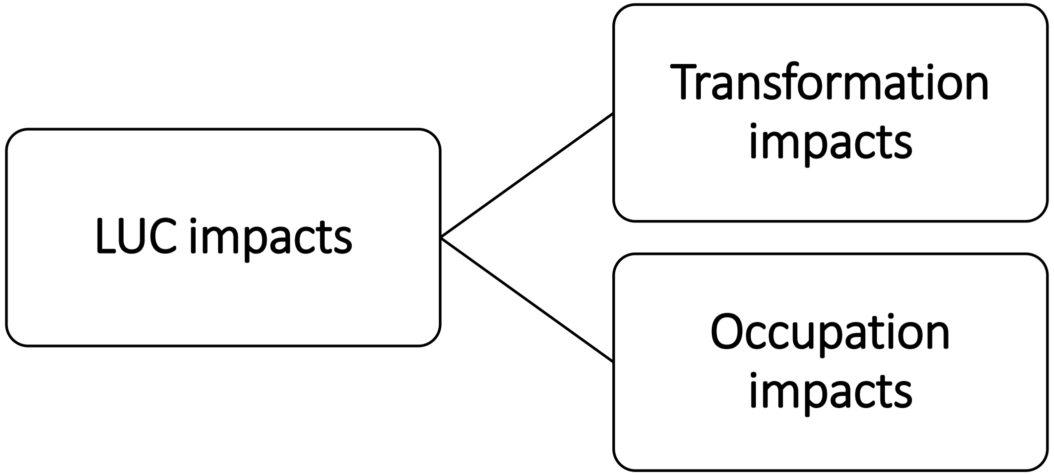
NR – Land Use Change relevance (supp.)

- Understand former land use types of current rubber plantation area → data and literature analysis
- Estimate LUC potential relevance → direct land use change screening methodology

NR production in Thailand during the time period 2000 – 2020



NR – LUC and variations in C stocks (supp.)



Transformation impacts: pertain to variations in the carbon stocks in living and dead biomass due to a conversion of land

Occupation impacts: related to changes in soil organic carbon resulting from the occupation of already transformed land

Information required and procedure:

1. obtain **average annual increment in land transformation** related to the farming of *Hevea b.* in Thailand and during the specific time period 2000 – 2020
2. the emissions originated from the **depletion of** above-ground biomass (AGB), below-ground biomass (BGB) and dead organic matter (DOM) **in the natural ecosystem** are evaluated;
3. thirdly, and finally, compute the **change** (loss or gain) **of soil organic carbon** (SOC) in mineral soil, together with its corresponding dinitrogen monoxide emission, the **change** (loss) **of** SOC retained in organic peat soil, and the potential **accumulation** of carbon in biomass form

Evaluation of C stocks and assessment of LUC (supp.)

Hevea b. **plantations and Thai forests:**

- C fraction, AGB, BGB, root-to-shoot ratio
- C_{AGB}, C_{BGB}, C_{DOM} stocks, and C_{soil}

Thai cropland:

- C fractions, AGB, BGB
- C stocks in biomass

32,151 ha/y

41,665 ha/y

Land use	C_{AGB} [ton/ha]	C_{BGB} [ton/ha]	C_{soil} (SOC) [ton/ha]	C_{DOM} [ton/ha]	Total C stock [ton C/ha]
Tropical forests	235[a]	87[a]	57[a]	15[c]	394
Hevea b.	107[c]	14[c]	40[a]	5[c]	166
	Average living biomass C stock [ton C/ha]				
Crops	34.1[c]				

a: from literature c: estimated in this study

Evaluation of C stocks and assessment of LUC (supp.2)

According to the methodology*:

