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Contribution of the transport sector to the objective of the Effort Sharing Decision on non Emission Trading System sectors greenhouse gas emissions

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Executive summary

The Decision 406/2009/EC on effort sharing aims to reduce greenhouse gas emissions from sectors not covered by the EU Emission Trading System (EU ETS). These so-called non-ETS sectors include (non aviation) transport, buildings, agriculture and waste. The Decision establishes national emission targets below which each Member State is committed to limit its non-ETS greenhouse gas emissions by 2020.

This report analyses the possible contribution of the transport sector in the Effort Sharing Decision (ESD) targets both at Member State level and at EU level. The analysis is based on the TREMOVE model and several scenarios on transport future trends, including its future CO_2 emissions (respectively TREMOVE3.3 and TREMOVE3.4 model versions). The work has also used some sensitivity cases to reflect the sensitivity to GDP and oil price assumptions.

According to the most recent scenario (TREMOVE 3.4 reference scenario), at aggregated EU27 level, the transport sector (excluding aviation) would contribute to a -28 Mton CO_2 emission reduction by 2020 compared with 2005. This represents about 10% of the non-ETS sector emission reduction target at EU27 level.

At Member State level, the expected contribution is in a very wide range.
For some countries (e.g. Netherlands, Germany, France), transport would significantly contribute to the fulfilment of the national targets (50%, 44% and 33% of non-ETS target respectively). For several other countries with net emission reduction targets in the non-ETS sectors, the transport sector contribution would remain positive, although less important (e.g. Belgium, Italy).

In the rest of counties that are assigned an emission reduction target, the substantial emission increase by the transport sector could counteract to this objective (e.g. Spain, Ireland).

Then, for countries where emissions increases are allowed by the non-ETS decision, transport emissions would represent a large fraction of the allowed emission increase.

2 Introduction

The Decision 406/2009/EC on effort sharing aims to reduce greenhouse gas emissions from sectors not covered by the EU Emission Trading System (EU ETS). These so-called non-ETS sectors include (non aviation) transport, buildings, agriculture and waste.

Each Member State will contribute to this effort with national emission targets ranging from -20% to + 20% in 2020 compared with 2005 levels, depending on their respective GDP (see Figure 1). At the Community level the Effort Sharing Decision will deliver about 10% reduction of emissions from the non-ETS sectors in 2020 compared with 2005 levels.

Within the transport sector, only aviation is so far covered by the EU Emission Trading System. The effort sharing decision thus concerns only the other transport modes and their direct GHG emissions (Tank-to-Wheel – TTW- emissions).

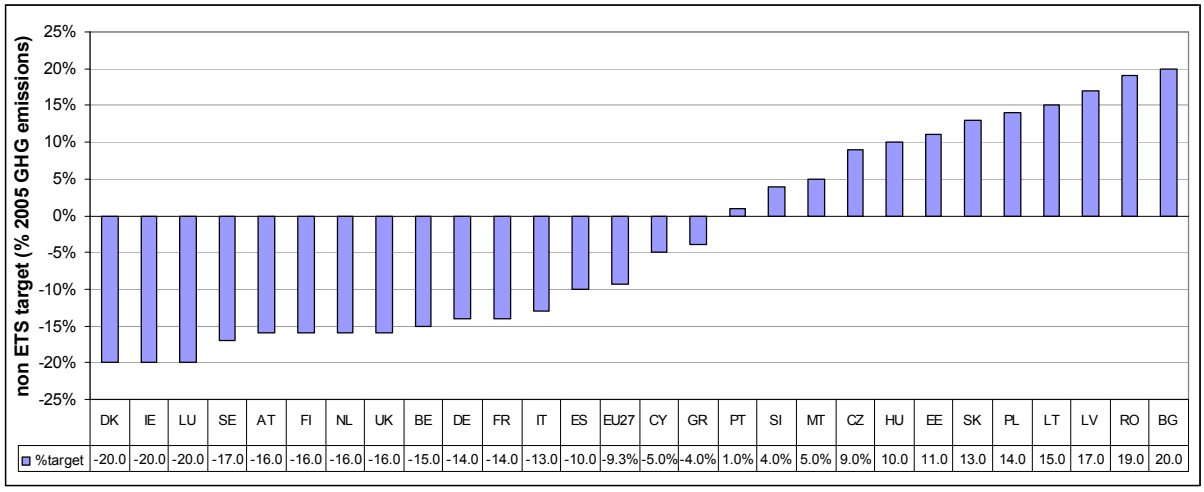


Figure 1: Non-ETS emission targets for the different Member States

This report analyses the possible contribution of the transport sector in the Efforts Sharing Decision targets as set at Member State level and at EU level. The analysis is based on several TREMOVE model-based scenarios and projected CO_2 emissions from transport.

This work has been carried out for DG CLIMA in the framework of the Administrative Arrangement ENVCC2006 (Amendment 3).

3 CO_2 emissions from transport in 2005

At EU level, transport (excluding aviation) represents almost 30% of non-ETS emissions. This share is even higher in some Member States[a]. The future trend of these emissions will therefore significantly determine the trajectory of non-ETS emissions and the fulfilment of emission targets.

[a] It is to be noted that, due to different data quality level, the degree of reliability emissions estimates varies from country to the other.

