

Preparatory study and impact support study on tyres

Draft report
Task 7 of the preparatory study

Draft for SH meeting 2026

Written by:
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Draft for SH meeting 2

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Preparatory Study and Impact Assessment support study on tyres

Draft report
Task 7 of the Preparatory study
Version 1

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List of Abbreviations and definitions

3PMSF	Three-Peak Mountain Snowflake
ADAC	Allgemeiner Deutscher Automobil-Club
BAT	Best Available Technology
BNAT	Best Not (yet) Available Technology
BOM	Bill of Materials
CB	Carbon Black
CLP	Classification, Labelling and Packaging
CN	Combined Nomenclature
dGTR	Devulcanised Ground Tyre Rubber
DPP	Digital Product Passport
EAf	Electric Arc Furnaces
EEA	European Environmental Agency
EF	Environmental Footprint
ELT	End-of-Life Tyres
ELV	End-of-Life Vehicles
EPD	Environmental Product Declaration
EPREL	European Product Registry for Energy Labelling
EoL	End of Life
ESPR	Regulation (EU) 2024/1781 of 13 June 2024 establishing a framework for the setting of Ecodesign for Sustainable Products, amending Directive (EU) 2020/1828 and Regulation (EU) 2023/1542 and repealing Directive 2009/125/EC
EUT	End-of-Use Tyres
(B)EV	Battery Electric Vehicle
HICP	Harmonised Index of Consumer Prices
HS	Harmonised System

HCV	Heavy Commercial Vehicle
H ₂ S	Hydrogen Sulphide
ICE	Internal Combustion Engine
IQR	Interquartile Range
JRC	Joint Research Centre
LCA	Life Cycle Assessment
LCC	Life Cycle Costs
LCV	Light Commercial Vehicle
LLCC	Least Life Cycle Costs
LHV	Lower Heating Value
NACE	Nomenclature of Economic Activities
MEErP	Methodology for Ecodesign of Energy-related Products
OE	Original Equipment
OEM	Original Equipment Manufacturer
PAH	Poly Aromatic Hydrocarbons
PCR	Product Category Rules
PEFCR	Product Environmental Footprint Category Rules
PET	Polyethylene Terephthalate
rCB	Recycled Carbon Black
RCC	Rolling Resistance Coefficient
RFT	Run-Flat Tyres
sCB	Sustainable Carbon Black
TaaS	Tyre-as-a-Service
TDF	Tyre Derived Fuel
TPG	Tyre Pressure Gauges
TPO	Tyre Pyrolysis Oil

TPMS	Tyre Pressure Monitoring Systems
ToR	Terms of Reference
V2X	Vehicle To Everything
WFD	Waste Framework Directive or Directive 2008/98/EC on waste
wt-%	weight percent (share based on mass)
ZnO	Zinc Oxide

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1. MEErP Task 7 – Scenarios

Editorial note on the current draft

The current draft has been prepared for the stakeholder meeting to be held on 8 June 2026.

Due to time constraints, it was not possible to perform a complete analysis of all policy options to accommodate all design options that have been developed in Task 6, and the study team has chosen to focus the work on policy options that are understood to be the most significant in terms of potential impacts. The discussion of policy options, assumptions and model results represent the initial findings from this process and shall be revised following the stakeholder meeting.

The modelling of the Business as Usual (BAU) baseline has been done including all base cases. For different policy options the modelling is limited to C1 and C3 tyres. Task 6 has not yet been performed for C2 tyres, and it is intended to add this to task 6 and 7 following the stakeholder meeting.

The modelling performed on retreading has been performed so far only for C3 tyres. This is in part due to the understanding that C3 tyres are the dominant tyre subjected to retreading practices but is also related to the more complete set of data available for this class of tyres that increases the certainty of assumptions and related results. The approach was also aimed at testing the modelling method and finetuning it before applying it to other tyre classes.

An assessment of the socio-economic costs/savings of the policy options is still to be added.

1.1. Objectives of MEErP Task 7

This draft task 7 report identifies and discusses policy options aimed at reducing the impacts of tyres on the environment as analysed in previous tasks. It provides in Task 7.2 and Task 7.3 an analysis of the impacts of future scenarios in line with policy measures that could be introduced at EU level. This is a key task, as it combines the results of the previous tasks. It discusses potential ESPR requirements and aims at providing an analytical basis in support of the decision-making process within the ESPR framework regarding the need to introduce ESPR legislation for this product group.

1.2. Introduction to the evaluation of scenarios using the MEErP

The MEErP provides a structured and comprehensive framework for assessing the environmental, economic, and technical performance of product design options. At its core, the MEErP facilitates a life-cycle-based evaluation that integrates environmental impact assessments with techno-economic analysis to identify the least life-cycle cost (LLCC) and best available technologies (BAT). This ensures that design decisions not only meet regulatory requirements but also promote sustainability and cost-effectiveness.

17 The evaluation of design options within the MEErP is prepared by several tasks, including the definition
18 of product scope (Task 1), market analysis (Task 2), use-phase and technical analysis of existing
19 products (Task 3 & 4), as well as the subsequent life-cycle assessment (LCA) and life-cycle-costing (LCC)
20 (Task 5). The revised MEErP methodology (2024) introduces refinements to better align the framework
21 with the EU's Green Deal objectives, emphasising aspects related to climate neutrality, circularity, and
22 SoC related to the product group under study. The work process for developing design options remains
23 structured around seven core tasks, with Task 6 playing a pivotal role in identifying and evaluating
24 improvement potentials. Design options are first mapped and evaluated, taking stakeholder input into
25 account, and then assessed, usually using the EcoReport tool, but in this study using a model
26 developed on the basis of the Product Environmental Footprint (PEF) methodology. The latter helps
27 to quantify the improvement potential of a design option (DO) against the Base Cases in terms of
28 environmental impact. This structured approach enables policymakers and stakeholders to compare
29 alternatives objectively and select the most sustainable and economically viable solutions. Thus, the
30 MEErP ensures that product innovations are aligned with broader environmental goals, such as
31 reducing greenhouse gas emissions and improving energy efficiency and the adoption of a circular
32 economy. Task 7 then develops policy options based on the DOs analysed in the earlier task and
33 analyses these based on a socio-economic analysis methodology.

34 Task 7 of this preparatory study encompasses the following sections:

- 35 • Policy analysis of pathways identified in Task 6;
- 36 • Preliminary Analysis of how data fields may support Task 6 use cases for the Digital Product
37 Passport
- 38 • Preliminary scenario analysis, including
 - 39 - Development of a stock model to track Business as Usual EU tyres fleet impacts
 - 40 - Development of a retread submodel which allows comparison of C3 budget tyre impacts
 - 41 - Sensitivity analysis of key parameters;
- 42 • Summary of results and main policy recommendations per product.
- 43 • The annex covers the Open Strategic Autonomy assessment

44 1.3. Policy analysis

45 1.3.1. Stakeholder consultation

46 Consultation efforts related to task 5 and task 6 generally enabled the collection of information
47 relevant for the development of policy options and scenarios in task 7. This includes the general
48 consultations on task 5 and on the substances of concern task held in the summer of 2025 and the
49 consultation launched on the task 6 DOs on March 4th 2026 which is still ongoing but where 7
50 Stakeholders returned the questionnaire within 4 weeks, allowing their inputs to be considered in the
51 drafting of this study task.

52 In addition, whereas interviews were held to collect information for task 6 on the DOs analysed
53 therein, they also allowed testing assumptions related to the policy options and scenarios of task 7

54 and on interactions of the various DOs that could be relevant to a specific scenario. Interviews were
55 held with the following stakeholder groups:

- 56 • Retreading/waste management network association
- 57 • Independent Retreader
- 58 • Premium EU manufacturer with retreading business
- 59 • Tyre additives producer
- 60 • Devulcanisation association
- 61 • Tyres manufacturer association
- 62 • Experts working for the EU Commission on tyre retreading label and abrasion methodologies
- 63 • Vehicle OEM

64 A second stakeholder meeting is planned for June 8th 2026 and shall provide an opportunity to validate
65 the work done so far and to collect further data and views for refining the results.

66 Due to the timings of the quantification of the impacts in the PEF LCA, the results in this report is
67 preliminary and subject to change. Additional feedback still expected to be sent by stakeholders after
68 the 2nd stakeholder meeting, a full re-run of the impact modelling will be conducted following feed-
69 backs from the second stakeholder meeting (from July 2026).

70 1.3.2. **ESPR Framework**

71 ESPR¹ seeks to enhance the sustainability of products in the EU market by improving their circularity,
72 energy performance, recyclability, and durability. It aims to foster a unified market for sustainable
73 products, replacing the Ecodesign Directive 2009/125/EC by extending its scope to nearly all physical
74 products (excluding food, feed, and medicinal products) and reinforcing ecodesign requirements. This
75 regulation supports economic opportunities in innovation, job creation, and sustainability.

76 The ESPR sets ecodesign requirements for product categories, focusing on:

- 77 (i) Durability, reusability, upgradability, and reparability,
- 78 (ii) Maintenance and refurbishment potential,
- 79 (iii) Energy and resource efficiency,
- 80 (iv) Limiting substances that hinder circularity,
- 81 (v) Increasing recycled content,
- 82 (vi) Simplifying remanufacturing and recycling,
- 83 (vii) Carbon and environmental footprint rules,

¹ https://commission.europa.eu/energy-climate-change-environment/standards-tools-and-labels/products-labelling-rules-and-requirements/ecodesign-sustainable-products-regulation_en

84 (viii) Waste reduction,

85 (ix) Information on product sustainability.

86 ESPR enables horizontal rules for product groups with shared characteristics and introduces several
87 new measures to enhance product sustainability.



88

89 **Figure 1-1: Type of requirements within the ESPR framework (source EC²).**

90 **1.3.3. Opportunities and barriers for improvement**

91 **1.3.3.1. Opportunities**

92 ESPR could support the EU to become less dependent on imports of a range of materials essential to
93 the tyres industry through improving circularity. Key opportunities lie in:

94 **Multiple lifetimes:** revive the EU retreading industry for C3 tyres to reach previous levels, promoting
95 the use of retreadable tyres over non-retreadable tyres to correct the current market preference
96 towards single use, disposable tyres. Retreading is a mature circular technology but is currently under
97 huge threat from cheap disposable imports. There is an opportunity to create a more level playing
98 field where more tyres are retreadable and thus used over multiple lifetimes as compared to the
99 existing situation of growing single-lifetime imports.

100 **Support to recycling sector:** a certain percentage of End of Life Tyres are currently exported as tyres
101 for re-use or for waste management abroad due to a lack of existing recycling capacities (also a result
102 of insufficient demand for recycling outputs). At the same time, some outlets for these recycled
103 materials such as artificial turf, will be banned due to microplastics issues from 2031. This may create
104 a large additional burden of tyres needing waste management but is also perceived as an opportunity
105 to develop higher quality closed loop recycling for tyres. Recycled content targets in tyres could give

² https://environment.ec.europa.eu/events/information-session-new-ecodesign-sustainable-products-regulation-espr-2024-05-22_en

106 recyclers the investment security to scale up operations, while indication of which tyres contain
107 substances that are problematic to recycling can support improving recycling processes and output
108 quality.

109 **Improve European Strategic Autonomy:** retreading, recycling and bio-based content targets reduce
110 dependencies on supply chains that are at high risk in the global economy: natural rubber, materials
111 dependent on fossil fuels (e.g. carbon black, synthetic rubber), and can support the development of
112 alternative sources (e.g. dandelion rubber).

113 **Digital Traceability via the Digital Product Passport (DPP):** a DPP can support circularity measures
114 through the provision of lifecycle information for retreaded tyres, labelling of substances of concern
115 relevant for recycling to enable better sorting and routing to recycling processes, and possibly even
116 help avoid exports of waste tyres.

117 **Create a level playing field:** The harmonisation of definitions and the development of standardisation
118 applicable at EU level help avoid unfair competition when it incurs due to differences in interpretations
119 and practices across Members states (and in some cases also beyond). End-of-waste criteria are
120 currently lacking at EU level and could create obstacles for transferring ELT shipments and ELT
121 fractions over borders. Documentation of targets for recycled or bio-based content require
122 standardised accounting methods to ensure traceability of content and compliance.

123 1.3.3.2. Barriers

124 **Magic triangle and technical performance limitations:** tyre performance and composition is subject
125 to physical and chemical limitations, with durability/abrasion, rolling resistance and wet grip
126 performance acting against each other. While advances in tyre engineering have enabled
127 manufacturers to make tyres that perform highly across these parameters, achieving acceptable
128 performance whilst not impacting the rolling resistance or safety of the tyre is a challenge.

129 **Chemical substitution is not simple:** Any materials which are substituted may require long R&D cycles
130 to achieve similar properties and ensure required performance standards are met. Tyre manufacturers
131 must already meet limits on abrasion under Euro 7, rolling resistance under UN R117 and ensure that
132 natural rubber is deforestation-free. Under REACH, substances like 6PPD and cobalt salts are also
133 being assessed among other substances of concern for possible regulatory action. While substitute
134 chemicals are under investigation, it can take up to 10 years to develop these and apply them
135 successfully in industry (example PAHs phase out in 2006).

136 **Verification:** recycled rubber in a tyre becomes a part of the chemical matrix and cannot be simply
137 verified in the end-product with currently available commercial technology. Market surveillance must
138 therefore rely on complex, digitally verifiable chain-of-custody models.

139 **Intellectual Property and IT Infrastructure Constraints:** Providing information on chemical
140 composition to support recycling or flag substances of concern must be done without revealing
141 manufacturer recipes and valuable IP. While the DPP envisions dynamic, highly granular tracking, a
142 tyre is subjected to stress during its lifetime and RFID tags are not able to store large quantities of
143 information. Actors across the supply chain will require infrastructure to handle any DPP and update
144 it, as well as providing different access levels depending on the data point concerned.

145 **Lack of End-of-Waste (EoW) Criteria:** The transition to a circular tyre economy is hindered by
146 fragmented regulations. Currently, there is a lack of harmonised, EU-wide End-of-Waste (EoW) criteria
147 for ELT-derived materials. Processed rubber may be considered a valuable product in one member
148 state but hazardous waste in another, deterring capital investments into advanced recycling
149 infrastructure

150 **Legacy Chemicals (PAHs) Blocking End-of-Waste Status** The transition of end-of-life tyres (ELTs) into
151 valuable secondary raw materials is hindered by legacy chemicals, particularly Polycyclic Aromatic
152 Hydrocarbons (PAHs). While modern tyres use treated oils to meet strict REACH limits, the REACH
153 restriction does not apply to carbon black, influencing the level of PAHs later contained in recycled
154 content like rubber or tyre pyrolysis oils and hindering tyre circularity. In addition, older tyres still in
155 circulation may contain also contain high PAH levels.

156 1.4. Potential policy options

157 1.4.1. Closing the Loop

158 This policy option aims to support the EU recycling market for tyres, through a) creating markets for
159 the uptake of recycled materials via recycled content and by b) removing barriers for recycling as a
160 means of increasing both the quality and quantity of recycling outputs.

161 1.4.1.1. Recycled Content

162 The scope of recycled content targets is proposed to be placed on **post-consumer waste** rather than
163 pre-consumer waste to support development of the recycling market and avoid incentivising
164 manufacturing inefficiencies.

165 Recycled content targets are proposed to be split into two material categories:

- 166 • Rubber compound; and
- 167 • Reinforcement materials.

168 The viability of a recycled content target depends on the following:

- 169 • Availability of feedstock in sufficient quantities;
- 170 • Quality of feedstock suitable to meet functional performance requirements; and
- 171 • Availability of reliable verification approaches.

172

173 Feedstock availability

174 As estimated in the design options of task 6, the feedstock availability depends on the quantity of EoL
 175 tyres entering different EoL pathways. The current EoL pathways (2024) are estimated to be the
 176 following:

177 **Table 1-1: Distribution of ELTs among different end-of-life treatment routes, in %.**

End-of-life treatment process	Share
Mechanical recycling (granulation – not including pre-treatment for pyrolysis or devulcanisation)	40.1%
Devulcanisation	0.5%
Pyrolysis	7.2%
Incineration in cement kiln	48.8%
Civil engineering/backfilling/public works	3.3%

178 Mechanical recycling is a necessary prior step before pyrolysis and devulcanisation, and often also
 179 applied before incineration in cement kilns. Based on available information, it is believed that up to
 180 one third of shredded rubber is also exported outside the EU 27 (+UK) to largely sub-standard recycling
 181 processes abroad in India, Morocco or Turkey. It is thus emphasised that the value specified in **Table**
 182 **1-1** for mechanical recycling does not reflect shredding performed prior to other treatment routes
 183 (i.e., pyrolysis, devulcanisation and incineration) or prior to export.

184 Exports are currently not reflected in the analysis in Task 6, since it was not taken up as part of the
 185 baseline LCA calculation and only considered as a sensitivity analysis. Micronised rubber and reclaim
 186 rubber are also thought to make up to a combined 1%, however, their impact is grouped with
 187 mechanical recycling in Task 5/6.

188 Beyond micronised and reclaim rubber, which have limited substitution potential in new tyres, closed
 189 loop recycled content targets for rubber compounds are highly dependent on devulcanisation, which
 190 at the present time delivers a compound containing the input additives and substances. As a result,
 191 the fraction may contain legacy Substances of Concern (SoC). Any gradual phase out of such materials
 192 must therefore be coupled with a recycled content exemption that allows the use of recycled content
 193 with unintentional presence of legacy substances in the manufacture of new tyres, provided that the
 194 share of such substances is to decrease over time.

195 Quality of recyclates

196 While several tyres made by manufacturers have shown ability to apply a range of recycled materials
 197 to reach high recycled content and high performance, the standards landscape for determining the
 198 quality of recyclates to enable tyre to tyre recycling is still underdeveloped.

199 The quality of recyclates for use in tyres does not necessarily need to be set at the level of the materials
 200 themselves, and can be achieved implicitly by the manufacturer ensuring the tyre meets a certain
 201 performance characteristic to ensure safety and other performance criteria. Performance and safety

202 is already governed by UN R117, R30 and R54, as well as through internal quality requirements at
 203 manufacturers and the REACH Regulation (e.g. restrictions on PAH limits in rCB and reclaimed rubber).
 204 However, recycle material quality standards can help achieve higher uptake of these materials
 205 across the market.

206 Recycled content standards for reinforcement materials of steel and rPET are already well established.

207 **Steel:** Recycled via electric arc furnace (EAF) melting, which returns material to virgin-equivalent
 208 chemistry. The resulting steel wire must meet the same well-established EN/ISO specifications (tensile
 209 strength, carbon content, diameter tolerances, corrosion resistance). Physical testing of the finished
 210 wire is performed against existing steel-cord specifications to establish quality.

211 **Rubber and carbon black:** EN standards categorising ELT granulates have been developed under
 212 CEN/TC 366 on Tyre Recycling. These standards focus on physical characteristics of rubber granulates.
 213 EN standards have not yet been developed on:

- 214 • Chemical quality of pyrolysis outputs (rCB, sCB);
- 215 • Devulcanisation efficiency or grading;
- 216 • Micronised Rubber particles performance characterisation.

217 Standards categorising EoL outputs from pyrolysis, devulcanisation and micronised rubber have been
 218 developed under ASTM (ASTM International, formerly known as American Society for Testing and
 219 Materials). An overview of the existing standards found relating to qualifying EoL materials from these
 220 EoL pathways is summarised in the table below.

221 **Table 1-2: Overview of existing standards found for materials coming out of EoL pathways for**
 222 **rubber compounds.**

Material	Standard	Description	Type
Whole Tyres (pre-processing)	CEN/TS 17045:2020	Quality criteria for whole tyre selection prior to material recovery	Visual and physical inspection of casings, suitability criteria for recycling/recovery
ELT Granulates	EN 14243 (Parts 1–3)	Categorises particle sizes, shred dimensions, physical characteristics of ELT-derived materials	Physical measurement of granulate properties
ELT Granulates	EN 17188, EN 16916, EN 17189, EN 17308:2024	Sampling, moisture, density, steel wire impurity testing	Laboratory testing of granulates and powders
Recovered Carbon Black (rCB)	ASTM D8178-22	Defines and differentiates market-ready rCB from raw pyrolysis char	Nomenclature/ classification standard
Recovered Carbon Black (rCB)	ASTM D8474-23	Compositional analysis of rCB (volatile matter, fixed carbon, ash)	Thermogravimetric Analysis (TGA)

Material	Standard	Description	Type
Carbon Black (general)	ASTM D1765-23b	Classification system for carbon blacks (N-grade: surface area, curing rate)	Nitrogen adsorption surface area measurement, curing rate testing
Devulcanised Rubber	ASTM D6814	Grades devulcanisation efficiency by measuring crosslink density reduction	allows the compounder to determine if more curing agents are needed during mixing of devulcanised rubber
Reclaimed Rubber	ISO/TS 16095:2021	Evaluates vulcanisation characteristics and mechanical properties of reclaimed natural rubber	Physical and chemical tests and evaluation methods
Micronised Rubber Powder (MRP)	ASTM D5603-23	Classifies recycled vulcanisate particulate rubber by feedstock and particle size	Classification against defined size limits
Micronised Rubber Powder (MRP)	ASTM D5644-23	Determines particle size distribution of recycled rubber	Mechanical sieving and analytical techniques

223 *Note: ISO 1408:1995 (carbon black content determination) and ISO 247-1:2018 (ash content) exist as*
 224 *general rubber analysis tools under ISO/TC 45 but were not designed for quality-grading recycled*
 225 *materials specifically. They could serve as methodological building blocks for future CEN harmonised*
 226 *standards.*

227 **Recovered Carbon Black (rCB) via Pyrolysis**

228 At the present time, rCB is difficult to incorporate in new tyres due to inter alia a high ash content. It
 229 is understood that additives are under development that improve the uptake of lower grades of
 230 carbon black.

231 ASTM is the most comprehensively standardised pathway. ASTM D36 Committee has built a near-
 232 complete framework: terminology (D8178), compositional analysis via TGA (D8474), and performance
 233 benchmarking against virgin N-grades (D1765). The remaining gap is that no standard defines
 234 minimum quality thresholds for rCB by specific tyre application (tread vs. sidewall vs. inner liner).

235 **Sustainable Carbon Black (sCB) via Pyrolysis Oil**

236 sCB has been communicated as the most viable substitute for virgin carbon black in new tyres. sCB is
 237 produced by substituting fossil feedstocks with tyre pyrolysis oil in existing furnace carbon black
 238 production processes, producing material that is chemically near-identical to virgin carbon black. It

239 can be benchmarked against existing ASTM D1765 N-grades. However, the sCB taxonomy is still being
240 formalised, and no standard governs the quality of the tyre pyrolysis oil (TPO) feedstock.

241 **Devulcanised Rubber**

242 In the past, devulcanised rubber was produced mainly from clean post-industrial production residues.
243 More recently, however, the feedstock base has increasingly expanded to include post-consumer tyre
244 waste.

245 ASTM D6814 provides a foundation for grading devulcanisation efficiency. However, significant gaps
246 remain: no standards are in place for the polymer backbone, linking grade to permissible application,
247 ageing/durability standard, nor differentiation by process route (microwave, chemical, thermo-
248 mechanical). ASTM has an active work item (WK73327) to develop a devulcanised rubber classification
249 standard, acknowledging this gap.

250 **Micronised Rubber Powder (MRP)**

251 ASTM D5603 and D5644 provide classification by feedstock and particle size distribution. Gaps include:
252 no reinforcing performance standard, no surface chemistry/activation standard, no contamination
253 limits (unlike rCB where ash is quantified).

254 **Reclaimed Rubber**

255 The only relevant standard is ISO/PDTS 16095, limited to natural rubber only. No published standard
256 governs reclaimed SBR or BR (the dominant synthetic elastomers in tyres). No compositional analysis,
257 no process-quality linkage, and no residual reclaiming agent limits exist. Asian standards (China GB/T
258 13460, Japan JIS K 6313) cover reclaimed rubber classification and may offer useful frameworks to
259 build upon.

260 **Harmonised standards**

261 Under Regulation ((EU) No 1025/2012 European Standardisation, 2012), only CEN, CENELEC, and ETSI
262 can develop harmonised European standards conferring a presumption of conformity. ASTM
263 standards cannot be harmonised standards, but they can be referenced in delegated acts and can
264 serve as the technical basis for equivalent CEN standards.

265 ESPR empowers the Commission to set product-specific requirements via delegated acts. These can
266 reference specific test methods, including non-EU ones. For example, the Renewable Energy Directive
267 framework references C-14 methodologies consistent with ASTM D6866, and the Construction
268 Products Regulation has referenced ISO test methods. Under the Vienna Agreement (CEN-ISO
269 cooperation), ISO standards can be adopted as EN ISO. CEN could also develop equivalent EN
270 standards that mirror ASTM methodologies. This is already partially happening: ISO 19984 parallels
271 ASTM D6866 for determining rubber biobased carbon content. Under ESPR Article 36, the Commission
272 can adopt common specifications via implementing acts if harmonised standards are absent. These
273 could incorporate equivalent test methodologies.

Question to stakeholders

1. To what extent is full recycling output standardisation necessary; to what extent can ASTM standards be relied upon or additional standardisation necessary to support uptake of recycled content?

274 **Recycled Content Targets**

275 Potential performance requirements on recycled content modelled in Task 6 for C1 and C3 tyres were
276 the following:

- 277 • Short term: 5% rubber compound materials, 50% reinforcement materials
- 278 • Long term: 20% rubber compound materials, 80% reinforcement materials

279 As described above, being able to reach these percentages would be dependent on available feedstock
280 in acceptable and reliable quality that can be used again in new tyres.

281 For the 5% target, initial calculations on the available capacities needed coming from EoL pathways
282 indicate that the largest change would be to the volumes entering devulcanisation processes, which
283 would rise from currently low percentages of 0.5% to around 5-6% to reach the 5% rubber compound
284 target. It is understood that currently only around 7.2% of tyres enter pyrolysis, but the outputs are
285 not yet viable for strong re-use in tyres. Here a qualitative upgrade would be necessary in the outputs
286 from pyrolysis in order to use them in new tyres. sCB could be used in the first instance, and at a later
287 date rCB may become more viable through e.g. supporting additives.

288 It is thought that current recycled content uptake for rubber compound in the tyres industry is
289 between 0-1%, making 5% initially a milestone that could be aimed for by 2032, with intermediate
290 targets along the way. A target of 20% could be set for 2040, assuming that capacities and
291 technological innovations catch up.

292 The 50% reinforcement materials target is thought to be relatively straightforward to achieve. With
293 steel and rPET currently thought to make up the majority of recycled content in the tyre. Estimates
294 put the current level of recycled content by weight around 5-8% in tyres, with this mainly coming from
295 these materials.

296 The table below shows the percentage of the weight of the recycled content derived from the recycled
297 steel and polyester in the reinforcement materials and the rubber compound substitution as
298 calculated in Task 6.

299

300 **Table 1-3: Base case targets as a percentage of tyre weight.**

Tyre category	Base Case	Recycled content in reinforcement [weight-%]	Recycled content in rubber compound [weight-%]	Total recycled content by weight of tyre
C1-tyre	2032-target: 5% compound 50% reinf.	8.3%	4.1%	12.4%
	2040-target: 20% compound 80% reinf.	13.1%	16.7%	29.8%
C3-tyre	2032-target: 5% compound 50% reinf.	10.2%	3.9%	14.1%
	2040-target: 20% compound 80% reinf.	16.5%	15.9%	32.4%

301 The majority of major tyres manufacturers have already set combined targets for renewable and
302 recycled content. These include natural rubber and other bio-based materials already in the tyre, with
303 the share of recycled content not always possible to distinguish from the numbers available in the
304 sustainability reports. It is observed that many manufacturers are currently hitting around 25% or
305 more “sustainable materials” and most apply ISCC+³ to verify using a mass balance approach. In a few
306 cases the percentage of recycled content in tyres is visible, with 5% being the highest number explicitly
307 mentioned amongst manufacturers sustainability reports looked at (see the table below). Many have
308 set targets of 40% renewable and recycled content for all their tyres in 2030, with a number also
309 setting the target of 100% sustainable materials by 2050.

310 **Table 1-4: Overview of manufacturer targets on renewable/recycled content and current**
311 **achievement (based on sustainability reporting).**

Company	Targets	Current	Demonstrator tyre	Source
Michelin	40% sustainable materials by 2030	32% in 2025	75%	https://www.michelin.com/en/sustainability/company
Pirelli	27% in weight of bio-based and recycled materials in 2025 and 40% in 2030	23.7% in 2024, of which 4.4% recycled content.	2025: over 70% combined, Bio-based 31.7% and recycled content 38,3%	https://corp-assets.pirelli.com/corporate/PIRELLI_A_NNUAL_REPORT_2024_ENG.pdf

³ A voluntary sustainability certification scheme for validating the sustainability of alternative feedstocks (e.g., bio-based, circular, and renewable feedstocks) across supply chains. The scheme allows tracking alternative materials through the supply chain by means of various chain of custody options.

Company	Targets	Current	Demonstrator tyre	Source
Goodyear	Demo of 100% sustainable materials tyre by 2030	23% renewable materials in 2024; 1.4% pre- and post-consumer recycled content in 2024	> 70% sustainable materials	https://corporate.goodyear.com/content/dam/goodyear-corp/documents/responsibility/goodyear-crr-2024-final.pdf
Bridgestone	2030: 40% and above; 2050: 100% sustainable materials	Recycled & renewable material ratio: 39.9% in 2024	90% concept tyre, 55% in production	https://www.bridgestone.com/ir/library/integrated_report/pdf/2025/ir2025_spread.pdf
Continental	40% by 2030	28.1% in 2025	Thermogravimetric Analysis (TGA)	https://www.continental.com/fileadmin/imported/sites/corporate/international/english/hubpages/30_20investors/30_20reports/annual_20reports/downloads/annual-report-2025.pdf
Sumitomo	40% by 2030, 100% by 2050			https://www.srigroup.co.jp/english/sustainability/dvql4p00000f222-att/2025p29-60.pdf
Hankook	100% by 2050	24.6% in 2024	70%, mass production tyre at 45%	https://www.hankook-motorsports.com/content/dam/hankooktire/local/pdf/Hankook_Tire_Technology_ESG_Report_2023-24_Eng_F.pdf
Yokohama	40% by 2030, 100% by 2050	29.7% in 2024	60% combined in racing tyres	https://www.yokohama.com/global/sustainability/environment/natural/materials/#stance_and_target
Giti Tyres	30% by 2030, 100% by 2050	26% in 2024		https://www.giti.com/storage/global/pdf/GITI_SR2024_250909_v3_Redacted.pdf
Apollo Tyres	40% by 2030	36.24% in FY25 (5% recycled materials)		https://corporate.apollotyres.com/content/dam/orbit/apollo-corporate/sustainability-and-ethics/reports-new/2025/Sustainability%20Report-JULY11_FINAL%20FY25.pdf

312

313

314 Verification

315 Tyres are thermoset composite materials, where vulcanisation makes irreversible sulphur cross-links
316 that bind together natural and synthetic rubber, carbon black, silica, steel and textiles. For steel and
317 textiles in reinforcement materials, existing frameworks may be applied which are relatively mature:

318 **Steel:** Recycled-content claims can be verified through mass-balance at the steelmaker level, which is
319 a mature practice. EAF producers routinely report scrap-input ratios. Recognised frameworks like
320 ResponsibleSteel certification or ISO 22095 chain-of-custody can be applied.

321 **Textiles:** Recycled-content claims rely on chain-of-custody / mass-balance from the PET recycler to
322 the yarn spinner. This supply chain is relatively short and well-documented (beverage-bottle collection
323 → rPET flake → yarn). For extra assurance, tracer / marker technologies (e.g., fluorescent markers in
324 rPET flake) exist commercially and can provide physical verification at the fibre level.

325 **Recycled rubber and carbon black:** here the situation is more complex. Currently it is understood that
326 no physical tests exist to determine recycled content of mechanically recycled crumb rubber,
327 devulcanised rubber, recovered carbon black (rCB), and micronised rubber powder (MRP). Verification
328 must therefore rely on chain-of-custody accounting: tracking what goes into a factory, what comes
329 out, and ensuring the bookkeeping is auditable, standardised, and resistant to double-counting. The
330 newly published ISO 22095-2:2026 mass balance standard provides a framework for this.

331 Tracer technologies (fluorescent markers, DNA tagging, isotopic labelling of additives) and advanced
332 machine learning technologies are advancing and may provide additional options in the future.

333 In practice, much of the sustainable materials reporting currently by manufacturers is being met by
334 bio-based materials inherently already in the tyre - natural rubber typically makes up around 17-21%
335 for a C1 tyre, and around 34-37% for a C3 tyre. A combined target set at the global level could
336 therefore allow for higher flexibility in meeting a target, but it could also have unintended effects:
337 manufacturers may meet the target by increasing the natural rubber content of their tyres, or by
338 expanding production of C3 tyres, or expanding their offerings in segments where natural rubber plays
339 a larger role such as off-the-road or agricultural tyres. These have a greater natural rubber proportion
340 to meet demands of mining or agricultural applications and weight ranging from 400 kg to several
341 tons. In the analysis in Task 6, it was proposed that natural rubber be excluded from any bio-based
342 content target so that there can be clear improvement incentives for manufacturers, however, this
343 would conflict with the carbon-based approaches which can be applied to verify the bio-based content
344 of a tyre.

345 ESPR sets requirements when a product enters the market, making global recycled content targets a
346 bad fit with the actual recycled content in an individual product. If, for instance, a manufacturer has
347 one factory in Asia and one in Europe and applies full recycled content in the Asian factory, but zero
348 in the European factory, then nothing is gained for circularity on the European market. For
349 manufacturers, reaching these targets at the global level are simplest, or thereafter on a factory level.
350 Not all manufacturers have mass balancing approaches currently capable of tracking individual
351 product batches and production lines in factories.

352 It would therefore be proposed that the first requirement would be to simply declare recycled content
353 information at the batch level as a first step, such as in 2029. Then the next step would be to introduce
354 the targets of 5%-50% recycled content in 2032, and 20%-80% recycled content in 2040.