- **Transformation impacts** resulting from the clear cutting of naturally regenerating forests. Assumptions made are

  i) 20% of AGB is burned,

  ii) 8% of AGB is harvested,

  iii) 72% of AGB decays,

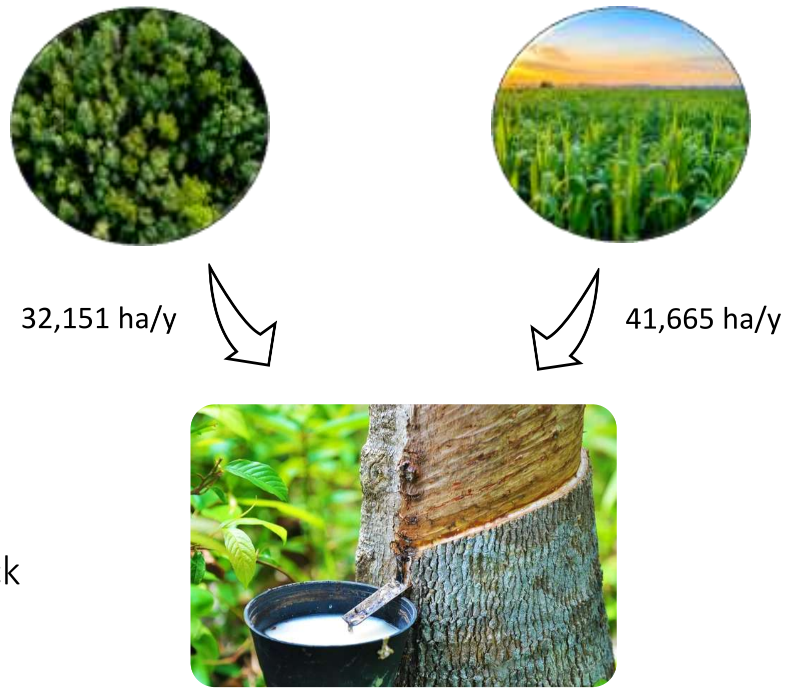
  iv) BGB and DOM decay.

- **Occupation impacts** concerning loss of SOC (and related N_2O emissions) and C gain in tree biomass

  a) transformation from forests to *Hevea b.* plantations leads to a decrease in SOC stock

  b) reduction of C in organic peat soils is negligible

  c) transformation from cropland to *Hevea b.* plantations yields a C gain in tree biomass (34.1 - 121 = - 86.9 ton C per ha)



*2019 IPCC Refinement and IPCC 2006 Guidelines, EMEP/EEA 2019

**GWPs 100-year from IPCC AR6 (i.e., sixth assessment report)

Field emissions – NR plantation (supp.)

From **agrochemicals**:

- glyphosate applied → considered to end up as emission to soil, in accordance with Ecoinvent
- Nitrogen fertiliser used → direct and indirect emissions calculated in compliance with IPCC 2006 (also 2019) tier-1 methodology
- Phosphorus fertiliser used → emissions calculated following SALCA-P models (the estimation of the P content in topsoil for the geography of Thailand was needed and thus performed).

From **biomass burning due to replanting** (in already rubber areas):

- firstly, the biomass of residues to be combusted was estimated
- calculations were performed according to EMEP/EEA 2019 tier 2 method

From **heavy metals**: not estimated (neglected) due to paucity of information

Field emissions – NR plantation (supp.2)

Application of NITROGEN fertiliser

(i) direct emissions of **N_2O** into air (i.e., directly from the fertilised soil)

(ii) indirect **N_2O** emissions due to volatilisation of NH_3 and NO_X and their succeeding deposition on soil and water surfaces

(iii) indirect **N_2O** emissions due to leaching and runoff of the nitrogen from the inorganic fertilisation to soil and water

(iv) emissions into air of the parts of **NH_3** and **NO_X** which do not convert into N_2O

(v) emissions into soil and water of the part of nitrogen (mainly in **NO_3^-** form) which do not convert into N_2O

Application of PHOSPHORUS fertiliser

(i) leaching of dissolved phosphorus (**soluble phosphate**) to ground water

(ii) runoff of dissolved phosphorus (**soluble phosphate**) to surface water

(iii) erosion of soil particulate phosphorus (**P-containing soil particles**) to surface water

Field emissions – NR plantation (supp.3)

