Impact Assessment Study on Possible Energy Labelling of Tyres

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Revised Impact Assessment Report
To the European Commission
Directorate-General Transport and Energy

Specific Contract:
DG TREN No TREN/D3/375-2006
Under Framework Contract No.
DG BUDG No BUDG06/PO/01/LOT no. 2
ABAC 101922

EPEC

31th July 2008

Contact name and address for this study:

GHK Consulting
25 rue de la Sablonnière – B-1000 Brussels
Nick Bozeat
Nick.Bozeat@ghkint.com
+44 (0)121 233 8900

European Policy Evaluation Consortium (EPEC)
Brussels contact address: 25 rue de la Sablonnière – B-1000 Brussels
Tel: +32 2 275 0100   Fax: +32 2 275 0109
E-mail: contact@epec.info   URL: www.epec.info

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ACKNOWLEDGEMENT

GHK Consulting and TNO would like to thank the following organisations for their active contribution and participation in this study: ETRMA, tyre producers (Bridgestone, Cooper, Continental, Goodyear, Michelin, Pirelli and Vredestein), Bipaver, T&E, VTI, M+P, IRU and ACEA.

1 INTRODUCTION

1.1 This Report

This Final Report has been prepared by GHK Consulting (one of the EPEC[1] Group members) with support from TNO, a world renowned specialist in automotive technology, to contribute to the Impact Assessment of the possible energy labelling of tyres[2]. The study has being undertaken for DG Transport and Energy (TREN) of the European Commission within the Framework Contract between EPEC and DG BUDGET (DG BUDG No BUDG06/PO/01/LOT no. 2 - ABAC 101922) on Evaluation and Evaluation-related Services.

1.2 Objectives of the Study

The overall policy aim is to shift the tyre market towards the use of low rolling resistance tyres (LRRT), taking into account the inter-relation with other tyre attributes, in particular dry and wet grip (safety), noise and tread wear.

According to the Terms of Reference, the general objective for this assignment is to:

> *'evaluate to which extent promotion of low rolling resistance tyres (LRRT) based on grading and labelling of tyres contribute to fuel savings and reduction of CO2 emissions. Both the tyre market governed by new vehicles sales and the replacement market will be covered. It should be assumed that the rolling resistance coefficient can be measured in accordance with the ISO 28580 test standard.'*

Specific objectives for the study were to:

- Analyse the current situation, including the linkage between rolling resistance (RR), safety (wet and dry grip), noise and tread wear;
- Elaborate policy options and study the interaction of policy options (such as between energy labelling of tyres with complementary legislative measures on minimum standards for RR) and consider possible synergies (such as displaying energy labelling of tyres along with fuel consumption labelling and other environment and safety measures such as grip and noise/tread wear);
- Assess, quantitatively and qualitatively, the impacts of the different policy options according to the Commission practice described in the Impact Assessment Guidelines and the cost-benefits and cost-effectiveness of the measures proposed as required in the Ex-Ante Evaluation Guidelines';
- Compare policy options, weighing strengths and weaknesses and effectiveness and efficiency;
- Identify core progress indicators for monitoring and evaluating key objectives.

1.3 Policy Context

The European Commission (EC) recognises that increasing transport emissions could seriously affect the achievement of economy-wide CO2 emission targets and the objective

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[1] European Policy Evaluation Consortium (EPEC) www.epec.info

[2] DG TREN No. TREN/D3/375-2006

of sustainable transport as formulated in the mid-term review of the European transport policy (COM(2006)314). Measures to further reduce transport emissions should be considered. It is however, imperative that CO2 targets are met by the most cost-effective measures. This has been recognised by several bodies, including the CARS 21 group, the European Commission in the 2006 Energy Efficiency Action Plan (COM(2006)545) further endorsed by the European Council and Parliament[3], and the European Conference of Transport Ministers from January 2007. Balancing environmental and economic interests will keep cars affordable and safeguard jobs and production in Europe, which is key to the future health and prosperity of the EU.

The interest of the EC in promoting an expansion in the use of low rolling resistance tyres for motor vehicles (LRRTs), as one of a number of policy initiatives, is based on their potential to contribute cost-effectively towards fuel savings and CO2 emissions targets. The market take-up of LRRT through a labelling scheme has been identified as one of the measures which can contribute to achieve the 20% energy savings potential by 2020, as formulated in the 2006 Energy Efficiency Action Plan (COM(2006)545). It will complement the European new integrated strategy to reduce CO2 emissions from passenger cars and light duty vehicles, which identified the setting of minimum requirements on rolling resistance by 2012 as one of the complementary measures designed to provide an additional 10 g/km CO2 reduction from new cars and contributing to the overall target of 120 g/km for new cars (COM(2007)19). Policies to further reduce road transport emissions after 2012 are currently being discussed by Commission Services, with a Communication on ‘Greening Transport’ expected later in 2008.

1.4 Problem Definition and the Need for an Energy Labelling Proposal

The policy proposal for energy labelling of tyres is a response to the possible opportunity to influence customer demand from individuals and businesses as a means of achieving improved fuel consumption and emissions reduction. Rolling resistance together with aerodynamic drag are the most important resistive forces that a vehicle has to overcome while moving. The level of rolling resistance of tyres, as measured by the Rolling Resistance Coefficient (RRC)[4], varies considerably for any tyre choice of a customer. This means for passenger cars, for instance, a difference in fuel consumption between the worst and the best performing tyre of up to 10% and a reduction of 10g C02/km. This variation provides scope to influence the tyre choice of the customer in favour of more fuel efficient tyres.

The influence of rolling resistance (RR) on fuel consumption depends partly on the way the vehicle is driven, and the type of roads and speeds (the driving cycle) because of the interplay with other resistive forces acting on the vehicle[5]. For example, tyre rolling resistance has more of an effect on fuel efficiency in highway driving conditions but less of an effect in urban driving conditions. Based on the ‘New European Driving Cycle’ (NEDC), the rolling resistance of tyres accounts for 20% (Continental, *pers comm*) and from 20% to 30% (TNO, 2006) of total fuel consumption. Fitting lower RR tyres can lead to fuel savings. The absolute and relative fuel savings potential of lower RR tyres is discussed in more detail in Section 3.0.

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[3] TTE, (Energy) Council on 23 November 2006, 15210/06; Brussels European Council 8/9 March 2007, presidency Conclusions, 7224/07; European Parliament resolution of 24 October 2007 on the Community Strategy to reduce C02 emissions from passengers cars and light-commercial vehicles (2007/2119 (INI)), point 32

[4] Rolling resistance can be expressed as a coefficient, with the units kg/t. More details in section 2.1

[5] California state fuel-efficient Tyre report: Volume II, January 2003

The potential need for a specific EC policy proposal on energy labelling responds to the current market failure to provide information that would allow customers in the replacement market from taking into account fuel efficiency and related impacts in tyre choice. This would contribute to reducing CO2 emissions and hence the scale of related externalities.

Whilst current EU legislation on fuel efficiency of vehicles already gives an incentive to car manufacturers to fit their vehicles with good performing tyres as original equipment (OE), no such incentive is provided in the tyre replacement market, which accounts for 78% of EU tyre sales. Consumers and vehicle operating companies have no access to systematic data on tyre rolling resistance performance for tyres available to them, and cannot compare tyre purchase costs with prospective fuel savings. Customers may be confronted by as many as 250 different brands with no objective information on tyre performance.

There is therefore a market failure due to the:

- *lack of market information on the rolling resistance of tyres* – the criteria for buying tyres are influenced by price, size, appearance, first fit, etc. Customers have no information on tyre rolling resistance;

- *lack of market information on the relative energy efficiency of tyres* – no tangible or transparent way for a customer to understanding a tyre’s capability to increase a vehicle’s fuel economy and to secure fuel cost savings;

- *lack of market information on the range of tyre attributes* – customers need to understand better the interplay between the range of tyre attributes (fuel efficiency, tyre safety, wear and noise) to make rational choices between tyres with different properties depending on customer preferences.

Energy labelling of tyres at the EU level would allow customers to make informed choices, and give an incentive/reward to tyre manufacturers to upgrade their product across the EU tyre market. Experience from the effects of energy labelling on the EU demand for household appliances (Directive 1992/75/EC) shows that energy labelling can have a significant influence on market trends and encourage a move towards more energy efficient products.

Market surveys show that after the life duration of tyres (tyre wear), tyre safety performance is the most important criterion in customers purchasing decision. Tyre energy performance is also an important criterion in purchasing decision even without harmonised information across tyres (Section 3.1).

Empirical and statistical evidence from tests carried out by magazines and academic studies have shown that tyres with low rolling resistance performance (measured as RRC) are generally associated with lower levels of wet grip. This is discussed in more detail in Section 2.3. There is therefore a risk that energy labelling would encourage a market change that at the same time as improving fuel efficiency might lead to a greater purchase of tyres with lower wet grip than would occur without energy labelling. Whether this market effect represents an increased risk of road traffic accidents is not clear from the available technical evidence. Further research is required to establish the causal relationship between levels of wet grip and safety, taking into account driver behaviour and the extent to which drivers adjust behaviour according to tyre choice.

The optimisation of tyre performance to achieve both lower RR and the maintenance or improvement of wet grip levels is possible within technical limits. The tyre industry is currently reaching the limits of tread compound development using silica and further improvement to optimise performance across all tyre attributes will require technological change and related investment and will increase the cost of tyres.

1.5 Definition of the Policy Objectives for Policy Intervention

Given the nature of the problem, and in light of the LRRT proposal, the **General Objective** is to contribute to an increase in the fuel efficiency of vehicles to achieve CO2 savings.

The **Specific Objective:** is to *'pull the tyre market towards low rolling resistance tyres (LRRT), taking into account the interrelation with further parameters, in particular dry and wet grip (safety), noise and durability'*. The desired outcome is an increase in market share of LRRT whilst maintaining at least minimum standards for other tyre attributes.

The **Operational Objective:** given energy labelling is the preferred option, is to build an information system (i.e. a labelling scheme) providing targeted and easy to understand information to consumers, companies and retailers on tyres performance.

1.6 Market Context

The size of the road vehicle tyre market in Europe is indicated in Table (1.1) below.

Table 1.1: The EU Market for Road Vehicle Tyres Sold for Original Equipment (OE) and as Replacements (million)

Market Segment	2005	2006	2007	2007 Share (%) by Vehicle Type	2007 Share (%) of Total Tyre Sales
PC replacement – EU production	181	189	182	61%	53%
PC replacement – Imports	43	45	48	16%	14%
Total PC replacement	**224**	**235**	**231**	**78%**	**68%**
PC OE – EU production	61	64	63	21%	18%
PC OE – Imports	1	0	2	1%	1%
Total PC OE	**62**	**64**	**65**	**22%**	**19%**
TOTAL Passenger Car (PC)	**286**	**299**	**296**	**100%**	**87%**
LT replacement – EU production	15	15	16	57%	5%
LT replacement – Imports	4	4	4	14%	1%
Total LT replacement	**19**	**19**	**20**	**71%**	**6%**
LT OE – EU production	7	7	7	25%	2%
LT OE – Imports	1	1	1	4%	0%
Total LT OE	**7**	**8**	**8**	**29%**	**2%**
TOTAL Light Truck (LT)	**26**	**27**	**28**	**100%**	**8%**
TBs replacement – EU production	11	11	11	61%	3%
TBs replacement – Imports	4	5	5	28%	1%
Total TBs replacement	**15**	**16**	**16**	**89%**	**5%**
TBs OE – EU production	0	2	2	11%	1%
TBs OE – Imports	0	0	0	0%	0%
Total TBs OE	**0**	**2**	**2**	**11%**	**1%**
TOTAL Trucks & Buses (TBs)	0	**18**	**18**	**100%**	**5%**
All Vehicle Tyre Sales in EU	**312**	**344**	**342**		**100%**
Total replacement sales	258	270	267		**78%**
Total OE sales	69	74	75		**22%**

Source: Europool (courtesy ETRMA), ACEA
PC – passenger cars, LT – Light transport vehicles, TBs – Trucks and buses

In 2007 some 296 million tyres for passenger cars were sold in the EU accounting for 87% of all tyres sold. A further 46 million were sold for other vehicles such as vans, trucks and buses.

Of total sales some 78% were sold in the replacement market, the remainder being supplied to vehicle manufacturers as original equipment (OE). Tyres sold in the replacement market for passenger cars can be differentiated by price into premium, mid-range and budget segments, accounting for 54%, 25% and 21% of the total passenger car replacement market respectively.

Summer tyres and winter tyres differ in their levels of RR and need to be considered separately. Summer and winter tyres account for 70% and 30% respectively of the total replacement tyre market (Table 1.2).

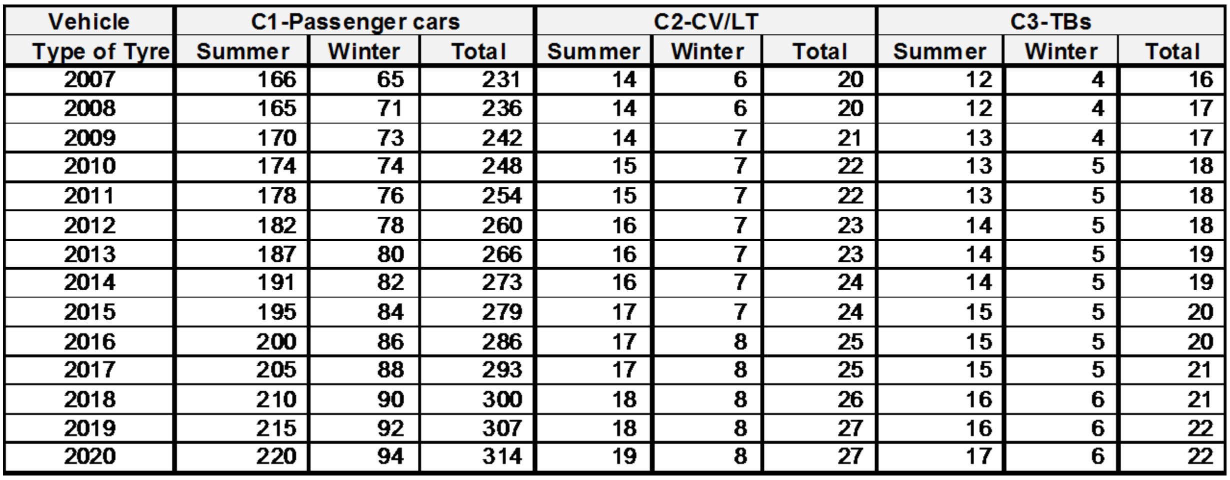
Table 1.2: Replacement Market Share of Winter and Summer Tyres by Tyre Class

Market Share	C1 (PC)	C2 (CV/LT)	C3 (TB)	All Tyres
Summer	70%	69%	74%	70%
Winter	30%	31%	26%	30%

Source: Europool (courtesy ETRMA), ACEA
PC – passenger cars, LT – Light transport vehicles, TBs – Trucks and buses

The future volume of EU tyre sales for the replacement market has been projected using the market data and DG Tren growth rates from the DG Tren Pocketbook. The projections are shown in Table (1.3) below. These indicate total EU sales in 2020 of 363 million tyres.

Table 1.3: The Projected EU Market for Replacement Tyres C1, C2 and C3 (millions), including imports



Vehicle	C1-Passenger cars			C2-CV/LT			C3-TBs		
Type of Tyre	Summer	Winter	Total	Summer	Winter	Total	Summer	Winter	Total
2007	166	65	231	14	6	20	12	4	16
2008	165	71	236	14	6	20	12	4	17
2009	170	73	242	14	7	21	13	4	17
2010	174	74	248	15	7	22	13	5	18
2011	178	76	254	15	7	22	13	5	18
2012	182	78	260	16	7	23	14	5	18
2013	187	80	266	16	7	23	14	5	19
2014	191	82	273	16	7	24	14	5	19
2015	195	84	279	17	7	24	15	5	20
2016	200	86	286	17	8	25	15	5	20
2017	205	88	293	17	8	25	15	5	21
2018	210	90	300	18	8	26	16	6	21
2019	215	92	307	18	8	27	16	6	22
2020	220	94	314	19	8	27	17	6	22

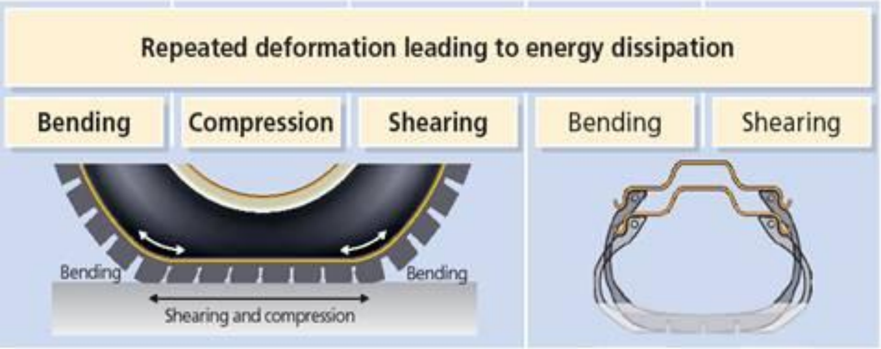
Source: *Europool (Courtesy ETRMA), ACEA and DG Tren Pocket Book*

2 THE TECHNICAL DEVELOPMENT AND COSTS OF LOWER ROLLING RESISTANCE TYRES

2.1 What is Rolling Resistance?

Rolling resistance is the resistance to motion that occurs when an object (e.g. a wheel or tyre) rolls. It is caused mainly by the deformation of the wheel or tyre or the deformation of the contact surface (e.g. the road) and thus it depends very much on the material of the wheel or tyre and the type of road surface.

A tyre's rolling resistance is defined as the energy dissipated by a tyre per unit of distance travelled (ie. rolling resistance force F_{RR}) and can be characterized by a coefficient of RR expressed in kg/t or ‰. The RRC gives the value of the rolling resistance force divided by the wheel load. RRC is by definition independent from the vehicle load. This allows for comparison across all tyres of RR properties irrespective of vehicle size. In the literature other units are used [J/m] and [N], but conceptually, rolling resistance is better understood as a loss per distance than a force. A lower coefficient means the tyres will use less energy to travel.



Source: Barand and Bokar, 2008, SAE

Rolling resistance is affected by:

- **Tyre design and construction** - diameter, width, mass, tread depth, internal components
- **Rubber compounds** – hysteretic properties, (low hysteresis material has lower RR)
- **Tyre inflation** - an under-inflated tyre is over deflected and dissipates more energy (For example, for a passenger car RRC increases by 6% when the tyres are 30kPa below recommended pressure and by 30% for 100kPa below)[6]
- **Roadway surface** - a macro rough road may mean 30% more RR than a smooth road; ground temperature also has an influence
- **Static and Dynamic Vehicle Settings** - toe, camber/steering effect
- **Vehicle usage** - torque, slip angle change due to acceleration
- **Ambient temperature** - a 10°C increase usually means 8% less RR
- **Tyre operating temperature** - a cold tyre has 30% more RR
- **Load** - RR is almost proportional to the load which is applied on the tyre

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[6] *Barand and Bokar, 2008, SAE*

2.2 Current Distribution of Low Rolling Resistance Performance on the EU Tyre Market

Levels of rolling resistance vary between passenger cars (C1), commercial vehicles (C2) and trucks (C3). Data supplied by the European Tyre and Rubber Manufacturers' Association (ETRMA) (Figure 2.1, Table 2.1) indicates the approximate market distribution of RR across the different vehicle types. According to ETRMA, this data is representative of all EU sales of tyres. For summer tyres for passenger cars, the largest market segment, 88% of tyres have a RRC over 10kg/t, which indicates the existence of a market failure, as tyres below 10 kg/t are cost – effective (see section 3 for more details).

Figure 2.1: EU Tyre Market Distribution of RR for Different Vehicle Types, 2004

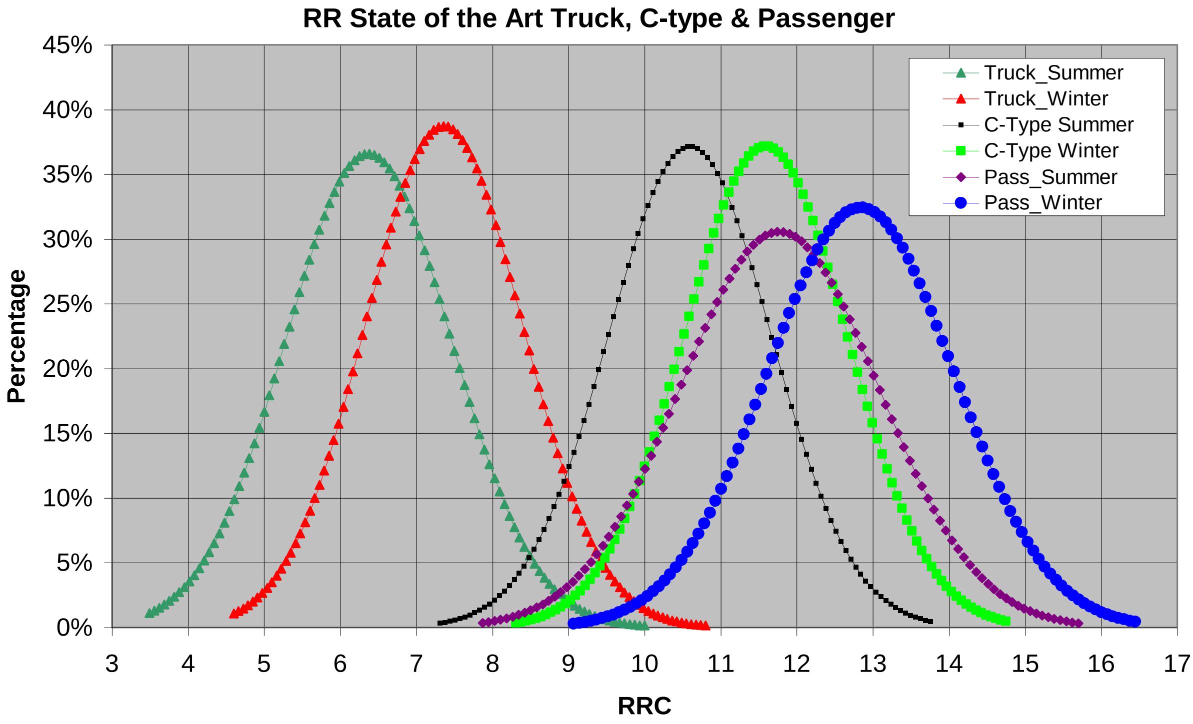


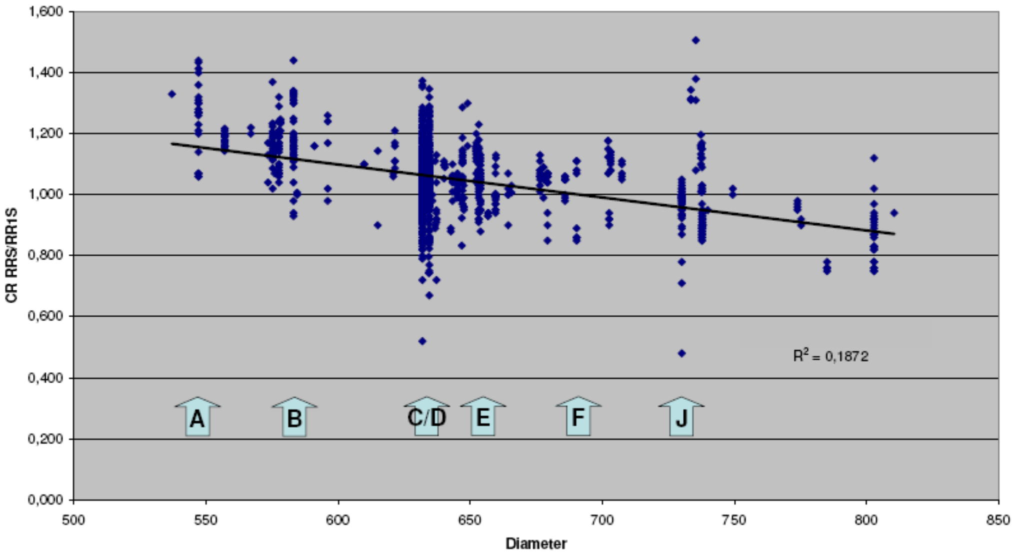
Table 2.1: Summary of Rolling Resistance (RRC, kg/t) by Vehicle Types, 2004

Vehicle Type	Average	Min	Max
Passenger Car – summer	11.8	7.9	15.7
Passenger Car – winter	12.8	9.1	16.5
All Passenger Cars (C1)	**12.1**	**8.2**	**15.9**
Light Truck – summer	10.4	7.3	13.8
Light Truck – winter	11.4	8.3	14.8
Al Light Trucks (C2)	**10.7**	**7.6**	**14.1**
Truck/Bus – summer (steer/trailer)	6.4	3.5	10.0
Truck/Bus – winter (Drive)	7.4	4.6	10.8
All Trucks & Buses (C3)	**6.6**	**3.8**	**10.2**

Source: ETRMA

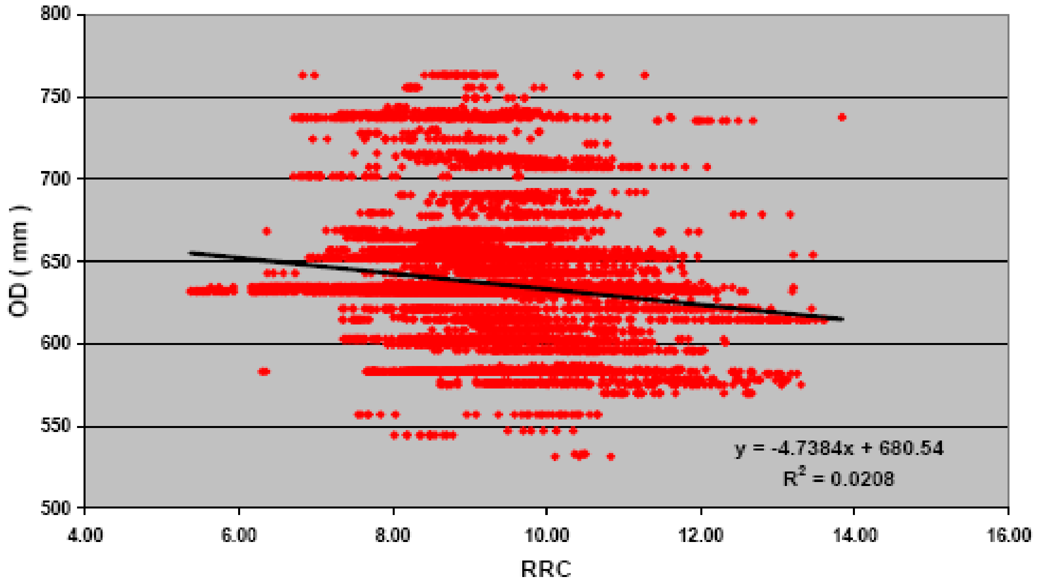
More recent data on RRC from two tyre companies (Continental and Goodyear) suggest that the minimum RRC value in 2008 is around 6.5-7 kg/t for passenger cars (Figures 2.2 and 2.3). However, according to Goodyear the lowest C1 tyre sold in the replacement and OE market is 8.4 kg/t, whilst Continental advise that the minimum value in the C1 replacement market, with an acceptable performance on wet grip, is 8kg/t. Tyres below this limit are prototypes. The maximum current C1 value is 14.4kg/t with an average of 10.5kg/t across the product range.

Figure 2.2: RRC by Outside Diameter, Continental (by EC vehicle categories)



A	MiniCars – eg. Smart, Fox,.
B	Small cars – eg. Fiat Punto
C	Medium class – eg. VW Golf
D	Upper medium class – eg. Volvo S70, 3er BMW
E	Upper class – eg. Audi A6, 5er BMW
F	Luxury class Mercedes S – eg. Audi A8, 7er BMW
J	Sport Utility Vehicle - SUV – eg. BMW X 5

Figure 2.3: RRC by Outside Diameter, Goodyear



These results (Figures 2.2 and 2.3) also suggest that RRC falls as the size of the tyre increases as measured by the outside diameter (OD). This relationship suggests energy labelling should take this into account in any adopted grading scheme otherwise incentives will tend to focus on innovation for tyres for smaller cars, rather than the whole market. To take this relationship into account and to maximise the range of grades available to all customers, a relative grading scheme should be used, where the actual RRC used to define any given grade would change between tyre sizes. We discuss this further in Annex 7.

As noted above, due to differences in tyre design for summer and winter use, there is a significant variation in RR. As tyres roll under the vehicle's weight, their shape is being deformed and their compounds, which are also designed to ensure traction and comfort, dissipate energy in the form of heat. Winter tyre deformations are greater and on average have 1kg/t greater RR than summer tyres, as shown in the ETRMA data.