	GHG emissions in 2005 (Mton CO_2 -eq)		share of transport sector
	non-ETS	(non aviation) transport sector	
AT	60	21	36%
BE	86	26	30%
BG	32	6	19%
CZ	63	16	26%
CY	5	3	76%
DE	503	152	30%
DK	37	12	33%
ES	251	96	38%
EE	7	2	31%
FI	35	12	33%
FR	425	125	29%
GR	62	18	29%
HU	54	11	21%
IE	46	12	26%
IT	347	109	31%
LT	16	4	25%
LU	11	6	54%
LV	8	3	34%
MT	1	1	92%
NL	132	35	26%
PL	187	29	16%
PT	50	18	36%
RO	80	12	15%
SE	48	21	43%
SI	11	4	37%
SK	25	5	20%
UK	412	118	29%
EU27	**2994**	**877**	**29%**

Table 1: Contribution of transport (excluding aviation) in the non ETS CO_2 emissions (year 2005)

Based on EEA GHG emission dataviewer: http://dataservice.eea.europa.eu/PivotApp/pivot.aspx?pivotid=475 (last viewed in October 2010)

4 Transport modelling and emissions projections

4.1 TREMOVE model versions, scenarios and key assumptions

TREMOVE is a policy assessment model for studying the impacts of different transport and environmental policies on the emissions of the transport sector, covering passenger and freight transports. Evaluated effects include changes in transport demand, including modal shifts, changes in vehicle stock renewal, new patterns in air pollutants and GHG emissions, and effects on welfare. Analysed policies can for instance concern road pricing, public transport pricing, emission standards, subsidies for cleaner cars, etc. TREMOVE model covers the period 1995 – 2030 (see also Appendix I).

This report builds upon two recent versions (versions 3.3 and 3.4) of the model, with their corresponding basecase / reference scenarios and sensitivity scenarios.

TREMOVE 3.3 was prepared in the framework of the contract study from DG CLIMA[b]. Compared with previous versions (2.7 and 3.1), fleet stock data were updated (based on FLEET and Extremis[c] projects). Two different basecase scenarios were also constructed, in line with the iTREN-2030 project[d]. The two scenarios (referred to "Basecase" and "Alternative basecase") differ in terms of assumptions about future economic growth and on implemented transport policies.

On top of the alternative basecase scenario, several sensitivity scenarios were constructed, in order to estimate the effect of different assumptions on fuel prices and on GDP growth.

TREMOVE 3.4 has been prepared in the framework of the preparation of the Transport White Paper. In that version, macro-economic assumptions and policy assumptions are aligned to the new PRIMES reference scenario[e].

The TREMOVE3.3 basecase scenario was built before the start of the economic crisis which was therefore not taken into account. Both TREMOVE 3.3 alternative basecase scenario and TREMOVE 3.4 reference scenario include these effects and use similar assumptions on future GDP growth, reflecting "*the recent economic downturn, followed by sustained economic growth resuming after 2010."*[f]

Table 2 summarises the assumptions on GDP growth in the three main scenarios.

GDP growth rate			
Scenario	10/20	20/30	10/30
TREMOVE3.3 baseline	1.8%	1.6%	1.1%
TREMOVE3.3 alt. baseline	2.1%	1.8%	1.3%
TREMOVE3.4 reference	2.2%	1.7%	1.3%

Table 2: Macro-economic assumptions in the three main scenarios – GDP growth (% annual growth)

Oil price assumptions are shown in Table 2.

Oil price (euros/barrel)		
Scenario	2020	2030
TREMOVE3.3 baseline	69	81
TREMOVE3.3 alt. baseline	66	72
TREMOVE3.4 reference	73	91

Table 3: Macro-economic assumptions in the three main scenarios – Oil price (2008 €/barrel))

[b] Contract N° 07.0307/2008/511584/SER/C5 "Update and further development of transport model TREMOVE"
[c] http://ex-tremis.eu
[d] http://isi.fraunhofer.de/isi/projects/itren-2030/
[e] http://ec.europa.eu/energy/observatory/trends_2030/doc/trends_to_2030_update_2009.pdf
[f] EU energy trends to 2030 — UPDATE 2009, 2010, EUROPEAN COMMISSION Directorate-General for Energy in collaboration with Climate Action DG and Mobility and Transport DG

Table 5 provides the list of **policies** considered in the three scenarios.

TREMOVE3.4 takes into account all policies adopted by the EU and, also those that have been proposed by the European Commission until March 2009. It is therefore the most up-to-date in terms of inclusion of recent policies.
TREMOVE 3.3 baseline scenario is the most conservative one.

4.2 Alternative scenarios

On top of the three main scenarios, sensitivity scenarios have been considered, around the TREMOVE3.3 alternative baseline scenario. Two sets of scenarios enable to assess the effects of alternative fuel prices and alternative economic future growth:

- For GDP, "low" and "high" GDP growth rates were considered, and set to half and double rates of the central basecase.
- For oil price, "low" and "high" oil prices were considered, and set to half and double rates of the central basecase.