Burning of RESIDUES due to replanting activities

Hevea b. organs:
- Stumps
- Roots
- Branches
- Foliage

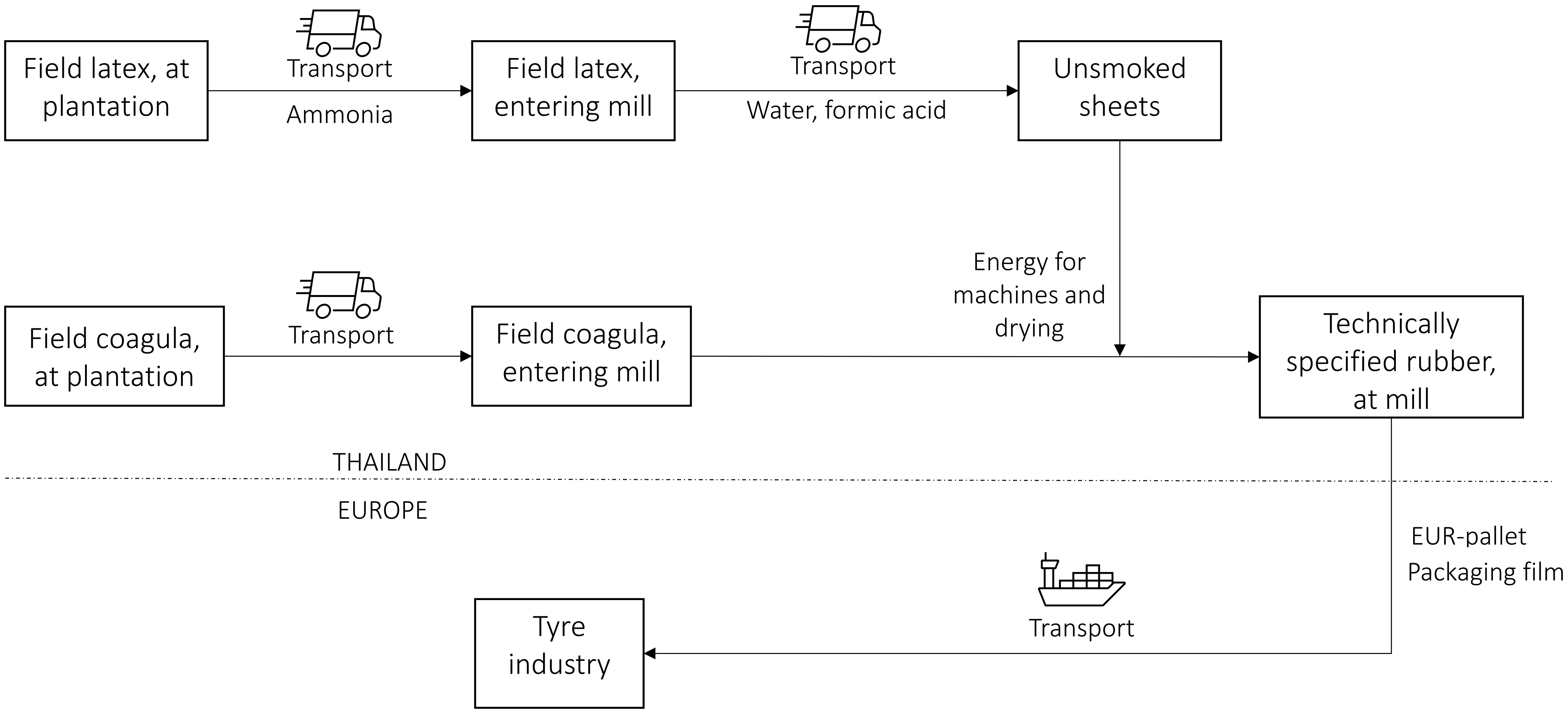
releasing

CO
CH_4
CO_2
NMVOC
NO_X
NH_3
N_2O
SO_X

TSP (< 50 – 100 µm)
PM10 (< 10 µm)
PM2.5 (< 2.5 µm)

SimaPro model of natural rubber (supp.)

From the natural rubber at plantation exit to the natural rubber supplied to the tyre industry



LCI – Natural rubber (supp.)