However, a study by VTI (2008) in Sweden found the opposite results (winter tyres 1kg/t less RR on average than summer tyres). These contrasting results may be the consequence of different designs of winter tyres: tyres are made for Scandinavian countries to roll on ice and snow, in other countries they are made to roll on mud and wet roads with in both cases different techniques and tread patterns used. There is no quantified data based on a representative EU sample demonstrating that winter tyres have a smaller RRC than summer tyres. The impact assessment is therefore based on the market distributions of RRC (summer and winter) as suggested by ETRMA.

2.3 Trade-offs between Improvements in Rolling Resistance and Other Tyre Attributes

Tyre performance is influenced by the materials, tyre components and construction methods used. Changes in these provide a different balance of attributes. Promoting one attribute such as rolling resistance may decrease the performance of the tyre in relation to other attributes. Thus tyre design optimises performance, managing trade-offs to achieve a performance balance that best meets customer or market requirements.

The most important tyre component when designing a tyre to reduce its rolling resistance is the tread compound, with the operation of the steel belt second. Change in tread compound is however also the major influence on most of the other attributes. The key trade-offs that are likely to arise from a focus on reducing rolling resistance are a reduced level of wet grip and possibly aquaplaning (Table 2.2).

Table 2.2: Technological Options for Reducing Rolling Resistance

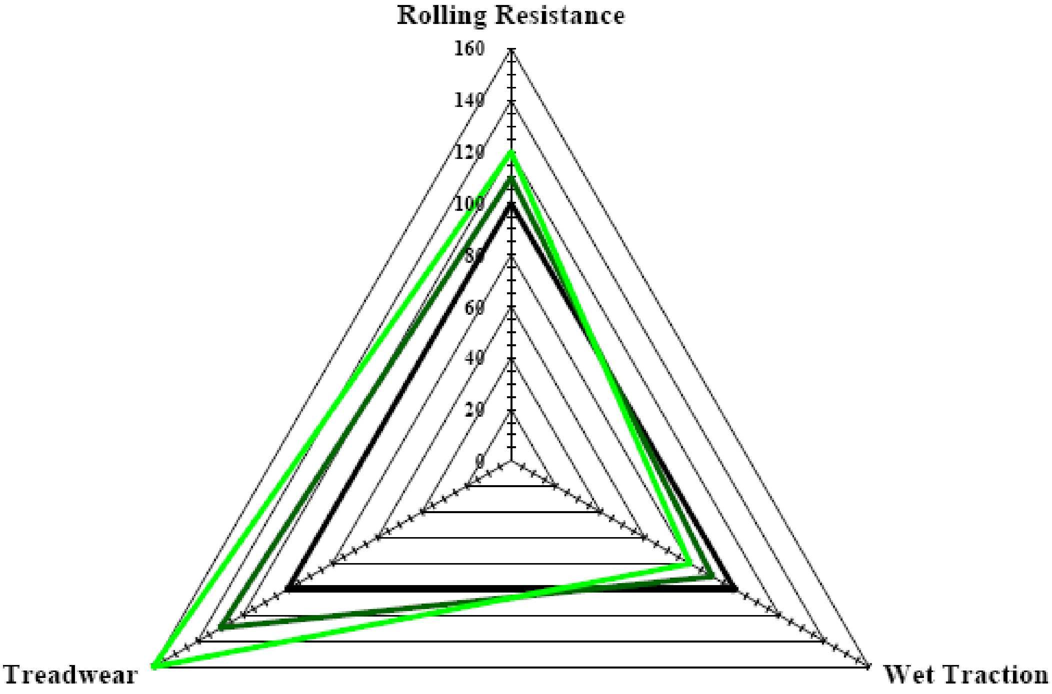
Rolling Resistance	Wet Grip	Dry Grip	Handling	Wear life	Noise	Aquaplaning	Durability	Endurance
Unit: kg/ton	Unit: Index, braking distance	Unit: ?	Unit: Lap time or points vs reference	Unit: Km	Unit: dB	Unit: If in strait line – Vmax; if in curve – various parameters	Unit: Km	Unit: Depend on the test evaluation parameter
Lowering RR by improvement/change to:								
Tread (only compound)	---	-	--	+	-	--	=	=
Side wall	=	=	-	=	=	=	--	-
Beading	=	=	=	=	=	=	=	-
Belt package	+	+	-	-	+	-	--	-

Source: GHK based on consultation with tyre producers

Note: **+++** *Strong positive correlation,* **++** *medium positive correlation,* **+** *low positive correlation,* **-** *low negative correlation,* **- -** *medium negative correlation and* **- - -** *high negative correlation,* **=** *stays the same. Durability is related to tyre body structural resistance over tyre life, until tyre is worn out, regardless the length of time life. Endurance related to resistance over tyre life to ageing, regardless the mileage accumulated.*

The interplay between rolling resistance and wet traction and treadwear for a given technology is shown in Figure 2.4 (where movement away from the centre represents an improvement), that indicates that wet traction is reduced as rolling resistance is reduced; but that reduced rolling resistance also improves treadwear.

Figure 2.4: Relationship between Rolling Resistance, Treadwear and Wet Traction for a Given Technology



Source: Goodyear

Based on a review of various studies examining the relationship between rolling resistance and other tyre attributes, mainly wet grip (WG), noise and wear (see Annex 3) a number of conclusions can be drawn:

- No correlation was found between RR and tyre noise
- Changing the tread pattern to improve wet grip is generally associated with an increase in tyre noise levels;
- Lower RR is generally associated with a lower level of wet grip across all tyre sizes;
- There is evidence that there are tyres in most sizes that can perform well on a number of tyre attributes (including wet grip) but at higher tyre costs;
- For fuel efficient tyres with low RR, there is a clear price premium for tyres which also perform well on WG compared to tyres which achieve low RR but with reduced WG performance. The price premium for the better performing tyres on RR and WG,

compared to the worst performing tyres on wet grip ranges from 20% to 40% and between 5% to 10% for tyres with an average level of performance for WG;

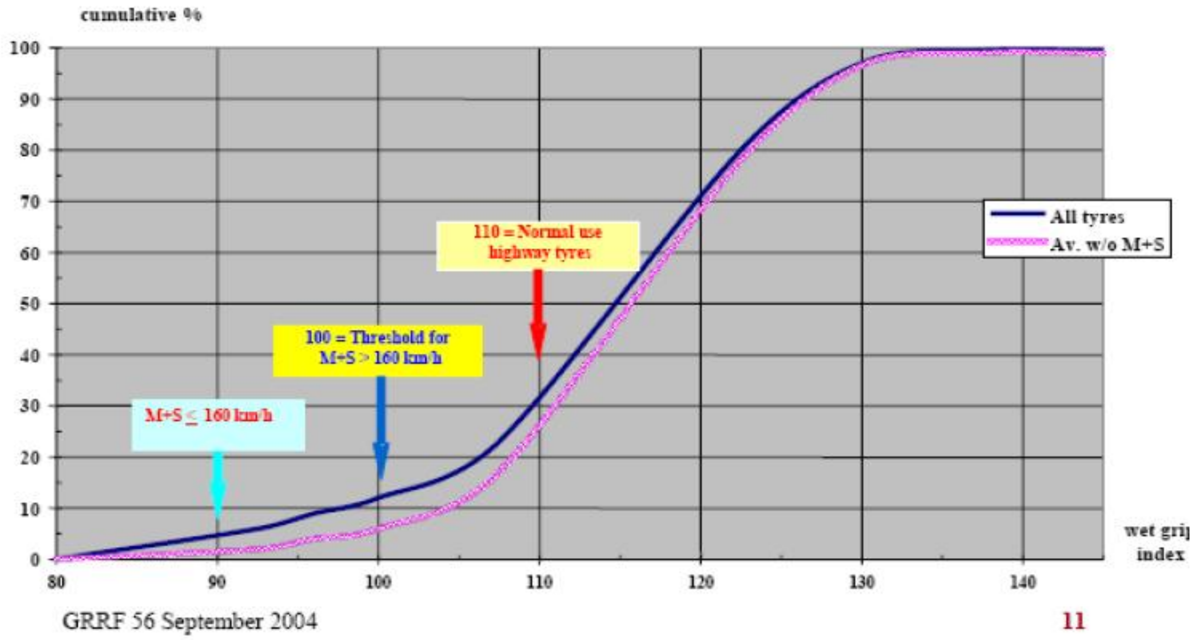
- None of the studies and tests showed that any one tyre (irrespective of cost) scored the best on all attributes. This suggests that better technology at higher cost allows some progress in reducing RR without compromising WG, but there are current technological limits to achieving the very best performance levels of RR with the very best performance standards for WG;

- Independent tests (ADAC, Which, Knall-effekt and Que Choisir) showed that imported tyres that had very low RR tended to perform very poorly on WG.

2.3.1 Accidents and wet grip

The importance of a trade-off between reduced rolling resistance and reduced level of wet grip depends on the extent to which reduced wet grip gives rise to an increase in braking distances for a given speed and road surface; and associated road traffic accidents and casualties. Wet grip is usually measured by braking distance under controlled circumstances and reported on an index with the wet grip as measured by the standard reference tyre type (SRTT) as approved by UNECE Regulation 117 providing the reference point (100%). The distribution of wet grip across the EU tyre market is presented in Figure 2.5.

Figure 2.5: Wet Grip Distribution in Europe



Note: Cumulative frequency distribution of the wet grip index (G) for a large number of tyres on the European market (GRRF 56-28, 2004). The limiting values according to the ECE R117 are indicated. The curve in lilac colour (lighter) shows data for 'normal/summer' tyres, whereas the blue curve (darker) shows data for all tyres together. Note that 'M+S' are 'mud & snow' or 'winter' tyres.

Although the SRTT provides a benchmark it does not provide a formal minimum standard which producers are required to meet. Under the UNECE regulation 117 there is a proposal to set a minimum standard at 110% of the SRTT for normal tyres and 90% to 100% for snow tyres[7]. The proposal for a Regulation on general safety of motor vehicles (COM(2008)316) foresees the introduction of this minimum standard in EU law in 2012-2014. Currently, some 30% of tyres on the EU market would fail to meet the proposed standard. The impact assessment has assumed that this standard and related testing is approved and implemented by the end of 2012.

The introduction of the standard will limit the trade-off between WG and RR that might otherwise have occurred without it; and policy options will need to comply with the minimum standard. However, promoting RR and not other attributes, especially wet grip, introduces the risk that customers will, without knowing, purchase tyres with lower wet grip than they would otherwise have done (but not less than the minimum standard). Whether this represents a serious risk of increased accidents is unknown.

Tyre-related accident data is scarce. In most cases it is not extensive or detailed enough for conclusive insight on the relationship between accidents and relevant tyre attributes. Understandably, the industry itself, both vehicle and tyre manufacturers, is very sensitive about publishing results and statistics of their own accident research or complaint departments. However, some conclusions can be drawn regarding tyre wet grip and the risk of accidents (see Annex 4). In summary:

- Tyres vary in their level of wet grip, as do road surfaces. Braking distances depend on tyre grip, the vehicle braking system and road surface;
- Grip performance of tyres on wet roads diminishes as roads wear over time because the skid resistance reduces;
- The risk of accidents on wet roads is higher, when the grip provided by the road surface is lower; by implication the risk of accidents should intuitively also be higher when tyre grip is reduced (although there is no available data to confirm this);
- The risk of accidents is highest for a tyre with low grip performance, on a wet road below a certain level of skid resistance;
- Where road accident data on the contribution of vehicle components to accident risk is available, it suggests that tyre performance is relatively more important than other vehicle components. The total percentage of tyre-related accidents in all reported motor vehicle accidents (not just technical defects) involving personal injury in Germany and Switzerland is 0.4% and 0.1% in Italy[8].

2.4 Additional Costs of Testing and Grading for Rolling Resistance and Wet Grip

The introduction of policy options requires tyres to be tested for their performance in relation to rolling resistance and also (in the case of some options) wet grip. Depending on the required accuracy of the grading and labelling scheme, additional testing costs will be incurred by tyre producers. Information on the additional costs of tyre testing and grading for both rolling resistance and wet grip was provided by ETRMA. The costs were evaluated by: Bridgestone, Cooper, Continental, Goodyear, Michelin, Pirelli and Vredestein. These producers account for approximately 50% of the sales to the EU market.

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[7] 90% for snow tyre with a speed symbol ("Q" or below minus "H") indicating a maximum permissible speed not greater than 160 km/h and 100% for snow tyre with a speed symbol ("R" and above, plus "H") indicating a maximum permissible speed greater than 160 km/h

[8] TÜV (2003) 'Survey on motor vehicle tyres and related aspects' EC DG Enterprise.

2.4.1 Rolling Resistance

The estimated cost per test for C1/C2 for rolling resistance (for each type approval or grading) is about 260 Euro and range between 250 and 300 Euro to allow a bandwidth of 1.5kg/t (Table 2.3a).

Table 2.3a: Costs of Rolling Resistance Testing (1.5kg bandwidth) for C1/C2/C3 Tyres

	Number of Tests per Year.	Average Cost per Test	Total Annual Cost
Reference Case - Compliance with minimum requirements set in COM(2008)316	400	€260 (250~300)	€0.1m
Grading for C1/C2	3,000	€260 (250~300)	€0.78m plus (annualised) fixed cost of €0.3m
Grading for C3	165 (@5.5% of C1/C2)	€260	€0.04m
Additional Cost			€1.04m

Source: ETRMA (C1/C2 only). C3 estimate based on share of tests for C1/C2 based on market share of C3 and assumes same average cost per test

Note: Assumes number of tests are twice the number identified to take account of market share

Note: Fixed costs include maintenance and laboratory alignment tests

The annual additional cost for rolling resistance grading is approximately €1.0m for C1/C2/C3 tyres. For the purposes of the impact assessment we have assumed that the average cost per tyre is similar to that for C1/C2 tyres and that the number of tests is in proportion to market share. This adds a small additional cost of €0.04m per year.

The cost includes the one-off start-up costs for rolling resistance grading, estimated to be approximately €2m with an annualised cost of €0.3m at 4% discount rate 2012-2020. The total annual additional cost of RR grading of €1 million represents approximately a cost per tyre sold of €0.003.

The additional costs associated with testing and grading to establish a 1.0 kg/t bandwidth could be higher given the need for more accurate testing. Based on discussions with the tyre producers the additional testing costs for a 1.0 kg/t bandwidth would be between a factor of 1 to 3 higher than the cost for the wider bandwidth (1.5kg/t). It is more likely however that the testing would be no more expensive because test equipment and test levels will already be precise enough for a 1kg/t bandwidth if they follow the future ISO 28580[9]. Assuming a factor of three, the additional RR testing and grading cost per tyre sold for a 1kg/t bandwidth would be at the most €0.01.

2.4.2 Wet Grip

For wet grip there is a wider range of costs per test, between €600 and €3,800, (Table 2.3b) The wet grip type approval for UN/ECE-Regulation 117.01 is based on a simple ‘pass’ or ‘no-pass’ test according to the required minimum performance.

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[9] ISO28580 is a tyre rolling resistance measurement method designed to ease international cooperation and, possibly, regulation building. ISO 28580 will be an improved testing method based on ISO 18164, aiming at a better repeatability and reproducibility.

Table 2.3b: Costs of Wet Grip Testing for C1/C2/C3 Tyres

	Number of Tests per Year	Average Cost per Test	Total Annual Cost
Reference Case – Homologation – R117 / COM(2008)316	364	€2,000 (600~3,800)	€0.7m
Grading for C1	1,100	€2,311 (800~4,017)	€2.5m plus fixed cost (annualised) of €0.7m
Grading for C2/C3	170 (@15.5% of C1)	€2,311	€0.4m
Additional Cost	n/a	n/a	€2.9m

Source: ETRMA (C1 only). C2/C3 estimate based on share of tests for C1 based on market share of C2/C3 and assumes same average cost per test
Note: Assumes number of tests are twice the number identified to take account of market share (although product range is more important than sales volume in determining test costs)

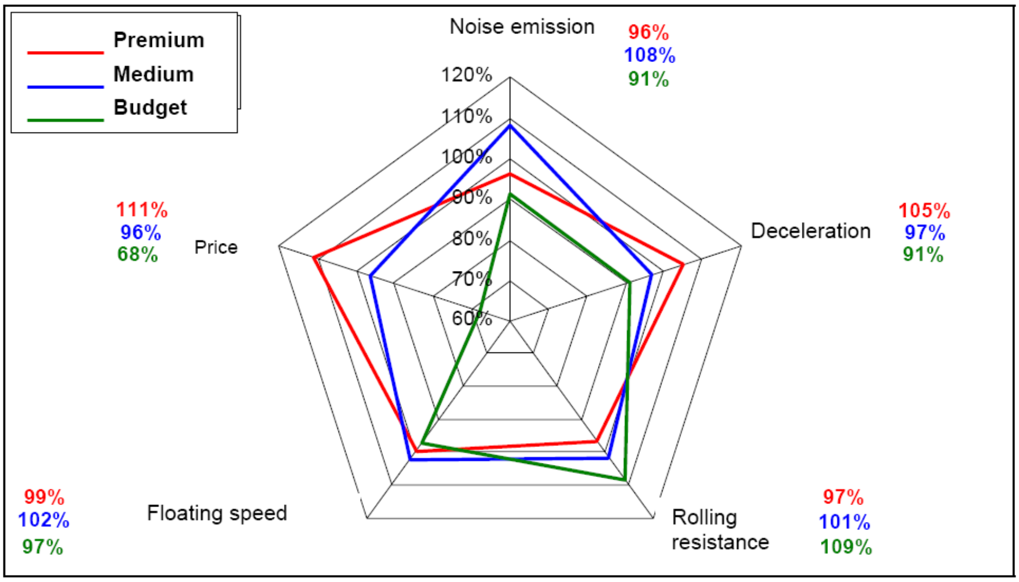
The total additional annual cost for wet grip grading per year is estimated to be approximately €2.9m for C1/C2/C3 tyres. Estimates for C2/C3 are based on number of tests for C1 and market share of C2/C3 and assuming the same average cost per test.

The cost includes an initial start up cost for wet grip grading of approximately €4.6 million in the first year to cover test facilities, or an annualised cost of €0.7m, over 8 years, 2012 - 2020, at a discount rate of 4%. The total annual additional cost of WG grading of €2.9m represents approximately a cost per tyre sold of €0.01.

2.5 Optimising RRC and Additional Costs

Technology does currently exist, given technological limits, for producing lower RR tyres without sacrificing wet grip performance, but at a higher cost. These premium tyres tend to have optimum performance on all fronts, although at higher price (Figure 2.6 below).

Figure 2.6: Spider Chart for Summer Tyres 205/55 R16 (N=8).



Source: TUV (2002)
Notes: -Relative noise emission: a higher percentage means a higher noise emission (i.e. >100% is worse)
-Relative deceleration: a higher percentage means a better braking performance (i.e. >100% is better)
-Relative rolling resistance: a higher percentage means a higher rolling resistance (i.e. >100% is worse)
-Relative floating speed: a higher percentage means a better aquaplaning behaviour (i.e. >100% is better)

-Relative sales price: a higher percentage means a higher sales price (i.e. >100% is worse)

Improving RR using the low cost option of treating only the tread compound leads to a large performance trade-off with wet grip and handling (see section 4.4.2 for an assessment of the significance of wet grip performance range). On the other hand, tyre producers and independent tests for C1/C2 indicate a 20% reduction in RR compared to the average is possible with no performance trade-off on other attributes but with 5% to 10% higher production costs (including additional R&D costs), (Table 2.4a). Annex 5 provides further details.

Table 2.4a: Production Cost of Options to Reduce RR, C1 and C2

Options	**Indicative Costs of Reducing RR from Average Levels in 2008 (11.9kg/t for C1 summer tyres)**
Zero Cost	No cost, no R&D cost, up to 20% RR reduction, but trade-off
Low Cost	**+2%** Production cost (including R&D costs), up to 10% RR reduction with partial trade-off
Medium Cost	**+3%** Production cost (including R&D costs), up to 15% RR reduction with partial trade-off
High Cost	**+5% to 10%** Production cost (including R&D costs), up to 20% RR reduction with no trade-off. Higher cost would be expected for a similar reduction in RRC in higher bands.

Source: Discussions with Tyre Producers

The main cost elements giving rise to the additional cost and change over time are as follows (in order of significance):

- Material costs – increased cost of raw material, such as silica
- Replacement cost of product lines – depending on timing of the new regulation and replacement cycle – assumed to be incurred in the reference case because of the need to meet minimum standards
- New machinery and plant costs – to allow change in tread and moulding
- R&D costs
- Personnel costs – costs of hiring additional labour
- Manufacturer's additional tyre testing and certification costs

In addition, in the case of energy labelling there would be additional costs to producers in relation to the costs of posters, stickers, communication and training (Box 2.1)

Box 2.1: Energy Labelling Costs for Producers

According to ETRMA, the estimated cost per year for the tyre industry to put a sticker based label on each tyre (C1/C2) at the factory is around €10m. The cost per tyre of stickers is thus around €0.04 for C1/C2 tyres. Costs of additional forms of communication such as leaflets, posters and marking on consumer invoices will depend on the retail and marketing structure in most member states. However, tyre producers do not expect these costs to be significant as they can be included in existing measures and communication practices. The label can also be moulded on the sidewall of the tyre. The tyre industry does not support this idea as the RRC (and/or) WG rating would only apply when the tyre is new. Moulding would incur significant additional costs if grading were applied simultaneously to all tyres in an existing production line. If it were applied to only new production lines, costs would be low with only €13 per mould per size.

Taking the estimated range of additional costs associated with producing more fuel efficient tyres whilst maintaining or improving wet grip performance for a 20% reduction on average levels of RRC in the market in 2008 (Table 2.4a), and applying these to the average market RRC in 2012, allows an estimate of the additional cost of achieving a reduction of 1 kg/t in RRC (Table 2.4b). The estimated additional cost per 1 kg/t reduction is estimated to be between 2.3% and 4.6% of production costs for reducing RR from average levels in 2012.

Table 2.4b: Additional Production Costs per kg/t Reduction in 2008, 2012 (C1 Summer Tyres)

Year	Average Market RRC for C1 (summer) (kg/t)	Reduction on average RRC (%)	20% reduction from average levels in RRC (kg/t)	Additional production cost for a 20% reduction in RRC (%)	Additional cost (% increase per 1 kg/t)
2008	11.9	20%	2.4	5 – 10	2.1 – 4.2
2012	11.0	20%	2.2	5 – 10	2.3 – 4.6

Sources: Table 2.4a and ETRMA/TPIA (2007)

Discussion with the tyre producers indicate that the costs of improving RR by a given level would increase for tyres with lower RRC; i.e. there is a rising marginal cost of production with the move to lower levels of rolling resistance. Table 2.5a sets out an indicative range of additional costs for reducing RRC by 1 kg/t, ranging from 2.3% to 5.0% (single label) and from 4.6% to 10.0% (dual label).

Assuming higher production costs (including R&D, testing and labelling) are passed on to customers (since in a competitive market, prices reflect production costs), there is a price premium for customers for improvements in RR without compromising wet grip.

Table 2.5a: Price Premium for Reductions in RRC by 1kg/t. Moving from 1 Band to the Next Highest Band (C1 summer tyres)

	A+	**A**	**B**	**C**	**D**	**E**	**F**	**G**
RRC kg/t	5 to 6	6 to 7	7 to 8	8 to 9	9 to 10	10 to 11	11 to 12	Above 12
Single Labelling	?	5.0%	3.5%	2.8%	2.5%	2.3%	0.0%	0.0%
Dual Labelling	?	10.0%	7.0%	5.6%	5.0%	4.6%	0.0%	0.0%

Dual labelling, compared to single labelling, provides an increased incentive to improve wet grip performance over the minimum limit, and as a consequence the additional costs for dual labelling are higher than single labelling. Dual labelling would thus encourage optimisation of both wet grip and RR. The higher price premium for dual labelling takes into consideration:

- higher grading and testing costs – ETRMA and TUV estimate;

- higher production cost – the costs of producing tyres in the higher bands of both RR and WG, and to maintain existing minimum standards for tyre rolling noise;
- higher manufacturer and retailer costs due the set up and maintenance of two databases.

The price premium of moving from Band F (taken as the band with the average market level of RRC (11.0kg/t in 2012) to higher bands is shown in Table 2.5b. This indicates that the price premium of purchasing tyres in the highest band compared to Band F is 16% (single label) and 32% (dual label). These additional costs are used to estimate the impact of market transformation in each of the years 2013-2020. These additional costs may decline over time with better understanding of the technology and with economies of scale as customers increase their purchase of higher performing tyres. This effect is not included in the estimated price premium and the estimate of additional costs may therefore represent an overestimate, especially in later years.

Table 2.5b: Price Premium for Reductions in RRC by RRC Bands, 1kg/t (C1 tyres), 2012, Compared to band F

	A+	**A**	**B**	**C**	**D**	**E**	**F**	**G**
RRC kg/t	5 to 6	6 to 7	7 to 8	8 to 9	9 to 10	10 to 11	11 to 12	Above 12
Single Labelling	?	16.1%	11.1%	7.6%	4.8%	2.3%	0.0%	0.0%
Dual Labelling	?	32.2%	22.2%	15.2%	9.6%	4.6%	0.0%	0.0%

2.5.1 Price elasticity of demand for tyres

The price premium provides a disincentive to customers to purchase lower rolling resistance tyres. The purpose of the policy options is to counter this effect through revealing the financial benefits of switching to LRRTs (via labelling) or counter acting the premium through tax changes such as VAT or new taxes (such as a carbon tax)

The estimated long-run price elasticity of demand for car tyres is 1.2[10]. The price elasticity of demand is the proportionate change in demand given a change in price; a 1% reduction in the price produces a 1.2% increase in demand for the product.

In the absence of a labelling scheme the higher costs of LRRTs will reduce their demand. An increase in price by 16.1% from Band F to A, for example, under single labelling would reduce demand by 19.3%. Labelling has to overcome the market failure and encourage customers to take account of fuel savings that offset the price premium. The extent to which labelling is able to do this is unknown. We return to this uncertainty in Section 4.

2.6 Technological Potential for Reducing Rolling Resistance

Tyre technology has been evolving over the years with a constant reduction in rolling resistance since the 1940s, with changes in tyre technology (Figure 2.7). According to the IEA/OECD (2005) there has been constant but slow improvement on rolling resistance over the past decades with a 5% decrease in rolling resistance per decade (after accounting for performance improvements). RRC of tyres in 2000 had declined by over 50% compared to the 1940s.

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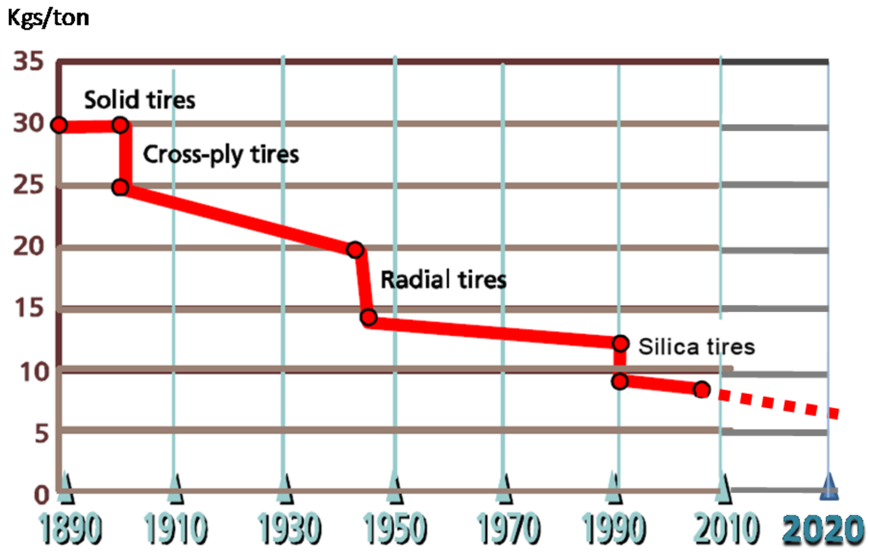
[10] Mackinac Center for Public Policy, “Price Elasticity of Demand,” November 13 1997, www.mackinac.org/1247 No later data has been found to update this estimate.

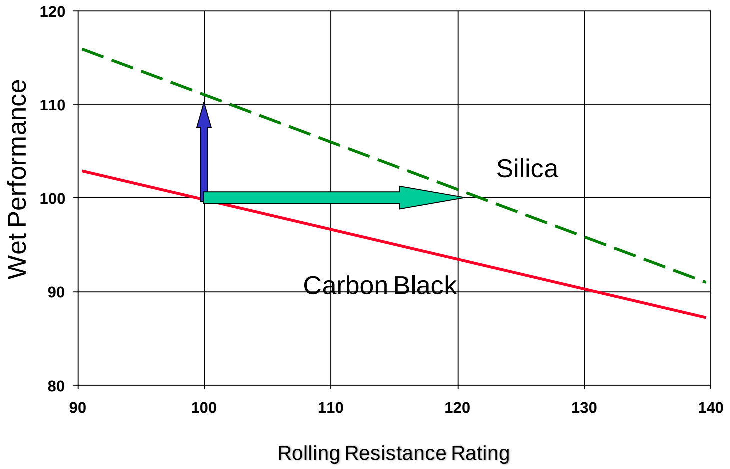
Figure 2.7: Main Tyre Technology and State-of-the-Art RRC Over Time



Source: Michelin Green-meter www.michelingreenmeter.com

In 1992, Michelin launched green energy saving tyres, which integrated silica in the tread as a partial substitute for carbon black. Silica, in decreasing the loss property of the compound, helps to lower rolling resistance without compromising performance in traction, grip (especially on wet surfaces) and tread life (Figure 2.8). This innovation enabled a reduction in fuel consumption of 1.7lt/1,000 kms.