Stakeholder Question

1. Would it be easier to fulfill the recycled content targets through the use of ELTs processed outside the EU, creating a risk to fair competition? Does this differ from material to material?

355 **1.4.1.2. Removal of hindering materials**

356 **Design for recycling policy options**

357 Certain substances or materials that may be present in a tyre can affect the recyclability of this
358 product. While in some cases, it is only critical to know about the presence of a material or substance,
359 its localisation or concentration so as to allow a more optimised management, in others the mere
360 presence of a material in the product would require the tyre's extraction from the material flow so as
361 to prevent adverse impacts on the safety or health of workers and the environment.

362 Task 5 (SoC annex) and Task 6 (DO) have identified several materials or substances, the presence of
363 which can affect the recyclability of a tyre. These differ from each other in the severity of related
364 impacts as well as in the availability of potential substitutes. The latter is understood to be a condition
365 for the restriction of a substance or material under ESPR, whereas impact severity would affect the
366 proportionality of certain measures in cases where substitutes are available. Policy options thus reflect
367 these two aspects in how each of the identified substances and materials is addressed under each
368 option, while also considering different levels of ambition. **Table 1-5** refers to the substances identified
369 that may negatively affect the reuse or recycling of the product materials (covered by ESPR Article
370 27(2)(d)). For each it summarises how the substance or material affects recycling, the severity of
371 impacts and related measures to apply in policy options of varying ambitions. As such this table defines
372 three possible policy options developed to address substances that negatively affect reuse or recycling
373 of tyre materials.

374 **Table 1-5: Substances and materials that may hinder recycling and proposed policy options of varying ambition.**

Substance	Impact on recyclability	Severity of impacts	Low ambition Policy Option	Moderate ambition Policy Option	High ambition measure Policy Option
Polyurethane foams	Leads to clogging, bridging, or jamming of shredding and grinding machines, increases share of non-recyclable material in tyre	Moderate impacts as long as bot used in many tyres: increased downtime for cleaning/ maintenance at shredding plants	Flag contents + require provision of removal instructions in DPP	Require redesign of foam integration in the tyre to ensure quick removal + flag contents + require provision of removal instructions in DPP	Prohibit the use of polyurethane foams
Sticky gel and elastomer self-sealants	Adhere to shredding and grinding equipment and lead to increased downtimes for cleaning and replacing blades	Severe impacts: Can lead to heating up of treated fractions that can result in fires; Increased downtime for cleaning/ maintenance at shredding plants	Flag contents + require provision of removal instructions in DPP	Prohibit use of sticky gels and elastomer self-sealants in tyres	Prohibit the placing on the market of self-sealing tyres
Aramid/ Kevlar fibres	See sticky gels	Severe impacts: See sticky gels	Flag contents in DPP	Declaration of textile class: Standard (Nylon/Poly) or Advanced (Aramid/Kevlar)	Prohibit use of aramid/Kevlar fibres in tyres
Lithium batteries in TPMS	Can induce explosions and fires in shredders	Severe impacts: Can lead to heavy damages to equipment, resulting in downtime and related losses	Flag contents + require provision of removal instructions in DPP (possibly also in vehicle DPP)	Flag contents + require provision of removal instructions in DPP (possibly also in vehicle DPP)	Require redesign of battery integration in the TPMS to ensure quick removal + Flag contents + require provision of removal instructions in DPP

Substance	Impact on recyclability	Severity of impacts	Low ambition Policy Option	Moderate ambition Policy Option	High ambition measure Policy Option
Silica	Can lower rCB quality when present in high amounts	Moderate impacts: Only hindering for pyrolysis treatment route	Flag contents in DPP	Specify contents in DPP as silica poor or silica rich	Specify contents in DPP as silica poor (<10%) or silica rich (≥10%)
Chlorobutyl rubber and bromobutyl rubber	Cause damage during the pyrolysis process via corrosion; Impacts TPO quality	Moderate impacts: Decrease in TPO quality affects feedstock for material re-use	Flag contents in DPP	Flag contents in DPP + restrict use of bromobutyl	Flag contents in DPP + restrict use of bromobutyl + limit maximum content of chlorobutyl to 5%
Cadmium and lead in ZnO	Can affect the quality of recycled carbon black when such tyres undergo pyrolysis	Depends on total cumulative content of inorganic elements	Flag contents in DPP	Flag contents in DPP	Introduce binding maximum content threshold for Pb and Cd in ZnO to be passed down to suppliers

375

Draft for

376 All performance requirements should apply after 2030. Information requirements should apply
 377 already in 2028. Where design for easy removal is proposed, this could require the development of
 378 guidelines to clarify what type of designs would facilitate easy removal in practice. Where a restriction
 379 is proposed, this is against the background of identification of suitable substitutes (see details in the
 380 Task 5 (SoC annex) and Task 6 (DO) reports).

381 In addition to the substances specified in **Table 1-5**, a few additional substances were considered in
 382 this context. They have not been taken up in the policy options as it was concluded that the REACH
 383 Regulation would be the appropriate place to address such substances (i.e., where safety, health and
 384 environmental impacts are the motivation for action). In most cases such processes are already
 385 underway.

386 **Table 1-6: Substances that should be addressed under other legislation.**

Substance name	Ongoing processes
6PPD (Anti-degradant)	A REACH restriction is in progress
PAHs	Though the consultants are not aware of any ongoing initiatives, PAHs are already addressed under REACH In Annex XVII, entry 50, which does not apply to its use in tyre derived carbon black so far, but which could be extended to prevent future problems in the use of tyre derived recyclable materials.
Cobalt salts	A REACH restriction for cobalt salts is in development and could impact the use of cobalt salts in rubber and their derivative materials.

387

Stakeholder Questions

1. Would the timeframes specified above allow compliance with each of the measures addressed under the various policy options?
2. Are the threshold limits specified for silica and for chlorobutyl appropriate?
3. Please comment on the feasibility of the measures described in each policy option.

388 Hazard flagging

389 Both in cases where a restriction or other performance measures are proposed and in other cases,
 390 information about the presence of the substances mentioned in **Table 1-5** is necessary to allow waste
 391 operators to optimise the processing of tyres in which such substances are contained. In some cases,
 392 such information would allow sorting specific tyres out of the waste stream. In others it would
 393 influence the choice of treatment route or would allow optimising batches going to treatment in a
 394 certain route, enabling a higher consistency in the composition of the resulting material outputs.

395 Information requirements are proposed for all substances mentioned in **Table 1-5** but described in
 396 more detail under **Section 1.4.3**

397 End of Waste Criteria

398 End-of-Waste (EoW) criteria are addressed in the Waste Framework Directive (EC No 2008/98 WFD,
399 2008) under Article 6, which specifies 4 general criteria that need to be fulfilled for an article that has
400 undergone a waste treatment for it to cease to be waste:

- 401 • the substance or object is to be used for specific purposes;
- 402 • a market or demand exists for such a substance or object;
- 403 • the substance or object fulfils the technical requirements for the specific purposes and meets
404 the existing legislation and standards applicable to products; and
- 405 • the use of the substance or object will not lead to overall adverse environmental or human
406 health impacts.

407 EoW criteria are particularly important for the reuse of articles that have been disposed of, for
408 introducing recycled materials onto the EU market or when transporting recycling outputs or articles
409 that have been sorted out of waste articles as their condition suggests that they could be reused (with
410 or without refurbishing or remanufacturing processes such as retreading). The WFD specifies that the
411 EC shall observe the further development of EoW criteria in the various Member States (MS) and
412 assess the need for harmonisation of the criteria at the EU level. The WFD further specifies aspects
413 that could be specified in EoW criteria, referring among others to quality criteria for end-of-waste
414 materials and requirements establishing the conformity of a certain fraction or product.

415 Both Recycling Europe and Tyres Europe have called in the past for the development of EU-wide EoW
416 criteria for the ELT-derived rubber waste stream, clarifying that the lack of harmonisation creates
417 significant difficulties for the tyre recycling industry and its supply chain, threatening the sector's
418 viability (Recycling Europe, 2025).

419 The impacts that Recycling Europe and Tyres Europe refer to clarify some of the impacts expected
420 from the introduction of such criteria:

- 421 • “Ensure a level playing field for trade across Europe by establishing equal conditions and with
422 equivalent opportunities across borders.
- 423 • Reduce administrative burdens associated with the trade of recycled materials trading.
- 424 • Ensure that tyre and rubber products manufacturers can incorporate recycled materials into
425 new products, thereby enhancing circularity.
- 426 • Secure that materials meet safety and quality criteria. Many regulations, like Declarations of
427 Performance for construction products, or the REACH restriction on chemical substances only
428 apply once the material has ceased being waste” (Recycling Europe, 2025).

429 In particular, the last aspect clarifies the necessity of harmonising EoW criteria for tyres across the EU
430 in relation to tyre derived secondary materials when these contain SoCs.

431 Though tyres have been ranked as a priority product for developing end-of-waste criteria, such criteria
432 are yet to be developed at the EU level. Currently there are 10 MS that have established EoW criteria
433 of relevance to tyres, including (Weibold Academy, 2022):

- 434 • Estonia and France which have established general EoW criteria,

- 435
- Portugal which has established EoW criteria for recycled tyres,
- 436
- Czech Republic, Denmark, Italy, Portugal, Slovakia who have established EoW criteria for
- 437
- granulates and
- 438
- The Netherlands which has established criteria for granulates used in infill applications
- 439
- (Weibold Academy, 2022).

440 A few additional countries are also further developing EoW criteria.

441 The Italian EoW criteria, dating from 2020, apply to vulcanised rubber originating from ELT. It specifies
442 both criteria that need to be fulfilled for vulcanised rubber to cease being waste (Annex I) as well as
443 specifying for what purposes it may be used (Annex II). While REACH conformity is referred to in
444 general, the decree also specifies a list of PAHs, giving a maximum threshold limit of 20 ppm and an
445 analytic method for testing. Among the allowed purposes, “external vehicle components” are
446 specified, which the consultants assume applies to use in the manufacture of tyres (DECRETO n. 78,
447 2020).

448 The Portuguese criteria refer to rubber material derived from used tyres and more specifically to
449 rubber powder, rubber granulate, rubber pieces and rubber fragments. While the Portuguese EoW
450 framework also refers to criteria that need to be fulfilled regarding origin and content, it also clarifies
451 that the EoW status only applies once the material is transferred (and not once the material is
452 generated) (Portaria n.º 20/2018, 2018).

453 Though general summaries refer to additional countries (see above), detail could not be found for
454 EoW criteria of Denmark, Slovakia, Netherlands, or Czech Republic. What is clear is that any
455 differences in relation to aspects like allowed inputs and outputs for secondary materials originating
456 from tyres, specific thresholds for SoCs and the likes could limit the free movement of such materials
457 between Member States and affect how tyre derived materials can be used in the manufacture of new
458 tyres and other products. While harmonisation of EoW criteria for tyres has already been prioritised,
459 evidence could not be found that this is underway. The consultant assumes that ESPR cannot specify
460 EoW criteria for tyres or their derivatives, however, should such criteria not be developed at MS level
461 (harmonised) to support requirements related to recycled content and SoCs, the harmonisation of
462 such criteria at MS level is pertinent. For SoCs addressed here (or under **Section 1.4.3**), this would
463 mean that information must be made available for waste fractions or secondary raw materials derived
464 from tyre waste management as to contents once a threshold is exceeded and further information on
465 locations and or concentrations could also be required as a condition for a product ceasing to be
466 waste. Where restrictions apply, these would also need to be addressed in EoW criteria, specifying
467 maximum limit thresholds (e.g., for PAHs) as well as analytical methods to be used for validation.

Stakeholder Questions

1. Are you aware of additional SoC related requirements in Member State EoW criteria for tyres or tyre derived materials and fractions?

468 **Potential impacts**

469 For sticky gels used in self-sealing tyres (to be restricted) and foams used in noise reduction tyres (to
470 be removed), impacts are based on the assumption that a larger share of tyres is delivered to recycling
471 and used to produce secondary raw materials. The share of such tyres has been assumed to be 2%,
472 and they are assumed to shift from the “civil engineering/backfilling public works” route to a route
473 where they would be shredded into rubber granules and then spilt evenly between pyrolysis,
474 devulcanisation and mechanical recycling routes. Though for self-sealing tyres a restriction could
475 mean that end-users of such tyres will be subjected to higher repair costs, the fact that such tyres
476 currently have such a small market share suggests that such impacts shall be negligible when viewed
477 from the market perspective. It is further noted that impacts are only expected in the C1 market
478 segment where such technologies are assumed to be more prevalent than for C2 and C3. Such impacts
479 would only be relevant in the moderate and the ambitious scenarios described above.

480 To quantify the impact of introducing information requirements for TPMS batteries, a report published
481 by EURiC on the problem of Li-battery related fires in WEEE is referred to. At the time, the report used
482 data from 2018 and estimated that per facility, an average of 190,000 € of costs would incur due to
483 battery related incidents. This included incidents such as fires and explosions that damage equipment,
484 can lead to injuries of employees, are associated with downtime of machinery and loss of the waste
485 that is burned during the fire and respective secondary materials that would otherwise be produced
486 and marketed. Increases in insurance premiums are also mentioned. This cost was said to be
487 significant, given that most waste operators are SMEs (EuRIC, 2021). To quantify the total costs savings
488 of policy options where the battery is removed, it is assumed that the savings in costs related to
489 damages and downtime of waste management equipment would decrease by 20% in the low ambition
490 policy option, by 50% in the moderate ambition policy options and by 80% in the high ambition policy
491 option. Data is not available on the total number of waste operators that shred tyres and would be
492 subjected to risks from batteries not properly removed. To allow a rough estimation it is assumed that
493 on average there are 5 shredding facilities in each of the 27 EU Member States, making up for a total
494 of 135 facilities. Assuming each of these facilities incurs annual costs of 190,000€ due to batteries left
495 in treated tyres would mean that in the base case, 25.6 million € worth of damages incur. Based on
496 the expected decrease in damages, this would mean that:

- 497 • the low ambition policy option would save 5.1 million € worth of damages per annum;
- 498 • the moderate ambition policy option would save 12.8 million € worth of damages per annum;
- 499 • the high ambition policy option would save 20.5 million € worth of damages per annum.

500

501

502 1.4.2. Bio-based material

503 Scope

504 The scope of a bio-based material requirement is proposed to focus on additional bio-based content
505 in tyres, rather than on bio-based materials already commonly used in tyre production. Natural rubber
506 in particular already accounts for a substantial share of tyre mass. Cellulosic rayon and stearic acid
507 derived from natural fats and oils are also inherently bio-based. Together, natural rubber, rayon and
508 stearic acid can account for around 20% of C1 and C2 tyre mass and more than 30% of C3 tyre mass,
509 mainly due to the higher share of natural rubber. A target covering all bio-based content could
510 therefore be met partly through business-as-usual formulations.

511 It is therefore proposed that the policy option distinguish between:

- 512 • inherently bio-based materials already widely used in tyres; and
- 513 • additional bio-based materials used to substitute fossil-derived inputs.

514 The objective of the requirement should be to increase the latter, thereby raising the share of
515 renewable, biomass-derived inputs in tyre manufacturing and displacing fossil-derived source
516 materials. In some cases, bio-derived alternatives may also apply to non-organic materials, such as
517 silica derived from rice husk ash. While these materials do not increase the biogenic carbon content
518 of the tyre, they may reduce reliance on fossil or virgin mineral supply chains and support the circular
519 use of agricultural residues.

520 Setting such a requirement is complex, given the variety of potential materials, feedstocks,
521 technologies and substitution pathways. Some options are near drop-in solutions requiring only minor
522 formulation changes, while others require technical validation, new compounding approaches or
523 mass-balance allocation. Moreover, bio-based materials are not inherently more sustainable than
524 their fossil-based counterparts. A robust sustainability assessment is therefore needed for each
525 material, particularly with regard to competition with food supply chains and land-use change impacts.

526 Feedstock and material availability

527 The availability of additional bio-based materials for tyres varies significantly by material group. It
528 depends not only on biomass feedstock supply, but also on technology readiness, compatibility with
529 tyre formulations, performance requirements and verification of the bio-based share.

530 Silica derived from rice husk ash and bio-based oils are considered near-term options. Rice husk ash
531 silica can support the use of agricultural residues, although it should be understood as bio-derived
532 rather than bio-based in the strict biogenic-carbon sense. Bio-based oils from feedstocks such as soy,
533 rapeseed or citrus residues have already been used in some tyre formulations, but their uptake is
534 limited by technical saturation points and potential effects on ageing, compatibility and performance.

535 Bio-based synthetic rubber offers larger substitution potential, but its availability is uncertain.
536 Synthetic rubbers such as SBR, BR, IIR and IR can in principle be produced from bio-based monomers,
537 for example via bioethanol or biobutanol routes. Bio-attributed polymers may also be supplied
538 through mass-balance approaches. However, large-scale use in tyres depends on further
539 commercialisation, certification and qualification by manufacturers.

540 In principle, other materials may also contribute, but their potential is hard to estimate. Some organic
541 additives and textile materials can be produced from bio-based feedstocks, while inorganic or mineral-
542 linked materials such as steel, zinc oxide, sulphur and cobalt compounds have no bio-based
543 substitution route or only part of the production route can be bio-based.

544 Therefore, a phased approach is proposed, starting with technically feasible and verifiable materials
545 and increasing ambition as higher-volume routes are **developed** and also **validated** for tyre
546 applications.

547 **Quality and performance requirements**

548 Bio-based materials used in tyres must meet the same safety and performance requirements as
549 conventional materials. Their use should not compromise compliance with existing tyre regulations,
550 including requirements on wet grip, rolling resistance, noise, abrasion, durability and structural
551 integrity.

552 Therefore, a low initial target is proposed which is ramped up over time, as described in Task 6:

- 553 • 2030: 2% (C1), 1.5% (C2), 1% (C3) of tyre mass
- 554 • 2032: 5% (C1), 3% (C2), 2% (C3) of tyre mass
- 555 • 2040: 15% (C1), 7% (C2), 5% (C3) of tyre mass

556 **Validation and verification**

557 Verification of bio-based content may rely on different methods depending on the material and supply
558 chain. For materials physically derived from biomass and containing biogenic carbon, radiocarbon
559 analysis can be used to determine the bio-based carbon share. However, this approach is less suitable
560 for materials that are bio-derived but inorganic, such as silica from rice husk ash, or for bio-attributed
561 materials supplied through mass-balance systems.

562 For such cases, chain-of-custody certification and auditable mass-balance accounting may be
563 required. Existing certification schemes, such as ISCC+, may provide a basis for verifying biomass
564 feedstock origin and allocation, but the policy design would need to specify whether mass-balance
565 claims are eligible and at which level verification should occur, for example product, batch, production
566 site or company level.

567 A declaration requirement could be introduced as a first step, requiring manufacturers to report the
568 type and share of bio-based materials used, the verification method applied and whether the claim is
569 based on physical bio-based content or mass-balance allocation. This would improve data availability
570 before binding targets are introduced.

571 1.4.3. Retreading

572 1.4.3.1. Definition of the scope and standards

573 For C1 and C2 tyres, the retreading market in the EU has reduced strongly during the last 30 years
574 from common practice in the 90s to around 1% of the current market. Retreaders face challenges of
575 over 1,200 different casing dimensions, making many tyres not suitable for retreading and at the same
576 time as fierce competition from budget tyres.

577 For C3 tyres, retreading practice has reduced from around 46% of the market in 2005 to 17% in 2024
578 (see calculations in scenario analysis), largely due to the challenges of budget tyres and to some extent
579 consumer preferences. At the time of writing, a study and proposal for an EU retreading energy label
580 is under development for C3 retreaded tyres. The aim of this proposal is to enable comparability
581 between retreaded tyres and enable public procurement to also choose retreaded tyres more easily
582 based upon their energy performance. Within this process, a retreadable tyre standard is being
583 investigated, which may, if successful, be used as the basis for further policy measures.

584 In terms of the scope of retreading policy options explored, C3 tyres are the initial priority and C1/C2
585 tyres a secondary priority. Safety and performance aspects of both sets of tyres are already regulated
586 by UN R108 and R109.

587 The supporting measures for more retreading are believed to be the following:

- 588 • Definition and/or standard of a retreadable tyre
- 589 • Performance comparison (retread label)
- 590 • For C1/C2: reduced number of casing dimensions to support retreading
- 591 • Measures that promote retreadable tyres and penalise non-retreadable tyres
- 592 • Financial support measures via EPR schemes
- 593 • Creating a market pull through Green Public Procurement

594 1.4.3.2. Performance requirements

595 **Ban single-use C3 tyres**

596 In task 6, the definition of a retreadable tyre via a standard has already been discussed. This is a
597 difficult task, however, if it would be possible, then a possible policy option could be to subject non-
598 retreadable tyres to a ban from the EU market after an agreed date. A test method (as described in
599 Task 6) to prove the retreadability of C3 tyres must be developed prior to this effective date.

600 Should such a standard be developed for C3, then it could also be extended to C1 and C2 tyres with a
601 more lenient target set for increasing fleet proportions of retreads.

602 **Define Retreadability/Casing Dimensions for C1 and C2 tyres**

603 The policy measures proposed for C1 and C2 tyres aim to create conditions for a retreading market to
604 emerge. The transition to EVs and higher load bearing tyres presents an opportunity to create a new

605 “retreadable” C1 / C2 casing definition, which could be determined by ETRTO. To ensure the viability
606 of retreading, specific design constraints into the initial mold manufacturing process of new tyres
607 would be necessary. New tyres would need to be designed with a maximum outside diameter that
608 accounts for casing growth, ensuring that once retreaded, the tyre remains strictly within ETRTO
609 maximum diameter limits. A standardised tread depth of 8mm for C1 and 12mm for C2 could create
610 the necessary “clearance” for a high-quality second life without exceeding legal size envelopes.

611 Limit the number of non-standard tyre sizes or harmonise dimensions to facilitate automated
612 retreading. Over 1,200 dimensions exist for C1 tyres on the market, and this is increasing – making the
613 viability of retreading C1 difficult. For C2 the number of dimensions is higher than C3, and also
614 increasing. Dimensions requirements are driven by OEM vehicle manufacturers. Criteria to limit the
615 number of casing dimensions that can be applied by OEM manufacturers to new tyres, for example:

616 1) 70% of C1 fleet should be within 50 standard casing dimensions.

617 2) Take advantage of stronger extra load (XL) and High Load (HL) tyres for EVs to define ETRTO
618 universal EV green casing: underlying casing geometry (the bead, the sidewall thickness, the
619 undertread radius) would be standardized across brands. When the tyre goes to a retreader,
620 it fits into a universal curing mold. Link Green Public Procurement to the EV green casing.

621 **Retreadable tyres are defined as those that declare buffing radius and tread width/depth within**
622 **appropriate limits.**

623 As an alternative to setting out specific standards, non-retreadable could be determined instead via
624 their geometry: non-retreadable tyres do not have viable buffing radius, as the retreader will hit the
625 steel directly during the buffing process when undertread is only 1mm. By declaring the tread width
626 and the buffing radius in the DPP, the manufacturer indicates that their tyre can be retreaded. All tyres
627 which do not declare are assumed to be non-retreadable. If a tyre falsely declares buffing radius and
628 tread width, lack of retreadability is notified by retreaders to market surveillance authorities and
629 sanctions applied.

630 Tyres with declared buffing radius and tread width within appropriate limits in DPP / EPREL are
631 considered retreadable. Tyres without this are considered not retreadable.

632 Market surveillance applies geometry checks to determine retreading viability.

633 1.4.3.3. Information requirements

634 **Information Requirements on tread width and buffing radius**

635 The Buffing Radius is the curvature across the crown of the tyre casing. If a retreader buffs with the
636 wrong radius, the new tread will not bond correctly, leading to premature failure or heat buildup. If
637 they buff too deep, they hit the steel belts and the casing is destroyed.

638 Tread Width is the exact width of the precured tread band needed to match the freshly buffed casing.
639 Some tyres have buffing radius printed on outer wall, but often it is guesswork for retreaders or reliant
640 on experience.

641 When a manufacturer produces a new C3 (or eventually C1/C2) tyre, they would be legally required
642 to upload the official buffing radius, optimum buffing depth, and original tread width into EPREL / the
643 tyre's Digital Product Passport (DPP). If this data is sensitive, buffing radius data could be made
644 accessible only to certified repairers and retreaders who are registered in the EU database.

645 This is expected to lead to:

- 646 • reduced rejection rates of accidentally destroyed casings in buffing process;
- 647 • higher safety and retread quality;
- 648 • expose disposable tyres where geometry of buffing radius not plausible for retreading.

649 1.4.3.4. Green public procurement

650 **GPP requirements on retreadable tyres**

651 Waste Management, municipal buses and postal services criteria prioritise retreadable tyres.
652 Definition of this is supported by a retreadability score, should a standardised lab test be agreed.

653 Tyre retreadability score is added into Green Public Procurement (GPP) rules. State-owned fleets,
654 municipal buses, and postal services are required to purchase tyres passing retreadability standard.

655 Financial incentive for manufacturers to upgrade their casing designs to win government contracts,
656 without banning lower-tier tyres for private consumers.

657 **GPP requirements on tyres as a service**

658 Public procurement requirements prioritise tyres contracts based on tyres as a service (TaaS), i.e. cost
659 per kilometer, instead of purchasing individual tyres. This incentivises use of durable and retreadable
660 tyres for cost reasons. Depends on independent retreaders also having option to provide tyres as a
661 service.

662 Conditions are applied to avoid monopoly lock in effects, for instance independent retreaders are
663 included by:

- 664 • joint ventures with regional, independent commercial tyre dealer/service networks.
- 665 • partnering with the financial leasing company that owns the vehicles, who handle upfront
666 financing and cash flow burden.
- 667 • Lots are split into regional lots of e.g. 100 buses, allowing local independent retreaders to bid
668 on a scale they can physically and financially manage.
- 669 • tender can stipulate that the provider must use local SME retreading infrastructure for a certain
670 percentage of the fleet's renewals

671 Retreadable tyres and circular, regional business models are supported via true cost incentives.

672

673

674 **Example provisions**

675 Currently France has shown how retreading can be supported via Green Public Procurement in French
676 AGEC Law (Art. L. 2172-6). The AGEC Law's Article L. 2172-6 (Code de la commande publique) tackles
677 retreading from the demand side of the market. It requires the State, local authorities and their
678 operators, when buying tyres, to opt for retreaded tyres by default, "in a concern for preserving
679 natural resources", and only allows them to turn to non-retreaded tyres if an initial tender procedure
680 is unsuccessful. This embeds retreads directly into public procurement rules, normalises them as the
681 standard choice for public fleets, and sends a strong and predictable demand signal to the market.

682 Alongside this, French technical regulations on tyres, like the Arrêté of 24 October 1994 and the Arrêté
683 of 18 July 2019, integrate retreaded tyres approved under UNECE Regulations 108 and 109 into the
684 general safety and performance framework. In other words, they spell out how retreads must be
685 designed, tested, marked and approved, and place them on a recognised legal footing comparable to
686 new tyres. In addition, in March 2026, French EPR schemes may now pay 6€ per tyre to retreaders,
687 supporting their financial situation⁴.

688 **1.4.3.5. Initial retreading policy scenario**

689 A number of policy measures are possible for retreading, and the study team is still in the process of
690 evaluating feedback. In terms of initial policy measures modelled in the scenario analysis, it was
691 deemed most important to first develop a good understanding of how retreads impact the
692 environmental performance of the market over time. A focus was therefore first placed on developing
693 a retreading sub-model that goes beyond standard MEErP methodology and enables the comparison
694 of a budget C3 tyre with a new C3 tyre that is retread up to 2 times. This enables a clearer view of the
695 production materials and waste avoided from a retreaded tyre compared to its direct competitor
696 which may cause much higher impacts due to a shorter lifetime. Due to time constraints, this has only
697 been applied to C3 tyres in the first instance.

698 A conservative policy mix is modelled, assuming that a combination of measures outlined above can
699 raise the retreading rate for C3 tyres from 17% to 45% again by 2045.

700 **Question to stakeholders**

701 1. Are the measures above sufficient to strongly increase retreading in the EU for C3 tyres?

702 Stakeholders who have not already provided feedback on the measures above are welcome to do so.

703

⁴ <https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000053723090>

704 1.4.4. Substances of concern

705 The contents of SoC present in a tyre can have a significant impact on the usability of tyre derived
706 materials, both when these are used in the manufacture of new tyres as well as when such materials
707 are used for other purposes (e.g., turf). Aside from possible impacts on reuse or recyclability,
708 compliance with chemical legislation is also relevant for SoC as a means of preventing environmental,
709 health and safety impacts as well as for the purpose of cleaning the material cycle.

710 To remove some of the obstacles that SoC content poses to the circularity of tyres, a few policy options
711 are proposed, differentiated based on the level of ambition. The latter is developed in relation to
712 different groups of substances for which compliance with information requirements is necessary.
713 While ESPR imposes information requirements by default on certain groups of substances, exemptions
714 from this requirement can be considered in certain cases. Performance requirements can also be
715 developed, but this is already addressed under **Section 1.4.1.2** and not repeated here.

716 In the following, information requirements are specified under three policy options. The requirements
717 refer to up to four different groups of substances as specified in ESPR Article 27(2) as follows:

- 718 • Substances covered by Article 27(2)(a): Substances that appear in the REACH Annex XIV
719 (Substances of Very High Concern, SVHC) Candidate List.
- 720 • Substances covered by Article 27(2)(b): Substances that fall under specific hazard classes in
721 Annex VI of the CLP Regulation;
- 722 • Substances covered by Article 27(2)(c): Substances that are regulated under the POPs
723 regulation; and
- 724 • Substances covered by Article 27(2)(d): Substances that negatively affect the reuse or recycling
725 of tyre materials.

726 Three policy options have been developed for addressing SoC information requirements and are
727 specified in the table below.

728 **Table 1-7: Information requirements for Article 27(2) substance groups.**

	Policy option 1: low ambition	Policy option 1: moderate ambition	Policy option 1: high ambition
27(2)(a) SVHCs	Provision of information in DPP above a threshold of 0.1% unless higher threshold specified in REACH Regulation	Provision of information in DPP above a threshold of 0.1% unless higher threshold specified in REACH Regulation	Provision of information in DPP above a threshold of 0.1% unless higher threshold specified in REACH Regulation

	Policy option 1: low ambition	Policy option 1: moderate ambition	Policy option 1: high ambition
27(2)(b) CLP substances		Tracking obligation, requiring retroactive provision of information on substance contents through the DPP within 6 months of the substance being subject to regulatory action that would restrict its use in tyres	Provision of information in DPP above a threshold of 0.1% unless higher threshold specified in CLP Regulation
Article 27(2)(c) PoPs	Provision of information in DPP above a threshold of 0.1% unless higher threshold specified in POPs Regulation	Provision of information in DPP above a threshold of 0.1% unless higher threshold specified in POPs Regulation	Provision of information in DPP above a threshold of 0.1% unless higher threshold specified in POPs Regulation
Article 27(2)(d) substances	Provision of information in DPP above a threshold of 0.1% for all substances specified under Section 1.4.3 , unless higher threshold specified therein (e.g., silica, chlorobutyl)	Provision of information in DPP above a threshold of 0.1% for all substances specified under Section 1.4.3 , unless higher threshold specified therein (e.g., silica, chlorobutyl)	Provision of information in DPP above a threshold of 0.1% for all substances specified under Section 1.4.3 , unless higher threshold specified therein (e.g., silica, chlorobutyl)

729 To begin with, tracking of substance content would be done according to a binary principle, specifying
730 whether the substance is contained above the threshold or not. Only in the case of silica and
731 chlorobutyl would it be necessary to further specify whether the substance content in the tyre is to
732 be considered “poor” or “rich”. Should this prove to be inappropriate to facilitate tyre recyclability,
733 the thresholds applied and the SoC addressed in each of the policy options should be reconsidered as
734 well as the necessity to provide information about the localisation of the substance (i.e., component
735 or material) and its concentration.

736 A five-year implementation period after adoption of the ESPR legislation is proposed for each of the
737 policy options.

738 1.5. Digital product passport

739 Based on the JRC methodology for defining data requirements of an ESPR digital product passport
740 (DPP) (Chawla et al., 2026), this section builds on the use cases and data needs identified in the Task
741 6 report to design and develop the system requirements further and validate the resulting proposed
742 data specification.

743 1.5.1. Step C: Design & development

744 As a first step, data needs of the use cases identified in task 6 are to be aligned with existing
745 vocabularies, specifying the necessary granularity for various data points and related access rights and
746 ensuring coherence and interoperability. Subsequently, in step D, the proposed approach shall be
747 consulted with stakeholders to allow consistency checks and validation.

748 1.5.1.1. Step C.1: Review of existing vocabularies

749 **Objective:** Evaluate how far existing, publicly available and freely accessible data dictionaries can be
750 applied to define the terms and definitions needed for the DPP. Identify where new vocabulary
751 elements or clarifications need to be developed.

752 For the Tyre DPP, the architecture can consider adopting the following established vocabularies as its
753 baseline semantic foundation:

- 754 • **ESPR vocabulary:** the DPP methodology developed by JRC (Chawla et al., 2026) specifies
755 vocabulary definitions that should be used across ESPR DPPs and refers to the following terms
756 of relevance for the tyre product group: recyclability, Substances of Concern Content,
757 Recycled Material Content.
- 758 • **EPREL (European Product Registry for Energy Labelling) Data:** For performance-related
759 attributes (Rolling Resistance, Wet Grip Class, external noise), the DPP can inherit the exact
760 naming conventions currently mandated by the EPREL database. EPREL data is collected at
761 tyre model level and further includes general identification parameters and some compliance
762 documentation. EPREL data is relevant for use case 1 and in some cases also for additional
763 use-cases and could be used to populate data points or relevance to some information
764 requirements. EPREL serves Regulation (EU) 2020/740 on Tyre Labelling and could be
765 expanded to include data on retreaded tyres in the future. As discussed in the Task 6 report,
766 it could be relevant to operate the DPP I parallel to EPREL or as an alternative. In any case, the
767 fact that various data points are already made accessible through EPREL suggests that the
768 effort of populating such data points in a DPP would not result in a significant additional
769 administrative burden.
- 770 • **SCIP** is the REACH aligned database for information on Substances of Concern In articles as
771 such or in complex objects (Products) established under the Waste Framework Directive
772 (WFD). The data base ensures that information on the presence of SVHC in an article or object
773 remains accessible to consumers and waste phase operators throughout the lifetime of a
774 product. In so far, data is collected at product level (i.e., tyre model) and needs to specify
775 when SVHCs are present at a level of above 0.1%. Such data could be used as a basis for
776 populating data points related to information requirements on SoC where Article 2(27)(a)
777 substances are concerned. It is however noted that the EC has circulated a proposal to
778 discontinue the SCIP data base⁵, meaning that use of existing data may only be relevant for

⁵ See communication on abolition of the SCIP database under <https://www.imds-professional.com/en/scip-database-on-the-brink/> last viewed 25.6.2026

779 populating the DPP in the short term. In this sense, the savings on the administrative burden
780 of populating relevant data points may be short termed.