Inventory analysis regarding the **unsmoked sheets** at mill, with reference to 1 kg of product

Flow category	Inflows/Outflows	Quantity	Unit
Raw materials	Field latex, entering mill	3.30E+00	kg
	Formic acid for coagulation	7.32E-03	kg
Water use	Water for dilution	2.20E-03	m^3
	Water for formic acid solution	2.94E-04	m^3
Products	Unsmoked sheet (USS)	1.00E+00	kg

Inventory analysis regarding the **technically specified rubber** at mill, with reference to 1 kg of this main product

Flow category	Inflows/Outflows	Quantity	Unit
Raw materials	Unsmoked sheet (USS)	3.67E-01	kg
	Field coagula, entering mill	1.18E+00	kg
Water use	Water	2.30E-02	m^3
Electricity use	Electricity	2.20E-01	kWh
Fuel use	Diesel	1.00E+00	MJ
	LPG	1.25E+00	MJ
Products	Technically Specified Rubber (TSR), at mill	1.00E+00	kg
	Scrap rubber, at mill	2.40E-02	kg
Wastewater	Wastewater	2.30E-02	m^3

LCIA – *Hevea b.* fresh latex (supp.)

Group analysis results for 1 kg field latex at plantation, expressed as percentages

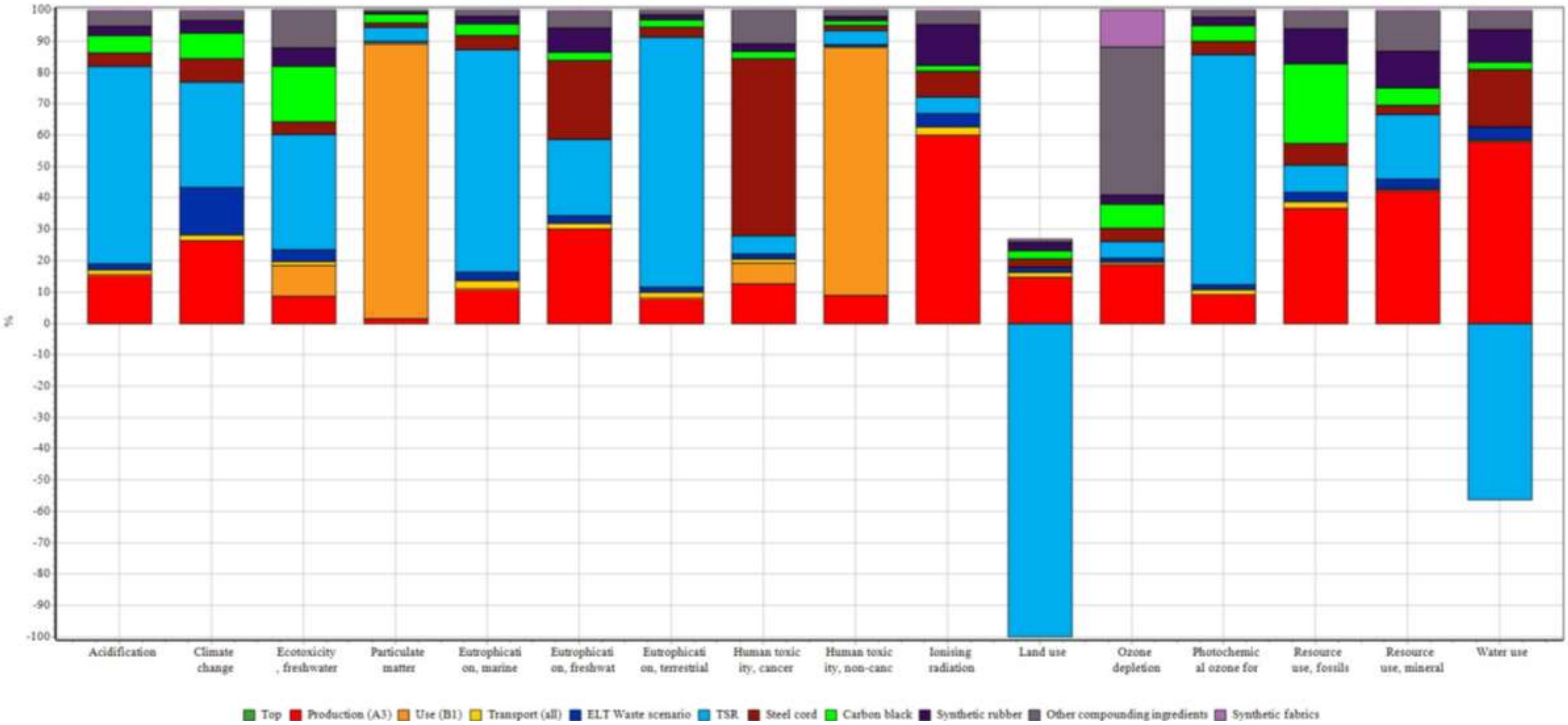
Impact category	Production of fertilisers	Use of fertilisers	Glyphosate production	Burning of residues	LUC impacts	*Eucalyptus* ssp. logs	Energy demand
Acidification	8.0	32.8	0.8	25.1	33.7	-1.0	0.6
Climate change	14.8	7.5	1.9	12.1	65.7	-3.2	1.2
Ecotoxicity, freshwater	82.5	1.0	11.1	1.1	1.5	-2.2	1.5
Particulate matter	18.1	33.5	1.9	27.6	37.1	-18.9	0.8
Eutrophication, marine	5.3	38.4	0.7	24.1	32.4	-1.9	1.1
Eutrophication, freshwater	49.3	33.5	28.4	0.0	0.0	-13.1	1.9
Eutrophication, terrestrial	4.7	38.1	0.4	24.5	32.9	-1.1	0.6
Human toxicity, cancer	74.8	0.0	39.7	0.0	0.0	-23.0	8.5
Human toxicity, non-cancer	59.8	0.3	6.6	11.5	15.6	-2.2	8.0
Ionising radiation	67.3	0.0	32.0	0.0	0.0	-2.4	3.1
Land use	3.8	0.0	0.4	0.0	0.0	-105.0	0.7
Ozone depletion	44.1	0.0	58.4	0.0	0.0	-5.9	3.4
Photochemical ozone formation	2.7	15.4	0.4	35.4	47.6	-2.1	0.7
Resource use, fossils	90.6	0.0	14.6	0.0	0.0	-12.3	7.1
Resource use, minerals and metals	93.0	0.0	5.0	0.0	0.0	-0.5	2.5
Water use	87.0	0.0	13.1	0.0	0.0	-0.9	0.8