Figure 2.8: Role of Silica in reducing RR without compromising wet grip



Source: Axel Friedrich, Umweltbundesamt (UBA), Germany, CEC Workshop 2002

Today, further advances are still possible. Researchers at Michelin, for example, believe that significant additional reductions in rolling resistance, up to 50 per cent on 2007 standards, is possible within the next 10 to 15 years – a technical challenge to which Michelin is responding with special research programmes.

As discussed in section 2.1, rolling resistance can be reduced by: a) reducing the deformation of the tyre and b) reducing the hysteretic properties of the compounds/textile fabrics. For example, the deformation of a steel wheel of a train is very low, hence an absolute RRC limit of around 0.1 – 0.2 kg/t. However, this drastically reduces the braking performance due to the small contact footprint and friction value (μ) compared to a car tyre.

The deformation can be reduced by increasing the tyre inflation pressure. However, experiments with high pressurized passenger car tyres have failed in the past because of reduced comfort as well as loss in braking performance. Deformations can also be reduced by optimizing the tyre contour, but this has been exploited considerably with reduced scope for further improvements.

The tyre industry is thus concentrating on reducing the hysteretic properties of the tyre. This is expected to be the main area for reducing rolling resistance in the next decade. This can be done by changing the compound itself with new rubber types and filler systems or by reducing the amount of material. Another way is to reduce the non skid depth, but this would also reduce the tyre lifetime mileage.

According to two tyre producers, the lowest RRC achieved in the replacement market at the current (2008) time for C1, with acceptable levels of wet grip performance is 8.0 to 8.5 kg/t. The state of the art RRC in 2008-2009 from Figure 2.5 (Michelin Green meter) is around 8-9kg/t. Extrapolating the RRC trend in Figure 2.5 indicates a level of RRC of 6 to 6.5kg/t in 2020.

However, it should be recognised that technological evolution cannot be accurately predicted. The tyre industry has to consider a number of factors such as material cost, material technology, market demands and availability of different raw materials. In addition to this the industry also has to meet the proposed noise and wet grip limits without any trade-off on tread wear performance. According to ETRMA, tyres with a RRC of 7.5kg/t in the C1 tyre category (with the possibility of a small number of tyres being available below this level) and 6 – 7.5kg/t in the C2 tyre category could be available by 2020. VTI (2008) indicated that in 2007, the state of the art was probably around 7 kg/t and cited unpublished measurements made in 2007 by tyre technical experts at the Technical University of Gdansk, Poland.

For the purposes of the impact assessment we have assumed that the technological limit in 2020, beyond which RRC can not fall is 6 kg/t for C1 tyres, and hence the maximum incentive is achieved by setting Band A with a RRC below 7kg/t. This reflects:

- tyres currently on the market with RRC of 6.5 - 7kg/t, see Figures 2.2 and 2.3, (although WG and wear performance can be compromised at these levels) and some existing prototypes as low as 5.5kg/t;
- ETRMA views that 7.5kg/t is achievable with a possibility of some tyres in the range 7.0kg/t to 6.0 kg/t;
- a possible 50% reduction (Michelin Greenmeter) in rolling resistance on 2007 standards within the next 10 to 15 years, to around 6kg/t (if the average is assumed to be around 11.5kg/t)

Given the maximum limit of 12kg/t in 2012 from the proposal for a Regulation on general safety of motor vehicles (COM(2008)316) which should set the lowest (worst) band, a RRC range of 12kg/t to 6kg/t is used for this study. However, in consultation with tyre producers it was clear that some producers have greater technological ability to produce tyres in higher bands (low RRC). Therefore, it is possible that not all producers will supply tyres in higher band.

2.7 The Proposed Grading Scheme for Rolling Resistance for the Impact Assessment

In the light of the technological review above, it is possible to consider the type of grading of RR that could provide a framework for assessing the impact of policy options. There are two main considerations: a) what accuracy of grading RRC using tests consistent with ISO 28580 can be achieved? b) what range should the grading cover, based on the likely market distribution in 2012 and the technically feasible reductions of RRC to 2020? Note the time period for the impact assessment was chosen to reflect the intended implementation of the proposed regulation COM (2008)316 in 2012 and the time required to implement agreements on testing. The end point of 2020 was chosen to comply with the objective of the Energy Efficiency Action Plan (COM (2006)545) which sets the target of achieving 20% energy saving by 2020. On the one hand sufficient time is required to elapse for policy options to take effect; on the other, impacts need to be established in a reasonable period of time. The increased benefits from accelerating implementation are examined as part of the impact assessment.

The highest level of accuracy of testing and scoring a tested tyre (in RRC) is approximately +/- 0.33 kg/t for C1/C2 and 0.3 kg/t for C3 tyres, excluding tyre to tyre variation. Based on a controlled sample (ETRTO – IEA Workshop) to assess tyre variation, including this uncertainty would suggest a testing accuracy of closer to 0.5kg/t[11].

There are some producers who suggest that to achieve this accuracy would be too expensive. The costs of testing, even with a three fold increase in costs to achieve an improvement on +/- 0.75kg/t accuracy, are €0.01 per sold tyre. With a testing accuracy of +/-0.5 kg/t it would be possible to band tyres to within at least 1.0 kg/t. It has been suggested in the VTI study that each tyre be given its own score rather than a band. This may work for say a carbon tax but for a labelling scheme where the point is to encourage comparisons bands would provide a clearer basis for customers. A banding would also be required for an instrument such as VAT rate reductions or as the basis of public procurement rules.

The technical range has to match the market range of tyres expected in 2020 to ensure there are tyres available to customers. Based on the review, an RRC range of 12 kg/t to 6 kg/t based on expected state of the art and technological limits in 2020 appears valid for C1. The RRC performance in the market should be monitored and if necessary additional bands should be added to include tyres with RRC below 6 kg/t if necessary. In the case of C2/C3 the number of measured values is smaller and makes definition of the range more difficult. However, the maximum limit should be reviewed when more data becomes available (VTI, 2008). The ranges for C2/C3 reflect the advice from the various consultations. The testing accuracy of 0.5 kg/t would allow 7 bands for C3. To the extent that C3 customers do not have a full choice of tyres across the full RRC range, because of the more specialist nature of the tyres chosen (by truck size, axle and transport use), narrower bandwidths may be required to provide sufficient choice as the basis of market transformation.

The following grading system for C1/C2/C3 has been used in the impact assessment (Table 2.6) based on the maximum limits set out in COM (2008)316 and the considerations described above. The labelling of the bands from G (highest RRC) to A (lowest RRC) is to assist with the presentation of the impact assessment; it is not intended as any specific recommendation for labelling. In the case of energy labelling being the preferred policy option the need for relative banding between C1, C2 and C3 would need to be considered with labelling of bands adjusted in each of the three tyre classes. The need for relative

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[11] This assumes the same accuracy is achieved as the one required for the alignment procedure in the draft ISO 28580 and reflects the uncertainty resulting from inter lab variation (μ=0.2) and intra lab test variation (ρ=0.043 for C1/C2 tyres and 0.035 for C3 tyres). Please see Annex 7 for more details.

grading to take account of the possible influence of outside tyre diameter on RRC would also need to be examined. This is discussed in more detail in Annex 7.

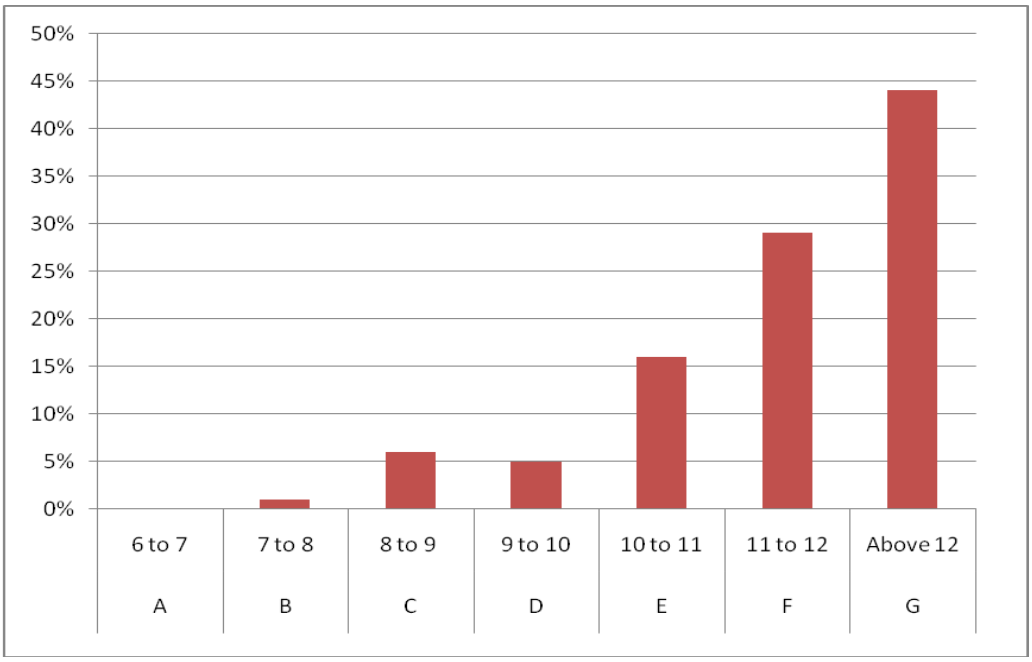
According to the available evidence, there is no requirement for any special classes for winter tyres, or to distinguish between steering and drive axle tyres for C3 tyres (ETRMA and VTI, 2008).

Table 2.6: Classification of Tyres into RRC Classes (kg/t)

	RRC Range for C1 (passenger car tyres)	**RRC Range for C2 (commercial vehicles)**	**RRC Range for C3 (trucks and buses tyres)**
G	Above 12		
F	11 to 12 (12 max limit from 2014 for all tyre types)	above 10.5	Above 8
E	10 to 11	9.5 to 10.5 (10.5 max limit from 2014 for all tyre types)	7 to 8 (8 max limit from 2016 for all tyre tyres)
D	9 to 10 (10.5 max limit from 2018 for all tyre types)	8.5 to 9.5 (9 max limit from 2018 for all tyre types)	6 to 7 (6.5 max limit from 2020 for all tyre types)
C	8 to 9	7.5 to 8.5	5 to 6
B	7 to 8	6.5 to 7.5	4 to 5
A	6 to 7	5.5 to 6.5	below 4

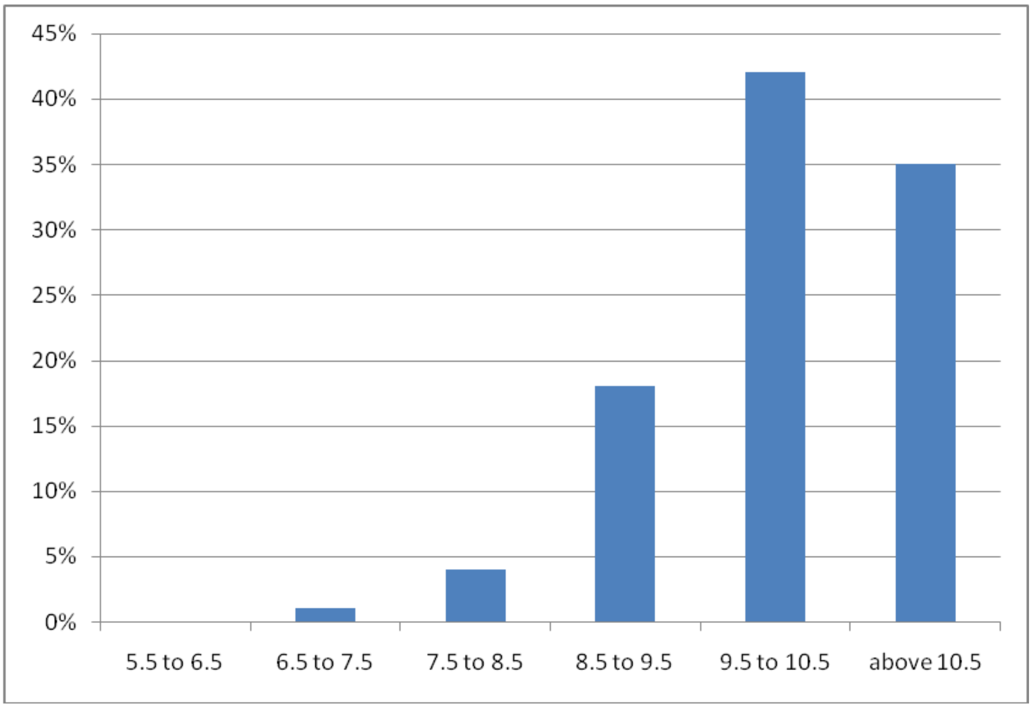
The expected market distribution in each of the three tyre classes in 2012 with respect to this grading is indicated in the following figures (Figures 2.9 to 2.11).

Figure 2.9: Expected RRC Market Distribution in 2012 Passenger Cars (C1 – summer and winter)



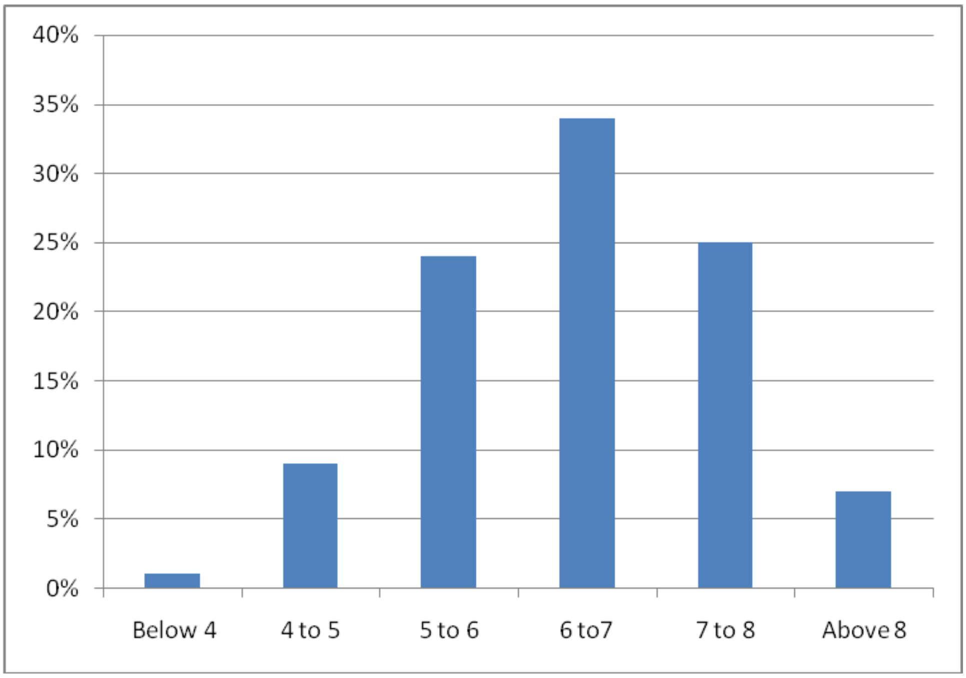
For C1 the grading scheme has approximately 75% of the market in the two lowest bands providing sufficent potential for interventions to secure market transformation (Figure 2.9). For C2 a similar share, 75%, of the market is also in the two lowest bands (Figure 2.10)

Figure 2.10: Expected RRC Market Distribution in 2012 Commercial Vehicles (C2 – summer and winter)



For C3 the market distribution is less skewed to the lowest bands, with only a third of the market in the two lowest bands (Figure 2.11). This refects the original tyre distribution advised by ERTMA, see Table 2.1.

Figure 2.11: Expected RRC Market Distribution in 2012, Trucks and Buses (C3 – summer and winter)



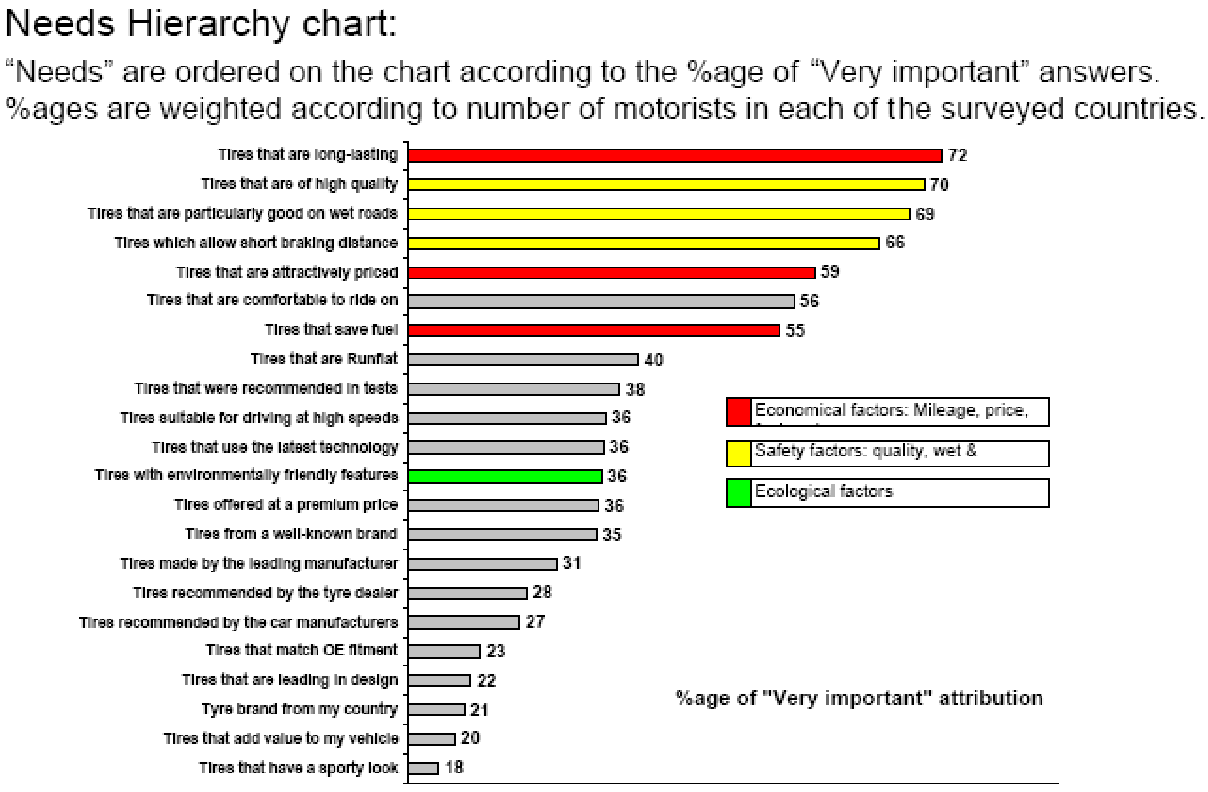
3 COSTS AND BENEFITS OF LOWER ROLLING RESISTANCE FOR TYRE CUSTOMERS

3.1 Criteria for Choosing Tyres

For new vehicles the vehicle manufacturer and in some cases the importer decides on the specifications of the set of original equipment (OE) tyres and thus decides the desired quality and costs. For the replacement tyre market the owner of a vehicle (including businesses and vehicle leasing companies) decides on the replacement fit. A share of the replacement market demand is from business rather than individual consumers. This includes the purchase by dedicated service stations for car dealers or by car dealers or service stations for car lease companies and vehicle fleet managers. Data from Benelux Member States and from the UK suggests that this demand could represent a third of the market. We define tyre customers to include both businesses and individual consumers.

Current consumer preferences are summarised in Figure 3.1 below. Tyre wear, good grip and braking properties are the most important attributes for consumers, though fuel savings are a very important attribute for 55% of consumers. Consumers may also decide beforehand to fit the same tyre as the OE (23% of respondents consider that "tyres that match the OE fitment" are ‘very important’ in their purchasing decision and 28% of respondents consider “tyres recommended by the retailer” to be ‘very important’). Business preferences are unlikely to be very different, with perhaps greater weight on those parameters such as price, tyre wear and fuel efficiency that effect costs.

Figure 3.1: Consumer Preferences for Tyre Attributes, 2006



Source: (TAAS) Tyre Awareness and Attitude Study, Frequency & Methodology: Yearly (since 1999). Includes face-to-face (or online) interviews and 30 minutes structured questionnaire (incl. Physical tyre check). Countries & no. of respondents (2006): France, Italy, UK, Spain, Switzerland, Portugal, Belgium, Austria, Greece, Denmark: 6908 Respondents + Germany (run by IPSOS): 1038 Respondents. Total: 7946 Respondents. Contracted agency: Open-air market research www.open-air.fr

3.2 Improved Fuel Efficiency and Fuel Cost Savings

In the literature (see Annex 5), a 10% reduction in RRC is estimated to provide between a 1% and 2% improvement in fuel economy. According to ETRMA, for C1/C2, a 6% reduction in RRC leads to a 1% reduction in fuel consumption (equivalent to a 10% reduction in RRC leading to a 1.67% reduction in fuel consumption). The impact assessment for C1/C2 is based on a 1.5% reduction in fuel consumption for a 10% reduction of RRC[12]. The fuel savings potential for trucks and buses (C3) is higher than for C1/C2, for a given reduction in RRC. A 15% reduction in RRC leads to a 5% reduction in fuel consumption (equivalent to a 10% reduction in RRC leading to a 3.33% reduction in fuel consumption) (INFRAS,2006 and Barand and Bokar, 2008). See Annex 5 for details

Empirical calculations by Barand and Bokar (2008) on the impact of reducing RRC by 1kg/t on fuel consumption for a medium sized EU gasoline (petrol) and diesel car under the New European Driving Cycle (NEDC) is given in Table 3.2a and Table 3.2b below. Three sets of tyres were chosen with nearly 2kg/t variation between them. The study also showed that real fuel savings are almost independent of the driving cycle.

Table 3.2a: Fuel Savings and CO2 Reduction on NEDC for Petrol – Mid-size Car

NEDC	Fuel consumption (l/100km)	CO2 emission (g/km)	Fuel savings per 1kg/t reduction in RRC (l/100km)	CO2 reduction per 1kg/t reduction in RRC (g/km)	Reduction in fuel consumption due to 1kg/t reduction in RRC (%)	Reduction in CO2 due to 1kg/t reduction in RRC (%)
Tyre set A	7.49	176.80				
Tyre set B	7.70	181.70				
Tyre set C	7.96	187.70				
Average	**7.72**	**182.07**	**0.13**	**3.00**	**1.68%**	**1.65%**

Source: Barand and Bokar, 2008, SAE

Table 3.2b: Fuel Savings and CO2 Reduction on NEDC for Diesel – Mid-size Car

NEDC	Fuel consumption (l/100km)	CO2 emission (g/km)	Fuel savings per 1kg/t reduction in RRC (l/100km)	CO2 reduction per 1kg/t reduction in RRC (g/km)	Reduction in fuel consumption due to 1kg/t reduction in RRC (%)	Reduction in CO2 due to 1kg/t reduction in RRC (%)
Tyre set A	5.86	154.90				
Tyre set B	5.99	158.40				
Tyre set C	6.17	163.00				
Average	**6.01**	**158.77**	**0.08**	**2.20**	**1.33%**	**1.39%**

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[12] Based on recent research published by Barrand J and Jason Bokar (Michelin), 2008, Reducing Tire Rolling Resistance to Save Fuel and Lower Emissions, SAE Technical Paper Series

Source: Barand and Bokar, 2008, SAE

Assuming that the EU passenger car fleet comprises of 50% gasoline and 50% diesel vehicles, a 1kg/t reduction in RRC leads to 1.5% (average of 1.68% and 1.33%) reduction in fuel consumption.

The 1.5% reduction in fuel consumption based on a 1 kg/t reduction for a mid-size passenger car is assumed to be representative of the average EU car fleet due to the absence of test data for vehicles of different sizes. The absolute impact of a 1.5% reduction in fuel consumption for a bigger car will be higher than a smaller car (Table 3.2c).

Applying the 1.5% reduction in fuel consumption from a 1kg/t reduction in RRC to the average fuel consumption (l/100km) and CO2 emissions (g/km) of the EU car fleet for years 2008 and 2012-2020 enables an estimate of the fuel and CO2 saving (Table 3.3a and 3.3b). In summary, 1.5% fuel savings (i.e. a 10% reduction of RR) is equivalent to a fuel saving of 0.12 l/100km and a CO2 saving of 3 g/km for the EU Fleet average in 2008[13]. Annex 5 provides equivalent fuel saving estimates for C2 and C3 tyres.

Table 3.2c: Fuel Consumption Performance by Car Size from 1.5% Reduction in Average Fuel Consumption

	Average CO2	**Average Fuel Consumption**	**1.5% Fuel Consumption Reduction**	**Revised Average Fuel Consumption**
	CO2 g/km	**l/100km**	**(l/100km)**	**(l/100km)**
Mini	128.5	6.19	0.09	6.09
Supermini	141.8	6.83	0.10	6.72
Lower medium	158.6	7.64	0.11	7.52
Upper medium	169.1	8.14	0.12	8.02
Executive	192.6	9.27	0.14	9.13
4x4	228.3	10.99	0.16	10.83
Luxury	273.8	13.18	0.20	12.98

Source: The Society of Motor Manufacturers and Traders, UK

Table 3.3a: Effect of a 1.5% Reduction in Fuel Consumption on the Average EU Passenger Car Fleet (l/100km)

	EU Fleet Average Fuel Consumption	**1.5% of EU Fleet Average Fuel Consumption**	**EU Fleet Average Fuel Consumption Following Reduction**
	l/100km	**l/100km**	**l/100km**
2008	8.04	0.12	7.92
2012	7.32	0.11	7.21
2020	6.18	0.09	6.08

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[13] The 1.5% reduction due to a 1kg/t reduction in RRC based on a mid-size car seems to be a good approximation for the EU average fleet . The saving in 0.12 l/100 km and 3.0 CO2 g/km when based on the EU fleet average matches very closely with the saving in fuel of 0.11 l/100km and 2.6 CO2 g/km from Table 3.2a and 3.2b

Source: ETRTO and CARS 21

Table 3.3b: Effect of a 1.5% Reduction in Fuel Consumption on CO2 Emissions of the Average EU Passenger Car Fleet (CO2 g/km)

	EU Fleet Average		**1.5% of EU Fleet Average CO2**		**EU Fleet Average CO2 Following Reduction**	
	TA CO2 g/km	**RW CO2 g/km**	**TA CO2 g/km**	**RW CO2 g/km**	**TA CO2 g/km**	**RW CO2 g/km**
2008	167	199	2.5	3.0	164	196
2012	152	182	2.3	2.7	150	179
2020	128	153	1.9	2.3	126	151

Source: ETRTO and CARS 21 Note: TA - Type Approval: RW- Real World

This estimated impact of a given reduction in RRC on fuel consumption allows an estimate of fuel cost savings per tyre in money terms for an individual car owner, given a lifetime tyre use of 40,000km or 2.5 years.

The level of future fuel cost savings depends on the future level of oil prices. This is highly uncertain, although future prices are expected to rise in real terms compared to current prices. The impact assessment has used three long term oil price scenarios to 2020 (Table 3.4). The fuel cost (i.e. the fuel price excluding all taxes) heavily depends on the price of oil. A relation between oil price and fuel cost has been determined in (TNO 2006) (See Annex 5 for more details).

Table 3.4: Future EU Oil and Fuel Price Scenarios in 2020

	Oil price €/bbl	Avg Fuel price €/lt (exc. Fuel Tax and VAT)	Avg Fuel price €/lt (inc. Fuel Tax and VAT)	Diesel price €/lt (inc Fuel Tax, exc. VAT)
Scenario 1	50	0.41	1.03	0.80
Scenario 2	75	0.61	1.28	1.02
Scenario 3	100	0.80	1.53	1.23

Source: Eurostat[14], TNO Estimates

Note: Relation between oil price and fuel price (with and without tax) is based on the average EU-27 diesel and petrol price (with and without tax) provided by Eurostat

The fuel cost savings from policy options are calculated by multiplying the change in fuel consumption due to the change in RRC band due to the option, by fuel prices assuming that the EU passenger car fleet is 50% petrol and 50% diesel.