781 • **The International Dismantling Information System (IDIS)** is a platform established by vehicle
782 manufacturers to provide information to authorised treatment facilities to promote the
783 environmental waste management of vehicles. The platform collects data at the vehicle level.
784 Among others it specifies the number and weight of tyres included in a vehicle at the time
785 PoM as well as the number and type of TPMS batteries when these are present. For the latter,
786 some data is further given to instruct dismantling of the batteries. The system also specifies
787 the presence and weight of “tyre puncture fluid” which the consultants assume to represent
788 vehicles in which self-sealing tyres are installed in the vehicle at the time of PoM. The data
789 specified in IDIS in this respect could be used to populate data points of relevance to DO-
790 02_Physical_Hindrances, however, it is noted that this data is only relevant for tyres initially
791 installed in vehicles when they are placed on the market. The availability of this data however,
792 suggests that the effort of providing such information is negligible (as already provided to
793 other platforms).

794 • **ETRTO (European Tyre and Rim Technical Organisation) Standards:** The DPP can utilise
795 ETRTO’s existing dimensional dictionaries for all geometric data. Specifically, parameters vital
796 for downstream automated remanufacturing—such as the exact **tread width** and the **buffing**
797 **radius** required to calibrate CNC machinery—can be drawn directly from ETRTO terminology.
798 Given that the ETRTO’s objectives are aligning standards, establishing common engineering
799 parameters and exchanging technical information on tyres, it is of relevance for aligning of
800 definitions and parameters but is not viewed as a data base and is thus not further assessed
801 to consider linkage to DPP Use cases.

802 • **WBCSD Tire Industry Project (TIP):** For defining end-of-life status and recovery pathways, the
803 DPP can align with TIP’s globally recognised definitions for End-of-Life Tyres (ELTs). Though
804 the TIP does not collect data e.g., at the tyre model level, the initiative has developed a
805 certification scheme for sustainable natural rubber that could be applied in a DPP for
806 validation of claims on natural rubber sustainability should the DPP be used to comply with
807 Deforestation Regulation requirements. TIP is thus not further assessed to consider linkage to
808 DPP Use cases.

809 • **Catena-X Ontology:** To ensure interoperability with the broader European automotive supply
810 chain, the DPP can map its batch-level traceability attributes (such as cryptographic
811 identifiers) to the established Catena-X semantic models. This platform enables exchange of
812 data between partners authorised in the system. It appears that tyre data is not shared based
813 on an obligatory scheme, but the platform could be used for this purpose. The same is true
814 for information on TPMS batteries installed in the proximity or in tyres. As such it is
815 recommended to ensure interoperability with this platform but is not further assessed to
816 consider linkage to DPP Use cases.

Question to stakeholders

1. Are there any additional established vocabularies or platforms that could be used as a basis for the DPP vocabulary

817 The following use cases were analysed to consider which data points are already collected through
 818 the above platforms, meaning that the effort for collecting and submitting the data to a platform is
 819 already incurring, and that the additional effort for populating them in a DPP would be negligible.
 820 These uses cases appear later on in the DPP data requirement proposal presented under step D, to
 821 clarify which data points are relevant for which use case.

- 822 1. Primary Purchase & Green Public Procurement (GPP)
- 823 2. Verification of Recycled Content/Bio-Based Content (DO-01/05)
- 824 3. Regulatory Compliance verification/auditing of parameters
- 825 4. Centralised EoL Tyre Sorting and Routing
- 826 5. Dynamic Lifecycle State & Event Log
- 827 6. Secondary Market Evaluation (Part-Worn & Retread Purchase)
- 828 7. Customs Export Blocking & Waste Enforcement (DO-11)
- 829 8. Automated Casing Intake for Retreading (DO-08)
- 830 9. Design for Recycling - Mechanical Shredding & Hazard Mitigation (DO-02/03)

831 Data points of relevance to these use cases were checked against the data points specified in above
 832 platforms. Though some data points could be covered through these existing schemes, for the most
 833 part, there are no data points cannot be covered by existing vocabularies.

834 1.5.1.2. Step C.2: Extending or developing vocabularies

835 **Objective:** Identify the critical data gaps where existing dictionaries fail to support the new ESPR
 836 mandates (e.g., circularity, hazard mitigation, and dynamic lifecycle tracking) and propose the
 837 necessary semantic extensions.

838 To operationalise the Use Cases defined in Step B, the Tyre DPP requires the development of specific,
 839 standardised extensions:

- 840 • **Categorises Lifecycle State:** Existing vocabularies treat "End of Life" as a binary state. To
 841 combat "fake re-use" in international waste shipments (Customs enforcement), the
 842 vocabulary would need to be extended to include a standardised, four-tier Lifecycle_State
 843 matrix: *Active*, *EoL_Retreadable*, *EoL_Material_Recovery*, and *EoL_Critical_Damage*.
- 844 • **Chemical Recovery Thresholds:** Current REACH declarations are too broad for circular
 845 industrial processing. A new semantic threshold for **silica-rich vs. silica-poor declarations**
 846 would be needed. This specific vocabulary extension is essential not for mechanical recycling,
 847 but to support advanced chemical recovery—specifically preventing ash contamination in
 848 **devulcanisation and pyrolysis** reactors. Similarly, for chlorobutyl rubber, a further semantic
 849 threshold is needed to distinguish between **chlorobutyl rich vs. chlorobutyl poor**.

- 850 • **Dynamic Asset Fatigue:** Standard vocabularies lack a methodology for expressing secondary
851 casing integrity. The DPP could also require the standardisation of a Shearography_Grade
852 (e.g., Grades 1 through 3) when retreading is carried out to quantify hidden structural fatigue,
853 acting as a verifiable quality certificate for the secondary and retread markets.

854 1.5.1.3. Step C.3: Setting DPP data granularity

855 **Objective:** Assign every required data attribute to the most cost-effective and technologically
856 proportionate level of granularity (Model, Batch, or Item) to minimise administrative burden while
857 satisfying regulatory use cases.

858 The data attributes identified in Step B are structurally assigned to the following granularity tiers:

859 1. Model Level (Static Baseline)

- 860 • *Scope:* Data that applies uniformly to an entire SKU or product line.
- 861 • *Attributes:* ETRTO dimensions (tread width, buffing radius), EPREL label parameters, Euro 7
862 Abrasion Indices, and textile class categories (e.g., Aramid presence).
- 863 • *Justification:* These are fixed engineering and regulatory baseline metrics required for Green
864 Public Procurement and automated sorting for EoL recycling processes. Tracking these below
865 the model level offers limited additional informational value.

866 2. Batch Level (Traceability Layer)

- 867 • *Scope:* Data associated with a specific production run, shift, or chemical mixing sequence.
- 868 • *Attributes:* Mass_Balance_Cert_ID (for verifying recycled content) and Safety Recall Status
869 Flags.
- 870 • *Justification:* mass balance ledgers at the item level cannot be physically tested. Linking
871 recycled content credentials—and targeted defect recalls—to the production Batch ID would
872 provide regulatory compliance without changing global chemical supply chains. At the
873 moment, some manufacturers only manage this at the global portfolio level and would need
874 time to implement batch-level systems.

875 3. Item Level (Dynamic Lifecycle Tracking)

- 876 • *Scope:* Data unique to the exact physical casing, requiring a UHF RAIN RFID physical-to-digital
877 connector.
- 878 • *Attributes:* Lifecycle_State, Lifecycle_Event_Log (timestamped repairs/retreads), and
879 potentially a Shearography_Grade when retreaded.
- 880 • *Justification:* Casing fatigue, accident damage, and retread history are completely unique to
881 the individual tyre's life on the road. Without item-level granularity, it is impossible to evaluate

882 safety for second-hand purchases, calibrate machine intake for individual worn casings, or
 883 stop a specific shipping container of illegal waste.

884 **Architectural & Hosting Implications:** This tiered approach to granularity also requires different
 885 physical IT hosting strategies and computational load for different parts of the DPP network.

- 886 • **Model-level** data can be hosted centrally or routed via simple, high-availability APIs (like the
 887 existing EPREL registry) to manage e.g. public procurement queries.
- 888 • **Batch-level** cryptographic tokens would likely need to be routed through secure, federated
 889 B2B data spaces to protect supply chain confidentiality.
- 890 • **Item-level** dynamic data would require a decentralised routing infrastructure capable of
 891 handling a high volume of write transactions generated by millions of physical tyres
 892 undergoing repairs, retreads, and decommissioning.

893 By separating the granularity, the computational cost of Item-level tracking can be applied where it
 894 adds the most value to circularity and safety enforcement.

895 **1.5.1.4. Step C.4: Setting DPP data access**

896 The Tyre DPP must navigate the tension between the desire for total public transparency and the
 897 private sector's absolute need for corporate confidentiality. Providing complete open-source access
 898 to tyre composition and manufacturing data would result in revealing intellectual property, exposing
 899 chemical compounding recipes, complex thermodynamic performance models, and strategic, globally
 900 integrated supply chain partnerships to rival international manufacturers. To mitigate this risk, the
 901 digital architecture may employ a Role-Based Access Control (RBAC) model. RBAC is an established
 902 cybersecurity paradigm that restricts network access and data authorization based strictly on the
 903 verified roles and responsibilities of the querying entity within the broader ecosystem. It adheres
 904 completely to the cybersecurity principle of least privilege, ensuring that users inherit only the exact
 905 permissions necessary to perform their specific job duties, thereby reducing the risk of unauthorised
 906 data harvesting or IP risks.

907 **Table 1-8: Proposed level of access to data in the DPP.**

RBAC Tier Designation	Primary Audience	Security Authentication Level	Data Scope and Purpose
Public/Consumers	Vehicle owners, fleet managers, general public (potential purchasers)	Open Access (No Authentication required)	Basic safety ratings, energy label, Euro 7 environmental labels, standard physical characteristics like tread depth, general sustainability claims
B2B / Specific Actors	Retreaders, pyrolysis operators, mechanical recyclers	Gated Access (Cryptographic Digital Identity Verification)	Dimensional compliance, chemical hazard flags, physical hindrance warnings, shearography

RBAC Tier Designation	Primary Audience	Security Authentication Level	Data Scope and Purpose
MSA / Customs	Market Surveillance Authorities, Border Control	Highly Privileged Sovereign Access	Abrasion, rolling resistance and wet grip testing methodologies, mass balance cryptographic tokens, end-of-life export blocking flags.

908 **1.5.1.5. Step C.5: Setting DPP data governance**

909 **Objective:** Establish the legal and technical rules for data quality, liability, identity verification, and
 910 system longevity to ensure the decentralised DPP network remains trustworthy and legally
 911 enforceable.

912 For the Tyre DPP architecture, data governance can be structured around three foundational pillars:

913 **1. Data Liability and Quality Control (The "Generator Owns It" Rule)**

- 914 • In a federated data space, liability must rest exclusively with the entity that generates the data
 915 point.
- 916 • **OEM Liability:** The Original Equipment Manufacturer is legally liable for the accuracy of
 917 production data (e.g., Initial_Tread_Depth, Mass_Balance_Cert_ID).
- 918 • **Secondary Actor Liability:** Downstream actors are exclusively liable for the data they append.
 919 If a retreader writes a passing Shearography_Grade, the OEM is entirely shielded from liability
 920 if that casing subsequently fails. The retreader's cryptographically signed update legally
 921 transfers liability for that specific structural claim.

922 **2. Decentralised Identity & Trust Anchors (IAM Governance)**

- 923 • To operationalise the "Write" capabilities defined, the network requires a neutral governance
 924 body (such as the GDSO or a designated European authority) to act as the Trust Anchor.
- 925 • This body can govern the issuance of **Verifiable Credentials (VCs)**. A local mechanic cannot
 926 simply create an account and declare a tyre "Decommissioned." They must present a
 927 cryptographic VC issued by their national business registry proving they are a certified end-of-
 928 life handling facility before the API accepts their 'Write' request.

929 **3. Data Survivability & Orphan Passport Management**

- 930 • Data stored on the DPP for a tyre must remain available over time to support objectives like
 931 retreadability, recyclability and market surveillance. This period is equivalent to the lifetime
 932 of the tyre, and in case of a tyre undergoing retreading can extend over a few lifetimes.
 933 Accordingly, data stored in the DPP for a specific tyre unit is to be retained until the tyre
 934 reaches end-of-life and is subjected to waste management under one of the viable treatment
 935 routes. This requires the following events to have taken place for the specific tyre unit:

- 936 - The tyre's operational status or Lifecycle_State, documented in the DPP
937 Lifecycle_Event_Log, is of a nature indicating that it is no longer roadworthy, i.e.,
938 EoL_Critical_Damage or EoL_Material_Recovery.
- 939 - A tyre specified with one of the above Lifecycle_States could still (illegally) be subjected to
940 processes intended for tyres still in the use phase (e.g., through export). Thus, a further
941 conformation is needed after the tyre is subjected to waste management to ensure that
942 its data can be removed from the DPP. It is thus proposed that once a tyre is shredded or
943 subjected in its entirety to incineration that notification is sent to the GDSO network that
944 the tyre has been destroyed. This could be done by submission of a digital token equivalent
945 to a certificate of destruction.
- 946 - Once the above steps have occurred, the GDSO network can remove the data of the
947 individual tyre unit from the DPP.
- 948 - Alternatively, the CIRPASS Project, which focused among others on tyres, has reported a
949 need to consider retaining data also after a tyre has been shredded (CIRPASS2, 2025). This
950 should serve the purpose of characterising the composition of secondary raw material
951 batches originating from processed ELTs. In a later analysis, CIRPASS explained that this
952 could provide "evidence supporting the properties of the secondary raw materials
953 produced (origin of the processed ELTs, presence of SVHCs, biogenic content)". The
954 document proposes that once a tyre is shredded, data on the tyre properties could be
955 reassigned to individual DPPs for the derived secondary materials. This model would
956 require ensuring an interoperability between the tyre DPP and the DPP of secondary
957 material to be produced (i.e., TPO, rCB, devulcanised rubber) (CIRPASS2, 2026).
- 958 • Commercial tyres may outlive the corporate entities that manufactured or retreaded them.
- 959 • The governance framework must establish a "**Data Escrow**" or **Orphan Protocol**. If an OEM or
960 retreader declares bankruptcy or ceases operations, the governance rules must mandate that
961 their active Item-level DPP ledgers are transferred to a centralised, neutral registry (e.g., an
962 EPR operator like Aliapur or a state-managed registry) to ensure the physical tyre can still be
963 legally evaluated, sorted, and decommissioned years after the manufacturer ceases to exist.

964

Stakeholder Question:

1. In your opinion, would the retaining of DPP data after tyre shredding serve the purpose of characterizing batch composition after waste management treatment has taken place? If so, for how long should data be retained after a tyre has been shredded?

965

966

967 **1.5.2. Step D: Internal validation and public consultation**

968 **1.5.2.1. Step D.1: Selection of the Data Carrier**

969 For the Tyre DPP, the architecture dictates a primary and secondary data carrier approach:

- 970 • **Primary Carrier (Industrial/B2B): Vulcanised UHF RAIN RFID.** The CIRPASS project
971 experiences and current practice indicates that the most suitable data carrier is a UHF RAIN
972 RFID tag embedded directly into the tyre casing prior to vulcanisation. This technology is
973 essential because it is non-line-of-sight and is the only carrier physically resilient enough to
974 survive both the extreme temperatures of manufacturing and the 10-year wear and tear
975 lifespan on a commercial vehicle.
- 976 • **Secondary Carrier (Consumer/B2C): 2D Matrix (QR) or NFC.** Because consumers and
977 independent mechanics generally lack industrial RFID wands, a secondary carrier such as a
978 laser-engraved QR code on the inside bead/sidewall linking to the same digital identifier could
979 be applied, enabling smartphone access. This secondary carrier would also provide a back-up
980 function in the rare case that the UHF RAIN RFID is damaged during the tyre use phase.

981 **1.5.2.2. Step D.2: Standardised Identifiers & Resolution**

982 **Objective:** Select the global identification standard that prevents serial number collisions across
983 different manufacturers and establishes the routing protocol (Resolver).

- 984 • **The Identifier (SGTIN):** The DPP will rely on the GS1 **Serialised Global Trade Item Number**
985 **(SGTIN)** standard. The RFID tag's EPC (Electronic Product Code) memory bank may store this
986 unique identifier. This ensures that every single tyre on the planet has a mathematically
987 unique ID that conforms to ISO/IEC 15459 standards.
- 988 • **The Decentralised Resolver (The GDSO Protocol):** Data is *not* stored on the RFID chip. The
989 chip merely holds the SGTIN. When a scanner reads the SGTIN, the request is sent to a
990 decentralised **Resolver Network** (managed by the Global Data Service Organisation - GDSO
991 for the tyre sector). The Resolver acts as a DNS lookup, translating the SGTIN and securely
992 routing the data request to the specific manufacturer's cloud where the product data actually
993 resides.

994 **1.5.2.3. Step D.3: IT Architecture & Data Hosting Infrastructure**

995 **Objective:** Map where the Step C granular data (Model, Batch, Item) physically lives to ensure high
996 availability, decentralised security, and GDPR compliance.

997

998 The Tyre DPP can operate on a strict **Federated Edge-to-Cloud Architecture**:

- 999 • **OEM PLM/ERP Clouds (Genesis Data):** The original manufacturer is responsible for hosting all
1000 Model and Batch-level data (e.g., ETRTO dimensions, Mass Balance Certs) on their own secure
1001 enterprise servers.
- 1002 • **Federated Item-Level Ledgers (Dynamic Data):** The dynamic Lifecycle_Event_Log and
1003 Lifecycle_State generated by downstream actors (retreaders, mechanics) will be hosted on
1004 federated, standardised data spaces (aligned with Catena-X standards). This prevents OEMs
1005 from having to pay the server costs to host data for products they no longer control, while
1006 ensuring downstream actors maintain sovereignty over the data they generate.

1007 1.5.2.4. Step D.4: Cybersecurity & Anti-Counterfeiting Measures

1008 **Objective:** Protect the physical-to-digital link from cloning, "sham re-use" circumvention, and
1009 malicious data injection.

- 1010 • **Physical Authentication:** To prevent the illicit market from cloning an RFID tag from a safe
1011 tyre and taping it onto a damaged casing, the architecture requires "Untraceable" or
1012 cryptographically secure RAIN RFID chips (e.g., Gen2v2 security protocols) that dynamically
1013 authenticate the reader before revealing the full SGTIN payload.
- 1014 • **Cloud-Side Anomaly Detection:** The decentralised ledger will utilise geographic and
1015 chronological anomaly detection. If the resolver receives an API request stating that Tyre ID
1016 #12345 was scanned at a sorting hub in Poland at 10:00 AM, and receives another scan for
1017 the exact same ID at a port in Spain at 10:05 AM, the system automatically flags the asset as
1018 digitally cloned, instantly blocking both products from further trade or certification.

1019 **Architectural Viability & Deployment Strategy:** By selecting UHF RAIN RFID and standard GS1 SGTINs,
1020 the Tyre DPP could integrate into the same hardware infrastructure that modern logistics and
1021 warehouse management systems already use globally. Furthermore, by utilizing the GDSO Resolver
1022 network as the decentralised routing hub, the architecture would comply with the European
1023 Commission's mandate that the DPP must be a federated system without a central point of failure.
1024 This structural separation of keeping the physical tag lightweight while pushing the computational
1025 load to the federated cloud would ensure that the DPP can scale to track the billions of tyres placed
1026 on the European market.

1027 1.5.2.5. Step D.5: DPP Requirement proposal

1028 On the basis of the data points identified in task 6 and in the above sections as well as the analysis of
1029 data granularity, data access and data governance, the following tables present the proposed Digital
1030 Product Passport (DPP) content for tyres. The data elements proposed correspond to the following
1031 overarching identified categories: Product identification and classification, Producer identification,
1032 Material compliance and substances of concern (SoC), Product environmental and circularity
1033 information, Tyre Labelling data, Other regulatory requirements, Retreading, DO-

1034 02_Physical_Hindrances and Lifecycle state and event log. The proposed data categories are
1035 presented below, and stakeholders are requested to comment on the proposal to support its
1036 refinement and validation.

1037 *Note: these may change following validation of the use cases in Task 6 and aim to provide initial*
1038 *orientation on the data requirements.*

1039 **Data category: Product identification and classification**

1040 Product identification and classification are the base layer of the Digital Product Passport (DPP) for
1041 tyres. The DPP must allow a unique and unambiguous identification of products placed on the EU
1042 market, ensure their traceability in the value chain, and support customs checks, market surveillance
1043 and public procurement. The information specified under this category is relevant for all of the use
1044 cases as a means of an initial identification.

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1045 **Table 1-9: Data points for Product identification and classification.**

Data requirement	Requirement type	Data description	Reference methodology	Applicable use cases	Data granularity	Initial data governance	Secondary data governance	Actors with access
Unique Product Identifier (UPI)	Obligatory	Model number	GS1 Serialized Global Trade Item Number (SGTIN)	1,2,3,4,5,6,7,8,9	Model	Tyre manufacturer/ importer	n.a	Public/Consumers
Unique unit identifier	Obligatory	Item number		1,2,3,4,5,6,7,8,9	Unit	Tyre manufacturer/ importer	n.a	B2B / Specific Actors: Waste management operators, repairers, retreaders MSA/ Customs
Product classification	Obligatory	C1, C2, C3, other	Regulation (EU) 2020/740	1,2,3,4,5,6,7,8,9	Model	Tyre manufacturer/ importer	n.a	Public/Consumers
Origin	Obligatory	Country of origin		1	Model	Tyre manufacturer/importer		Public/Consumers
Manufacturing_Date_ Timestamp	Obligatory	Date		1,6	Model	Tyre manufacturer/importer		Public/Consumers
Retread date	Obligatory	Date		4,5,6,8	Unit	n.a	Retreader/s	B2B / Specific Actors: Waste management operators, repairers, retreaders MSA/ Customs
Repair date	Obligatory	Date		4,5,6,8	Unit	n.a	Repairer/s	B2B / Specific Actors: Waste management operators, repairers, retreaders MSA/ Customs

1046

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Stakeholder questions

1. Are there any data points missing under the “Product identification and classification” category?
2. Do you have comments on any of the specified parameters?

1047 **Data category: Producer identification**

1048 Producer identification refers to a set of data elements required to identify all economic operators responsible for placing tyres (new, reused, retreads) on the
 1049 EU market. This ensures traceability across the value chain and supports regulatory controls such as customs checks, market surveillance and procurement
 1050 verification. The information specified under this category is relevant for most of the use cases.

1051 **Table 1-10: Data points for Producer identification.**

Data requirement	Requirement type	Data description	Reference methodology	Applicable use cases	Data granularity	Initial data governance	Secondary data governance	Actors with access
Supplier type	Obligatory	Manufacturer /Authorised representative	Regulation (EU) 2020/740	1,2,3,4,5,6,7,8,9	Model	Tyre manufacturer/ importer		Public/Consumers
Customer care service	Obligatory		Regulation (EU) 2020/740	1,2,3,4,5,6,7,8,9	Model	Tyre manufacturer/ importer		Public/Consumers
Phone	Obligatory		Regulation (EU) 2020/740	1,2,3,4,5,6,7,8,9	Model	Tyre manufacturer/ importer		Public/Consumers
Email	Obligatory		Regulation (EU) 2020/740	1,2,3,4,5,6,7,8,9	Model	Tyre manufacturer/ importer		Public/Consumers
Website	Obligatory		Regulation (EU) 2020/740	1,2,3,4,5,6,7,8,9	Model	Tyre manufacturer/ importer		Public/Consumers

Data requirement	Requirement type	Data description	Reference methodology	Applicable use cases	Data granularity	Initial data governance	Secondary data governance	Actors with access
Address	Obligatory		Regulation (EU) 2020/740	1,2,3,4,5,6,7,8,9	Model	Tyre manufacturer/ importer		Public/Consumers
Repairer name	Obligatory	Repairer name, address, contact		4,5,6	Unit	n.a	Repairer/s	B2B / Specific Actors: Waste management operators, repairers, retreaders MSA/ Customs
Retreader name	Obligatory	Retreader name, address, contact		4,5,6,8	Unit	n.a	Retreader/s	B2B / Specific Actors: Waste management operators, repairers, retreaders MSA/ Customs

Stakeholder questions

1. Are there any data points missing under the “Producer identification” category?
2. Do you have comments on any of the specified parameters?

1052 **Data category: Material compliance and substances of concern (SoC)**

1053 ESPR requires the disclosure of Substances of Concern (SoC) in accordance with Article 7(5). Based on the Task 5 SoC report annex, general information
 1054 requirements have been developed for SoCs that fall under the ESPR Article 2(27)(a,c and d). The following table proposes the scope of data points to be
 1055 considered for inclusion in the DPP, referring mainly to chemical composition data related to SoC contained in the tyre. Though most of the data fields are
 1056 mandatory, a few voluntary fields are included as well. It is understood that manufacturers keep records of substances included in their tyre recipes.
 1057 Nonetheless, providing data on actual concentrations is not always straightforward as some constituents of rubber mixtures react in the curing process and/or
 1058 during the use phase. For this reason, at this stage, locations and exact concentrations are specified as a voluntary data field. In addition, it is possible that
 1059 substances that were used in the manufacture of a tyre are to be identified as SVHC or as POPs after they have been included in the product at the time of
 1060 manufacture. In such cases, the manufacturer or importer is required to retroactively update the necessary information in the DPP, making this category one of
 1061 potentially dynamic nature.

1062 **Table 1-11: Data points for Material compliance and substances of concern (SoC).**

Data requirement	Requirement type	Data description	Reference methodology	Applicable use cases	Data granularity	Initial data governance	Secondary data governance	Actors with access
Name/numerical code of SoC present in the product	Obligatory	IUPAC name or other international name if IUPAC not available	IUPAC Available via ECHA CHEM database	3,4	Batch	Tyre manufacturer/importer	Tyre manufacturer/importer (retroactive updated); Retrearder/s	B2B / Specific Actors: Waste management operators, repairers, retreaders MSA/ Customs
Other names	Obligatory	Usual name, trade name, abbreviation		3,4	Batch	Tyre manufacturer/importer	Tyre manufacturer/importer (retroactive updated); Retrearder/s	B2B / Specific Actors: Waste management operators, repairers, retreaders MSA/ Customs
EC number	Obligatory	Numerical identifier	EC Inventory Available via ECHA CHEM database	3,4	Batch	Tyre manufacturer/importer	Tyre manufacturer/importer (retroactive updated); Retrearder/s	B2B / Specific Actors: Waste management operators, repairers, retreaders MSA/ Customs
CAS number	Obligatory	Numerical identifier	Chemical Abstracts Service	3,4	Batch	Tyre manufacturer/importer	Tyre manufacturer/importer (retroactive updated); Retrearder/s	B2B / Specific Actors: Waste management operators, repairers, retreaders MSA/ Customs
Location of the substance of concern within the product	Voluntary	Component/Material	SCIP	3,4	Batch	Tyre manufacturer/importer	Tyre manufacturer/importer (retroactive updated); Retrearder/s	B2B / Specific Actors: Waste management operators, repairers, retreaders MSA/ Customs
Concentration, maximum concentration or concentration range of the substance of concern in the product, its relevant component or spare part	Voluntary	Concentration descriptor: concentration; maximum concentration; concentration range Value (numeric) Units (eg %, g/kg, etc.)	SCIP	3,4	Batch	Tyre manufacturer/importer	Tyre manufacturer/importer (retroactive updated); Retrearder/s	B2B / Specific Actors: Waste management operators, repairers, retreaders MSA/ Customs

Data requirement	Requirement type	Data description	Reference methodology	Applicable use cases	Data granularity	Initial data governance	Secondary data governance	Actors with access
Instructions for safe use (as relevant)	Obligatory	Description	SCIP	3,4		Tyre manufacturer/importer	Tyre manufacturer/importer (retroactive updated); Retreater/s	B2B / Specific Actors: Waste management operators, repairers, retreaders MSA/ Customs

Stakeholder questions

1. Are there any data points missing under the “Material compliance and substances of concern (SoC)” category?
2. Do you have comments on any of the specified parameters?

1063 **Data category: Product environmental and circularity information**

1064 Environmental and circularity data points include the sustainability-related parameters required under the ESPR. For tyres, the data points included are related
 1065 to the recycled content and bio-based content performance requirements that have been developed. The table below summarises the proposed scope for a
 1066 declaration of product environmental and circularity information for tyres. Reference methodologies have been specified particularly with chain of custody and
 1067 mass balancing methods in mind; however verification may require additional standardization work, requiring these fields to be revised in the future. The same
 1068 fields are included for each of the four materials of relevance for recycled content targets. Inclusion of a pre/post-consumer material split is aimed at enabling
 1069 market surveillance authorities to validate if the total content fulfills the minimum target which is proposed to be based on post-consumer recycled material.
 1070 At this stage the targets are addressed at manufacturers placing tyres on the EU market for the first time, however they could be extended in the future to the
 1071 tread being applied to a used tyre during the retreading practice, requiring a revision of this related parameters. For bio-based content, only the provision of
 1072 the total content and conformity declaration is envisioned at this stage, not requiring a breakdown to specific materials used to comply with the target for bio-
 1073 based content.

1074 **Table 1-12: Data points for Product environmental and circularity information.**

Data requirement	Requirement type	Data description	Reference methodology	Applicable use cases	Data granularity	Initial data governance	Secondary data governance	Actors with access
Recycled Material Content (ReCo) carbon black	Obligatory	Recycled content declaration	ISCC+ or equivalent mass balancing method (ISO 22095-2:2026)	2	Batch	Tyre manufacturer/importer	n.a	MSA / Customs
	Obligatory	Pre-/post-consumer material split	ISCC+ or equivalent mass balancing method (ISO 22095-2:2026)	2	Batch	Tyre manufacturer/importer	n.a	MSA / Customs
	Obligatory	Conformity declaration/certification	ISCC+ or equivalent mass balancing method (ISO 22095-2:2026)	2	Batch	Tyre manufacturer/importer	n.a	MSA / Customs
Recycled Material Content (ReCo) rubber	Obligatory	Recycled content declaration	ISCC+ or equivalent mass balancing method (ISO 22095-2:2026)	2	Batch	Tyre manufacturer/importer	n.a	MSA / Customs
	Obligatory	Pre-/post-consumer material split	ISCC+ or equivalent mass balancing method (ISO 22095-2:2026)	2	Batch	Tyre manufacturer/importer	n.a	MSA / Customs
	Obligatory	Conformity declaration/certification	ISCC+ or equivalent mass balancing method (ISO 22095-2:2026)	2	Batch	Tyre manufacturer/importer	n.a	MSA / Customs
Recycled Material Content (ReCo) steel	Obligatory	Recycled content declaration	ResponsibleSteel certification or ISO 22095 chain-of-custody	2	Batch	Tyre manufacturer/importer	n.a	MSA / Customs

Data requirement	Requirement type	Data description	Reference methodology	Applicable use cases	Data granularity	Initial data governance	Secondary data governance	Actors with access
	Obligatory	Pre-/post-consumer material split	ResponsibleSteel certification or ISO 22095 chain-of-custody	2	Batch	Tyre manufacturer/importer	n.a	MSA / Customs
	Obligatory	Conformity declaration/certification	ResponsibleSteel certification or ISO 22095 chain-of-custody	2	Batch	Tyre manufacturer/importer	n.a	MSA / Customs
Recycled Material Content (ReCo) textiles	Obligatory	Recycled content declaration	Chain-of-custody / mass-balance verification (ISO 22095-2:2026)	2	Batch	Tyre manufacturer/importer	n.a	MSA / Customs
	Obligatory	Pre-/post-consumer material split	Chain-of-custody / mass-balance verification (ISO 22095-2:2026)	2	Batch	Tyre manufacturer/importer	n.a	MSA / Customs
	Obligatory	Conformity declaration/certification	Chain-of-custody / mass-balance verification (ISO 22095-2:2026)	2	Batch	Tyre manufacturer/importer	n.a	MSA / Customs
Bio-based material content	Obligatory	Bio-based content declaration	ISCC+ or equivalent mass balancing method + Radiocarbon testing (14c analysis)	2	Batch	Tyre manufacturer/importer	n.a	MSA / Customs
	Obligatory	Conformity declaration/certification		2	Batch	Tyre manufacturer/importer	n.a	MSA / Customs

Stakeholder questions

1. Are there any data points missing under the “Product environmental and circularity information” category?
2. Do you have comments on any of the specified parameters?

1076

1077 **Data category: Tyre Labelling data and other regulatory requirements**

1078 Though it is yet to be considered if the EPREL database should continue to run in parallel to the DPP, for various stakeholders it may be more convenient to have
 1079 all data accessible in one place, i.e., in the DPP. It is thus proposed to enter all Tyre Labelling data into the DPP even if EPREL should remain functional for the
 1080 tyre product group. Various studies have been held to consider expanding tyre labeling requirements to retreaded tyres. Should these lead to the requirements
 1081 of new data points in the labelling scheme, the EC is to consider if these should be uploaded in both schemes or only in the DPP in the case that it is decided to
 1082 discontinue the running of EPREL for tyres. In addition, based on the screening of other regulations, data points could be added where other legislation foresees
 1083 the collection of product data. This is currently anticipated for the abrasion rating to be required in the context of EURO 7 but could be extended in the future
 1084 in relation to other legislations and requirements.