4.3 Summary

In total, 7 scenarios are used in this report to perform the analysis of possible future trends in transport CO_2 emissions and resulting role in the effort sharing decision.
This set of scenarios enables to derive a range of possible emission levels for transport by 2020 and 2030. This provides corresponding possible ranges of emission change compared to the 2005 level, and, (positive or negative) contribution of transport in the ESD targets.

It is to be noted that not all alternative scenarios have the same likelihood, especially by 2020. At 4% growth increase (high GDP sensitivity case) is much less likely than a 1% growth rate (low GDP sensitivity case) at least until 2020. Also, a 140 €/barrel oil price (high fuel price case) by 2020 is more likely than a ~40 €/barrel (low fuel price case).

model version	scenario	GDP	Fuel price	scenario accronym
3.3	basecase	central	central	v33_BC_GDPc_FPc
	alternative basecase			v33_BCalt_GDPc_FPc
		high	high	v33_BCalt_GDPh_FPh
		high	low	v33_BCalt_GDPh_FPl
		low	low	v33_BCalt_GDPl_FPl
		low	high	v33_BCalt_GDPl_FPh
3.4	WP_ref			v34_WPref

Table 4: Scenario definition

Area	Mode	*Vehicle type*	Policy	Period	Area of application / Level	Remark on TREMOVE 3.3
Fuel	**all**	*all*	Directive 2003/30/EC and Directive 2009/28/EC on the promotion of renewable energy	2005-2020	By 2010: 5.75% share of renewable energy in the transport sector. By 2020: Minimum 10% share of renewables in transport in each Member State.	Biofuels considered in TREMOVE 3.3 scenarios but with lower shares
	all	*All*	*Fuel quality Directives* *98/70/EC* *2009/30/EC*	*2011-2030*	*Art 4: concerns sulphur content in diesel fuel for non-road mobile machinery, including inland waterway vessels (<1000 mg/kg by 2008; 20 mg/kg by 2011). For rail vehicles, sulphur can be kept at 1000 mg/kg.* *Art 7a: Life cycle greenhouse gas emissions from fuel to be reduced by suppliers by 10% by 2020:* *1. 6% from the use of biofuels and alternative fuels and reductions in flaring and venting at production site.* *2. 2% from carbon and storage technologies, electric vehicles* *3. 2% in purchase of Credits under the Clean Development Mechanism* *In the reference scenario, the 6% reduction is considered.*	Requirements in Directive 98/70/EC were already taken into account in TREMOVE3.3 alt. baseline
Transport pricing and taxation	**road**	*road freight and passenger*	*Eurovignette (amendment 2006/38/EC) on road infrastructure charging*	*2005-2030*	*Country / road segment level: charges according to real external costs of specific vehicle types using certain parts of the network*	TREMOVE3.3 scenarios consider country Distance-based motor-way charges for HDVs
	road	*all*	Energy Taxation Directive2003/96/EC	2009-2030	Fuel tax levels per member state according to 2003 Directive. Countries currently below the foreseen minimum levels are modelled as reaching minimum levels according to the plan in the 2003 IA. Countries over minimum level remain at current levels (see http://ec.europa.eu/taxation_customs/resources/documents/taxation/excise_duties/energy_products/rates/excise_duties-part_II_energy_products-en.pdf)	
Infrastructure	**all**	*all*	TEN network		Improvement of current networks Addition of new road and rail links	
Emissions and fuel efficiency	**road**	*HDV and busses*	Euro V and Euro VI	2012-2030	Emission limits set by Euro V and EuroVI regulation	Euro V only in 3.3 scenarios
	road	*cars and LDVs*	Euro 6 (Regulation n° 715/2007)	2015-2030	NOx, PM emission limits for new cars to be met from 2015 onwards	Considered in TREMOVE3.3 alt baseline
	road	*cars*	*Binding CO_2 emission targets for cars*	*2009-2030*	*2015: 135 g CO_2/km; 2020 115 g CO2/km 2025-2030: 95 g CO2/km* *This is to be achieved with vehicle motor technology improvement and additional measures (see measure on Low resistance tyres and labelling; low viscosity liquids)*	3.3 baseline: no binding target 3.3 alt. baseline: 135 g CO2/km in 2012; 130 g CO2/km in 2015; 105 g/km from 2020 onwards
	road	*vans*	*Binding CO_2 emission targets for vans*	*2009-2030*	*2012: 181 g CO2/km; 2016: 175 g CO2/km; 2025-2030: 135 g CO2/km*	Also in 3.3 alt. baseline
	road	*cars, vans and HDVs*	*Low rolling resistance tyres and low viscositty liquids, tyre labelling*	*2010-2030*	*For passenger cars, this measure is one of the additional measures contributing to reaching the binding CO2 emission targets.* *It is assumed to resulting in 10 g CO2/km reduction per new vehicles, achieving the 95g CO2/km level in 2025.*	Also in 3.3 alt. baseline
	road	Cars, vans, busses, HDV	Directive on the Promotion of Clean and Energy Efficient Road Transport Vehicles	2010-2030	Total annual vehicle procurement by public authorities has been estimated to be in the order of 110 000 passenger cars, 110 000 light commercial vehicles, 35 000 lorries and 17 000 buses for the EU. The expected effect is the biggest for busses as the corresponding market share represents one third of total sales (below 1% for cars, around 6% for vans and lorries).	
	road	*HDV*	HDV autonomous fuel efficiency improvement	1997-2030	Yearly 1% Improvement of (ACEA estimate)	Also in 3.3 alt. baseline
	rail	*diesel trains*	*Emission standards for diesel trains (UIC Stage IIIA)*		*http://www.dieselnet.com/standards/inter/uic_loco.php*	
	aviation	*airplanes*	ICAO Chapters 3 (emissions)	from 2007 onwards	NOx and CO emission standards for airplanes built after 2007.	
	aviation	*airplanes*	Inclusion of aviation in the EU Emission Trading System (Directive 2008/101/EC)	from 2012 onwards	Operators will be included in the ETS and will have to participate in auctions in order to purchase allowances for CO2 emissions. In practice, this will lead into operators paying the carbon allowance market price for the CO2 they emit.	
	aviation	*airplanes*	Single European Sky	from 2012 onwards	Improved utilisation of airspace and flight paths	
Other	**rail**	*all*	*Liberalisation: 3rd railway package (gradual opening up of international rail services to competition)*	*2010-2030*	*Although a price decrease is expected under a non-monopolistic market, the competition is expected to remain moderate in most cases. No steep price drops should thus be expected. A 2% discount on user prices is assumed compared to the scenario without liberalisation.*	*Considered in TREMOVE3.3 alt baseline*