The fuel cost savings per tyre resulting from a change of 1.0 kg/t is presented in Table 3.5. Since the fleet average fuel consumption (l/100km) and CO2 g/km reduces over time, the fuel cost savings per tyre from a one band change decreases during the period 2012-2020. Fuel costs savings should be considered as savings per set of 4 tyres. This is because the

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[14] http://epp.eurostat.ec.europa.eu/portal/page?_pageid=1996,39140985&_dad=portal&_schema=PORTAL&screen=detailref&language=en&product=Yearlies_new_environment_energy&root=Yearlies_new_environment_energy/H/H2/H21/ebc24848

http://epp.eurostat.ec.europa.eu/portal/page?_pageid=1996,39140985&_dad=portal&_schema=PORTAL&screen=detailref&language=en&product=Yearlies_new_environment_energy&root=Yearlies_new_environment_energy/H/H2/H21/ebc25360

fuel savings from the use of low RR tyres would only apply if all four tyres are changed at the same time.

Table 3.5: Life-time Fuel Cost Savings (€) per Tyre from a 1 Band Change – 1.0kg/t bandwidth (1.5% fuel saving per 1.0 kg/t reduction)), inc. tax, for Oil Price Scenarios

	Fuel Cost Saving per Tyre (€)		
	Scenario 1	Scenario 2	Scenario 3
2012	11.3	14.0	16.8
2013	11.0	13.7	16.4
2014	10.7	13.4	16.0
2015	10.5	13.1	15.6
2016	10.3	12.8	15.3
2017	10.0	12.5	15.0
2018	9.8	12.3	14.7
2019	9.7	12.0	14.4
2020	9.5	11.8	14.2

Source: GHK estimate

3.3 Additional Costs of Lower RR Tyres per Tyre

The current weighted average price of premium, mid and budget C1 summer tyres is €87 inc VAT and €70 exc VAT. The incremental cost of moving from one band to the next highest is calculated by applying the price premium in Table 2.5a to the weighted average tyre price. Results are given in Tables 3.6 and 3.7. For example, for single labelling, the price premium of moving from Band F to Band E is 2.3% or €2 with VAT. To move from Band B to Band A the price premium is 5% or €4.3 with VAT.

Table 3.6: Price Premium for Reductions in RRC by 1kg/t, Moving from 1 Band to the Next Highest Band, RR only labelling (C1 Summer Tyres)

	A+	A	B	C	D	E	F	G
RRC kg/t	5 to 6	6 to 7	7 to 8	8 to 9	9 to 10	10 to 11	11 to 12	Above 12
Price premium (%)	?	5.00%	3.50%	2.80%	2.50%	2.30%	0	0
Price premium (€) inc. VAT	?	4.3	3.0	2.4	2.2	2.0		
Price premium (€) exc. VAT	?	3.5	2.5	2.0	1.8	1.6		

Table 3.7: Price Premium for reductions in RRC by 1kg/t. Moving from 1 Band to the Next Highest Band, Dual labelling (C1 Summer Tyres)

	A+	A	B	C	D	E	F	G
RRC kg/t	5 to 6	6 to 7	7 to 8	8 to 9	9 to 10	10 to 11	11 to 12	Above 12
Price premium (%)	?	10.00%	7.00%	5.60%	5.00%	4.60%	0	0
Price premium (€) inc. VAT	?	8.7	6.1	4.9	4.3	4.0		
Price premium (€) exc. VAT	?	7.0	4.9	3.9	3.5	3.2		

Applying the price premium (Table 2.5b) of purchasing a tyre in a higher band compared to band F to the weighted average price of car summer tyres (€87 inc VAT and €70 exc VAT) indicates the cost (2008 prices) of moving bands relative to band F, (Tables 3.8 and 3.9).

Table 3.8: Price Premium for Moving Bands Compared to Band F (RR only labelling, 1 kg/t), C1 Summer Tyres

	A+	A	B	C	D	E	F	G
RRC kg/t	5 to 6	6 to 7	7 to 8	8 to 9	9 to 10	10 to 11	11 to 12	Above 12
Price premium (%)	?	16.10%	11.10%	7.60%	4.80%	2.30%	0	0
Price premium (€) inc. VAT	?	14.0	9.6	6.6	4.2	2.0		
Price premium (€) exc. VAT	?	11.3	7.8	5.3	3.4	1.6		

Table 3.9: Price Premium for Moving Bands Compared to Band F (Dual labelling, 1 kg/t), C1 Summer Tyres

	A+	A	B	C	D	E	F	G
RRC kg/t	5 to 6	6 to 7	7 to 8	8 to 9	9 to 10	10 to 11	11 to 12	Above 12
Price premium (%)	?	32.20%	22.20%	15.20%	9.60%	4.60%	0	0
Price premium (€) inc. VAT	?	27.9	19.2	13.2	8.3	4.0		
Price premium (€) exc. VAT	?	22.6	15.6	10.7	6.7	3.2		

The additional tyre cost and fuel cost saving per tyre allows the payback period for an individual car owner to be calculated. This is shown in Table 3.10 below. For example, if a customer purchases 4 tyres from band E then this will cost them an additional €8 compared to band F (from Table 3.8). Tyres are expected to last 2.5 years on average during which a set of 4 tyres purchased in 2012 would provide (under oil price scenario 2) €56 worth of fuel cost savings (€14x4, from Table 3.5). This gives a pay-back period of around 4 months under the RR only labelling[15]. Note that the payback period increases with moves to higher bands as a result of the rising marginal price premium in higher bands, and as a result of dual labelling compared to single labelling because of the greater price premium for dual labelling.

Table 3.10: Average Payback Period (Months) in 2013 for Moving Bands Compared to Band F (inc. Vat), RRC 1 kg/t, Oil Price Scenario 2

	A+	**A**	**B**	**C**	**D**	**E**	**F**	**G**
RRC kg/t	5 to 6	6 to 7	7 to 8	8 to 9	9 to 10	10 to 11	11 to 12	Above 12
Single Labelling (RR only)	?	6	5	5	4	4		
Dual Labelling (RR & WG)	?	8	8	7	7	7		

3.4 Net Cost Savings per Tyre for a Vehicle Owner for a 1 Band Move (C1 summer)

The fuel cost savings per tyre for a given reduction in RRC by 1kg/t are greater than the additional costs to customers. There is a marginal reduction in net cost savings with a move to higher bands. This is summarised in Table 3.11 and 3.12.

Table 3.11: Net Cost Savings (€) per Tyre per Band for a Reduction of RRC of 1kg/t, 2020 (inc. VAT), RR only labelling

RR only		**Additional costs of LRRTs (€ per tyre)**	**Fuel saving per band (€ per tyre)**	**Net cost saving (€)**
G	Above 12			
F	12 to 11			
E	11 to 10	2.0	11.8	9.8
D	10 to 9	2.2	11.8	9.6
C	9 to 8	2.4	11.8	9.3
B	8 to 7	3.0	11.8	8.7
A	7 to 6	4.3	11.8	7.4
A+	6 to 5			

Note: Based on oil price scenario 2

Table 3.12: Net Cost Savings (€) per Tyre per Band for a Reduction of RRC of 1kg/t, 2020 (inc. VAT), Dual labelling

Dual labelling		**Additional costs of LRRTs (€ per tyre)**	**Fuel saving per band (€ per tyre)**	**Net cost saving (€)**
G	Above 12			
F	12 to 11			
E	11 to 10	4.0	11.8	7.8
D	10 to 9	4.3	11.8	7.4
C	9 to 8	4.9	11.8	6.9
B	8 to 7	6.1	11.8	5.7
A	7 to 6	8.7	11.8	3.1
A+	6 to 5			

Note: Based on oil price scenario 2

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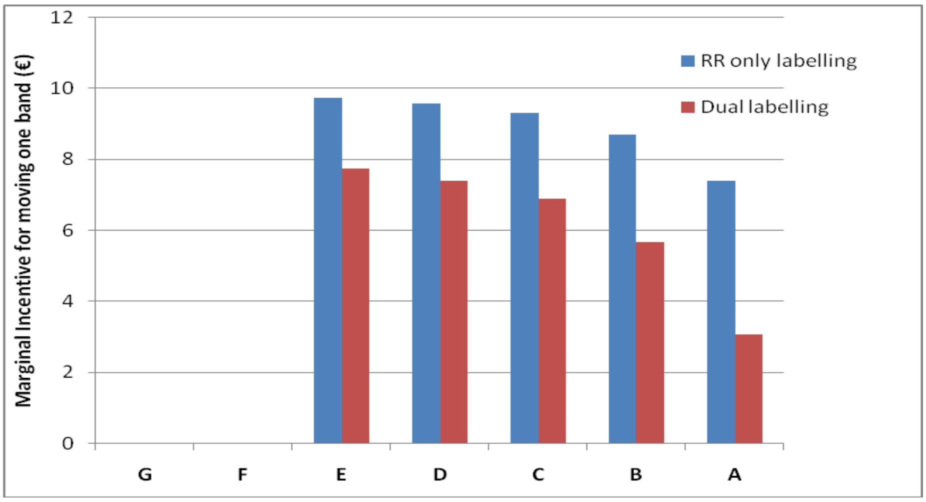
[15] €8 divided by €1.86 fuel savings per month (€56/30mths).

Table 3.11 and 3.12 suggest that the rate of market transformation towards lower RR tyres will be influenced by the effect of declining economic incentives at higher bands (Figure 3.2 below). Even though a shift to higher bands is cost-effective and economically rational for customers, the incentive is greater to move in the lower bands than to move in the higher bands (say band B to band A). A faster switch from say Bands F or E to say D or C would be expected compared to a switch from bands C or D to bands B or A. Because fuel savings from a change to LRRTs decline slightly in later years as overall vehicle efficiencies improve, the disincentive to switch in higher bands will be lower in earlier years.

Figure 3.2: Marginal Incentive for Moving One Band



3.5 Cumulative Net Cost Savings per Tyre for a Vehicle Owner Moving From Band F (C1 summer)

Following the introduction of a labelling scheme, under RR only labelling if a customer for example, switches tyres from an F band to a B band in 2013 then the additional cost of 4 tyres would be €38 inc. VAT (From Table 3.8 €9.6×4). The fuel cost saving over the lifetime of the 4 tyres would be €219 inc tax (From Table 3.5, €13.7x4x4[16]). This gives a net cost saving of €181 per vehicle or €45.3 per tyre. The estimated cumulative fuel cost savings and net savings of moving from F to a higher band are given in Table 3.13 below.

Table 3.13: Net Savings of a Shift from F to Higher Band (€ per tyre), in 2013, RRC 1kg/t

			RR only labelling		Dual labelling	
		Cumulative fuel savings per tyre(€)	Additional costs per tyre (€)	Net savings of a shift from F to higher band (€)	Dual labelling additional costs per tyre (€)	Net savings from a shift from F to higher band (€)
G	Above 12					
F	12 to 11					
E	11 to 10	13.7	2.0	11.7	4.0	9.7
D	10 to 9	27.4	4.2	23.2	8.3	19.1
C	9 to 8	41.1	6.6	34.5	13.2	27.9
B	8 to 7	54.8	9.6	45.2	19.2	35.6
A	7 to 6	68.5	14.0	54.5	27.9	40.6

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[16] €13.7 x 4 tyres x 4 band shift (F to B)

3.6 Costs of CO2 Abatement

The abatement costs of reducing CO2 emissions by reducing RR by 1 kg/t from passenger cars with LRRTs depend on the fuel savings, oil prices and additional costs of LRRTs, described above. This allows an estimate of the costs to achieve a given reduction or abatement in CO2 emissions.

The abatement costs per tyre in Table 3.14a and Table 3.14b below are based on real world fuel consumption and CO2 emissions in 2020 assuming all four tyres are changed. For an oil price of 75 €/bbl the CO2 abatement costs, under oil price scenario 2, range from -54 €/tonne to -155 €/tonne under single labelling and from 152 €/tonne to -66 €/tonne under dual labelling. Note the negative sign indicates that because fuel cost savings are greater than the price premium of LRRTs, the abatement is achieved without additional cost. In other words the abatement per tonne is associated with an economic saving to the EU economy.

Table 3.14a: CO2 Abatement Cost (€/tonne) per Tyre per Band for a Reduction of RRC of 1kg/t, 2020 (ex. VAT), RR Only Labelling (assuming all 4 tyres are changed)

	A+	**A**	**B**	**C**	**D**	**E**	**F**	**G**
RRC kg/t	5 to 6	6 to 7	7 to 8	8 to 9	9 to 10	10 to 11	11 to 12	Above 12
CO2 abatement (€/tonne) sc. 1		31	-30	-58	-69	-75		
CO2 abatement (€/tonne) sc. 2		-54	-114	-140	-150	-155		
CO2 abatement (€/tonne) sc. 3		-138	-197	-222	-231	-235		

Table 3.14b: CO2 Abatement Cost (€/tonne) per Tyre per Band for a Reduction of RRC of 1kg/t, 2020 (ex. VAT), Dual Labelling (assuming all 4 tyres are changed)

	A+	**A**	**B**	**C**	**D**	**E**	**F**	**G**
RRC kg/t	5 to 6	6 to 7	7 to 8	8 to 9	9 to 10	10 to 11	11 to 12	Above 12
CO2 abatement (€/tonne) sc. 1		237	112	54	30	14		
CO2 abatement (€/tonne) sc. 2		152	28	-28	-51	-66		
CO2 abatement (€/tonne) sc. 3		68	-55	-110	-132	-146		

4 MARKET IMPACT OF POLICY OPTIONS

4.1 Policy Options

The impact assessment has identified a range of policy options designed to secure a market transformation to lower rolling resistance tyres. These are summarised in Table 4.1.

Options considered, but now removed after initial research, were:

- Tyre labelling based on 'brands' such as the Nordic eco-label or the Blue Angel label in Germany – because there is no evidence that they are capable of providing a dynamic incentive, and fail to focus attention on RR. Producers are also opposed because of cost and lack of market impact

- Voluntary agreements – because although there is a high concentration of EU sales among EU producers, there would be a requirement to include other producers (especially of EU imports), of which there are too many for a feasible agreement

During the course of the impact assessment major changes have been made or are proposed, which are assumed to be part of the reference case. The first is the proposed EC regulation (COM(2008)316) on general safety of motor vehicles which includes minimum standards for rolling resistance introduced over a period starting in 2012. The second is a proposal for changes in the Type Approval test for vehicles on fuel efficiency, which requires the tyre with the worst RR for the test (or where there are more than three sizes of tyre, the second worst); and that tyres fitted to production models should reflect those used in the test.

Based on the initial assessment the following options have been agreed as the basis of the detailed impact assessment. It is assumed within the framework of this study that the implementation date for a labelling scheme is October 2012 at the same time as the supposed entry into force of the new standards on tyre defined in COM(2008)316, which will have a market impact in 2013 and in subsequent years:

- **Option A:** No new EU actions = reference case including the adoption of minimum requirements on Rolling Resistance as proposed in (COM(2008)316) and existing incentives on car producers to fit their vehicles with LRRT in order to reduce type approved (TA) emissions measurement.

- **Option B:** Single criteria labelling scheme for C1 tyres on energy efficiency (RR) with limit values on other parameters (wet grip (safety) and rolling noise)

- **Option C:** Multi-criteria labelling scheme for C1 tyres, adoption of a labelling scheme which provides a grading on both RR and wet grip and possibly noise

- **Option D:** Single criteria labelling scheme extended to C2 and C3 tyres (respectively light and heavy duty vehicles) representing respectively 8% and 5% of total tyre sales.

- **Option E:** Economic instruments and public procurement. This option does not necessarily substitute other options but could complement energy labelling.

Note: The total impact assessment only account for savings occurring on the replacement market as it is assumed that a labelling scheme will have no significant impact on the OE market. See more explanation in annex 1.

Table 4.1: Assessment of Policy Options

Assessment Criteria	Policy Options					
	Do Nothing – Reference Case (including minimum standards)	Energy Labelling	Public Procurement	Economic Instrument	Voluntary Agreement	Type Approval (part of the reference case –Do Nothing)
Problem Relevance	Market trends will be influenced by the proposed EC regulation (COM(2008)316) on general safety of motor vehicles and TA legislation on car emissions	Labelling information on RR will influence those consumers concerned about fuel economy. Market failure in tyre replacement market addressed	Public sector environmental responsibilities are reflected in standards for products including 'green' vehicles	Fiscal incentives to purchase LRRT. Incentives could be based on emissions (carbon tax) or changes in current tax rates (VAT)	Tyres with the worst fuel economy would be withdrawn to an agreed schedule	TA rules put pressure on car producers to lower vehicle emissions. As tyres impact TA measured values, TA provides incentives for car producers to fit cars with LRRT
Objective Relevance & Outputs	The proposed regulation will introduce minimum standards for rolling resistance	Market transformation to LRRT requires changes in consumer preferences, or ways in which preferences can be expressed – information will help	Public sector market share in OE and replacement markets will influence direct outputs (greater in C2 and C3). Some indirect influence on other consumers	Incentives change consumer preferences in favour of LRRT depending on relative scale compared to market price	As with standards, withdrawal of tyres with high rolling resistance would force consumers to select tyres with lower rolling resistance	TA tyre rules may influence OEM; and, because replacement of like for like is common, influence choices in the replacement market
Evolution & Context	The proposed regulation will replace the existing Type Approval for tyres (defined in Directive 92/23/CE and its amendments)	Energy efficiency labelling of household electrical appliances provides some insight to possible rates of market transformation over time	Growing use of public sector procurement to further environmental objectives	A range of economic instruments have been used to incentivise carbon savings, including carbon taxes and differential VAT rates	Voluntary agreements have been used in a wide range of contexts to secure environmental objectives	TA for tyres and vehicles are well established based on international agreement. Recent proposals for changes to TA for vehicle fuel efficiency and specification of RR tyres for test
Activities &	Proposed regulation will introduce minimum	Mandatory use of labels including the use	Addition of LRRT to tyre procurement	VAT differentials can be implemented by MS.	Producers would need to conclude a	TA rules are rigorously defined and implemented.

Assessment Criteria	Policy Options					
	Do Nothing – Reference Case (including minimum standards)	Energy Labelling	Public Procurement	Economic Instrument	Voluntary Agreement	Type Approval (part of the reference case –Do Nothing)
Implementation	standards starting in 2012, and periodically to 2018. Prior investment in testing and grading for RR will be required	of internet access to databases of tyre performance, and posters. Labelling based on grading tyres into bands to allow comparison.	standards	Carbon taxes require MS unanimity at EU level. Taxes apply to all tyres sold in EU irrespective of origin of production	common agreement. Given competition from imports, non-EU producers would need to participate	Changes require major review.
Expected Outcomes	Will ban worst performing tyre and progressively improve RR of tyres	Increase in replacement market share of LRRT, depending on pace of change. Labels of limited use in OE market	Changes in public sector procurement. Overall market impact largely limited to public share	Depending on relative scale of incentives, increases in LRRT market shares can be expected	A concluded agreement could, depending on scheduled withdrawal, lead to changes in market share	TA rules have a direct effect on OEMs and, indirectly on replacement tyres when replacing OE

4.1.1 Energy Labelling Options

Product labelling is a long established method for producers to influence consumer demand. Energy labelling has become a strong market and sales tool in the case of domestic appliances. Providing customers for tyres with information on RR and fuel efficiency would be expected to influence the demand of a share of tyre customers and to increase the share of the market taken by lower rolling resistance tyres.

The effect of energy labelling (including the provision of performance data on RRC via the Internet) is to encourage customers to buy energy efficient tyres in higher bands. Over time the market share of tyres in lower bands should decline as the market moves to higher bands. The likely pace of change is unknown but can be informed by evidence from the experience of energy labelling of domestic appliances. Experience with labelling schemes has shown that uptake of products in the higher energy efficient bands takes time to occur. To allow for the inherent uncertainty over the pace of change that a labelling scheme will have on customers, the impact assessment examines a slower and a faster pace of change. This is based on different assumptions about the share of the market in any one band moving to the next highest band within a year, over the period 2012 to 2020.

The number of bands and hence the number of tyre choices provided to the customer can be expected to influence the effectiveness of energy labelling. Use of a narrower bandwidth to grade RRC (of say 1.0 kg/t) would provide customers with more choice compared to the use of a broader bandwidth (of say 1.5 kg/t), although change from one band to the next has less effect on levels of RR in the market when moving between bands of a narrower bandwidth. The use of a narrower bandwidth requires greater accuracy in the testing and grading of tyres generating a higher cost, although this cost is marginal in comparison with the estimated level of production costs (say €0.01 per sold tyre on an average price before tax of €70 per tyre).

Providing customers with information on rolling resistance will therefore change the demand of some customers. In the absence of any information on wet grip, these customers are likely to seek to purchase tyres with lower RRC at the price normally paid, resulting, in some cases, in customers purchasing tyres with lower wet grip performance than they would otherwise have chosen. Thus it is important to test two variants of energy labelling – (1) a single grading scheme on RR only, and (2) a multi-criteria grading scheme on different tyre parameters. Stakeholder consultation has suggested that 3 parameters could be considered in the short term for a multi-criteria grading scheme including, RR, WG and rolling noise.

Due to the timeframe of the study, it has focused on a dual labelling scheme on RR and wet grip, but this does not imply the exclusion of rolling noise from a labelling scheme. The need to comply with minimum rolling noise standards in any policy option has been taken into account in the estimate of costs. The single grading scheme will ensure that future RR reductions achieve at least the minimum standards for WG and rolling noise while a dual labelling scheme will ensure simultaneous improvement in both RR and WG above the minimum requirements.

The market impact of energy labelling has been assessed against a reference case that takes into account a number of new or proposed polices that will directly or indirectly influence RR in the future, including the adoption of minimum standards for rolling resistance, wet grip and rolling noise. The introduction of a minimum standard on wet grip to be brought in by 2012/14 is stricter than the current benchmark. The standard is expected to remove 30% of the current tyres on the market that fall below the proposed standard.

The impact of energy labelling is considered only in relation to the replacement tyre market (summer and winter tyres). The impact of energy labelling on vehicle producers who specify the original equipment (OE) tyres is considered to be negligible given that they already undertake extensive market research into the preferences of consumers (including fuel efficiency). They are also subject to incentives as a result of the Type Approval requirements for certifying vehicle fuel efficiency, which will also cause them to negotiate the optimum level of rolling resistance for OE with tyre producers. Further discussion is provided in Annex 1.

4.1.2 Economic instruments and public procurement

The first stage of the impact assessment also identified the possibility of securing market transformation to LRRTs using economic instruments. The use of market based instruments to influence demand is a well established principle and one which receives regular recommendation, especially for responding to environmental externalities. In the case of tyres, given the grading framework proposed for certifying rolling resistance and the technical evidence on the scale of externality associated with higher rolling resistance tyres, it is feasible to consider either a carbon tax based on the social cost of carbon as revealed by the EU emissions trading scheme (ETS), or a simple reduction in VAT rates for tyres achieving a given and certified level of rolling resistance. These are both examined further as individual options. They are not necessarily an alternative to energy labelling, although it would make policy design more complex to combine an economic instrument with energy labelling. The scope to use economic instruments as a complement to energy labelling is considered further in the impact assessment.

The review of options also identified the possibility of using public procurement rules as a means of encouraging take up of LRRTs. Since the share of the market taken by public bodies is likely to be small, it was considered that rather than a stand alone option, it could act to complement other policy options. This is examined below in Section 4.6.3.

4.2 Base Case – Business as Usual (BAU) Tyre Market Distribution by RRC

Before examining the policy options, the impact assessment has reviewed the possible ‘business as usual’ case in the absence of any new public intervention in terms of the market distribution of RRC. ETRMA provided an estimate of the approximate share of the replacement tyre market in 2012, based on the ‘State of the Art, 2004’ data in Figure 2.1 above. This is based on the tyre industry’s expectation of future supply and demand characteristics (Table 4.1).

Table 4.1: ETRMA ‘Business as Usual’ Estimate of the Share (%) of Replacement C1 Summer Tyre Market by 1.5 kg/t RRC Bands, 2012

	Grade A	B	C	D	Above D
RRC (kg/t)	below 9	9 to 10.5	10.5 to 12	12 to 13.5	Above 13.5
SOA 2004	2%	15%	41%	34%	9%
2012	10%	25%	35%	30%	0%

Source: ETRMA TPIA (2007)

This assessment has been translated into an approximate representation of the market profile indicated, but using the grading framework described in Section 2.7, using 1kg/t bandwidths. The resultant translation is presented in Table 4.2. This provides a benchmark for examining subsequent policy changes.

Table 4.2: 'Business as Usual' Estimate of the Share (%) of Replacement C1 Summer Tyre Market by 1.0 kg/t RRC Bands, 2012

Bands	**A**	**B**	**C**	**D**	**E**	**F**	**G**
RRC	6 to 7	7 to 8	8 to 9	9 to 10	10 to 11	11 to 12	Above 12
Base SOA 2004		0%	1%	6%	19%	30%	43%
2012		1%	9%	7%	20%	33%	30%

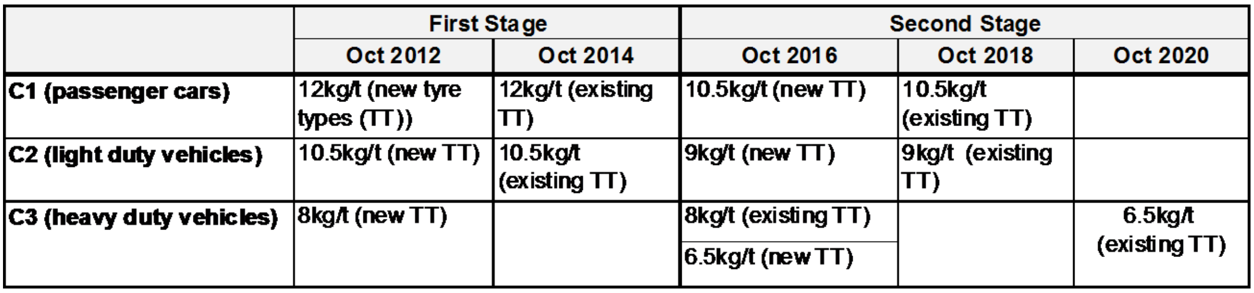
Source: GHK estimate

Data for C2/C3 tyres for 2012 was not available. The BaU case for C2/C3 is based on the estimates for 2004.

4.3 Option A: Reference Case – Based on Minimum Standards for RR

The reference case provides an estimate of market changes projected to occur from 2012 in the absence of the policy options, but assuming implementation of current proposals, including COM(2008)316 and especially minimum standards for rolling resistance. Minimum standards according to the latest Commission proposal on the Regulation of the European Parliament and of the Council concerning type-approval requirements for the general safety of motor vehicles, COM(2008) 316 final on 23.05.2008, are summarised in Table 4.3:

Table 4.3 Proposed Minimum Standards for RRCs for Vehicle Tyres



	First Stage		**Second Stage**		
	Oct 2012	**Oct 2014**	**Oct 2016**	**Oct 2018**	**Oct 2020**
C1 (passenger cars)	12kg/t (new tyre types (TT))	12kg/t (existing TT)	10.5kg/t (new TT)	10.5kg/t (existing TT)	
C2 (light duty vehicles)	10.5kg/t (new TT)	10.5kg/t (existing TT)	9kg/t (new TT)	9kg/t (existing TT)	
C3 (heavy duty vehicles)	8kg/t (new TT)		8kg/t (existing TT) 6.5kg/t (new TT)		6.5kg/t (existing TT)

Source: COM(2008)316

Note: TT – tyre type

The reference case is based on the assumed market evolution in the absence of policy interventions until 2020 (calculated in projecting the observed 2004-2012 trend) and is then adjusted to reflect minimum standards. The adjustment is based on an assumption that the switch by consumers from tyres that fail to meet the minimum standard to tyres in other tyre bands is proportional to the size of the sales in each band. There is no reason to assume that customers of tyres no longer allowed have any systematic preference for tyres with higher or lower RR.

In 2012, the minimum standards are applied in the First Stage (Table 4.3) to new tyre products. On average tyre product lines change every 3-4 years and are therefore assumed to be a third of the market in any given year. Existing tyre products are given a further 2 years to comply. This leaves a certain proportion of the tyre market above the limit in 2012, but none of the market above the limit in 2014 for PCs and CVs. Estimates for later years take account of the proposed Second Stage increase in standards.

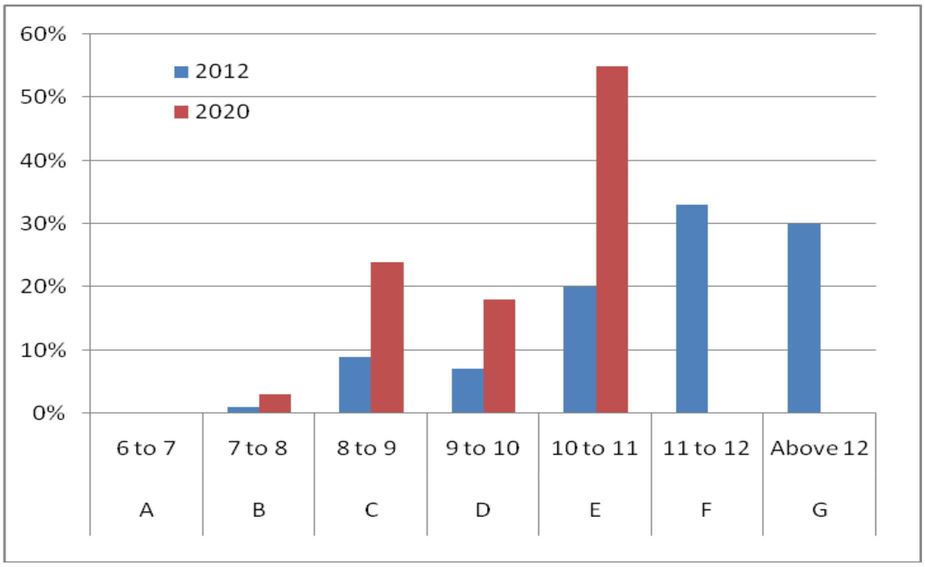
The results of the analysis, using 1 kg/t bands to grade RRC (Table 4.4) indicate that by 2020 the EU summer tyre market for C1 (passenger cars) has a maximum level of RRC of 10.5kg/t, with 27% of the tyres sold having a RRC of less than 9 kg/t. The shift in the market from 2012 is shown in Figure 4.1. Similar reference cases have been estimated for C1 winter tyres and for C2 and C3 vehicles (with separate estimates for summer and winter).