LCIA – TSR (supp.)

Group analysis results for 1 kg TSR at mill exit, expressed as percentages of the total

Impact category	Total	Raw materials supply	Energy consumption	Wastewater treatment
Acidification	6.63E-02	96.8	3.2	0.1
Climate change	5.74E+00	93.1	6.7	0.2
Ecotoxicity, freshwater	4.79E+01	95.6	2.7	1.7
Particulate matter	2.86E-07	97.2	2.6	0.2
Eutrophication, marine	1.75E-02	93.2	4.3	2.4
Eutrophication, freshwater	6.35E-04	74.2	19.4	6.4
Eutrophication, terrestrial	2.93E-01	97.2	2.7	0.1
Human toxicity, cancer	7.41E-10	82.3	16.0	1.7
Human toxicity, non-cancer	2.62E-08	84.3	10.0	5.6
Ionising radiation	3.83E-02	91.4	7.3	1.4
Land use	-1.14E+02	-100.3	0.3	0.0
Ozone depletion	3.43E-08	77.9	21.9	0.2
Photochemical ozone formation	1.02E-01	97.5	2.4	0.0
Resource use, fossils	1.60E+01	68.6	30.9	0.6
Resource use, minerals and metals	1.84E-05	91.4	8.4	0.2
Water use	-2.31E+00	32.0	1.3	-133.3

LCIA – virgin tyre life cycle (supp.)