Table 5: Policy assumptions in TREMOVE scenarios: All listed policies are taken into account in TREMOVE3.4. Cells in last column are left blank where the corresponding policy is ignored in both TREMOVE 3.3 scenarios. Otherwise, it specifies the element considered in TREMOVE3.3 scenarios

5 Emission trends over the period 1995 to 2030

In accordance with the emission accounting rules (UNFCCC), the analysis is focused on TTW emissions. Furthermore, GHG emissions from transport are largely dominated by CO_2 emissions (~98%), justifying a focus on CO_2 emissions. Aviation is also excluded from the following analysis as it now covered by the EU ETS.

In the following we first compare the emission trends as projected in the different basecase/reference scenarios. Then the sensitivity to fuel prices and GDP growth is analysed. A decomposition of the emission reduction into the different driving factors is then made. The possible contribution of transport in effort sharing decision emission targets is then analysed.

5.1 Sensitivity to GDP and fuel price

The two following graphs show the CO_2 emissions from non-ETS transport by 2020 and 2030 (change in emissions from 2005 to 2020/2030 as % of 2005 level) in the case of 3.3 alternative basecase and sensitivity cases.

They show the combined effects of alternative assumptions on GDP growth and oil prices (and fuel prices). Low GDP growth (higher GDP growth) combined with high oil price (low oil price) result in the lowest (highest) transport activities, and, consequently, highest (lower) emission levels. This explains the ranges in terms of relative emission changes by 2020 (and 2030) as compared with 2005.

At EU level, the TREMOVE 3.3 alternative basecase scenario projects a 3.6% emission reduction by 2020 and 3.9% emission reduction by 2030 compared with 2005. According to the sensitivity scenarios, these changes could be within a range -11.5% to 12.8%. Given the likelihood of the respective sensitivity cases (section 4.2), the emission levels in the upper part of that range should be considered the least likely.

At Member State level, the range of possible outcomes in terms of emission change varies from 19% (Germany) to 60% (Romania). In this last case, and similarly for other EU12 countries, such wide ranges are linked to the important transport demand growth (expected to grow significantly, especially in New Member States) and its high sensitivity to GDP[g].

[g] Higher uncertainties on data in some countries could also explain some high ranges.

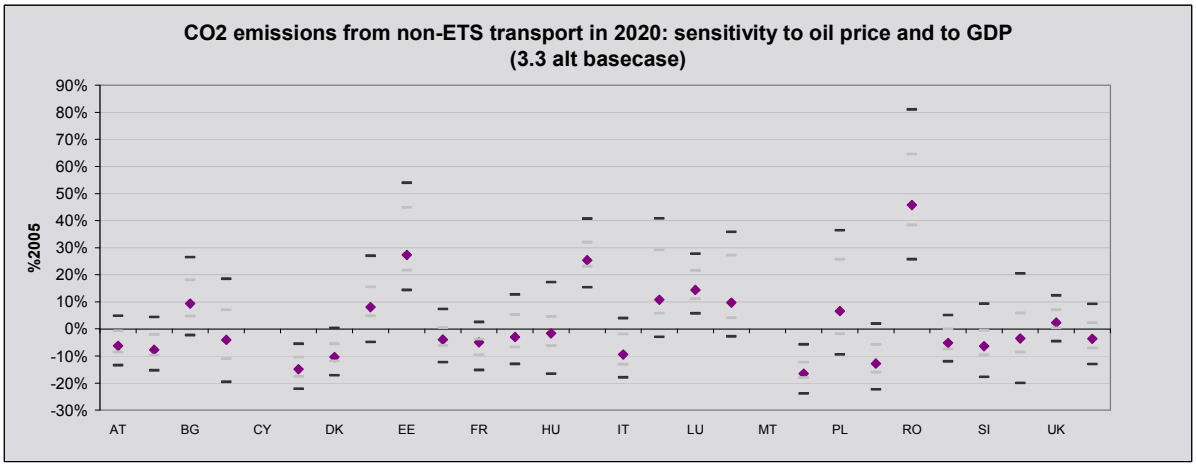


Figure 2: CO_2 emissions by 2020 for the TREMOVE3.3 alternative basecase scenario and sensitivity cases