Table 4.4: EU Market Distribution of C1 Summer Replacement Tyres by RRC – Reference Case

Bands	A	B	C	D	E	F	G
RRC	6 to 7	7 to 8	8 to 9	9 to 10	10 to 11	11 to 12	Above 12
Base SOA 2004		0%	1%	6%	19%	30%	43%
2012		1%	9%	7%	20%	33%	30%
2013		1%	10%	8%	23%	37%	20%
2014		1%	11%	8%	25%	40%	13%
2015		1%	13%	10%	29%	46%	
2016		1%	13%	10%	29%	46%	
2017		2%	16%	13%	38%	31%	
2018		2%	19%	14%	43%	21%	
2019		3%	24%	18%	55%		
2020		3%	24%	18%	55%		

Note: The Second Stage minimum standard of 10.5kg/t for C1 new tyre types comes into effect in 2016 (with impact in year 2017), we thus assume that all tyres in band E are below 10.5kg/t.

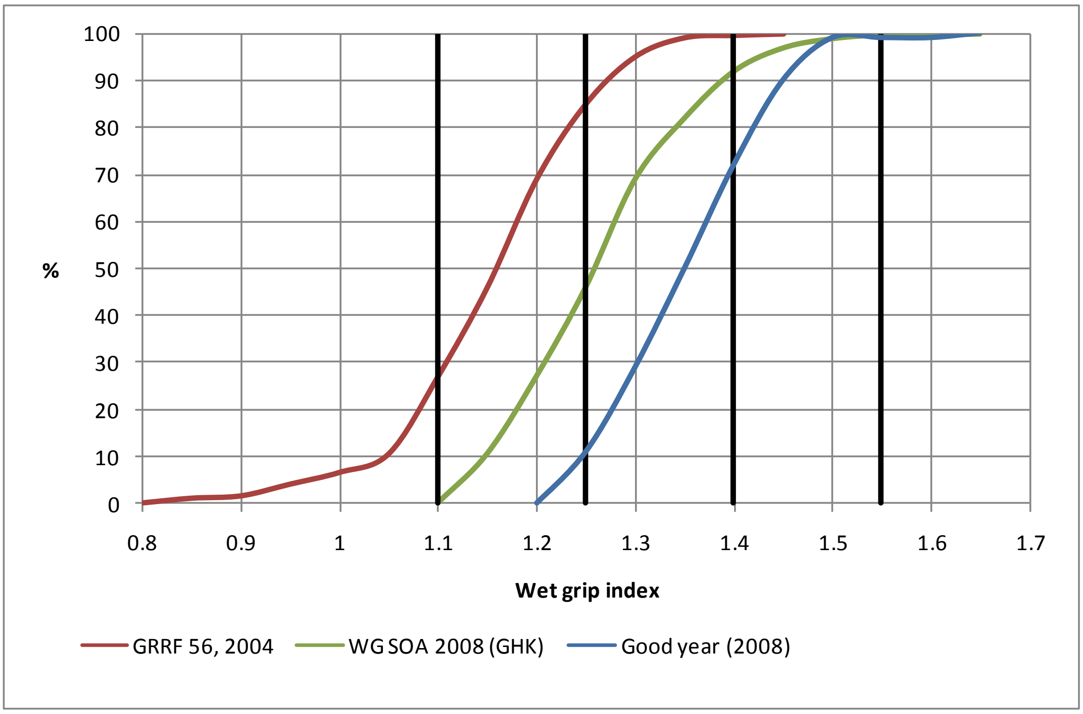
Figure 4.1: Change in C1 Summer Tyre Market Distribution by RRC from 2012 to 2020 in the Reference Case



Source: GHK based on Table 4.4

To examine the impact of a dual label for RRC and WG, a new reference case has to be estimated, that projects changes in the market distribution of RRC and WG. The market distribution of wet grip is estimated based on GRRF, 56 (2004) data. In order to estimate a realistic distribution of the market in 2008 an average of the GRRF, 56 (2004) and WG distribution from Goodyear, was calculated by GHK (Figure 4.2).

Figure 4.2: Market Distribution of Wet Grip Performance (PC summer tyres)

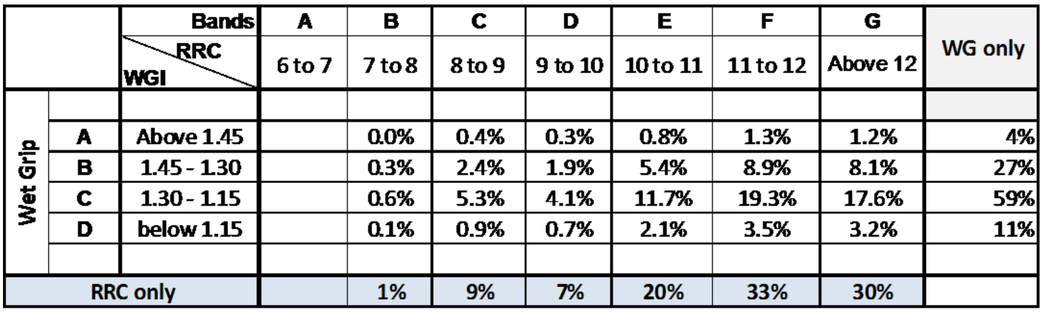


Note: Goodyear data is based on a very small tyre sample that does not cover the entire Goodyear/Dunlop product portfolio.

The minimum requirement on wet grip for C1 summer tyres by 2012-14 (COM (2008) 316, Annex 1 Part A) is 1.1 on the WG index (WGI) (where 1.0 is set by the SRTT). Tyre producers have advised that the wet grip state of the art has moved from the 1.4 indicated in the GRRF data to approximately 1.5 (as shown in the move from the GRFF curve to the SOA (2008) curve in Figure 4.2). In 2008, according to tyre producers, no tyres above 1.55 are available on the market. For the purpose of the impact assessment, in the absence of any further data on the projected trends in WG market distribution, the distribution of the SOA (2008) WG is assumed to remain constant over the period 2012-2020, in the reference case.

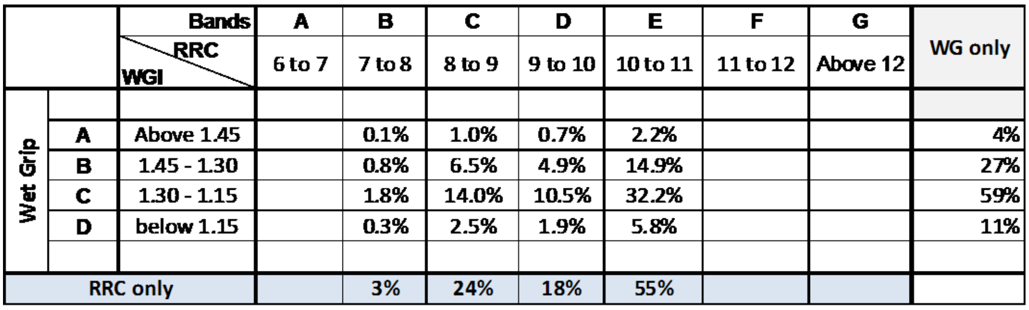
For the purposes of the impact assessment, the grading scheme for wet grip is based on the WGI using four bands to reflect the market distribution in Figure 4.2. Based on the current market limit, the highest band for wet grip is set at 1.45 or above. Based on the reference case distributions for RRC and WGI for the period 2012-2020, estimates of the market distribution have been provided for combinations of WG and RR. The 2012 and 2020 reference case for RRC and WGI is given in Tables 4.5a and 4.5b below.

Table 4.5a: EU Market Distribution of C1 Summer Replacement Tyres by RRC and WG – 2012 reference case



		Bands	A	B	C	D	E	F	G	WG only
		RRC WGI	6 to 7	7 to 8	8 to 9	9 to 10	10 to 11	11 to 12	Above 12	
Wet Grip										
	A	Above 1.45		0.0%	0.4%	0.3%	0.8%	1.3%	1.2%	4%
	B	1.45 - 1.30		0.3%	2.4%	1.9%	5.4%	8.9%	8.1%	27%
	C	1.30 - 1.15		0.6%	5.3%	4.1%	11.7%	19.3%	17.6%	59%
	D	below 1.15		0.1%	0.9%	0.7%	2.1%	3.5%	3.2%	11%
RRC only				1%	9%	7%	20%	33%	30%	

Table 4.5b: EU Market Distribution of C1 Summer Replacement Tyres by RRC and WG – 2020 reference case



		Bands	A	B	C	D	E	F	G	WG only
		RRC WGI	6 to 7	7 to 8	8 to 9	9 to 10	10 to 11	11 to 12	Above 12	
Wet Grip										
	A	Above 1.45		0.1%	1.0%	0.7%	2.2%			4%
	B	1.45 - 1.30		0.8%	6.5%	4.9%	14.9%			27%
	C	1.30 - 1.15		1.8%	14.0%	10.5%	32.2%			59%
	D	below 1.15		0.3%	2.5%	1.9%	5.8%			11%
RRC only				3%	24%	18%	55%			

4.4 Energy Labelling Options – Policy Options B, C and D

The estimated pace of change of market transformation to LRRTs is based on the assumption that labelling is sufficient to encourage a share of the market in any one band to move to the next highest band in a year. This share is unknown but estimates can be informed by the comparison with the effects of energy labelling on the demand for domestic appliances. Given the technological limits to ever declining levels of rolling resistance, we have assumed that for the purposes of the impact assessment, the minimum level of RRC by 2020 is 6 kg/t.

There are arguments for a relatively slow pace of change to reflect the situation that many customers do not buy tyres off-the shelf as with domestic appliances and may not actually see the new tyres until they are fitted to the vehicle. Customers may decide beforehand to fit the same tyre as OE or buy the one recommended by the retailer rather than refer to labelling information. Also, as discussed in Section 3, tyre consumer preference for fuel cost savings has previously ranked below tyre durability, grip and tyre cost, though a labelling scheme is intended to change customer preferences by raising awareness.

A ‘fast’ pace of change should also be considered since the evidence is that where price penalties for switching are small (say less than 5% of price) a greater share of the market will switch more quickly. Moreover, because of projected increases in the real costs of fuel, energy labelling is likely to become more important in framing customer choice.

Experience from energy labelling of household appliances (Table 4.6) shows variation in the rates of change achieved by different appliances.

Table 4.6 Share of Band A or above in Total Market (%)

Share (%)	**1995**	**2000**	**2005**	**First 8 years (EU-15)**
Washing machines	2	34	85	50 – 60[a]
Dishwashers	na	21	82	
Refrigerators (Cooling)	2	22	70	15 - 20 [b]
Freezers	4	19	56	
Cookers/Ovens	na	2	34	

Source: Stockle, GfK (2006), [b]Europe Economics (2007)

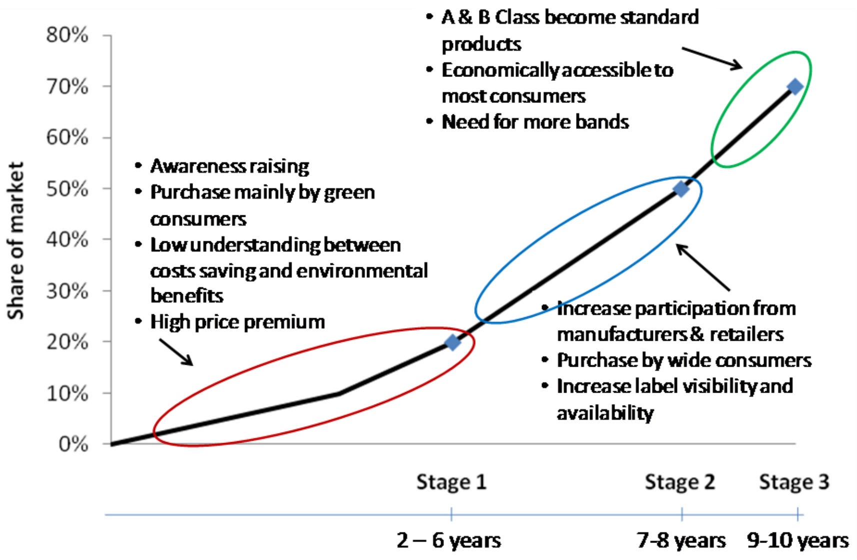
Note: Basis: 1995 to 2005 for 8 countries West Europe, measured by GfK since 1995. Countries: AT, BE, DE, ES, FR, GB, IT and NL.

[a] Only 2004 share available for EU Centre-East countries. 50 to 60% is an estimate based on the trend for 8 western EU countries and share of band A washing machines in 2004 for centre-east EU countries.

Some appliances, such as washing machines had a faster rate of growth of ‘Band A’ sales compared to cookers and ovens over the ten year period. The share of fridges in Band A or above increased from 2% in 1995 to 70% in 2005 in 8 western European countries. According to Europe Economics (2007), the share of ‘Band A’ fridges in the EU-15 increased from 2% in 1992 to around 16% in 1999 and 45% in 2003[17].

The experience has shown that the uptake of products in higher energy efficient classes takes several years (Figure 4.3) and depends on a number of factors including initial levels of awareness, economic incentives and disincentives, and levels of manufacture and retailer participation.

Figure 4.3: Labelling Stages and Share of Market (A & B class)



Source: GHK Estimates

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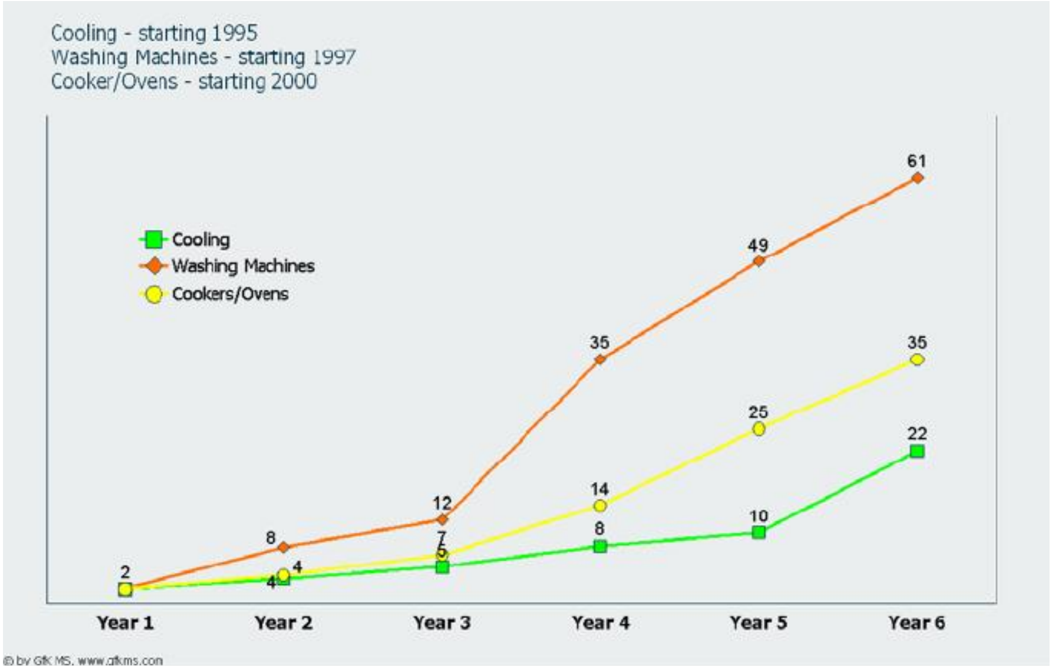
[17] Please see Annex 7 and Europe Economics (2007), Appendix 1 for more on trends of domestic appliance sales by labelling bands.

The effect of these factors is to delay a greater uptake of products in higher bands usually to the 5th and 6th year (Figure 4.4).

Figure 4.4: Share of Sales in Band A or above



Source: Stockle, GfK (2006)

Note: Basis: 8 countries West Europe, measured by GfK since 1995. Countries: AT, BE, DE, ES, FR, GB, IT and NL

4.4.1 *Policy Option B – RR only grading scheme for C1 tyres with minimum requirements on other parameters*

The actual pace of change in market transformation cannot be known in advance. Some customers will be highly motivated and will switch immediately to tyres shown to be in the higher bands. Others will be constrained because of price constraints from any switch. The evidence from energy labelling for domestic appliances allows some idea of the possible range in the rate of market change attributable to energy labelling. Based on this evidence, but allowing for a high level of uncertainty, a range from slow to fast in the pace of market transformation has been estimated for the purposes of the impact assessment. The rate of change is based on the assumptions relating to the share of the market in one band switching to the next band in a year (Table 4.7). The resultant changes in market distribution can be considered against the evidence for domestic appliances as a rough test of 'reasonableness'.

Table 4.7: Pace of Market Change Due to Energy Labelling, RR only (1.0 kg/t bandwidth) – share of market in any one band moving to the next band in the year

	Slow	Fast
2012	0%	0%
2013	1.0%	5.0%
2014	2.0%	10.0%
2015	5.0%	15.0%
2016	7.5%	20.0%
2017	10.0%	30.0%
2018	12.5%	40.0%
2019	15.0%	50.0%
2020	20.0%	60.0%

The estimated EU market distribution by RRC, 2012-2020, as a result of energy labelling is based on the application of the assumed rates of change (Table 4.7) to the reference case (Table 4.4). The slow and fast pace of change in Table 4.7, indicate the worst and the best case scenario of the labelling effect. The results are presented in Tables 4.8a to reflect the slow pace of change and Table 4.8b for the faster rate of change. This suggests that the policy option increases the share of the market in Bands A and B from 1% in 2012 to 17% in 2020 in the slow case and 48% in 2020 under the fast pace.

Table 4.8a: EU Market Distribution of C1 Summer Replacement Tyres by RRC – Tyre Labelling (slow pace)

Bands	**A**	**B**	**C**	**D**	**E**	**F**	**G**	
RRC kg/t	6 to 7	7 to 8	8 to 9	9 to 10	10 to 11	11 to 12	Above 12	
2012	0%	1%	9%	7%	20%	33%	30%	100%
2013	0%	1%	10%	8%	24%	37%	20%	100%
2014	0%	2%	11%	9%	26%	40%	13%	100%
2015	0%	2%	12%	11%	30%	43%		100%
2016	0%	3%	12%	13%	31%	40%		100%
2017	1%	5%	15%	18%	37%	24%		100%
2018	1%	6%	15%	20%	35%	21%		100%
2019	3%	10%	21%	28%	38%			100%
2020	5%	12%	22%	30%	31%			100%

Source: GHK Estimates, Note: Figures may not add due to rounding

Table 4.8b: EU Market Distribution of C1 Summer Replacement Tyres by RRC – Tyre Labelling (fast pace)

Bands	A	B	C	D	E	F	G	
RRC kg/t	6 to 7	7 to 8	8 to 9	9 to 10	10 to 11	11 to 12	Above 12	
2012		1%	9%	7%	20%	33%	30%	100%
2013		2%	10%	9%	24%	36%	19%	100%
2014		3%	11%	11%	27%	37%	11%	100%
2015	0%	5%	12%	15%	32%	35%		100%
2016	1%	6%	13%	19%	33%	28%		100%
2017	4%	9%	16%	26%	32%	13%		100%
2018	7%	12%	20%	28%	24%	8%		100%
2019	14%	17%	26%	28%	13%			100%
2020	23%	25%	28%	19%	5%			100%

Source GHK Estimates, Note: Figures may not add due to rounding

Figure 4.4a below, summarises the projected sales in each band due to labelling (slow and fast) compared to the reference case in 2020. Figure 4.4b indicates the share of the market by band in 2020 due to labelling (slow and fast).

Figure 4.4a: Comparison of the EU Market Distribution of C1 Summer Replacement Tyres by RRC for RR Only labelling (with the Reference Case, 2020)

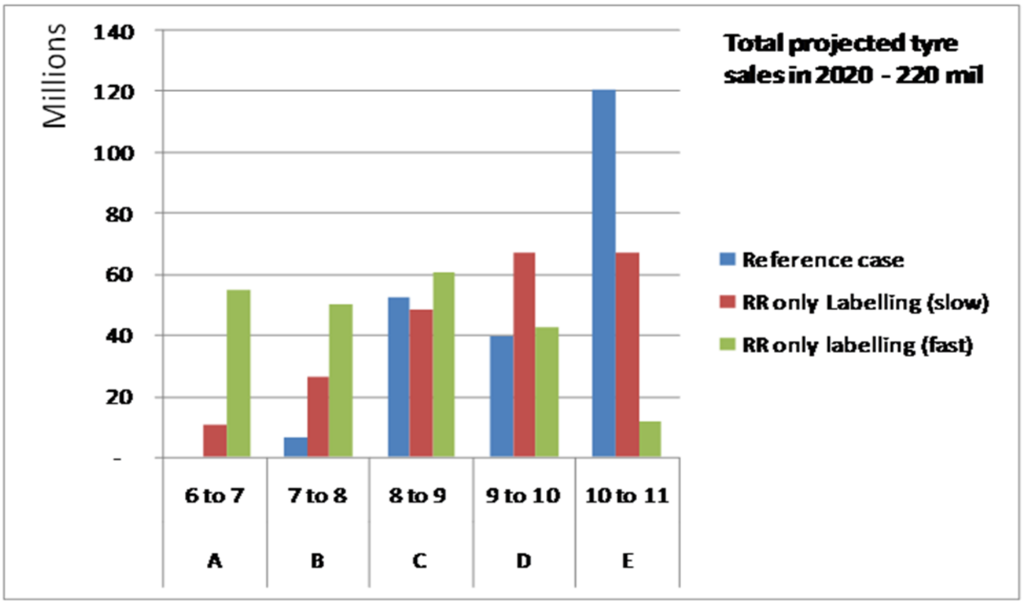
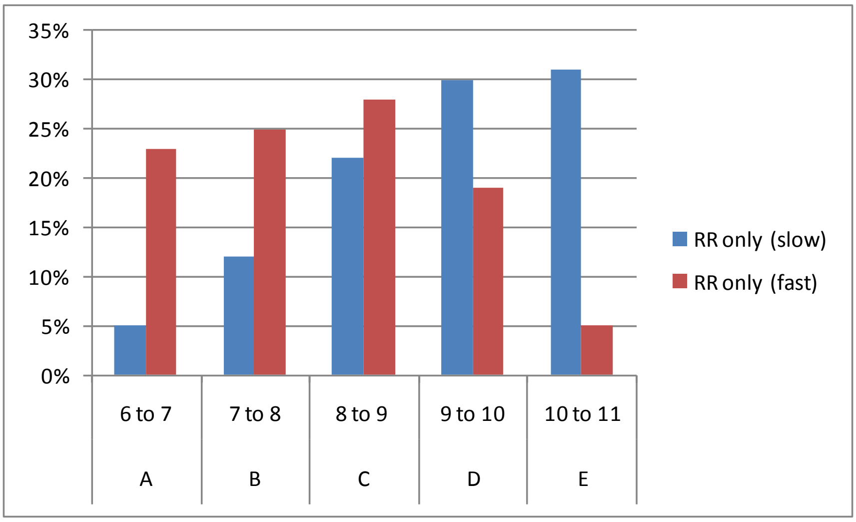


Figure 4.4b: Share (%) of C1 Summer Replacement Tyre Market by RRC for RR Only Labelling, 2020



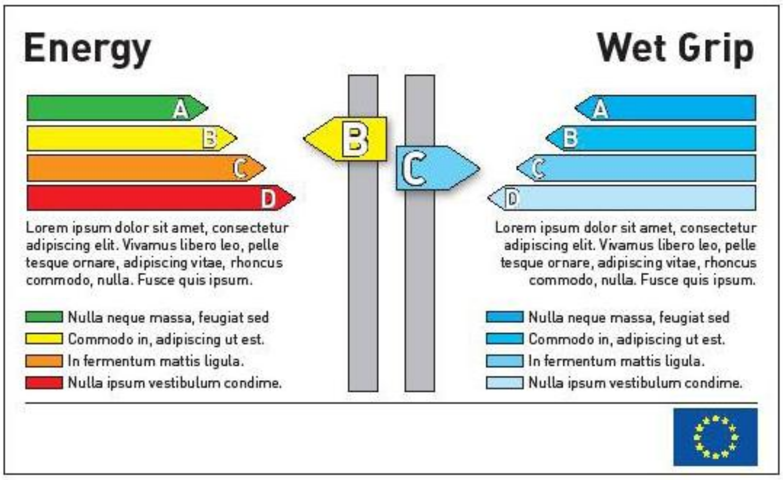
This range in market changes after 8 years can be compared with the experience of domestic appliances and the move to higher bands. The lower end of the range is consistent with that for those appliances where a combination of limited alternatives and higher costs prevented rapid change, for example in the case of fridges and freezer. For these products approximately 15-20% (for EU-15) of the market had moved to higher bands after a similar period of time. The higher end of the range is consistent with those appliances where market transformation has been much quicker such as washing machines. For these products approximately 50-60% (for EU-15) of the market had moved to higher bands after a similar period.

It should also be noted that even after a prolonged period of labelling, a part of the market will still make economically irrational purchasing decisions (as shown in Figure 4.4 and Table 4.8b); with a share of budget tyre customers unable to afford the increased purchase price even taking into account later savings in fuel.

4.4.2 Policy Option C – multiple grading scheme (with wet grip and possibly rolling noise) for C1 tyres

This option includes performance data in the labelling information on wet grip (WG) as well as RRC. Dual labelling on WG and RRC will provide a safeguard for those customers who might otherwise have purchased tyres with lower levels of wet grip than they preferred when purchasing improved rolling resistance. However, dual labelling increases the complexity of tyre choice for customers. For example, for a 4 band scheme for WG and RRC there can be 16 tyre choices for any given tyre (Figure 4.5).

Figure 4.5: Indicative Dual Tyre Label (ETRMA proposal)



Note: A more detailed design is provided in Annexe 8

The analysis of the impact of the dual labelling option requires an analysis of the effect of including wet grip in labelling information, on the likely pace of change of market transformation, generated by the energy label. As noted in the previous section, consumer preference for the safety performance of the tyre is higher than for the fuel saving performance. By making the safety aspect of the tyre more visible in the dual label it would be expected that it would encourage customers to choose tyres on the basis of the wet grip rating rather than rolling resistance, lowering the pace of change compared to that for an RR only label. This is reflected in the assumed pace of change (Table 4.9). In terms of the market transformation for wet grip, we have assumed a constant pace of change of 10%. This modest pace of change for wet grip reflects the much larger bandwidths that are used to measure the market distribution.

Table 4.9: Pace of Market Change Due to Energy Labelling, RR and WG (1.0 kg/t bandwidth) – share of market in any one band moving to the next highest band in a year

	RRC		WG
	Slow	**Fast**	
2012	0%	0%	0%
2013	1.0%	2.5%	10%
2014	2.0%	5.0%	10%
2015	4.0%	10.0%	10%
2016	6.0%	15.0%	10%
2017	8.0%	20.0%	10%
2018	10.0%	25.0%	10%
2019	12.0%	30.0%	10%
2020	15.0%	40.0%	10%

Using the pace of change assumptions above applied to the market distribution by RR and wet grip in the reference case the EU market distribution by RR and wet grip can be calculated for each year 2012-2020. The market transformation by 2020 is presented in Tables 4.10a (slow pace) and 4.10b (fast pace). This suggests that under dual labelling the market share of bands A and B increases from 1% in 2012 to 14% in 2020 under the slow case and 30% in 2020 under the fast case.