1085 **Table 1-13: Data points for Tyre Labelling data and other regulatory requirements.**

Data Category	Data requirement	Requirement type	Data description	Reference methodology	Applicable use cases	Data granularity	Initial data governance	Secondary data governance	Actors with access
Tyre Labeling data	Tyre size designation	Obligatory	(width, aspect ratio, rim)	Regulation (EU) 2020/740	1	Model	Tyre manufacturer/importer		Public/Consumers
	Tyre type identifier			Regulation (EU) 2020/740	1	Model	Tyre manufacturer/importer		Public/Consumers
	Load-capacity index	Obligatory		Regulation (EU) 2020/740	1	Model	Tyre manufacturer/importer		Public/Consumers

Data Category	Data requirement	Requirement type	Data description	Reference methodology	Applicable use cases	Data granularity	Initial data governance	Secondary data governance	Actors with access
	Speed category symbol	Obligatory		Regulation (EU) 2020/740	1	Model	Tyre manufacturer/importer		Public/Consumers
	Reinforced /XL			Regulation (EU) 2020/740	1	Model	Tyre manufacturer/importer		MSA / Customs
	Snow tyre designation (3PeakMountain SnowFlake)			Regulation (EU) 2020/740	1	Model	Tyre manufacturer/importer		MSA / Customs
	Ice-grip tyre designation			Regulation (EU) 2020/740	1	Model	Tyre manufacturer/importer		MSA / Customs
	Load version	Obligatory		Regulation (EU) 2020/740	1	Model	Tyre manufacturer/importer		Public/Consumers
	Fuel efficiency - rolling resistance class	Obligatory	Class A-E	Regulation (EU) 2020/740	1	Model	Tyre manufacturer/importer		Public/Consumers
	RRC - Rolling resistance coefficient	Obligatory	Value	Regulation (EU) 2020/740	1,3	Model	Tyre manufacturer/importer		MSA / Customs
	Wet grip class	Obligatory	Class A-E	Regulation (EU) 2020/740	1	Model	Tyre manufacturer/importer		Public/Consumers
	Wet grip index	Obligatory	Value	Regulation (EU) 2020/740	1	Model	Tyre manufacturer/importer		MSA / Customs

Data Category	Data requirement	Requirement type	Data description	Reference methodology	Applicable use cases	Data granularity	Initial data governance	Secondary data governance	Actors with access
	External rolling noise class	Obligatory	Class A-C	Regulation (EU) 2020/740	1	Model	Tyre manufacturer/importer		Public/Consumers
	External rolling noise	Obligatory	dB	Regulation (EU) 2020/740	1	Model	Tyre manufacturer/importer		Public/Consumers
	Measured noise value	Obligatory	dB	Regulation (EU) 2020/740	1	Model	Tyre manufacturer/importer		MSA / Customs
	Snow-grip pictogram	Obligatory		Regulation (EU) 2020/740	1	Model	Tyre manufacturer/importer		Public/Consumers
	Snow-grip test value	Obligatory		Regulation (EU) 2020/740	1	Model	Tyre manufacturer/importer		MSA / Customs
	Ice-grip pictogram	Obligatory		Regulation (EU) 2020/740	1	Model	Tyre manufacturer/importer		Public/Consumers
	Ice-grip test value	Obligatory		Regulation (EU) 2020/740	1	Model	Tyre manufacturer/importer		MSA / Customs
	QR code (link to EPREL)	Obligatory		Regulation (EU) 2020/740	1	Model	Tyre manufacturer/importer		Public/Consumers
	Date of placing on the EU market	Obligatory		Regulation (EU) 2020/740	1	Model	Tyre manufacturer/importer		Public/Consumers

Data Category	Data requirement	Requirement type	Data description	Reference methodology	Applicable use cases	Data granularity	Initial data governance	Secondary data governance	Actors with access
	Declaration of conformity	Obligatory		Regulation (EU) 2020/740	1	Model	Tyre manufacturer/importer		MSA / Customs
	Technical documentation (test reports, conformity evidence)	Obligatory		Regulation (EU) 2020/740	1	Model	Tyre manufacturer/importer		MSA / Customs
	Test laboratory details / accreditation	Obligatory		Regulation (EU) 2020/740	1	Model	Tyre manufacturer/importer		MSA / Customs
	Label template version	Obligatory		Regulation (EU) 2020/740	1	Model	Tyre manufacturer/importer		Public/Consumers
	QR-code consistency with EPREL entry	Obligatory		Regulation (EU) 2020/740	1	Model	Tyre manufacturer/importer		Public/Consumers
Other regulatory requirements	Euro 7 abrasion ratings	Obligatory	Class and value	Regulation (EU) 2024/1257	1	Model	Tyre manufacturer/importer	n.a	MSA / Customs

Draft

Stakeholder questions

1. Are there any data points missing under the “Tyre Labelling data and other regulatory requirements” category?
2. Do you have comments on any of the specified parameters?

1087

1088 **Data category: Retreading**

1089 Tyre retreading has proven to be a sustainable practice associated with savings on material use and reduction of waste generation, however its market is in
 1090 decrease. To support the development of the retreading market, various performance measures have been proposed related to the retreadability and the
 1091 retreading of tyres and for this purpose related data is to be entered in the DPP. Data on whether a tyre has been retreaded in the past is relevant for consumers
 1092 and procurers as also to ELT sorters considering if a tyre could be retread a further time and should be rerouted to a retreader. As such various data points refer
 1093 not only to whether the tyre can be retread and its technical parameters of relevance for the process, but also to whether the tyre has been retreaded in the
 1094 past. The latter data points are not relevant at the time the tyre is placed on the market but are dynamic and will need to be updated if relevant during the
 1095 tyre’s lifetime. Furthermore, monitoring the data on tyre’s placed on the market and changes to these dynamic fields shall allow market surveillance to analyse
 1096 whether tyres placed on the market are retreadable in practice and not just specified as such in the DPP.

1097 **Table 1-14: Data points for retreading.**

Data requirement	Requirement type	Data description	Reference methodology	Applicable use cases	Data granularity	Initial data governance	Secondary data governance	Actors with access
Retreading date	Obligatory	Date		8	Unit	n.a	Retreader/s	B2B / Specific Actors: Waste management operators, repairers, retreaders MSA/ Customs
Retreadable_Casing	Obligatory	Yes/No		3,8	Model	Tyre manufacturer/ importer	n.a	B2B / Specific Actors: Waste management operators, repairers, retreaders

Data requirement	Requirement type	Data description	Reference methodology	Applicable use cases	Data granularity	Initial data governance	Secondary data governance	Actors with access
Number of (previous) retread/repair events (< 2 previous retread events), unit level, public access;	Obligatory	Number of events		1,3,4,5,8	Unit	n.a	Retreader	Public/Consumers
Buffing radius	Obligatory	Dimension		8	Model	Tyre manufacturer/importer	?	Retreaders (B2B)
Tread width	Obligatory	Dimension		8	Model	Tyre manufacturer/importer	?	Retreaders (B2B)
Optimal buffing depth	Obligatory	Dimension		8	Model	Tyre manufacturer/importer	?	Retreaders (B2B)

1098

Stakeholder questions

1. Are there any data points missing under the “Retreading)” category?
2. Could the values for buffing radius, tread width and optimal buffing depth change once the tyre has been retread? Should input be anticipated for these fields by the retreader?
3. Do you have comments on any of the specified parameters?

1099

1100 **Data category: DO-02_Physical_Hindrances**

1101 In consideration of ESPR Article 5(14), the SoC analysis identified a few substances (and in some cases materials or components) that “make the reuse, or
 1102 recycling process more complicated, costly, environmentally impactful, or energy- or resource-demanding” and/or that “impair the technical properties or
 1103 functionalities, the usefulness or the value of the recycled material coming from the product” (ESPR, 2024). For each of these substances or materials,

1104 information requirements are proposed, leading to the data points presented in the table below. For most identified SoCs or materials/components,
 1105 manufacturers are required to indicate if the material/component or SoC is contained in the product (or in the case of batteries at risk of being contained in the
 1106 ELT once removed from a vehicle). For materials and components, manufacturers are also required to provide instructions for removal or dismantling in the
 1107 DPP. These two data points are aimed to allow tyres containing such materials to be sorted out of ELT batches for the purpose of removal of the material or
 1108 component prior to rerouting to a suitable waste treatment. As batteries are usually not integrated in the tyre but rather adjacent to it, vehicle dismantlers are
 1109 required to indicate the potential presence of a battery in this case, under the assumption that this could incentivise that such batteries are removed by the
 1110 dismantler or alternatively ensure that information is included in the DPP that a battery may be present so that the tyre can be removed during sorting for the
 1111 purpose of battery removal. In this case, though a battery may be inserted in the tyre by a manufacturer (e.g. smart tyres), in most cases it is part of the TPMS,
 1112 and as such affixed to the tyre valve by the manufacture, resulting in a risk that it shall not be removed prior to sending the tyre to waste management. In the
 1113 case of substances considered disruptive, the data point intends to ensure that a substance is no longer used due to restriction (e.g., bromobutyl rubber), or to
 1114 allow sorting between tyres with higher and lower amount (e.g., silica, chlorobutyl rubber). For the content of lead and cadmium in zinc oxide, the ESPR
 1115 requirements proposed foresee that manufacturers control the amounts of these impurities in purchased ZnO through supply chain requirements and the data
 1116 point is aimed at monitoring implementation.

1117 **Table 1-15: Data points for DO-02_Physical_Hindrances.**

Data requirement	Requirement type	Data description	Reference methodology	Applicable use cases	Data granularity	Initial data governance	Secondary data governance	Actors with access
Potential presence of TPMS battery	Obligatory	Yes/No	IDIS	4,9	Unit	Tyre or vehicle manufacturer/importer	Dismantler	B2B / Specific Actors: Waste management operators, retreaders and tyre manufacturers
	Obligatory	Removal instructions		4,9	Unit	Tyre or vehicle manufacturer/importer	Dismantler	B2B / Specific Actors: Waste management operators, retreaders and tyre manufacturers
PU Foam presence	Obligatory	Yes/No		4,9	Model	Tyre manufacturer/importer		B2B / Specific Actors: Waste management operators, retreaders and tyre manufacturers
	Obligatory	Removal instructions		4,9	Model	Tyre manufacturer/importer		B2B / Specific Actors: Waste management operators, retreaders and tyre manufacturers

Data requirement	Requirement type	Data description	Reference methodology	Applicable use cases	Data granularity	Initial data governance	Secondary data governance	Actors with access
Sticky gel presence	Obligatory	Yes/No	IDIS/Manufacturer	4,9	Model	Tyre manufacturer/importer		B2B / Specific Actors: Waste management operators, retreaders and tyre manufacturers
	Obligatory	Removal instructions		4,9	Model	Tyre manufacturer/importer		B2B / Specific Actors: Waste management operators, retreaders and tyre manufacturers
Textile_Class: standard/advanced	Obligatory	Nylon/Poly/Armaid/Kevlar		4,9	Model	Tyre manufacturer/importer		B2B / Specific Actors: Waste management operators, retreaders and tyre manufacturers
Silica_Ratio_Category <10%	Obligatory	Yes/No		4	Model	Tyre manufacturer/importer		B2B / Specific Actors: Waste management operators, retreaders and tyre manufacturers
Natural rubber content	Obligatory	Yes/No		4	Batch	Tyre manufacturer/importer	Retreader	B2B / Specific Actors: Waste management operators, retreaders and tyre manufacturers
Bromobutyl rubber content	Obligatory	Yes/No		4	Batch	Tyre manufacturer/importer	Retreader	B2B / Specific Actors: Waste management operators, retreaders and tyre manufacturers
Chlorobutyl rubber content > 5%	Obligatory	Yes/No		4	Batch	Tyre manufacturer/importer	Retreader	B2B / Specific Actors: Waste management operators, retreaders and tyre manufacturers
Cadmium and lead content in ZnO	Obligatory	Specify content in tyre ZnO		4	Batch	Tyre manufacturer/importer	Retreader	B2B / Specific Actors: Waste management operators, retreaders and tyre manufacturers
Presence of legacy/contaminants	Obligatory	Yes/No per substance		4	Batch	Tyre manufacturer/importer		B2B / Specific Actors: Waste management operators, retreaders and tyre manufacturers

Stakeholder questions

1. Are there any data points missing under the “DO-02_Physical_Hindrances” category?
2. For cadmium and lead in ZnO, what tolerance level should be set to ensure that these substances do not affect the quality of recycled carbon black when related tyres are sent to pyrolysis?
3. Do you have comments on any of the specified parameters?

1119

1120 **Data category: Lifecycle state and event log**

1121 During the use phase of a tyre, some events may take place that damage the tyre beyond a state where it could be repaired to retain road worthiness. In other
1122 cases, a tyre that has been used and sent to waste management may be worn, at a level that would require its repair or retreading to be reused, or at a level
1123 that would only allow it to be routed to various waste treatment processes. Nonetheless, in some cases such tyres may come into a situation in which they
1124 could remain in use or could be presented as still usable. To increase the transparency to the consumer as well as to various stakeholders along the value chain,
1125 this category envisions the establishment of data points on the status of the tyre, making it clear if the tyre is still in active use or if it is no longer road worthy
1126 (at least as long as it has not been retreaded or repaired, again changing the status of the tyre). This is in line with the ESPR option of setting requirements to
1127 support reuse, repair and manufacturing of products (ESPR Article 5(1)(c,e,l)) or when this is no longer possible, to ensure that the product is sent to waste
1128 management and can be reouted to recycling or material recovery (ESPR Article 5(1)(m,n)).

1129 Though a tyre is placed on the market and specified by the manufacturer or importer as “Active”, these data points are dynamic and are to be revised during
1130 the lifecycle once a tyre is identified as no longer fit for use, either due to critical damage inflicted in an accident or due to the level of wear. The table below
1131 thus includes such data points, which are envisioned as a dynamic part of the DPP. In particular, such data is expected to serve custom authorities in flagging
1132 tyres that should be removed from tyre shipment intended for export as “reusable tyres”, as a means of reducing impacts related to tyre waste management
1133 which is not environmentally sound, in cases where non-road worthy tyres are exported as still usable ones. Though all tyres placed on the market will be
1134 indicated as active, allowing a “model” data granularity, throughout the lifecycle, any event that affects the tyre status is only relevant for the specific unit,
1135 requiring a higher granularity for updating the tyre status.

1136

1137 **Table 1-16: Data points for Lifecycle state and event log.**

Data requirement	Requirement type	Data description	Reference methodology	Applicable use cases	Data granularity	Initial data governance	Secondary data governance	Actors with access
Lifecycle_State	Obligatory	Active/ EoL_Retreadable/ EoL_Material_Recovery/ EoL_Critical_Damage		5,6,7,8	Unit	Tyre manufacturer/ importer	Retreader/repairer/waste operator	Public/Consumers
EoL_Status_Flag	Obligatory	Waste/destined for material recovery/destined for reuse/destined for retreading		7	Unit	n.a	Retreader/repairer/waste operator	B2B / Specific Actors; MSA/ Customs
Destined for EoL	Obligatory	Yes/No		8	Unit	n.a	Retreader/repairer/waste operator	B2B / Specific Actors: Waste management operators, retreaders and tyre manufacturers

1138

Stakeholder questions

1. Are there any data points missing under the “Lifecycle state and event log” category?
2. Please consider the above data points carefully and comment if in your view they are repetitious and could be formulated in a more efficient manner.
3. Do you have comments on any of the specified parameters?

1139

1140 1.6. Scenario analysis

1141 To model different policy scenarios over the next years and the environmental impacts, a stock
1142 model was developed. In an initial step, the Baseline (Business As Usual, BAU) was set up.

1143 The baseline model serves three primary purposes:

- 1144 • Quantify the stock of tyres in use, annual sales, and end-of-life tyre (ELT) arising volumes
1145 by tyre category across the full modelling horizon from 2005 to 2040.
- 1146 • Calculate the GHG and PEF (Product Environmental Footprint) impacts of the European
1147 tyre fleet across three lifecycle phases (production, use, and end-of-life) under a
1148 Business-as-Usual (BAU) scenario, applying rolling resistance improvements and electric
1149 vehicle penetration from 2005 to 2040.
- 1150 • Assess the environmental benefits of retreading and the comparative impact of budget
1151 tyres versus retreadable C3 tyres.

1152 With the baseline in place, policy scenarios can then be modelled against it.

1153 1.6.1. Description of EU27 Tyres Stock Model

1154 Five tyre categories are modelled: C1 (passenger car), C2 (light van), C3 (heavy truck), C3
1155 Retread, and C3 Budget⁶. Each is defined by the parameters in the table below.

1156 **Table 1-17: Typical design parameters of the five tyre categories modelled (own
1157 compilation).**

Parameter	C1	C2	C3	C3 Retread	C3 Budget
Lifetime (years)	4	3	3	3	1.54
Total km	40,000	57,000	253,410	245,920	130,000
Annual km	10,000	19,000	81,973	84,470	84,416
New weight (kg)	8.5	12	64	66*	64
Tread applied (kg)	—	—	—	22	—
Tyre wear (kg)	1.6	1.9	12.3	12.3	12.3
EoL weight (kg)	6.9	10.1	51.7	51.7	51.7

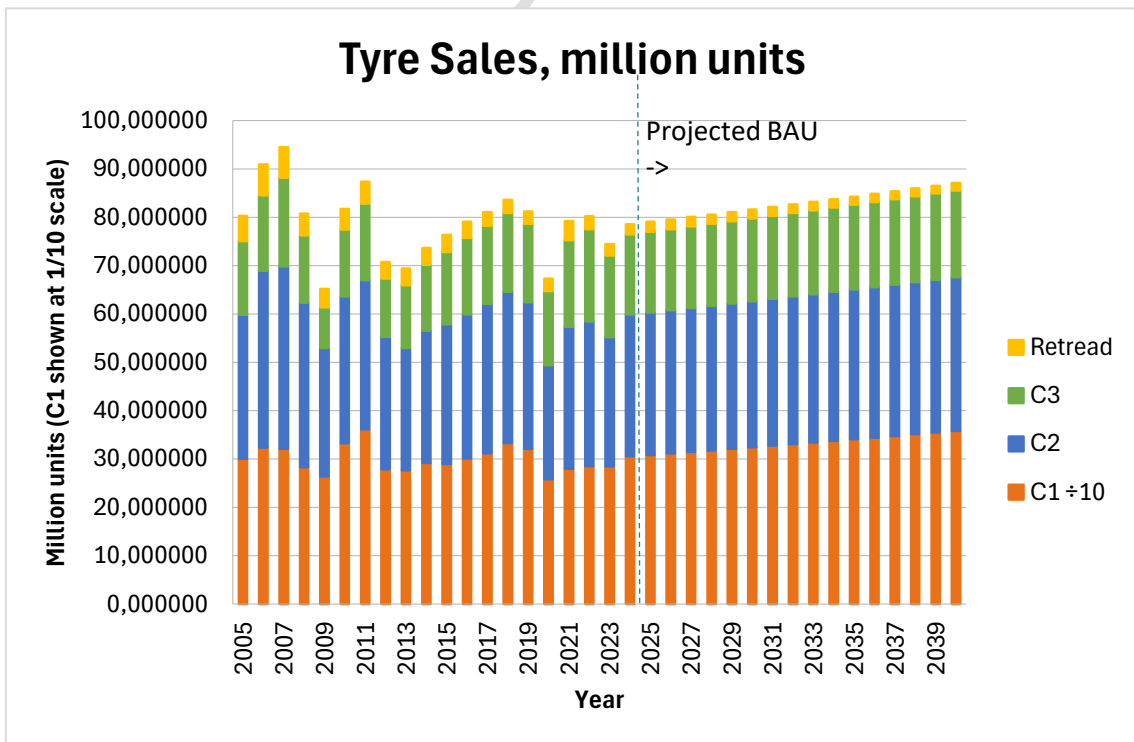
⁶ Seeing as the base-case represents the average tyre on the market, for C3, where retreading is common, the standard C3 reflects a “premium” tyre that is retreadable. Thus a C3 budget tyre category has been added to allow analysis of policy options affecting the retreading of tyres.

1158 *Retread "new weight" refers to the C3 carcass weight at start of retread life; the 22 kg figure is new tread rubber
 1159 applied during the retreading process. The weight of the casing is the weight of a new retread tyre – the retread
 1160 rubber, in this case 44 kg. It is assumed that 7,7 kg is then lost to the retread buffing process.

1161 Annual sales volumes (million units) are entered in the model for each tyre category from 1999
 1162 to 2040. Retread sales are split 85% first-life retreads and 15% second-life retreads, reflecting
 1163 survival rates through the retreading process. Budget tyres are modelled as a sub-segment of
 1164 C3 sales defined by the budget market share percentage to determine impacts on the retreading
 1165 market.

1166 **Table 1-18: Market data of the five tyre categories applied in model (millions of units).**

Category	2005	2011	2017	2024	2032	2040	Growth Rate Applied post 2024
C1 (m units)	300.3	361.8	311.6	305.7	331.0	358.4	1%
C2 (m units)	29.8	30.9	31.0	29.3	30.5	31.8	0.5%
C3 (m units)	15.3	15.8	16.1	16.6	17.3	18.0	0.5%
C3 Retread (m units)	5.2	4.6	2.8	2.1	1.8	1.5	-2%
C3 Budget (m units)	1.8	3.2	5.0	5.8	7.2	8.6	



1167

1168

Figure 1-2: Tyre sales in the EU between 2005 and 2039, millions of units.

1169 Stock and ELT arising are modelled using survival rate curves rather than a fixed single lifetime
 1170 assumption. Each tyre category is assigned a survival rate profile that describes the proportion
 1171 of a sales cohort still in service at each age, reflecting the real-world distribution of tyre
 1172 replacement behaviour around the mean service life.

1173 For each year Y and tyre category, the in-use stock is calculated as the sum of surviving fractions
 1174 across all active cohort years:

1175
$$Stock_Y = \sum (Sales_{\{Y-n\}} \times Survival_rate_n)$$

1176 where n runs from 0 (current year's sales, all still in service) to the maximum age of that category.

1177 The corresponding waste arising (ELT) in year Y is the sum of the fractions of each cohort that
 1178 exit service in that year, i.e. the year-on-year decline in the survival rate applied to the relevant
 1179 sales cohort:

1180
$$ELT_Y = \sum (Sales_{\{Y-n\}} \times Waste_rate_n)$$

1181 where the waste rate at age n equals the survival rate at age n-1 minus the survival rate at age
 1182 n. The waste rates sum to 1 across the full life of each cohort, ensuring that every tyre sold
 1183 eventually becomes an ELT only once.

1184 The survival and waste rate profiles used are specified in the following table.

1185 **Table 1-19: Survival and waste rate profiles used in modelling (%).**

Category	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Tyre survival rate						
C1 (Passenger)	1.00	0.90	0.75	0.50	0.25	0.10
C2 (Vans)	1.00	0.80	0.50	0.20	0.05	—
C3 (Trucks)	1.00	0.70	0.30	0.10	—	—
Retread 1st life	1.00	0.60	0.20	—	—	—
Retread 2nd life	1.00	0.40	0.05	—	—	—
Tyres Reaching EoL						

Category	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Category	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6
C1 (Passenger)	0.10	0.15	0.25	0.25	0.15	0.10
C2 (Vans)	0.20	0.30	0.30	0.15	0.05	—
C3 (Trucks)	0.30	0.40	0.20	0.10	—	—
Retreads	0.40	0.40	0.20	—	—	—

1186 The C1 profile spans six age cohorts, reflecting the wide distribution of passenger car tyre
 1187 replacement intervals from early failures through to extended use beyond the nominal four-year
 1188 lifetime. C3 and retread lifetimes are shorter, consistent with heavier use and fleet maintenance
 1189 regimes typical of commercial vehicle operators. The two retread profiles (1st and 2nd life) are
 1190 shown differently with 2nd life retreads expected to be used for a shorter time (40% exiting in
 1191 year 1, 40% in year 2).

1192 When a cohort exits its lifetime, it enters the ELT stream. C3 ELT is calculated by subtracting and
 1193 deferring the number of retreads sold in any given year.

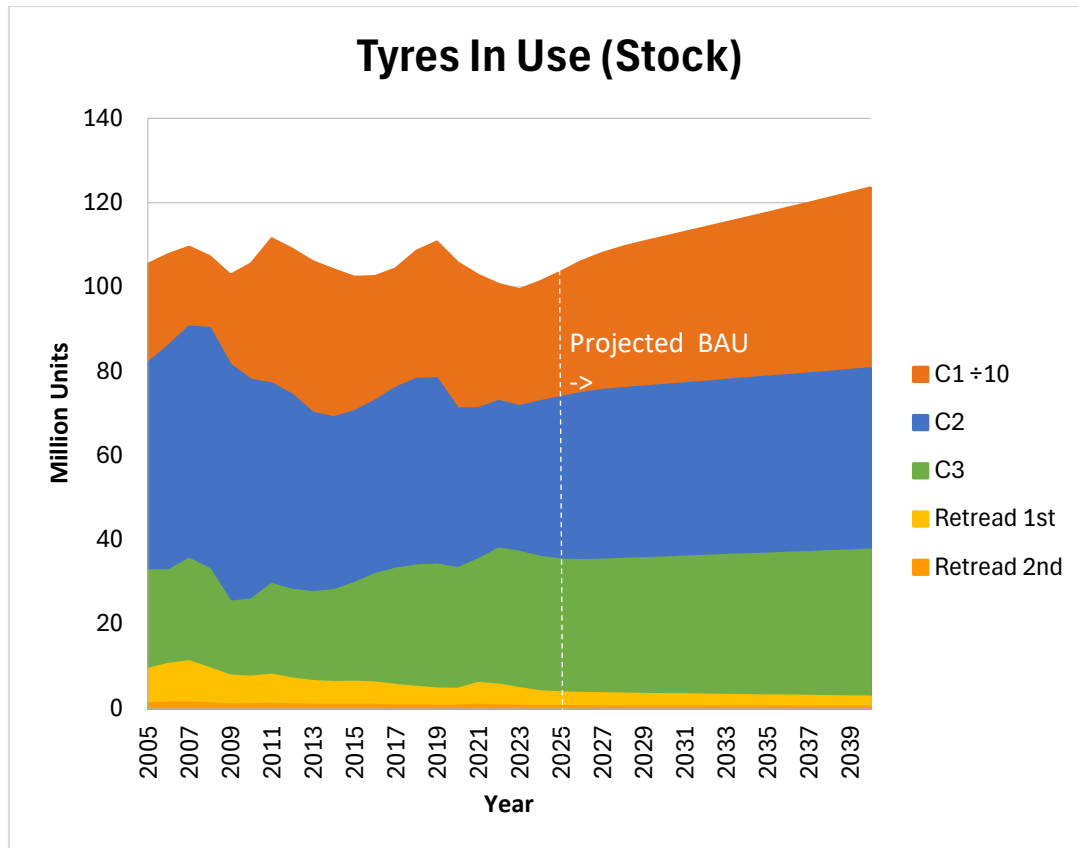
1194 1.6.2. Stock Model Results

1195 1.6.2.1. Tyres in use

1196 The C1 fleet dominates by volume: with approximately 1,012–1,235 million tyres in use across
 1197 the modelling period, its total volume is roughly 14× larger than C2 and 28× larger than C3. C1
 1198 is shown at 1/10th scale in the stock and sales chart below to allow the smaller categories to be
 1199 visible.

1200 **Table 1-20: In use stock of the five tyre categories modelled in various years (millions of**
 1201 **units).**

Category	2005	2017	2024	2032	2040
C1 in use (m units)	1,054	1,043	1,012	1,141	1,235
C2 in use (m units)	82	76	73	77	81
C3 in use (m units)	33	33	36	36	38
Retread in use (m units)	10	6	4	4	3



1202

1203

Figure 1-3: Tyre in use stock in the EU between 2005 and 2039, millions of units.

1204

1.6.2.2. ELT Arising

1205

C1 ELT is approximately 300–350 million units per year, again reflecting the scale of the C1 fleet.

1206

C3 ELT peaked around 2007–2008 (pre-financial crash: 16–17 million units), dipped through

1207

2009–2010 as fleet volumes contracted, and has since returned to the 17 million unit range. The

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retread ELT volume has declined consistently as the retread rate falls: from 5.1 million units in

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2005 to 2.3 million by 2024.

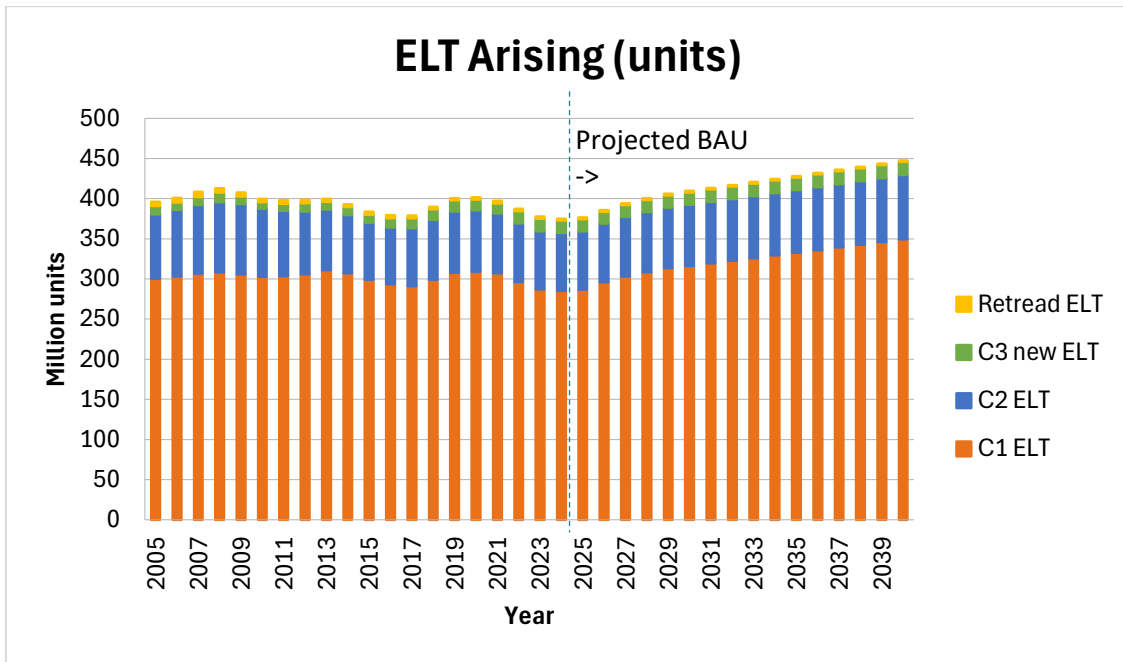
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Table 1-21: Tyres reaching end-of-life in the EU of the five tyre categories modelled in

1211

various years (millions of units).

Category	2005	2011	2017	2024	2032	2040
C1 ELT (m units)	300.2	303.7	291.1	285.4	322.9	349.6
C2 ELT (m units)	80.3	81.3	72.1	72.1	76.9	80.0
C3 net ELT (m units)	10.5	8.8	12.7	15.5	15.4	16.4
Retread ELT (m units)	5.1	4.3	3.2	2.8	1.8	1.5



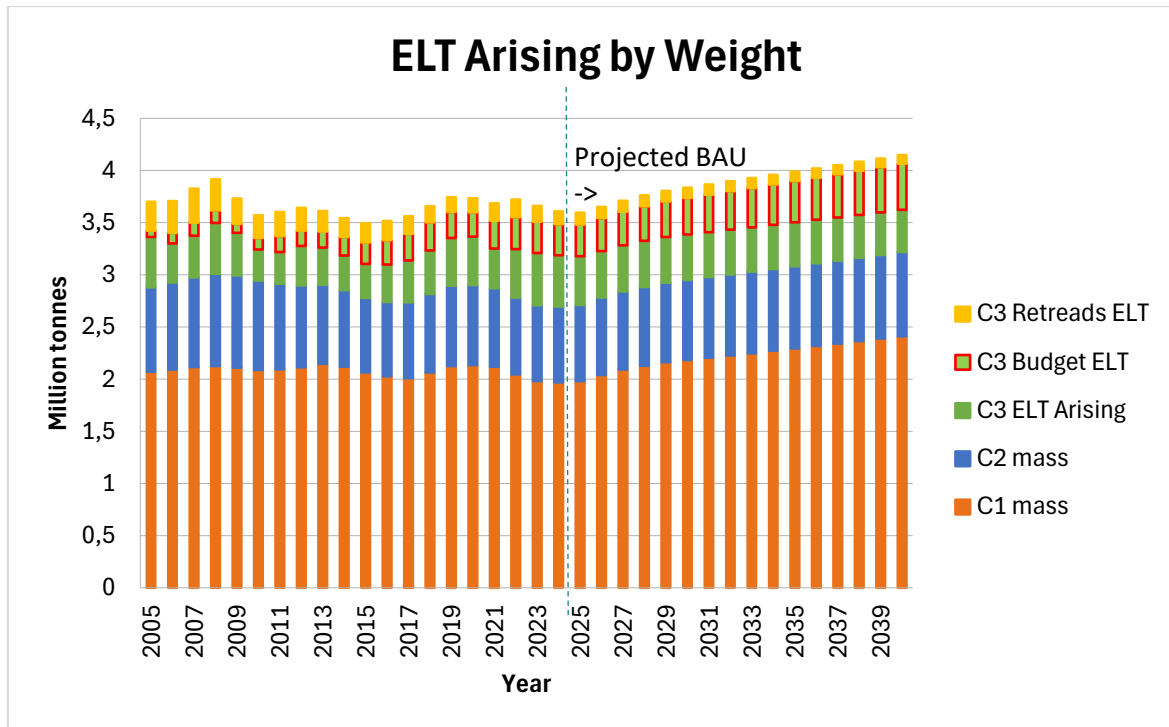
1212

1213 **Figure 1-4: Tyres reaching end-of-life in the EU between 2005 and 2039, millions of units.**

1214 **Table 1-22: Tyres by weight reaching end-of-life in the EU of the five tyre categories**
 1215 **modelled in various years (millions of tonnes).**

Category	2005	2011	2017	2024	2032	2040
C1 ELT (m tonnes)	2.071	2.096	2.009	1.969	2.228	2.412
C2 ELT (m tonnes)	0.811	0.821	0.728	0.728	0.776	0.808
C3 net ELT (m tonnes)	0.543	0.455	0.657	0.801	0.796	0.848
Retread ELT (m tonnes)	0.264	0.222	0.165	0.145	0.093	0.078
Total ELT (m tonnes)	3.689	3.593	3.558	3.643	3.893	4.145
10% Export for reuse	0.37	0.36	0.36	0.36	0.39	0.41

1216



1217

1218 **Figure 1-5: Tyres by weight reaching end-of-life in the EU between 2005 and 2039 (millions of**
 1219 **units).**

1220 These ELT data compare well with the latest annual reports from ETRMA, which state 4.2 million
 1221 used tyres were generated in 2023 in EU27 + UK, Switzerland and Norway, of which 600,000
 1222 tonnes are re-used or retreaded and 3.6 million tyres become ELT. For EU27, the total used tyres
 1223 generated is closer to 3.6Mt, and around 3.1 Mt are thought to become ELT at EoL in 2023. The
 1224 numbers above do not yet take into account exports for re-use. If it is assumed that around 10%
 1225 of tyres are exported for re-use, then the total ELT arising from the stock model in 2024 is
 1226 3.28Mt, which appears to align well with industry reporting.