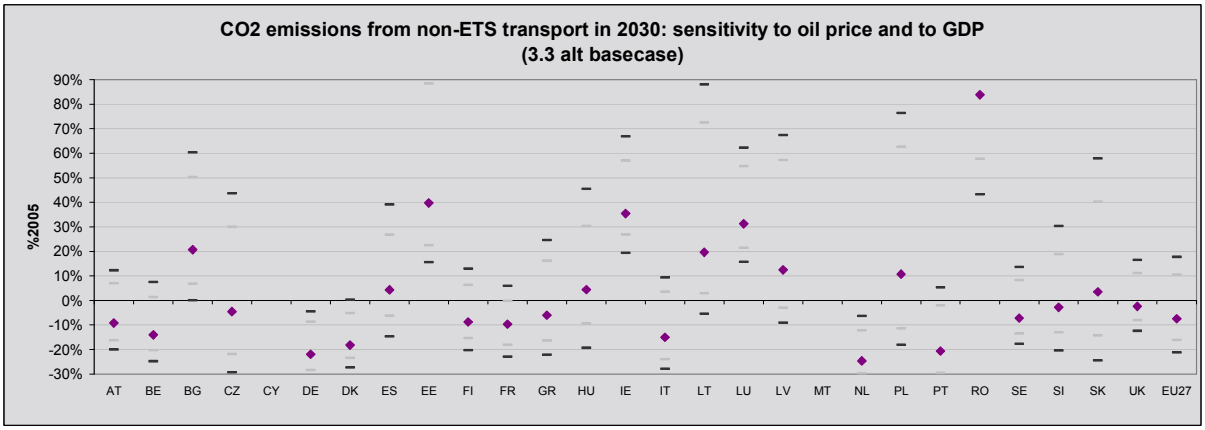


Figure 3: CO_2 emissions by 2030 for the TREMOVE3.3 alternative basecase scenario and sensitivity cases

Remark:

- *Diamonds represent 3.3 alternative baseline scenario*
- *The two (upper and lower) black lines represent the sensitivity scenarios with respectively high GDP/low fuel prices and low GDP/high fuel prices*
- *The two (upper and lower) grey lines represent the sensitivity scenarios with respectively high GDP/high fuel prices and low GDP/low fuel prices*

The transport demand in the different modes and scenarios (3.3 alternative baseline and sensitivity) is shown in Table 6. Freight transport is modelled to be the most sensitive to GDP and fuel price future trends.

		3.3 alternative baseline	Sensitivity scenarios			
			High GDP High Fuel price	High GDP Low Fuel price	Low GDP Low Fuel price	Low GDP High Fuel price
passenger transport	Urban Public	386 084	*107%*	*107%*	*95%*	*94%*
	Urban Private	1 941 747	*113%*	*119%*	*94%*	*89%*
	Non Urban Rail	360 440	*109%*	*110%*	*94%*	*93%*
	Non Urban Road	5 542 872	*114%*	*120%*	*93%*	*89%*
freight transport	Urban	623 133	*142%*	*150%*	*83%*	*78%*
	Non Urban Rail	711 562	*160%*	*159%*	*79%*	*79%*
	Non Urban Road	2 140 706	*150%*	*163%*	*81%*	*75%*
	Inland Water Way	164 869	*158%*	*157%*	*77%*	*78%*

Table 6: Transport activity (Gpkm/Gtkm) in 2030, in the alternative basecase scenario (v33) and comparison of the sensitivity cases (%)

5.2 Combined effects of macro-economic assumptions and of policy assumptions

The two following graphs show the CO_2 emissions from non-ETS transport by 2020 and by 2030 (as % of 2005 level) for the three main scenarios (baseline and alternative baseline 3.3 scenarios and 3.4 reference scenarios). In this comparison, GDP, oil price and policy assumptions altogether explain the different patterns. The 3.3 baseline scenario (almost) systematically projects CO_2 emission levels higher than the other two scenarios. Emissions are projected to increase (at the best, stabilise) by 2020 and 2030. Background assumptions behind the two other scenarios are more similar and therefore, emission trends in these two scenarios are more comparable.

At EU level, the emissions would decline in both case, by 2020 (-3.5% in 3.3 alternative baseline and -3% in 3.4 reference scenario) and 2030 (-7.4% in 3.3 alternative baseline and -11% in 3.4 reference scenario).