Table 4.10a Market distribution for RRC and WG, passenger cars (C1) summer – 2020 – dual labelling case (slow pace)

		Bands	A+	A	B	C	D	E	F	G	WG only
		RRC WGI	5 to 6	6 to 7	7 to 8	8 to 9	9 to 10	10 to 11	11 to 12	Above 12	
Wet Grip	A+										
	A	1.55		0.5%	1.4%	2.9%	4.0%	4.8%			14%
	B	1.4		1.0%	3.0%	6.1%	8.3%	9.9%			28%
	C	1.25		1.3%	4.1%	8.3%	11.3%	13.5%			39%
	D	1.1		0.7%	2.1%	4.3%	5.8%	6.9%			20%
	Above D	1.1 below		0.0%	0.0%	0.0%	0.0%	0.0%			0%
RRC only				3%	11%	22%	29%	35%			

Table 4.10b Market distribution for RRC and WG, passenger cars (C1) summer – 2020 – dual labelling case (fast pace)

		Bands	A+	A	B	C	D	E	F	G	WG only
		RRC WGI	5 to 6	6 to 7	7 to 8	8 to 9	9 to 10	10 to 11	11 to 12	Above 12	
Wet Grip	A+										
	A	1.55		1.8%	2.3%	3.5%	3.9%	2.0%			14%
	B	1.4		3.7%	4.8%	7.4%	8.1%	4.2%			28%
	C	1.25		5.0%	6.6%	10.1%	11.1%	5.8%			39%
	D	1.1		2.6%	3.4%	5.2%	5.7%	3.0%			20%
	Above D	1.1 below		0.0%	0.0%	0.0%	0.0%	0.0%			0%
RRC only				13%	17%	26%	29%	15%			

Figure 4.6a below, summarises the projected sales in each band due to dual labelling (slow and fast) compared to the reference case in 2020. Figure 4.5b indicates the share of the market by band in 2020 due to dual labelling (slow and fast).

Figure 4.6a: Comparison of the EU Market Distribution of C1 Summer Replacement Tyres by RRC for Dual Labelling with the Reference Case, 2020

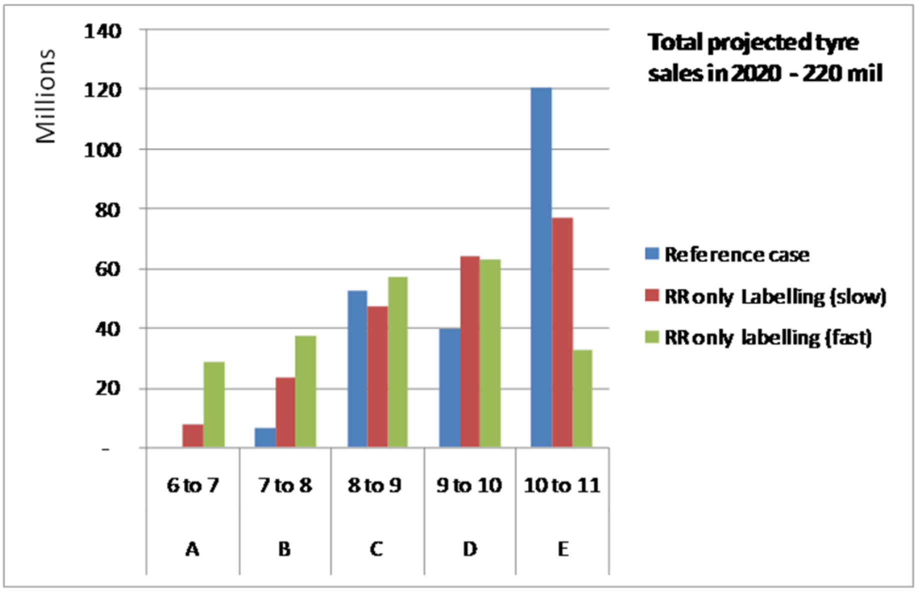
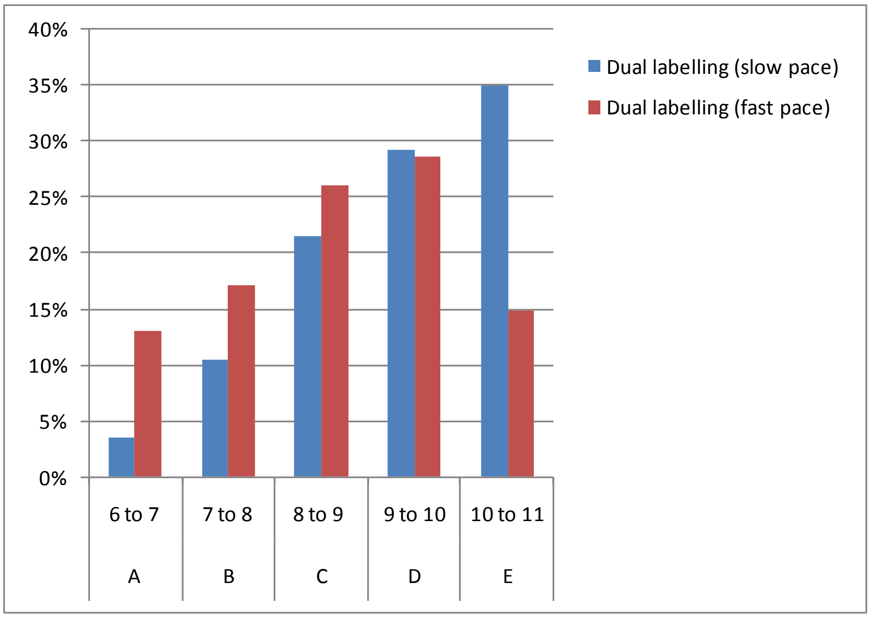


Figure 4.6b: Share (%) of C1 Summer Replacement Tyre Market by RRC for Dual Labelling, 2020



4.4.3 *Policy Option B and C for C1 tyres (summer and winter)*

The reference case market distribution for C1 tyres combining summer and winter based on their respective market shares is given in the table below. This indicates that only 2% of replacement tyres in 2020 are expected to have a rolling resistance of less than 8 kg/t and 19% to have a rolling resistance of less than 9 kg/t in the reference case (Table 4.11). Changes in market share by band due to energy labelling on RR only are shown in Tables 4.12a (slow pace) and 4.12b (fast pace). Tables 4.13a and 4.13b provide comparable estimates for a dual labelling on RR and WG.

Table 4.11: Market Distribution of C1 Replacement Tyres (summer and winter), Reference Case

Bands	A	B	C	D	E	F	G
RRC	6 to 7	7 to 8	8 to 9	9 to 10	10 to 11	11 to 12	Above 12
2012		1%	6%	5%	16%	29%	44%
2013		1%	7%	6%	19%	37%	29%
2014		1%	8%	7%	22%	43%	19%
2015		1%	9%	8%	27%	54%	
2016		1%	9%	8%	27%	54%	
2017		1%	11%	12%	39%	36%	
2018		1%	13%	13%	47%	25%	
2019		2%	17%	17%	63%		
2020		2%	17%	17%	63%		

Note: The Second Stage minimum standard of 10.5kg/t for C1 new tyre types comes into effect in 2016 (with impact in year 2017), we thus assume that all tyres in band E are below 10.5kg/t.

Table 4.12a: EU Market Distribution of C1 Replacement Tyres (summer and winter) by RRC – Single RR Only Labelling (slow pace)

Bands	**A**	**B**	**C**	**D**	**E**	**F**	**G**
RRC	6 to 7	7 to 8	8 to 9	9 to 10	10 to 11	11 to 12	Above 12
2012	0%	1%	6%	5%	16%	28%	44%
2013	0%	1%	7%	6%	20%	37%	28%
2014	0%	1%	8%	7%	22%	42%	19%
2015	0%	2%	9%	9%	28%	51%	
2016	0%	2%	9%	11%	30%	47%	
2017	1%	3%	11%	17%	39%	28%	
2018	1%	4%	12%	21%	40%	21%	
2019	2%	7%	17%	30%	43%		
2020	3%	9%	20%	33%	35%		

Table 4.12b: EU Market Distribution of C1 Replacement Tyres (summer and winter) by RRC – Single RR Only Labelling (fast pace)

Bands	**A**	**B**	**C**	**D**	**E**	**F**	**G**
RRC	6 to 7	7 to 8	8 to 9	9 to 10	10 to 11	11 to 12	Above 12
2012	0%	1%	6%	5%	16%	28%	44%
2013	0%	1%	7%	7%	20%	37%	27%
2014	0%	2%	7%	9%	25%	40%	16%
2015	0%	3%	9%	13%	32%	41%	
2016	1%	4%	10%	17%	34%	33%	
2017	3%	7%	14%	26%	35%	16%	
2018	5%	10%	19%	30%	27%	8%	
2019	11%	16%	27%	31%	15%		
2020	20%	22%	29%	21%	6%		

Table 4.13a: EU Market Distribution of C1 Replacement Tyres (summer and winter) by RRC – Dual Labelling (slow pace)

Bands	A	B	C	D	E	F	G
RRC	6 to 7	7 to 8	8 to 9	9 to 10	10 to 11	11 to 12	Above 12
2012	0%	1%	6%	5%	16%	29%	44%
2013	0%	1%	7%	6%	20%	37%	28%
2014	0%	1%	8%	7%	22%	42%	19%
2015	0%	2%	9%	9%	28%	51%	
2016	0%	2%	9%	10%	30%	48%	
2017	0%	3%	11%	16%	39%	30%	
2018	1%	4%	12%	19%	41%	23%	
2019	2%	6%	16%	28%	46%		
2020	2%	8%	18%	31%	40%		

Table 4.13b: EU Market Distribution of C1 Replacement Tyres (summer and winter) by RRC – Dual Labelling (fast pace)

Bands	A	B	C	D	E	F	G
RRC	6 to 7	7 to 8	8 to 9	9 to 10	10 to 11	11 to 12	Above 12
2012	0%	1%	6%	5%	16%	29%	44%
2013	0%	1%	7%	6%	20%	37%	28%
2014	0%	1%	8%	8%	23%	41%	18%
2015	0%	2%	9%	11%	30%	47%	
2016	1%	3%	9%	14%	33%	39%	
2017	1%	5%	12%	22%	38%	21%	
2018	3%	7%	15%	27%	34%	14%	
2019	6%	11%	22%	34%	28%		
2020	10%	15%	26%	31%	17%		

4.5 Policy Option D – Single labelling of RR Applied to C2 and C3 Tyres

This option examines the impact of single labelling of RR on the market for C2 and C3 tyres, using the pace of change assumptions as for C1, but applied to the different market distribution of RR for C2 and C3 in the reference cases. The assessment is based on the same grading framework as set out in Section 2.7 and using the same methodology as for C1 tyres (market distribution in 2012, technological state of the art and target by 2020, minimum requirements setting the worst band), to estimate changes from energy labelling on production costs and fuel and CO2 savings.

4.5.1 Market Transformation of C2 Tyres

The reference case and the estimated single labelling (slow and fast pace) market distribution for C2 tyres is given below. In the absence of any available data, the reference case is based on the assumption that the RRC distribution of C2 tyres in 2012 is the same as the SOA RRC distribution in 2004 (Table 4.14). The effect of energy labelling on C2 tyres is to increase the market share of C2 tyres with a rolling resistance below 7.5kg/t from 1% in 2020 to 31% (slow pace) or to 68% (fast pace), Table 4.15a,b..

Table 4.14: Market Distribution of C2 Tyres (summer and winter), Reference Case

Bands							
RRC	5.5 to 6.5	6.5 to 7.5	7.5 to 8.5	8.5 to 9.5	9.5 to 10.5	above 10.5	
Base SOA 2004		0%	5%	18%	36%	41%	100%
2013	0%	1%	4%	18%	42%	35%	100%
2014	0%	1%	4%	21%	50%	23%	100%
2015	0%	1%	6%	27%	66%	0%	100%
2016	0%	1%	6%	27%	66%	0%	100%
2017	0%	1%	8%	46%	45%	0%	100%
2018	0%	1%	10%	58%	30%	0%	100%
2019	0%	1%	14%	84%	0%	0%	100%
2020	0%	1%	14%	84%	0%	0%	100%

Note: The 2nd stage min. std. of 9kg/t for C2 new tyre types comes into effect in 2016 (year 2017), we thus assume that all tyres in band 8.5 to 9.5 are below 9kg/t.

Table 4.15a: EU Market Distribution of C2 Replacement Tyres by RRC (winter and summer) – Energy Labelling (slow pace)

Bands							
RRC	5.5 to 6.5	6.5 to 7.5	7.5 to 8.5	8.5 to 9.5	9.5 to 10.5	above 10.5	
2013	0%	1%	4%	19%	42%	34%	100%
2014	0%	1%	5%	22%	50%	22%	100%
2015	0%	1%	7%	30%	61%	0%	100%
2016	0%	1%	9%	32%	57%	0%	100%
2017	1%	8%	33%	23%	34%	0%	100%
2018	2%	13%	38%	27%	20%	0%	100%
2019	4%	21%	40%	34%	0%	0%	100%
2020	7%	24%	39%	27%	0%	0%	100%

Table 4.15b: EU Market Distribution of C2 Replacement Tyres (summer and winter) by RRC – Energy Labelling (fast pace)

Bands							
RRC	5.5 to 6.5	6.5 to 7.5	7.5 to 8.5	8.5 to 9.5	9.5 to 10.5	above 10.5	
2013	0%	1%	4%	19%	41%	33%	100%
2014	0%	1%	7%	25%	46%	20%	100%
2015	0%	2%	12%	35%	50%	0%	100%
2016	0%	5%	17%	38%	40%	0%	100%
2017	3%	18%	34%	26%	19%	0%	100%
2018	11%	26%	32%	22%	8%	0%	100%
2019	26%	32%	21%	21%	0%	0%	100%
2020	45%	23%	21%	10%	0%	0%	100%

4.5.2 Market Transformation of C3 Tyres

The reference case and the estimated single labelling (slow and fast pace) market distribution for C3 tyres is given below. In the absence of available data, the reference case is based on the assumption that the RRC distribution of C3 tyres in 2012 is the same as the SOA RRC distribution in 2004 (Table 4.16). The effect of energy labelling on C3 tyres is to increase the market share of C3 tyres with a rolling resistance below 4kg/t from 3% in 2020 to 11% (slow pace) or to 39% (fast pace), Tables 4.17a,b.

Table 4.16: Market Distribution of C3 Tyres (summer and winter), Reference Case

RRC kg/t	Below 4	4 to 5	5 to 6	6 to 7	7 to 8	Above 8	
Base SOA 2004/2008	1%	8%	23%	33%	23%	10%	100%
2013	1%	9%	24%	34%	25%	7%	100%
2014	1%	9%	24%	35%	26%	4%	100%
2015	1%	9%	25%	36%	26%	3%	100%
2016	1%	9%	25%	36%	26%	2%	100%
2017	2%	13%	36%	30%	19%	0%	100%
2018	2%	16%	43%	26%	12%	0	100%
2019	3%	17%	48%	24%	8%	0	100%
2020	3%	19%	51%	22%	6%	0	100%

Note: The 2nd stage min. std. of 6.5kg/t for C3 new tyre types comes into effect in 2016 (year 2017), we thus assume that all tyres in band 6 to 7 are below 6.5kg/t.

Table 4.17a: EU Market Distribution of C3 Replacement Tyres (summer and winter) by RRC – Energy Labelling (slow pace)

RRC kg/t	Below 4	4 to 5	5 to 6	6 to7	7 to 8	Above 8	
2013	1%	9%	24%	34%	25%	7%	100%
2014	1%	9%	25%	35%	25%	4%	100%
2015	1%	10%	26%	35%	25%	3%	100%
2016	2%	11%	26%	35%	23%	2%	100%
2017	3%	16%	36%	29%	15%	0%	100%
2018	6%	21%	41%	23%	9%	0	100%
2019	7%	23%	45%	19%	6%	0	100%
2020	11%	28%	43%	14%	3%	0	100%

Table 4.17b: EU Market Distribution of C3 Replacement Tyres (summer and winter) by RRC – Energy Labelling (fast pace)

RRC kg/t	Below 4	4 to 5	5 to 6	6 to7	7 to 8	Above 8	
2013	1%	9%	25%	33%	24%	7%	100%
2014	2%	11%	26%	34%	23%	4%	100%
2015	4%	13%	27%	33%	21%	2%	100%
2016	6%	17%	29%	31%	17%	2%	100%
2017	8%	21%	36%	23%	10%	0%	100%
2018	17%	29%	34%	15%	5%	0	100%
2019	21%	32%	35%	9%	3%	0	100%
2020	39%	35%	21%	4%	1%	0	100%

4.6 Policy Option E: Use of Market Based Instruments and Public Procurement

4.6.1 Reduction of VAT Rates in Highest Band

The average full rate of VAT in the EU-27 is 19% and the reduced rate (used for various items because they are deemed to represent basic necessities or to encourage some form of market change) is on average 7%. Based on these averages it is possible to estimate the change in demand for low RR tyres if the price is reduced by a VAT reduction from 19% to 7%. This is based on the market transformation in the reference case already estimated, using the bands to indicate the distribution and the price premium already calculated for improved RR whilst maintaining minimum standards on other tyre attributes. The VAT reduction only provides an incentive to switch to tyres with lower RR, there is no incentive in relation to wet grip.

It is assumed that the reduction would only take place for tyres with a rolling resistance below a given level (adjusted for outside diameter). This would lead to a reduction in price of around 12% for tyres that meet the required level. In the reference case the highest band is for tyres which have a RR of between 7kg/t and 8kg/t (Band B). Applying the VAT discount to tyres in Band B reduces the price premium for moving to band B from tyres with a RR of 11kg/t or more (band F) from €9.6 to €8.4 (Table 4.18). The incremental cost of moving from the next lowest band (band C) to band B is reduced from €3.0 to €1.8.

Table 4.18: Price Premium under VAT Option Compared to Reference Case, C1 Summer Tyres

Move from Band C to B		Move from Band F to B	
Reference Case	**VAT Case**	**Reference Case**	**VAT Case**
3.5% (€3.0)	2.2% (€1.8)	11.1% (€9.6)	9.8% (€8.4)

As previously noted, (Section 2.5.1), the estimated long-run price elasticity of demand for automobile tyres is 1.2. Thus a price reduction of 12% in band B would increase the demand for band B tyres by almost 14% (price elasticity of 12x1.2). The change in market distribution by RRC due to this VAT discount is shown in Table 4.18 below based on a pro-rate reduction in demand in other bands. The VAT discount would increase the market share of tyres less than 9kg/t from 27% in the reference case to 34% in 2020 (Table 4.19).

Table 4.19: EU Market Distribution of C1 Summer Replacement Tyres by RRC – VAT Policy Option

Bands	A	B	C	D	E	F	G
RRC	6 to 7	7 to 8	8 to 9	9 to 10	10 to 11	11 to 12	Above 12
2012		1%	9%	7%	20%	33%	30%
2013		1%	10%	8%	23%	37%	20%
2014		2%	11%	8%	25%	40%	13%
2015		2%	13%	10%	29%	46%	
2016		3%	13%	10%	29%	46%	
2017		4%	16%	12%	37%	30%	
2018		5%	19%	14%	42%	20%	
2019		7%	23%	18%	52%		
2020		9%	25%	16%	50%		

4.6.2 Carbon tax

A tax based on C02 emissions and the EU ETS price of €25/tonne of CO2 (or €0.025/kg) would increase the costs of all tyres but would provide no incentive for market transformation, given the small absolute difference between bands and the total level of emissions. An alternative is this option which examines a tax based on the relative CO2 emission of tyres in lower bands compared to band A, as a complement to energy labelling. Tyres in the highest band would be zero rated, with the tax increasing in lower bands based on the increased level of emissions compared to band A. The tax internalises the CO2 cost of tyres in lower bands relative to tyres in the highest band.

A 1kg/t reduction (a 1 band move to the next highest band) in RRC leads to a reduction of 10 kg CO2 per tyre per year (Table 4.20). A carbon tax based on the EU ETS price can be levied on the increased emissions relative to band A, i.e €0.25 for each band move from band A. Thus the tax per tyre increases from zero for band A to €1.0 for tyres in band E. This halves the difference in the price premium of Band A over Band E. As a result there is a greater likelihood of a faster switch to LRRTs.

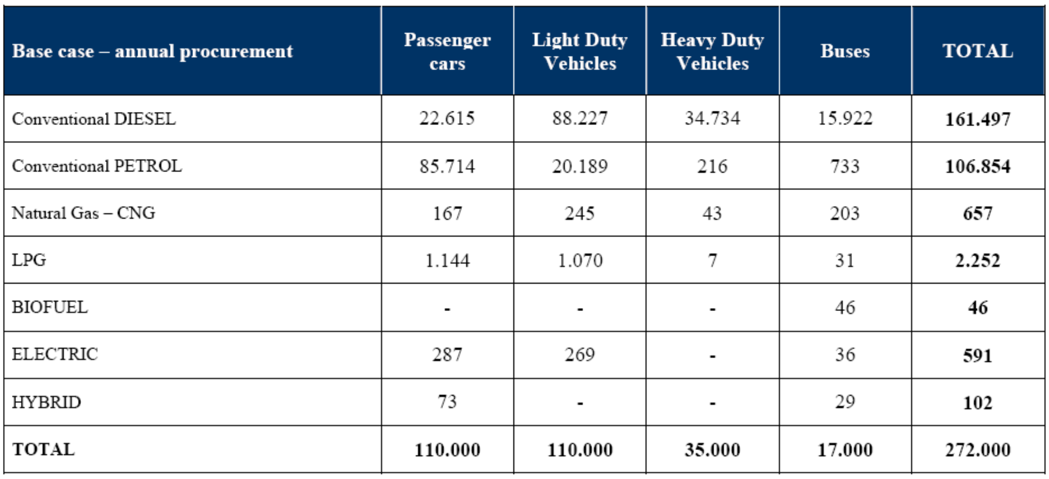
Table 4.20: Carbon Tax on CO2 Emissions per Tyre (C1 Summer) by Band and Relative to Band A

RR only 1kg/t	A+	A	B	C	D	E
	5 to 6	6 to 7	7 to 8	8 to 9	9 to 10	10 to 11
RW CO2 g/km		154	156	159	161	164
CO2 kgs per annum per tyre		615	625	635	645	655
CO2 tax (@€0.025/kg)		15.4	15.6	15.9	16.1	16.4
Increase in CO2 emissions (from band A) kg/tyre/pa		0	10	20	30	40
CO2 tax (€) relative to Band A (@€0.025/kg)		0.00	0.25	0.50	0.75	1.00
Previous Price Premium		4.3	3.0	2.4	2.2	2.0
Revised Price Premium		4.3	3.3	2.9	3.0	3.0

4.6.3 Public Procurement

A study by Pricewaterhouse Coopers (2007) estimated the annual number of vehicles procured by public bodies in EU-25 (Table 4.21).

Table 4.21: Annual Pubic Procurement of Road Vehicles, (2005)



Base case – annual procurement	Passenger cars	Light Duty Vehicles	Heavy Duty Vehicles	Buses	TOTAL
Conventional DIESEL	22.615	88.227	34.734	15.922	**161.497**
Conventional PETROL	85.714	20.189	216	733	**106.854**
Natural Gas – CNG	167	245	43	203	**657**
LPG	1.144	1.070	7	31	**2.252**
BIOFUEL	-	-	-	46	**46**
ELECTRIC	287	269	-	36	**591**
HYBRID	73	-	-	29	**102**
TOTAL	**110.000**	**110.000**	**35.000**	**17.000**	**272.000**

Source: Impact Assessment On A New Approach For The Cleaner And More Energy Efficient Vehicles Directive Proposal (2007), PWC

It was assumed in the PWC study that the procurement level does not vary during the time period of the analysis (2007 – 2017). It was also assumed that scrapped conventional vehicles are replaced with new ones complying with the current emissions Euro standard. As for the alternative technologies already included in the public fleets, it is assumed that they are replaced with the same technology.

Assuming that the procurement level provides an approximation to the size of the vehicle fleet operated by public bodies in the EU, the approximate number of tyres procured can be calculated, based on the number of replacement tyres per vehicle per annum. The estimated number purchased, and as a share of the replacement market is given in Table 4.22. Public procurement of energy efficient tyres can only affect a very small part of the replacement market and is unlikely to have any significant effect on market transformation except as a complement to energy labelling. In absolute terms however, the cumulated net savings may be significant.

Table 4.22: Total Number of Public Procured Replacement Tyres (2005)

	Passenger Cars (C1)	Light Duty Vehicles (C2)	Trucks and Buses (C3)	Total
Total Replacement Tyres	173,000	241,000	281,000	695,000
Share of Total Replacement Market	0.1%	1%	2%	0.3%

Source: GHK Estimates

Assuming that currently the RRC distribution of all publically procured tyres (C1, C2 and C3) is the same as the reference case replacement market distribution, the aggregate and average annual savings if all public procurement tyres were in Band B and C is shown in Table 4.23a and 4.23b below. The total aggregated social benefits including economic value of CO2 savings would be around €226 million (NPV) from 2012-2020. The average annual benefit would be around €34 million. For PCs, the cumulative CO2 savings is 0.08 mt and average annual CO2 savings is 0.01 mt. For CVs/LTs, the cumulative CO2 savings is 0.27 mt and average annual CO2 savings is 0.03 mt. For TBs, the cumulative CO2 savings is 1.3 mt and average annual CO2 savings is 0.2 mt.

Table 4.23a: Impact of Public Procurement of Tyres in Band B or C on the EU Economy, NPV of Costs and Savings, 2012-2020, 2008 prices (oil price scenario 2)

	Additional Costs of LRRTs	Fuel Cost Saving	Net Consumer Savings	Cumulative CO2 Savings	Total Social Benefit
	(€m, NPV)	(€m, NPV)	(€m, NPV)	(€m, NPV)	(€m, NPV)
Passenger Cars (C1)	7	16	9	2	11
Light Duty Vehicles (C2)	12	69	57	6	63
Trucks and Buses (C3)	124	250	125	27	152
Total	143	335	191	35	226

Note: Numbers may not add up due to rounding

Table 4.23b: Public Procurement of Tyres in Band B or C on the EU Economy, Average Annual Benefit, 2012-2020, (sensitivity analysis to oil price scenario)

	Additional Costs of LRRTs	Fuel Cost Saving	Net Consumer Savings	CO2 Savings	Total Social Benefit
	(€m)	(€m)	(€m)	(€m)	(€m)
Passenger Cars (C1)	1.1	2.5	1.4	0.2	1.6
Light Duty Vehicles (C2)	1.8	10.5	8.7	0.9	9.5
Trucks and Buses (C3)	19.0	38.0	19.0	4.0	23.0
Total	21.9	51.0	29.1	5.1	34.1

Note: Numbers may not add up due to rounding

5 TOTAL IMPACT ASSESSMENT

5.1 Assessment Criteria

The impact assessment of policy options for energy labelling and VAT reduction builds on the market analysis in the previous section to estimate changes in the economy, and for safety and the environment for the different labelling options. The specific assessment criteria examined are:

1) Economy – impact on customers

2) Environment – overall savings in CO2 emissions and abatement costs

3) Economy – impact on the EU economy

4) Safety – effects of changes in wet grip performance (only considered in the framework of this study in the labelling for passenger cars though it may be necessary as well for light and heavy duty vehicles)

5) Administrative costs

The impact assessment separately considers policy options for tyres for each of the three vehicle markets (passenger cars (C1), light trucks and vans (C2), and heavy trucks and buses (C3). In each case the analysis is based on the detailed analysis for each of summer and winter tyres. The impact assessment is defined in terms of the cumulative costs and benefits of the policy options, compared to the reference case, over the period 2012 to 2020 reported as the net present value (NPV) (using a discount rate of 4%), or as the average annual costs and benefits over this 8 years period. Note that implementation of policy options is assumed to take place late in 2012, with no effects on the tyre market until 2013.

5.2 Impact Assessment of Energy Labelling for Tyres for Passenger Cars (C1)

Tyre sales to replace original equipment (OE) for passenger cars represents 78% of all tyres sold for passenger cars and 68% of all tyres sold for all vehicles in the EU. The impact of energy labelling depends on the labelling option (single labelling of RR only, or dual labelling of RR and WG). The impact also depends on the assumed pace of change (slow/fast) in market transformation. Given the uncertainty over the market impact the respective impacts under the slow and fast pace of change provide an approximate range to the scale of impact.

5.2.1 Impact on Customers

The economic impact of energy labelling on customers including both retail customers and business customers is determined by the extent of market transformation and by the consequent effect of energy labelling on the cost of new replacement tyres and the savings in fuel costs as a result of the improved fuel efficiency. The higher price of more fuel efficient tyres (the price premium) reflects the higher costs to producers of improving fuel efficiency by reducing rolling resistance without any reduced loss of performance on any other tyre attributes, especially wet grip. The additional costs are higher in the case of dual labelling because of the need not only to improve RR whilst maintaining minimum standards for wet grip, but because of the incentive to improve both RR and wet grip simultaneously.

On a per tyre basis (Section 3.4 above) the additional costs to customers of purchasing lower rolling resistance tyres is more than offset by the fuel savings achieved over the life of the tyre (assuming oil price scenario 2). These savings, when calculated on the basis of the share of the sales of EU passenger car tyres in different bands of RR when compared with the reference case, in each of the years 2012-2020 provide an estimate of the aggregate financial saving to customers, on average each year and in total over the period (Table 5.1a) as a result of energy labelling.

The impact assessment indicates that customers collectively achieve an average annual saving of between €139m and €983m as a result of energy labelling (assuming oil price scenario 2) and depending on the pace of market transformation. The fuel cost saving in Table 5.1a is equivalent to 2 Mtoe to 11 Mtoe (or 2,700m litres to 11,430m litres of fuel)[18]. This is equivalent to the load carried by between 13 to 54 crude oil super tankers[19].