LCIA – virgin tyre life cycle (supp.2)

Group analysis results for new tyre LC, expressed as percentages of the total impacts

Impact category	Production (A3)	Use (B1)	Transport (all)	ELT Waste scenario	TSR	Steel cord	Carbon black	Synthetic rubber	Other compounding ingredients	Synthetic fabrics
Acidification	15.2	0.3	1.6	1.8	63.1	4.4	5.5	3.0	5.0	0.1
Climate change	26.5	0.0	1.7	15.3	33.6	7.4	8.1	4.0	3.2	0.2
Ecotoxicity, freshwater	8.6	9.8	1.4	3.7	36.7	4.1	17.6	5.9	12.1	0.1
Particulate matter	1.4	87.8	0.4	0.3	4.6	1.3	2.7	0.7	0.7	0.0
Eutrophication, marine	10.6	0.4	2.6	2.7	70.9	4.5	3.8	2.3	2.1	0.1
Eutrophication, freshwater	30.1	0.0	1.7	2.5	24.4	25.1	2.6	7.8	5.5	0.3
Eutrophication, terrestrial	7.9	0.1	1.9	1.6	79.9	3.1	2.4	1.5	1.5	0.1
Human toxicity, cancer	12.5	6.8	1.3	1.6	5.7	56.4	2.4	2.6	10.6	0.1
Human toxicity, non-cancer	8.8	78.9	0.4	0.7	4.6	1.6	1.4	1.3	2.2	0.1
Ionising radiation	60.0	0.0	2.6	4.3	5.2	8.1	2.0	12.9	4.5	0.2
Land use	20.1	0.0	2.4	2.1	-136.9	3.7	3.5	3.5	1.6	0.2
Ozone depletion	18.7	0.0	0.8	1.4	5.1	4.2	7.9	2.8	47.1	12.0
Photochemical ozone formation	9.1	0.0	1.7	1.5	73.4	4.3	4.9	2.7	2.2	0.1
Resource use, fossils	36.7	0.0	2.1	2.9	8.7	7.1	25.3	11.3	5.7	0.3
Resource use, minerals and metals	42.1	0.0	0.8	3.1	20.5	3.0	5.6	11.6	13.0	0.2
Water use	132.2	0.0	1.2	9.7	-128.5	41.8	5.6	23.3	14.4	0.4

Comparison new and retreaded LCs (supp.)

Impact category	Unit	Life Cycle New Tyre	Life Cycle Retreaded Tyre	Difference [%]
Acidification	mol H+ eq	1.95E-02	1.23E-02	-37%
Climate change	kg CO_2 eq	3.16E+00	1.93E+00	-39%
Ecotoxicity, freshwater	CTUe	2.42E+01	1.63E+01	-33%
Particulate matter	disease inc.	1.16E-06	1.12E-06	-4%
Eutrophication, marine	kg N eq	4.57E-03	2.94E-03	-36%
Eutrophication, freshwater	kg P eq	4.81E-04	2.76E-04	-43%
Eutrophication, terrestrial	mol N eq	6.80E-02	4.40E-02	-35%
Human toxicity, cancer	CTUh	2.40E-09	1.44E-09	-40%
Human toxicity, non-cancer	CTUh	1.05E-07	9.68E-08	-8%
Ionising radiation	kBq U-235 eq	1.35E-01	7.48E-02	-45%
Land use	Pt	-1.54E+01	-9.63E+00	-37%
Ozone depletion	kg CFC11 eq	1.24E-07	6.68E-08	-46%
Photochemical ozone formation	kg NMVOC eq	2.58E-02	1.65E-02	-36%
Resource use, fossils	MJ	3.42E+01	2.03E+01	-41%
Resource use, minerals and metals	kg Sb eq	1.66E-05	9.99E-06	-40%
Water use	m^3 depriv.	3.33E-01	1.29E-01	-61%
PM10	kg PM10 eq	5.31E-03	5.25E-03	-1%
PM2.5	kg PM2.5 eq	4.89E-03	4.43E-03	-9%

Comparison new and retreaded (supp.2)

Considering **climate change** category: 78 % of both the carbon footprints is CO_2 , of which the 81 % is from fossil origin!