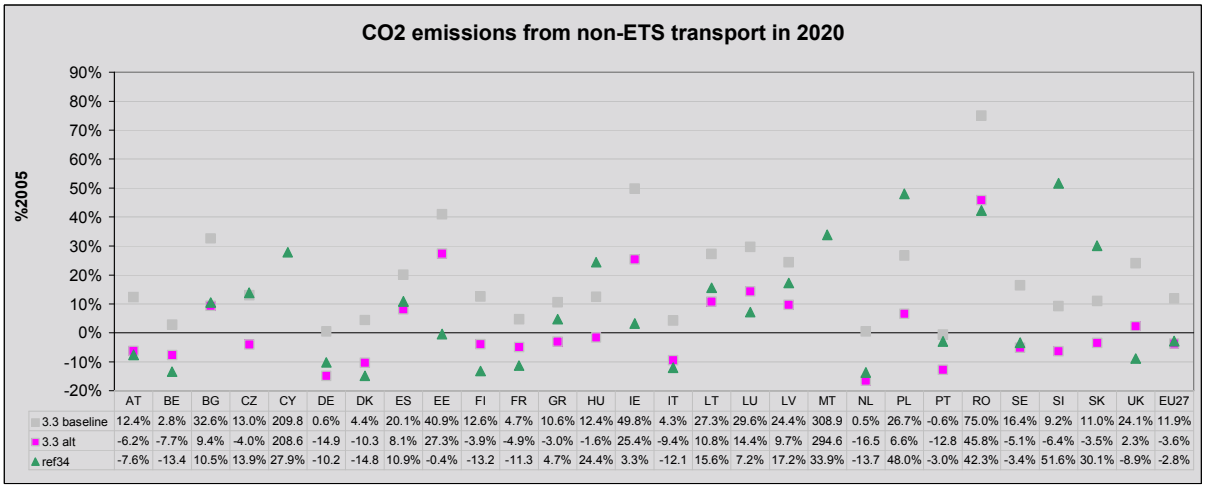
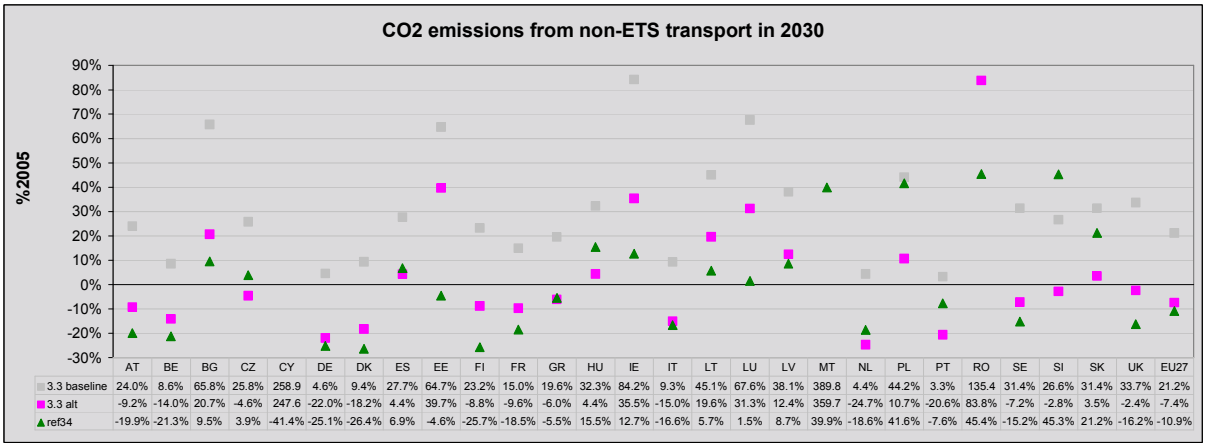


Figure 4: CO_2 emissions by 2020 for three main scenarios TREMOVE3.3 baseline and alternative baseline scenario and TREMOVE3.4



	AT	BE	BG	CZ	CY	DE	DK	ES	EE	FI	FR	GR	HU	IE	IT	LT	LU	LV	MT	NL	PL	PT	RO	SE	SI	SK	UK	EU27
3.3 baseline	24.0%	8.6%	65.8%	25.8%	258.9	4.6%	9.4%	27.7%	64.7%	23.2%	15.0%	19.6%	32.3%	84.2%	9.3%	45.1%	67.6%	38.1%	389.8	4.4%	44.2%	3.3%	135.4	31.4%	26.6%	31.4%	33.7%	21.2%
3.3 alt	-9.2%	-14.0%	20.7%	-4.6%	247.6	-22.0%	-18.2%	4.4%	39.7%	-8.8%	-9.6%	-6.0%	4.4%	35.5%	-15.0%	19.6%	31.3%	12.4%	359.7	-24.7%	10.7%	-20.6%	83.8%	-7.2%	-2.8%	3.5%	-2.4%	-7.4%
ref34	-19.9%	-21.3%	9.5%	3.9%	-41.4%	-25.1%	-26.4%	6.9%	-4.6%	-25.7%	-18.5%	-5.5%	15.5%	12.7%	-16.6%	5.7%	1.5%	8.7%	39.9%	-18.6%	41.6%	-7.6%	45.4%	-15.2%	45.3%	21.2%	-16.2%	-10.9%