Table 5.1a: Impact of Energy Labelling of Passenger Car Tyres on EU Customers, 2012-2020, 2008 prices (oil price scenario 2)

	Additional Tyre Costs (inc VAT) (€m, NPV)		Fuel Cost Savings (inc VAT) (€m, NPV)		Net Cost Savings (inc VAT) (€m, NPV)		Net Average Annual Cost Savings (€m)	
Pace of Change	Slow	Fast	Slow	Fast	Slow	Fast	Slow	Fast
Single Labelling	1,240	4,392	4,291	14,611	3,052	10,219	295	983
Dual Labelling	1,967	5,373	3,441	9,128	1,474	3,754	139	358
Net Benefits of Single Labelling compared to Dual Labelling	-728	-982	850	5,483	1,578	6,465	156	625

Source: GHK estimates based on unit cost and cost savings and estimates of market transformation

The impact assessment indicates that the single label option provides a greater cost saving than dual labelling because of the higher costs associated with tyres purchased under a dual labelling scheme to achieve the same level of improved fuel efficiency. The cost penalty to end users (including foregone fuel savings) per year on average of dual labelling is between €156m and €625m. This cost penalty is offset by an improved level of wet grip compared to that achieved under a single labelling option. It is not possible to

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[18] On average 1000lt of fuel=0.92 toe, 1000 lt of diesel = 0.98 toe and 1000 lt of petrol = 0.86 toe

[19] 1.5 gallons of crude oil is required to make 1 gallon of gasoline (www.eia.doe.gov). A super tanker on average carries around 2 million barrels of crude oil (Source: Wikipedia)

quantify the value of this benefit except by an inferred improvement in safety. This is discussed in Section 5.2.4 below.

These savings depend critically on the assumed level of oil price in the period to 2020. Table 5.1b illustrates the sensitivity of the estimated impact on customers of changes in the oil price. Compared to the savings for RR only under scenario 2, the average annual savings range from –28% lower (scenario 1) to +28% higher (scenario 3). The range for dual labelling is -47% to +49%.

Table 5.1b: Impact of Energy Labelling of Passenger Car Tyres on EU Customers, 2012-2020, 2008 prices (sensitivity analysis to oil price scenario)

	Net Average Annual Savings – Scenario 1 (€m)		Net Average Annual Savings – Scenario 2 (€m)		Net Average Annual Savings – Scenario 3 (€m)		Range in Net Average Annual Savings Compared to Scenario 2 (%)	
Pace of Change	Slow	Fast	Slow	Fast	Slow	Fast	Slow	Fast
Single Labelling	213	704	295	983	377	1,261	-28%	28%
Dual Labelling	74	183	139	358	205	532	-47%	49%
Net Benefits of Single Labelling compared to Dual Labelling	139	522	156	625	172	729		

Source: GHK estimates based on unit cost and cost savings and estimates of market transformation

5.2.2 Impact on the Environment

The intended purpose of energy labelling is to switch the demand for tyres to more fuel efficient tyres, away from tyres that are less fuel efficient, and hence secure a reduction in fuel use and the related CO2 emissions per vehicle kilometre.

The market transformation from 2012 to 2020 gives rise to an aggregated reduction in CO2 emissions of between 9mt (slow pace) and 38mt (fast pace) depending on the labelling option (Table 5.2a). Multiplying this reduction by the social cost of carbon revealed by the EU emission trading scheme of €25/t indicates a social benefit of between €167m and €709m (NPV) from 2012 to 2020. The average annual CO2 saving ranges from 0.6 million tonne to 2.7 million tonne depending on the labelling option. This is equivalent to having 215,000 to 914,000 fewer cars on EU roads per year[20]. Assuming a set of 4 tyres is sold per car translates into an average annual CO2 saving of 15 to 62 kgs per car depending on the labelling option.

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[20] Assuming an average car emits 3 tonne of CO2 per year (GHK/TNO estimate).

Table 5.2a: Impact of Energy Labelling of Passenger Car Tyres on EU Vehicle CO2 Emissions, 2012-2020, 2008 prices (oil price scenario 2)

	Cumulative CO2 Savings (mil tonnes)		Average Annual CO2 Savings (mil tonnes)		Cumulative CO2 Savings (€m, NPV)		Average Annual CO2 Savings (€m)		Average Annual CO2 Savings per car (kgs)	
Pace of Change	Slow	Fast	Slow	Fast	Slow	Fast	Slow	Fast	Slow	Fast
Single Labelling	11	38	0.8	2.7	208	709	20	69	18	62
Dual Labelling	9	23	0.6	1.7	167	443	16	43	15	29
Net Benefits of Single Labelling	2	14	0.2	1	41	266	4	26	3	33

Source: GHK estimates based on unit fuel savings of EU vehicle fleet per kg/t RRC reduction and estimates of market transformation

From the average annual CO2 savings for cars and the projected tyres sold the CO2 g/km saved per vehicle (assuming projected tyres are fitted as set of 4 tyres) can be calculated. On average the replacement market for C1 tyres would fit around 72 million cars a year. Assuming that the average annual distance covered by a car is around 16,000 km a year would generate a 1.2 to 4.1 CO2g/km reduction under single labelling and 1.0 CO2g/km to 2.6 CO2g/km under dual labelling.

Table 5.2b CO2 Abatement Cost (€/tonne) (average annual), by Oil Price Scenario

	Scenario 1		Scenario 2		Scenario 3	
Pace of Change	Slow	Fast	Slow	Fast	Slow	Fast
Single Labelling	-59	-55	-138	-135	-211	-207
Dual Labelling	47	50	-33	-29	-112	-109

Note: Excludes the economic value of the environmental benefits of C02 emissions reduction

CO2 abatement costs for low RR tyres are sensitive to fuel prices and additional costs of low RR tyres. LRRTs are most cost effective under single labelling compared to dual labelling because of the lower costs compared with tyres purchased under a dual labelling scheme, to achieve the same level of improved fuel efficiency. With dual labelling for oil price scenario 1(€50/bbl) the CO2 abatement cost is positive as the additional cost of LRRTs is higher than the fuel cost saving but remains cost-effective compared to other technological options (e.g. low viscosity lubricants, biofuels and CNG) to reduce CO2 from passenger cars (see for example INFRAS 2006 report p.111) since it is still below or equal to €50/tonne.

The impact assessment has examined the evidence of possible trade-offs of tread wear and tyre noise with reduced levels of rolling resistance which could give rise to environmental costs. In both cases the evidence for substantial trade-offs does not exist. In the case of tyre wear, its primary importance in customer choice means that it is considered unlikely that customers would choose tyres, or retailers would recommend tyres, that had significantly reduced life with no incentives for tyre producers to compromise on tread wear. In the case of noise, the new standards for tyre noise currently proposed will reduce current impacts. The supply of tyres with energy labelling will need to comply with these standards.

However, there is an identified trade-off between increased performance on wet grip and tyre noise (see Section 2.3 above), such that dual labelling might give rise to increased tyre noise levels (although not above adopted standards). This increased challenge for tyre producers to optimise not just rolling resistance and wet grip but also to ensure tyre noise does not exceed the standards set is reflected in the higher tyre production costs estimated for dual labelling. The rationale for including wet grip on a labelling scheme together with RR, to give incentives for the simultaneous optimization of both attributes above minimum standards, may well apply to rolling noise. This was however not analysed in this study for time constrains.

In relation to the life-cycle of tyres, a tyre's greatest environmental impact, as high as 86%, occurs during its use phase compared to the manufacture or disposal phase. Figure 5.1 below shows the environmental impact of a tyre throughout its life. LRRTs have integrated silica in the tread as a partial substitute for carbon black. Silica helps to lower rolling resistance without compromising performance in traction, grip (especially on wet surfaces) and tread life. The CO2 footprint of carbon black[21] is higher than silica as it is sourced from fossil fuels. The introduction of energy labelling and market transformation is not considered to have a negative impact on the life-cycle impacts of a tyre.

Figure 5.1: Life Cycle Assessment of an Average European Passenger Car Tyre

Source: Michelin Green-meters (Originally from study conducted by Préc Consultant B.V, 2001)

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[21] Carbon black is a material produced by the incomplete combustion of heavy petroleum products such as FCC tar, coal tar, ethylene cracking tar, and a small amount from vegetable oil (Source: Wikipedia)

5.2.3 *Impact on the EU Economy*

The impact of energy labelling on the EU economy is calculated in a similar way as for the impacts on customers. The main differences are that the estimates of costs and savings exclude VAT because changes in VAT do not represent any economic gain or loss at the level of the EU economy and represent transfer payments; and the value of reduced CO2 emissions is included.

The average annual economic benefit to the EU of the energy labelling of tyres over the period to 2020, including CO2 savings, range from €115m (slow pace of market transformation) to €376m (fast pace of market transformation) for the single label and €11m to €18m for the dual label. The respective sum of cumulative economic benefits derived over the period 2012-2020 (calculated as Net Present Value (NPV)), range from €142 m (slow pace for dual label) to €3,933m (fast pace from single label), (Tables 5.3a and 5.3b). The benefits from the fast pace single label are equivalent to 4% of the EU-27 value added in the motor vehicles sector (€134 billion in 2004)[22].

Table 5.3a: Impact of Energy Labelling of Passenger Car Tyres on the EU Economy, Average Annual Cost and Savings, 2012-2020, 2008 prices (oil price scenario 2)

	Additional Tyre Costs (€m)		Fuel Cost Savings (€m)		Net Cost Savings (€m)		CO2 Savings (€m)		Total EU Benefit (€m)	
Pace of Change	Slow	Fast	Slow	Fast	Slow	Fast	Slow	Fast	Slow	Fast
Single Labelling	103	362	198	669	95	307	20	69	115	376
Dual Labelling	163	446	158	420	-5	-26	16	43	11	18
Net Benefits of Single Labelling	-60	-84	40	249	100	332	4	26	104	358

Source: GHK estimates based on unit cost and cost savings and estimates of market transformation

Notes: Values exclude VAT

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[22] Source: Eurostat http://epp.eurostat.ec.europa.eu/portal/page?_pageid=2293,59872848,2293_68195486&_dad=portal&_schema=PORTAL

Table 5.3b: Impact of Energy Labelling of Passenger Car Tyres on the EU Economy, Net Present Value (NPV) of Costs and Savings, 2012-2020, 2008 prices (oil price scenario 2)

	Additional Tyre Costs (€m, NPV)		Fuel Cost Savings (€m, NPV)		Net Cost Savings (€m, NPV)		CO2 Savings (€m NPV)		Total EU Benefit (€m NPV)	
Pace of Change	Slow	Fast	Slow	Fast	Slow	Fast	Slow	Fast	Slow	Fast
Single Labelling	1,042	3,690	2,031	6,915	989	3,224	208	709	1,198	3,933
Dual Labelling	1,653	4,516	1,628	4,320	-25	-196	167	443	142	247
Net Benefits of Single Labelling	-612	-825	402	2,595	1,014	3,420	41	266	1,055	3,686

Source: GHK estimates based on unit cost and cost savings and estimates of market transformation

Notes: Values exclude VAT. Discount rate of 4%

As in the case of cost savings to customers, the benefits to the EU economy depend on the future price of oil. The sensitivity of the estimate of EU economic benefit to changes in oil price are shown in Table 5.3c. This indicates that the benefits, compared to those estimated under scenario 2, range from -463% (scenario 1) to +761% (scenario 3).

Table 5.3c: Impact of Energy Labelling of Passenger Car Tyres on the EU Economy, Average Annual Benefit, 2012-2020, 2008 prices (sensitivity analysis to oil price scenario)

	Total EU Benefit – Scenario 1 (€m)		Total EU Benefit – Scenario 2 (€m)		Total EU Benefit – Scenario 3 (€m)		Range in Total EU Benefit Compared to Scenario 2 (%)	
Pace of Change	Slow	Fast	Slow	Fast	Slow	Fast	Slow	Fast
Single Labelling	50	157	115	376	179	594	-56%	+58%
Dual Labelling	-40	-120	11	18	62	155	-463%	+761%
Net Benefits of Single Labelling	91	277	104	358	117	439		

Source: GHK estimates based on unit cost and cost savings and estimates of market transformation

The minimum proposed standards for RRC and WG in 2012 (COM(2008)316) will affect imports as well as EU production. Imports account for around 21% of the C1 replacement market (Table 5.3d). A significant share of the imported tyres in the replacement market, are sold in the budget segment. Findings from the independent tests (Annex 3) showed that tyres in the budget segment in general had low rolling resistance but tended to perform very poorly on wet grip. Thus, single or dual labelling of tyres would be expected to reduce imports due to increased costs of complying with EU proposed standards or encourage importers to shift into higher value products to protect market share. Either way it is unlikely that the option will have a significant impact on imports. The impact on exports is uncertain, but given the high levels of customisation of tyres to the demands of regional markets the changes in the EU market may have only modest influence over export activity.

Table 5.3d: Share of Tyre Imports for C1 – summer and winter, Replacement Market (millions)

	2005	**2006**	**2007**
C1 import replacements	43	45	48
Total EU C1 replacement	224	235	231
Share of imports (%)	19%	19%	21%

Source: Table 1.1

5.2.4 Impact on Safety

The lack of a quantitative relationship between changes in wet grip performance and the number and severity of road accidents and related injuries and fatalities prevents a direct assessment of the effects of including wet grip in the tyre labelling.

We note that:

- The market transformation to LRRTs can be achieved by compromising wet grip performance above minimum standards if low cost methods are used (although the adoption of minimum standards for wet grip will limit the scale of this compromise and guarantee a satisfactory level of safety)
- A reduction in wet grip performance increases braking distances
- Longer braking distances increase the risk of accidents, other factors being the same.

Dual labelling has a reduced effect on market transformation compared to a single label based on RR. This is because customers are likely to rank safety as a more important attribute than fuel efficiency when purchasing a tyre (although this may change because of increases in the real cost of fuel). But, the dual labelling ensures customers do not inadvertently trade-off levels of wet grip performance when switching to a tyre with lower rolling resistance. Dual labelling therefore may have a positive effect on road safety in giving incentives to tyre producers to continuously improve wet grip above minimum standards and hence possibly reduce the risk of a road accident. This benefit is not included in the total benefit estimated for dual labelling because it is not possible to calculate the size of the improved safety and possible reduction in road accidents. It is also important to underline that tyre grip on wet roads also greatly depends on driver behaviour, braking systems and road surface. However, the benefit from the improved braking distance would have to be greater than the difference in economic benefits between the two labelling options for the dual label option to have the larger economic benefit.

Using estimates of the social cost of a road traffic accident casualty of €0.96m per casualty (UNECE, 2007 and Trawn et. al, 2003), the minimum number of casualties that dual labelling would need to prevent before it provided the greater benefit can be calculated (Table 5.4). This estimate then provides some indication of how effective the dual label needs to be, and whether it is likely that the dual label would have a greater economic benefit than a single label.

Table 5.4: Estimated Required Safety Benefits of Dual Labelling (oil price scenario 2)

	Single Label **(A)**	**Dual Label** **(B)**	**Difference in Impact of Single vs Dual Label (C) = (A-B)**
Average annual economic benefit of label option (excluding safety benefits) (Table 5.3a)	€115m (slow) to €376m (fast)	€11m (slow) to €18m (fast)	€104m (slow) to €358m (fast)
Estimated minimum prevention of road traffic accident casualties from dual labelling required to equal the benefits of a single label, per year		€104m / €0.96m = 108 casualties (slow) €358m / €0.96m = 373 casualties (fast)	
Estimated minimum prevention of road traffic accident casualties required, as share of total EU road accident casualties, per year		108 casualties / 2.1m = 0.01% (slow) 373 casualties / 2.1m = 0.02% (fast)	

The calculation indicates that the minimum number of casualties to be prevented by dual labelling before it is the preferred labelling option ranges from 108 to 373. To put this effect in context, there are an estimated 2.1m road traffic casualties in the EU each year. The required dual label effect would need to account for a reduction in casualties amounting to between 0.01% to 0.02%. This suggests that the dual label has only to achieve a modest reduction in risk before it would be preferred to the single label.

5.2.5 Administrative Costs

The introduction of energy labelling would require a stand alone legislative proposal. The same costs can be assumed as those found in the background study for the impact assessment for the revision of the Energy Labelling Framework Directive 92/75/EEC (Europe Economics, 2007), which calculated the administrative costs of developing a new Implementing Directive of about €720,000 per new Directive[23]. The transposition

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[23] The amount includes all considered technical changes.

cost by national administrations of the Directive is estimated to be about € 4 million[24]. We have also assumed a multiplier of 1.5 for calculating the administrative costs of implementing a dual labelling scheme compared to single RR label.

In summary, the one-off administration costs assumed for the impact assessment and borne by Member States are:

- Labelling on RR only: €4.76 million
- Labelling on RR and WG: €7.14 million

Producers will be mainly responsible for the running and maintenance of the labelling scheme but Member States would have to monitor and enforce the scheme. We do not have estimates for monitoring and enforcement costs, this information is confidential to the EC available from national authority budgets[25].

5.2.6 *Overall Assessment*

The impact assessment indicates that the introduction of the energy labelling of C1 tyres, compared to a reference case based on the introduction of minimum standards for rolling resistance but no energy labelling, would have a net economic benefit to the EU, irrespective of the specific choice of a labelling option, excluding safety benefits but including administrative costs. Under oil price scenario 2 the option generates both economic and environmental benefits; a real case of a 'win-win' intervention.

The impact assessment suggests that because of the risk associated with generating additional road traffic accidents from a single label on RR compared to a dual label, and the very limited requirement of a dual label in terms of risk avoidance, the dual labelling scheme, despite generating lower economic and environmental benefits and having a higher administrative cost, is the preferred option. The dual label option, even though it generates fewer economic and environmental benefits is likely to have a positive social net benefit.

5.2.7 *Intensity of the Measure (for C1 only)*

Assuming that the benefits as estimated over the 8 year period 2013-2020, can be secured two years earlier, the benefit of early implementation is simply the effect of avoiding the discounting of annual benefits. With a 4% annual discount rate the benefit of early implementation (by two years) is 8% of the annual average benefits (Table 5.5). Under oil price scenario 2, the benefits range from €1m with a dual label and a slow pace of change, to €30m with a single label and a fast pace of change.

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[24] 27 Member States x €150.000 = €4.040.000.

[25] Europe Economics, et. al: 'Impact assessment study on a possible extension, tightening or simplification of the framework directive 92/75 EEC on energy labelling of household appliances'

Table 5.5: Intensity of the Measure of Energy Labelling of Passenger Car Tyres on the EU Economy, Economic Benefit from Early (2 Year) Implementation, 2008 prices

	Total EU Benefit – Scenario 1 (€m)		Total EU Benefit – Scenario 2 (€m)		Total EU Benefit – Scenario 3 (€m)	
Pace of Change	Slow	Fast	Slow	Fast	Slow	Fast
Average Annual Benefits of Single Labelling	50	157	115	376	179	594
Average Annual Benefits of Dual Labelling	-40	-120	11	18	62	155
Average Annual Benefits from early Implementation: Single Labelling	4	13	9	30	14	48
Average Annual Benefits from early Implementation: Dual Labelling	-3	-10	1	1	5	12

5.3 Impact Assessment of Energy Labelling for Tyres for Light Trucks and Van (C2)

Commercial vehicles such as light trucks and vans can also benefit from a labelling scheme. The impact assessment has only examined a labelling option on RR only. It maybe desirable to use a dual label, but data on wet grip distribution for C2 tyres is not available to test.

Generally, light commercial vehicles use the same type of tyres as passenger cars. The impact of reducing 1kg/t of RRC leads to a 1.5% reduction in fuel consumption but it is assumed that the EU fleet comprises of 100% diesel vehicles. A labelling scheme for commercial vehicles would also help in making cost-effective decisions regarding tyre choice. We have assumed the same pace of change (slow and fast) as estimated for C1. The nature of the market for C2 tyres is different to C1 tyres and would not necessitate a sticker based labelling scheme. Annex 6 provides more details.

5.3.1 Impact on Customers – C2

The impact assessment indicates that C2 customers collectively achieve an average annual saving of between €78m and €144m as a result of energy labelling (assuming oil price scenario 2). The fuel cost saving in Table 5.6a is equivalent to 1 Mtoe to 2 Mtoe (or 1,050m to 1,981 litres of fuel), which is equivalent to the load carried by 5 to 9 crude oil super tankers[26].

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[26] 1.5 gallons of crude oil is required to make 1 gallon of gasoline (www.eia.doe.gov). A super tanker on average carries around 2 million barrels of crude oil (Source: Wikipedia)

Table 5.6a: Impact of Energy Labelling of C2 Tyres on EU Customers, 2012-2020, 2008 prices (oil price scenario 2)

	Additional Tyre Costs (ex VAT) (€m, NPV)		Fuel Cost Savings (inc fuel tax, ex VAT) (€m, NPV)		Net Cost Savings (€m, NPV)		Net Average Annual Cost Savings (€m)	
Pace of Change	Slow	Fast	Slow	Fast	Slow	Fast	Slow	Fast
Single Labelling	159	314	1,068	2,020	909	1,706	78	144

Source: GHK estimates based on unit cost and cost savings and estimates of market transformation

These savings depend critically on the assumed level of oil price in the period to 2020. Table 5.6b illustrates the sensitivity of the estimated impact on customers of changes in the oil price. Compared to the savings under scenario 2, the average annual savings range from –27% lower (scenario 1) to +27% higher (scenario 3).

Table 5.6b: Impact of Energy Labelling of C2 Tyres on EU Customers, 2012-2020, 2008 prices (sensitivity analysis to oil price scenario)

	Net Average Annual Cost Savings – Scenario 1 (€m)		Net Average Annual Cost Savings – Scenario 2 (€m)		Net Average Annual Cost Savings – Scenario 3 (€m)		Range in Net Average Annual Savings Compared to Scenario 2 (%)	
Pace of Change	Slow	Fast	Slow	Fast	Slow	Fast	Slow	Fast
Single Labelling	57	105	78	144	96	183	-27%	27%

Source: GHK estimates based on unit cost and cost savings and estimates of market transformation

5.3.2 *Impact on the Environment – C2*

The market transformation from 2012 to 2020 gives rise to a aggregated reduction in CO2 emissions of between 4mt (slow pace) and 7mt (fast pace) (Table 5.7a). Multiplying this reduction by the social cost of carbon of €25/t indicates a social benefit of between €69m and €130m (NPV) from 2012 to 2020. The average annual CO2 saving ranges from 0.3 million tonne to 0.5 million tonne depending on the labelling option. This is equivalent to having 86,000 to 160,000 fewer cars on EU roads per year[27].

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[27] Assuming an average car emits 3 tonne of CO2 per year (GHK/TNO estimate)

Table 5.7a: Impact of Energy Labelling of C2 Tyres on EU Vehicle CO2 Emissions, 2012-2020, 2008 prices

	Cumulative CO2 Savings (mil tonnes)		Average Annual CO2 Savings (mil tonnes)		Cumulative CO2 Savings (€m, NPV)		Average Annual CO2 Savings (€m)	
Pace of Change	Slow	Fast	Slow	Fast	Slow	Fast	Slow	Fast
Single Labelling	4	7	0.3	0.5	69	130	6	12

Source: GHK estimates based on unit fuel savings per kg/t RRC reduction and estimates of market transformation

Table 5.7b CO2 Abatement Cost (€/tonne) (average annual), Energy Labelling for C2 Replacement Tyres

	Scenario 1		Scenario 2		Scenario 3	
Pace of Change	Slow	Fast	Slow	Fast	Slow	Fast
Single Labelling	-107	-105	-183	-181	-259	-257

5.3.3 Impact on EU Economy – C2

The average annual economic benefit to the EU of the energy labelling of tyres over the period to 2020, including CO2 savings, range from €52m (slow pace of market transformation) to €93m (fast pace of market transformation) for the single label. The respective sum of cumulative economic benefits derived over the period 2012-2020 (NPV), range from €545m to €1,018m (Tables 5.8a and 5.8b).

Table 5.8a: Impact of Energy Labelling of C2 Tyres on the EU Economy, Average Annual Cost and Savings, 2012-2020, 2008 prices (oil price scenario 2)

	Additional Tyre Costs (€m)		Fuel Cost Savings (€m)		Net Cost Savings (€m)		CO2 Savings (€m)		Total EU Benefit (€m)	
Pace of Change	Slow	Fast	Slow	Fast	Slow	Fast	Slow	Fast	Slow	Fast
Single Labelling	15	29	60	110	45	81	6	12	52	93

Source: GHK estimates based on unit cost and cost savings and estimates of market transformation

Table 5.8b: Impact of Energy Labelling of C2 Tyres on the EU Economy, NPV of Costs and Savings, 2012-2020, 2008 prices (oil price scenario 2)

	Additional Tyre Costs (€m, NPV)		Fuel Cost Savings (€m, NPV)		Net Cost Savings (€m, NPV)		CO2 Savings (€m NPV)		Total EU Benefit (€m NPV)	
Pace of Change	Slow	Fast	Slow	Fast	Slow	Fast	Slow	Fast	Slow	Fast
Single Labelling	159	314	636	1,202	476	888	69	130	545	1,018

Source: GHK estimates based on unit cost and cost savings and estimates of market transformation

Notes: Values exclude VAT. Discount rate of 4%

The sensitivity of total benefits to oil price scenario is shown in Table 5.8c below.

Table 5.8c: Impact of Energy Labelling of C2 Tyres on the EU Economy, Average Annual Benefit, 2012-2020, 2008 prices (sensitivity analysis to oil price)

	Total EU Benefit – Scenario 1 (€m)		Total EU Benefit – Scenario 2 (€m)		Total EU Benefit – Scenario 3 (€m)		Range in Total EU Benefit Compared to Scenario 2 (%)	
Pace of Change	Slow	Fast	Slow	Fast	Slow	Fast	Slow	Fast
Single Labelling	32	57	52	93	71	129	-38%	+39%

Imports account for 20% of the EU tyre replacement market for C2 (Table 5.8d). As with C1 tyres a significant share of the imported tyres in the replacement market, are sold in the budget segment. Energy labelling of tyres would be expected to reduce imports due to increased costs of complying with EU proposed standards or encourage importers to shift into higher value products to protect market share. There is unlikely to be a significant impact on imports.

Table 5.8d: Share of Tyre Imports for C2 – summer and winter, Replacement Market (millions)

	2005	2006	2007
C2 import replacements	4	4	4
Total EU C2 replacement	19	19	20
Share of imports (%)	21%	21%	20%

Source: Table 1.1

5.4 Impact Assessment of Energy Labelling for Tyres for Heavy Trucks and Buses (C3)

According to the PHEM[28] model, the potential to reduce fuel consumption and CO2 emission using LRRTs is relatively higher for trucks and buses (C3) compared to passenger cars (C1). A 15% reduction in rolling resistance would provide reductions in fuel consumption by between 4% and 7% depending on the amount of urban compared to motorway driving. The additional cost is expected to be in the range of €50 per tyre (INFRAS, 2006). Additionally, Michelin have recently reported that their new 2nd generation of LRRTs, depending on operational circumstances, can save up to 6% in fuel consumption compared to the previous generation tyre[29] and around 9% in fuel consumption compared to non-Michelin tyres (Faber Maunsell, 2008). This report has also acknowledged that a labelling scheme could be adopted for Heavy Duty Vehicles, though the form of communication due to the nature of the market would be different to one based on a sticker based scheme. Annex 5 and 6 provide details on the costs of benefits of low RR tyres for Trucks and Buses.

We present a brief summary of the main results. As with C2 tyres, the impact assessment has only examined a single label on RR, although a dual label including wet grip may be desirable. No data on C3 wet grip performance for the market is available. Since a C3 tyre customer will not have a choice of tyres across the entire RRC range, we have calculated the market transformation and related impact based on a shift from the average level of RRC for C3 tyres (Band 6 to 7), rather the highest level of RRC, to higher bands.

5.4.1 Impact on Customers – C3

The impact assessment indicates that C3 customers collectively achieve an average annual saving of between €163m and €498m as a result of energy labelling (assuming oil price scenario 2). The fuel cost saving in Table 5.9a is equivalent to 2.6 Mtoe to 8 Mtoe (or 2,615m to 8,105m litres of fuel), which is equivalent to the load carried by 12 to 38 crude oil super tankers[30].

Table 5.9a: Impact of Energy Labelling of C3 Tyres on EU Customers, 2012-2020, 2008 prices (oil price scenario 2)

	Additional Tyre Costs (ex VAT) (€m, NPV)		Fuel Cost Savings (inc fuel tax, ex VAT) (€m, NPV)		Net Cost Savings (€m, NPV)		Net Average Annual Cost Savings (€m)	
Pace of Change	Slow	Fast	Slow	Fast	Slow	Fast	Slow	Fast
Single Labelling	704	2,308	2,667	8,267	1,963	5,959	163	498

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[28] Passenger car and Heavy duty vehicle Emission Model (PHEM). The model has been developed in several international and national projects including the EU 5th research framework program ARTEMIS, the COST 346 initiative and the benefitted from German-Austrian-Swiss cooperation on the Handbook of Emission Factors.