1227 **1.7. LCA Fleet Impact Methodology**

1228 **1.7.1. LCA Impacts**

1229 To calculate the environmental impacts, the PEF single scores and Greenhouse Gas (GHG)
 1230 Emissions values for each tyre category are considered along the lifecycle, using the values
 1231 derived in Task 5 to calculate the baseline.

1232 The fleet impacts are based upon calculating the sum of production (raw materials,
 1233 manufacturing, transport and distribution), use phase and EoL impacts across the lifecycle.
 1234 Production and End of Life impacts occur as full product lifecycle impact when the product is
 1235 placed on the market or becomes waste. Use phase impacts are derived based on the annual
 1236 km driven for the tyre multiplied by per km values.

1237

1238

1239 Annual **production impacts** are calculated as:

1240 $Production\ Phase\ Impact = Tyre\ sales\ (million\ units) \times Tyre\ Full\ Lifecycle\ Impacts\ (Raw\ materials$
 1241 $+ Transport + Manufacturing + Distribution)$

1242 Annual **Use Phase Impacts** are calculated as:

1243 $Use\ Phase\ Impact = In-service\ stock\ (million\ tyres) \times Annual\ km \times Per-km\ LCA\ impact$

1244 Annual **EoL impacts** are calculated as:

1245 $EoL\ Impact = ELT\ generated\ (million\ units) \times \Sigma [treatment\ route\ share \times (per-route\ LCA / base-$
 1246 $year\ share)]$

1247 1.7.2. Electric Vehicle and Rolling Resistance Projections

1248 Use phase efficiency improvements factors are modelled through to 2040:

1249 **Rolling Resistance Coefficient (RRC) improvement:** historical RRC data for C1, C2, and C3
 1250 relative to the 2024 baseline are assumed based on efficiency gains observed since 2005. It is
 1251 assumed that beyond 2024, the RRC limits introduced under stage 2 of UN R117 reduce average
 1252 rolling resistance again in 2026 for C1, and 2028 for C2 and C3 tyres. Further RRC improvements
 1253 are not assumed, with further RRC improvements considered asymptotic to the 2040 value. The
 1254 rolling resistance values are applied as a percentage factor to increase use phase GHG before
 1255 the base case year 2024, and decrease it thereafter.

1256 **Table 1-23: Estimated decrease in GHG emissions for the three main vehicle categories as a**
 1257 **result of RRC and changing energy mix (own compilation).**

Factor	2005	2011	2017	2024	2032	2040
C1 Average RRC (N/kN)	12	11	10	8.8	8.1	8.1
% change to 2024 Base Case Value	+36%	+27%	+14%	0%	-8%	-8%
C2 Average RRC (N/kN)	11	10,4	9,3	8,5	7,9	7,9
C2 % change to 2024 Base Case Value	+29%	+22%	+9%	0%	-7%	-7%
C3 RRC(N/kN)	8	7	5,9	5,3	5	5
C3 % change to 2024 Base Case value	+51%	+32%	+11%	0%	-6%	-6%

1258 **Electric vehicle fleet penetration:** the EV fleet sales projected through to 2040 are applied to
 1259 determine a fleet share of EVs for passenger and light commercial vehicles, as well as heavy
 1260 goods vehicles. The sensitivity analyses modelled in Task 5 calculates the impact of a C1 tyre
 1261 using the EU electricity grid mix of 2024 (approx.: 18.2% wind, 11.1% solar, 14.8% hydropower,
 1262 23.2% nuclear, 10.3% coal, 15.5% gas, 1.7% oil, 3.9% biofuels) and for a tyre used in an EV in an

1263 electricity grid mix of 50% solar – 50% wind. To model the renewables mix forward to a realistic
 1264 grid mix in 2040 it is assumed that EU renewable energy from wind and solar continues to
 1265 displace fossil fuels, leading to a total renewables proportion of 72% by 2040, and fossil fuels
 1266 drop to 8% in 2040 in EU27; the remaining 20% is nuclear. In Task 5, the use phase GHG
 1267 emissions were found to drop by 91% when the grid is 100% wind and solar. Accounting for the
 1268 8% fossil fuels share in the grid in 2040, this leads to a use phase reduction per C1 tyre of 83%
 1269 of GHG emissions.

1270 For C2 and C3 tyres, no EV sensitivity analysis has been carried out in Task 5. The C2 fleet has
 1271 the same targets for decarbonisation as passenger vehicles, therefore the same fleet
 1272 penetration is assumed. For C3 tyres, a slower penetration of the EV fleet is assumed, based on
 1273 longer life-times of these vehicles and the slower shift to electric versions. EVs have around 90%
 1274 power efficiency conversion, vs. petrol cars \approx 25-30% and diesel heavy goods vehicles around
 1275 40-45%. The switch to EV for diesel trucks is therefore assumed to improve efficiency by a factor
 1276 of 2 in comparison to passenger cars where it improves by a factor of around 3. Based on the C1
 1277 efficiency improvements in GHG, it is therefore assumed that C2 tyres on an EV in 2024 have the
 1278 same reduced use phase impact as C1 tyres of 45% as compared to 2024, and of 83% in 2040 as
 1279 the grid shifts to higher renewables share. For C3, a higher thermodynamic efficiency is assumed
 1280 from diesel engines, leading to half the EV efficiency gains: 22.5% in 2024 up to 41.5% by 2040.

1281 The EV fleet is based upon the decarbonisation and sales targets set by the EU for passenger and
 1282 light commercial vehicles and heavy-commercial vehicles (HCV). The HCV BEV sales take into
 1283 account both buses and goods vehicles. Sales and stock figures are based on datasets used in
 1284 the ELV impact assessment. The assumed renewables levels in the grid are based on targets.

1285 The "Fit for 55" package established the timelines for the phase-out of internal combustion
 1286 engines (ICE), which dictates the EV penetration rates.

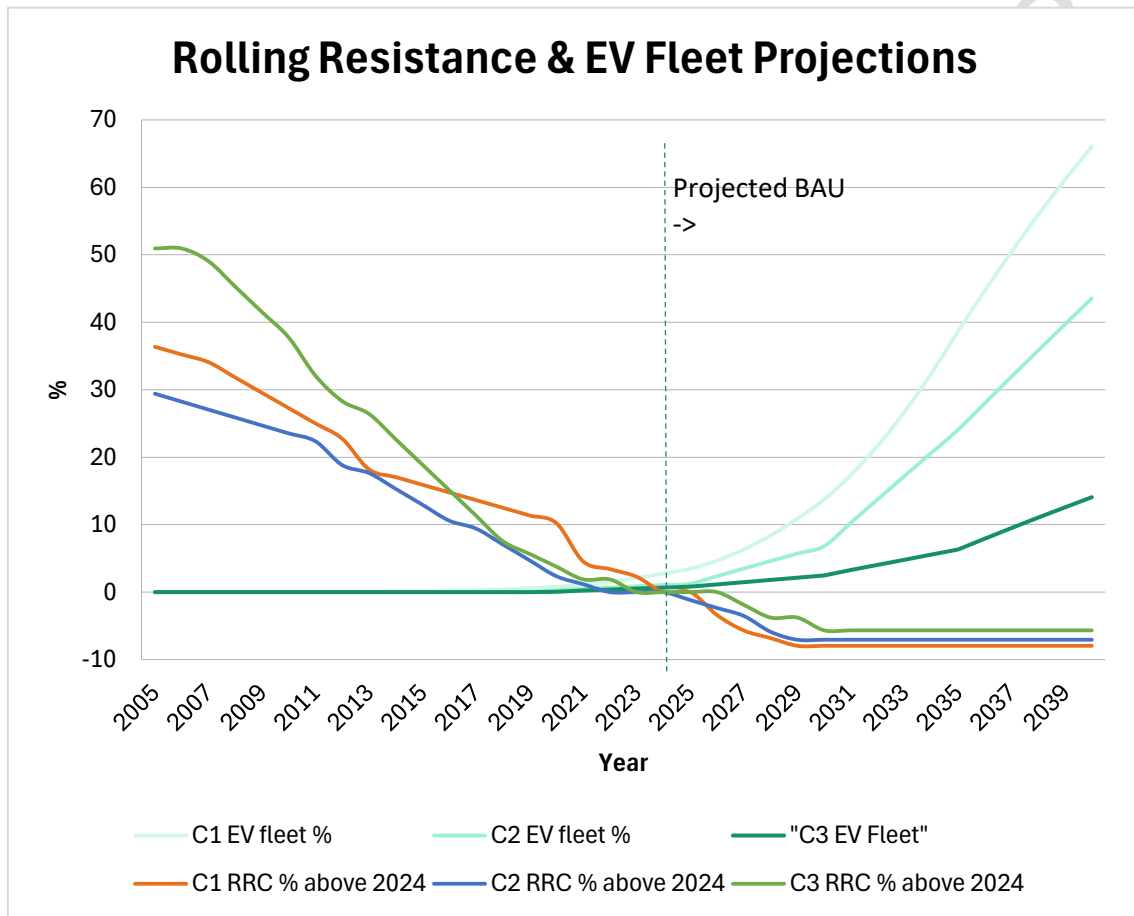
1287 For Passenger Cars (C1) and Vans (C2): 2030: 55% CO₂ emission reduction for new cars, 40% for
 1288 new vans (compared to 2021 levels). 2035: 90% zero-emission mandate for all new sales.

1289 For Heavy-Duty Vehicles (C3): 45% (2030), 65% (2035), and 90% (2040) reduction targets for new
 1290 truck sales 2030: 45% CO₂ emission reduction for new truck sales.

1291 **Table 1-24: Share of improvement in emissions as compared to baseline of the tyre**
 1292 **categories as a result of rolling resistance and developing energy mix.**

Factor	2005	2011	2017	2024	2032	2040
Passenger/car BEV sales share (C1)	0%	0.11%	1.57%	8.96%	65.27%	100%
C1 BEV fleet share	0%	0%	0.27%	2.75%	21.69%	66.1%
Commercial Vehicle BEV sales share (C2)	0%	0%	0%	5%	61,6%	100%
C2 BEV fleet share	0%	0%	0%	1.05%	13.76%	43.55%
HDV BEV sales	0%	0%	0%	0.42%	3.1%	12.96%
C3 EV fleet share	0%	0%	0%	0.67%	4.04%	14.07%

Factor	2005	2011	2017	2024	2032	2040
Renewables share in grid	Not relevant	Not relevant	Not relevant	48%	60%	72%
C1 Use Phase EV GHG Savings vs ICE	-	-	-	45%	64%	83%
C2 Use Phase EV GHG Savings vs ICE	-	-	-	45%	64%	83%
C3 Use Phase EV GHG Savings vs ICE	-	-	-	22.5%	32%	41.5%



1293

1294 **Figure 1-6: Development of GHG emissions over the years as a result of rolling resistance and**
 1295 **energy mix developments (own compilation).**

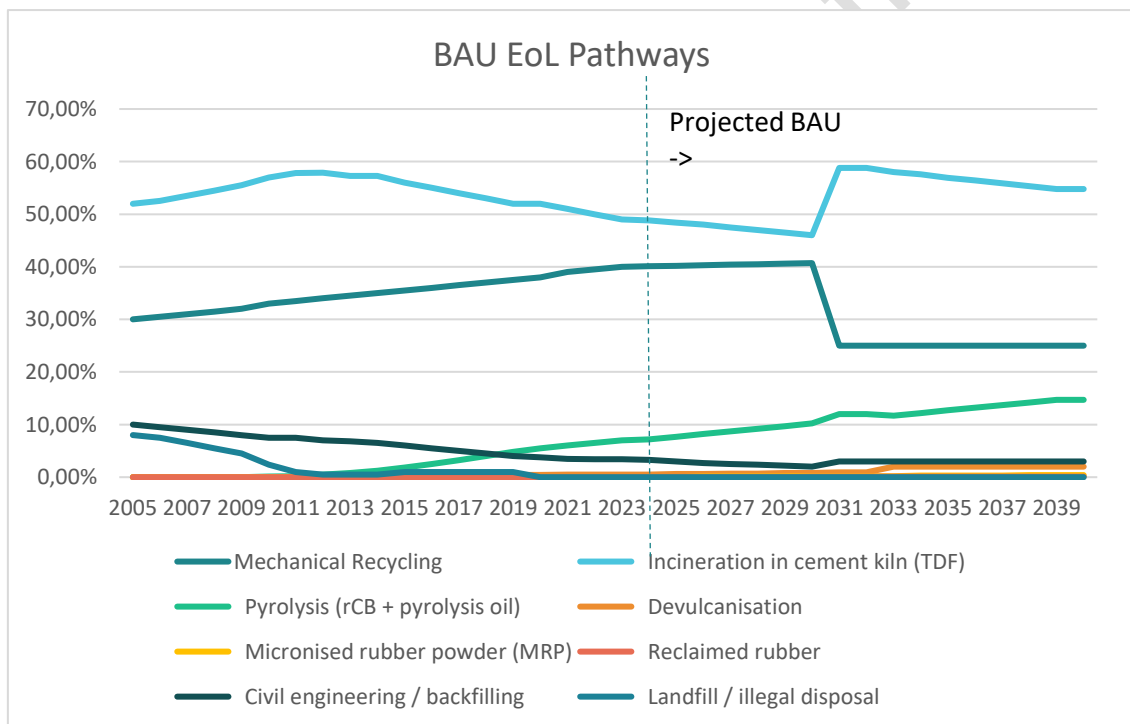
1296 **1.7.2.1. End of Life Pathways**

1297 The BAU EoL pathway trajectory reflects:

- 1298 • Mechanical recycling (granulation): the development of volumes recycled is broadly flat
 1299 through 2030, then declining sharply from 2031 as the EU Microplastics Regulation
 1300 restricts artificial turf applications. It is assumed in the model that this will cause more
 1301 co-processing in cement kilns, when it may in fact be more likely that these tyres are

- 1302 exported to third countries (depending on how effective the waste shipment regulation
 1303 implementation is).
- 1304 • Incineration in cement kiln (TDF): slow decline as higher-value routes expand.
- 1305 • Pyrolysis (rCB + pyrolysis oil): growth from commercial scale-up, significant from 2028
 1306 onwards.
- 1307 • Devulcanisation and MRP: pre-commercial to commercial expansion through the 2030s.
- 1308 • Civil engineering, export and landfill: declining across the projection period.

1309 In the current modelling, the EoL PEF values are available for the years 2024 and for the design
 1310 options as calculated in 2024, and per kg. These are in the first instance somewhat negligible in
 1311 the current analysis of Task 5 when compared to the use phase, as any assumed “recycling”
 1312 leads to credits in the PEF Circular Footprint Formula. The diagram below shows the assumed
 1313 EoL pathways taken by different waste streams with no further intervention.



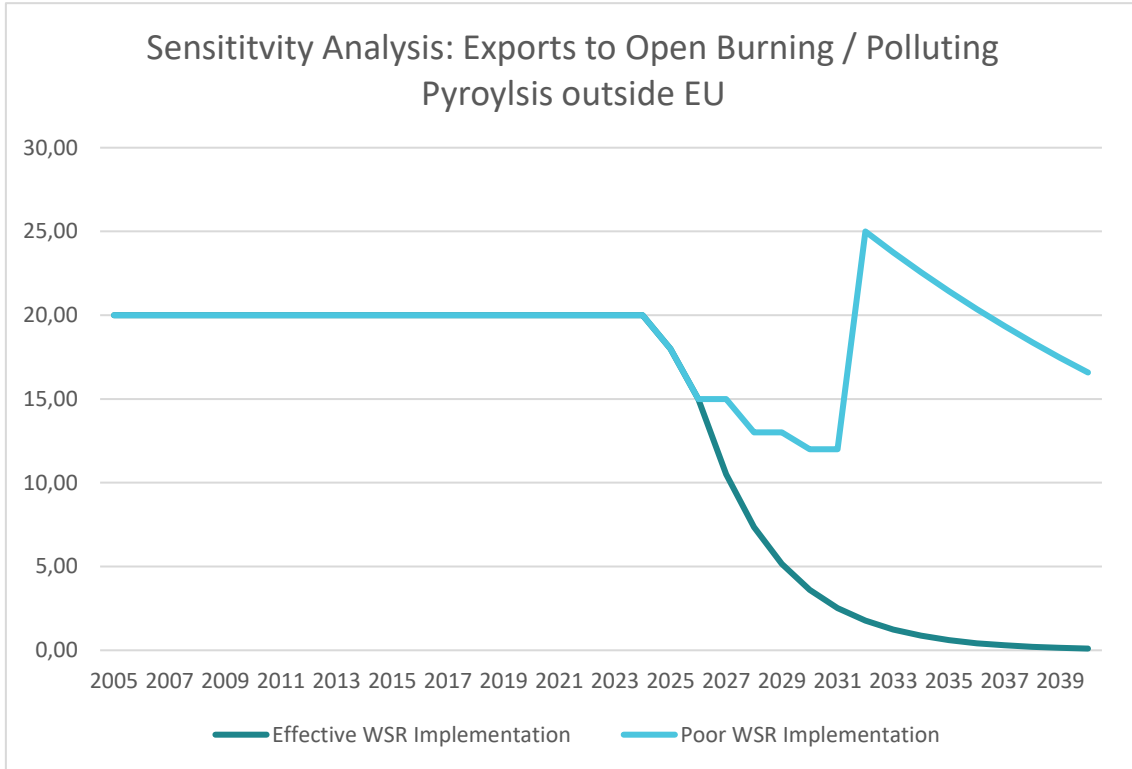
1314

1315 **Figure 1-7: Assumed development of volumes of tyres treated in various EoL pathways in**
 1316 **BAU (share in %).**

1317 In Task 5 a sensitivity analysis was applied to determine the impacts of tyres exported to
 1318 pyrolysis or other practice outside the EU. To better understand the impacts of these exports,
 1319 an isolated export factor was applied of 20% until 2024, with two scenarios:

- 1320 a) exports to open burning decrease over time due to successful implementation
 1321 of the Waste Shipment Regulation (WSR), which also stops increases in exports
 1322 in 2031 due to microplastic bans.
- 1323 b) Exports to open burning decrease a little due to the WSR, but not massively
 1324 due to difficulties in implementation. Here a decrease over time until 2031 is

1325 projected in BAU, but then the lack of recycling markets in 2031-2032 for
 1326 mechanical recycling outputs leads to a large uptick in ELT exports to countries
 1327 that cannot process this waste effectively. Improvements in processing
 1328 capacities in these countries have not been accounted for in the calculation to
 1329 maintain simplicity.

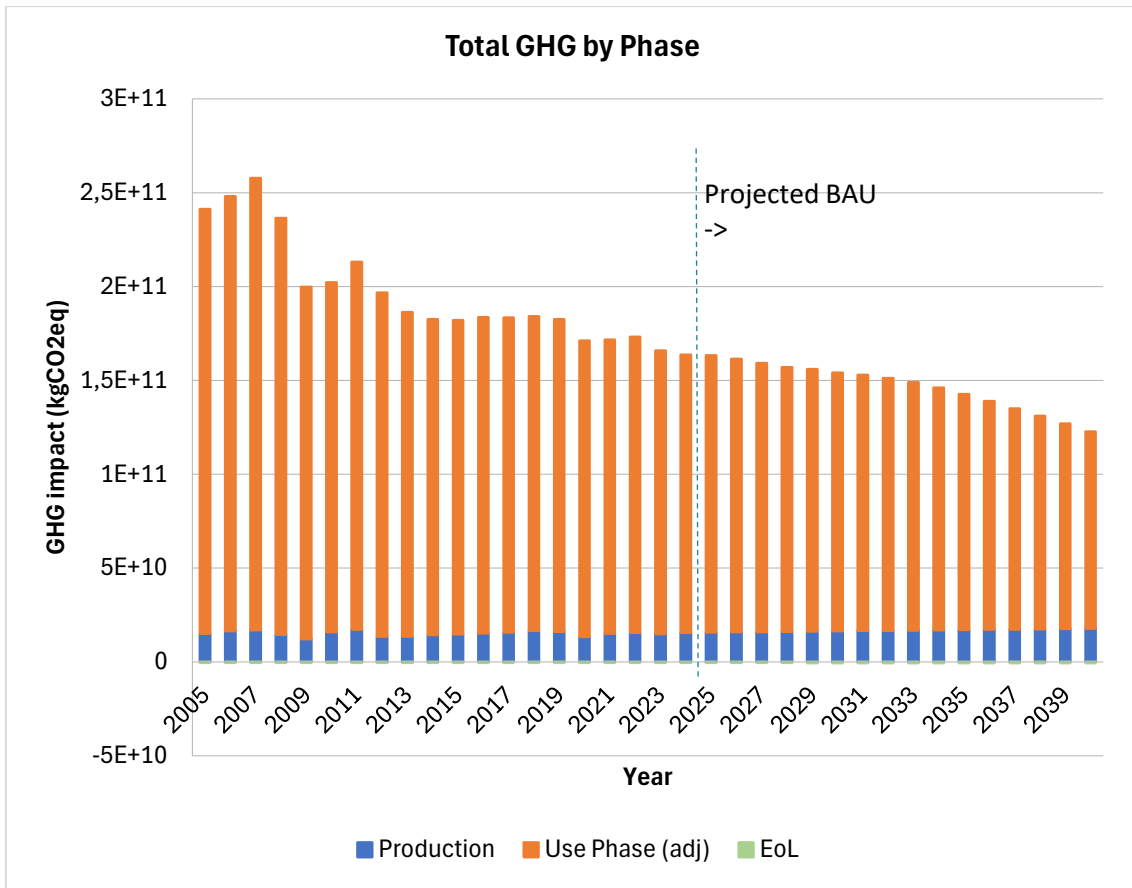


1330
 1331 **Figure 1-8: Exports to open burning/polluting pyrolysis outside the EU in BAU (share in %).**

1332 Both Figure **Figure 1-7** and **Figure 1-8** assume that minimal actions are taken to soften the blow
 1333 of the mechanical recycling market losing around one third of its output market in 2031 when
 1334 the artificial turf regulation comes into play. They make it clear that measures to improve
 1335 recycling output markets are needed to avoid these impacts.

1336 **1.7.3. LCA Impact Results Baseline**

1337 The following figures show the BAU assumed impacts. In **Figure 1-9**, it can be seen that the total
 1338 GHG emitted is dominated by the use phase, which declines as the EU vehicle fleet becomes
 1339 more electrified. **Figure 1-10** shows the use phase GHG emissions through to 2040 by tyre type.



1340

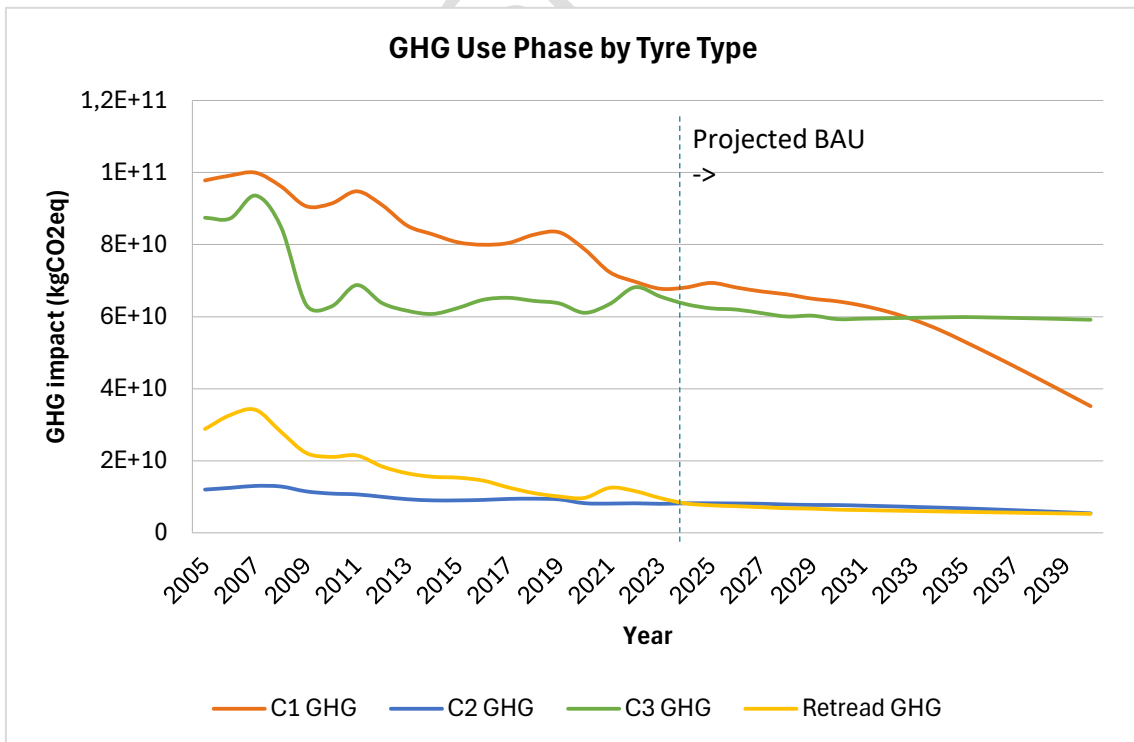
1341 **Figure 1-9: Development of total GHG impacts in BAU of tyres placed on the market in the U**
 1342 **throughout their lifecycle (share in %).**

1343 As can be seen in **Table 1-25** below, the overall annual Greenhouse Gas emissions from the tyres
 1344 fleet is estimated to be 164 Mt CO₂eq in 2024, decreasing to 123 Mt CO₂eq in 2040 thanks to
 1345 electrification of the vehicle fleet. Correspondingly, for C1 tyres the use phase reduces from 86%
 1346 of the total GHG impacts to 68% as a result of electrification and more renewable energies in
 1347 the electricity mix. This increases the importance of measures that reduce impacts in the
 1348 production and EoL phase and the downward trend will continue as the passenger car fleet EV
 1349 penetration increases from 66% EVs in 2040 in the future.

1350 **Table 1-25: Share of improvement in emissions as compared to baseline of the tyre**
 1351 **categories as a result of rolling resistance and developing energy mix.**

	2024	2032	2040
C1 (kgCO ₂ eq)			
Total GHG	7,77E+10	7,17E+10	4,64E+10
Use Phase	6,81E+10	6,14E+10	3,52E+10
Production	1,01E+10	1,09E+10	1,18E+10
EoL	-4,78E+08	-5,41E+08	-5,86E+08

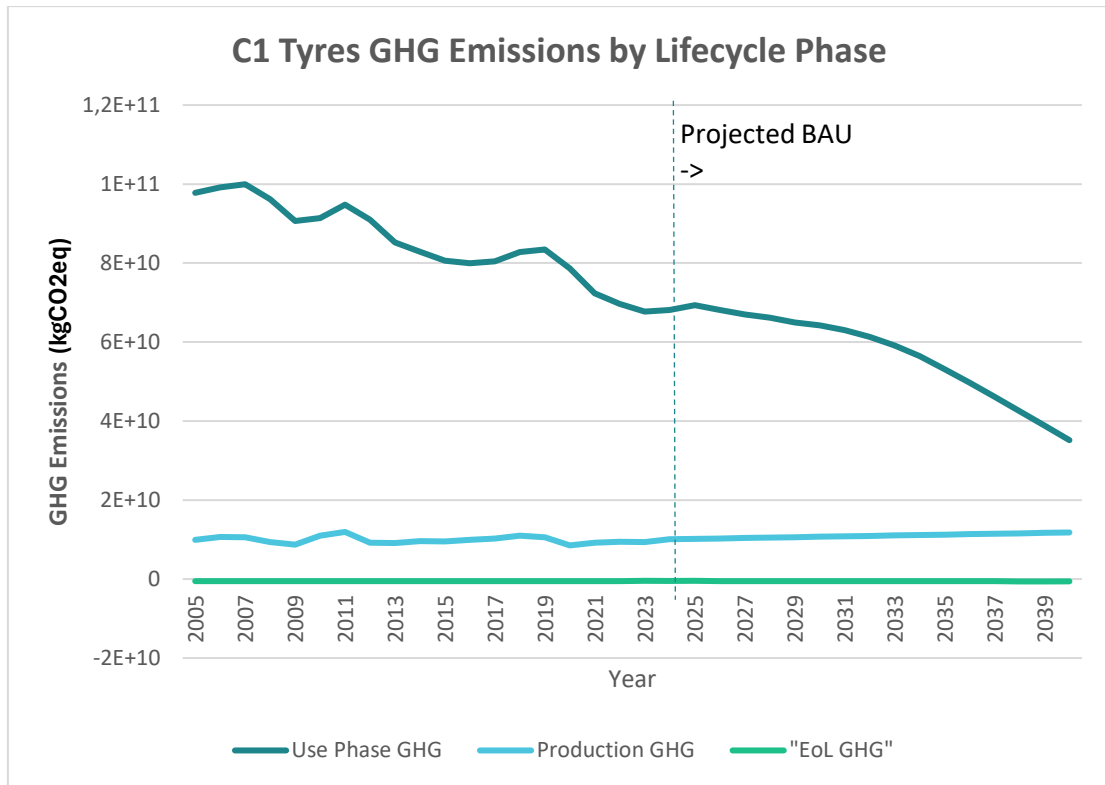
	2024	2032	2040
Production & EoL as % of Use Phase	14%	17%	32%
C3 (kgCO2eq)			
Total GHG	6,90E+10	6,51E+10	6,48E+10
Use Phase	6,54E+10	6,13E+10	6,09E+10
Production	3,87E+09	4,02E+09	4,19E+09
EoL	-2,64E+08	-2,61E+08	-2,72E+08
Production & EoL as % of Use Phase	6%	6%	6%
Total (C1, C2, C3, retreads) (kgCO2eq)			
Total GHG	1,64E+11	1,52E+11	1,23E+11
Use Phase	1,50E+11	1,36E+11	1,07E+11
Production	1,56E+10	1,67E+10	1,78E+10
EoL	-9,71E+08	-1,05E+09	-1,11E+09
Production & EoL as % of Use Phase	10%	11%	16%



1352

1353
1354

Figure 1-10: Development of total GHG impacts in BAU in use phase by tyre category (kgCO2eq).



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1356

Figure 1-11: C1 tyre fleet GHG emissions by lifecycle phase.

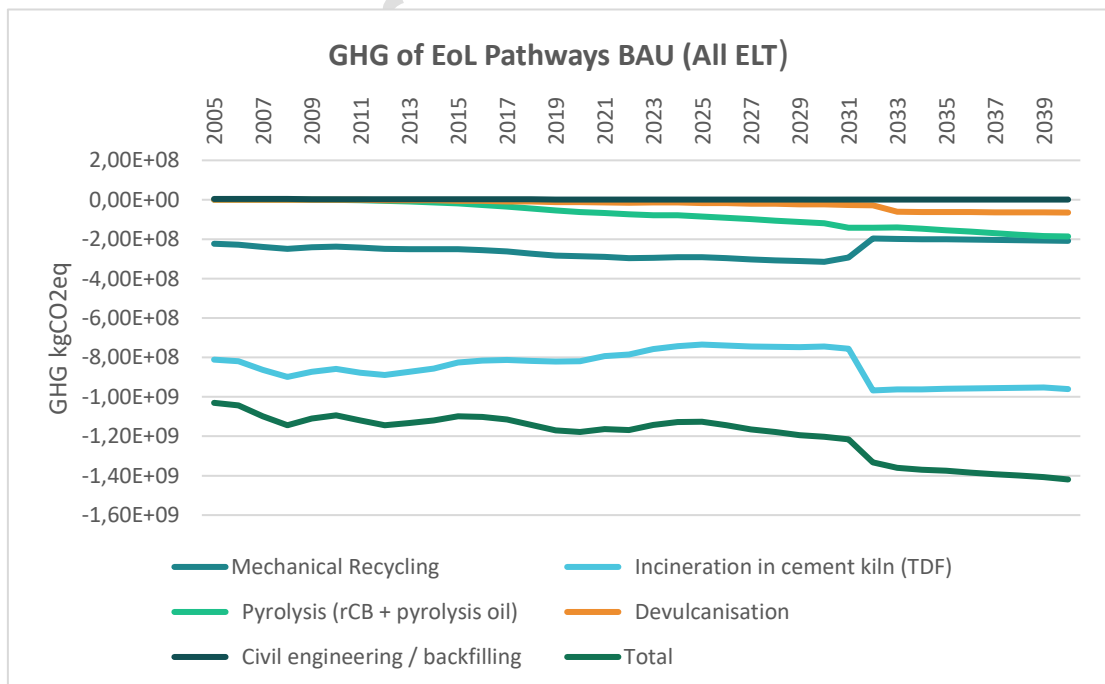
1357

For the end of life pathways, the ELT arising are multiplied by the EoL tyre mass and the percentage share entering different treatment pathways. Since the Circular Footprint Formula assigns credits to material re-use, all EoL impacts are considered GHG savings according to the PEF methodology. In total, the annual savings are calculated around -1.1 MT CO₂eq in 2024.