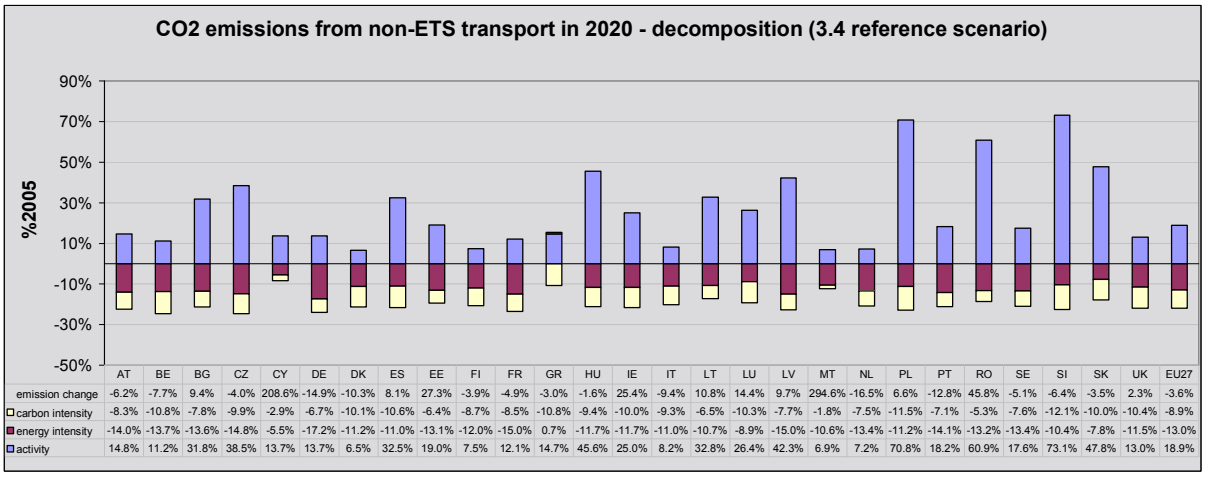
Figure 5: CO_2 emissions by 2030 for three main scenarios TREMOVE3.3 baseline and alternative baseline scenario and TREMOVE3.4

5.3 Activity, energy intensity and carbon intensity

Future CO_2 emissions trends depend on future transport demand (which, on its turn mainly depends on GDP, oil price), energy intensity and carbon intensity. These last two factors depend on the future modal mix, technology improvement, and alternative fuel penetration.

The following graph shows the contribution of these factors to the future changes in CO_2 emissions from non-ETS transport by 2020 (as % of 2005 level) for the most recent scenario (3.4 reference scenario).

At EU level, the emission growth induced by growing transport demand is totally offset by the combined effect of decreasing energy intensity (mainly driven by car energy efficiency improvement) and lower carbon intensity (resulting from biofuels in road transport).
The situation at Member State level may vary significantly from one country to the other. In several countries, the emission trend (increase) will be mainly dominated by the transport demand increase.



	AT	BE	BG	CZ	CY	DE	DK	ES	EE	FI	FR	GR	HU	IE	IT	LT	LU	LV	MT	NL	PL	PT	RO	SE	SI	SK	UK	EU27
emission change	-6.2%	-7.7%	9.4%	-4.0%	208.6%	-14.9%	-10.3%	8.1%	27.3%	-3.9%	-4.9%	-3.0%	-1.6%	25.4%	-9.4%	10.8%	14.4%	9.7%	294.6%	-16.5%	6.6%	-12.8%	45.8%	-5.1%	-6.4%	-3.5%	2.3%	-3.6%
carbon intensity	-8.3%	-10.8%	-7.8%	-9.9%	-2.9%	-6.7%	-10.1%	-10.6%	-6.4%	-8.7%	-8.5%	-10.8%	-9.4%	-10.0%	-9.3%	-6.5%	-10.3%	-7.7%	-1.8%	-7.5%	-11.5%	-7.1%	-5.3%	-7.6%	-12.1%	-10.0%	-10.4%	-8.9%
energy intensity	-14.0%	-13.7%	-13.6%	-14.8%	-5.5%	-17.2%	-11.2%	-11.0%	-13.1%	-12.0%	-15.0%	0.7%	-11.7%	-11.7%	-11.0%	-10.7%	-8.9%	-15.0%	-10.6%	-13.4%	-11.2%	-14.1%	-13.2%	-13.4%	-10.4%	-7.8%	-11.5%	-13.0%
activity	14.8%	11.2%	31.8%	38.5%	13.7%	13.7%	6.5%	32.5%	19.0%	7.5%	12.1%	14.7%	45.6%	25.0%	8.2%	32.8%	26.4%	42.3%	6.9%	7.2%	70.8%	18.2%	60.9%	17.6%	73.1%	47.8%	13.0%	18.9%

Figure 6: Change in CO_2 emissions by 2020 in the TREMOVE3.4 reference scenario: decomposition into activity, energy intensity and carbon intensity

5.4 Contribution to the emission targets for non-ETS sector

In the next table, the emission changes 2005-2050 projected in the TREMOVE3.4 reference scenario are compared with the national targets set for the non-ETS sector.

At aggregated EU27 level, the transport sector (excluding aviation) would contribute to a -28 Mton CO_2 emission reduction by 2020 compared with 2005. This represents about 10% of the non-ETS sector emission reduction target at EU27 level.

At Member State level, the expected contribution is in a very wide range.
For some countries (e.g. Netherlands, Germany, France), transport would significantly contribute to the fulfilment of the national targets (50%, 44% and 33% of non-ETS target respectively). For several other countries with net emission reduction targets in the non-ETS sectors, the transport sector contribution would remain positive, although less important (e.g. Belgium, Italy).