1.2 kg fossil–CO_2
Retread tyre

vs

2 kg fossil-CO_2
Virgin tyre

derive from

1
Electricity used
new tyre (25%) and retreaded tyre (21%)

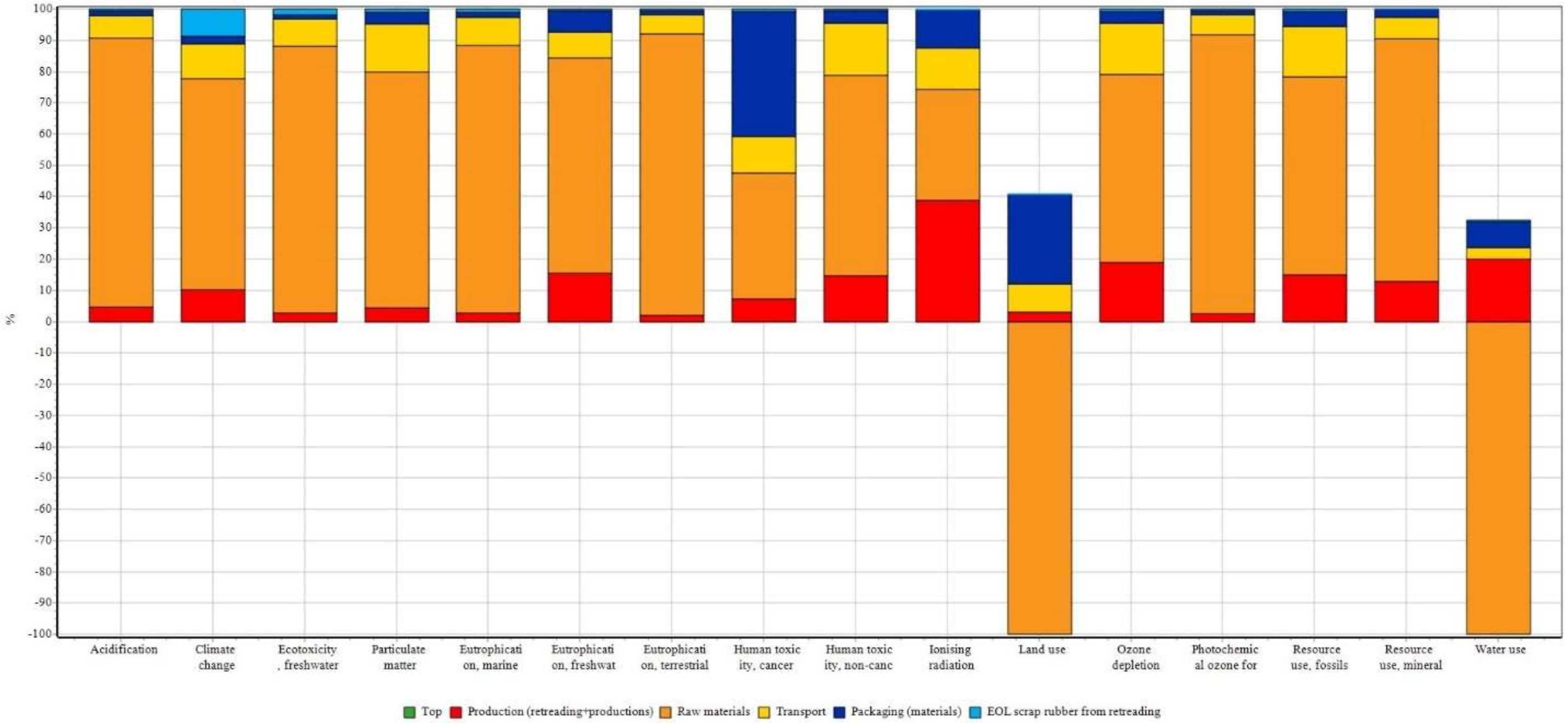
2
Incineration waste rubber
new tyre (20%) and retreaded tyre (19%)

3
Carbon black production
new tyre (10%) and retreaded tyre (11%)

4
Steel production
new tyre (10%) and retreaded tyre (9%)

LCIA – Retreading process

Group analysis results for 1 tyre retreaded (so not Life Cycle!). Note that only the processes under operational control of company are considered.