1358

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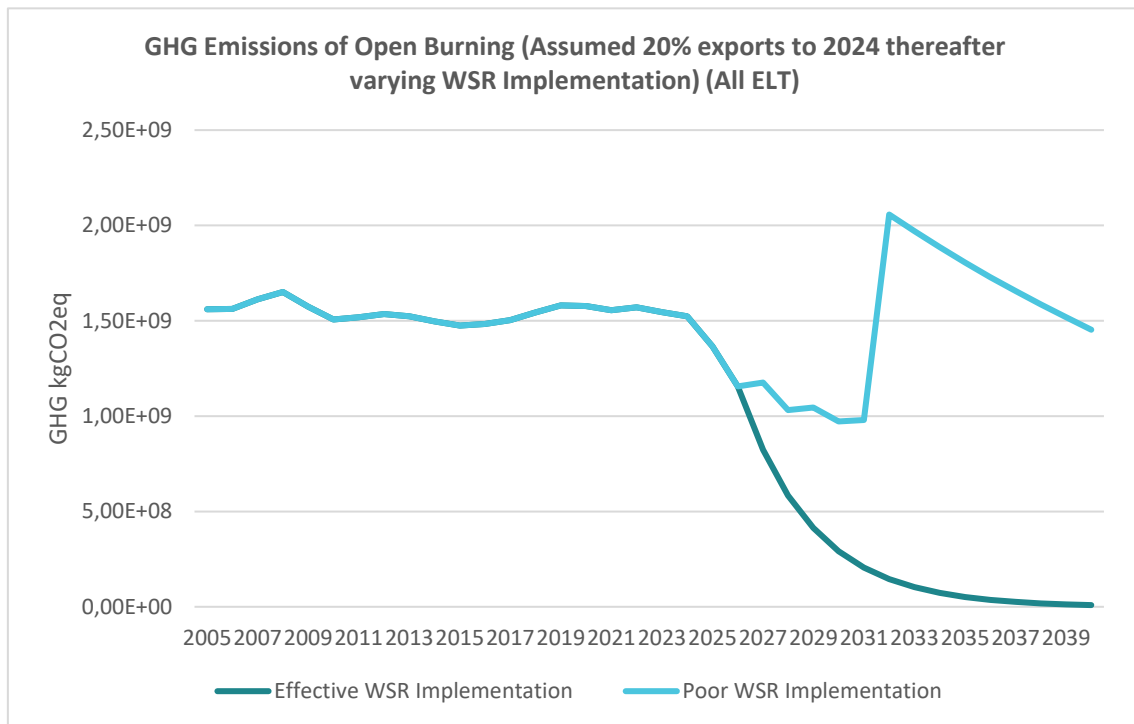
1361

1362

1363

Figure 1-12: Annual EoL GHG impacts of tyres sent to various treatment pathways in BAU (kgCO₂eq).

1364 Unlike other EoL pathways, open burning does not contribute to recycling credits. The sensitivity
 1365 analysis applied to 20% of all modelled tyre types exported to such processes in 2024 would lead
 1366 to annual GHG impacts of 1.5 Mt CO₂eq in 2024.



1367

1368 **Figure 1-13: Annual GHG emissions of export of 20% ELT to open burning treatment routes**
 1369 **outside the EU (kgCO₂eq).**

1370 **1.7.4. C3 Retreading Model**

1371 To calculate more clearly the impacts of retreading on the market, a specific sub-model was
 1372 developed to consider how the share of budget tyres impacts the market over time.

1373 Budget tyres are considered to be in the lower-quality segment of the C3 market. They are
 1374 assumed in the model to have the same weight and materials as the base case C3 tyre with the
 1375 same production and EoL impacts. However, they are modelled to have a significantly shorter
 1376 service life of 130,000 km versus 245,920 km for a new C3, and a higher use phase impact if
 1377 assumed that they generally have worse RRC than a good retread.

1378 To take this into account, a budget share of C3 tyres was modelled over time. Since increasing
 1379 budget tyres undercut and impact the retreadable tyres in the market, in the BAU scenario, the
 1380 retread rate goes down into the future as the budget rate goes up over time. Retread rates are
 1381 calculated from 2005 to 2024 based on replacement sales data. Since Eurostat provides total C3
 1382 sales which represent both OEM and replacement sales, and OEM Sales data from Tyres Europe
 1383 are only available from the years 2019 – 2024 in the Task 2 report it was necessary to estimate
 1384 the OEM Sales for other years in the model. This was done based on a supplementary stock
 1385 model, where ACEA bus and HCV new vehicle registrations are used to determine an
 1386 approximate OEM C3 vehicle sales, based on multiplying by an average of 8 tyres per vehicle
 1387 (allowing fitting to the data points available from Tyres Europe).

1388 With the estimated OEM sales, it is possible to calculate the retread rate as the following:

1389
$$\text{C3 Retread Rate} = \text{Retread sales} \div (\text{Eurostat total sales} - \text{OEM sales})$$

1390 **Table 1-26: Total sales and sale shares of tyre categories under BAU and retread scenarios.**

Year	2005	2011	2017	2024	2032	2040
BAU Budget share of C3	12%	20%	31%	35%	42%	48%
BAU Budget Sales Million Units	1.83	3.16	5.05	5.81	7.18	8.62
Retread Scenario Budget Share	12%	20%	31%	35%	31.5%	27.5%
Retread Scenario Budget Sales Million Units	1.83	3.16	5.05	5.81	5.44	4.94
BAU Retread rate	45.9%	37.4%	23.7%	16.7%	13.7%	11.3%
BAU Retread Sales (Million units)	5.16	4.55	2.81	2.05	1.71	1.49
Retread Scenario Retread Rate	45.9%	37.4%	23.7%	16.7%	26.2%	45.0%
Retread sales million units	5.16	4.55	2.81	2.05	3.33	5.93
Assumed C3 OEM Sales (million units) *est.	4*	3.6*	4.3*	3.34	4.9*	5,3*

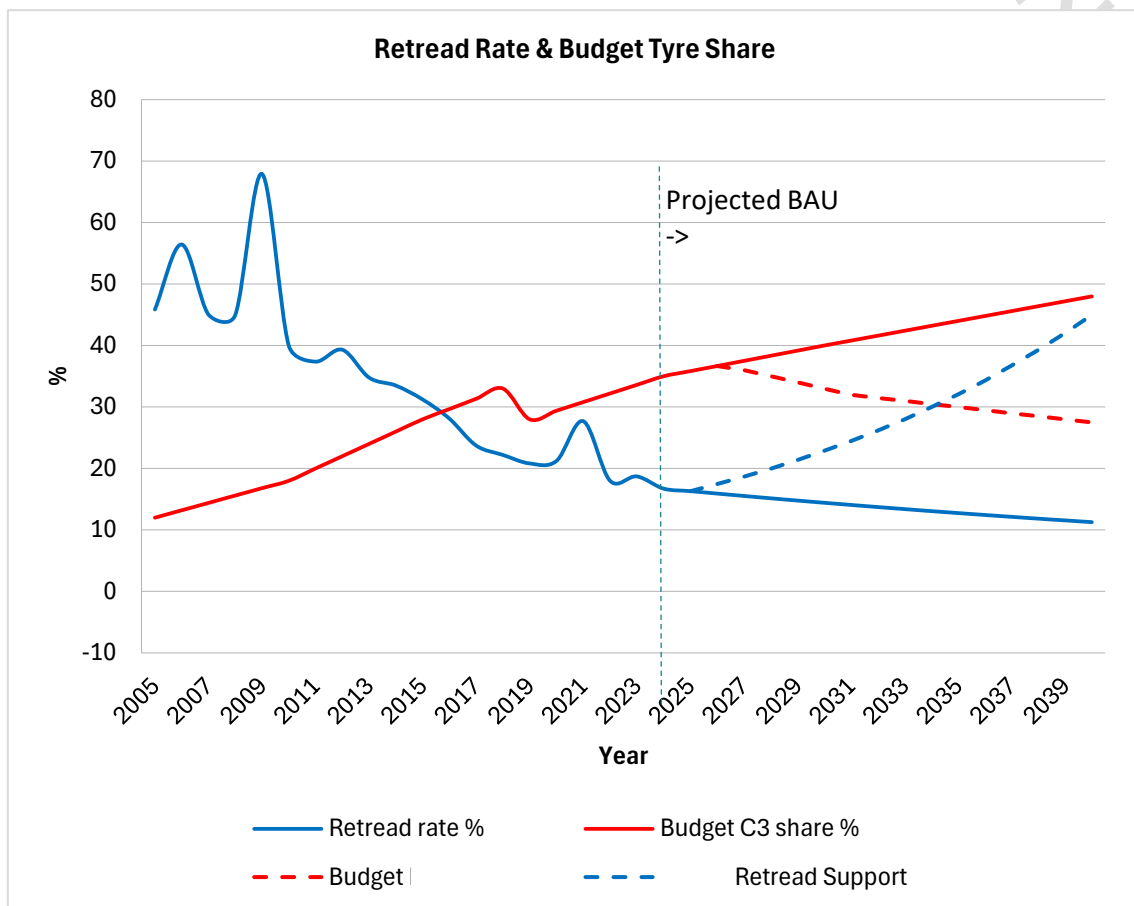
1391 For the business as usual scenario, it is assumed that no specific regulatory measures are taken
 1392 to support the market, and the market decline continues slowly downwards. Given the past
 1393 drops, this is possibly too optimistic and assumes that additional losses in the market come from
 1394 independent retreaders going out of business while larger manufacturers manage to maintain
 1395 their operations. Without further intervention, it is assumed that the budget tyre share
 1396 increases over time. The drop in the budget tyre share in 2019 aims to simulate EU anti-dumping
 1397 measures on cheap imports which had a brief impact on the percentage of budget imports. It
 1398 can be seen that the retread rate increased during the financial crisis, where less new tyres were
 1399 purchased, as well as during Covid.

1400 For the retread scenario, support to retreading is modelled in a conservative approach: it is
 1401 assumed there is not a ban of non-retreadable tyres, but the combined policy measures lead to
 1402 a reversal in C3 retreading rates back to 2005 levels by 2040. It is assumed that this leads to a
 1403 lower share of budget tyres in the market as shown in **Table 1-26** above.

1404 *Note: due to time constraints, in its current form the retreading sub-model does not take into*
 1405 *account the fact that a larger proportion of budget tyres would lead to a larger total number of*
 1406 *sales in the EU market due to the assumed shorter lifetimes of budget tyres requiring a larger*
 1407 *number of tyres to meet the same service km of the EU fleet (1.54 years and 130,000 km vs 3*

1408 years and 253,000 km for new C3). This means that the modelled results to follow can be
 1409 considered conservative, as environmental impacts related to budget tyres are calculated for a
 1410 lower number of tyres than would be needed to meet the km needs of the vehicle fleet.

1411 The retread rate and budget tyre share are shown in **Figure 1-14** below. The budget share is
 1412 assumed to take a drop in 2018/19 due to sanctions introduced on imports which were,
 1413 however, soon after circumvented. The share itself is a first indication which requires validation
 1414 from stakeholders. First indications of import/export consumption across the EU indicate it may
 1415 be 10% higher across all modelled years. The retread rate can be seen to increase following the
 1416 2007 financial crisis and during Covid, implying that when supply chains breakdown or costs are
 1417 cut, retreading increases.

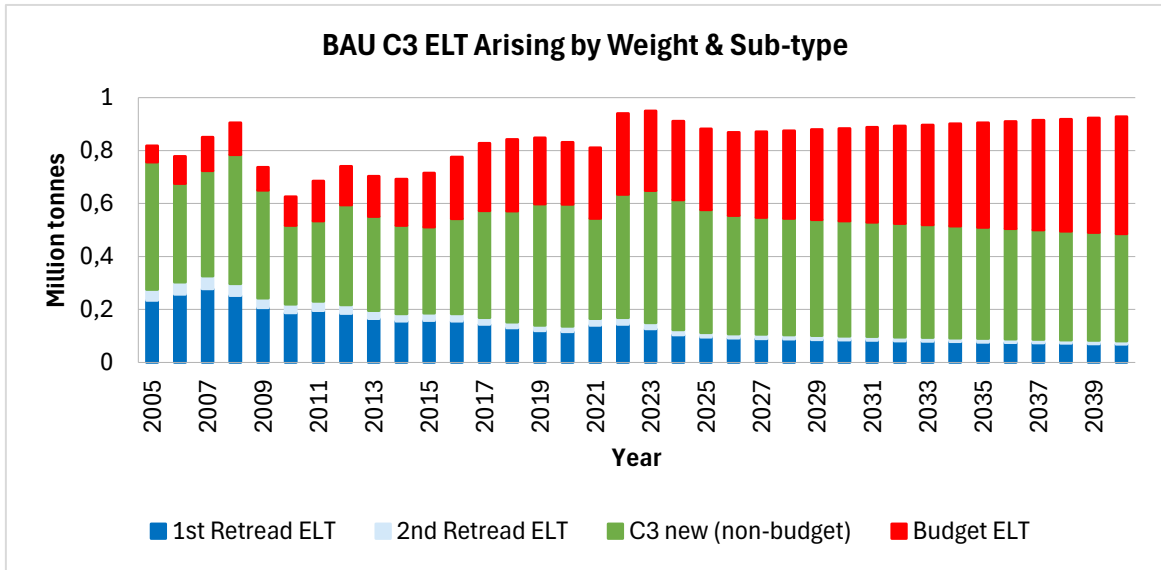


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1419 **Figure 1-14: Trend development of the sales of budget tyres and retreads under BAU and**
 1420 **retread scenarios (own illustration).**

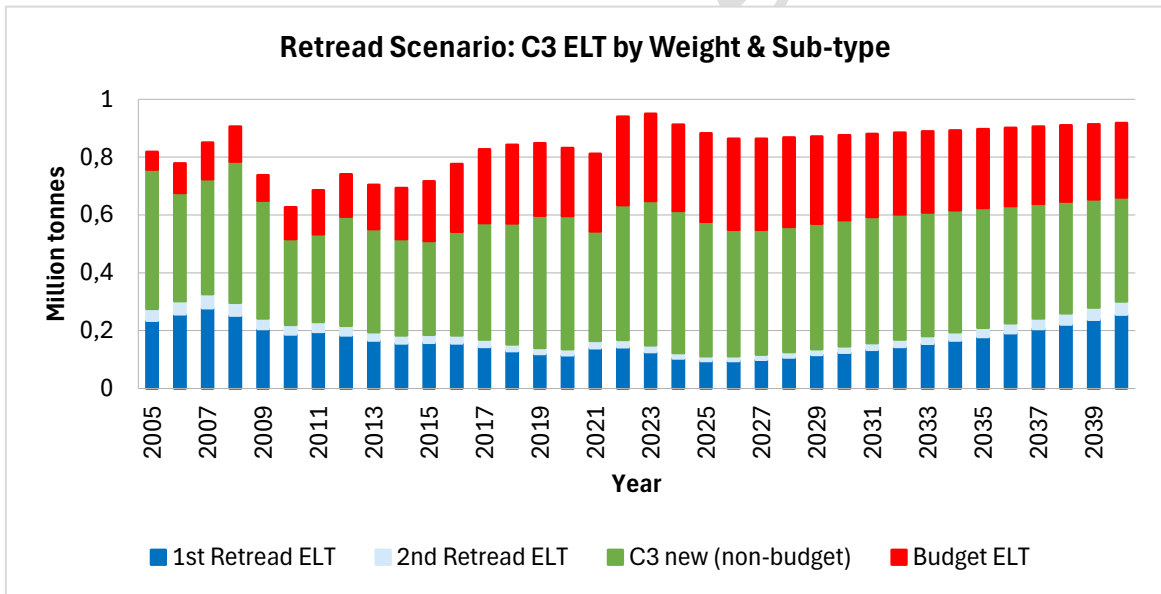
1421

1422 Applying the budget tyre segment and reduced lifetimes to the *static projected* C3 sales, the
 1423 following ELT arising is observed:



1424

1425 **Figure 1-15: ELTs arising in BAU by sub-category (millions of tonnes).**



1426

1427 **Figure 1-16: ELTs arising in retread scenario by sub-category (millions of tonnes).**

1428 **1.7.4.1. Mass flow and waste avoided**

1429 The retreading process involves three distinct material events for each carcass:

- 1430 • Buffing: approximately 7.7 kg of rubber is removed from the worn carcass surface to
 1431 prepare it for the new tread. This is a separate waste stream (rubber crumb/dust) not
 1432 counted as ELT. Form exchanges with tyre manufacturers who have their own retreading
 1433 facilities, the consultants are aware that this material is often used as recycled content in
 1434 tyre manufacture. Nonetheless, it is not clear if this is also a common practice for

1435 independent retreaders and there is no estimate on the split of retreads performed
 1436 between tyre manufacturers and independent retreaders. The credits related to the use
 1437 of this stream are thus not included in this modelling as a conservative approach.

1438 • Tread application: 22 kg of new tread rubber is bonded to the buffed carcass, bringing
 1439 the retread tyre weight to approximately 66 kg at the start of its second life.

1440 • End of retread life: after wearing through its tread (wear \approx 12.3 kg), the retread tyre
 1441 becomes an ELT at approximately 51.7 kg. 85% of retread sales are assumed to be first
 1442 retreads, and 15% to be second retreads.

1443 The waste and material saving from retreading is assessed on a cohort basis:

1444 • Waste avoided in year Y = retread sales \times C3 EoL weight: these C3 carcasses did not enter
 1445 the ELT stream in year Y.

1446 • Waste from the rubber crumb/dust fraction is disregarded as assumed to be recycled
 1447 (usually this is a good fit for devulcanisation).

1448 • Material avoided = retread sales \times casing weight: the net carcass material reused rather
 1449 than discarded and replaced with a full new tyre carcass. The casing weight is deduced to
 1450 be the retread weight minus the newly added tread, in this case: 44 kg.

1451 Additional waste generated by budget tyres relative to a new premium C3 tyre

1452 • A new C3 casing covers 253,410 km before becoming waste at approximately 51.7 kg. A
 1453 budget tyre covers 130,000 km before becoming waste at the same weight. To deliver
 1454 the same 253,000 km that one premium C3 provides, $253,000 / 130,000 = 1.95$ budget
 1455 tyres are needed, generating $1.95 \times 51.7 = 100.6$ kg of waste. The premium C3 produces
 1456 one EoL event of 51.7 kg for the same distance. The difference of $100.6 - 51.7 = 48.9$ kg
 1457 is the additional waste burden per budget tyre sold relative to a single new premium C3
 1458 covering the same kilometres.

1459 Additional waste generated by budget tyres relative to the retread system

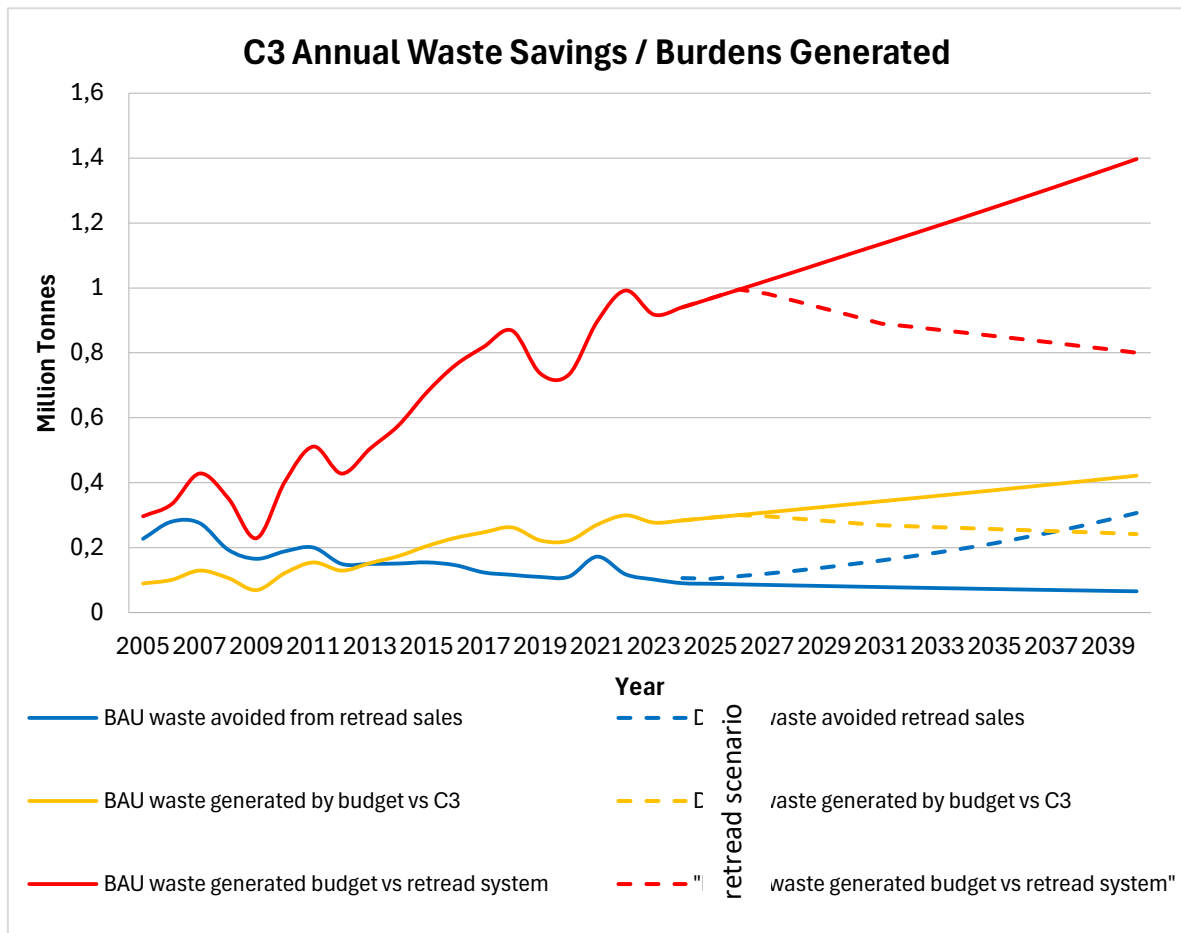
1460 • A premium C3 casing that enters the retreading system delivers an average of 536,668
 1461 km of service over its full life (253,410 km as a new tyre, plus an average of 1.15 retread
 1462 lives of 245,920 km each, reflecting the 85% of casings that receive one retread and the
 1463 15% that receive two). That service life produces exactly one EoL waste event, at which
 1464 point the casing weighs 51.7 kg.

1465 • A budget tyre covers 130,000 km before becoming waste, with the same assumed EoL
 1466 weight of 51.7 kg. To deliver the same 536,668 km of service that one retreaded casing
 1467 provides, $536,668 / 130,000 = 4.13$ budget tyres, generating 4.13 EoL events totalling 4.13
 1468 $\times 51.7 = 213.7$ kg of waste. The retread system produces just one EoL event of 51.7 kg for
 1469 the same km. The difference of $213.7 - 51.7 = 162$ kg is the additional waste burden per
 1470 budget tyre sold relative to the km-equivalent retread system output.

1471 This is a simplified attribution, as the budget waste burden is applied at the point of sale,
 1472 assuming that this burden is future waste.

1473 Alternatively, these waste impacts can be demonstrated on a per million km basis:

- 1474 • Retread system: 0.096 tonnes per million km
- 1475 • Premium C3: 0.210 tonnes per million km
- 1476 • Budget: 0.398 tonnes per million km



1477

1478 **Figure 1-17: C3 annual waste savings (burdens generated in BAU and retread scenario by**
 1479 **sub-category (millions of tonnes).**

1480 It can be seen from the graph above that increasing budget shares lead to significantly higher
 1481 waste volumes overall compared with a retread system (these are annual values, *not*
 1482 cumulative).

1483 **1.7.4.2. GHG savings End of Life and Production**

1484 **Per-km equivalence basis**

1485 All retread saving and budget penalty comparisons are made on a per-kilometre-of-service basis.
 1486 Assumptions for the calculation of the per-km GHG for each scenario and results are presented
 1487 in the table below.

1488 **Table 1-27: Assumptions and results for the per km GHG impacts of the BAU and Retread**
 1489 **scenarios (own compilation).**

Scenario	Total km covered	GHG formula (per km)
A: C3 new, once	253,410	(Production C3 + Use C3 + EoL C3) / 253,410
B: C3 + 1 retread	499,330	(Production C3 + Use C3 + Production Retread + Use Retread + EoL Retread) / 499,330
C: C3 + 2 retreads	745,250	(Production C3 + Use Phase C3 + 2xProduction Retread + 2xUse Retread + EoL Retread) / 745,250
D: Budget, once	130,000	(Production C3 + Use Budget + EoL C3) / 130,000

1490

1491 **Retread savings vs single use C3**

1492 When a retreader takes a worn C3 carcass and applies a new tread, the carcass gets a second
 1493 life covering 253,410 km, and a new C3 tyre does not need to be manufactured to cover those
 1494 same kilometres. The savings per retread are therefore the difference between what those
 1495 253,410 km would have cost environmentally as a new C3 tyre, and what the retread actually
 1496 costs.

1497 A new C3 covers 253,410 km, so to cover the retread km, $245,920 \div 253,410 = 0.97$ new C3 tyres
 1498 are needed. Each retread avoids slightly less than one full new C3 production and EoL cycle, and
 1499 adds a retread manufacturing and End of Life step.

1500 The use-phase impact cancels out because both are covering the km at the same rolling
 1501 resistance. The annual fleet saving is the per-retread saving multiplied by the number of retreads
 1502 sold in each year.

- 1503 • C3 prod+EoL net: $233.1 - 15.2 = 217.9$ kg CO₂eq per tyre
- 1504 • Retread prod+EoL net: $82.1 - 20.5 = 61.6$ kg CO₂eq per retread
- 1505 • Saving = $0.97 \times 217.9 - 61.6 = 149.8$ kg CO₂eq per retread

1506 Based on the LCA values used in this study, this translates to a production and EoL saving of
 1507 approximately 150 kg CO₂eq per retread sold.

1508 Each successive retread continues to avoid one new C3 production and EoL cycle for
 1509 approximately the same km. The second retread therefore generates approximately the same
 1510 saving as the first. The cumulative production and EoL saving from a carcass that goes through
 1511 two retreads is therefore roughly twice the saving from a single retread.

1512 **Budget tyre vs retread system**

1513 The most direct way to express the GHG cost of a budget tyre is to compare it against a retread
 1514 which competes as a replacement option in the C3 market. To cover the same 245,920 km that
 1515 one retread delivers, a fleet operator would need $245,920 / 130,000 = 1.89$ budget tyres, each

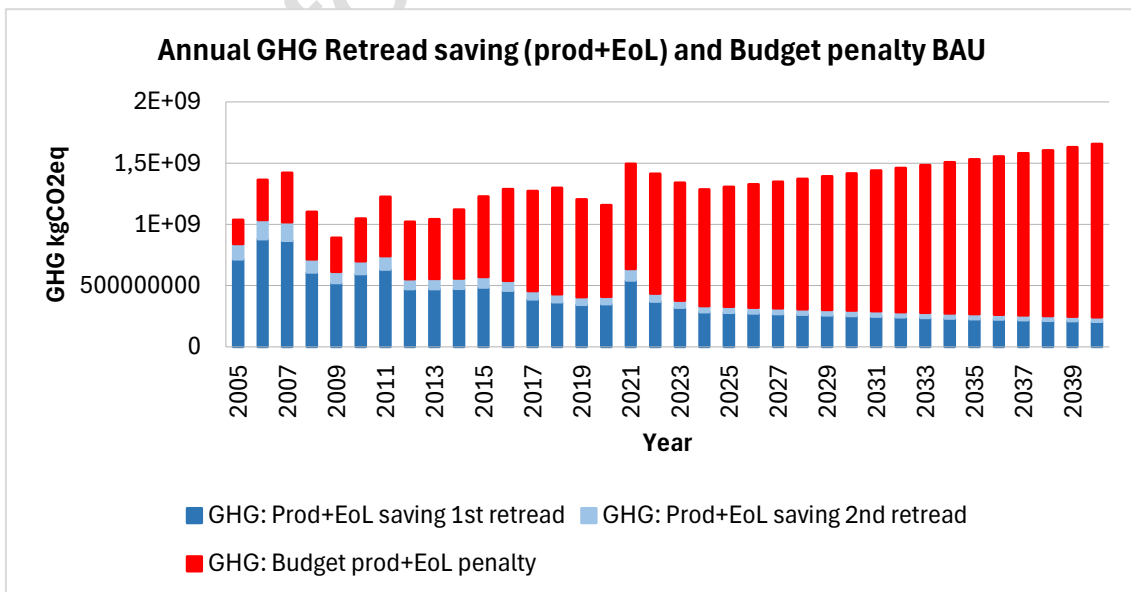
1516 carrying the full C3 production and EoL footprint of 217.9 kg CO₂eq. The retread covers those
 1517 same kilometres at a production and EoL cost of only 61.6 kg CO₂eq. The difference — 1.89 ×
 1518 217.9 – 61.6 = **350.6 kg CO₂eq** — is the excess production and EoL impact of choosing budget
 1519 over a retread for the same distance.

1520 A broader framing compares the budget tyre against the full retread system — a premium C3
 1521 casing that is retreaded an average of 1.15 times, delivering 536,218 km in total before its single
 1522 EoL event. The total production and EoL impact of that system is:

- 1523 • C3 production: 233.1 kg CO₂eq
- 1524 • 1.15 × retread production: 1.15 × 82.1 = 94.5 kg CO₂eq
- 1525 • Single EoL event at end of system life: -20.5 kg CO₂eq
- 1526 • System total: 307.1 kg CO₂eq for 536,218 km

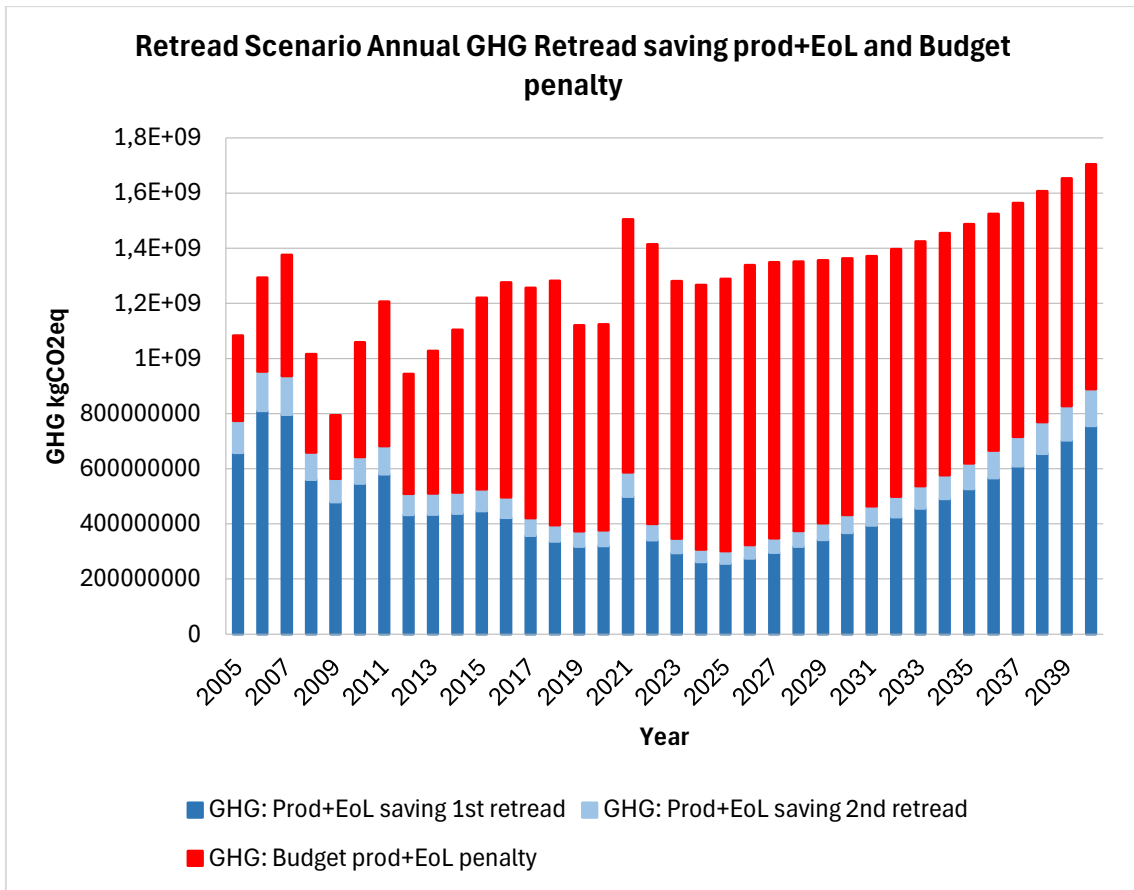
1527 A budget tyre covers 130,000 km — 24.2% of the system lifetime — so the system prod+EoL
 1528 impact attributable to those 130,000 km is 0.242 × 307.1 = 74.4 kg CO₂eq. A budget tyre incurs
 1529 217.9 kg CO₂eq for the same distance, giving a penalty of 217.9 – 74.4 = 143.5 kg CO₂eq per
 1530 budget tyre sold relative to the system baseline. This is a slightly lower figure than the direct
 1531 retread comparison because it spreads the retread system's own manufacturing footprint (94.5
 1532 kg for 1.15 retread production steps) across the full system lifetime, reducing the apparent
 1533 baseline cost per km.

1534 The 350.6 kg figure represents the transaction-level decision between buying a retread or a
 1535 budget tyre, while the 143.5 kg figure captures the lifetime opportunity cost of a budget tyre
 1536 relative to a casing that would have been retreaded. The annual fleet penalty in either case is
 1537 the per-tyre figure multiplied by budget tyre sales. As budget market share grows from 12% in
 1538 2005 to 48% in 2040, this penalty grows substantially even though the per-tyre penalty remains
 1539 fixed. The lifetime penalty is demonstrated in **Figure 1-18** and **Figure 1-19**, however it is
 1540 conservative as the total sales numbers remain fixed in the model.