[29] http://www.michelintransport.com/ple/front/affich.jsp?codeRubrique=42&codePage=PLOE_ENERGY&lang=EN

[30] 1.5 gallons of crude oil is required to make 1 gallon of gasoline (www.eia.doe.gov). A super tanker on average carries around 2 million barrels of crude oil (Source: Wikipedia)

Source: GHK estimates based on unit cost and cost savings and estimates of market transformation

These savings depend on the assumed level of oil price in the period to 2020. Table 5.9b illustrates the sensitivity of the estimated impact on customers of changes in the oil price. Compared to the savings under scenario 2, the average annual savings range from –30% lower (scenario 1) to +30% higher (scenario 3).

Table 5.9b: Impact of Energy Labelling of C3 Tyres on EU Customers, 2012-2020, 2008 prices (sensitivity analysis to oil price scenario)

	Net Average Annual Cost Savings – Scenario 1 (€m)		Net Average Annual Cost Savings – Scenario 2 (€m)		Net Average Annual Cost Savings – Scenario 3 (€m)		Range in Net Average Annual Savings Compared to Scenario 2 (%)	
Pace of Change	Slow	Fast	Slow	Fast	Slow	Fast	Slow	Fast
Single Labelling	115	347	163	498	212	649	-30%	30%

Source: GHK estimates based on unit cost and cost savings and estimates of market transformation

5.4.2 *Impact on Environment – C3*

The market transformation from 2012 to 2020 gives rise to a aggregated reduction in CO2 emissions of between 9mt (slow pace) and 28mt (fast pace) (Table 5.10a). Multiplying this reduction by the social cost of carbon of €25/t indicates a social benefit of between €171m and €530m (NPV) from 2012 to 2020. The average annual CO2 saving ranges from 0.6 million tonne to 1.8 million tonne depending on the labelling option. This is equivalent to having 15,000 to 46,000 fewer trucks on EU roads per year[31].

Table 5.10a: Impact of Energy Labelling of C3 Tyres on EU Vehicle CO2 Emissions, 2012-2020, 2008 prices

	Cumulative CO2 Savings (mil tonnes)		Average Annual CO2 Savings (mil tonnes)		Cumulative CO2 Savings (€m, NPV)		Average Annual CO2 Savings (€m)	
Pace of Change	Slow	Fast	Slow	Fast	Slow	Fast	Slow	Fast
Single Labelling	9	28	0.6	1.8	171	530	15	46

Source: GHK estimates based on unit fuel savings per kg/t RRC reduction and estimates of market transformation

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[31] Assuming an average truck emits 40 tonnes of CO2 per year (GHK/TNO estimate).

Table 5.10b: CO2 Abatement Cost (€/tonne) (average annual), Energy Labelling for C3 Replacement Tyres

	Scenario 1		Scenario 2		Scenario 3	
Pace of Change	Slow	Fast	Slow	Fast	Slow	Fast
Single Labelling	-44	-39	-120	-115	-196	-191

5.4.3 *Impact on EU Economy – C3*

The average annual economic benefit to the EU of the energy labelling of tyres over the period to 2020, including CO2 savings, range from €85m (slow pace of market transformation) to €254m (fast pace of market transformation) for the single label. The respective sum of cumulative economic benefits derived over the period 2012-2020 (NPV), range from €1,054m to €3,142m (Tables 5.11a and 5.11b).

Table 5.11a: Impact of Energy Labelling of C3 Tyres on the EU Economy, Average Annual Cost and Savings, 2012-2020, 2008 prices (oil price scenario 2)

	Additional Tyre Costs (€m)		Fuel Cost Savings (€m)		Net Cost Savings (€m)		CO2 Savings (€m)		Total EU Benefit (€m)	
Pace of Change	Slow	Fast	Slow	Fast	Slow	Fast	Slow	Fast	Slow	Fast
Single Labelling	67	217	137	426	70	208	15	46	85	254

Source: GHK estimates based on unit cost and cost savings and estimates of market transformation

Table 5.11b: Impact of Energy Labelling of C3 Tyres on the EU Economy, NPV of Costs and Savings, 2012-2020, 2008 prices (oil price scenario 2)

	Additional Tyre Costs (€m, NPV)		Fuel Cost Savings (€m, NPV)		Net Cost Savings (€m, NPV)		CO2 Savings (€m NPV)		Total EU Benefit (€m NPV)	
Pace of Change	Slow	Fast	Slow	Fast	Slow	Fast	Slow	Fast	Slow	Fast
Single Labelling	704	2,308	1,587	4,920	883	2,611	171	530	1,054	3,142

Source: GHK estimates based on unit cost and cost savings and estimates of market transformation

Notes: Values exclude VAT and tax. Discount rate of 4%

Table 5.11c: Impact of Energy Labelling of C3 Tyres on the EU Economy, Average Annual Benefit, 2012-2020, 2008 prices (sensitivity analysis to oil price

	Total EU Benefit – Scenario 1 (€m)		Total EU Benefit – Scenario 2 (€m)		Total EU Benefit – Scenario 3 (€m)		Range in Total EU Benefit Compared to Scenario 2 (%)	
Pace of Change	Slow	Fast	Slow	Fast	Slow	Fast	Slow	Fast
Single Labelling	40	115	85	254	130	393	-53%	55%

Imports account for a larger share of the tyre replacement market for C3 than for the other tyre classes, accounting for 31% in 2007. As in the case of C1 and C2, it is not expected that there would be major impact on import penetration.

Table 5.11d: **Share of Imports, C3 – summer and winter, Replacement Market (millions)**

	2005	**2006**	**2007**
C3 Imports	4	5	5
Total EU C3 replacement	15	16	16
Share of imports (%)	27%	31%	31%

Source: Table 1.1

5.5 Total Impact Assessment (C1, C2 and C3) of Energy Labelling

5.5.1 Impact on the EU Economy

The average annual benefit of energy labelling (RR only) for all vehicle types is given in Table 5.12 below. Energy labelling, if applied to all vehicle types, has the potential to generate between €252m and €723m economic benefit per year.

Table 5.12: Impact of Energy Labelling (RR only) on C1, C2 and C3 on the EU Economy, Average Annual Benefit, 2012-2020, 2008 prices (oil price scenario 2)

Vehicle Type	Total Annual Average EU Benefit (€m)	
	Slow	Fast
Passenger cars (C1)	115	376
Commercial vehicles (C2)	52	93
Trucks & Buses (C3)	85	254
All Vehicles	**252**	**723**

The total economic benefits by vehicle type depends on the combination of a number of factors (Table 5.13a) that determine total fuel cost savings from a given market transformation. A market distribution of RRC that is more concentrated around the average (small standard deviation) will mean that a 1 kg/t reduction will have a slightly bigger effect than where the distribution is less concentrated (Figure 5.13b).

5.5.2 Impact on Fuel Savings

The impact of the three options on fuel savings compared to the reference case is shown in Table 5.13, in physical units. Financial savings are presented below.

Table 5.13: Average Annual Fuel Savings

	Annual Average Fuel Savings (Mil litres)		Average Annual Fuel Savings (Mtoe)	
Tyre class	Slow	Fast	Slow	Fast
C1 (labelling RR)	326	1,104	0.30	1.02
C1 (multi-criteria label)	260	694	0.24	0.64
C2 (labelling RR)	99	181	0.10	0.18
C3 (labelling RR)	226	701	0.22	0.69

Note: Assumption for C1 tyres (passenger car fleet): 50% fuel, 50% diesel, Assumption for C2 and C3 tyres (vans, trucks and buses): 100% diesel

The fuel savings from energy labelling when introduced into all three tyre classes is greatest from Option B, the use of energy labelling in the C1 market (Figures 5.14a and 5.14b).

Figure 5.14a: Fuel Cost Savings (€m) for the EU Economy for Energy Labelling Options in C1/C2/C3 Replacement Market (Slow pace)

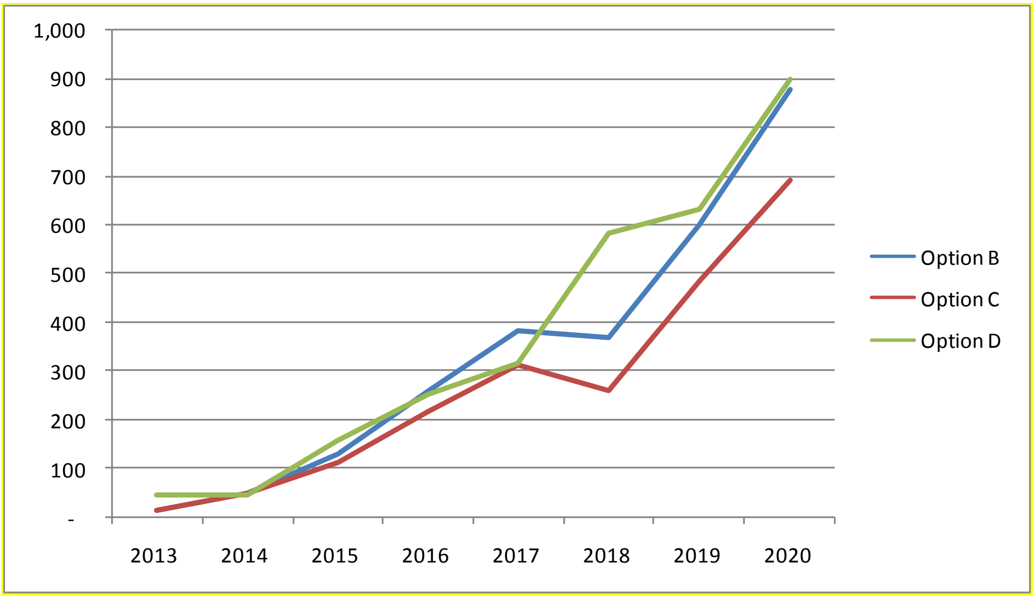
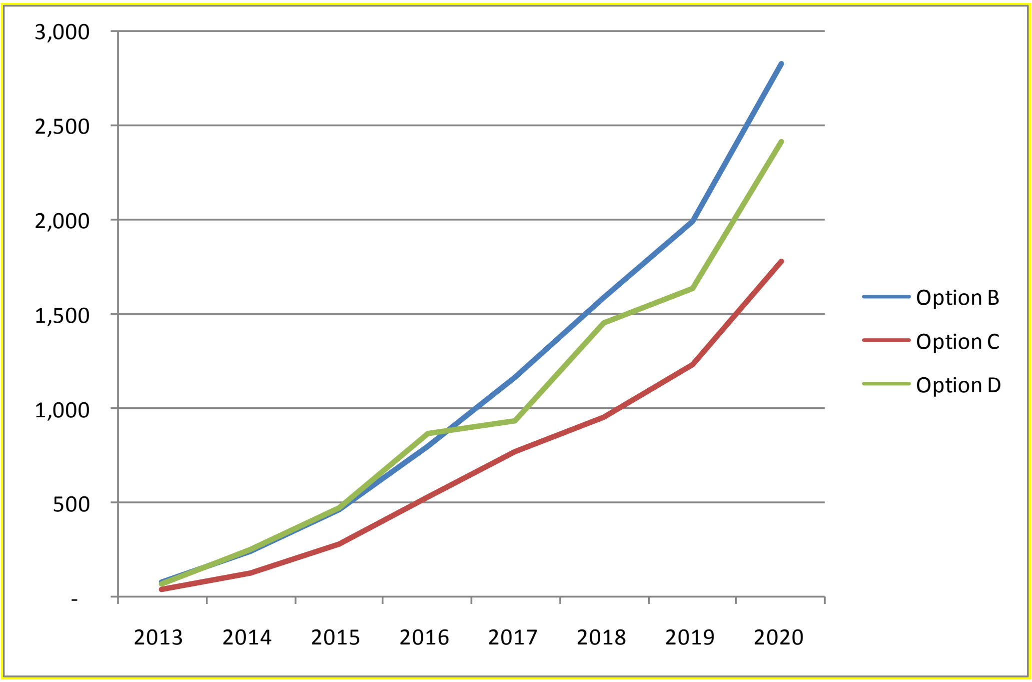


Figure 5.14b: Fuel Cost Savings (€m) for the EU Economy for Energy Labelling Options in C1/C2/C3 Replacement Market (Fast Pace)



5.5.3 *Impact on the Environment*

The total CO2 savings from all vehicle types per year ranges from 1.7m tonnes to 5m tonnes, equivalent to removing 0.6m to 1.6m cars from EU roads (Table 5.14). This in turn approximates to between 3% to 10% of new EU passenger car registrations per year.

Table 5.14: Impact of Energy Labelling (RR only) on C1, C2 and C3 on the EU Environment, Average Annual CO2 Savings, 2012-2020, 2008 prices (oil price scenario 2)

Vehicle Type	Average Annual CO2 Savings (million tonnes)		Average Annual CO2 Savings (€m)	
	Slow	Fast	Slow	Fast
Passenger cars (C1)	0.8	2.7	20	69
Commercial vehicles (C2)	0.3	0.5	6	12
Trucks & Buses (C3)	0.6	1.8	15	46
All Vehicles	**1.7**	**5**	**41**	**127**

5.6 Impact Assessment of VAT Reduction on Highest Band for Passenger Cars (C1 – summer tyres)

5.6.1 *Impact on Customers*

The impact assessment indicates that for C1-summer tyres, the market transformation results in customers securing an average annual saving of €139m as a result of a VAT discount of 12% on the highest band (assuming oil price scenario 2).

Table 5.15a: Impact of VAT Reduction on Highest Band on Passenger Car Tyres (summer) on EU Customers, 2012-2020, 2008 prices (oil price scenario 2)

Additional Tyre Costs (inc VAT)	Fuel Cost Savings	Net Cost Savings	Net Average Annual Cost Savings
(€m, NPV)	(€m, NPV)	(€m, NPV)	(€m)
229	1,082	853	139

Source: GHK estimates based on price elasticity, unit cost and cost savings and estimates of market transformation

5.6.2 *Impact on Environment*

The market transformation from 2012 to 2020 due to the VAT discount gives rise to a cumulative reduction in CO2 emissions of 3mt (Table 5.16a). Multiplying this reduction by the social cost of carbon of €25/t indicates a social benefit of €53m (NPV) from 2012 to 2020. The average annual CO2 savings is around 0.3mt. The abatement cost (Table 16b) indicates that the reduction is achieved at no net cost to the economy.

Table 16a: Impact of VAT Reduction on Highest Band of Passenger Car Tyres (summer) on EU Vehicle CO2 Emissions, 2012-2020, 2008 prices (Oil price scenario 2)

Cumulative CO2 Savings	Average Annual CO2 Savings	Cumulative CO2 Savings	Average Annual CO2 Savings
(mil tonnes)	(mil tonnes)	(€m, NPV)	(€m)
3	0.3	53	9

Source: GHK estimates based on price elasticity, unit fuel savings of EU vehicle fleet per kg/t RRC reduction and estimates of market transformation

Table 5.16b: CO2 Abatement Cost (€/tonne) (average annual), for Reduced Rate of VAT on Highest Band

Scenario 1	Scenario 2	Scenario 3
-84	-164	-243

5.6.3 *Impact on EU Economy*

The average annual economic benefit to the EU of a VAT reduction on the highest band over the period to 2020, including CO2 savings, is around €60m. The cumulative economic benefits derived over the period 2012-2020 (NPV), is around €372m.

Table 5.17a: Impact of VAT Reduction on Highest Band for Passenger Car Tyres (summer) on the EU Economy, Average Annual Cost and Savings, 2012-2020, 2008 prices (oil price scenario 2)

Additional Tyre Costs	Fuel Cost Savings	Net Cost Savings	CO2 Savings	Total EU Benefit
(€m)	(€m)	(€m)	(€m)	(€m)
38	84	52	9	60

Table 5.17b: Impact of VAT Reduction on Highest Band for Passenger Car Tyres (summer) on the EU Economy, NPV of Costs and Savings, 2012-2020, 2008 prices (oil price scenario 2)

Additional Tyre Costs	Fuel Cost Savings	Net Cost Savings	CO2 Savings	Total EU Benefit
(€m, NPV)	(€m, NPV)	(€m, NPV)	(€m NPV)	(€m NPV)
227	512	320	53	372

Source: GHK estimates based on price elasticity, unit cost and cost savings and estimates of market transformation

Note: *Values exclude VAT. Discount rate of 4%*

5.6.4 Comparison with Energy Labelling (C1 summer, tyres)

The option of introducing a VAT reduction of 12% on tyres with the lowest levels of rolling resistance has a smaller effect, of approximately half, on the economy and the environment than RR only labelling when based on the slow pace of change (Table 5.18).

Table 5.18: Comparison of Energy Labelling and VAT Reduction on the EU Economy, Average Annual Benefit, 2012-2020, 2008 prices (C1 summer tyres, oil price scenario 2)

Assessment Criteria	Policy Options			Benefit of Label (Slow) cf VAT Reduction
	Label – Slow	Label - Fast	VAT Reduction	
Total Annual EU Benefit (€m) p.a.	115	376	60	55
CO2 Savings (mt)	0.8	2.7	0.3	0.5
CO2 Savings (€m)	20	69	9	11

6 CONCLUSIONS OF THE IMPACT ASSESSMENT

6.1 The Nature of the Problem

Rising emissions of greenhouse gases from road transport seriously affect the achievement of economy-wide CO2 emission targets. Measures to further reduce transport emissions should be considered if they can be shown to be relatively cost-effective. The interest of the EC in promoting an expansion in the use of low rolling resistance tyres for motor vehicles (LRRTs), as one of a number of policy initiatives, is based on their potential to contribute towards fuel savings and CO2 emissions targets proposed by the Commission in a cost-effective manner.

The case for intervention in the tyre market is made not just on the potential for environmental benefits. The market for tyres is characterised by market failure arising from the lack of information on tyre performance, preventing customers from making rational choices concerning the most cost-effective tyre choice for a given set of customer preferences. It is therefore likely that if the intervention could address these market failures then a relatively cost-effective way to reduce CO2 emissions should exist.

However, improving market information on tyre performance, if only focused on fuel efficiency, could have a perverse effect on tyre choice with regard to other tyre attributes. Tyre design seeks to optimise a range of tyre attributes. Improving the fuel efficiency of tyres can be achieved by reducing the wet grip performance of tyres. Optimising both rolling resistance and wet grip performance (and maintaining compliance with tyre noise standards) will increase costs. Although there are proposals for a minimum standard for wet grip, increasing tyre costs could, without information on wet grip, lead customers to choose tyres with a lower wet grip than they would otherwise have done. To avoid this risk, dual labelling, containing information on both rolling resistance and wet grip, may provide a solution, recognising the shortcomings of wet grip measurement. These include the limited coverage of wet grip testing in relation to other safety aspects such as aquaplaning or handling in a curve. Using wet grip as a proxy measure for safety is also uncertain when safety performance is dependent on a range of influences such as driver behaviour and road conditions.

6.2 Policy Options

The impact assessment has examined a range of options to encourage customers to choose lower rolling resistance tyres. Two options appear to have the greatest potential to secure this change. The first is energy labelling using either a single label providing information on rolling resistance / fuel efficiency or a dual label that also includes information on wet grip. The second is a reduction in VAT on tyres with the lowest rolling resistance.

The first option has the advantage that it addresses market failure and allows the possible risk of trade-offs with other attributes to be addressed. The second option provides a direct financial incentive to customers to choose the tyres with the lowest rolling resistance. The scope to address possible trade-offs with this option does not exist, unless some form of adjustment was made for wet grip, but this would undo the purpose of the option to provide a clear price incentive. This option would also require as a fully alternative option unanimity at the EU level to the change in VAT. It is more likely that individual MS would consider a change in VAT as a complementary measure to the energy label. The option of a CO2 tax, designed as a complement to energy labelling, was also examined and found capable of compensating in large part for the relative price premium of tyres in higher bands compared with tyres in lower bands. As such the tax has a significant potential to encourage a faster pace of market transformation. However, even as a complement to energy labelling it would require MS unanimity to implement.

6.3 Qualitative Assessment of Selected Policy Options

The impact assessment allows a qualitative assessment of the selected policy options (A to E), compared against the reference case, (Table 6.1). All options have positive or negligible impacts on end-users, the economy and the environment. Energy labelling for tyre types C2 and C3 (Option D) has the largest positive impacts on these three criteria, followed by single labelling of RR for C1 (Option B). Multiple criteria labelling (Option C) and VAT reductions (Option E) also have positive impacts. Public procurement is judged to have a negligible impact.

Table 6.1: Qualitative Assessment of Selected Policy Options to Increase the Demand for Lower Rolling Resistance Tyres

	Assessment Criteria				
Policy Option	End-User	Economy	Environment	Safety	Administrative
A – Reference Case – Do Nothing	+	+	+	+	**0**
B – RR Only Energy Label – C1	+++	+++	+++	**0**	**-**
C – Multiple Criteria Energy Label – C1	+	+	+	++	**- -**
D – RR Only Energy Label – C2 & C3	+++	+++	+++	**0**	**-**
E – Market Based Instruments	+	+	+	**0**	**- - -**

Key to Scale of Impacts

Very Strongly Positive	+++
Strongly Positive	++
Weakly Positive	+
Negligible or No Impact	**0**
Weakly Negative	**-**
Strongly Negative	**- -**
Very Strongly Negative	**- - -**

All the options, compared to the reference case, with the exception of the multiple criteria labelling, are assessed to have a negative impact on safety as a consequence of a possible risk that interventions focused exclusively on rolling resistance may incentivise customers to purchase tyres with a lower wet grip than they would have done. Whether this market effect represents an increased risk of road traffic accidents is not clear from the available technical evidence. Further research is required to establish the causal relationship between levels of wet grip and safety, taking into account driver behaviour and the extent to which drivers adjust behaviour according to tyre choice. Conversely, by providing information on wet grip, the multiple criteria label option improves safety compared to the reference case.

The public sector cost of implementation was estimated for energy labelling and found to be modest in comparison with the financial benefits. The feasibility of implementing the policy options in terms of the scope to introduce new policies is probably lowest in relation to the introduction of market based instruments and especially the carbon tax, which would require the unanimous adoption by Member States. The introduction of a VAT reduction across the EU, with MS free to determine the level of reduction would also raise a significant challenge. In the case of public procurement, proposals would be required for tyre performance standards including levels of rolling resistance above which public entities would not be allowed to or would be strongly encouraged not to buy tyres in public procurement. In the case of the multiple criteria label this is likely to have higher costs than the single label.

The administrative costs, relative to the financial benefits are small. The identification of the preferred option depends on the weight attached to the safety benefits of multiple criteria labelling. The high social costs of road accident casualties, even if the probability of contributing to a higher number of road traffic accidents is very low, suggests that it would be prudent, at least for C1 to favour multiple criteria labelling.

6.4 Quantitative Assessment of Selected Policy Options

The impact assessment has examined:

- The costs and benefits of single labelling compared to dual labelling for passenger car (C1) tyres
- The costs and benefits of applying single labelling to light and heavy truck (C2 and C3) tyres
- The costs and benefits of VAT reduction

in terms of the impacts on customers, the environment and the EU economy. Issues of safety have also been examined in the context of dual labelling for C1.

6.4.1 Impacts on Customers

The impact of both labelling options and VAT reduction is to provide net cost savings to customers. The additional costs of higher performing tyres are more than offset by the fuel savings that they provide. The additional costs of tyre purchase are, on average, paid back within 6 months of purchase. These net savings are however dependent on projections on the future price of oil. Three scenarios describing future oil prices have been used. In the case of the lowest price ($50 bbl) customers still secure net savings, which increase if higher oil price are assumed.

6.4.2 Impacts on Safety (C1 only)

The lack of detailed technical data on the relationship between wet grip performance and the risk of road accidents prevents any formal estimate of the potential safety costs associated with single labelling. Dual labelling is associated with a higher cost of switching to tyres with lower rolling resistance because of the optimisation with wet grip. Dual labelling, because it also provides incentive to select tyres with improved wet grip rather than fuel efficiency, also has less effect on the market switch to LRRTS. It is also more expensive to implement. The cost penalty of dual labelling provides a basis for estimating the minimum numbers of accident casualties that it would need to prevent for it to have a greater social benefit. Given the high social cost of road accident casualties the numbers are not large and represent at most 0.02% of total annual casualty numbers.

6.4.3 Impacts on the Environment

The policy options, by securing fuel savings, generate reductions in CO2 emissions. Because of the net savings these emissions reductions are achieved at no net cost to the economy. The policy options represent a win-win policy, generating economic and environmental benefits. The total CO2 savings from energy labelling applied to all vehicle types per year ranges from 2.5m tonnes to 7.8m tonnes, equivalent to removing 0.8m to 2.5m cars from EU roads. This in turn is equivalent to reducing, by between 5% to 16%, the number of new EU vehicle registrations per year. The VAT reduction option has only one third of the environmental benefit than is derived from energy labelling, with a relatively poorer abatement cost. In terms of the vehicle emissions from new cars expressed in g/km of CO2, energy labelling generates between 1and 4 g/km reduction. A CO2 tax, as a complement to energy labelling, would be efficient by accelerating the pace of change from slow to fast by reducing substantially the price premium of tyres in higher bands relative to tyres in lower bands.

6.4.4 Impacts on the EU Economy

The annual average savings to the EU economy after taking into account both the additional tyre production costs and the economic value of CO2 reductions based on the social cost of carbon, is positive for all energy labelling options and for VAT reduction, under oil price scenario 2 ($75 per bbl). Again the main factor influencing the scale of impact is future oil price. However, only dual labelling for passenger cars has a net cost under low oil prices, with an annual net cost of between €40m and €120m. Under oil price scenario 2, energy labelling for all vehicle types has the potential to generate between €0.5bn and €1.4bn economic benefit per year.

6.5 Final Conclusions

In the light of the impact assessment:

1. interventions to move the replacement tyre market to LRRTs generate both economic and environment benefits and represent win-win policies;

2. energy labelling has a greater benefit than VAT reduction even with a slow pace of change; however, the use of market based instruments as a complement to energy labelling should be seriously encouraged;

3. the dual energy label has an average annual net cost to the EU economy of between €104m and €358m compared to single labelling. However, the limited effect required from dual labelling to reduce any possible risk from a relative reduction in wet grip performance under single labelling suggests that dual labelling should be considered as the preferred option taking the shortcomings of wet grip as a measure of safety into account;

4. the extension of energy labelling to C2 and C3 should be seriously considered, with or without multiple criteria labelling.

7 MONITORING AND EVALUATION FRAMEWORK

7.1 Monitoring the Policy Objectives

The preferred policy intervention of energy labelling should be monitored periodically for its effectiveness and efficiency. We suggest the following objectives and indicators as the basis of this activity.

The **General Objective** (the overall policy goal, expressed in terms of its ultimate impact): is to contribute to an increase in the fuel efficiency of vehicles. Fuel efficiency and related CO2 savings need to be achieved.

Key monitoring indicators:

- Vehicle fuel efficiency and related CO2 emissions
- Real changes in oil and fuel prices

The **Specific Objective** (the immediate objectives of a policy, expressed in terms of direct and short term effects or outcomes of the policy) is to *'pull the tyre market towards low rolling resistance tyres (LRRT), taking into account the interrelation with further parameters, in particular dry and wet grip (safety), noise and durability'*. The desired outcome is an increase in market share of LRRT whilst maintaining minimum standards for other parameters where trade-offs are identified.

Key monitoring indicators:

- Market share of tyres (by tyre class (C1, C2, C3) by RRC and wet grip
- Levels of (non-)compliance with minimum standards for tyre performance (rolling resistance, wet grip and rolling noise)
- Evidence of technological progress, by tyre class, enabling the achievement of lower RRC whilst maintaining performance on other attributes.

Operational Objectives (normally expressed in terms of outputs, i.e. the direct results of the intervention). The operational objective is to implement energy labelling for all three tyre classes (C1, C2, C3) using a range of advertising, labelling and web-based information sites on tyre performance.

Key monitoring indicators:

- Energy labelling costs to producers and public administration costs
- Take-up and use of labelling information (eg through counts of web-site hits and public awareness surveys)
- Real changes in replacement tyre price, by tyre class and market segment (premium, mid-range, budget)

7.2 Review of the Policy Option

The proposed regulation COM(2008)316 proposes the introduction of minimum standards periodically through to 2018 as part of the reference case. It would therefore by timely to review the performance of both minimum standards and policy options in 2020 or just after. In the case of the energy label option, market transformation and technological development will be subject to regular (say annual) monitoring. There may be an argument for a review of the scheme before 2020 if the market share in the highest bands is very high (say over 75%) because further incentives would be required. A review may also be justified if producers are able to supply tyres with an RRC below 6.0 kg/t whilst maintaining minimum standards, enabling a higher band to be specified and strengthening the incentive provided by the label. Experience from energy labelling of domestic appliances showed that new higher bands had to be introduced around the 8th year for most appliances as the top two bands accounted for the majority of sales and the label ceased to provide an incentive.