Analisi d’inventario pneumatico nuovo

RAW MATERIALS SUPPLY (A1)

- Elastomeric compound (62.94 kg)

Natural rubber (37%), Synthetic rubber (10%), Carbon black (22%), Silica (1%), Process oil (1%), Zinc oxide (2%), Stearic acid (1%), Sulphur (1%), 6PPD (<1%), TMQ (<1%), TBBS (<1%), Phenolic resin (<1%), Chlorinated paraffins (<1%), Zinc borate hydrate (<1%)

- Wires (17 kg)

Steel cord (15%), Bead wire (6%), Synthetic textile fabrics (0%)

wt. % with respect to total tyre mass

TRANSPORT (A2)

- Container ship
- Train
- Lorry

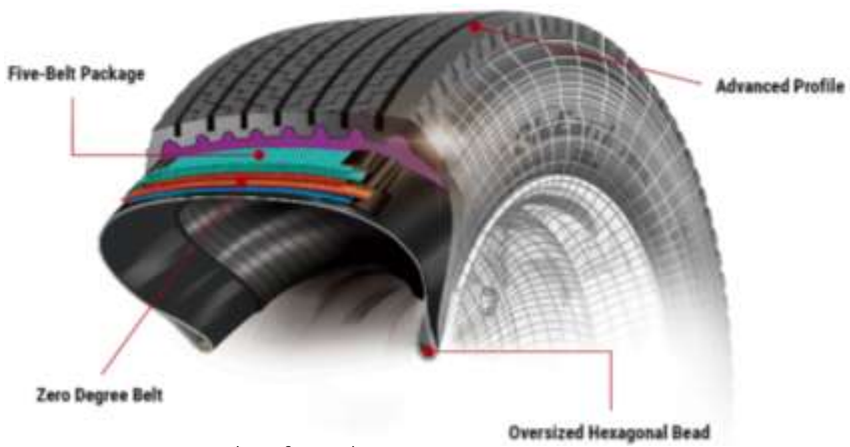
MANUFACTURING (A3)

- Production of virgin tyre

Electricity, Steam, Heat, Water

- EOL of manufacturing scrap

Landfill, Incineration, Open burning



Example of truck tyre

USE (B1)

- Wear

Tyre and road wear particles (TRWP)

TRANSPORT (C2)

- Waste collection truck

EOL RECOVERY/DISPOSAL TREATMENTS (C3)

- Recycling

Rubber (53%), Steel (90%)

- Incineration

Rubber (40%), Steel (8%)

- Landfilling

Rubber (4%), Steel (2%)

- Backfilling

Rubber (3%)

Analisi d’inventario pneumatico ricostruito

RAW MATERIALS SUPPLY (A1)

- Carcass (69.44 kg)
- Ring compound (15.78 kg)

Natural rubber (56%), Carbon black (30%), NR regenerated (3%), rubber particles from retreading processes (3%), Zinc oxide (2%), Paraffinic plasticiser oil (2%), Stearic acid (1%), 6PPD (1%), Sulphur (<1%), CBS (<1%), Organozinc (<1%), TMQ (<1%), DBD (<1%), CTP (<1%)

- Substrate compound (1.56 kg)

Natural rubber (47%), Carbon black (24%), SBR (12%), Naphtha (4%), Zinc oxide (3%), Acetylene/4-tert-butylphenol copolymer (1%), Carbonaceous residue (1%), Insoluble sulphur (1%), Stearic acid (1%), TMQ (1%), MBTS (<1%), DPG (<1%), DDTS (<1%), 6PPD (<1%)

- Solution compound (0.13 kg)

Naphtha (83%), Natural rubber (13%), Carbon black (2%), Aromatic hydrocarbon resin (<1%), Paraffinic plasticiser oil (<1%)

- Envelopes

Chlorobutyl rubber, Carbon black, Paraffinic oil, other chemicals

- Packaging materials

EUR pallet, PE film, Cardboard, Board box, Label, Adhesive tape

TRANSPORT (A2)

- Container ship
- Train
- Lorry

USE (B1)

- Wear

Tyre and road wear particles (TRWP)

TRANSPORT (C2)

- Waste collection truck

MANUFACTURING (A3)

- Production of ring, substrate, envelopes

Electricity, Steam, Heat

- Retreading

Electricity, Steam

- Internal transport
- EOL of manufacturing scrap & packaging

EOL RECOVERY/DISPOSAL TREATMENTS (C3)

- Recycling

Rubber (53%), Steel (90%)

- Incineration

Rubber (40%), Steel (8%)

- Landfilling

Rubber (4%), Steel (2%)

- Backfilling

Rubber (3%)