1541

1542 **Figure 1-18: BAU Annual GHG retread savings and budget penalty (production and EoL) of EU**
 1543 **stock (in kgCO₂eq).**



1544

1545 **Figure 1-19: Retread Scenario annual GHG retread savings and budget penalty (production**
 1546 **and EoL) of EU stock (in kgCO2eq).**

1547 **Table 1-28: EoL and Production impacts from retread and budget tyres.**

Scenario	Factor	2024	2032	2040
BAU Scenario	Budget Penalty	9,59E+08	1,19E+09	1,42E+09
	Savings 1st Retread	2,62E+08	2,23E+08	1,89E+08
	Savings 2nd Retread	4,62E+07	3,93E+07	3,34E+07
	Total Savings Retreads	3,08E+08	2,62E+08	2,23E+08
Retread Scenario	Budget Penalty	9,59E+08	8,97E+08	8,15E+08
	Savings 1st Retread	2,62E+08	4,25E+08	7,56E+08
	Savings 2nd Retread	4,62E+07	7,49E+07	1,33E+08
	Total Savings Retreads	3,08E+08	4,99E+08	8,89E+08
BAU budget penalty is X% higher than retread scenario			32%	75%
Savings from retreading in retread scenario vs BAU			91%	299%

1548 **1.7.4.3. GHG Use Phase Sensitivity Analysis**

1549 The above calculations assume that a retread has the same RRC as a new C3 tyre, in the BC3
 1550 case, this is 5.3 N/kN. In discussions with stakeholders, it was mentioned that while reaching the
 1551 same RRC value is possible, it often falls within 0.3 N/kN of that value. The actual value is subject

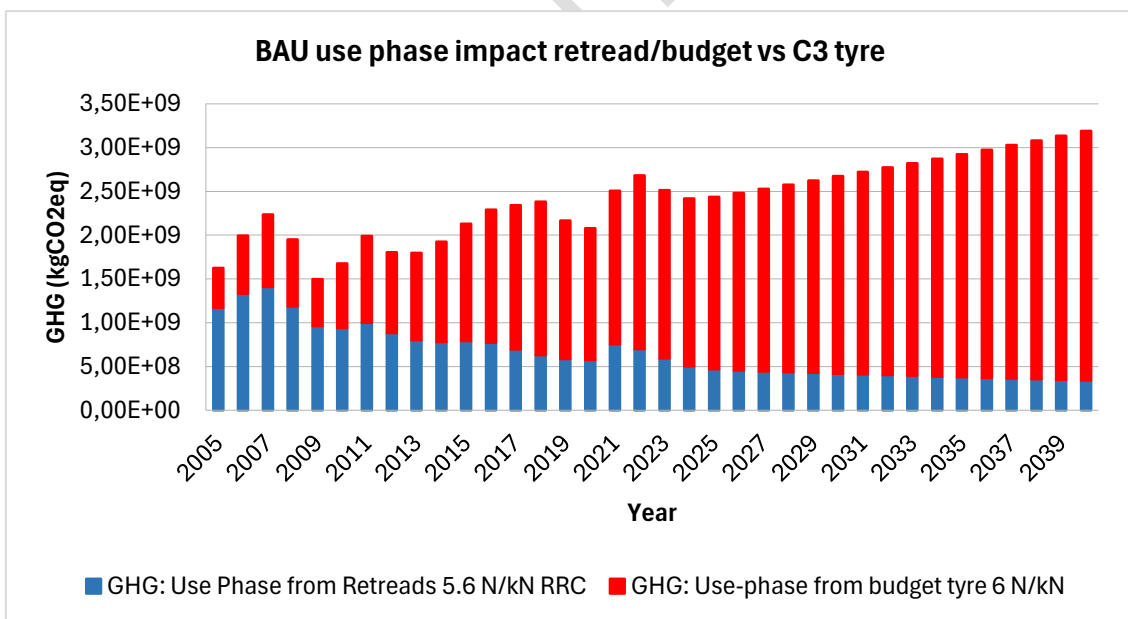
1552 to large variations, depending on the casing history and initial rolling resistance as well as the
 1553 retread process (hot/cold cure) and tread used. The LCA sensitivity analyses in Task 5 showed
 1554 that for an ICE vehicle, a value of 0.3 N/kN worse can already cancel out the savings of a retread
 1555 in EoL and production compared with a new C3 tyre with RRC 5.3 N/kN through increased fuel
 1556 use. However, retreads usually compete not with new C3 tyres, but with budget tyres. For the
 1557 purpose of comparing savings vs the budget tyre taken, a simplified sensitivity analysis in the
 1558 use phase is carried out based upon a budget tyre with RRC 6 N/kN (limit post 2028) and a
 1559 retread with RRC 5.6 N/kN. This analysis assumes that the gap in RRC remains constant between
 1560 years.

1561 To determine the use phase penalty compared to a new C3 tyre, the difference to the RRC of a
 1562 new C3 tyre per km is multiplied by the stock of retreads or budget tyres according to the BAU
 1563 and retread scenarios.

1564 The following factors are used:

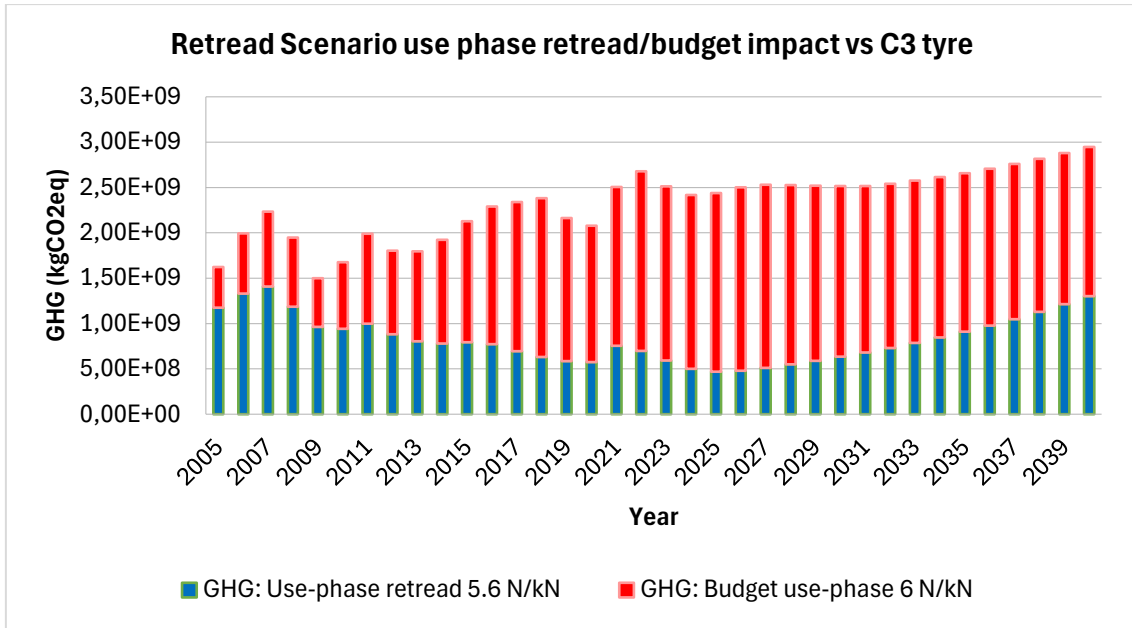
1565 **Table 1-29: Use Phase RRC values.**

Tyre	RRC	Use Phase per km (kgCO ₂ eq)
C3 new	5.3 N/kN	0,0216
C3 retread	5.6 N/kN	0,0229
C3 budget	6.0 N/kN	0.0245



1566

1567 **Figure 1-20: BAU Scenario retread/budget tyre annual GHG use phase impacts compared**
 1568 **with new C3 (kgCO₂eq).**



1569

1570 **Figure 1-21: Retread Scenario retread/budget tyre annual GHG use phase impacts compared**
 1571 **with new C3 (kgCO₂eq) (note: higher stock compared with BAU).**

1572 Within the non-premium C3 segment, BAU sees use-phase intensity rise from 198 to 218 kg
 1573 CO₂eq per tyre in service as budget share grows. The retread scenario reverses this trend,
 1574 reducing intensity to 162 kg CO₂eq by 2040 as retreads with a lower RRC of 5.6 N/kN displace
 1575 budget tyres at 6 N/kN, a 26% difference in fleet efficiency between the two scenarios.

1576 **Table 1-30 Use Phase impacts from retread and budget fleet vs C3 5.3 N/kN.**

Scenario	Parameter	2024	2032	2040
BAU	Retread 5.6N/kN Use Phase	5,02E+08	4,03E+08	3,43E+08
	Budget 6 N/kN Use Phase	1,92E+09	2,37E+09	2,85E+09
	Stock Budget & Retreads	1,22E+01	1,32E+01	1,46E+01
	GHG per tyre in service within retread+budget segment (kg CO ₂ eq)	1,97E+02	2,10E+02	2,18E+02
Retread Scenario	Retread 5.6N/kN Use Phase	5,02E+08	7,32E+08	1,30E+09
	Budget 6 N/kN Use Phase	1,92E+09	1,81E+09	1,65E+09
	Stock Budget & Retreads	1,22E+01	1,38E+01	1,82E+01
	GHG per tyre in service within retread+budget segment (kg CO ₂ eq)	1,97E+02	1,84E+02	1,62E+02

1577

1578 **1.7.5. Design Options Impacts Calculation**

1579 The Design Options calculated in Task 6 are used as the basis for determining fleet impacts across
1580 the policy scenarios developed in Task 7. Impacts across the following Design Options have been
1581 calculated across the fleet in 2032 and 2040 and compared with the BAU Scenario:

- 1582 - Recycled Content: 2032 5% rubber compound, 2040 50% reinforcement materials;
1583 changes in EoL pathways to meet feedstock supply needs.
- 1584 - Bio-Based Content: 2032 5% C1 by weight, 2040 15% C1 by weight; 2032 2% C3 by
1585 weight, 2040 5% C3 by weight.

1586 Design for recycling: building on the design options from T6, the only impacts are considered to
1587 EoL of channeling a small fraction (1-2%) of the market to civil engineering or co-processing. The
1588 preceding chapter considers separately how retreads can contribute to reductions in production
1589 and EoL for C3 tyres.

1590 Omitted from this draft version are impacts from lifetime extension (considered to take place
1591 under Euro 7 mileage indications).

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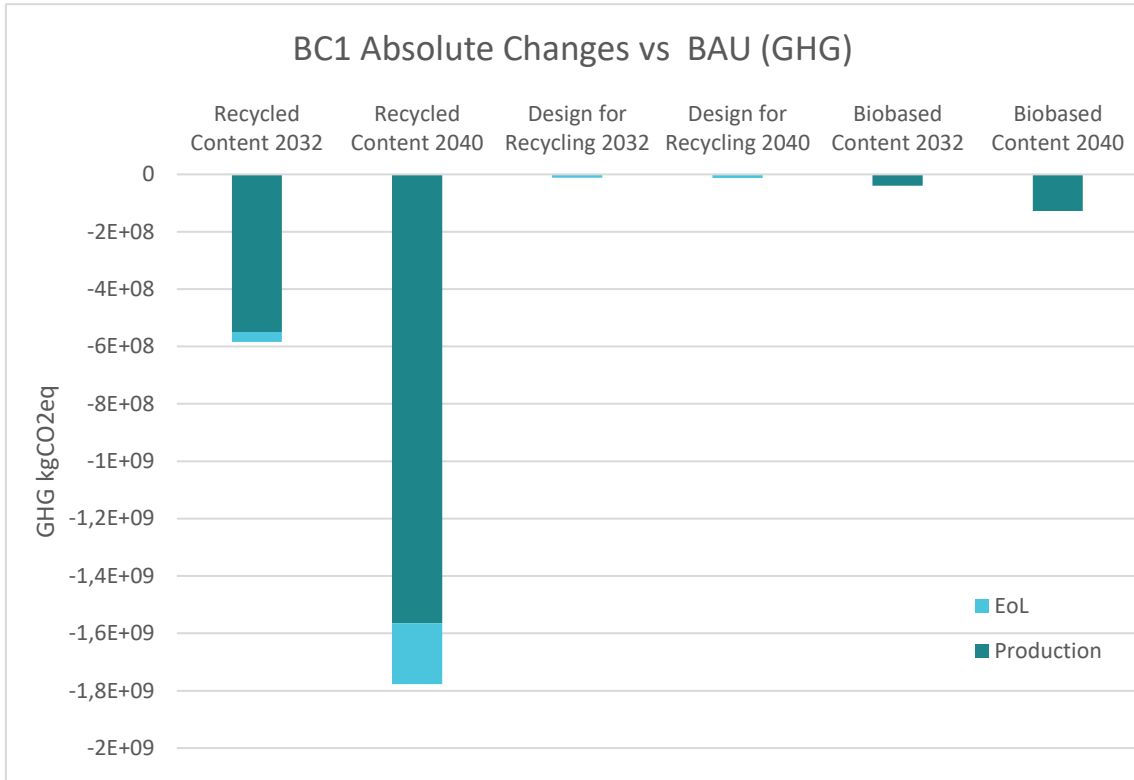
1592 Table 1-31: Overview of GHG and PEF Impacts from different design options on BC1 excluding use phase.

BC1	Recycled Content		DO-02 Design for Recycling		DO-03 Design for Recycling		Bio-Based Content		BAU		
	5%/50%	20%/80%	2032	2040	2032	2040	5% by weight	15% by weight	2024	2032	2040
GHG Emissions	2032	2040	2032	2040	2032	2040	2032	2040	2024	2032	2040
Production GHG Full Lifetime	1,00E+10	9,88E+09	1,06E+10	1,14E+10	1,06E+10	1,14E+10	1,05E+10	1,13E+10	9,76E+09	1,06E+10	1,14E+10
EoL GHG	-5,89E+08	-8,12E+08	-5,66E+08	-6,13E+08	-5,52E+08	-5,98E+08	-5,54E+08	-6,00E+08	-5,12E+08	-5,54E+08	-6,00E+08
Total	9,43E+09	9,07E+09	1,00E+10	1,08E+10	1,00E+10	1,08E+10	9,98E+09	1,07E+10	9,25E+09	1,00E+10	1,08E+10
Diff to BAU EoL & Prod	6%	16%	0%	0%	0%	0%	0%	1%			
Diff. To BAU Production GHG Full Lifetime	-5,50E+08	-1,57E+09	0,00E+00	0,00E+00	0,00E+00	0,00E+00	-3,92E+07	-1,27E+08			
Diff to BAU EoL GHG	-3,47E+07	-2,12E+08	-1,15E+07	-1,25E+07	2,38E+06	2,58E+06	0,00E+00	0,00E+00			
Total Diff to BAU EoL & Prod	-5,84E+08	-1,78E+09	-1,15E+07	-1,25E+07	2,38E+06	2,58E+06	-3,92E+07	-1,27E+08			
PEF Single Score	2032	2040	2032	2040	2032	2040	2032	2040	2024	2032	2040

BC1	Recycled Content		DO-02 Design for Recycling		DO-03 Design for Recycling		Bio-Based Content		BAU		
	5%/50%	20%/80%					5% by weight	15% by weight			
Production PEF	1,31E+06	1,29E+06	1,37E+06	1,48E+06	1,37E+06	1,48E+06	1,36E+06	1,45E+06	1,26E+06	1,37E+06	1,48E+06
EoL PEF	-7,13E+04	-1,07E+05	-6,68E+04	-7,23E+04	-6,59E+04	-7,14E+04	-6,55E+04	-7,09E+04	-6,05E+04	-6,55E+04	-7,09E+04
Total	1,24E+06	1,18E+06	1,30E+06	1,41E+06	1,30E+06	1,41E+06	1,30E+06	1,38E+06	1,20E+06	1,30E+06	1,41E+06
Diff to BAU EoL & Prod	5%	16%	0%	0%	0%	0%	1%	2%			
Diff. To BAU Production PEF Full Lifetime	-6,04E+04	-1,92E+05	0,00E+00	0,00E+00	0,00E+00	0,00E+00	-9,06E+03	-2,94E+04			
Diff to BAU EoL PEF	-5,81E+03	-3,66E+04	-1,28E+03	-1,38E+03	-4,38E+02	-4,75E+02	0,00E+00	0,00E+00			
Total Diff to BAU EoL & Prod	-6,62E+04	-2,28E+05	-1,28E+03	-1,38E+03	-4,38E+02	-4,75E+02	-9,06E+03	-2,94E+04			

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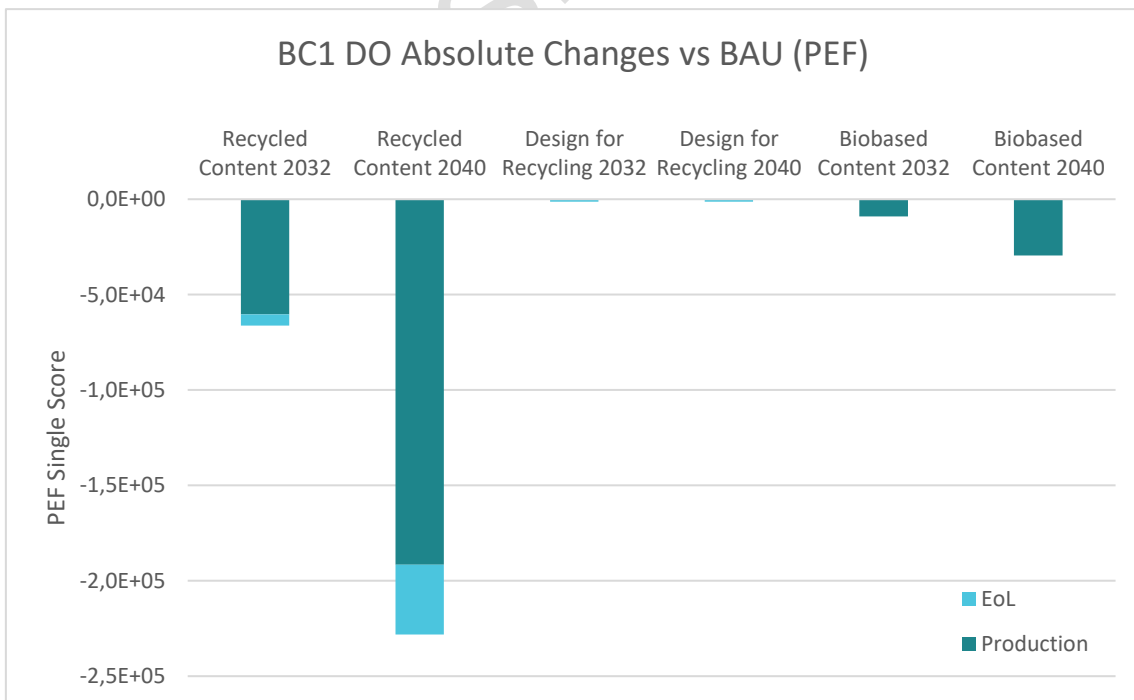
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1595 **Figure 1-22: Absolute changes of the BC1 fleet annual impacts on GHG emissions compared**
 1596 **with BAU for the years 2032 and 2040.**

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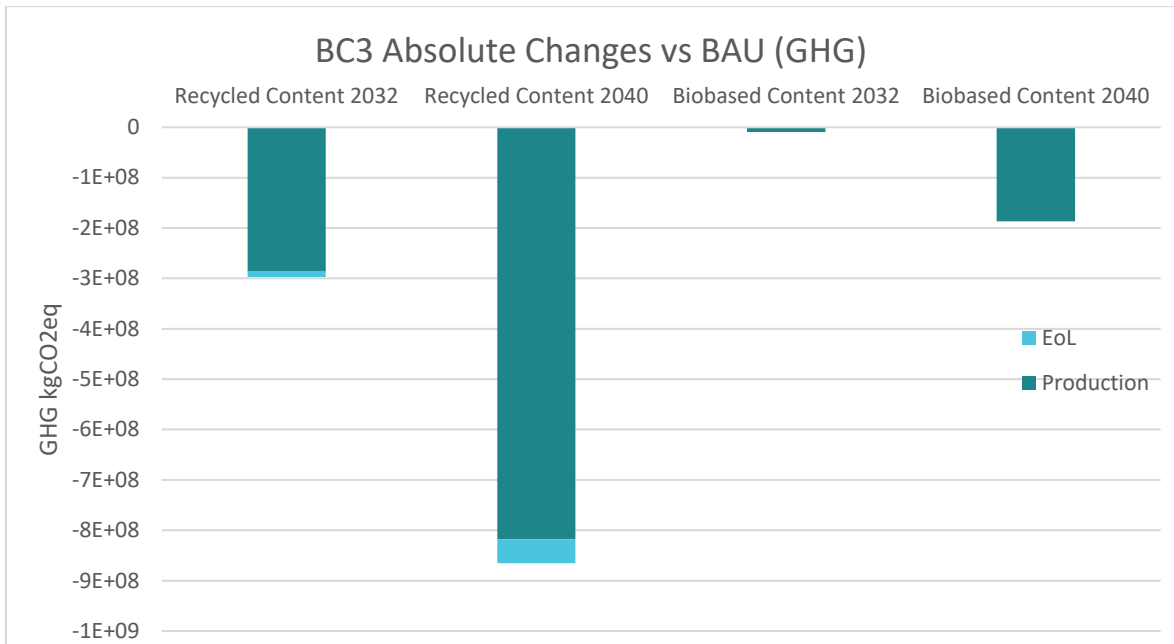


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1599 **Figure 1-23: Absolute changes of the BC1 fleet annual impacts on PEF single score compared**
 1600 **with BAU for the years 2032 and 2040.**

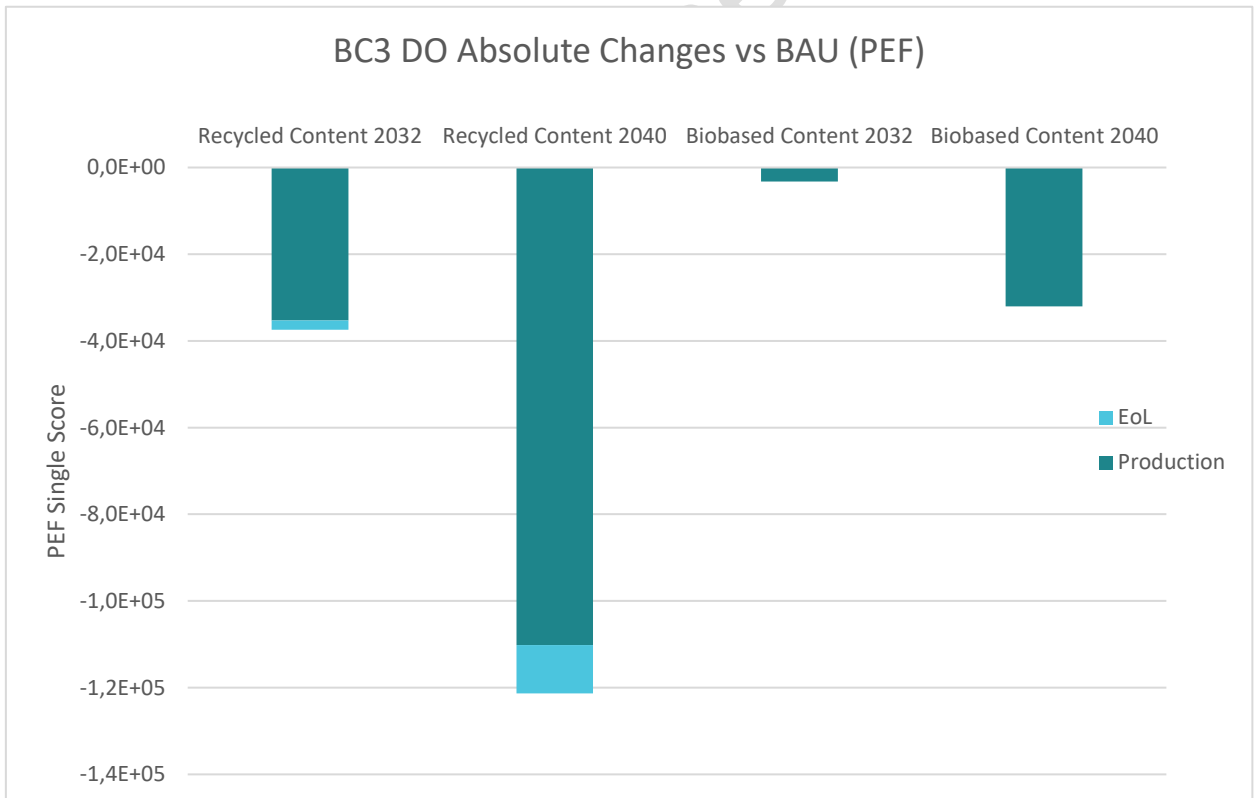
1601
1602**Table 1-32: Overview of GHG and PEF Impacts from different design options on BC3 excluding use phase.**

BC3	Recycled Content		Bio-Based Content		BAU		
	5%/50%	20%/80%	2% by weight	5% by weight	2024	2032	2040
GHG Emissions	2032	2040	2032	2040	2024	2032	2040
Production GHG Full Lifetime	3,74E+09	3,37E+09	4,01E+09	4,00E+09	3,87E+09	4,02E+09	4,19E+09
EoL GHG	-2,73E+08	-3,21E+08	-2,63E+08	-2,73E+08	-2,52E+08	-2,63E+08	-2,73E+08
Total	3,46E+09	3,05E+09	3,75E+09	3,73E+09	3,61E+09	3,76E+09	3,91E+09
Diff to BAU EoL & Prod	8%	22%	0%	5%			
Diff. To BAU Production GHG Full Lifetime	-2,87E+08	-8,17E+08	-9,19E+06	-1,87E+08			
Diff to BAU EoL GHG	-1,08E+07	-4,77E+07	0,00E+00	0,00E+00			
Total Diff to BAU EoL & Prod	-2,98E+08	-8,65E+08	-9,2E+06	-1,9E+08			
PEF Single Score	2032	2040	2032	2040	2024	BAU 2032	BAU 2040
Production PEF	5,53E+05	5,03E+05	5,86E+05	5,81E+05	5,66E+05	5,89E+05	6,13E+05
EoL PEF	-3,05E+04	-4,06E+04	-2,83E+04	-2,95E+04	-2,72E+04	-2,83E+04	-2,95E+04
Total	5,23E+05	4,62E+05	5,57E+05	5,51E+05	5,39E+05	5,60E+05	5,83E+05
Diff to BAU EoL & Prod	7%	21%	1%	5%			
Diff. To BAU Production PEF Full Lifetime	-8,16E+05	-9,81E+05	-3,23E+03	-3,21E+04			
Diff to BAU EoL PEF	-2,13E+03	-1,12E+04	0,00E+00	0,00E+00			
Total Diff to BAU EoL & Prod	-8,18E+05	-9,92E+05	-3,2E+03	-3,2E+04			



1603

1604 **Figure 1-24: Absolute changes of the BC1 fleet annual impacts on GHG emissions compared**
 1605 **with BAU for the years 2032 and 2040.**



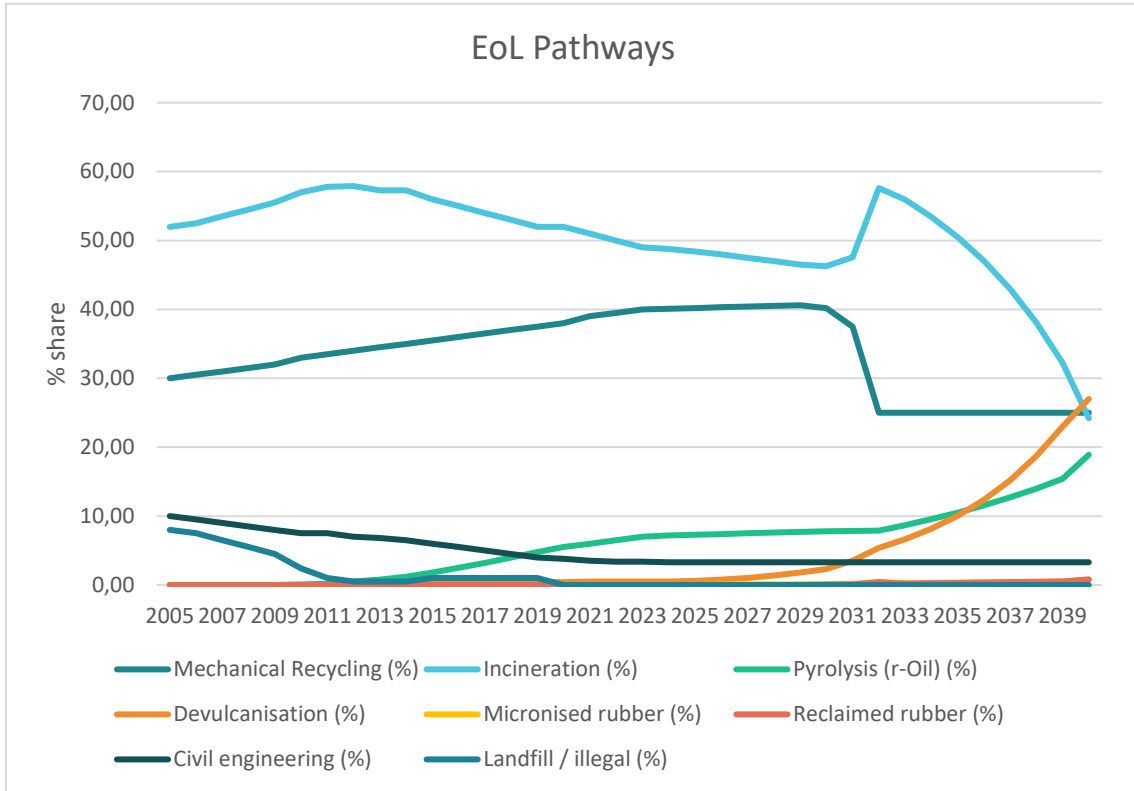
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1607 **Figure 1-25: Absolute changes of the BC3 fleet annual impacts on PEF single score compared**
 1608 **with BAU for the years 2032 and 2040.**

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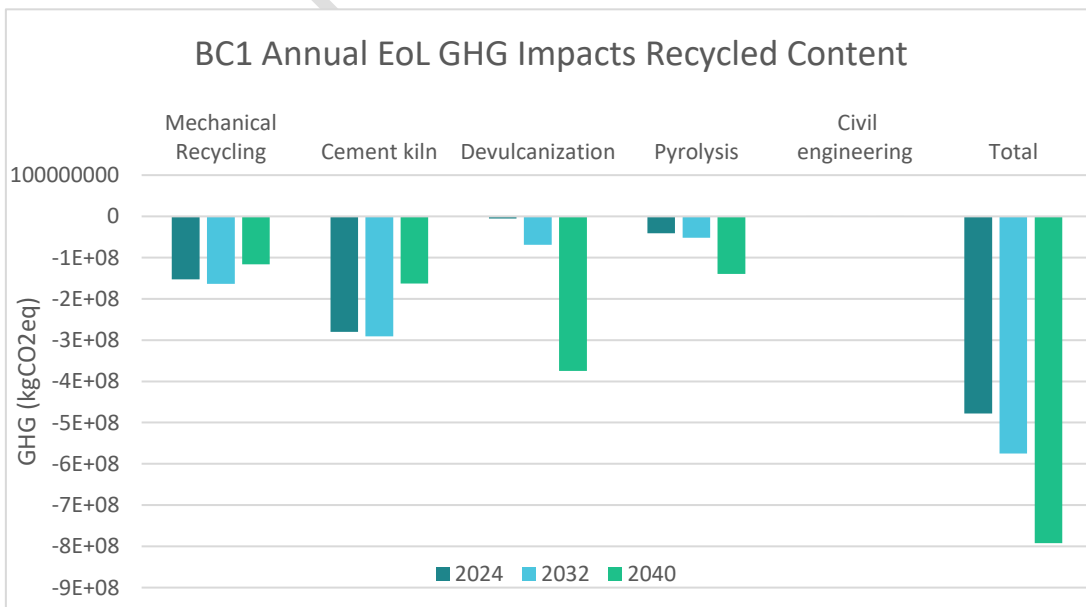
1611 For recycled content, the EoL treatment pathways must change correspondingly to provide
 1612 enough feedstock. The assumed % pathway transition is depicted below. The ban on mechanical
 1613 recycling outputs to artificial turf/playgrounds is still shown impacting the market in 2031,
 1614 albeit with a lesser impact due to higher devulcanisation and pyrolysis components.



1615

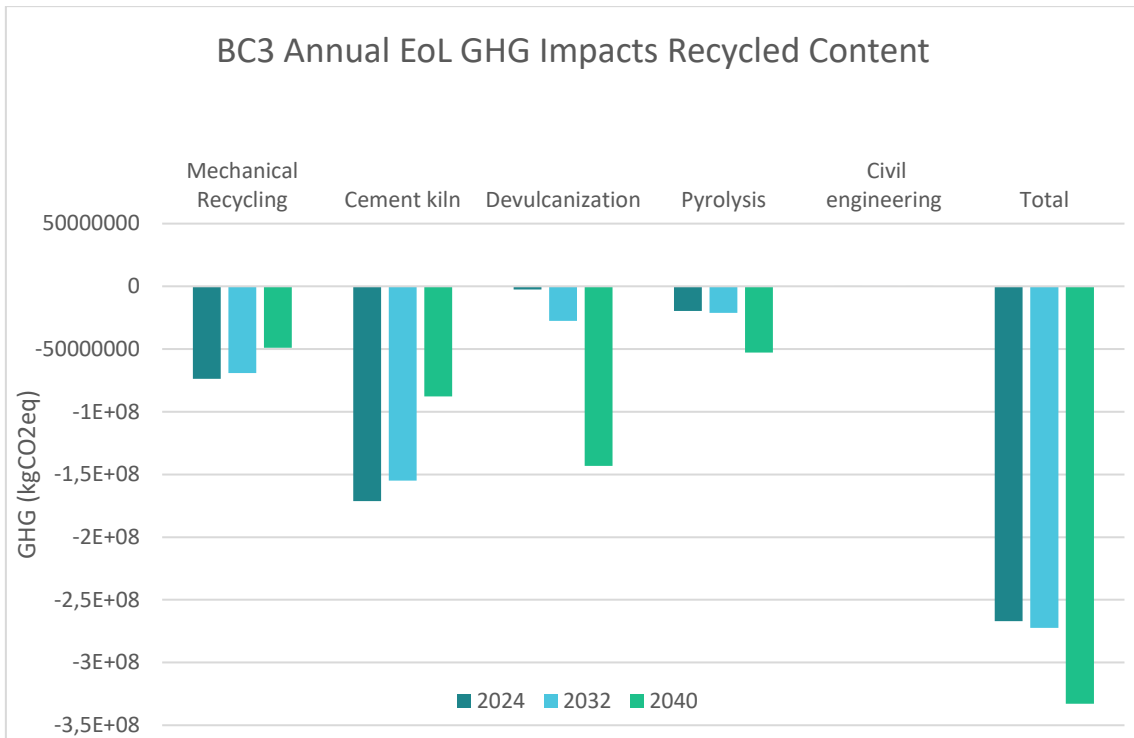
1616 **Figure 1-26: Modelled EoL pathways to meet recycled content targets.**

1617 This leads to the following EoL savings in GHG impacts for the years 2032 and 2040, vs 2024
 1618 splits in BC1 and BC3.