In the rest of counties that are assigned an emission reduction target, the substantial emission increase by the transport sector could counteract to this objective (e.g. Spain, Ireland).

Then, for countries where emissions increases are allowed by the non-ETS decision, transport emissions would represent a large fraction of the allowed emission increase.

	Effort Sharing Decision Target	3.4 reference scenario	projected emission change/target
EU27	-277.5	-26.1	0.09
DE	-70.4	-31.7	0.45
UK	-66.0	-34.8	0.53
FR	-59.5	-21.4	0.36
IT	-45.1	1.4	-0.03
ES	-25.1	12.0	-0.48
NL	-21.1	-9.8	0.47
BE	-12.9	-1.8	0.14
AT	-9.5	3.3	-0.34
IE	-9.3	5.5	-0.59
SE	-8.2	2.0	-0.24
DK	-7.5	-2.0	0.27
FI	-5.7	-2.7	0.48
GR	-2.5	7.6	-3.07
LU	-2.1	4.5	-2.12
CY	-0.2	3.5	-15.71
MT	0.0	0.9	20.42
SI	0.5	3.2	7.00
PT	0.5	1.9	3.87
EE	0.7	0.5	0.73
LV	1.4	0.5	0.32
LT	2.5	0.8	0.32
SK	3.2	1.0	0.32
HU	5.4	5.8	1.08
CZ	5.7	5.4	0.95
BG	6.3	-0.2	-0.03
RO	15.2	6.2	0.41
PL	26.2	12.2	0.47

Figure 7: Comparison of national target for the Effort Sharing Decision on non ETS sectors and projected emissions changes 2005-2020 (Mton CO_2)

Appendix 1: TREMOVE model

TREMOVE is a policy assessment model for studying the effects of different transport and environmental policies on the emissions of the transport sector. The model is used to estimate the effects of various policy measures on transport demand, the resulting modal shifts, the vehicle stock renewal, the emissions of air pollutants and the effects on welfare. The model can be applied for the analysis of different policies such as road pricing, public transport pricing, emission standards, subsidies for cleaner cars, etc. TREMOVE models both passenger and freight transport, and covers the period 1995 - 2030.

The model consists of 31 parallel country models[h], each of them consisting of three inter-linked modules: a transport demand module, a vehicle turnover module and an emission and fuel consumption module.

The **transport demand module** describes transport flows and the users' decision-making process in terms of modal choice. Starting from the baseline level of demand for passengers and freight transport per mode[i], period, region etc., the module describes how the implementation of a policy measure will affect the choice of the users and of the companies between the different transport modes. The key assumption is that the choices are made based on the generalized price for each mode: cost, taxes or subsidy and time cost per kilometre travelled. The output of the demand module consists of passenger-kilometres (pkm) and ton-kilometres (tkm) that are demanded per transport type for a given policy environment. The pkm and tkm are also converted into vehicle kilometres (vkm).

The **vehicle stock turnover module** describes how changes in demand for transport or changes in vehicle price structure influence the share in the stock by age and vehicle type. The output of the vehicle stock module is twofold: total fleet and the number of km for each year according to vehicle type and age.

The fuel consumption and **emissions module** calculates fuel consumption and emissions (greenhouse gas and air pollutants emissions), based on the structure of the vehicle stock, the number of km driven by each vehicle type, and the driving conditions using the COPERT methodology.

Outputs from the vehicle stock and fuel consumptions and emissions modules are fed back into the **demand module**. As fuel consumption, stock structure and usage influence usage costs, they are important determinants of transport demand and modal split.

In addition to the three core modules, the TREMOVE model includes a well-to-tank emissions and a welfare cost module. The **well-to-tank emissions** module calculates the emissions during the production of fuels and electricity.

The **welfare cost module** enables a calculation of the cost to society associated with emission reduction scenarios in European urban and non-urban areas. The welfare effect of a policy

[h] EU27 countries + Norway, Iceland, Switzerland and Turkey

[i] TREMOVE is not a transport network model and doesn't enable to project baseline transport activity. It therefore requires an exogenous baseline demand projection.

change is calculated as the discounted sum of changes in utility of households, production costs, external costs of congestion and pollution and benefits of tax recycling. These benefits of tax recycling represent the welfare effect of avoiding public funds being collected from other sectors, when the transport sector generates more revenues.

The detailed scenario results (per Member States and EU27 aggregated level) have been provided in seven separate spreadsheets, giving the following standard sheet.

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Abstract

The Decision 406/2009/EC on effort sharing aims to reduce greenhouse gas emissions from sectors not covered by the EU Emission Trading System. These non-ETS sectors include (non aviation) transport, buildings, agriculture and waste. The Decision establishes national emission targets below which each Member State is committed to limit its non-ETS greenhouse gas emissions by 2020.
This report analyses the possible contribution of the transport sector in the Effort Sharing Decision targets at Member State level and at EU level. The analysis is based on the TREMOVE model scenarios, including sensitivity cases on GDP and oil price.

According to the most recent scenario, at aggregated EU27 level, the transport sector (excluding aviation) would contribute to a -28 Mton CO2 emission reduction by 2020 compared with 2005. This represents about 10% of the non-ETS sector emission reduction target at EU27 level. At Member State level, the expected contribution is in a very wide range.

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