1619

1620 **Figure 1-27: BC1 Contributions of specific EoL pathways to GHG emissions.**



1621

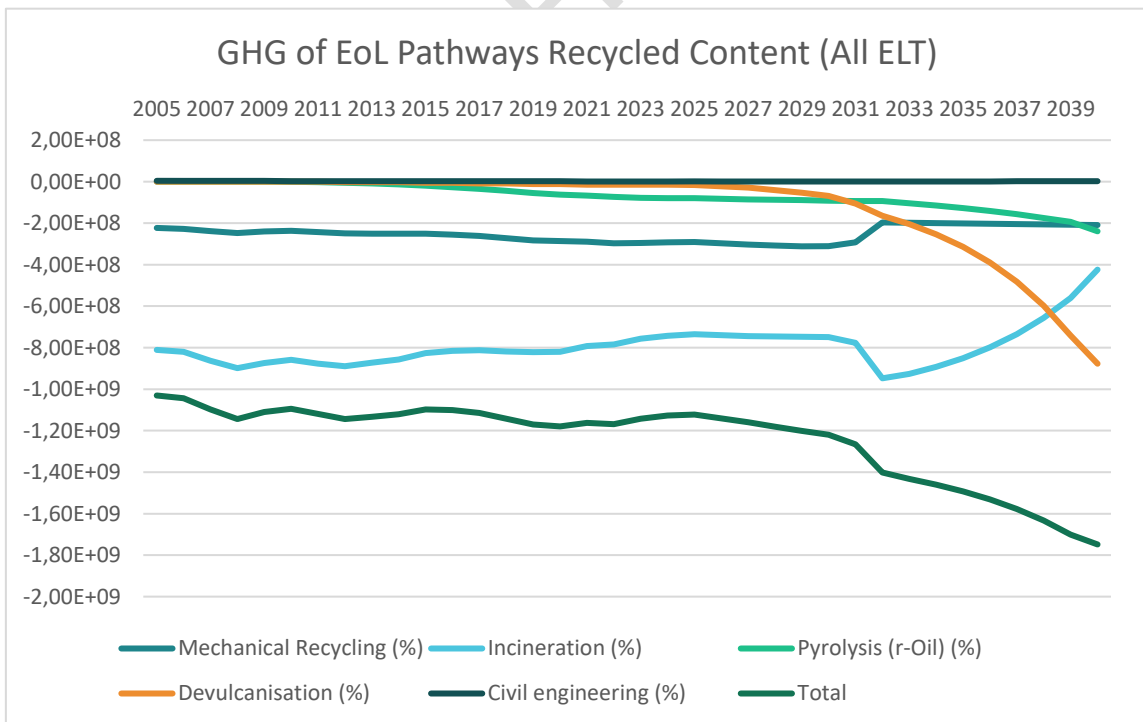
Figure 1-28: BC3 Contributions of specific EoL pathways to GHG emissions.

1622

1623

Considering EoL flows of all ELT to these pathways leads to the impacts shown below. The value of -1.75 Mt CO₂eq in 2040 compares favourably with the BAU scenario thanks of -1.42 Mt CO₂eq.

1624



1625

Figure 1-29: impacts of all ELT arising treated across EoL pathways through to 2040.

1626

1627 **1.7.6. Results: socio-economic impact analysis**

1628 A determination of societal costs as monetary value from PEF impact factors is still to be added.

1629 **1.7.7. Overview of results**

1630 **Table 1-33: Overview of Results from Stock Model Baseline (BAU) and parameters used.**

Parameter	Base Case	BAU		
		2024	2032	2040
Sales (Million Units)	C1	305.7	331.0	358.4
	C2	29.3	30.5	31.8
	C3	16.6	17.3	18.0
	Retreads	2.1	1.8	1.5
Tyres in Use (Million Units)	C1	1,012	1,141	1,235
	C2	73	77	81
	C3	36	36	38
	Retreads	4	4	3
ELT Arising (Million Units)	C1	285.4	322.9	349.6
	C2	72.1	76.9	80.0
	C3	15.5	15.4	16.4
	Retreads	2.8	1.8	1.5
ELT Arising (Mt)	C1 ELT	1.969	2.228	2.412
	C2 ELT	0.728	0.776	0.808
	C3 net ELT	0.801	0.796	0.848
	Retread ELT	0.145	0.093	0.078
	Total ELT	3.643	3.893	4.145
	10% Export for reuse	0.36	0.39	0.41
RRC Change to 2024 Applied	C1	0%	-8%	-8%
	C2	0%	-7%	-7%
	C3	0%	-6%	-6%
EV Fleet Penetration	C1	2.75%	21.69%	66.1%
	C2	1.05%	13.76%	43.55%
	C3	0.67%	4.04%	14.07%
EoL Pathways	Mechanical Recycling	40,10%	25,00%	25,00%
	Incineration in cement kiln (TDF)	48,80%	58,80%	54,80%
	Pyrolysis (rCB + pyrolysis oil)	7,20%	12,00%	14,70%
	Devulcanisation	0,50%	0,90%	2,00%
	Micronised rubber powder (MRP)	0,00%	0,20%	0,40%
	Reclaimed rubber	0,00%	0,10%	0,10%
	Civil engineering / backfilling	3,30%	3,00%	3,00%
Sensitivity Exports	Export (WSR Weak)	20,00%	25%	16.6%
	Export (WSR Strong)	20%	1.76%	0.1%
GHG Impacts				
Total GHG (BC1-BC4)	Total GHG	1,64E+11	1,52E+11	1,23E+11

Parameter	Base Case	BAU		
		2024	2032	2040
	Use Phase	1,50E+11	1,36E+11	1,07E+11
	Production	1,56E+10	1,67E+10	1,78E+10
	EoL	-9,71E+08	-1,05E+09	-1,11E+09
	Production & EoL as % of Use Phase	10%	11%	16%
BC1	Total GHG	7,77E+10	7,17E+10	4,64E+10
	Use Phase	6,81E+10	6,14E+10	3,52E+10
	Production	1,01E+10	1,09E+10	1,18E+10
	EoL	-	-	-
	Production & EoL as % of Use Phase	14%	17%	32%
BC3	Total GHG	6,90E+10	6,51E+10	6,48E+10
	Use Phase	6,54E+10	6,13E+10	6,09E+10
	Production	3,87E+09	4,02E+09	4,19E+09
	EoL	-	-	-
	Production & EoL as % of Use Phase	6%	6%	6%

1631

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1632 **Table 1-34: Overview of Results from Retreading C3 Model.**

Parameter		BAU			Retread Scenario		
Year		2024	2032	2040	2024	2032	2040
Budget share of C3		35%	42%	48%	35%	31.5%	27.5%
Budget Sales Million Units		5.81	7.18	8.62	5.81	5.44	4.94
Retread rate		16.7%	13.7%	11.3%	16.7%	26.2%	45.0%
Retread Sales (Million units)		2.05	1.71	1.49	2.05	3.33	5.93
EoL + Prod Impacts GHG (kgCO ₂ eq)	Budget Penalty	9,59E+08	1,19E+09	1,42E+09	9,59E+08	8,97E+08	8,15E+08
	Savings Retreads	3,08E+08	2,62E+08	2,23E+08	3,08E+08	4,99E+08	8,89E+08
Use Phase Impacts (RRC budget 6N/kN, retread 5.6 N/kN) GHG per tyre in service within retread+budget segment (kg CO ₂ eq)		1,97E+02	2,10E+02	2,18E+02	1,97E+02	1,84E+02	1,62E+02
Normalised over 10 Mio. Tyres		1,97E+09	2,10E+09	2,18E+09	1,97E+09	1,84E+09	1,62E+09

- 1633 • Production Material Avoided per Retread vs C3 single use: 44kg
- 1634 • Waste burden per budget tyre vs C3 single use: 48.9 kg
- 1635 • Waste burden per budget tyre vs C3 retreaded 1.15 times: 162 kg
- 1636 • GHG savings per retread vs C3 single use (EoL + Prod): 149.8 kgCO₂eq
- 1637 • GHG burden per budget tyre vs C3 retreaded 1.15 times: 143.5 kgCO₂eq

1638 **Table 1-35: Overview of Design Option Impacts on BC1 & BC3 excluding use phase.**

	Recycled Content		DO-02 Design for Recycling		DO-03 Design for Recycling		Bio-Based Content	
	5%/50%	20%/80%					5% C1 2% C3	15% C1 5% C3
	2032	2040	2032	2040	2032	2040	2032	2040
BC1								
GHG Diff to BAU	6%	16%	0%	0%	0%	0%	0%	1%
GHG Total Diff to BAU	-5,84E+08	-1,78E+09	-1,15E+07	-1,25E+07	2,38E+06	2,58E+06	-3,92E+07	-1,27E+08
PEF Diff to BAU	5%	16%	0%	0%	0%	0%	1%	2%
Total PEF Diff to BAU	-6,62E+04	-2,28E+05	-1,28E+03	-1,38E+03	-4,38E+02	-4,75E+02	-9,06E+03	-2,94E+04
BC3								
GHG Diff to BAU	8%	22%					0%	5%
Total Diff GHG to BAU	-2,98E+08	-8,65E+08					-9,2E+06	-1,9E+08
PEF Diff to BAU	7%	21%					1%	5%
Total Diff PEF to BAU	-8,18E+05	-9,92E+05					-3,2E+03	-3,2E+04

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1640 1.8. Conclusions

1641 The following gives preliminary conclusions relating to the analysis made in this report. These
1642 conclusions will be refined for presentation in the stakeholder meeting on June 8th.

1643 The baseline modelling of the Business as Usual (BAU) scenario allows for several important
1644 conclusions relating to the use phase:

- 1645 • For BC1, the use phase emissions decline significantly by 2040 as a result of high EV
1646 penetration (66%) and an electricity grid supported by a higher share of renewables. In
1647 2040, the production and EoL phases are projected to account for 32% of GHG emissions
1648 compared to the use phase.
- 1649 • For BC2 and BC3 use phases changes are less dramatic, owing to the lower penetration of
1650 electric vehicles in these segments (44% and 14%) and the higher conversion efficiency
1651 of diesel engines heavy goods vehicles compared with petrol engines.

1652 Depending on the scope for additional fleet emissions reductions in the use phase (determined
1653 by UN R117 performance requirements), the additional savings in the use phase possible
1654 through ESPR are expected to be limited. For the BAU it is assumed that the retreading share of
1655 the market is expected to continue to decline, and the budget share of C3 tyres sold in the
1656 market is expected to increase.

1657 In the EoL phase, it is assumed that mechanical recycling loses a substantial off-take market in
1658 2031, as microplastic restrictions on artificial turf/playgrounds come in. If alternative recycling
1659 pathways relating to pyrolysis and devulcanization are unavailable, it is assumed that this waste
1660 must enter co-processing in cement kilns, or depending on the implementation of the Waste
1661 Shipment Regulation, is exported to questionable treatment processes in low and middle
1662 income countries. A sensitivity analysis applied to 20% of ELT being exported to open burning in
1663 2024 estimates that this would cause GHG emissions on the order of 1.5 MtCO₂eq.

1664 In the retread model for C3 tyres, the impact of lifetime on waste generation becomes clear:
1665 each time that a retread is made to a C3 tyre, 44 kg is saved. However, if a budget tyre with
1666 approximately half the lifetime (130,000 km) is selected instead, it causes an additional waste
1667 burden of 48.9 kg vs a new C3 tyre, or 162 kg vs a C3 tyre which is retreaded 1.15 times. Applying
1668 a similar logic to GHG emissions, it is found that a budget tyre brings a EoL and Production
1669 penalty of 143.5 kgCO₂eq vs a retreaded C3 tyre over its full lifetime. Comparing only the retread
1670 lifetime to a budget tyre directly to provide the same km, the savings from EoL and production
1671 of a retread tyre rise to 350.6 kgCO₂eq per tyre.

1672 A retread scenario was applied where retreads make up 45% of the market in 2040, finding
1673 annual production and EoL savings of 1.3 MtCO₂eq from retreading in 2040 vs single use C3
1674 tyres. This saving would be 0.2 MtCO₂eq if only 11% of C3 tyres are retreaded in 2040 as
1675 projected in the BAU scenario. The penalty from budget tyres vs a retreaded C3 tyre was also
1676 modelled with 2.85 MtCO₂eq in the BAU scenario, or 1.65 MtCO₂eq in the retread scenario
1677 where fewer budget tyres are sold as a result of retreading – this budget model is conservative,
1678 however, in that the total sales do not yet dynamically adjust to budget lifetimes.

1679 From the design options modelled, recycled content shows the highest savings. Recycled
1680 content targets find for BC1 annual savings of 1.8 MtCO₂eq and for BC3 savings of 0.87 MtCO₂eq
1681 estimated in 2040, assuming no changes to use phase. Design for recycling brings limited gains

1682 as it was modelled, but this was expected (diversion of small % of the market out of certain
1683 recycling processes) would be a necessary support option to enable recycling infrastructure to
1684 manage ELT better.

1685 To enable high recycled content targets, a large ramp up of materials diverted to devulcanization
1686 to enable closed loop recycling of tyres is necessary (27% by 2040), as well as pyrolysis (18.90%),
1687 where it is assumed that technological innovation allows better usage of these outputs in closed
1688 loop recycling (i.e. uptake of rCB through novel additives, or better conversion to sCB).

1689 The improvements from bio-based content targets as modelled are smaller, with 0.13 MtCO₂eq
1690 for BC1 and 0.19 MtCO₂eq for BC3 in 2040. This is due in part to the fact that the targets
1691 themselves are less ambitious for BC1 and BC3.

1692 The Open Strategic Autonomy (OSA) assessment (see annex) finds that tyres are exposed to
1693 structural dependencies on geographically concentrated natural rubber, fossil-derived synthetic
1694 rubber and carbon black, and a significant gap between current EoL material recovery practice
1695 and technically achievable circularity.

- 1696
- recycled content requirements reduce fossil feedstock demand and build domestic
1697 circular material supply;
 - retreading mandates reduce the volume of virgin imported materials required per km
1698 of service delivered;
 - Bio-based substitution contributes but its impact is conditional on whether EU-
1700 domestic feedstock pathways (dandelion, guayule) are commercially available within
1701 the regulatory timeframe, or whether substitution merely shifts geographic
1702 dependency rather than eliminating it.
- 1703

1704 The DPP analysis was also carried out, with a range of potential data fields for use cases defined
1705 in Task 6 outlined.

1706 In sum, it can be said that policy measures on retreading and recycled content, supported by
1707 measures that remove hindrances for recycling and facilitate both these lifecycle phases show
1708 the most promise for ESPR intervention from both open strategic autonomy and environmental
1709 impacts. Specifically taking measures to lengthen lifetimes, i.e. by reducing incentives for budget
1710 tyres appear to strengthen this, however, specific lifetime extension modelling was not yet
1711 carried out.

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1714 2. Annex: Open Strategic Autonomy (OSA) 1715 Assessment

1716 2.1. OSA Framework overview

1717 The OSA assessment applies the framework developed by the European Commission Joint
1718 Research Centre in their Open Strategic Assessment Methodology for ESPR (Maury et al., 2025).
1719 The JRC OSA report provides a standardised methodology for assessing a product's contribution
1720 to EU Open Strategic Autonomy — defined as the EU's capacity to act independently and with
1721 strategic intent in securing critical materials and technologies while remaining open to
1722 international cooperation.

1723 The OSA methodology evaluates products across four analytical aspects, each representing a
1724 distinct dimension of strategic vulnerability:

- 1725 • Aspect 1: Material composition — exposure through raw materials used in production
- 1726 • Aspect 2: Energy demand — exposure through energy-intensive manufacturing or use-
1727 phase energy requirements
- 1728 • Aspect 3: Market dynamics — exposure through import dependence and projected
1729 demand growth
- 1730 • Aspect 4: Production and EoL routes — exposure through production technology
1731 concentration and end-of-life recirculation gaps

1732 In addition to the four core aspects, the JRC framework includes a set of Lifecycle and Circularity
1733 parameters that assess specific environmental and supply-chain vulnerabilities across the full
1734 product lifecycle. These Lifecycle and Circularity parameters are directly relevant to the ESPR
1735 ecodesign requirements and are weighted accordingly in this assessment.

1736 2.1.1. OSA Scoring system

1737 Each parameter is scored on a 0–3 scale representing the level of improvement potential (i.e.,
1738 current vulnerability):

Score	Interpretation	Criteria
3	High vulnerability / high improvement potential	High import dependence, concentrated supply, fossil-intensive, or large circularity gap. Significant policy intervention justified.
2	Moderate vulnerability / improvement potential	Some import exposure or supply risk. Policy measures would provide meaningful improvement.
1	Low vulnerability / limited improvement potential	Minor exposure. Policy measures provide marginal improvement.
0	Not relevant or already at best practice	Parameter not applicable to this product, or current practice already meets best-available standard.

1739 Scores are assigned for S0 (current baseline) and for three policy scenarios (S1 Moderate, S2
1740 Ambitious, S3 Full Policy Package). The difference between S2 and S0 represents the net OSA
1741 improvement under the preferred scenario. A lower score indicates reduced vulnerability and
1742 improvement of the OSA position.

1743 The JRC OSA Report includes tyres as one of two product case studies assessed under the OSA
1744 framework (Section 5.2). The present assessment uses the JRC tyre case study as its
1745 methodological baseline and adopts the parameter scores from the JRC report where
1746 applicable⁷.

1747 Three substantive additions have been made beyond the published JRC tyre case study:

1748 Precipitated silica (SiO₂, CN code 2811.22) has been added to the BoM and Aspect 3.2 import
1749 reliance assessment. At 10–12%wt in modern green-tyre C1 formulations, precipitated silica
1750 represents a material supply-chain exposure not captured in the JRC baseline. Approximately
1751 30–35% of EU precipitated silica demand is imported from China. This addition is flagged for
1752 formal incorporation into the Aspect 3.2 quantitative import reliance calculation.

1753 A retreaded tyre BoM sub-row has been added, covering only the tread compound
1754 (approximately 33% of new tyre compound mass). This enables quantification of the finding that
1755 a retreaded HCV tyre carries approximately 67% lower import exposure per km of service
1756 delivered than a new tyre, because the casing — representing the majority of mass and
1757 embedded material — is reused from EU-domestic stock.

1758 A geopolitical stress scenario section has been added, covering three acute risks that exceed the
1759 0–3 scoring ceiling and cannot be adequately captured within the ordinal framework: Strait of
1760 Hormuz disruption, China precipitated silica concentration, and EUDR natural rubber
1761 deforestation compliance.

1762 2.2. Scenario definitions

1763 The four scenarios assessed correspond to the ESPR preparatory study policy scenarios and
1764 reflect progressively more ambitious ecodesign requirements:

Scenario	Label	Key OSA-relevant features
S0	Baseline	No new policy beyond current regulations. Current UN R117 RRC class distribution. Market-driven recycled content (~5%). Retreading at current EU rate (~21% HCV). Pyrolysis/devulcanisation at 2024 scale (~7.7% combined).
S1	Moderate	Labelling and minimum RRC requirements. 10–12% recycled rubber content. 5% bio-based substitution. Retreading +5% HCV. Incremental pyrolysis scale-up.

⁷ The OSA methodology is described as a qualitative-to-semi-quantitative framework. Scores represent expert judgement calibrated against the criteria in JRC Table 2 (p.14) and the tyre case study calibration in Section 5.2. Where quantitative data is available (e.g., import reliance percentages from Eurostat COMEXT), it is used to anchor scores. Where quantitative data is pending, scores reflect the JRC baseline.

Scenario	Label	Key OSA-relevant features
S2	Ambitious	Strong ecodesign requirements. 15–18% recycled rubber + 12–15% recycled reinforcement. 12% bio-based. HCV retreading +15–20pp. Advanced material recovery (pyrolysis + devulc) scaling to 15–20% of ELT.
S3	Full Package	Maximum feasible by 2030–2035. 20%+ recycled rubber. 15% bio-based. Retreading 60–65% HCV. Advanced material recovery 35–40% of ELT. Significant domestic bio-based rubber capacity.

1765 2.3. Tyre Bill of Materials and OSA Exposure Profile

1766 2.3.1. BoM composition (C1 PC reference tyre)

1767 The BoM composition is based on the JRC's OSA analysis Table IV (p.68) for the C1 passenger car
 1768 tyre, with a correction applied for precipitated silica. C3 HCV tyres have a broadly similar
 1769 composition by mass fraction but with higher natural rubber content and lower synthetic rubber
 1770 content in premium formulations.

Material	%wt	OSA concern	Primary risk	Notes
Natural rubber (NR)	22%	HIGH	Geographic concentration	~73% from SE Asia (Thailand, Indonesia, Vietnam). EUDR compliance risk.
Synthetic rubber (SBR/BR)	23%	HIGH	Fossil feedstock + sanctions	Butadiene precursor exposed to Russia sanctions and Hormuz disruption risk.
Carbon black (CB)	22%	HIGH	Fossil feedstock + Russia HFO	Heavy fuel oil feedstock; Russia sanctions affect HFO supply.
Steel cord	15%	LOW	Diversified supply	Established EU recycling stream; diverse global supply.
Precipitated silica (SiO ₂)	10–12%	MEDIUM	China import concentration	~30–35% EU imports from China.
Process oils / plasticisers	3–5%	MEDIUM	Fossil-derived	TDAE/SRAE replacing aromatic oils; fossil feedstock dependency persists.
Retreaded casing (HCV)	~35% ^x	LOW-MED	Casing reuse reduces import exposure	×% of new tyre compound mass used per retread event. ~67% lower import exposure vs new tyre.

1771 2.3.2. Fossil feedstock dependency

1772 Approximately 45–50%wt of a standard C1 tyre is fossil-origin: synthetic rubber (~23%), carbon
 1773 black (~22%), and process oils (~3–5%). This gives tyres a high score (fossil feedstock) in the SO
 1774 baseline. The DO1 recycled content and DO5 bio-based material scenarios directly address this

1775 exposure, with combined potential to reduce fossil-origin content to below 30%wt by 2035
1776 under S3.

1777 2.4. OSA Assessment Results

1778 2.4.1. Full parameter scoring table

1779 Table 3.1 presents the OSA score for each parameter across all four scenarios. A score of 0
1780 indicates the parameter is not relevant or already at best practice. A score of 3 indicates high
1781 current vulnerability and high improvement potential from policy intervention. The delta
1782 column shows the change from S0 to S2 — a negative value represents OSA improvement.

Parameter	Max	S0 Baseline	S1 Moderate	S2 Ambitious	S3 Package	Δ S2 vs S0
ASPECT 1 — MATERIAL COMPOSITION (max 6)						
1.1 Critical raw material (CRM) supply risk	3	0/3	0/3	0/3	0/3	—
1.2 Import ban / sanctions / deforestation risk	3	3/3	3/3	2/3	1/3	-1
1.3 Fossil-based feedstock dependency	3	3/3	3/3	2/3	1/3	-1
Aspect 1 subtotal	/6	6	6	4	2	-2
ASPECT 2 — ENERGY DEMAND (max 6)						
2.1 Energy-intensive manufacturing	3	0/3	0/3	0/3	0/3	—
2.2 Energy-related product (ErP) use-phase	3	2/3	2/3	1/3	0/3	-1
Aspect 2 subtotal	/6	2	2	1	0	-1
ASPECT 3 — MARKET DYNAMICS (max 6)						
3.1 Forecasted demand growth (CAGR)	3	2/3	2/3	1/3	1/3	-1
3.2 Product import reliance (EU27)	3	2/3	2/3	1/3	1/3	-1
Aspect 3 subtotal	/6	4	4	2	2	-2
ASPECT 4 — PRODUCTION ROUTES & EoL (max 6)						
4.1 Critical technology dependency	3	0/3	0/3	0/3	0/3	—

Parameter	Max	S0 Baseline	S1 Moderate	S2 Ambitious	S3 Package	Δ S2 vs S0
4.2/4.3 Production routes + EoL recirculation	3	2/3	2/3	1/3	0/3	-1
Aspect 4 subtotal	/6	2	2	1	0	-1
LIFECYCLE & CIRCULARITY PARAMETERS (max 15)						
LC1 Recyclability / design for disassembly	3	1/3	1/3	1/3	0/3	—
LC2 Recycled content (current vs best available)	3	3/3	2/3	1/3	1/3	-2
LC3 Lifetime / durability	3	2/3	1/3	1/3	0/3	-1
LC4 In-use dissipation (TRWP / abrasion)	3	3/3	3/3	2/3	1/3	-1
LC5 EoL collection and recycling rate	3	2/3	2/3	1/3	1/3	-1
LC subtotal	/15	11	9	6	3	-5
GRAND TOTAL	/36	25	23	14	7	-11

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Table notes:

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Parameter 1.1 (CRM): Natural rubber is not currently on the EU CRM list (2023 assessment). The next CRM assessment is anticipated in 2026. If NR is listed, Aspect 1.1 would move from 0 to 3, increasing the grand total by 3 points and changing the S2 delta.

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Parameter 2.1 (manufacturing energy): Tyre production is not classified as EU ETS energy-intensive. Score is 0 across all scenarios.

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Parameter 4.1 (critical technology): No proprietary or single-source production technology identified for standard tyre types.

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Parameter LC4 (TRWP): Score reflects current high exposure. A dedicated abrasion/TRWP design option (DO7, linked to Euro 7 test method) is outside the scope of the current ESPR scenario set and would be required to reduce this score below 2.

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2.4.2. Results interpretation

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The S0 baseline score of 25/36 (69%) confirms that tyres carry a meaningful but not exceptional OSA exposure profile. The dominant vulnerabilities are in Aspect 1 (material composition — NR geographic concentration and fossil feedstock) and Lifecycle/Circularity (recycled content gap, TRWP, and EoL recirculation).

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The S2 Ambitious scenario achieves a reduction from 25 to 14 points (-11, a 44% reduction in vulnerability score). This is primarily driven by improvements in LC2 (recycled content), Aspect

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1801 1.2 (sanctions/EUDR exposure reduced through bio-based substitution), and Aspect 3.2 (import
1802 reliance reduced through domestic circular economy capacity).⁸

1803 The S3 Full Package scenario reduces the score to 7/36, achieving near-best-practice levels for
1804 most parameters with the exception of LC4 (TRWP — not addressed by any current design
1805 option) and Aspects 3.1/3.2 (market dynamics — residual score of 1 reflecting continued EU
1806 import dependency even at maximum domestic content).

1807 2.4.3. Geopolitical Stress Scenarios

1808 Three acute geopolitical risks have been identified that exceed the 0–3 scoring ceiling and
1809 cannot be adequately represented within the ordinal OSA framework. These risks are presented
1810 as supplementary scenario analysis, following the approach suggested in JRC report Section 2.4
1811 (acute risk register).

Geopolitical risk	Acute exposure	S2 mitigation	S3 mitigation
Iran conflict / Strait of Hormuz disruption	~20% of global oil trade. 2024 Houthi data: +25% freight costs, +2–4 wk transit. SBR/CB cost shock +35–50%.	Bio-based penetration insufficient for acute closure (5–12%). Short-term exposure remains high.	Bio-based at 15% + devulcanisation at scale provides partial buffer. Full mitigation requires EU domestic capacity.
China precipitated silica concentration	~65% of global precipitated SiO ₂ capacity. EU imports 30–35% from China. S2 increases silica demand (green tyre specs).	No direct mitigation in S2. EU silica supply chain not addressed by design option set.	Partial mitigation only via DO3 bio-based (alternative compound design). Not sufficient.
EUDR natural rubber — deforestation compliance	~73% of EU NR demand at risk if SE Asia suppliers non-compliant. Dandelion/guayule at pre-commercial stage.	DO3 bio-based (12%) provides partial NR substitution. Traceability requirements impose compliance cost.	DO3 at 15% + Guayule/dandelion development provides stronger buffer if commercially available by 2032–35.

1812 These stress scenarios are informational — they do not modify the numerical OSA scores but
1813 are flagged as considerations for policy design under S2 and S3.

⁸ The total score improvement of –11 under S2 should be interpreted as policy-additive: it represents the combined effect of all design options acting simultaneously. The OSA assessment does not attribute fractional scores to individual design options — the Design Option Impact Matrix in Section 5 provides a qualitative attribution.

1814 2.5. Design Option vs OSA Impact Matrix

1815 The table below maps each design option in the ESPR scenario set to the OSA aspects it
 1816 addresses. Legend: ✓ = positive OSA impact; △ = mixed or conditional; ✗ = negative (increases
 1817 vulnerability); — = no impact.

Design Option	Aspect 1 Material	Aspect 2 Energy	Aspect 3 Market	Aspect 4 Prod/EoL
DO1: Recycled content	✓	—	✓	✓
DO5: Bio-based materials	△	—	△	✓
DO8: Retreading	✓	—	✓	✓
D10: Lifetime extension	✓	—	✓	△
DO8/10: ELT reduction / circularity	✓	—	✓	✓

1818 Key observations from the matrix:

1819 DO1 (Recycled content) is the strongest single contributor to OSA improvement, addressing
 1820 Aspects 1, 3, and 4 simultaneously by reducing fossil feedstock demand, increasing domestic
 1821 material circularity, and decoupling production from import-dependent virgin material supply.

1822 DO8 (Retreading) is the strongest contributor to reduced physical import volume per km of
 1823 service delivered, due to the casing reuse mechanism. Each retread event avoids the production
 1824 of a new tyre, including all embedded fossil-origin and geographically-concentrated materials in
 1825 the casing (~65% of total tyre mass).

1826 DO5 (Bio-based materials) presents a trade-off: it reduces Aspect 1.3 (fossil feedstock) but may
 1827 introduce new Aspect 1.2 exposure (deforestation risk, new geographic dependencies for
 1828 feedstocks). The net OSA benefit of DO3 is conditional on the specific bio-based material
 1829 sourcing strategy and EUDR compliance.

1830 2.6. Conclusions and Recommendations

1831 The OSA assessment confirms that tyres present a well-defined and addressable strategic
 1832 vulnerability profile for the EU. The S0 baseline score of 25/36 reflects structural dependencies
 1833 on geographically concentrated natural rubber, fossil-derived synthetic rubber and carbon
 1834 black, and a significant gap between current EoL material recovery practice and technically
 1835 achievable circularity. These vulnerabilities are not minor — approximately 45–50% of C1 tyre

1836 mass by weight is fossil-origin, and the three highest-risk materials (natural rubber, synthetic
1837 rubber, carbon black) together account for roughly two-thirds of tyre composition.

1838 The S2 Ambitious scenario achieves a 44% reduction in OSA vulnerability score (25→14),
1839 demonstrating that ESPR ecodesign requirements can materially improve EU strategic
1840 autonomy in this product category. The improvement is not driven by any single design option
1841 but by the complementary action of several:

- 1842 • recycled content requirements (DO2) reduce fossil feedstock demand and build
1843 domestic circular material supply;
- 1844 • retreading mandates (DO8) reduce the volume of virgin imported materials required
1845 per km of service delivered;
- 1846 • and lifetime extension (DO10) reduces annual replacement demand and therefore
1847 annual import exposure.
- 1848 • Bio-based substitution (DO5) contributes but its impact is conditional on whether EU-
1849 domestic feedstock pathways (dandelion, guayule) are commercially available within
1850 the regulatory timeframe, or whether substitution merely shifts geographic
1851 dependency rather than eliminating it.

1852 The assessment identifies one structural gap the current design option set does not address:
1853 tyre and road wear particles (TRWP), representing the largest in-use dissipation parameter (LC4,
1854 scored 3 across S0–S2). Regulation of abrasion rates requires the Euro 7 test method to be
1855 finalised before it can be incorporated into ESPR requirements.

1856 Overall, the analysis supports a strong regulatory case for the S2 scenario. The combination of
1857 recycled content, retreading, and lifetime extension requirements delivers substantial and
1858 traceable OSA improvement at EU fleet scale, reduces material import dependence, and builds
1859 domestic circular economy capacity in rubber and carbon black recovery — addressing
1860 simultaneously the environmental, circularity, and strategic autonomy objectives of the ESPR
1861 framework.

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Getting in touch with the EU

In person

All over the European Union there are hundreds of Europe Direct centres. You can find the address of the centre nearest you online (european-union.europa.eu/contact-eu/meet-us_en).

On the phone or in writing

Europe Direct is a service that answers your questions about the European Union. You can contact this service:

by freephone: 00 800 6 7 8 9 10 11 (certain operators may charge for these calls),
at the following standard number: +32 22999696,
via the following form: european-union.europa.eu/contact-eu/write-us_en.

Finding information about the EU

Online

Information about the European Union in all the official languages of the EU is available on the Europa website (european-union.europa.eu).

EU publications

You can view or order EU publications at op.europa.eu/en/publications. Multiple copies of free publications can be obtained by contacting Europe Direct or your local documentation centre (european-union.europa.eu/contact-eu/meet-us_en).

EU law and related documents

For access to legal information from the EU, including all EU law since 1951 in all the official language versions, go to EUR-Lex (eur-lex.europa.eu).

EU open data

The portal data.europa.eu provides access to open datasets from the EU institutions, bodies and agencies. These can be downloaded and reused for free, for both commercial and non-commercial purposes. The portal also provides access to a wealth of datasets from European countries.

